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Evaluation of Directive 2002/49/EC Relating to the Assessment and Management of Environmental Noise

Final Report

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EUROPEAN COMMISSION

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Directorate-General for Environment
Knowledge, Risks and Urban Environment

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GLOSSARY OF ABBREVIATIONS, TERMS AND DEFINITIONS

A glossary and definition of acronyms, abbreviations and technical terms is provided below:

Abbreviations and acronyms	Full wording
Art.	Article (in an EU legal text)
CBA	Cost-benefit assessment
CA / CAs	Competent Authority/ Competent Authorities
CDR	The Central Data Repository, the database set up by the EEA for the collation of END reporting on SNMs and NAPs. The CDR is based on shared information infrastructure accessible to Member States through the EEA's EIONET.
CNOSSOS-EU	Common Noise Assessment Methods in Europe. This is the methodology that was developed for the purpose of achieving a common approach to strategic noise mapping through the revision of Annex II and adoption of Commission Directive (EU) 2015/996.
DALYs	Disability-Adjusted Life Years
DF/ DFs	Data Flow(s) are the different EC databases developed drawing on END reporting data and information submitted by the EU MS are drawn up in different databases and reports known as DFs.
EC	European Commission
EIONET	European Environment Information and Observation Network, through which END reporting information in respect of SNMs and NAPs is collected.
ENDRM	END Reporting Mechanism (the mechanism developed for END reporting of data and information by the EU MS to the EC
ETC/ACM	European Topic Centre on Air Pollution and Climate Change Mitigation (assists the EC and EEA in reporting tasks).
END	The Environmental Noise Directive - Directive 2002/49/EC.
ERFs	Exposure-response functions
FTEs	Full-Time Equivalents
HA	Highly Annoyed
ICAO	International Civil Aviation Organization
JRC	Joint Research Centre
LV(s)	Limit Value(s)
MS	Member State
NAPs	Noise Action Plans
OPC	Open Public Consultation
Reportnet	The EEA's reporting mechanism which has been tailored to gather data and information on END implementation through the EIONET network of Member State authorities. See https://www.eionet.europa.eu/reportnet
SNMs	Strategic Noise Maps
VOLY	Value of Life Year
WHO	World Health Organisation
xml	Extensible Mark-up Language (relating to reporting through Reportnet)

Technical terms/ definitions	Description
Action Planning Body	An organisation nominated in the capacity of a Competent Authority responsible for producing a Noise Action Plan.
Agglomeration	'Agglomeration' shall mean part of a territory, delimited by the Member State ("MS"), having a population in excess of 100,000 persons and a population density such that the MS considers it to be an urbanised area. However, it should be noted that in R1, an agglomeration was an area with a population in excess of 250,000 persons as part of a transitional period.
Major airports	A civil airport with >50,000 movements per year (a movement being a take-off or a landing).
Major railway	'Major railway' shall mean a railway, designated by the MS, which has more than 30,000 train passages per year. Note: Major railways in R1 were defined as > 60,000 train passages per year and in R2, the threshold changed to > 30,000 train passages per year.
Major roads	'Major road' shall mean a regional, national or international road, designated by the MS, which has more than 3 million vehicle passages a year; Note - major roads in R1 were defined as a road with > 6 million vehicle passages a year. In R2, the threshold was changed to > 3 million vehicle passages a year.
NRA	National Road Authority
R1/ Round 1	The noise mapping which took place in 2007 and the subsequent adoption of Action Plans in 2008 onwards.
R2/ Round 2	The noise mapping which took place in 2012 and the subsequent adoption of Action Plans in 2013 onwards.
R3/ Round 3	The noise mapping that will take place in 2017 and the subsequent Action Plans that will be prepared in 2018. There will be a transition in some EU MS towards the use of the CNOSSOS-EU methodology (voluntary only).
R4 / Round 4	The noise mapping that will take place in 2022 and the subsequent action plans that will be prepared in 2023. The use of CNOSSOS-EU, as defined in the revised Annex II will be mandatory.
TFEU	Treaty for European Union, the Lisbon Treaty, adopted in December 2009.

A list of some of the acoustical and technical terms used in the report for the benefit of non-technical readers is provided below:

Technical term	Explanation/ description
A 'common approach'	The term 'a common approach' is used in the report as shorthand when referring to Art. 1(1) of the END whose full aim is to "define a common approach intended to avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to exposure to environmental noise".
Annoyance	One of the health endpoints mentioned in the current WHO guidelines for quantifying the burden of disease from environmental noise. The WHO defines annoyance as an emotional state connected to feelings of discomfort, anger, depression and helplessness.
Cardiovascular diseases	One of the health endpoints mentioned in the current WHO guidelines, includes minor changes in cardiovascular activity and myocardial infarction.
Competent Authority (CA)	The CA is an organisation designated as being responsible either for the development of Strategic Noise Map(s), Noise Action Plans or both.

Technical term	Explanation/ description
Disability-Adjusted Life Years (DALYs)	One DALY represents one lost year of "healthy" life. The sum of these DALYs across the population, or the burden of disease, can be thought of as a measurement of the gap between current health status and an ideal health situation.
Dose-effect relationships	The END describes this as meaning “the relationship between the value of a noise indicator and a harmful effect”. This also describes the change in effect on exposed population caused by differing levels of exposure (or doses) to noise (measured in dBs) after a certain exposure time.
Health endpoints	Examples of health endpoints mentioned in the current WHO guidelines are: annoyance, sleep disturbance and cardiovascular diseases.
Sleep disturbance	Sleep disturbance is a further health endpoint mentioned in the current WHO guidelines, includes EEG awakening, motility, changes in duration of various stages of sleep, sleep fragmentation, waking etc.
Noise metrics	*There are two key indicators that are used in implementing the END, L_{den} and L_{night}. Definitions of these terms are provided below:*
L_{den}	‘L_{den}’ (day-evening-night noise indicator) shall mean the noise indicator for overall annoyance, as further defined in Annex I of the END.
L_{night}	L_{night}’ (night-time noise indicator) shall mean the noise indicator for sleep disturbance, as further defined in Annex I of the Directive;
TSIs	Technical Standards for Interoperability – voluntary standards in the rail sector.
VOLY	A Value of a Life Year is a concept used in the CBA relating to the monetisation of the health benefits associated with reducing high levels of environmental noise.

This is the final report of the study led by the Centre for Strategy & Evaluation Services (CSES) and ACCON supported by a further acoustics and environmental consultancy, AECOM.

Authorial team

The lead authorial team was comprised of the following team members:

- Mark Whittle, CSES (lead author and evaluation)
- Shane Rimmer, CSES associate (implementation review)
- Stephan Kreutzer, CSES (implementation review and evaluation)
- Markus Petz, ACCON (case study data collection and analysis)
- Petrina Rowcroft, AECOM (cost-benefit assessment)

Quality review of specific aspects of the study has been undertaken at various stages of the assignment by Colin Grimwood (CJGEM) and Paul Shields (AECOM).

The following consultants have also made important contributions to the research:

- Colin Grimwood, CJG Environmental Management (EU-level research and analysis, workshop, lead country researcher for the UK)
- Abigail Bristow, AECOM associate consultant (QA and advisory work on the cost-benefit assessment)

The following consultants were involved as country researchers for the second implementation review.

- Mark Whittle, CSES, country researcher - France, Ireland, Latvia, Lithuania, Luxembourg, Netherlands and partly the UK.
- Stephan Kreutzer, CSES, country researcher - Denmark and Estonia.
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A Brief Summary

This study presents the findings from the second implementation review and the evaluation of the Environmental Noise Directive ("END"), carried out under the EC's REFIT programme.

The study has drawn on desk research, an online survey, an interview programme with more than 100 stakeholders across all EU Member States and a workshop (September 2015) to validate the results.

The Directive's objectives were found to remain relevant to identified policy needs, and coherent with other EU and national legislation (although internal coherence within the legal text could be improved). Regarding effectiveness, it was found that progress has been made towards the two core objectives of the END (a "common approach" to noise management and informing EU noise-at-source legislation), but implementation has been delayed in many MS, especially regarding action planning. The research also identified evidence of a favourable cost-benefit ratio at measure level, implying that the Directive has been efficient, as well as strong European Added Value. Whilst the Directive demonstrates fitness for purpose overall, there are a number of ways in which its effectiveness and impacts might be improved in future.

EXECUTIVE SUMMARY

1. INTRODUCTION

This Executive Summary sets out the findings and conclusions from the second implementation review and evaluation of the Environmental Noise Directive (the "END"). The study was undertaken by the Centre for Strategy & Evaluation Services and ACCON, supported by AECOM.

1.1. Directive 2002/49/EC

Directive 2002/49/EC (the Environmental Noise Directive, "END") is the EU legislative instrument for the assessment and management of environmental noise[1]. The Directive was adopted on 25 June 2002, and came into force on 18 July 2002. The END has two objectives:

- Art. 1(1) - Achieve a **common European approach** to **avoid, prevent** or **reduce** the effects of exposure to environmental noise harmful for health, which includes annoyance; and
- Art. 1(2) – to provide a basis for developing **Community measures to reduce noise emitted by major sources**, in particular road and rail vehicles and infrastructure, aircraft, outdoor and industrial equipment and mobile machinery.

The END is being implemented over 5-yearly cycles (rounds). Round 1 took place from 2007-2012 and Round 2 is taking place between 2012-2017.

1.2. Objectives of the second implementation review

Under Article 11(1), a review of the Directive's implementation is required once every five years. A technical study[2] to inform the first implementation review of the END was undertaken in 2010 and the European Commission ("EC") published a Report outlining the findings from the first implementation review in 2011[3]. The second implementation review assessed progress over the most recent five-year implementation period, taking into account the evolution in implementation (and any changes in administrative approaches and in national transposition legislation) between R1 and R2. The objectives of the second implementation review of the END were to:

- Assess the legal and administrative implementation of the Directive and its key provisions across EU28 and by Member State ("MS"); and
- Identify difficulties experienced by competent authorities in implementing these provisions.

The extent to which challenges and outstanding issues identified in the first implementation review have remained or been addressed in R2 through remedial actions was examined. The research also assessed how far any new challenges or implementation issues have emerged during R2.

[1] Environmental noise is defined in the Directive as "unwanted or harmful outdoor sound created by human activities, including noise emitted by transport, road traffic, rail traffic, air traffic and from sites of industrial activity".

[2] Final Report on Task 1, Review of the Implementation of Directive 2002/49/EC on Environmental Noise, May 2010, Milieu

[3] COM (2011) 321 final of 1st June 2011, http://eur-lex.europa.eu/legal-content/EN/TXT/DOC/?uri=CELEX:52011DC0321&from=EN

1.3. Objectives and scope of the evaluation

The European Commission ("EC") announced in 2013 in its Communication on Regulatory Fitness and Performance (REFIT)[4] that an evaluation of the END would be undertaken, an evidence-based assessment as to whether EU actions are proportionate and delivering on defined policy objectives. The objective was to evaluate the Directive within the REFIT programme framework[5]. The evaluation was undertaken drawing on methodological guidance on evaluation[6] and a detailed set of evaluation questions were assessed, based on the criteria of *relevance, coherence, effectiveness, efficiency* and *European Added Value*. In a REFIT context, checking whether the END is 'fit for purpose' and provides a *"simple, clear, stable and predictable regulatory framework"* is an issue cutting across each of these evaluation criteria. The evaluation scope covered the period from the Directive's adoption in 2002 until late 2015.

1.4. Methodology

The study methodology was structured over three phases, an inception phase, a core data collection phase and an analysis and reporting phase. The research methods used to collect and analyse the data are summarised in the following table:

Table 1 Research methods for data collection – Second implementation review and evaluation of the END
Interview programme – interviews with 104 END stakeholders (e.g. competent authorities, EU industry associations, acoustics consultants, NGOs and community organisations).
Online survey - three online surveys were carried out between March-May 2015 with (i) public authorities (ii) NGOs/ community groups and (iii) acoustics consultancies.
Validation workshop – three working papers were presented and discussed at the workshop on (1) the second implementation review (2) the REFIT evaluation of the END and 3) on the proposed methodology for the cost-benefit assessment ("CBA"). Input was collected from stakeholders participating in and following the workshop.
Desk research – literature from the EU and national sources was examined such as the Directive's legal text, good practice guidance documents (e.g. on quiet areas, noise mapping) a review of a sample of Strategic Noise Maps ("SNMs") and Noise Action Plans ("NAPs") was undertaken, and an assessment of 'state of the art' methodologies to quantify the costs and benefits of environmental noise and their health effects.
Case studies – for the assessment of costs and benefits (which informed the CBA), 19 case studies examining noise reduction measures were undertaken for airports (5), major railways (2) and major roads (2). Less data was available for agglomerations (10). The purpose was to identify the costs/ benefits.

2. KEY FINDINGS - SECOND IMPLEMENTATION REVIEW

The main findings from the Second Implementation Review of the END are now summarised.

2.1 The overall approach to END implementation and legislative transposition

- Considerable differences between "MS" were identified in respect of END implementation approaches, such as more centralised and decentralised approaches. The administrative level at which implementation takes place (i.e. national, regional

4 COM(2013)685 final

5 http://ec.europa.eu/smart-regulation/refit/index_en.htm

6 See http://ec.europa.eu/smart-regulation/evaluation/docs/20131111_guidelines_pc_part_i_ii_clean.pdf and *Evaluating EU Activities: A practical guide for Commission services (2004)*

and local) was found to vary between agglomerations, roads, railways and airports. This reflects the fact that the END is implemented under the subsidiarity principle.

- The transition to the definitive thresholds of the END between R1 and R2 has increased the scope of END coverage, with a significant increase in the volume of km's (major roads, major railways) and in the number of agglomerations and airports covered.
- There have continued to be considerable delays in END implementation in R2 in ensuring that all EU MS submit SNMs and NAPs by the dates stipulated in the Directive (c.f. Art. 7, Art. 8). However, similar difficulties were also encountered in R1.
- The END and its definitions have generally been correctly transposed into national legislation, either through the adoption of new implementing regulations or through adjustments to existing legislation.
- However, in some EU MS, there have been problems in ensuring that national legislation transposing the END correctly transposes all the definitions of key terms and that the terminology used is sufficiently close to the concepts described in the END (e.g. quiet areas in an agglomeration).

2.2 Designation and delimitation of agglomerations, major roads, major railways and airports

- No significant problems were identified in the designation of major roads, major railways, airports and agglomerations that fall within the scope of the END, since the definitions of thresholds were regarded as being clear.
- However, in some MS, there remain practical challenges within agglomerations, relating to the delimitation of administrative responsibilities between national bodies and local authorities for the purposes of producing SNMs. This is especially the case for major railways and major roads situated within agglomerations.

2.3 Noise limits and targets

- Although the END does not set any source-specific limit values ("LVs") at an EU level, establishing national LVs was viewed as being helpful by national Competent Authorities ("CAs") in many EU MS, since exceedance was often used as the basis for prioritising noise mitigation measures.
- Whilst mandatory noise LVs have been set in 21 EU MS, and non-binding targets in a further 4 EU MS[7], there was limited evidence of their effective enforcement either in R1 or R2. However, since national LVs are a MS responsibility, this is outside the END's scope.

2.4 Quiet areas

- Although many MS have made progress in developing definitions of quiet areas (in agglomerations and open country) and in defining selection criteria to designate quiet areas, less than half of all EU MS (13) have yet designated any quiet areas.
- Nevertheless, in those EU MS that have formally designated or identified quiet areas, their number has increased considerably between R1 and R2.
- There remains a perceived need among stakeholders for the EC to develop further practical guidance on quiet areas, regarding their initial designation, the types of measures that could be implemented to ensure their subsequent protection and how to preserve areas of 'relative quiet' within urban areas.
- A reluctance was identified in some MS to designate quiet areas due to uncertainty with regard to whether the process could be reversed in future and also whether a

[7] Denmark has both binding and indicative values in place, depending on noise source.

designated quiet area could be subject to legal challenges (e.g. by developers, local authorities etc.).

2.5 Strategic Noise Maps (SNMs)

- Across EU-28, good progress has been made in undertaking strategic noise mapping and in collecting data on population exposure to high levels of environmental noise, defined as L_{den}>55 dB(A) and L_{night} >50 dB(A).
- The L_{den} and L_{night} indicators are being used by CAs responsible for noise mapping across the EU and these indicators, sometimes complemented by additional national noise indicators.
- There have been significant delays in some EU MS in both R1 and R2 in the submission of SNMs to the EC (and also instances of non-submission). It is difficult to compare data completeness between rounds however, since this would be dependent on having comparable data with a similar cut-off date.
- Problems remain with regard to the late submission of SNMs in respect of aircraft noise within agglomerations (only 52% complete) and major railways and airports in general. Major delays in carrying out strategic noise mapping and in reporting SNMs to the EC were generally recognised as a problem by CAs in those MS concerned.
- Ongoing barriers to producing SNMs on a more timely basis identified are: a lack of human and financial resources within CAs in EU MS with a highly decentralised implementation structure, overly complex administrative arrangements leading to difficulties in ensuring effective coordination and a lack of political will at local level to allocate resources, especially where no central government funding was available.
- In both R1 and R2, most CAs outsourced noise mapping to acoustics consultants. Nevertheless, CAs gained experience in coordinating the production of SNMs in R1 and in better defining their procurement needs.
- In some EU MS, evidence was identified that there were cost reductions in R2 implementation as a result of the strengthening capacity to procure such services.
- Over half of MS attested to discernible improvements in R2 in the quality and availability of input data in R2 compared with R1. In other MS, difficulties remain in respect of the lack of input data in both rounds.
- Examples were identified of delays in the procurement of noise mapping services in R2 due to delays in the political approval of budgets for noise mapping due to the economic and financial crisis, and delays in the timely availability of input data (especially population census data).

Common assessment methods and data comparability

- Ensuring adequate continuity and consistency between rounds in input data collection was identified as being important to ensure comparability of output data during strategic noise mapping. Some stakeholders argued that input data needs to become more standardised to strengthen its comparability. However, other stakeholders questioned whether this was realistic, since the required data is context-specific.

- There was broad recognition that the development of common noise assessment methods through the development of the CNOSSOS-EU methodology between 2009 and 2015 was a major achievement. The replacement of Annex II of the Directive with Commission Directive (EU) 2015/996 should, over time, lead to more comparable data which is a pre-requisite in order to better inform the development / revision of source legislation by transport source.
- Ensuring data comparability between rounds for the same source and between EU MS will remain a challenge until Commission Directive (EU) 2015/996 has been implemented on a mandatory basis from R4 onwards. Currently, there are differences in the noise modelling software and computation methods used for mapping the same

source between rounds in some EU MS, such that consistent comparability cannot yet be ensured across EU-28.

2.6 Noise Action Plans and Public Consultations

The completeness of reporting data and information - NAPs

- There have been delays in the submission of R2 NAPs in several MS (for instance, in CZ, EL, ES, FR, LU, MT, PT and RO). The most recent reporting information on data completeness shows that more than 2 years after the formal reporting deadline for R2, NAP submission completeness is below 50% across all sources[8], with pronounced gaps for major railways and airports.
- However, it should be emphasised that the delays encountered in reporting to the EC are not unique to R2. Delays were also encountered in R1 NAP submissions in several MS (including several that have also experienced delays in R2).
- Delays in the finalisation of R2 SNMs in several MS have had a knock-on effect in terms of the timeframe for the drawing up and submission of NAPs to the EC.
- The timeframe of 12 months between the formal reporting deadline to the EC for the submission of SNMs and NAPs was viewed by the majority of stakeholders as being too short to allow sufficient time for NAP finalisation.
- Stakeholders pointed to the need to allow adequate time to organise public consultation processes, to review consultation submissions and to give adequate consideration to the integration of feedback into the finalisation of NAPs.
- A particular problem was identified in respect of the timeliness of the completion of NAPs in agglomerations. In MS that have adopted a decentralised approach to END implementation, it was found that when many different actors are involved, it can be difficult to coordinate the development and finalisation of NAPs in an efficient and timely manner.
- There are divergent approaches to action planning between MS due to the fact that the END is implemented under subsidiarity. This is reflected in the types of noise mitigation, abatement and reduction measures identified, the balance between expenditure/ non-expenditure measures[9] and the extent to which there is a strategic or operational focus.
- Although some R2 NAPs include cost-benefit information, others include no data at all, or only partial data, for instance, on the estimated costs but nothing on the anticipated benefits, required under the 'financial information' section in Annex V *(minimum requirements for NAPs)*.
- There was not found to be a major improvement in the quality of cost-benefit information and data between rounds. Stakeholders attributed this to the complexity of assessing costs and benefits at measure level.

Public Consultations of NAPs

- The quality of consultation responses to the publication of draft NAPs was found to vary. Whilst some CAs were satisfied with the quantity and quality of feedback received, others had received little input from relevant stakeholders, despite informing on the consultation in advance.
- NGOs that have participated in consultations stated that although NAPs often include a summary of the consultation responses, it is often unclear how these responses have been taken into account in NAP finalisation.

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[8] However, this depends on what is meant by data completeness, since some competent authorities have understood that they should only formally submit a summary of the NAP, as opposed to the complete NAP.

[9] Soft measures that do not require expenditure, such as encouraging greater use of public transport and promoting walking and cycling are a feature of some NAPs.

- Examples of good practices in carrying out consultations were identified, such as ensuring that the draft version of the NAP is published at the outset of the consultation process (and/ or before it is launched), and running the consultation for a minimum period of 2 months to allow sufficient time for stakeholders to review the draft NAP and to develop a considered response. Proper assessment of responses lengthens the time for the preparation, development and finalisation of NAPs, which is not currently taken into account in EU reporting timelines.

The implementation of NAPs

- A difficulty in respect of measure implementation within agglomerations was that the CAs responsible for developing the NAP (often local authorities) do not have strategic or budgetary decision-making powers to determine whether measures included within NAPs are realistic, feasible and can be funded. This was less of a problem for other sources, such as major railways and major roads, where the responsible CA for action planning sometimes also has budgetary or decision-making powers.
- NAPs are meant to report on the previous 5 year period of implementation, but many NAPs do not report systematically on the achievements of the previous 5 year cycle in terms of which measures have gone ahead in full, partially or not at all.

Information accessibility of SNMs and NAPs

- Almost all EU MS have made SNMs available and accessible to the public online. Noise maps have been made available through different website information portals at national, city and municipal levels. From a citizen’s perspective, it is important to have access to SNMs covering a given locality at a local level of governance.
- However, continued delays in the submission of reporting data and information for noise mapping and action planning in R2 mean that in some EU MS, SNMs and NAPs are still not being made accessible online until several years after they were meant to be completed and publicised.
- It would also be useful from the point of view of monitoring the overall implementation position at an EU level (and also for policy makers) to provide in addition access to SNMs and NAPs prepared at national level (e.g. especially for major railways and major roads) through a single information portal to avoid the over-fragmentation of information.

3. EVALUATION FRAMEWORK AND KEY FINDINGS

3.1. Key Evaluation Findings

The evaluation findings are now presented grouped under the key evaluation criteria.

3.1.1. Relevance

Art 1(1) of the END, of *“defining a common approach to **avoid, prevent** or **reduce** the effects of exposure to environmental noise harmful for health”*, remains highly relevant. Collecting comparable data/ information based on a common, EU-wide approach to assessing the extent of population exposure at specific dB(A) thresholds is a pre-requisite to achieving the END’s second objective, informing the development of noise measures through EU source legislation. Stakeholders also recognised that the Directive’s second objective remains highly relevant since EU policy makers responsible for the revision of existing environmental noise-at-source legislation are dependent on the availability of EU-wide, reliable population exposure data at receptor, for instance, to help set appropriate Limit Values in source legislation.

Whilst the Directive’s two core objectives remain relevant, Art. 1(1) sets out an intermediate objective of defining a “common approach”, but lacks a more strategic objective pertaining to what the Directive’s implementation should ultimately lead to, such as setting a target for reducing environmental noise exposure in Europe by a particular percentage relating to the number of people exposed to high noise levels.

The ultimate goal, alleviating the adverse impacts on public health, is presently implicit in the recitals, rather than explicit in the objectives. This makes it difficult to directly attribute measure implementation and the resulting level of noise reduction to the END itself.

3.1.2. Coherence

In relation to '**internal coherence',** the Directive was found to be generally **consistent and coherent**. However, there remain minor inconsistences in the legal text. In addition, some of the definitions provided in Art. 3 *(e.g. agglomeration, quiet area in an agglomeration and quiet area in open country)* were regarded as being in need of revision or further clarification to strengthen the internal coherence of the text.

With regard to **'external coherence'**, the END was found to be strongly coherent with EU noise-at-source legislation. No major inconsistences or duplications were identified in the assessment of different legal texts. However, since the END was adopted 14 years ago, when the legal text is reviewed at some point in future and updated to ensure consistency with changes to primary legislation (e.g. the entry into force of the Lisbon Treaty in December 2009).

National noise control legislation has been transposed in a way that is coherent with the END, although in the early stages of the Directive's transposition, there were practical challenges in the 13 countries that already had such legislation in place prior to the Directive's adoption to update and ensure consistency with national legislation.

3.1.3. Effectiveness and Impacts

There has been **significant progress in defining a 'common approach'** (Art 1(1)). In particular, the development of common noise assessment methods through CNOSSOS-EU[10] and the replacement of Annex II of the END with Commission Directive (EU) 2015/996 is a major achievement and was acknowledged as such by END stakeholders. The study found evidence that **scientific and technical progress in noise measurement** had been taken into account in the phased development of CNOSSOS-EU (2009-2015). A long timeframe was required, reflecting its technical complexity and the need to allow sufficient time for MS to make the transition from the use of interim and national approaches to common assessment methods.

However, the full implementation of a common approach is dependent on the implementation of Commission Directive (EU) 2015/996 from R4, when SNMs will be produced on a common basis. Population exposure data was found to be not yet fully comparable across EU-28 between rounds. The data should become comparable in future however. In terms of progress towards a common approach in measuring the **harmful effects of noise**, the EC has commenced work to develop assessment methods on dose-response relationships for Annex III. However, finalising Annex III is dependent on the WHO finalising their own guidance on dose-response relationships, expected in 2017.

The late submission of **SNM and population exposure data and of the submission of action plans to the EC** through reporting processes in at least some EU MS in R1 and R2 has undermined the effectiveness of implementation. A lack of timely data and information completeness across EU-28 makes it more difficult to utilise MS submissions, for instance, for the EC, to report on the situation across the EU (Art. 11) and to inform source legislation (Art. 1(2)).

[10] https://ec.europa.eu/jrc/sites/default/files/cnossos-eu%2520jrc%2520reference%2520report_final_on%2520line%2520version_10%2520august%25202012.pdf

In relation to the **second objective,** the research identified evidence that the END has already played an important role in informing the development of source legislation. The END provides a strategic reference point, and has been referred to in the recitals of other EU noise-related legislation and in relevant impact assessments. Source legislation revised in the past three years has made explicit reference to linkages between source legislation and the END. However, exposure data collected through the END has not yet been directly used by EU source policy makers.

The research found that activities relating to the first objective of the END have had a number of **positive impacts**, such as promoting a more strategic approach to environmental noise management, mitigation and reduction through action planning, strengthening the visibility of environmental noise and the adverse health effects of high levels of noise (at receptor) for EU citizens, and increasing policy attention at MS level.

Awareness has been heightened among policy makers not specialising in environmental noise (e.g. transport planning, infrastructure development, urban development and planning) about the importance of building in environmental noise mitigation and abatement from the outset of the legislative development, policy-making and the programme design process, with evidence of more "joined-up" working between different stakeholder organisations that have different roles and responsibilities.

Enforcement was an aspect of END implementation where weaknesses were identified. Although the EC could potentially take action against EU MS for the late submission of legally-required reporting information and data to the EC through infringement procedures, according to MS CAs interviewed in 2015, the EC has not yet done so.

3.1.4. Efficiency

The **administrative costs** of implementing the END were found to have remained stable between rounds in absolute terms with at least €75.8m each spent by 23 EU MS who provided data. When extrapolated to EU28 aggregate level, the total costs would be €80.3m in R1 and €107.4m in R2. Given the increased volume of noise mapping and action planning requirements in R2, which has approximately doubled due to the transition to the definitive END thresholds, this points to a reduction in the costs of procuring external noise mapping services and the absence of one-off regulatory implementation costs (such as familiarisation with the legislative requirements and information obligations) in R2. The median costs per inhabitant (out of the **total population** of 11 EU MS who provided the necessary data) for noise mapping – circa €0.15 – and for action planning - €0.03 – were low. The estimated costs per **affected inhabitant** estimated by acoustics consultancies were €0.50 – €1.00 (noise mapping only) and €1.50 - €2.00 (noise mapping, action planning and the organisation of public consultations, but only in instances where external technical support was procured to assist competent authorities).

Given that END implementation costs are borne by public administration, and ultimately by the taxpayers in each country, it seems more appropriate to use the competent authority data of €0.15 and €0.03 figures as a benchmark for the administrative costs of END implementation, since this applies to the total population, not only the exposed population. However, even the estimate of €1.50-€2.00 per affected inhabitant shows that when looking at the affected population in isolation, the administrative costs were found to be proportionate relative to the benefits (for a quantitative assessment of benefits, see CBA below, for a qualitative assessment, see effectiveness section in main report).

A **cost-benefit analysis (CBA)** was conducted to quantify (in monetary terms) the cost-effectiveness of the END. The benefits are mainly gained by the population affected by excessive noise. It was not possible to quantify some of the strategic benefits of the END, such as its role in stimulating awareness of noise as an issue, facilitating the generation of large and consistent spatial datasets on noise exposure and supporting actions in other areas (e.g. development of technical standards). The CBA is therefore based primarily on an assessment of the contribution made by measures identified in R1 NAPs to reducing exposure to harmful levels of noise.

The analysis revealed that the END has made a positive contribution to reducing population exposure to high levels of environmental noise. Whilst the **magnitude of costs and benefits** of noise mitigation measures was found to vary between countries and sources, a positive cost-benefit relationship was identified under a range of scenarios, where the scenarios reflect both differences in the underlying assumptions regarding the extent to which costs and benefits can be attributed to the END and the range of uncertainty in relation to the value of impacts on human health. The base case scenario results in a favourable cost-benefit ratio (of 1:29) overall, although the ratios vary substantially between measures. The benefits are likely to be understated, since the analysis only considered the effects of noise reduction on the 'highly annoyed' and 'highly sleep disturbed' populations. It should be noted that whilst the CBA is an important element of assessing efficiency, measure-level data only provides a proxy, since NAP measure implementation is not compulsory and does not take into account the strategic, qualitative benefits of the END (see impacts under "effectiveness").

The END has already made a **positive contribution to reducing noise through the implementation of (voluntary) measures in NAPs** that have either been fully or partially implemented. These estimates suggest that the benefits from efforts to reduce noise from all sources across the EU-28 are substantial, even if only a proportion of the total benefits can be attributed to the END (since other policy drivers can explain why some measures not directly targeting noise reduction go ahead e.g. air quality, planned transport infrastructure development). Less positively, fewer R1 measures went ahead than expected due to the global economic and financial crisis, which affected the budget available for noise mitigation in many EU MS.

The END Reporting Mechanism ("ENDRM") was found to be **generally efficient in collecting SNMs (and population exposure data) and NAPs from EU MS** since competent authorities that are members of EIONET can already access Reportnet for broader environmental reporting purposes. However, there is scope to simplify reporting processes and to make Reportnet more user-friendly for national competent authorities and the ease of data extraction at EU level could be improved. Further clarification is also needed as to which types of data within, and outside agglomerations should be submitted under each source, since presently, there are some areas where the lack of clarity as to what information is meant to be reported could lead to inconsistencies in data comparability.

3.1.5. European Added Value ("EAV")

Overall, the END demonstrates strong EAV, by providing an **EU-wide regulatory framework to collect noise mapping data on population exposure on environmental noise at receptor on a common basis**. There was found to be a clear EAV for EU policy makers responsible for source legislation since they need complete and comparable population exposure data at EU level to inform the development of source legislation. The END has also added value through the collection of population exposure data across EU-28 so as to better monitor and assess the impact of environmental noise at receptor on health (previously, at national level, population exposure data was not generally available to the public).

The research identified differences among END stakeholders in perceptions of EAV between EU MS where national legislation on noise was already in place prior to the END (13), and MS where there was previously no legislative framework (15). In MS without any prior environmental noise legislation, the END has helped to enhance the visibility of environmental noise domestically and has made environmental noise issues more prominent in national policy-making and made noise mitigation more visible in national and regional public expenditure programmes (e.g. road building and transport infrastructure development, urban planning and land use). Where national legislation on noise was already in place prior to the END, there was still perceived to be strong added value, since it was recognised that a European approach had facilitated data collection across the EU and promoted the exchange of experiences and benchmarking.

Putting in place a five-yearly noise action planning process through the END has added value by **promoting a more strategic approach to environmental noise management and mitigation** across the EU than existed previously in most countries, including those that already had a national regulatory framework. MS were positive about the usefulness of action planning and appreciated the considerable flexibility in national implementation approaches that the END allows, reflecting subsidiarity. Even though END stakeholders recognised that there are still various ways in which the END might be improved in future, they were strongly against the "counterfactual scenario" of the Directive's possible repeal, examined in the context of the Fitness Check.

3.1.6. Overall conclusions

The evaluation has involved a detailed assessment of key evaluation issues relating to the END's implementation to date. The conclusions are that:

- The END is fit for purpose overall, although there are a number of ways in which its effectiveness and impacts might be improved in future, as detailed in the "future perspectives" section of the final report.
- The longer-term objective as to what the END is ultimately trying to achieve (reducing the incidence of high levels of environmental noise) across different transport sources needs to be made more explicit.
- The Directive overall and the specific requirements relating to the achievement of the first objective of the END (noise mapping and action planning under Article 1(1)), are widely accepted by stakeholders.
- Whilst significant progress has been made towards the first objective of the END of a "common approach" (under Article 1(1)), especially in respect of the use of common assessment methods, the lack of time availability of a complete reporting information dataset on SNMs and NAPs in both R1 and R2 continues to undermine the END's full and effective implementation.
- Although the use of public consultation is effective in some countries, the role of public consultation could be strengthened in others.
- The lack of EU-level enforcement actions to date to ensure the timely delivery of reporting information in respect of SNMs and NAPs has arguably hindered achieving the END's full impact. However, in the view of the evaluators, launching infringement proceedings may not always be an appropriate mechanism when delays occur, given that national CAs in some EU MS face resource constraints to implement the END, and some stakeholders pointed to cumbersome data entry reporting procedures for submission to the EC.
- Without the existence of the END, there would be less attention to tackling the problem of high levels of environmental noise across EU-28 as a whole, some EU MS would not have introduced any legislation and only minimum numbers of noise maps and population exposure data would have been made publicly available.
- The measure-level assessment has identified positive cost-benefit relationships for investing in noise mitigation, abatement and reduction measures across all transport sources – major railways, major roads and airports.
- Overall, the END was found to be cost-effective, although its full potential has not yet been reached, but this will be strengthened once the data is fully comparable, and is being actively used by EU policy makers responsible for source legislation.

1. INTRODUCTION AND BACKGROUND

This introductory section sets out the study objectives and scope of the second implementation review and evaluation of the Environmental Noise Directive (the "END"). It summarises the baseline situation in respect of the problem of high levels of environmental noise in the EU, and considers the scale of the problem by transport source.

The competences of the Member States ("MS") and the EU in END implementation are then considered. The Directive's objectives and the implementation context are then summarised. It should be noted that the methodology adopted is described in Section 2.2 (second implementation review) and Section 3.1.3 (evaluation).

1.1 Study objectives

The study objectives are, in summary, to:

- Carry out the second implementation review of Directive 2002/49/EC relating to the assessment and management of environmental noise ("the END"); and
- Undertake an evaluation of the Directive within the framework of the European Commission's Regulatory Fitness and Performance programme (REFIT)[11].

Section 2 of this report provides an assessment of the findings from the second implementation review. Section 3 sets out the evaluation findings grouped around the five key evaluation issues that are central in all REFIT evaluation studies, namely the *relevance, effectiveness, efficiency, coherence* and *EU added value* of the END. In accordance with a REFIT evaluation carried out in the context of the wider Better Regulation agenda, *fitness for purpose* was an important issue considered across all the evaluation issues.

Given the complex and technical nature of the END and its implementation, the evaluation has characteristics of an interim evaluation. For instance, progress towards a "common approach" to noise measurement through the development of common noise assessment methods (Annex II) and progress towards the development of common EU level dose-response relationships, which is transport source-specific, requires considerable technical work, with a need to take into account scientific progress and technical 'state of the art'. Further details of the progress made to date and the long-term nature of the achievement of a common approach is set out in Section 3.2.3 under the effectiveness criterion.

1.2 Study scope and Steering

Since an implementation report is required once every five years under Art. 11 of the Directive, the time scope of the **second implementation review** of the END focuses on the second round of noise mapping and action planning (2012-2017). However, in order to assess differences between Rounds 1 and 2, the implementation review also provides an overall assessment of administrative and legal implementation to date.

The purpose is to identify the extent to which implementation challenges and problems identified in R1 have been addressed, or remain in R2. The **evaluation scope** covers the period since the Directive's adoption until November 2015. In terms of the time cut-off for different aspects of the data analysis:

- Data completeness in respect of action plans – November 2015

[11] http://ec.europa.eu/smart-regulation/refit/index_en.htm

- Data completeness in respect of noise maps – 30 June 2015, the cut-off date the EEA used for their latest update.
- Administrative cost data – received from EU MS up to November 2015.
- Written contributions to the working papers prepared for the validation workshop were also received into November 2015.

A Steering Group ("SG") was established by the European Commission ("EC") so as to guide the evaluation process and provide expert technical feedback on key deliverables. This was comprised of representatives from a number of Directorate Generals, namely ENV (F1 and F3), GROW, RTD and MOVE. The Secretariat General also participated, reflecting its central role in promoting Better Regulation through the REFIT programme. The EC's Joint Research Centre (JRC), which played an important technical role in the END's development (although it now only has an observer role), was also represented.

1.3 The problem of environmental noise in Europe

1.3.1 Overview and current situation

High levels of environmental noise (defined as noise levels above 55dB L_{den} and 50dB L_{night}), are a significant environmental health problem across the EU. The EEA's 2014 **Noise in Europe Report**[12] notes that a majority of Europeans living in major urban areas are exposed to high levels of noise, particularly traffic noise, and that adverse health effects frequently occur, particularly due to noise at night. The report states that population exposure due to environmental noise is a major health problem in Europe which "causes at least 10000 cases of premature death in Europe each year, with almost 20 million adults annoyed and a further 8 million suffering from sleep disturbance due to environmental noise". It also notes that noise pollution causes 43000 hospital admissions in Europe per year.

The **7th Environment Action Programme (7th EAP)**[13] provides an overarching policy framework for European environment policy until 2020 and sets out a long-term vision for 2050. Priority Objective 3 addresses challenges to 'human health and wellbeing', such as air and water pollution and **excessive noise.** Priority Objective 8 – 'Sustainable Cities' notes that "Europe is densely populated and 80 % of its citizens are likely to live in or near a city by 2020. Cities often share a common set of problems such as [*inter alia]* poor air quality and **high levels of noise".**

In order to safeguard the Union's citizens from environment-related pressures and risks to health and well-being, the 7th EAP aims to ensure that by 2020 noise pollution in the Union has significantly decreased, moving closer to the WHO recommended levels. It notes that this implies "implementing an updated Union noise policy aligned with the latest scientific knowledge, and measures to reduce noise at source, including improvements in city design".

The 7th EAP notes the important role of complementary EU legislation and policy initiatives in helping to reduce noise emissions, namely the Industrial Emissions Directive (IED) and the Roadmap to a Single European Transport Area. The earlier 6th EAP is also worth mentioning, since it specifically emphasised the concept of a knowledge-based approach to policy-making through the adoption of the END to strengthen understanding of the significant impacts on, and the risks to human health of environmental noise.

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[12] Noise in Europe 2014 Report, EEA, 2014
[13] http://ec.europa.eu/environment/action-programme/

1.3.2 The adverse health effects of environmental noise

The three adverse effects of environmental noise within the scope of this study in terms of health end-points are: (1) Sleep disturbance (2) Annoyance and (3) Cardiovascular disease. The cost-benefit assessment ("CBA") set out in Section 3.2.5 of this report (by January 15th) considers these three health data end-points, where there is information available in the existing WHO guidelines[14] on dose-response relationships. The WHO guidelines are currently under revision and are expected to be issued in late 2016. Whilst other potential effects of environmental noise have been identified, such as tinnitus and cognitive impairment, the evidence supporting their inclusion is not yet robust enough (at least for tinnitus). The report therefore only considers the health endpoints as identified by the WHO.

The WHO's current 2009 guidelines[15] on night noise in Europe examine the negative effects on human health and well-being. The guidelines provide estimates of the adverse health effects of exposure to night-time noise, examine dose–effect relations and present interim guideline values for exposure. In 2011, the WHO also estimated the health effects of high levels of noise in Europe[16]. According to the WHO, a Disability-Adjusted Life Years (DALY) represents one lost year of "healthy" life. "The sum of these DALYs across the population, or the burden of disease, can be thought of as a measurement of the gap between current health status and an ideal health situation where the entire population lives to an advanced age, free of disease and disability"[17].

Using conservative assumptions, the guidelines estimated that the number of DALYs lost from environmental noise are 61,000 years for ischaemic heart disease, 45,000 years for cognitive impairment of children, 903,000 years for sleep disturbance, 22,000 years for tinnitus and 654,000 years for annoyance in EU MS. These results indicate that at least one million healthy life years are lost every year from traffic-related noise in Western Europe alone. Sleep disturbance and annoyance, mostly related to road traffic noise, are among the main burdens of environmental noise.

1.4 The objectives of Directive 2002/49/EC and implementing actions

The END was adopted on 25 June 2002 and came into force on 18 July 2002. It is the legislative tool for the assessment and management of environmental noise[18] at receptor. The END has two objectives, namely:

- Art. 1(1) - Achieve a **common European approach** to **avoid, prevent or reduce** the effects of exposure to environmental noise harmful for health, which includes annoyance; and
- Art. 1(2) – to provide a basis for developing **Community measures to reduce noise emitted by major sources,** in particular road and rail vehicles and infrastructure, aircraft, outdoor and industrial equipment and mobile machinery.

[14] http://www.euro.who.int/en/health-topics/environment-and-health/noise

[15] Night noise guidelines for Europe, WHO European Centre for Environment and Health, 2009 - http://www.euro.who.int/__data/assets/pdf_file/0017/43316/E92845.pdf

[16] The burden of disease from environmental noise through the quantification of healthy life years lost in Europe, WHO, 2011 - http://www.euro.who.int/__data/assets/pdf_file/0008/136466/e94888.pdf

[17] http://www.who.int/healthinfo/global_burden_disease/metrics_daly/en/

[18] In the END, environmental noise is defined as being unwanted or harmful outdoor sound created by human activities, including noise emitted by means of transport, road traffic, rail traffic, air traffic and from sites of industrial activity.

The first objective of the END is being implemented through a five yearly cycle which consists of three main actions (as described in Art. 1(1) a-c):

- **Action A - the development of Strategic Noise Maps (SNMs)** for all major roads, major railways, airports, and agglomerations of >100,000 inhabitants. Within agglomerations, roads, railways, airports and industrial installations are mapped. These provide five-yearly updates on the extent of population exposure by 5dB threshold;
- **Action B – information accessibility.** Ensuring that information on environmental noise and its effects is made available to the public; and
- **Action C – the preparation of Noise Action Plans (NAPs)** for noise management for all major roads, major railways and airports, as well as agglomerations.

For both mapping and action planning, according to the timetable outlined below, reporting in respect of the 2nd round should theoretically have been completed by now (although action plan and measure implementation should continue until the new Round 3). MS have recently (summer 2015) reported lists of entities for which they will need to do mapping and action planning in Round 3. The implementation of measures in action plans is halfway through the second round.

A summary is provided in the table on the following page as to the timing of R1 and R2 implementation (hereafter Round is abbreviated to "R" e.g. R1 and R2 etc.). In addition, the planned future timings of R3 and R4 are indicated.

Table 1.1 Summary of the timing of END implementation

Round and timing of 5 year cycle	Timing of submission of Strategic Noise Maps	Timing of submission of Noise Action Plans	Notes
Round 1 2007-2012	30 June 2007	18 July 2008	Delays encountered in some MS in submission of SNMs and NAPs
Round 2 2012 - 2017	30 June 2012	18 July 2013	Delays encountered in some MS in the submission of SNMs and NAPs.
Round 3 – 2017-2022	30 June 2017	18 July 2018	Use of CNOSSOS-EU methodology for noise mapping voluntary
Round 4 2022 - 2027	30 June 2022	18 July 2023	Use of CNOSSOS-EU methodology for noise mapping mandatory

It should be noted that in addition to these deadlines or data collection cut-off points, the EEA updates the Noise Viewer at regular intervals – the latest updates were made on the 28th of August 2013 (summarised in the EEA Report "Noise in Europe 2014"), 10th June 2014, and 30th June 2015. Those data have informed this study

1.5 The competences of the Member States and the EU in END implementation

1.5.1 The competences of the Member States

The END is implemented under the subsidiarity principle since the EU MS have competence for the management of environmental noise at receptor. This reflects the fact that taking action to mitigate environmental noise is an issue best tackled at local level. Recital 7 of the END points out that *"the Treaty objectives of achieving a* **high level of protection of the environment and health** *will be better reached by complementing the action of Member States by a Community action to achieve a common understanding of the noise problem.*

Data about environmental noise levels should therefore be collected, collated or reported in accordance with comparable criteria. This implies the use of harmonised indicators and evaluation methods, as well as criteria for the alignment of noise-mapping. Such criteria and methods can best be established by the Community".

Strategic noise mapping has initially been carried out on the basis of the national and interim methods (as set out in Annex II of the END), but in future will be based on common assessment methods developed at EU level through the CNOSSOS-EU process, and set out in Commission Directive (EU) 2015/996. Detailed noise mapping activities and noise action planning are carried out at MS level. Although there is no mandatory requirement to implement measures, Noise Action Plans (NAPs) should identify appropriate noise abatement, mitigation and reduction measures.

The preparation of NAPs (and their implementation) is also under the responsibility of Competent Authorities ("CAs") at national, regional and local levels. Under Art. 4 (Implementation and responsibilities), MS are required to designate at appropriate levels the CAs and bodies that are responsible for implementing the END, including the authorities responsible for: (a) making and, where relevant, approving Strategic Noise Maps ("SNMs") and NAPs for agglomerations, major roads, major railways and major airports; and (b) collecting noise maps and action plans.

1.5.2 The role of the European Commission in END implementation

The EC plays an important role in supporting END implementation, both in respect of the achievement of the first and second objectives of the END. In summary, its role can be summarised as follows:

- **Coordination –** the EU plays an overall coordination role in the Directive's implementation over a five year cycle;
- **Monitoring and reporting**
    - Reporting data and information has to be submitted by the Member States to the EC in respect of SNMs on population exposure by round and also summaries of NAPs.
    - The EEA then makes population exposure data available via the Noise Viewer and reports back to the EC on the extent to which SNMs comply with the END's requirements[19].
    - The EC has a number of monitoring and reporting responsibilities relating to the END, specifically through Art. 11 - Review and reporting. The EC is supported in carrying out these tasks by the EEA.
        - Art. 11(1) the EC has to submit a report on the Directive's

[19] http://noise.eionet.europa.eu/viewer.html

implementation every five years.

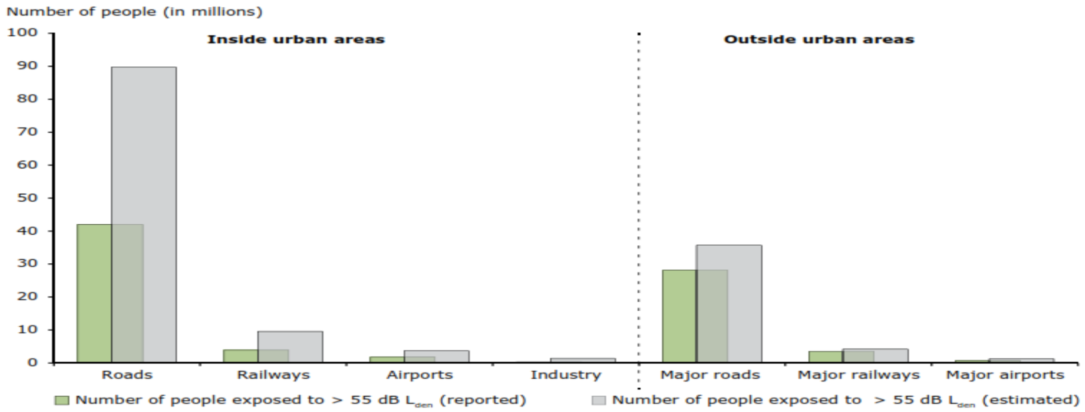
– Art 11(3) - an EU level report has to be produced to include a review of the acoustic environment quality in the EU based on the data referred to in Art. 10. This shall take account of scientific and technical progress and any other relevant information.

- **Informing the development of EU noise at source legislation**[20] – under Art. 1(2), the EEA supports the EC in collecting EU-wide data on population exposure data at receptor. This in turn supports EU decision makers by providing a more informed basis on which to review existing, and develop new source legislation.
- **The development of common noise assessment methods**, with support from the JRC, over a 10 year period in the form of a new assessment methodology relating to the revisions to Annex II of the END. The EC proposed a new draft Annex II, which was adopted by MS through Comitology and led to the adoption of a new Directive in 2015[21] to replace Annex II. The process was supported by technical working groups comprised of MS representatives.
- **The development of a common approach to Noise Assessment Methods for Harmful Effects (Annex III)** so as to be able to better measure the health effects of high levels of noise.

1.6 Noise at receptor by transport source

In order to assess progress to date in the Directive's implementation and its achievements against objectives, it is important to provide an overview of the current situation in respect of levels of population exposure to environmental noise and the extent to which different transport modes contribute to the problem, since this varies considerably between sources. It should be noted that different sources of transport noise at receptor have differing exposure-response relationships. Such contextual information is useful when assessing how the END has contributed to addressing the problem of high levels of noise across different sources, and also the most appropriate combination of measures to tackle noise at receptor and at source. Before addressing each of the transport sources addressed through the END separately, the Figure on the following page taken from the EEA Noise in Europe Report 2014 illustrates the different level of noise exposure by noise source

Figure 1.1 Number of people exposed to noise in Europe > 55 dB L_{den} in EEA member countries (2012): reported and estimated data



Source: EEA Noise in Europe Report 2014.

[20] http://ec.europa.eu/environment/noise/sources_en.htm

[21] DIRECTIVE (EU) 2015/996 of 19 May 2015 establishing common noise assessment methods according to Directive 2002/49/EC

The data shows that road traffic noise is the most significant problem in terms of the number of people exposed, followed by noise from railways. Noise from airports and industry affects less people overall, but for some health end-points, the level of annoyance may on average be higher. For instance, the WHO report referred to above states that "at the same average noise level, aircraft noise tends to be more annoying and conventional railway noise less annoying than road traffic noise". This raises the issue of differences between sources of perceptions of noise rather than the number of people exposed measured through noise mapping. Different studies have also identified differences between sources in respect of other health end-points.

For instance, in the recently published NORAH study[22] in the Rhine-Main Region, it has been observed that railway noise may be especially problematic for cardiovascular diseases. Each of the main transport sources addressed through the END are now examined.

1.6.1 Noise from major roads

The END applies to **major roads.** The main sources of traffic noise are noise from noisy road surfaces, tyre rolling noise and aerodynamic noise from vehicles.

The EEA's 2014 Noise in Europe Report notes that road traffic noise is the most significant source of transport noise "with an estimated 125 million people affected by noise levels greater than 55 decibels (dB) L_{den} (day-evening-night level)" across the 33 EEA member countries (which includes all 28 EU Member States. WHO guidance[23] confirms that road traffic noise is the principal source of environmental noise.

According to the WHO[24], "results from epidemiological studies performed in past few years consistently indicate significant increases in the risk of myocardial infarction and elevated blood pressures among the population exposed to road or aircraft traffic noise". The WHO also notes in the same study that "one in three individuals is annoyed during the daytime and one in five has disturbed sleep at night because of traffic noise".

A report[25] by CE Delft in the Netherlands has sought to assess the health effects and social costs of environmental noise. Among the findings were that traffic noise is especially harmful to vulnerable groups, such as children, the elderly and the poor, who are disproportionately affected, being more likely than average to live in close proximity to major roads. The study also found that in the 22 countries covered by the research, the social costs of traffic noise were estimated at over EUR 40 billion a year. The study estimated that "road and rail traffic noise are responsible for around 50,000 premature deaths per year in Europe".

Among the most common measures identified to reduce, abate and mitigate road traffic noise at receptor are: traffic calming measures, speed reductions and the installation of noise barriers. However, literature on the potential impact of different measures suggests that technical measures to reduce noise emissions at source from vehicles and tyres and laying quiet road surfaces have the potential to bring about the greatest reduction in noise.

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[22] http://www.laermstudie.de/fileadmin/files/Laermstudie/NORAH_Knowledge-14.pdf, pg. 8

[23] Burden of disease from environmental noise (quantification of healthy life years lost in Europe), WHO/JRC, 2011

[24] Burden of disease from environmental noise: Report on WG meeting, 14–15 October 2010

[25] Traffic noise reduction in Europe - Health effects, social costs and technical and policy options to reduce road and rail traffic noise, CE Delft, the Netherlands, 2007, Eelco den Boer, Arno Schroten.

1.6.2 Noise from major railways

The END also applies to **major railways.** The dominant source of railway noise is rolling noise from rail freight wagons. In addition, other types of noise include power equipment noise and aerodynamic noise. Data on population exposure collected through the END indicates that railways are the second greatest source of noise at receptor. This is confirmed in wider literature. For instance, according to a 2012 study for the EP[26], 12 million EU inhabitants are affected by railway noise during the day and 9 million during the night.

The situation varies significantly across different EU countries, since in some countries, there is a growing trend towards building residential housing ever closer to railways, due to lack of affordable housing and population growth. The study for the EP on railway noise found that the problem of railway noise is geographically "concentrated in central Europe, where the majority of the affected citizens live and the volume of rail freight transport is highest (primarily Germany, Italy and Switzerland, but traffic density is high also in Poland, Austria, the Netherlands and France, and noise mapping indicates that significant population is affected in Belgium and Luxembourg)".

In contrast with other sources addressed through the END, it can be noted that measures to tackle railway noise through abatement strategies often focus on tackling noise at source rather than at receptor since these are acknowledged as being most effective in tackling the core problem of rolling noise from trains and rolling stock.

Among the most common measures to tackle railway noise at source are the replacement of cast iron by composite brake blocks on rail freight cars to reduce rolling railway noise. The development of "European Railway Technical Specifications for Interoperability (TSIs)" which is formally part of an ongoing process of standardisation across Europe's railways, is equally concerned with noise reduction and mitigation. The main focus of mitigation measures has been on reducing noise levels for existing rolling stock[27], recently extended to include new rolling stock.

There has been tangible progress in reducing noise at source in the railways sector. For instance, according to the study carried out for the EP mentioned above, *"Rolling stock introduced from the year 2000 is about 10 dB(A) less noisy then rolling stock from the 1960s and 1970s".* However, the problem of population exposure at receptor remains significant, given the issue mentioned above of increased numbers of residential housing being built in close proximity to railways.

1.6.3 Noise from airports

Airports with more than 50,000 aircraft movements per annum fall within the scope of the END. **Aircraft noise** arises in close proximity to airports (i.e. take-off and landing) and along flight corridors within a certain radius of an airport when aircraft fly at lower altitude. Whilst airport noise is a significant problem for citizens living in residential areas either in proximity to major airports, or directly under the flight path, data shows that the number of persons exposed is comparatively fewer than for either roads or railways.

In assessing the impact of the END on airport noise, it is important to take into account the fact that there is broader relevant EU and national legislation to manage aircraft noise and noise at airports. At EU level, Directive 2002/30 concerning noise-related operating restrictions at EU airports was introduced, implementing the International

[26] Reducing Railway Noise Pollution, Policy Dept. B: Structural and Cohesion Policies - transport and tourism, Study for the European Parliament, 2012

[27] The new European Railway Technical Specification for Interoperability (TSI) for Noise (TSI Noise), document No. 2011/229/EU (published on April, 4th 2011) defines maximum noise levels for rolling stock [TSI Noise 2011].

Civil Aviation Organization's (ICAO) global agreement to ban older and noisier aircraft and the ICAO "Balanced Approach".

Regulation (EU) No 598/2014[28] replaced the 2002 Directive and reaffirms the principles of the ICAO 'Balanced Approach', which consist of four pillars: (1) reduction of noise at source, (2) land-use planning limiting population encroachment in the vicinity of airports, (3) operational improvements and (4) operating restrictions. The ICAO guidance stresses that (4) should be not as a first resort but after consideration of the three first options.

In addition, community engagement is a horizontal aspect that supports the implementation of the Balanced Approach. Noise at source standards for aircraft are also set by the ICAO and are implemented through EU source legislation, which is complementary to the END.

According to aviation industry sources, approximately a 50% reduction in aircraft noise at source has been achieved in the past 10 years and a 75% reduction compared with the first generation of jet aircraft[29] (equivalent to a 6dB reduction), reflecting investment by manufacturers in R&D to reduce aircraft noise at source through a combination of improvements in aircraft design (e.g. advanced aerodynamics, lighter aircraft etc.) and engine design (e.g. next generation engines). This development has been supported by the increasingly stringent standards for noise at source set by the International Civil Aviation Organization (ICAO), the United Nations' intergovernmental body on aviation, which date back to the 1970s.

In 2013, the ICAO introduced the fourth new noise certification standard in its history, Chapter 14. This set a requirement that new aircraft types should be least seven dB quieter than those built to the previous Chapter 4 standard. The purpose of aircraft noise standards is to ensure that the best noise technology continues to be used on future aircraft types. ICAO estimates that between 1998 and 2004, the number of people exposed to aircraft noise around the world was reduced by 35%[30].Procedural operating efficiencies have also been introduced, such as Continuous Descent Approaches and Continuous Climb Operations, which reduce noise by flying aircraft higher, routing aircraft differently within the airspace and/or optimising the use of engine thrust).

However, the problem of aviation noise close to major airports and under flight paths remains significant, since there has been considerable growth in the number of aircraft movements over the past two decades in many EU countries. In assessing the role of the END at national level, it should be recalled that in many Western EU countries, there are long-established noise regulations to address the problem of aircraft noise to protect residents living in close proximity to airports. In some countries, airports have committed significant expenditure in implementing noise insulation programmes for residents living close to airports. The impact of legislation other than the END in influencing changes in population exposure is taken into account in the cost-benefit assessment (see Section 3.2.3).

1.6.4 Noise within agglomerations

A number of different transport modes (i.e. major rail and major roads, air traffic), as well as industrial noise, are included within the scope of an **agglomeration** under the END.

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[28] Regulation (EU) No 598/2014 on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Union airports within a Balanced Approach.

[29] http://aviationbenefits.org/environmental-efficiency/noise/

[30] http://www.icao.int/environmental-protection/pages/noise.aspx

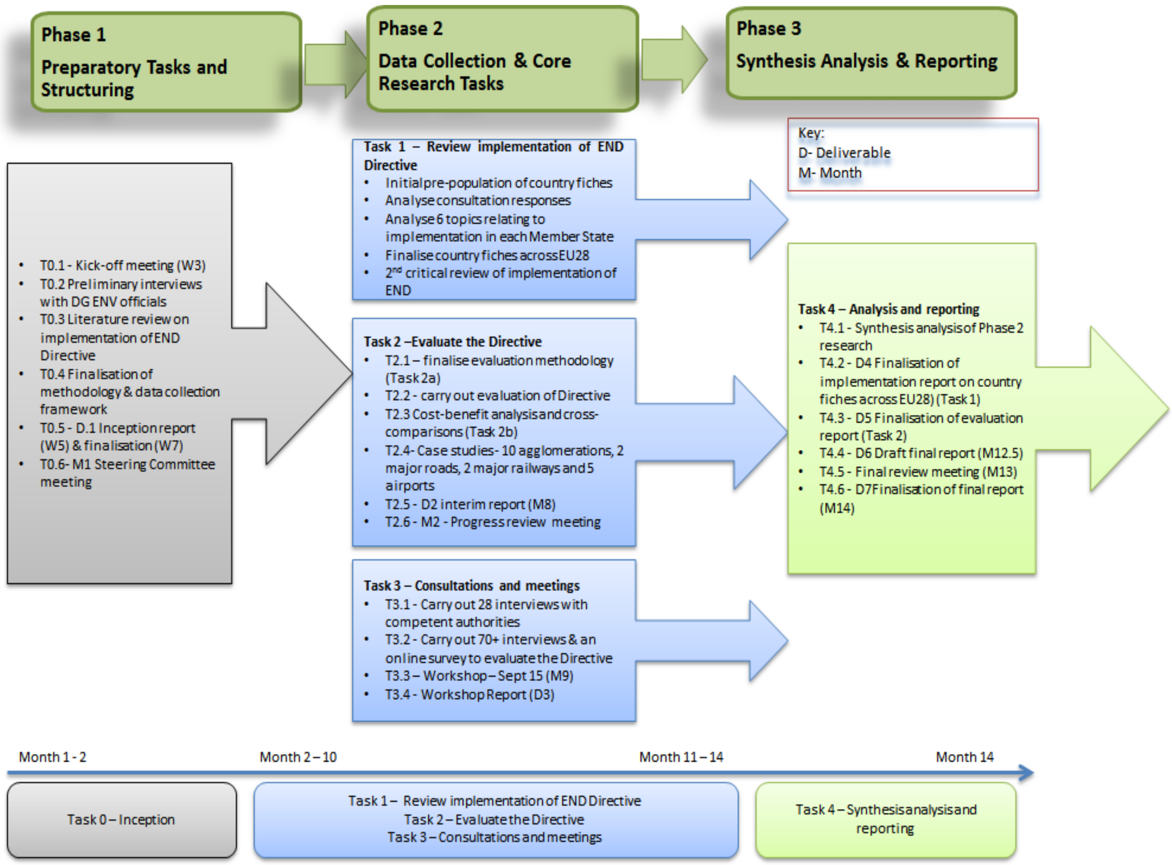
Whereas in R1, a transitional threshold applied to noise mapping and action planning in urban areas with > 250,000 population, in R2 (and also in future rounds), the definitive threshold of >100,000 inhabitants has been applied.

Since agglomerations address a number of different sources of noise, there are a wide variety of different types of measures designed to tackle environmental noise relating to roads, railways and airports. Since people in urban areas are exposed to noise from a number of different sources, the **cumulative effects of noise across different transport issues** are an important issue.

1.7 Overview of methodology

An overview of the methodology adopted to carry out this assignment is now provided. The methodological approach that was adopted is summarised in the following figure:

Figure 1.2 - Work plan overview



The assignment was carried out in three phases:

- **Phase 1 - Structuring phase**. The methodological approach was finalised, the data collection and analytical framework and research tools were prepared (e.g. interview checklists and online survey-based questionnaires);
- **Phase 2 - Core data collection phase.** This consisted of field research and the holding of a validation workshop on September 23rd 2015; and
- **Phase 3 – Analysis and final reporting.** An EU-wide synthesis analysis was carried out of the primary and secondary data collected through the study.

A number of different research methods have been used in order to collect primary and secondary data, as outlined in the following table:

Table 1.2 Research methods for data collection for the second implementation review and the REFIT Evaluation

Data type	Research method & detail
Primary	**Interview programme** with 106 END stakeholders designed to be geographically balanced and to include a representative sample of relevant stakeholders (e.g. CAs, other bodies at national, regional and local level involved in END implementation such as providing input data, NGOs and community organisations and EU industry associations). The interview feedback has been utilised to inform both the implementation review and evaluation. The interviews were facilitated using an interview guide, tailored to the different categories of stakeholders.
Primary	**Online survey -** three online surveys were carried out between March-May 2015 with (i) public authorities (ii) NGOs/ community groups and (iii) consultancies involved in the development of SNM and/ or providing technical assistance to assist in action plan development.
Primary	**Validation workshop** – a workshop was held on September 23rd 2015 to provide feedback on the preliminary evaluation findings. This was attended by 53 END stakeholders (a combination of CAs, industry associations, consultancies, NGOs etc.) and 70 people in total (including representatives from the EC and the contractor). Three working papers (WPs) were distributed in advance and presented at the workshop, namely : • WP1 - the second implementation review of the END. • WP2 – the evaluation of the END. • WP3 - the quantitative case study work and proposed methodological approach to cost-benefit assessment (CBA). Following the workshop, the working papers were published online[31] and non-participants had the opportunity to make comments in writing (20 responses were received from a combination of participants and wider organisations.
Secondary	**Desk research** – a wide range of documentation has been examined at EU and national levels for both the implementation review and evaluation (see Appendix B - bibliography). For the evaluation part, a review of ‘state of the art’ methodologies in relation to monetising the costs and benefits of noise and their health effects was also undertaken to inform the approach to the quantitative case studies and the CBA.

The specific methodology used to carry out (i) the second implementation review and (ii) the evaluation of the END are outlined in further detail in Sections 2 and 3 respectively.

The table below provides an overview of the interviews carried out by type of stakeholder. There inevitably are overlaps between some of the categories, e.g. a competent authority at national level may also be in charge of noise mapping and / or action planning for a specific type of transport infrastructure.

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[31] http://ec.europa.eu/environment/noise/evaluation_en.htm

Table 1.3 – Overview of interviews by stakeholder type (total: 106)[32]

Stakeholder type	Number
Academic experts	4
Civil society organisations	7
Competent authorities (national)	30
Competent authorities (regional)	12
Consultancies	13
EU and international industry associations	8
EC officials (MOVE, GROW, the JRC)	3
Public authorities* (general)	7
Public authorities (agglomeration)	7
Public authorities (rail)	6
Public authorities (roads)	6
Other	3
Total	**106**

*Note * – it should be noted that a distinction is made between CAs designated under Art. 4 of the END, and wider public authorities that are involved in assisting CAs, for instance, in the provision of input data by local authorities to facilitate strategic noise mapping, or the bodies that assist CAs in advising on prioritisation and measure identification.*

In order to ensure that stakeholder organisations not part of the interview programme were also able to provide their views, questionnaires were made available via an **online survey**. In total, 73 valid responses were received from public authorities, 7 from consultancies involved in strategic noise mapping, and 10 from NGOs/community groups. Whereas the responses to the online survey from public authorities were sufficient to allow for a quantitative analysis, the responses from acoustics consultancies and from NGOs/community groups were analysed qualitatively due to the low number of responses.

The feedback received was helpful in the identification of the outstanding challenges in END implementation and in cross-checking and corroborating the findings from the interview programme. It was especially relevant for certain issues covered through the second implementation review, such as whether any problems were encountered in relation to definitions, and the key challenges relating to noise mapping and action planning.

[32] Including written responses received

2. IMPLEMENTATION REVIEW

This section presents the analysis of the research findings of the second implementation review of the END. Following a description of objectives, scope, and methodology of the review, the research findings and conclusions are presented at EU aggregate level.

2.1 Introduction, Objectives and Scope

Art. 11 of the END (Directive 2002/49/EC) requires a review of its implementation to be carried out once every five years. The first implementation review was published in 2011, and covered the 2002-2009 implementation period. This was carried out by an external contractor, which contained an EU-level synthesis assessment and 27 country reports. Based on this study, the European Commission published a Report[33].

The specific approach to the second implementation review is now outlined.

2.1.1 Objectives of the second implementation review

The formal objectives of the second implementation review of the END are to:

- Critically assess the legal and administrative implementation of the Directive and its key provisions across EU-28 and by MS; and to
- Identify the main difficulties experienced by MS and CAs in implementing these key provisions, and highlight best practices showing how implementation can be improved.

The purpose of presenting the evolution in implementation between Rounds 1 and 2 (hereafter "R1" & "R2") is to determine the extent to which key issues, challenges and problems identified by the first legal implementation review during the early stages of the Directive's implementation have remained problematic in R2, and the nature and extent of remedial actions taken to address them.

2.1.2 Implementation mechanisms

In order to achieve the objective of bringing about a common approach "intended to avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to exposure to environmental noise, there are three main actions required from Member States, as defined in Art. 1(1) of the Directive, namely to:

a. Determine the noise exposure of the population through noise mapping;

b. Make information on environmental noise and its effects available to the public;

c. Establish Noise Action Plans based on the results of noise mapping.

The Directive's implementation is therefore centred on the preparation of **Strategic Noise Maps (SNM) and the development of Noise Action Plans (NAP).**

[33] COM (2011) 321 final of 1st June 2011, http://eur-lex.europa.eu/legal-content/EN/TXT/DOC/?uri=CELEX:52011DC0321&from=EN

2.1.3 Scope

The first implementation report covered the initial period of implementation of the END up until 2010. However, this was only mid-way through the first five yearly END implementation cycle, therefore although the second implementation review focuses mainly on R2 implementation, it also covers the latter part of R1. In particular, it examines how the implementation situation has evolved between R1 and R2. Whilst Section 2.3 contains the EU-level synthesis assessment for the second implementation review (supported by EU aggregate data), the 28 country reports developed as part of the full implementation report are provided in a separate, standalone document.

The scope of the second implementation review covers the following six topics:

- Topic 1: Designation of agglomerations, major roads, major railways and major airports;
- Topic 2: Competent authorities and bodies responsible for implementing the Directive, including availability to the public of this information;
- Topic 3: Noise limits and targets and their implementation;
- Topic 4: Definition, delimitation and protection of quiet areas in agglomerations and open country;
- Topic 5: Strategic noise mapping; and
- Topic 6: Noise action planning.

Whilst Topics 1, 2, 4, 5 and 6 directly relate to the implementation of the END, Topic 3 provides an examination of the situation at national level in relation to whether binding or non-binding limit values ("LVs") have been put in place. Although there are no common EU noise limit values in the END, feedback on the interplay between national noise LVs and the effectiveness of END implementation is relevant. For instance, some EU MS use exceedance of LVs as the basis for prioritising measures through action planning. Moreover, at the validation workshop (23rd September 2015), participants expressed interest in sharing benchmarking data on different approaches to setting national limit value across the EU.

2.2 Methodology

2.2.1 Information and data sources

A number of methods and data sources were used in order to carry out the analysis for the second implementation review, such as desk research to analyse relevant data on END implementation, interviews with the nominated national CA in each MS and the validation workshop, which also provided useful feedback on the implementation part. The approach to the different research methods for data gathering and analysis are now examined in further detail.

An **interview programme** was carried out with at least one designated member from the national CA in each MS and with other CAs involved in END implementation. Although CAs provided valuable information, in order to inform the finalisation of the country fiches, it was sometimes necessary to gather supplementary information and to help cross-check the information and data provided. Several complementary interviews were therefore carried out in most MS to obtain further feedback. A number of national road and railway authorities, local and regional authorities and infrastructure operators were interviewed in order to obtain supplementary information on different aspects of implementation at national, regional and local levels.

Following the development of a first draft of each country report, the nominated person from each CA was then asked to clarify any outstanding issues and to provide their formal sign off of the country report.

To supplement the interview programme, and to confirm the preliminary research findings, a **validation workshop** was held on 23rd September 2015 in Brussels with 70 key stakeholders including national CAs. This included a dedicated session covering the findings from this implementation review. Opinions and statements voiced at the workshop are analysed in conjunction with the interview feedback.

An **online survey** was also carried out with different categories of stakeholders. 73 valid questionnaire responses were received from public authorities, 7 from consultancies involved in strategic noise mapping, and 10 from NGOs/community groups and industry associations. The feedback received was helpful for the identification of implementation challenges and subsequently to corroborate the more detailed research findings on implementation that emerged from the interviews. Due to the limited number of responses from consultancies and NGOs/community groups and industry associations, these responses were only analysed in a qualitative manner whereas all aggregate survey findings reported in this and subsequent sections refer to the 73 responses from public authorities.

The online survey was especially relevant to allow for a quantitative analysis of certain issues covered through the second implementation review, such as the extent to which implementation issues were encountered by public authorities, the key outstanding challenges relating to noise mapping and action planning and whether measures were taken to address problems identified in the first implementation review.

28 country reports have been developed to inform the carrying out of an EU-level aggregate analysis of the situation in respect of END implementation. The country reports focus on updating the earlier country reports to highlight any changes that have emerged in the past five years of implementation. They also compare how the situation has evolved between R1 and R2.

The following tools and sources were used to inform the development of country reports:

- The first implementation review from 2010-2011 and the 27 country reports developed to support this review. These however only covered the initial period of R1 implementation (2008-2010) rather than the full five-year cycle;
- National guidelines on Strategic Noise Mapping and Noise Action Planning;
- National legislative texts;
- Any evaluation or similar materials that highlight the lessons learned from R1 implementation; and.
- Verification and supplementary interviews with national CAs as described above.

As part of the data collection exercise for the country reports, data was received from national authorities on:

- Strategic Noise Maps ("SNMs") – overall numbers (received for 28 MS), methodologies and public consultations (received for 21 MS).
- Noise Action Plans ("NAPs") – overall numbers (received for 25 MS), methodologies (received for 18 MS), measures (received for 19 MS), and public consultations (received for 18 MS).

The country reports also include an analysis of issues at subnational level in those MS which have adopted a decentralised approach to implementing the END (also see Section 3). In addition, and to complement the country reports, the following data sources were utilised:

- Data from the EEA's Noise in Europe report, 2014[34]
- EEA data on SNMs, where the most recent data cut-off was 30th June 2015[35];
- Data on the number of NAPs available through the EIONET database and individual country reports (cross-checked and updated during interviews);
- Data provided by national CAs on the number of SNMs and NAPs completed and submitted to the EC, respectively (see 2.2.2 below).

2.2.2 Data on reporting completeness

Data on reporting completeness was obtained from the EEA on SNMs and from the EC on NAPs. The purpose was to analyse the extent to which Member States have reported the information that they were meant to report in respect of R1 and R2 implementation. In particular, the following data sources are analysed in this report:

- Data completeness in respect of the SNMs – data provided by the EEA on the percentage of SNMs that have been submitted by EU MS to the EC in respect of R1 and R2 compared with what was meant to be submitted.
- Data on the number of NAPs submitted to the EC through EIONET. This data has a few caveats: (1) they focus on R2 only; (2) the database on reporting completeness does not distinguish in the 'not submitted' category between NAPs that are available in draft at MS level and those that are still undergoing public consultation and (3) data for agglomerations, roads and railways could not yet be assessed for completeness for France; data for roads and railways not for Germany. No data is available for Greece.

Data reported by the EU MS to the EC has been analysed to assess its completeness because this sheds light on whether MS are complying with the requirement in Art. 10 (*Collection and publication of data by MS and the EC*) to submit reporting data within six months of the dates laid down in Art. 7 and 8 of the END, respectively. In turn, this has helped to check the state of play in implementation and to identify any specific implementation problems remaining now that the definitive, rather than the transitional END thresholds foreseen in the Directive have been implemented in R2. The data and information provided on the extent of completeness of reporting data on SNMs and NAPs has also been useful for assessing how far the EC's reporting responsibilities under Art. 11 have been impeded by the late submission by some MS in both R1 and R2 of reporting data.

In addition, in order to cross-check the data, the study team has collected data on the number of SNMs and NAPs submitted to the EC / EEA at MS level. This was collected through a bottom-up data collection exercise by contacting the CAs as part of the preparation of country reports. In the case of agglomerations, major roads and major railways, data was also collected on the change in the volume of mapping between R1 and R2 due to the transition to the definitive END thresholds. This useful contextual information is provided in the country reports.

[34] http://www.eea.europa.eu/publications/noise-in-europe-2014

[35] The most recently available R2 data is from 30th June 2015 - http://forum.eionet.europa.eu/etc-sia-consortium/library/noise_database/end_df4_df8_results_2012_150630

It was pointed out by various stakeholders during the research that comparing the total *number* of SNMs and NAPs between Rounds and MS may not be meaningful because very different implementation approaches have been adopted in different MS, reflecting the subsidiarity principle. For instance, a single noise map may be prepared for a whole agglomeration in some MS, whilst in others, multiple SNMs may be prepared for a similar sized agglomeration. Similarly, in the case of major roads and major railways, data on the total number of kilometres that have been mapped and crucially how this has evolved between R1 and R2 is more useful than the number of SNMs produced.

Under subsidiarity, some MS have implemented the END on a centralised, whereas others have implemented the Directive on a decentralised basis. There are also MS where a combination of centralised and decentralised approaches has been adopted, depending on the source. Some countries may have defined the entire major roads network as a single map whereas others may produce many different noise maps specific to particular stretches of road. Therefore, the number of SNMs and NAPs will vary widely. In MS where a centralised approach has been adopted, there are considerably fewer SNMs (and sometimes also NAPs), but for instance a single SNM may cover a very large area and the maps may be used to inform a number of different NAPs.

2.2.3 Scale and scope of END implementation

The definitive thresholds envisaged for the END are set out in Art. 3 (definitions). However, the EU legislators foresaw a 2-stage implementation of the Directive, with an evolution in thresholds for when an entity falls within the scope of the END between R1 of implementation in 2007-2012 (the transitional phase) and R2 and subsequent rounds (the definitive phase of implementation), as outlined in the table below.

Table 2.1 – Applicability of the Environmental Noise Directive in R1 and R2

Type of entity	Round 1 (2007-2012)	Round 2 (2013-2018) and thresholds for subsequent rounds
Agglomerations	> 250,000 inhabitants	> 100,000 inhabitants
Major airports	Civil airport, designated by the Member State, which has > 50,000 movements per year (a movement being a take-off or a landing)	Civil airport, designated by the Member State, which has > 50,000 movements per year (a movement being a take-off or a landing)
Major roads	> 6 million vehicle passages a year	> 3 million vehicle passages a year
Major railways	> 60,000 train passages per year	> 30,000 train passages per year

Source: CSES review of END legal text.

A key issue examined later in this section is how far the change from the transitional to the definitive thresholds between R1 and R2 has impacted implementation.

2.2.4 Introduction – the role of a clustering approach in the analysis

It is difficult to generalise and group countries together because many different implementation approaches have been adopted across EU-28, reflecting the non-prescriptive approach under the END, which is implemented under subsidiarity. It is nevertheless helpful to analyse the findings based on a **clustering approach that groups together different Member States that share similar characteristics**, such as whether environmental noise legislation was in place prior to the END's adoption or not, the administrative level (e.g. national, regional, local) the national CA has chosen to implement the key actions required under the END, etc.

Given the complexity of the END and the wide differences in implementation between EU countries, rather than grouping countries together based on one variable alone, three different aspects of implementation are instead focused on. This should facilitate an examination as to whether particular trends can be observed or general observations reached about groups of countries. Examples are provided as to the different clustering approaches that might be applied in the following table:

Table 2.2 - Clustering groups of countries to structure the analysis – key parameters

Clustering approach	Description
1 - Clustering by approach to END implementation	A contrast can be made between centralised and decentralised approaches or approaches combining elements of both. Within decentralised countries, a further distinction can be made between regionalised, federalised and localised approaches.
2 – Environmental noise legislation in place prior to the END (or not)	Clustering according to whether particular EU MS had national environmental noise legislation in place prior to the END. 13 EU countries already had noise legislation prior to the END whilst 15 EU countries had no environmental noise legislation in place at national level prior to the END. With respect to those countries that already had such legislation, further sub-groupings could be made depending on the length of time that legislation to tackle noise was in place prior to the END e.g. <5 years, <10 years, 10-20 years, >20 years, etc.
3 – Clustering by approach to the implementation of NAPs and the type of noise mitigation, abatement and reduction measures identified in NAPs	There are both differences and commonalities between different EU countries in terms of the types of measures that are most frequently implemented. Countries could be grouped together based on the five most common measure types.

In Section 2.3, some implementation issues have been analysed in a way that takes into account the above analytical framework for grouping countries together wherever similarities (or conversely major differences) in approach have been identified.

In addition, where applicable, further correlations have been established between variables in order to identify any relevant trends and patterns. For instance, the extent to which there are common factors that might explain why some MS have submitted reporting information relating to SNMs and NAPs with a major delay, such as the type of implementation approach.

2.3 EU-level synthesis findings

2.3.1 Legislative transposition

Art. 14 of the END requires "Member States [… to] bring into force the laws, regulations and administrative provisions necessary to comply no later than 18 July 2004". This deadline was extended for those EU MS which joined the EU after this date: (Romania and Bulgaria in 2007 and Croatia (2013)).

The END has been transposed in full in 27 out of 28 EU MS. This represents significant progress compared with the first implementation review, when a number of transposition issues were identified and several MS had not fully transposed the Directive by the due deadline. However, the desk research and interviews suggest that these issues have since been addressed by the MS concerned. In R2, the EC identified that one MS still has shortcomings with regard to the transposition of several END articles, although the MS concerned (Croatia) only acceded to the EU in 2013. A stakeholder in **Latvia** suggested that the recent legislative revisions relating to the transposition of the END mean that the concept of "quiet areas in an agglomeration" is no longer defined in Latvian legislation. However, the relevant CA stated that the concept has been translated more broadly as "quiet area in a populated area", which they stated includes agglomerations.

Given that the Directive has been legally transposed, the main challenges in R2 have largely related to the administrative and organisational challenges of implementing the Directive at national level, and ensuring effective cooperation and coordination rather than relating to legal transposition. However, in a number of MS (**BU, DK, DE, EL, LV, LT, NL, PL** and **RO**), there has been an ongoing process of updating, revising and consolidating national implementing legislation on environmental noise since R1. **Croatia** only acceded to the EU in 2013, and thus did not participate in R1 of END implementation. In **Latvia**, in 2015, there was a legal codification exercise to consolidate all existing legislation on environmental noise into a single legal act, which brings together both the legislation transposing the END and wider legislation relating to environmental noise, such as nuisance noise.

2.3.2 Pre-existing legislation on environmental noise

As part of the assessment of the implementation situation across EU-28, Member States were asked whether they had noise legislation in place prior to the introduction of the END in 2002. The findings suggest that 13 Member States already had noise legislation at the national level before the END was adopted. The MS concerned (in alphabetical order) are: **CZ, DK, DE, EL, FR**, **HU, IE, IT**, **LU, PT**, **SE, SK**[36] and the **UK.** In addition, **Lithuania** had some limit values set for noise during the Soviet period, but no comprehensive legislation.

[36] Guidance, even if not binding legislation

In some cases, existing national legislation was longstanding, such as **Luxembourg** and the **UK,** which have had environmental noise legislation since the 1970s, **Denmark** since the 1980s and then a series of countries in the 1990s, such as **France, Greece, Ireland** and **Italy. Portugal** has had legislation pre-dating the END since 2000. These countries also transposed the END into national legislation, either by developing new legislation or by amending an existing body of regulation.

Nevertheless, these findings suggest that in an estimated **15 Member States, the END was the first piece of national legislation specifically designed to address the problem of (environmental) noise.**

2.3.3 Competent authorities

Art. 4 of the Directive stipulates that "Member States shall designate at the appropriate levels the competent authorities […] for implementing this Directive". The EU MS are therefore responsible for determining what levels of administration are appropriate for carrying out the different actions required under Art. 1a, 1b and 1c of the END. They are also responsible for specifically allocating responsibilities for approving SNMs and NAPs under Art. 4(1a) and for collecting them under Art. 4(1b).

MS have generally assigned an environmental-related Ministry or public agency as the national CA for END-related communication and reporting activities to the EC. In a small number of countries, such as **Lithuania** and the **Slovak Republic**, the national CA has been designated with the Ministry of Health.

It is possible to categorise different EU MS according to the way in which they have organised the preparation of SNMs and NAPs between centralised and decentralised approaches, as shown in the table below.

Table 2.3 – Clustering by overall approach to END implementation.

Approach to END implementation	Member States
Centralised	BG, HR, CY, DK, EE, FI, EL, HU, IE, LT, LV, LU, MT, PL, RO, SE, SI, SK
Combination of centralised and decentralised approaches[37]	AT, CZ, PT[38], ES, FR, UK
Decentralised/regionalised	BE, DE, IT, NL (from 2018, the NL system will become further decentralised)

Source: own research, 28 country reports.

Many MS have adopted a more centralised approach to implementing the END. This includes designating CAs for noise mapping, action planning and other implementation activities at national level, with the exception of agglomerations which generally see at least some involvement of local authorities (with the exception of **Austria** where these are dealt with by regional authorities and the **UK** where these are dealt with either by national ministers or by the authorities responsible for the three transport modes).

[37] A mix of national *and* regional implementing legislation and/ or shared responsibilities for END implementation between the national, regional and / or local levels

[38] Nationally centralised implementation with exception of the Azores region who passed independent legislation.

Many small MS such as the **Baltic countries**, **Cyprus**, **Denmark**, **Slovenia**, etc., have adopted a relatively centralised approach but many local municipalities are still involved in mapping and action planning activities in all those countries with a more centralised approach.

The categorisation refers to the *overall* approach, i.e. in countries with a centralised approach, national ministries retain control over the coordination of work for all transport modes, as well as agglomerations even if responsibility for mapping within agglomerations may be delegated to the local municipality. In countries that have elements of both a centralised and a decentralised approach, some END-related competencies have been delegated to the regional level, for instance in **Belgium,** where responsibility for implementing the END lies entirely at regional/subnational level i.e. with the regions of Brussels, Flanders and Wallonia.

The **UK** is an example of a country which combines elements of both a centralised and a decentralised approach. Whilst the Department for Environment, Defra, plays a coordinating role at national level, END implementation overall in the UK also has strong elements of decentralisation, with five different sets of regulations for **England, Wales, Scotland, Northern Ireland** and **Gibraltar** respectively and each country is responsible for producing its own action plans and maps. Therefore, since the Devolved Administrations (DAs) play a lead role in coordinating implementation (with their own set of relevant stakeholders), overall, the implementation system cannot be characterised as centralised.

Within each of the five jurisdictions, implementation is not fully centralised either. In common with other countries, other actors are involved at national and regional level. In **England,** for instance, under Defra's overall coordination, some aspects of implementation, such as noise mapping and action planning, take place at a centralised level, but broader relevant actors at national level also input directly into the process. For instance, in the case of major roads, the Department of Transport and Highways England were involved in the development of a national action plan, and a single major roads NAP was prepared under Defra's coordination. In agglomerations, although the approach is again quite centralised, with Defra playing the lead role, local authorities are involved in the process of the development of SNMs and NAPs.

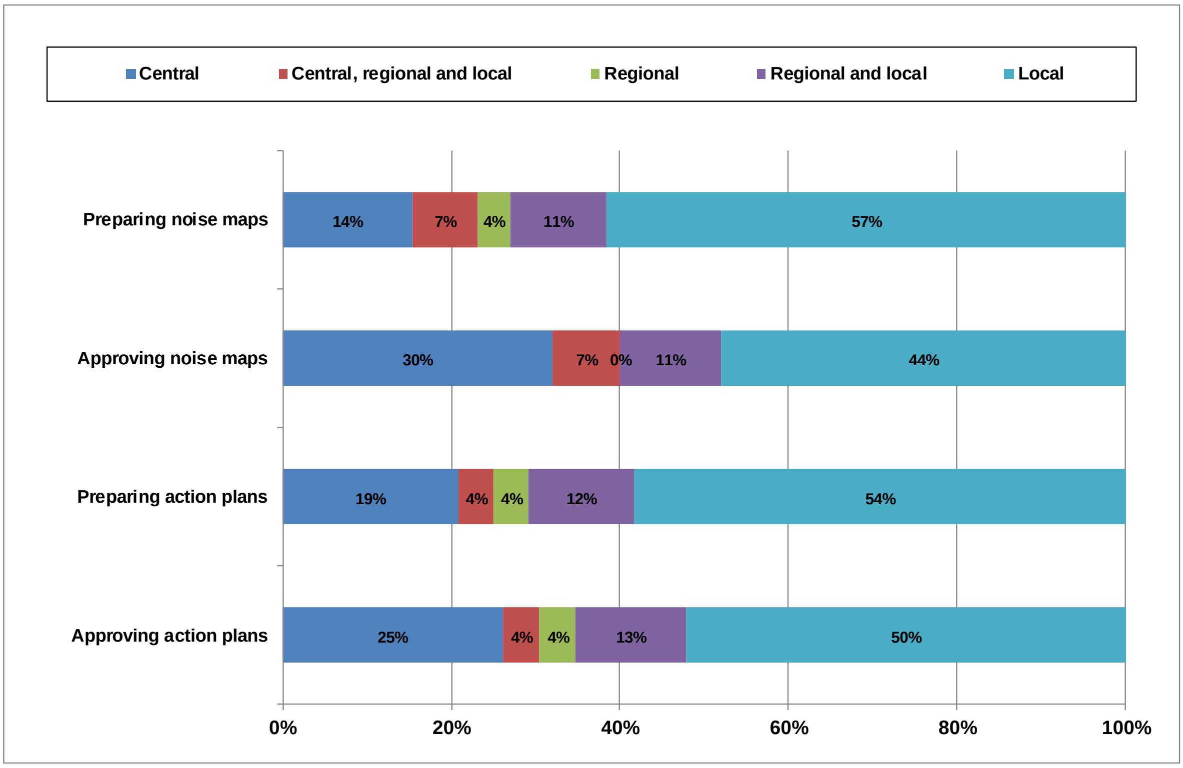
Some Member States have implemented the END in a way that reflects their prevailing administrative structures more broadly. For instance, **Germany** and **Austria** implement the END according to their federalised administrative structures, although in the former, there is a strong element of further decentralisation from the Länder to the local level. **Spain** and **Italy** have a strongly regionalised administrative structure generally, so have implemented the END in a way that is broadly decentralised, although national CAs continue to play a key role in some aspects of implementation e.g. major railways and major roads.

It should be stressed that whilst the approach to END implementation often reflects different prevailing traditions in national administrative systems, this is not always the case. Some countries may conversely have a relatively centralised or decentralised administrative system generally, but have chosen to implement the END differently. For instance, contrary to its traditionally centralised administrative structure, **France** has adopted a strongly decentralised approach where state representatives in each of the 96 *départements* are responsible for the designation of sites, the preparation of noise maps and drafting of action plans for major roads and major railways and the designation of the municipal bodies responsible for mapping and action planning within agglomerations. In the **Netherlands,** whilst some laws are implemented on a more centralised basis, reflecting national administrative structures, the END is implemented on a strongly decentralised basis.

Whilst recognising that different countries have adopted a more centralised or a decentralised approach overall, it should be strongly emphasised that **END implementation arrangements are also strongly linked to the transport source in question**. For instance, in almost all EU Member States (an exception being England within the UK, SNMs and NAPs for agglomerations are drawn up on a localised basis. Conversely, in the case of major railways and major roads, national railway authorities and national road authorities often play a significant role in noise mapping and in action planning, often (but not always) in a CA capacity.

The patterns that can be identified in implementation structures are now analysed further, distinguishing **between agglomerations and by mode of transport.** The END specifies that **agglomerations** with more than 100,000 inhabitants fall within scope. There were 495 such agglomerations in EU-28 in 2015. Within each agglomeration, SNMs covering the different sources of noise (*roads, railways, airports* and *industry*) need to be produced and NAPs drawn up. The approach to implementation for agglomerations differs between EU MS depending in part on whether agglomerations are a nationally-recognised administrative term and level or not. At an EU aggregate level, the preparation of NAPs for agglomerations is largely undertaken by local authorities (57% or 16 MS), which also play a prominent role in approving SNMs (44% - 12 MS), and in preparing (54% - 14 MS) and approving (50% - 12 MS) action plans (see figure below). Unsurprisingly, national authorities play a more prominent role in approving SNMs and NAPs for agglomerations than in preparing them.

Figure 2.1 – Overall EU Profile of contributors to Noise Mapping and Action Planning – Agglomerations (% of n=28 MS)



Source: bottom-up feedback collected from the Member States, as presented in the 28 country reports

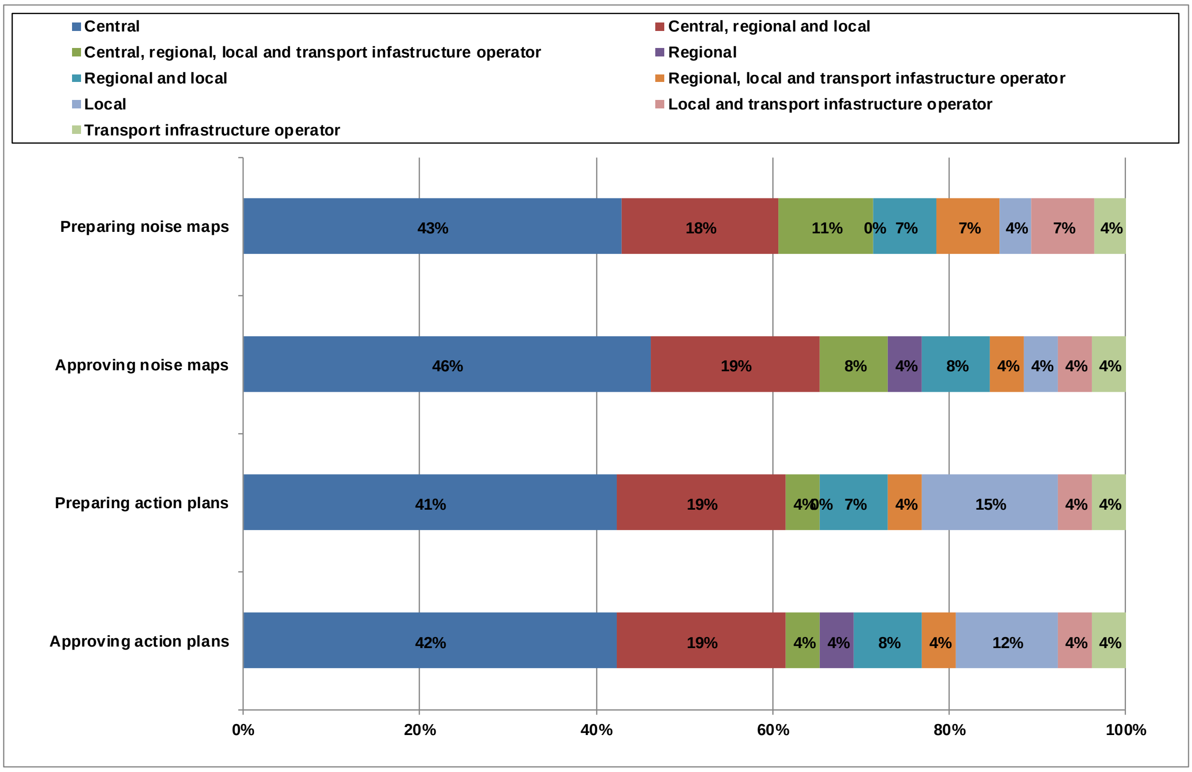
In some MS, such as **Italy,** even when mapping and action planning for ***agglomerations*** is carried out by local authorities, regional and provincial authorities still play an important coordination role and assume responsibility for collating data for EU reporting purposes.

The END also provides that **major roads (outside agglomerations)** with traffic higher than 3 million vehicles per year are within scope. In R2, this affected 154,738 km of roads in the EU-28. A distinction needs to be made for major roads between those located *within* and *outside* agglomerations. Whereas noise mapping and/or action planning activities for major roads within agglomerations are often dealt with by local authorities directly within the agglomerations, major roads outside agglomerations are often administered by National Road Authorities (NRAs) at central level on a country-wide basis.

More generally, the implementation approach was partly dependent on how road networks are organised in each country. The table below illustrated the administrative responsibilities for noise mapping and action planning for major roads outside agglomerations. *Central* signifies that *only* central authorities are responsible (e.g. in 43% of MS, central authorities have exclusive responsibility for preparing noise maps for major roads outside of agglomerations), whereas *regional* signifies that *only* regional authorities bear responsibility, and *local* indicates that *only* local authorities are responsible.

As the table shows, in close to half of EU MS, noise mapping and action planning are carried out at a central level for major roads. In those countries where a combination of national, regional and/or local authorities are involved, there is generally a division of labour in which national authorities produce the SNMs and NAPs for major roads *outside* agglomerations whereas local authorities produce SNMs and NAPs for major roads *within* agglomerations. In some cases, roads are administered by private sector operators who often also produce the SNMs and NAPs, even if public authorities may be responsible for approving them.

Figure 2.2 - Overall profile of contributors to Noise Mapping and Action Planning – Major roads outside of agglomerations (% of n=28 MS)

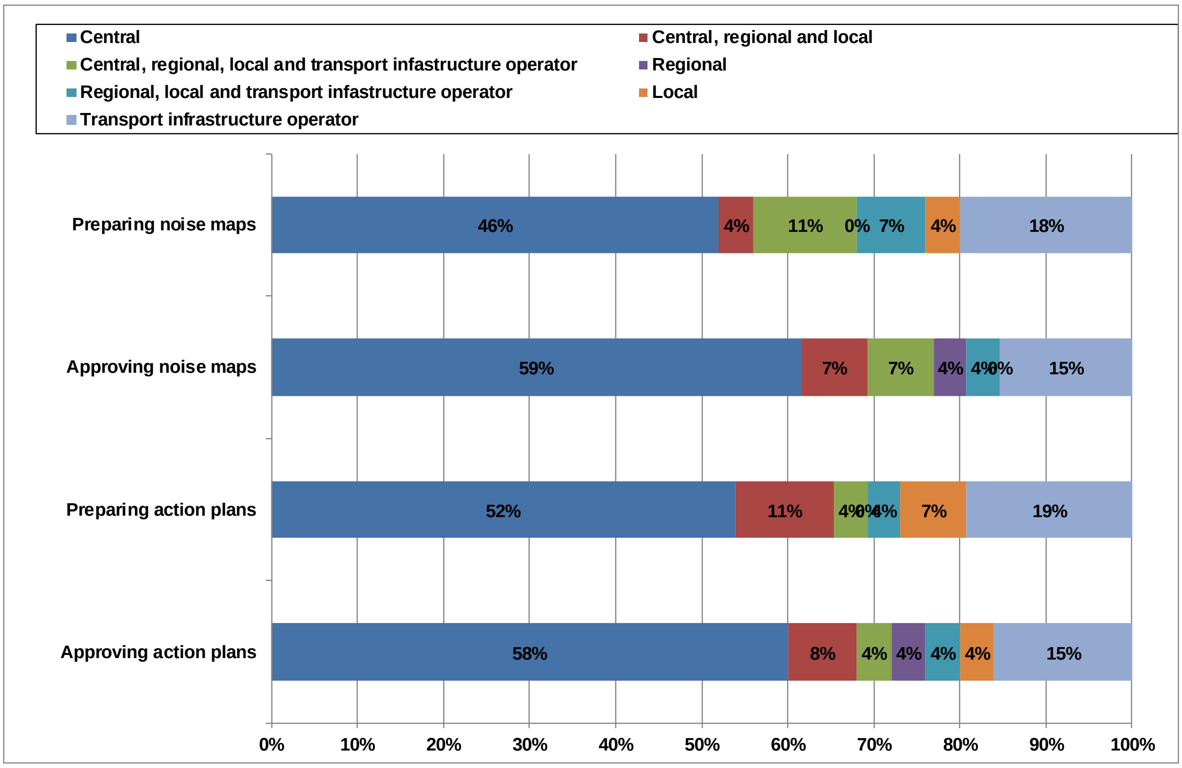


Source: bottom-up feedback collected from the Member States, as presented in the 28 country reports

In most EU countries, National Road Authorities (NRAs)[39] played a key role in noise mapping in both R1 and R2. A national CA is then commonly responsible for providing for the approval of road NAPs. Local authorities are also involved in mapping roads located within their agglomeration, but are often dependent on NRAs for mapping major roads within their agglomeration and for roads bordering the agglomeration. Regional bodies also play an important role. For instance, in **France,** roads are a state competence, but road NAPs have been prepared at a departmental level. In **Ireland,** the NRA is responsible for noise mapping but not action planning. It has provided road mapping of major roads not only outside agglomerations but has also assisted local and city authorities in preparing SNMs in agglomerations. In **England**, although the NRA, Highways England, does not have direct responsibility for preparing noise action plans, it works very closely with the Department for Transport and with Defra, the overall lead for END implementation.

Major railways (outside agglomerations) with more than 30,000 train passages per year are included in the END. In R2, the scope covered 72,341 km of rail across EU-28. Railways-related Noise Mapping and Action Planning activities are run by national authorities in many countries. In some EU MS, Ministries of Transport and their equivalent are closely involved (e.g. the UK but working in close conjunction with the private railway infrastructure manager), whereas in other MS, the state railways take the lead role as the CA, at least for noise mapping (e.g. **Ireland** and **Italy**).While the preparation of NAPs and SNMs for major rail is often carried out at a subnational or at several administrative levels, or by different infrastructure operators, national authorities have responsibility for approving NAPs in 59% of Member States for SNMs and in 58% of EU MS in the case of NAPs.

Figure 2.3 – Overall EU Profile of contributors to Noise Mapping and Action Planning – Major railways (% of n=28 MS)



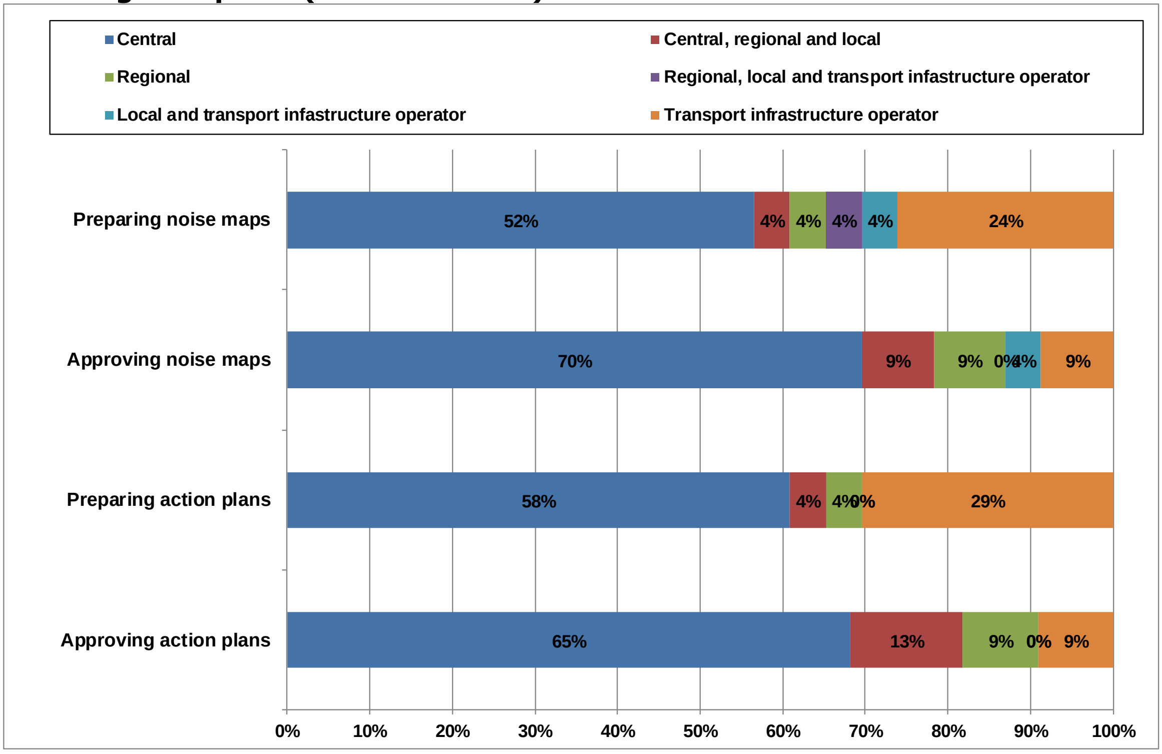
Source: bottom-up feedback collected from the Member States, as presented in the 28 country reports

[39] See for instance the END and NRAs – Final Summary Report CEDR Road Noise 2009-2013

Finally, **major airports** are defined in the END as airports with more than 50,000 aircraft movements (take-offs and landings) per year. There were 92 airports that met this criterion in R2. Airports are often located within or in vicinity to agglomerations, and aircraft noise is therefore one of the sources of noise to be addressed within agglomerations. This means that at times, local authorities and airport operators are both involved in END implementation with regard to airports and noise from aircraft.

Airport operators (both state-owned and private sector) in some EU countries play a major role in the preparation of SNMs and NAPs and in the implementation of measures identified in NAPs. However, in the majority of Member States, SNMs and NAPs are produced by national authorities. In some countries, airport infrastructure is privately owned (e.g. **DK, IE** and the **UK**) while in others it remains managed by the public sector (e.g. **FR, LT**). In other countries, the situation can be more complex, when there is a combination of privately owned and state-owned airports. In addition, many national authorities, such as Ministries of Transport, play a role in approving NAPs for airports.

Figure 2.4 – Overall EU Profile of contributors to Noise Mapping and Action Planning – Airports (% of n=28 MS)



Source: bottom-up feedback collected from the Member States, as presented in the 28 country reports

A few **specific implementation issues** were highlighted with regard to the designation of CAs and administrative arrangements for implementing the END:

- Several stakeholders mentioned that whilst overall responsibility for implementing the END lies at national level, action planning is often carried out by organisations at local level. Whilst this may raise issues related to accountability for END implementation. Many stakeholders pointed out that noise at receptor could best be tackled through a local level approach.
- In some MS, stakeholders perceived there to be insufficient communication between CAs in charge of action planning at national level and organisations on the ground that actually have to implement measures foreseen in NAPs. This may in part be explained by a fragmented approach to END implementation and a lack of

coordination between the different CAs and other public authorities (such as those involved in the provision of information and data for SNMs and NAPs).

- In the case of roads and railways, it was pointed out by some stakeholders that it may be better to carry out noise mapping on a centralised basis but action planning on a decentralised basis. This was seen as being a means of avoiding over-fragmentation of noise mapping.

Overall, there do not generally appear to be problems with the procedures for the designation of CAs. Member States have adopted different approaches in terms of the administrative level at which CAs have been designated (national, regional and local), often reflecting their general administrative arrangements and traditions. Whilst the designation itself does not appear to have caused problems, in countries that have a strongly decentralised approach, there have sometimes been practical implementation difficulties, such as ensuring coordination when there are many different CAs involved in END implementation at different administrative levels.

2.3.4 The designation and delimitation of agglomerations, major roads, major railways and major airports

The preliminary thresholds used for determining which entities fall within the scope of the END in R1 as specified under Art. 7 and Art. 8 differ from the definitive thresholds used under Art. 3 (see Table 2.1 – Applicability of the Environmental Noise Directive in R1 and R2). The use of the definitive thresholds in R2 had a major impact on the number of agglomerations covered by the END and the amount of mapping required for roads and railways. The table below presents the numbers of agglomerations, airports and km of roads and rail designated in R1 and R2 and the magnitude of the increases in scale and scope of mapping activities:

Table 2.4 – Designations in Round 1 and Round 2 (Strategic Noise Mapping)

EU28	Round 1	Round 2	Increase by (%)
Agglomerations	176	467	165
Airports	73	92	26
Rail (km)	31,576	72,341	129
Road (km)	67,488	154,738	129

Source: EEA data, supplemented by bottom-up feedback collected from the MS

The definitive END thresholds used in R2 are 50% lower for major roads and major railways compared with the transitional thresholds used in R1. This led to a significant increase in the number of kilometres (km) of major roads and major railways that had to be mapped (by 129% in each case). For agglomerations, the change in thresholds between R1 and R2 from >250,000 to >100,000 people led to an increase in the number of agglomerations by 165%.

Since the threshold for airports did not change between Rounds, there was only a moderate increase (26%) in the number of airports that had more than 50,000 movements per year. This may be explained by changes in airport traffic movement data.

The increase in the scope of END coverage in R2 affected most Member States. Those countries that experienced particularly strong increases in coverage between Rounds often had a low R1 baseline in terms of mapping requirements. A number of examples are provided below to illustrate the effects on the volume of noise mapping involved due to moving from the transitional to the definitive thresholds of the END in terms of the corresponding increase in coverage between R2 and R1:

- In **Austria,** whereas in R1 only one agglomeration was mapped, in R2, this increased to 6. In **Lithuania**, the corresponding figures were 2 in R1 and 5 in R2.
- In Ireland, there was an increase of 24 times the number of km of major rail that had to be mapped (from 8 to 189) and an increase of 15 times the amount of km of major roads within scope (564km to 8294 km).
- In **Bulgaria**, there were 12 times the amount of km of major roads covered (89km to 1044 km)
- In **Hungary**, there was an increase of 37 times the amount of km of major rail covered (25 km to 914 km)

In the table below, examples of changes in END scope between Round 1 and 2 of more than 5 times are illustrated.

Table 2.5 - Changes in END scope between Round 1 and 2 of more than 5 times

	AT	BG	EE	FI	FR	EL	HU	IE	LT	PL	RO	SE
Agglomerations				7		7	9					
Airports	6											
Rail					7		37	24		18		
Road		12	22	12				15	7	10	12	6

Source: own research, 28 country reports

Although the transition to the definitive END threshold was envisaged from the outset in the legislation itself, it is important to note the evolution in the scale and scope of noise mapping activity since according to some stakeholders, this may partially explain why there were greater delays in R2 than in R1, as will be shown in Section 2.3.7.

This second implementation review has identified a range of **implementation challenges** faced in Member States in delimitating agglomerations, roads, railways and airports for END implementation, such as:

- There seems to be a lack of clarity around the definition of, and the delimiting method to be used for, agglomerations (identified as a challenge in 5 Member States- BE, FR, IT, LV, UK)
  - In FR, the definition of agglomeration has caused difficulties. 60 agglomerations including 1,500 '*communes*' are considered as falling within the scope of the Directive. Some might argue that France 'over-transposed' the Directive in designating agglomerations.
  - In IT, while sometimes an agglomeration is synonymous with the delimitations of a city, in other instances, several agglomerations make up one city. This creates confusion among stakeholders as to what constitutes an agglomeration;
- Complex administrative arrangements and the non-transparent division of competencies between different actors at local, regional and national levels slowed down the process of designation and delimitation, potentially causing delays in noise mapping as well (6 Member States – AT, ES, FR, HU, IE, IT);

- There was (initial) confusion among CAs with regard to the designation of administrative responsibilities for quiet areas within agglomerations (3 Member States – LT, NL, RO);
- The definition of major roads was not always easy to reconcile with national practice (e.g. DK, and in EE where the threshold of 3 million vehicles per year is not directly in line with the national definition of a major road);
- In DE, annoyance is defined differently in different agglomerations with some going beyond the requirements in the END in terms of the scope of roads that are included in the noise mapping process, limiting data comparability in the country.

2.3.5 Noise limits and targets

The END does not set any noise limit values ("LVs") at EU level at receptor, but rather under the subsidiarity principle relies on Member States to consider whether national limit values are required and to define appropriate national LVs for the determination of noise levels. It is left to Member States' discretion to determine these in general and with regard to quiet areas in agglomerations (Recital 8 of the END). Nevertheless, if Member States do chose to set limit values, they are required under Art. 5 to inform the Commission.

The discretion provided to Member States means that a range of policies may be adopted with regard to noise limits. A distinction should be made between **binding and non-binding noise LVs.** Whilst binding LVs are statutory limits, non-binding LVs are aspirational targets that may be used in guidance documents and to help identify priorities for noise action planning. Noise limits may be set for planning purposes, i.e. only forward-looking, or also for existing infrastructures or installations.

Noise limits also differ depending on whether they are measured indoors or outdoors, and for single transport sources or for the cumulative effects across several sources. It was observed by acousticians within the study team that the impact that noise LVs or targets may have in practice also very much depends on the level at which they are set. For instance, unambitious levels may not have any impact, whereas very ambitious levels could potentially produce a backlash amongst stakeholders or have unintended consequences. Moreover, levels that are not clearly linked to existing research (e.g. the WHO health-based assessments) on noise impacts may be less accepted amongst authorities, developers and other stakeholders.

The first implementation review report highlighted that **most MS (21) had set noise "LVs" which were legally enforced** and whose transgression should in theory have led to measures to control noise and/or insulate exposed populations, and/or in some MS, the imposition of penalties on those responsible for the source. In practice, SNMs revealed that their transgression neither led to measures being implemented nor any specific action being taken, although they did inform NAPs in those MS.

In the table on the following page, the updated situation in respect of binding (albeit not necessarily enforced) noise LVs is provided. The situation has not changed greatly from the first implementation report from 2011, with the exception that Croatia has now become an EU member and has also adopted national LVs.

Table 2.6 – Noise limit values in the EU-28 – second implementation review

	Noise Limit Values in force	Guidance / indicative values	Noise trigger values for action
AT	X		
BE	X		
BG	X		
CY	X		
CZ	X		
DE	X		X
DK	X	X	
EE	X		
EL	X		
ES	X		
FI		X	
FR	X		
HR	X		
HU		X	X
IE		X	
IT	X		
LT	X		
LU	X		X
LV	X		
MT	--	--	--
NL	X		
PL	X		
PT	X		
RO	X		
SE		X	
SI	X		
SK	X		
UK		X	

Source: bottom-up feedback collected from the MS through 28 country reports. Note – each cross indicates an instance where the MS has a particular type of LV (e.g. binding, non-binding). Two dashes (e.g. Malta indicate no information available).

In most EU MS, different values have been set for different sources of noise, and for day and night. The strictest limits imposed range from 33-35 dB and relate, for example, to evening noise near hospitals and recreational areas (BG, DE, LU), special protected areas (IT) whereas the highest levels relate range from 70-75 dB, for example for rail noise during the day (FR) and for heavy industry during the day. Responses from CAs in relation to implementation challenges in R2 indicated that few changes have been made by MS to strengthen the enforcement of noise LVs since the first implementation review.

The research found that, as already identified in the first implementation review, there remains a problem with regard to the lack of enforcement of national LVs. Among the 75% of MS that have noise limits, less than 25% were able to categorically confirm that LVs were (fully) enforced. Since there are no common mandatory limit values at EU level, MS were not asked to report back systematically as to whether there were any specific implementation challenges in applying national LVs. However, interview feedback indicates that it is sometimes difficult to convince national policy makers in other areas of the importance of enforcing national limit values. Weak enforcement of noise LVs in cases of exceedance was a recurring theme raised by END stakeholders in many EU MS.

The putting in place of national LVs was however found to have assisted in END implementation. For instance, the exceedance of LVs was often used as a starting point for prioritising interventions to mitigate or reduce noise through action planning and through policies more generally, such as in **Austria** (modernisation of railways), **Belgium** (airline accountability), **Croatia, Czech Republic, Denmark, Slovakia** (construction of new roads), **Germany, Hungary, Ireland, Latvia, Luxembourg, Netherlands** (noise zoning and abatement); **Slovakia, Slovenia** and in the **UK** (determining eligibility for façade sound insulation, planning).

2.3.6 Definition, delimitation and protection of quiet areas

Introduction

Before analysing the current state of play in respect of the implementation of quiet areas, it is necessary to examine the treatment of quiet areas in the text of the Directive.

Quiet areas are mentioned in various parts of the Directive. Recital 8 states that "The concrete figures of any limit values are to be determined by MS, taking into account, *inter alia*, the need to apply the principle of prevention in order to preserve quiet areas in agglomerations". Art. 2 specifies that the END applies "in public parks or other quiet areas in an agglomeration, in quiet areas in open country". Art. 3(l) (definitions) states that *inter alia* "a quiet area in an agglomeration' shall mean an area, delimited by the competent authority", but leaves MS to determine the values that apply. Art. 3(m) 'quiet area in open country' shall mean an area, delimited by the competent authority, that is undisturbed by noise from traffic, industry or recreational activities". Art. 8(1b) stipulates that NAPs should also aim to protect quiet areas in agglomerations. The need for action on quiet areas in open country is left open under Art. 11.

Definitional and interpretation issues

The END leaves **considerable discretion to MS with regard to the delimitation of quiet areas.** Whilst this was welcomed by many stakeholders, there were a number of perceived definitional ambiguities raised by CAs:

- There were differences in interpretation between EU MS as to whether the designation of quiet areas is mandatory, or voluntary under the END. In fact, there is no compulsory requirement to designate quiet areas. However, quiet areas are meant to be part of action plans within agglomerations, which "shall also aim to protect quiet areas against an increase in noise", which may have resulted in different legal interpretations.
- It is unclear in the legal text of the END whether the term 'quiet' should be defined in absolute terms or in relation to surrounding areas. For instance, a quiet area in an agglomeration may not be particularly quiet in absolute terms, but still considered quiet *relative* to its urban environment and thus still deserve attention (mentioned at the validation workshop by several participants).

- The definition of quiet areas in urban areas remains unclear in the view of at least some END stakeholders. This has led to difficulties in determining how quiet areas should be approached in agglomerations (3 Member States– **BE** and **LV**).
- There was a perception of a general lack of clarity regarding the delimitation and protection of quiet areas in open country (**HU, LV).**
- It was also unclear whether quiet areas in agglomerations and open country are mutually exclusive or whether a quiet area in open country can also be delimited within an agglomeration (mentioned by stakeholders in **LT** and in **NL**). This may constitute a problem where agglomerations include both noisy urban areas and in the wider periphery relatively rural areas that could be classified as quiet open areas. However, there is no impediment in the legal text of the END to designating both types of quiet areas within a single agglomeration.

Among the consequences of challenges in arriving at an agreed definition of quiet areas have been:

- Ongoing debate in relation to the definition of quiet areas potentially undermines the consistency of measures to protect such areas. For instance, in **Germany,** quiet areas have been interpreted differently across different Länder and among local municipalities.
- Delays in Member States designating quiet areas under the END, especially in rural areas in open country that have not generally been mapped.
- The country-specific definition and delimitations of quiet areas need to be taken into account when making cross-country comparisons.

Selection criteria for quiet areas and delimitations

The criteria for the delimitation of a quiet area are not specified in the END, and hence neither in the transposing national legislation. Rather, separate guidance documents set out the criteria for selecting, delimiting and designating quiet areas. Despite the limited delimitation of quiet areas, a lot of groundwork has been carried out to define quiet areas between R1 and R2 and to develop appropriate selection criteria (**e.g. in Finland, France, Lithuania** and **Poland)**. However, in many MS, specific values to define a quiet area are determined at the local level.

In **Lithuania,** non-binding guidelines were prepared in 2008 by the former State Environmental Health Centre. Updated guidelines for delimiting quiet areas were incorporated into the non-binding Exemplary Model for the Organization and Implementation of Environmental Noise Prevention in 2012.

In Poland, although a clear definition (supported by selection criteria) has been established for determining quiet areas, no quiet areas have been designated either in R1 or R2. However, 15 potential quiet areas have been identified.

In some EU MS, threshold values have been set as to how to define quite areas, although there is discretion as to how these are applied.

For instance, the Technical Guidelines for Noise Mapping in **Germany** allow CAs discretion to designate quiet areas through action plans. Threshold values of between L_{den} 50 and 55 dB(A) are commonly applied. However, many cities also use a differential value e.g. 6 dB(A) to distinguish the border and inner centre of a quiet area. In some cases, a minimum area size is determined and more quiet areas are often differentiated in categories with regard to noise levels, location, size and accessibility.

In **Poland,** a suggested threshold of >55dB has been adopted, but a number of further criteria have also been determined that have to be taken into account, such as:

- Demographical considerations relating to population density;
- Land use plans with maps for transportation network development;
- Spatial management consideration;
- Guides for future land use planning and spatial management; and
- Prioritising nature preservation areas, especially Nature 2000 areas.

The possible risk of "double designation" of the same geographic areas as a quiet area under the END and as a protected area under the Habitats Directive was mentioned as a problem in the **UK (England).** However, this does not appear to constitute a problem in other EU MS.

Current state of play in implementation

This sub-section looks at the current state of play in terms of *practical* implementation of the Directive with regard to the designation of quiet areas.

To date, the country research found that **13 Member States have designated quiet areas** – an increase compared to R1: **AT, BE, DE, DK, EE, HU, IE, IT, LV, LT, NL, RO** and the **UK** (Scotland and Wales only). However, this means that **the majority of EU Member States had not designated any (END-related) quiet areas by R2.**

In some of the MS that have designated quiet areas, this has only been done to a very limited degree, however. Moreover, in some instances, quiet areas have merely been identified without actually being *formally* designated. To illustrate these differences, the respective situation in a selected number of EU MS is considered below:

- **Belgium:** No quiet areas have been designated based on the END but in Flanders 'rural silent areas' had been designated prior to the END which are now being adapted in line with the END framework.
- **Denmark:** Quiet areas are defined within the municipality action plans. Before the END, Denmark also sought to preserve certain natural areas for their quietness.
- **Estonia:** The number of designated quiet areas has increased from 24 in R1 to 44 in R2.
- **Germany:** Quiet areas have been identified in four major cities/agglomerations, but none have been formally designated.
- **Italy:** In the region of Tuscany, 552 quiet areas have been defined. These appear to relate to very small areas of acoustic quality where it is good. This is different from the way in which quiet areas have been implemented in most EU MS.
- **Latvia:** 36 quiet areas were designated in R1 with a total size of 11.9 km2, none yet in R2.
- **Netherlands:** The total size of quiet areas amounts to 650 hectares, including some wetlands (i.e. quiet areas in open country).
- **Romania:** Parks in agglomerations have been designated quiet areas.
- **UK:** The number of designated quiet areas increased from 41 in R1 to circa 140 in R2.

One MS was identified as intending to designate quiet areas in the near future (**Sweden),** but has not yet formally done so. **Norway**, which implements the END on a voluntary basis, has also designated quiet areas.

The 2014 EEA report[40] on quiet areas was also reviewed to validate the findings against the assessment of quiet areas carried out as part of the country report assessment. This found that 14 MS (**BE, CZ, DE, DK, EE, EL, ES, FR, IE, IT, NL, PL, SE, UK**) had adopted at least some actions relating to quiet areas, primarily in agglomerations. Sound-pressure levels play an important role in almost all of these schemes. The report identifies **Belgium, the Netherlands, Sweden** and the **UK** as the MS with the most developed soundscape approaches. In the **Netherlands**, there were already "protected quiet areas" prior to the adoption of the END in national legislation. However, it remains unclear whether France has actually has designated quiet areas, since evidence was only presented for Lyons in the report and there was no data for France as a whole.

An illustration as to how progress has been made in strengthening attention to quiet areas was identified in **Ireland.** In the Dublin City agglomeration, the number of quiet areas increased from 0 in R1 to 8 in R2 after preparatory work to identify these areas on the basis of appropriate selection criteria had been carried out in R1.

In four Member States, (e.g. **Greece, Hungary, Ireland** and **Latvia**), quiet areas have so far only been defined in agglomerations, but not in open country. In **Germany,** quiet areas in open country are not usually defined either, since relevant areas are not covered through END noise mapping.

Further relevant issues, such as the extent to which there was any overlap with other EU legislation, and possibly explanatory factors for the low numbers of designations of quiet areas are now considered.

In the **UK**, there are no quiet areas in **England,** since there was a concern about the potential double designation of particular areas already designated as protected under the Habitats Directive, which are regarded by the national CA as *de facto* quiet areas even if they have not been designated as such. Quiet areas have however been designated in **Wales** and **Scotland.** In Wales, for instance, in R1, a procedure was developed for the designation of quiet areas in agglomerations and in R2, 63 quiet areas[41] within large urban areas were subsequently designated. This demonstrates that even *within* EU MS, there can be differences in approach and interpretation to implementing quiet areas.

Finland has not designated any quiet areas under the END. However in R1, the city of Helsinki has undertaken some research into quiet areas and quiet areas are likely to be included for Round 3. The concept of "protected quiet areas" existed in national legislation in the **Netherlands** prior to the END's implementation (under the responsibility of the Dutch provinces). Under the END, local authorities are responsible for the designation of quiet areas. Consequently, confusion has arisen between quiet areas under the END and other types of protected areas that can be characterised as being quiet that were already protected under existing national legislation.

A possible explanation for **the slow designation of quiet areas across EU 28** in both R1 and R2 is that it is not clear to Member States whether it is possible to reverse the process, i.e. to 'un-designate' quiet areas once they have been designated. As long as it remains unclear whether that is possible, MS authorities will hesitate to designate quiet areas because of legal implications and possible restrictions in future construction and economic development. Another explanation may be that it is difficult to require municipalities to provide spatial information on quiet areas that have not already been mapped in the absence of national enforcement mechanisms to compel public authorities to designate quiet areas. This was the case for example in **Lithuania.**

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[40] EEA Technical Report No 4/2014. Good practice guide on quiet areas.

[41] http://gov.wales/topics/environmentcountryside/epq/noiseandnuisance/environmentalnoise/noisemonitoringmapping/1stroundquietareas/?lang=en

Good practice guidance on quiet areas and their implementation

It is worth summarising the current situation in respect of the availability of good practice guidance on the implementation of quiet areas, since this was mentioned as an important issue by END stakeholders.

According to some stakeholders interviewed, it was unclear what steps ought to be taken once quiet areas have been designated in urban areas, since the END is not prescriptive in this regard. Without follow-up action, it was suggested that the act of designation in itself would not achieve positive change. Stakeholders participating in the workshop also pointed to the need for further guidance from the EC as to how to select, designate and delimit quiet areas and once selected, how to protect designated quiet areas. However, it should be noted that the EEA has already produced a Good Practice Guide[42] on quiet areas in 2014. It appears that not all stakeholders are aware of this guidance.

A number of stakeholders noted that useful research has been undertaken through **FP6, FP7 and the LIFE+ programme into quiet areas in urban areas and into the preservation of acoustic quality where it is good.** Whilst such projects are outside the Directive's scope, they are complementary to the implementation of quiet areas as defined under the END.

In the **Netherlands**, a number of examples of good practices were identified in respect of the identification and implementation of quiet areas and the preservation of acoustic quality where it is good. A stakeholder interviewed provided the following example:

Box 2.1 The QUADMAP Project

The QUADMAP project (Quiet Areas Definition and Management in Action Plans) - http://www.quadmap.eu/- was funded under the EU programme LIFE+. It is concerned with repositioning local noise policy approaches to quiet urban areas. The project aims to develop a harmonized methodology for the selection, assessment and management of quiet urban areas (QUAs). Best practices, lessons learned and empirical study data was assessed in order to define – acoustic and other – parameters relevant for the perception and evaluation of quiet urban areas by EU citizens.

The municipalities of Amsterdam and Rotterdam were involved in the project and undertook measurements to help monitor acoustic quality where it is good.

There have been a number of pan-European projects to promote research into quiet urban areas, such as the QSIDE project, which examined the positive effects of quiet facades and quiet urban areas on traffic noise annoyance and sleep disturbance and the SILENCE project [43](Quieter surface transport in urban areas)[44], both funded under FP7, and the CityHush project (Acoustically Green Road Vehicles and City Areas - (http://www.cityhush.eu/)) supported through FP6.

Besides these European initiatives, at the national level, a few Member States have developed good practice guidance on quiet areas. For instance, in **France,** a National Guide[45] was developed in 2008 which provides a definition of quiet areas and suggested criteria for their creation. It also serves as a "national repository" for information about good practices in respect of quiet areas.

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[42] http://www.eea.europa.eu/publications/good-practice-guide-on-quiet-areas

[43] http://ec.europa.eu/research/transport/projects/items/silence_en.htm

[44] http://ec.europa.eu/research/transport/projects/items/_qcity__and__silence____eu_projects_target_urban_noise_en.htm

[45] http://www.developpement-durable.gouv.fr/IMG/pdf/Referentiel_national_pour_la_definition_et_la_creation_des_zones_calmes_-_2008-2.pdf

In **Northern Ireland**, draft Guidance[46] on the identification and designation of quiet areas was subject to a recent consultation which closed in November 2015.

Conclusions - quiet areas

A summary of the main implementation challenges with regard to quiet areas in R2 is provided below. This includes issues that remain problematic from R1, as reported by CAs, and the identification of new issues that only emerged in R2.

- There are a number of definitional issues relating to quiet areas that have remained problematic in both R1 and R2 of END implementation, with evidence of different interpretations across the EU;
- It was regarded as especially difficult to identify quiet areas in open country (Art. 2) since these areas (outside agglomerations and often far away from major transport routes) have not been mapped as part of the development of SNMs;
- Although progress has been made at national level in most EU MS in establishing definitions and criteria for the selection of quiet areas since R1, only a small number of MS had actually designated quiet areas midway through R2 implementation;
- The low take-up of protecting the quality of the acoustic environment where it is still good was explained by some stakeholders by stating that it was difficult for public authorities to justify any measures in these areas when there were other areas that population exposure data indicated were a greater priority for the reduction of noise.

2.3.7 Strategic Noise Mapping

Introduction

Strategic noise mapping is a method used to visualise noise pollution in a specified geographic area. According to Art. 3 of the END, it means *'the presentation of data on an existing or predicted noise situation in terms of a noise indicator, indicating breaches of any relevant limit value in force, the number of people affected in a certain area, or the number of dwellings exposed to certain values of a noise indicator in a certain area'.* The END also defines a strategic noise map (SNM) as '*a map designed for the global assessment of noise exposure in a given area due to different noise sources or for overall predictions for such an area'.*

One of the END's objectives is to establish a common approach to assess the exposure to environmental noise throughout the EU. On the basis of indicators of population exposure such as annoyance and sleep disturbance, SNMs have to be produced by Member States according to Art. 7 of the END and updated as required every five years from 2007 onwards. Where relevant, these need to be approved by CAs. SNMs need to be produced for all major roads, railways, airports and agglomerations (the latter requiring several SNMs by individual transport source as well as industrial noise). Annex IV of the END sets out the minimum requirements for strategic noise mapping. Member States are obliged to provide the EC with information from their SNMs at regular intervals. Information is submitted via the Electronic Noise Data Reporting Mechanism.[47]

Two years before the submission deadline for SNMs, MS have to inform the EC in relation to the list of agglomerations for which exposure data has to be submitted by noise source:

[46] https://www.doeni.gov.uk/consultations/consultation-quiet-area-policy-guidance
[47] Noise in Europe Report. 2014. P. 13

- Roads
- Railways
- Aircraft
- Industry

The total number of agglomerations within END scope was 163 in R1 and 468 in R2 for EU-28. Since some agglomerations may not be affected by all sources of data, the total number of agglomerations for which exposure data has to be submitted may differ by source of noise. For example, in R1, data on aircraft noise only had to be submitted for 144 agglomerations since the remaining 19 did not have any relevant aircraft noise.

- The list of major airports for which exposure data has to be submitted; and
- The list of major road and railway segments for which exposure data has to be submitted.

Two years later, exposure data would then be expected to have been submitted by Member States to the EC as announced.

The completeness of Strategic Noise Maps in the EU

The Noise in Europe Report by the EEA from 2014[48] assessed the completeness of SNMs in R1 and R2 based on the gap between (a) the number of SNMs to be developed according to source data provided by the Member States and (b) the number of SNMs actually reported to the EC 8 months later (August 2013). The data was last updated on 30th June 2015 for the EEA by an independent contractor. The table below shows the completeness of data on SNMs by round and noise source as last updated by the ETC/ACM on 30 June 2015. The coverage figures take into account all the mandatory fields to be reported for under the label 'DF4_8 (strategic noise maps dataflow)' except the "Computation and measurement methods report details".

Table 2.7 – Completeness of SNMs – share of number initially envisaged that has actually been reported to the EC[49]

Round	Inside agglomerations				Major Roads	Major Railways	Major Airports
	Road	Rail	Aircraft	Industry			
1 (2007)	78%	72%	66%	89%	96%[50]	95%[51]	97%
2 (2012)	78%	75%	52%	69%	79%[52]	73%[53]	75%

Source: END_DF4_Results_2007 sheet for R1; END_DF4_DF8_Results 2012 sheet for R2 provided by European Topic Centre on Air Pollution and Climate Change Mitigation. Data last updated in June 2015.

[48] EEA Report. Noise in Europe 2014. P. 13, June 2014
[49] Source: END_DF4_DF8_Results
[50] 26 out of 27 countries – Greece did not provide data
[51] 19 out of 20 countries – Greece did not provide data, 8 countries did not have any major railways in 2005.
[52] 22 out of 28 countries
[53] 19 out of 26 countries – 2 countries did not have any major railways in 2010.

The table indicates that **there have been significant delays in noise mapping in both Rounds**. For instance, in R2, at the cut-off date for the analysis, reporting data was at best complete for 79% of Member States for major roads.

Although the data in R1 is almost complete for major roads, it is difficult to compare this to R2 completeness since an additional five years have passed since the R1 SNMs were supposed to be submitted.

In R2, there are still major gaps in the completeness of data on SNMs and population exposure data from road, rail and aircraft sources inside agglomerations. However, as explained further below, the 79% reporting submission completion estimate refers to the number of Member States that have submitted data, rather than to the proportion of major roads mapped. The data does not necessarily cover all major roads segments within these Member States.

Within agglomerations, the table shows the percentage completeness separately for each of the three different modes of transport plus noise from industry. This is due to the fact that CAs are required to report information on population exposure through SNMs for agglomerations separately for each source of noise, as mentioned above. Data on aggregate noise exposure to all sources within agglomerations is not collected systematically by MS since this is voluntary information.

The percentages provided describe the number of agglomerations out of the total reported by MS CAs to the EC two years before the due submission date for which a complete dataset as to the number of exposed people must be reported. The figures cover all road/railway/aircraft including the data to be reported for *major sources* and industry exposure. For example, the 78% for roads inside agglomerations (both Rounds) means that 78% of agglomerations that were expected to report data on exposure to road noise, including noise from major roads, did in fact report this data by 30th of June 2015.

Completeness has improved considerably compared to the data presented in the Noise in Europe report: i.e. in the period between August 2013 (the original cut-off date for analysing completeness data included in the Noise in Europe report) and June 2015, when an additional data cut-off analysis of SNM data was run. For instance, the completeness of SNMs and population exposure data for agglomerations for road noise increased from 62% to 78%, and for rail noise up from 57% to 75%, for aircraft from 44% to 52% and for industrial noise from 56% to 69% (percentage values referring to R2).

The percentages for SNMs for major roads and major railways correspond to the number of Member States out of the EU-28 (EU27 for R1 since Croatia acceded in 2013) who have submitted data rather than the number of road or rail segments for which information has been provided. Completeness of the road and railway network infrastructure as such (measured in road and rail segments to be mapped) cannot be calculated due to how the information is provided at the moment.

Consequently, the percentages given for major roads and major railways do not necessarily imply that these MS have submitted complete data covering the *total length* of km within END scope. This means that the percentages may present completeness in a more favourable way than if the data was based on road and rail segments measured in km. It should furthermore be noted that it is not entirely clear whether data submitted by MS on major roads and major railways refers only to those railway and road segments located *within* or *outside* agglomerations, or *both*. The contractor supporting the EEA states that MS (and regions within MS) define agglomerations and major infrastructures differently, and have chosen different interpretations and a different scope for the reporting mechanism. For further information on the implications for the reporting mechanism, please refer to EQ12 in Section 3.

The data for airports refers to the number of airports out of the total within END scope for which data has been reported to the EC in each Round. This refers to the number of major airports rather than the number of agglomerations affected by aircraft noise.

Overall, **the level of reporting data and information completeness in R2 is below the corresponding level of completeness in R1 even three years after the required submission date for R2 SNMs.** This is the case for all SNMs except for those for road and railway noise inside agglomerations where data is more complete in R2 than in R1. However, as mentioned in the previous paragraph, the data does have some limitations and for this reason, the completeness of road and railways' network cannot be evaluated as such, and only values at country level can be presented. This issue and its implications for the efficiency of the reporting mechanism are further discussed in section 3.2.4. Moreover, the finding that completeness in R2 is below completeness for R1 needs to be viewed in the context of the increased amount of mapping necessary given, the move to definitive thresholds (see section 2.2.3).

The data above present the picture at EU-28 aggregate level.

During the interview programme, EU MS put forward a number of possible explanatory factors for the delays in noise mapping in R2. In **Germany,** for instance, delays were attributed to a lack of knowledge among responsible CAs at local level about input data acquisition needed for strategic noise mapping purposes. A further issue was the need for coordination in noise mapping for administrative areas within agglomerations that border one another. This was a considerable problem due to the strong element of decentralisation in respect of noise mapping under the German national implementing rules.

Examples of implementation challenges relating to noise mapping that may have contributed to the aforementioned delays are outlined below. These are ranked according to the frequency that they were mentioned by Member States.

- **A lack of sufficient human and financial resources** to meet noise mapping commitments in full and / or the lack of in allocating these resources sufficiently promptly made it difficult to meet R2 SNM reporting deadlines (**15 MS – AT, BE, BG, CZ, ES, HR, FI, IT, LV, LT, PL, RO, SE**[54]**, SK and the UK**);
- **Budgetary difficulties due to the economic and financial crisis were explicitly mentioned in some EU Member States as having led to delays in noise mapping being undertaken.** In PT and ES, there were significant cuts in public and private budgets, especially after 2011, in the context of the financial bailout that took place in PT. Although in ES, there was no bailout, there was a financial assistance package at national level, which imposed very tight conditions on budgets. This was one of the major reason for delays in R2 noise mapping.
- **Additional resources were needed** in order to meet the full implementation scope of the END once the definitive thresholds came into effect in R2 **(5 MS– IE, LU, PT, RO and SK)**;
- **Lack of centralised, complete and consistent traffic, spatial input and noise emissions data** – often, estimates were used when actual data was unavailable (e.g. in FR for road data, **7 MS– BE, BG, CZ, FR, HR, IT and RO**);
- **Lack of effective coordination among CAs** responsible for the END in the collection, management and administration of input data for noise maps (**6 MS – AT, CY, DE, FR, NL and PT**);
- **Lack of data comparability –** there are a number of different reasons why it has proved difficult to achieve full data comparability between Rounds across all sources

[54] Only in some agglomerations

and EU MS, such as differences between rounds in the sources of input data, the methodology and computation method applied, changes in the modelling software used, etc. Comparability issues were mentioned in **DK, NL, SK and the UK,** among others). The issue of comparability was found to affect different sources to varying degrees of magnitude. For instance, airports tend to be more comparable between Rounds, since the thresholds have not changed (although there may still be differences, e.g. in input data, methodologies, software to estimate noise exposure).

- **Lack of data comparability between different EU MS –** different approaches to noise mapping have been adopted in different MS. Some MS currently use the interim methods presented in Annex II of the END, whereas other continue to use national methods. Data comparability will remain limited until based on the CNOSSOS-EU methodology, has been implemented.
- There are differences in approaches between EU MS with regard to the mapping of major roads. For instance, in **DE**[55]**,** in R1, outside of agglomerations, the network of "major roads" was defined as being required only for federal and regional roads with more than 3 million movements. Whilst the formal requirements of the Directive were met, corresponding to the R1 thresholds, in the view of some stakeholders, this meant that mapping of road noise outside agglomerations was "incomplete" for the purposes of informing noise action planning.
- Lack of a suitable database to allow input data to be easily updated in subsequent rounds rather than to start afresh **(CY)**.
- Another issue relates to the fact that noise levels in agglomerations may be affected by noise from sources in another, adjacent administrative region (the same applies to national borders where agglomerations are located near them). In these cases, data on the noise from sources across the administrative border has to be requested from other administrative authorities. At times, such data was not readily available at the time when noise maps were being developed (**BE, DE, HU, RO**).
- One of the reasons for the delay in noise mapping in Romania was the need to wait for the results of the 2011 Population Census to become available **(RO)**. This was also cited as one of the reasons for delays (among others) in **CZ** and in **MT.**
- In **DE,** some delays were encountered. These were attributed to over-fragmentation of responsibilities within agglomeration for procuring noise mapping services. There also appeared to be a lack of knowledge among responsible CAs at local level about the need for timely and consistent input data acquisition needed for noise mapping.
- A further issue identified in **DE** was the need for coordination in noise mapping for administrative areas within agglomerations that border one another. This was a considerable problem due to the strong element of decentralisation in respect of noise mapping under the German national implementing rules.

Delays in the preparation and submission for reporting purposes of SNMs in R2

A number of reasons were put forward by stakeholders interviewed and participants taking part in the workshop as to the possible reasons for the delays experienced in the submission of R2 SNMs in some EU countries.

- At local level, noise mapping was sometimes viewed as an administrative burden passed on from the EC to national CAs (and in turn on to local authorities).
- As a consequence, delays were experienced in the preparation of SNMs wherever local authorities either lacked the budget to undertake noise mapping at the local level (e.g. at the commune level in FR) or did not see the value added in producing

[55] Umsetzung der Richtlinie 2002/49/EG über die Bewertung und Bekämpfung von Umgebungslärm in Deutschland. P. 3

maps (e.g. smaller municipalities in **DK, FR and NL**), since they did not appreciate the direct link with informing policy development.

- Several stakeholders (e.g. interviewees in **ES, FR and NL**) stated that noise mapping had been delayed in R2 because local authorities did not assign it as a high priority (and in some instances, refused to produce the required SNMs).
- A stakeholder from Germany taking part in the workshop suggested that delays in R2 may be explained by the shift in resources devoted from noise to other environmental issues such as climate change and air pollution (which are often covered by the same budget lines).

Several issues relating to SNMs were also highlighted by respondents to the online survey. Whilst it was acknowledged by more than 50% of respondents that problems in R1, such as difficulties in data collection and in the quality of input data, had largely been resolved by R2, other issues remain, such as a lack of interest in the results of noise mapping among citizens and local levels of administration. Not all stakeholders agreed that the main problems identified in R1 have now been resolved however, since challenges in relation to the lack of quality input data remain in a number of EU countries.

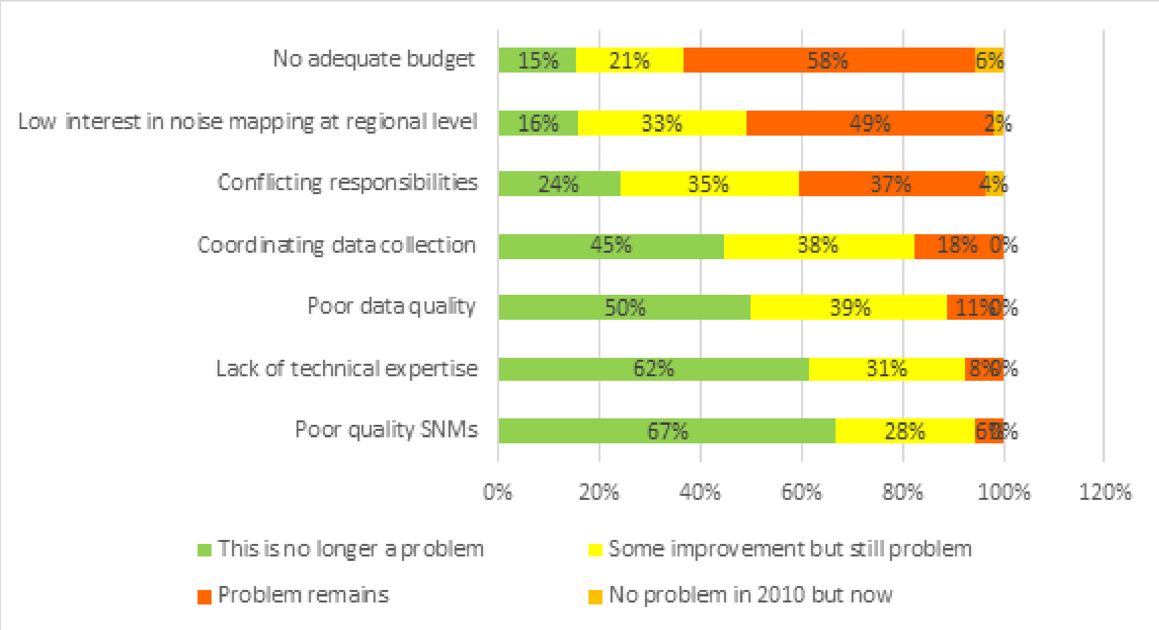
Art. 1(1b) of the Directive requires MS to **"ensure that information on environmental noise and its effects is made available to the public".** Through the second implementation review, the extent to which such information is being made available was assessed through the country reports.

The provision of SNMs online is the predominant means of providing noise maps and information on population exposure in a clear, comprehensible and accessible manner. A number of stakeholders confirmed that there were challenges in ensuring that noise maps were correctly interpreted by those using them. Some noise mapping bodies have therefore published a list of FAQs to ensure that noise maps by source are not misinterpreted (see case study in Appendix I on the publication of FAQs in Ireland).

Some general findings based on the analysis of the online survey regarding challenges affecting both strategic noise mapping and noise action planning are presented at the end of the next sub-section.

The figure on the following page summarises the feedback received from public authorities responding to the online survey on **key implementation issues related to noise mapping**.

Figure 2.5 - When surveyed as part of the first legal implementation review in 2010, those involved in implementing the Directive highlighted various issues in respect of noise mapping. Please indicate whether the issues identified still apply to your organisation? (n=56)



Source: Online survey of public authorities

As the above Figure shows, some END implementation issues related to noise mapping have been at least partially successfully addressed between R1 and R2. For instance, issues such as the poor data quality of input data and the lack of technical expertise seem to have been broadly resolved by R2. Good progress was found to have been made between Rounds in respect of core END implementation activities by national CAs, such as coordinating the process of data collection on SNMs, where 41% of respondents believed that this issue were no longer a problem. However, the position appears to be more nuanced across the EU-28 as a whole. For instance, 38% of respondents believed that although there had been some improvements between rounds, there were still difficulties in coordinating data collection.

With regard to the issue of poor data quality, there was a difference between the findings from the online survey and the findings from the research presented in the country reports which also took into account interviews with CAs. These suggested that there remains a problem with the quality of input data in 11 MS in R2. The country reports are judged as being more accurate, since these are based primarily on interviews with national CAs who ought to be in a position to judge, given their overarching coordination role.

Among those aspects of END implementation relevant for noise mapping where there does not appear to have been progress and problems remain are the low level of interest in some MS at local and regional levels in the END, as well as a lack of adequate budget, which was seen as a problem remaining for 58% of respondents.

Strategic noise mapping and the cross-border dimension

Belgium's geographic situation in close proximity to several other EU MS (FR, NL, LU, DE) necessitated co-operation with neighbouring regions, and intra-regional alignment to ensure that cross-border regions were covered through noise mapping.

In **Germany,** there was a lack of political willingness at regional level and among local authorities at municipality level to classify which areas crossed national borders as agglomerations and the associated challenges of delimiting such agglomerations.

In **Austria**, the difficulty of noise mapping in border areas was highlighted in R1, since noise levels in agglomerations can be affected by noise from sources in another, adjacent administrative region (the same applies to national borders where agglomerations are located in proximity). Data on noise sources across the administrative border has had to be requested from other administrative authorities. Such data was not readily available at the time when noise maps were developed. This problem has persisted in R2, since no remedial action was taken.

Strategic noise mapping and industrial noise within agglomerations

Lastly, given that strategic noise mapping also covers industry as a source of noise within agglomerations, it is worth examining some of the implementation issues with regard to **noise mapping and industry.**

In **Latvia,** the main problem identified was a lack of suitable input data for industrial sources. There has been an effort to improve the availability and quality of input data between R1 and R2. In particular, changes were made to requirements for industrial objects for IPPC permit applications. However, this hasn't been effective so far in improving data quality.

Further feedback with regard to issues relating to the END and industrial noise are addressed in the evaluation part of the report since these are less relevant to the implementation review (see Section 3.2.2 EQ3 specific legal gaps, overlaps and inconsistencies).

2.3.8 Noise Action Planning

Introduction

According to Art. 8 of the END, MS CAs are required to draw up Noise Action Plans ("NAPs") based on noise mapping results. NAPs must contain measures addressing noise issues and their effects for major roads, major railways, airports and agglomerations. The action plans must meet the minimum requirements laid down in Annex V of the END, relating, *inter alia,* to designation of CAs, noise-reduction measures already in place and projects in preparation, actions to be taken in the following 5 years, long-term strategies and financial information. Also under Art. 8, the END also requires that the public shall have the opportunity to comment on proposals for action plans and the possibility to participate in the elaboration and reviewing of the action plans.

This sub-section considers, in summary:

- The completeness of information on Noise Action Plans ('NAPs');
- Noise mitigation, abatement and reduction measures identified in NAPs;
- Availability of guidance on the preparation of Noise Action Plans
- Issues relating to the main challenges in action planning and in the implementation of NAPs; and
- Variations between EU MS as to whether (expenditure) measures identified in NAPs have actually been implemented.

The completeness of information on Noise Action Plans

Since there was a significant increase in the number of SNMs between R1 and R2 due to the transition to the definitive END threshold, it can be reasonably assumed that there has also been a major increase in the number of NAPs falling within the scope of the END. This has been confirmed through the EIONET data on NAPs and through the research to develop country reports.

Data on the **completeness of information** reported on NAPs has been obtained from the EIONET reporting system. The table below provides an overview of the situation on the completeness of NAP information submitted to the EC across the 28 EU Member States in R2 as at the most recent cut-off point (end November 2015).

Table 2.8 - Completeness of data submitted to the EC by 28 EU MS in R2.

Member State	Completeness			
	Agglomerations: submitted/no. of agglomerations within END scope (%)	Roads (in % of action plans submitted out of total number of road segments within scope)	Railways (in % of action plans submitted out of total number of rail segments within scope)	Airports (submitted/no. of airports within END scope)
AT	5/5 (100%)	100	100	1/1 (100%)
BE	6/6 (100%)	0	0	1/1 (100%)
BG	4/7 (57%)	100	n/a	n/a
CY	0/2 (0%)	0	n/a	n/a
CZ	0/7 (0%)	0	0	0/1 (0%)
DE	21/71 (30%)	Analysis not possible	Analysis not possible	2/9 (22%)
DK	4/4 (100%)	100	100	3/3 (100%)
EE	2/2 (100%)	100	0	0/1 (0%)
FI	8/8 (100%)	6	100	1/1 (100%)
FR	Analysis not possible	Analysis not possible	Analysis not possible	4/9 (44%)
EL	Analysis not possible	Analysis not possible	Analysis not possible	Analysis not possible
ES	2/64 (3%)	4	0	0/13 (0%)
HR	0/4 (0%)	13	0	n/a
HU	8/9 (89%)	0	0	0/9 (0%)
IE	2/2 (100%)	100	100	1/1 (100%)
IT	3/29 (10%)	0	99	0/10 (0%)
LV	1/1 (100%)	100	0	1/1 (100%)
LT	5/5 (100%)	100	100	n/a
LU	0/1 (0%)	0	0	0/1 (0%)
MT	0/1 (0%)	100	n/a	n/a
NL	17/21[56] (81%)	10/12 provinces	100	1/1 (100%)
PL	22/39 (56%)	0.4	0	0/1 (0%)
PT	1/6 (17%)	0.7	0	2/2 (100%)

[56] In case of the Netherlands, the 21 agglomerations were further broken down into 96 municipalities for which 85 NAPs have been submitted to date.

Member State	Completeness			
RO	2/19 (11%)	0	6	1/1 (100%)
SI	0/2 (0%)	0	0	n/a
SK	0/2 (0%)	30	0	n/a
SE	11/13 (85%)	100	100	3/3 (100%)
UK	73/73 (100%)	100	100	15/15 (100%
Total	197/403 (49%)	47 (average)	41 (average)	36/84 (43%)

Source: November 2015 data provided by DG Environment based on data in the EIONET reporting system.

For agglomerations and airports, data is also available on the completeness in R1, allowing for a comparison: Whereas 75% of R1 agglomeration NAPs have been submitted, this is the case for only 54% of R2 agglomeration NAPs. For airports, submission is similarly incomplete for both Rounds (only 46% have been submitted).

Since there were more frequent delays in the submission of SNMs to the EC in R2 compared with R1, particularly within agglomerations and for airports (both within and outside agglomerations), there have been knock-on effects in the timeframe for the drawing up, adoption and submission of *NAPs* to the Commission. The data above present the picture at EU-28 aggregate level. For more detailed contextual information, the country reports provide a bottom-up estimate as to the numbers of NAPs that each MS has submitted (or in instances where the NAP has been submitted late, the data relates to the number of NAPs that are due to be submitted to the EC).

Delays in R2 reporting submissions and possible explanatory factors

The previous table shows that less than half the agglomerations for which NAPs were meant to be submitted by July 18th 2013 for R2 had indeed submitted NAPs by November 2015 for (197 out of 403 or 49%) while on average, 47% of NAPs for major road segments and 41% of NAPs for major railways segments had been submitted by that date. Moreover, NAPs had been submitted for only 36 out of 84 (or 43%) airports. The table also shows that by November 2015, only 5 out of 28 Member States (**AT, DK, FI, IE and the UK)** had submitted all NAPs that were due in R2. In the remaining 23 Member States, some NAPs for at least one transport mode or for agglomerations were still missing.

An analysis of the information by transport mode shows that as of November 2015:

- NAPs for agglomerations were complete in 8 MS (AT, BE, DK, EE, FI, LV, LT, UK),
- NAPs for major roads were complete in 10 MS (AT, BG, DK, EE, IE, LV, LT, MT, SE, UK),
- NAPs for major railways were complete in 8 MS (AT, DK, FI, IE, LT, NL, SE, UK), and
- NAPs for airports were complete in 11 MS (AT, BE, DK, FI, IE, LV, NL, PT, RO, SE, UK).

A number of explanatory factors were put forward to explain the delays in the submission of NAPs:

- Delays in the preparation of SNMs in some EU MS (see previous sub-section) have led to knock-on delays in the drawing up, adoption and submission of NAPs (since these have to be prepared based on noise mapping results).
- The period of 12 months between the submission of SNMs and NAPs was considered as too short and unrealistic in the majority of EU MS **(15 MS– AT, BE, CZ, FI, EL, FR, HU, LV, NL, PL, PT, RO, SE, SK, UK).**
- In particular, stakeholders stated that there is a need to allow sufficient time for meaningful consultation to take place, for NAPs to be prepared and to ensure public acceptance. Whereas in R1, delays were mainly related to the need for familiarisation but benefitted from the fact that there was less volume of mapping and action planning work under the transitional thresholds, the increase in workload due to the definitive thresholds being applied appears to have been partly responsible for the delays in R2.
- The implementation approach itself, particularly when a decentralised approach has been adopted that requires coordination among many different actors at different levels of governance.
- Whilst in some countries, the implementation approach worked reasonably well in R1, when only the transitional thresholds applied, but once the definitive thresholds were applied, there were problems in coping with the volume of work implied by the significant increase in the amount of NAPs that had to be produced in R2.

Feedback was received on this issue through the interviews, with further feedback from participants in the validation workshop:

- **FR –** the delays were attributed primarily to the strongly decentralised way in which the END has been implemented for agglomerations. The interpretation of an 'agglomeration' as relating to the *commune* level means that large numbers of NAPs need to be produced for agglomerations. In smaller communes, there were difficulties in persuading the local *mairie* to carry out noise mapping and action planning due to lack of budget and expertise.
- **DE –** there were delays in the completion of SNMs (explained in the earlier sub-section on NAPs), which led to knock-on delays in the finalisation of NAPs. There was also a problem that the methods selected for ensuring adequate public participation in action planning was insufficient given the expected 12 months' timeframe between when MS are required to submit SNMs and NAPs. Significant delays were also reported in DE due to the fact that political bodies must approve the noise action plans for municipalities. A further issue was that responsibility for preparing NAPs lies with different CAs from those involved at local level in undertaking mapping, which requires additional coordination time.
- **IT –** there was a particular problem with the non-submission of NAPs for agglomerations and airports. This was attributed to the decentralised approach, which required a complex coordination of multiple actors along the process, from the definition of SNMs to the development of NAPs. In R1, the national CA failed in providing effective guidance to the designated CAs on how to gather and elaborate data to develop SNMs and NAPs. Municipalities and provinces were particularly affected, especially when definitive thresholds were applied in R2. There were problems in coping with the volume of work implied by the significant increase in the amount of NAPs that had to be produced in R2. This was particularly challenging for local authorities dealing with agglomerations due to lack of resources and technical knowledge.
- **LU** - there have been delays in the development of draft NAPs and significant delays in the adoption of final versions of NAPs and in making these publicly accessible. The NAPs require political approval before they can be finalised, even if the drafts

have been submitted to the EC. The delays were attributed in part to the need to allow sufficient time for public consultation and to enable feedback received through consultations to be taken into account and reflected in revised NAPs.

- **NL -** the 12-month timeframe does not pose a problem in instances when the corresponding SNMs and levels of population exposure have not changed much between Rounds – meaning that authorities can already start action planning processes before SNMs are completely updated.
- **SE -** political decision making leading to the final adoption of NAPs following the initial completion of SNMs already takes up to 6 months, i.e. half the total time allocated to the period between the submission of SNMs and NAPs. However, it was suggested that this could be remedied by starting the political decision-making process before SNMs are finalised.

Noise mitigation, abatement and reduction measures identified in Noise Action Plans

An analysis was carried out of the **different types of measures supported in NAPs** in each round to ascertain whether there was continuity between Rounds. A key finding was that in R2, the types of measures identified are broadly similar to those supported through R1 NAPs. There are many examples of measures mentioned in NAPs in both R1 and R2. This includes those that continue to be implemented over a period that extends between Rounds. The most frequently mentioned measures in NAPs analysed in the 28 MS reports are: technical measures at source, noise insulation, land-use planning, traffic planning, quieter road surfaces and the installation of noise barriers.

In the following table, MS are clustered according to the types of measures that were most commonly identified in NAPs.

Table 2.9– Clustering of EU Member States by measure type

List of common noise reduction and mitigation measures	Clustering of Member States by most commonly used measure types
Technical measures at noise source	19 MS – AT, BE, BG, CZ, DE, EE, EL, ES, FR, HR, HU, IT, LT, LV, LU, PL, RO, SE, SK, UK
Noise insulation	18 MS – AT, BE, BG, CY, CZ, DE, DK, EE, EL, ES, FR, HU, IT, LT, LU, NL, PL, PT, RO, SE, SK
Land-use planning	19 MS – AT, BE, BG, CZ, DK, EE, ES, FI, FR, HR, HU, IE, IT, LT, LV. PL, RO, SI, SK, UK
Traffic planning (incl. speed reductions)	14 MS – AT, BE, CY, DK, EE, FR, IE, IT, LT, LV, NL, PL, PT, RO, UK
Quieter road surfaces	10 MS – AT, BE, DE, EE, EL, IE, IT, NL, PL, RO, UK
Installation of noise barriers	12 MS – BE, CY, DK, EE, EL, FI, IE, LT, LU, PL, PT, SE, SK
Selection of quieter sources (incl. promotion of quieter public transport)	5 MS – BE, CY, CZ, LT, LV
Other (e.g. measures to reduce sound transmissions in buildings, incentives and capacity-building)	6 MS – BE, ES, MT, LT, LV, SK.

Source: own assessment of measures based on 28 country reports.

The table above indicates that there is considerable diversity as to the types of measures identified by Member States in NAPs. The most common measures have been adopted by more than half of all Member States. Measures vary greatly in terms of their scope and the level of expenditure required to implement them.

The criteria mentioned by CAs for determining the selection of noise mitigation, abatement and reduction measures included cost-effectiveness (although a proper assessment was in many MS undermined by a lack of data), compatibility with existing legislation, flexibility in application, number of beneficiaries and how easy measures could be implemented. More information on the typical cost benchmarks for measures is provided in Section 3.2.4, which draws on 19 case studies that were carried out to assess the costs and benefits of measures to tackle noise at receptor.

Availability of guidance on the preparation of Noise Action Plans

In R1, several MS developed **national guidance** on Noise Action Planning. Those MS with legally binding noise limit values and guidelines had generally used exceedance as the basis for prioritising measures contained in NAPs. MS that specified that they used health-based assessments in the establishment of priorities include **Cyprus, Finland, Romania** and **Belgium (Wallonie).** The use of population exposure as a criterion to establish priorities was also common. A similar profile was seen in R2, although NAPs were still being developed and/or subject to approval in Q2 2015 in Bulgaria, Greece, Malta and Wallonia (Belgium).

However, despite the availability of national guidance, some stakeholders interviewed perceived there to be a lack of guidance at EU level on the drawing up of Noise Action Plans, and in particular on cost-benefit analysis.

Whereas guidance has been produced at EU level to assist CAs in carrying out strategic noise mapping[57], this does not appear to be the case in respect of noise action planning. In 2010, the EEA developed a *Good practice guide on noise exposure and potential health effects*[58]*.* This provides some guidance on how to measure costs and benefits but with a focus on measuring the health effects. It sets out exposure-response relationships and thresholds for health endpoints and provides background information about concepts relevant to measuring health effects, such as the use of DALYs and hedonic pricing techniques.

The EC discussed with MS the future revision of Annex III of the END, which would provide guidance on assessing the health effects of noise, and the appropriate dose response relationships to be applied by source. This will be based on the revised WHO guidance on dose response relationships that is expected to be published in the end of 2016.

However, many END stakeholders maintained that more practical guidance is also needed as to how the costs and benefits of individual measures can be assessed as part of the 'financial information' section when preparing their NAP.

The evaluators note that the work carried out through the CBA and the development of quantitative case studies as part of this study could provide the basis for updating EU guidance in future. For instance, cost and benefit benchmarks are provided for the order of magnitude of costs/ benefits for different types of measures.

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[57] Good Practice Guide for Strategic Noise Mapping and the Production of Associated Data on Noise Exposure, 2007, WG-AEN

[58] EEA Technical report No 11/2010

The research identified a number of examples of countries (e.g. **DE, IE, LT and the UK – England, Wales, Northern Ireland and Scotland have produced separate guidance**) that have developed non-binding guidance at national level on the preparation of NAPs. Examples of the wide range of guidance available are provided in the following:

Box 2.2 National guidance on noise action planning (selected examples)

In **Germany,** national guidelines for noise action planning have been developed, the "Hinweise zur Lärmkartierung", by the Bund-Lander working group on emissions protection, although these are non-binding recommendations. A number of individual cities and / or Länder, such as Brandenburg, Hamburg, Hesse, North-Rhine Westfalia, Saarland and Schleswig-Holstein have developed complementary guidelines.

Ireland produced a Guidance Note for Noise Action Planning[59] for the first round of the Environmental Noise Regulations 2006. In the UK (**England),** Defra prepared Guidance for Airport Operators to produce noise action plans under the terms of the Environmental Noise (England) Regulations 2006 (as amended) July 2013. For other transport sources, Defra provides a Noise Action Plan Support Tool to help relevant authorities with the action planning process. In **Portugal,** guidance[60] has been provided for the development of noise reduction plans by municipalities.

Guidance at the national level has also been developed in many but not all of the new member states. For example, in **Hungary,** guidelines have been produced on action planning at national level[61]. In **Slovakia,** a guidance document "Expert Guideline No. OZPaZ/ 5828/2007" was produced by the Public Health Authority of the Slovak Republic. The aim was to define the principles of action plan preparation and the rules and procedures for information to the public, in accordance with Act. No. 2/2005 Coll.[62] and the END. In **Lithuania,** national guidance has been developed to provide methodological assistance and to harmonise the preparation of noise action plans through a common noise action planning methodology (the Exemplary Model for the Organization and Implementation of Environmental Noise Prevention)[63].

In **Latvia,** guidelines were established at national level for drawing up and implementing noise action plans (NAPs)[64]. In **Estonia,** national guidelines for drawing up action plans are available online.[65]

Among EU13 (new) member states that have not developed formal guidance are **Romania** (where nevertheless there is some internal guidance on what has to be reported to the environmental authority in terms of common data to be provided in each NAP).

Although many MS have developed national guidance, the interview feedback found that national CAs would like the EC to provide EU level guidance on action planning so as to help strengthen and update existing national guidance. This was especially the case in those MS that joined the EU more recently.

[59] epa.ie/pubs/advice/noisemapping/EPA%20Guidance%20Note%20for%20Noise%20Action%20Planning.pdf

[60] www.apambiente.pt/_zdata/DAR/Ruido/NotasTecnicas_EstudosReferencia/PMRR.pdf

[61] http://www.kvvm.hu/cimg/documents/_12___tmutat__zaj.doc

[62] http://www.health.gov.sk/redsys/rsi.nsf/0/3e6b545e2697a78cc1256f970033e1b0/$FILE/vestnik0707.pdf.

[63] An exemplar of a NAP is published on the website of the National Public Health Surveillance Laboratory under the Ministry of Health at http://nvspl.lt

[64] www.health.gov.sk/redsys/rsi.nsf/0/3e6b545e2697a78cc1256f970033e1b0/$FILE/vestnik0707.pdf

[65] http://www.riigiteataja.ee/ert/act.jsp?id=13164685 and http://www.riigiteataja.ee/ert/act.jsp?id=917329

Variations as to whether measures identified in NAPs have actually been implemented

There are wide differences between EU MS as to whether measures identified in NAPs are actually implemented. Formally speaking, the END only requires a NAP to be drawn up. Art. 8(1) states that MS shall draw up action plans designed to manage, within their territories, noise issues and effects, **including noise reduction if necessary.** There is however no explicit requirement for measures to be implemented. Art. 8 notes that *"the measures within plans are at the discretion of competent authorities, but should address priorities which may be identified by the* **exceeding of any relevant limit value** *or by other criteria chosen by the Member States and apply in particular to the most important areas as established by strategic noise mapping".*

It is of course implicit that Member States should not only identify, but actually implement suitable measures. Although the regulatory approach **fully reflects subsidiarity,** the research found that different MS have interpreted the lack of a formal requirement to implement measures differently. For instance, some MS have supported measures that require expenditure, whereas others have mainly identified non-spending measures. A further issue is that due to the **global economic and financial crisis** and associated **cuts in public budgets, some MS may have** identified spending measures in NAPs, but they have not been in a position to identify budget to actually implement these measures.

It is consequently difficult to obtain a comprehensive picture across the EU as to which measures have been fully implemented, those that have been partially implemented and those that have not gone ahead at all. Whilst Annex V of the END setting out the minimum requirements does stipulate that NAPs should contain information about what measures have gone ahead previously, there is in practice often a lack of clear information on which measures were implemented in the previous round.

Selected examples from different MS of the situation in respect of the implementation of measures in NAPs and associated challenges are now provided.

In the **Netherlands,** considerable budget was set aside for measures identified in NAPs in both R1 and R2, with evidence of an increase in funding for noise mitigation, abatement and reduction compared with the situation before the END was introduced. However, a particular problem was identified that even in cities that had expended significant resources, such as Rotterdam which invested significantly in quieter road surfaces, the situation had actually worsened in terms of the number of persons exposed. This was due to a lack of comparability of noise maps across Rounds – the different noise modelling tools used in R2 resulted in a higher figure for the number of people exposed. While the investment should in theory have reduced the number of people sleep disturbed or highly annoyed, the lack of data comparability made it difficult to quantify the impact. This in turn made it more difficult to persuade politicians of the need for further spending measures in R2, given the question mark as to the cost-effectiveness of measures already implemented.

The lack of resources due to the financial crisis was identified as a problem in a number of MS. This has meant that to date, in several EU MS, the measures that have been implemented have mainly been non-expenditure measures, such as promoting increased use of public transport, encouraging more walking and cycling etc. In **Italy,** for instance, the lack of resources due to the financial crisis was a major problem, according to interviewees from both the national and regional authorities. However, some expenditure measures were implemented, such as laying quieter asphalt, although it was difficult for the responsible authorities to specify the extent of attribution to the END, as opposed to Italian national legislation on noise.

In **Ireland,** whilst a number of spending measures were identified in the NAP for Dublin City agglomeration in R1, due to the crisis, only non-spending measures were actually implemented, such as encouraging more sustainable forms of transport use (walking and cycling, travelling more often by public transport rather than by car, etc.). In **Latvia** and **Lithuania**, it was also acknowledged by the respective national CAs that the crisis had led to a scaling back of the level of ambition at the measure level during implementation compared with the original intention when the R1 NAPs were produced.

A further problem identified in both R1 and R2 was that in many EU MS, there was a lack of dedicated budget for environmental noise. Achieving progress in tackling noise at receptor therefore remained strongly dependent on whether funding could be earmarked from other policy areas such as transport, urban development and planning, infrastructure development etc. A number of interviewees recognised that one of the challenges for CAs responsible for implementing NAPs is that environmental noise mitigation and reduction is not the primary driver of many measures, but rather an important secondary benefit.

There are however some types of measures identified in NAPs where environmental noise reduction is the primary driver, such as noise barriers (to tackle road traffic and sometimes railway noise) and noise insulation of windows (aircraft noise). Examples are provided in the table below to illustrate this point:

Table 2.10 - Examples of measures identified in NAPs and extent to which noise mitigation a primary or secondary driver

Policy area	Policy objective (primary)	Measure type	Environmental noise – driver type (primary, secondary)
Transport	• Reduce road traffic noise	• Noise barriers	Primary
Transport	• Reduce aircraft noise at receptor	• Noise insulation measures	Primary
Transport Urban planning	• Road safety • Improving air quality	• Traffic calming measures • Speed reductions	Secondary
Transport/ infrastructure development and planning	• Infrastructure improvement • Economic development	• Pre-planned road infrastructure programmes • Laying quieter asphalt	Often secondary, but sometimes primary

Source: bottom-up feedback collected from the Member States, as presented in the 28 country reports

In some instances, measures that were identified in NAPs have gone ahead, but it was difficult to attribute these solely to the END, either because the measures originated from national legislation that preceded the END or the measures were already planned prior to the END being adopted (reflecting the long-term nature of many transport and infrastructure-related measures that have benefits from an environmental noise abatement, mitigation and reduction perspective).

It is also important to observe that there are differences between MS in action planning approaches that are reflected in the way in which **measures are identified.** Whereas in some MS (e.g. DE)**,** a long-list of measures is provided in NAPs, and only some of these measures have a realistic chance of being implemented, in other MS for instance, in southern Europe and in many of the new MS, measures are only included if expenditure has actually been identified and set aside for costed measures. In **France**, the national CA referred to a concern among many local authorities involved in action planning in agglomerations that measures should not be mentioned in NAPs unless there was a realistic chance of them going ahead. Otherwise, this risked raising false expectations among citizens at local level.

In **Germany,** for instance, among the research findings from a review of a sample of NAPs was that many measures identified in R1 NAPs were already planned prior to the END coming into effect and have simply been continued. Interviewees mentioned that this was due to the fact that Germany had strong environmental noise legislation prior to the END coming into effect. However, if the END is seen as an umbrella for bringing together different types of measures that help to mitigate and reduce environmental noise at receiver, then evidence of considerable expenditure can be found, for instance, through measures such as laying noise-reducing asphalt and noise insulation of windows.

In assessing how far progress has been made through the implementation of measures identified in NAPs to tackling noise at receptor, the baseline situation should also be taken into account. For instance, although **Ireland** has mainly implemented non-expenditure measures, during the economic boom of the 1990s, an interviewee stressed that significant investment had been made in the development of a new motorway network, which meant that there were much quieter road surfaces compared with many other Member States.

Other issues relating to the implementation of Noise Action Plans

A number of implementation challenges were identified in the first implementation report relating to action planning in 2011. Whilst some issues have been resolved, for instance, there is greater access to technical expertise to assist in supporting action planning in R2 than in R1, there remain a number of outstanding implementation issues in R2.

A summary of the main issues related to the implementation of NAPs raised through the online survey and interview programme is now provided (it should be noted that issues relating to the delays encountered in R2 were analysed earlier). Where appropriate, participant feedback from the workshop is also highlighted:

- Lack of adequate participation in public consultations on draft NAPs (**5 MS– DK, EE, HU, NL, UK**);
- Lack of enforcement mechanisms to ensure that measures to promote noise reduction are effective, such as sanctions in the case of exceedence (**5 MS- BG, DE, DK, LT, RO**);
- Lack of experience and appropriately qualified local noise experts **(EL, LV, PL, RO);**
- Lack of know-how as to how to assess the costs and benefits of individual measures within NAPs and at the level of the action plan overall (almost all EU MS).
- Lack of assessment of the economic impacts of proposed measures in NAPs adopted (**CZ);**
- Examples of insufficient consultation between local and national authorities in instances where local authorities were responsible for action planning, but the measures identified in NAPs would require significant expenditure by public authorities at a national level **(e.g. IE, LT)**.

- In **Greece**, a combination of a lack of adequate budget and administrative capacity, and awareness among civil servants about the problem of environmental noise at receptor, which made it difficult to implement measures that require expenditure**.**
- It was noted by stakeholders in a number of MS (e.g. **DE, IE**) that there is a need for closer cooperation between public authorities in charge of major road and major rail infrastructure *within* agglomerations and the CA responsible for agglomerations

in the action planning process in order to develop more effective strategies and measures to tackle environmental noise at receptor. At present, the main problem identified is that local authorities produce NAPs, but the implementation of the measures contained therein depends on national level bodies responsible for different transport infrastructure, who have the spending power to decide whether measures will be funded. This was mentioned both in interviews and at the workshop.

Cross-border cooperation - Noise Action Planning

Issues were identified relating to the lack of sufficient cross-border cooperation in some MS (see the country fiches for DE, HU). For instance, in HU, whilst in R1, there was cooperation and according to the 2010 country fiche, noise protection measures were put in place to upgrade the three rail corridors in Hungary where there was a cross-border railway crossing (Budapest – Hegyeshalom - Vienna, Budapest – Szolnok – Romania and Budapest – Boda – Slovenia). However, in R2, two of those three major railways NAPs had not been completed and only Budapest- Hegyeshalom. However, there was no cross-border cooperation in the second round.

Public information accessibility – Noise Action Plans

An effort has been made in many MS to ensure that EU citizens have a number of different means available to them in order to obtain copies of draft NAPs to enable them to participate in public consultation. In addition to making NAPs available online, in some instances, hard copies have been made available at the offices of local or regional authorities, public meetings and workshops have been organised and held, and comments registers have been made available in local authority and council buildings. In order to promote awareness about public consultations on NAPs, adverts have been taken out in newspapers and other media to inform the public about these meetings and to provide advance notice that a public consultation will take place.

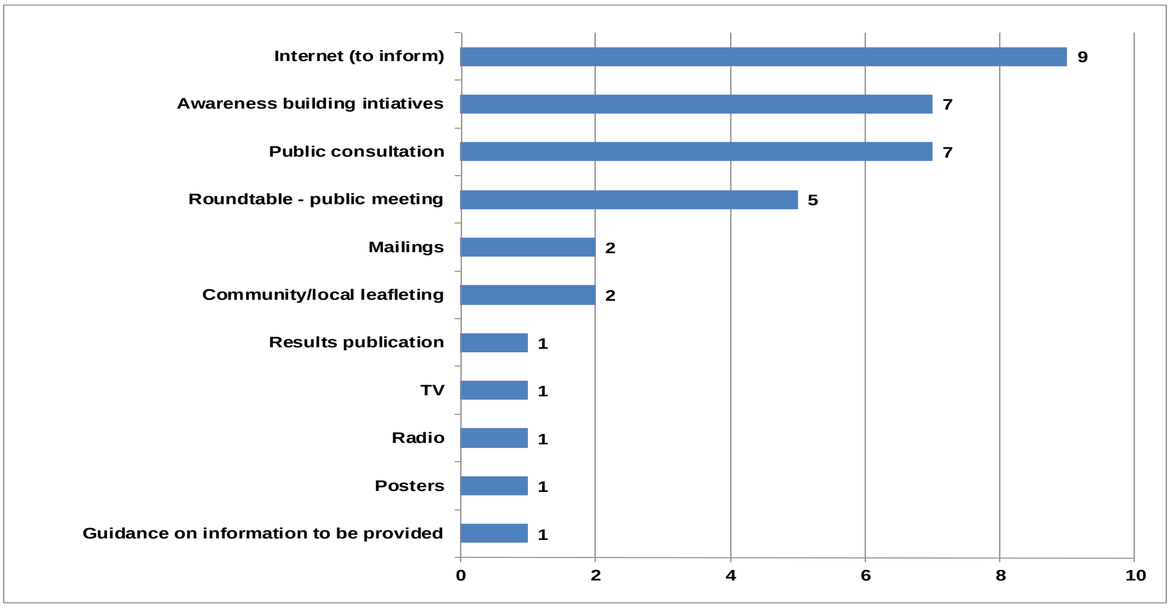
In terms of the **accessibility of public information** and how this has evolved between the two rounds of END implementation to date, the majority of R1 NAPs have been published online. In R2, as detailed earlier, some NAPs for at least one transport mode or for agglomerations were still missing in 23 MS. This means that in those MS, EU citizens, civil society organisations and NGOs do not yet have access to all R2 NAPs, even two years after these were meant to be submitted.

Public consultations on Noise Action Plans

Art. 8 obliges CAs to **consult with the public on draft NAPs** prior to their finalisation. The aim is to provide an early opportunity for the public to participate in the preparation and review of NAPs, with the results taken into account and the public kept informed about the decisions taken. In R2, CAs used a range of mechanisms to meet these obligations, such as publishing draft NAPs on websites (the most commonly used method), holding public meetings and workshops during the action planning process to engage with the public, etc.

The consultation channels that were mentioned by national CAs in the country reports is summarised in the Figure on the following page:

Figure 2.6 - Consultation channels – R2



Source: Own compilation based on 28 country reports

There were a number of findings from the implementation review in relation to how MS manage public consultation processes, and feedback on the extent to which holding consultations has had an effect on improving the quality of NAPs (or not as the case may be). A further consideration was whether consultation procedures have had an impact on improving the outcomes associated with implementing NAPs (and the measures contained therein).

In many EU MS, the **length of the public consultation period to obtain feedback on draft NAPs** was between 4 weeks and 14 weeks. For instance, in **France,** the standard duration of consultations was 2 calendar months. However, examples were also cited of insufficient time being given to review draft NAPs and to provide feedback, such that the effectiveness of the process was considered by NGOs and community groups to have been undermined in some instances. It is inappropriate to name particular MS in this regard, since in some MS, both negative and positive feedback was received with regard to experiences of participating in public consultations.

In terms of how consultations were carried out, typically, these were carried out separately for each individual transport source. However, in the **UK** (**England),** in R2, a public consultation was organised by Defra[66] on three draft Noise Action Plans covering roads, railways and agglomerations (large urban areas) and this was open for 14 weeks (just over 3 months).

Problems were identified in **securing adequate participation from the public and/ or relevant stakeholders such as NGOs/ community organisations** in some MS (e.g. mentioned in EE, EL, FI, HU, NL and the UK), even where the role of public consultation had been well-publicised in advance. CAs confirmed that it was **difficult to obtain a sufficient number of responses** to be considered representative and several stated that they had received very few (or no) responses to public consultations. As a consequence, they regarded the process as being ineffective. Taking the Defra consultation mentioned above as an example, only 23 responses were received to the consultation for the whole of England across all transport modes, although several were received from highly relevant organisations, such as national bodies responsible for roads and railways.

[66] www.gov.uk/government/uploads/system/uploads/attachment_data/file/276066/noise-action-plan-sum-resp-201401.pdf

However, some CAs noted that effective consultation is more about securing informed responses than achieving a high level of response of varied quality. Allocating insufficient budget to consultation was also identified as a problem in some MS. This may limit the visibility and promotion of action planning consultation and thus the quantity and quality of responses.

There were concerns about the **quality of consultation input** among some CAs. It was viewed as being risky to rely on contributions from individual citizens who may not be sufficiently well informed to provide ideas that can be directly incorporated into an action planning document. It was viewed as being more effective to engage with well-established NGOs with the necessary technical capacity to be able to provide a useful input to public consultation.

In terms of **how consultation results are presented**, a common practice was to include consultation responses as an annex to the final adopted versions of NAPs. This approach was seen by stakeholders as having the advantage of ensuring transparency. However, stakeholders observed that not that many NAPs provided a clear explanation or overview as to how feedback has been taken into account. This was confirmed by the study team in reviewing NAPs through the desk research as part of the preparation of 28 country fiches. Some CAs provided a written response to consultation feedback and demonstrated how they had analysed and considered the feedback, but it was often unclear how CAs had dealt with the feedback received.

Several NGO stakeholders interviewed pointed to a **lack of concrete outcomes from their participation in R1 noise action planning consultation processes.** It was not always clear how CAs had used consultation feedback. This has discouraged subsequent public engagement in R2. Conversely, CAs pointed to a lack of public engagement in the first place.

A number of NGOs and local community groups have been interviewed through the research. Among the feedback received in relation to their experiences of participating in public consultations were that:

- There were concerns with regard to the effectiveness of public consultations. There was a perception among some NGOs / community groups that consultation involved going through the motions rather than leading to tangible changes in the final drafts of NAPs.
- There was also concern in some countries that action planning was “all planning and no action”, since CAs responsible for NAP implementation often lacked sufficient budget to implement measures included in the NAP. Moreover, since tackling environmental noise is often a secondary rather than the primary driver behind spending decisions, the CA responsible for NAP implementation is often dependent on securing budget from other policy areas to achieve progress.
- The above points were seen as factors potentially reducing the level of participation in public consultations in subsequent rounds of END implementation.
- More positively, even though some NGOs/ community groups were disappointed by the perceived level of impact their feedback had had on the NAP, it was appreciated to at least have the opportunity to review and comment on the NAP.

Despite the weaknesses identified above, there was also some positive feedback about how public consultation has been approached during END implementation in some MS, and about its potential value in strengthening the effectiveness of NAPs.

In some MS (**e.g. FR, DE, LT, LU and NL)**, the research identified evidence of a concerted effort having been made to promote participation in public consultations. Moreover, the feedback received through public consultation was regarded as having been highly useful and taken into account in the revision of some NAPs.

A number of examples of good practices were identified in organising public consultations, as detailed in the following two examples:

Box 2.3 Examples of the role of public consultation

Example 1 – public consultation on R2 NAPs in England

Consultation approach. In England, the consultation process was used by Defra as a mechanism to check whether stakeholders were happy with the overall change in approach to action planning between R1 and R2. For instance, there was a greater focus in R2 on the concept of the identification of “Important Areas” for the purposes of prioritising noise abatement, mitigation and reduction measures. The consultation was used to validate whether this approach was appropriate as well as to ascertain views on whether the approach to quiet areas in agglomerations was seen as the most effective way forward. Three specific questions were put to consultation respondents:

Question 1: Do you agree with the overall approach being proposed for identifying **Important Areas**? If not, what alternative approach would you advocate?

Question 2: Do you agree with the approach being proposed for identifying and **preserving quiet areas in agglomerations**? If not, what alternative approach would you advocate?

Question 3: We have restructured and aimed to simplify the Noise Action Plans covered by this consultation, so that there are three in total covering all roads, all railways and all agglomerations. Are you content with the approach?

Utility of the consultation and any changes made to the NAP. The feedback received was deemed useful in the analysis of consultation responses subsequently published. For instance, some stakeholders noted that "restricting Important Areas to the "top 1%" of those affected could overlook a significant proportion of the population exposed to relatively high levels of transport noise. Some respondents proposed instead extending the definition of Important Areas to encompass a higher percentage of the population; with suggestions ranging from the top five to the top 20%. The outcome was that Defra retained the proposed approach to identifying Important Areas, focussing on the top 1% of those affected by road and railway noise, since this was supported by the majority of respondents. The rationale was that there were likely to be budgetary constraints that precluded extending the approach beyond the top 1%.

Some suggestions made by consultees were however taken into account. For example, in respect of quiet areas in an urban area, the documentation on quiet areas now clarifies that “when preparing quiet area applications, the planning authority may need to liaise with other relevant departments.

In addition, Defra simplified the quiet areas application form and intend to pilot this with a selection of local authorities prior to wider roll-out”.

In summary, consultation played a positive role as a mechanism to allow the national CA to obtain feedback directly from stakeholders as to whether they agreed with different aspects of the proposed approach to END implementation in R2.

Example 2 – public consultation on R1 NAPs in Luxembourg

Consultation approach. In Luxembourg, the national CA interviewed emphasised the importance attached to carrying out effective public consultation as a means of ensuring transparency in the finalisation of NAPs. In both R1 and R2, a series of transport-specific consultations were organised.

For instance, in R1, a consultation meeting took place to discuss the draft NAP on major roads and major railways[67]. In the final NAP, a meeting note summarising the proceedings and the comments made during the consultation meeting was provided.

[67] Plan d'action de lutte contre le bruit des grands axes routiers de plus de six millions de passages de véhicules par an, May 2010, http://www.environnement.public.lu/air_bruit/dossiers/BR-bruit/bruit_plans_action/plan_action_routes.pdf

Relevant Ministries and other national public bodies were represented at the consultation meeting, such as the Ministry of Environment, Ministry of Transport, Ministry of Public Works, the national administration for roads and bridges and the national environmental agency. Ensuring that the right actors attended helped to ensure that the consultation process itself was meaningful and useful to participants. Representatives from the commune level also attended the meeting.

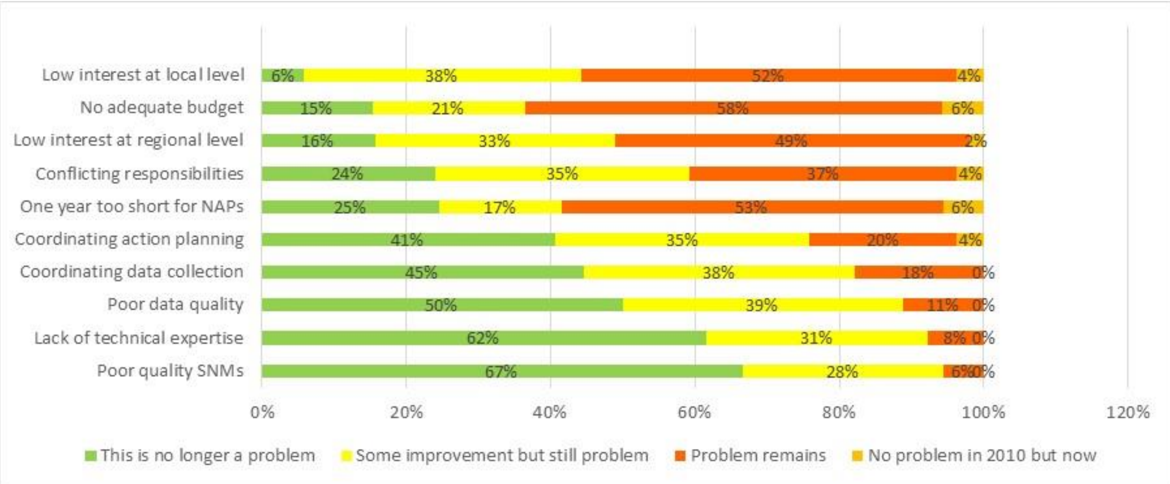
Utility of the consultation and any changes made to the NAP. A series of questions were raised at the meeting by participants. Many of the questions were of quite a basic level, but were useful in reassuring the public and community organisations that the NAP had been fully thought through. Participants were then given the opportunity subsequent to the meeting to express their views by providing written comments to any of the 33 communes that are covered through the roads NAP, which were then fed through to the responsible CAs.

The consultation was viewed as useful because it provided a forum to engage with the public and to explain the purpose of the NAP and the measures contained within it. Some more detailed exchanges took place with regard to the views of citizens on particular types of noise mitigation and reduction measures. The need to take into account the diversity of views among citizens was emphasised. For instance, some citizens were in favour of installing noise barriers to reduce noise but others were strongly against because they viewed the barriers as being an eye sore.

Source: own research, based on interviews and desk research

The figure on the following page summarises feedback from public authorities responding to the online survey on **key implementation issues related to action planning**.

Figure 2.7 - When surveyed in 2010[68], those involved in implementing the Directive highlighted various issues related to noise action planning. Please indicate whether the issues identified still apply to your organisation? (n=56)



Source: Online survey of public authorities

[68] This survey question picked up on issues identified in the first legal implementation review and sought to ascertain if the same issues were still problematic in R2 or had been addressed through remedial actions.

As the above Figure shows, good progress was found to have been made between Rounds in respect of core END implementation activities by national CAs, such as coordinating the process of action planning, where 45% of respondents believed that this issue was no longer a problem. However, the position appears to be more nuanced across EU-28 as a whole. For instance, 35% of respondents believed that although there were some improvements, there were still difficulties in respect of action planning.

Among those aspects of END implementation relevant for action planning where there does not appear to have been progress and problems remain are the low level of interest in some MS at local and regional levels in the END, a lack of adequate budget, which was seen as a problem remaining in 58% of cases, and the 12-month timeframe for the development of NAPs (where 53% stated that the problem has remained in both R1 and R2.

2.4 Conclusions

The overall conclusions from the second implementation review are now presented, grouped under a number of different headings:

Legislative transposition

- The END has been correctly transposed into national legislation in 27 out of 28 different Member States (Croatia still needs to ensure that all articles are transposed correctly).
- Although when the first implementation review was produced in 2010, there were some outstanding transposition issues in national regulations, these have been resolved.
- However, there appear to be practical implementation challenges relating to translating some of the definitions used in the END, depending on the national-specific context. For instance, the definition of quiet area in an agglomeration and the concept of an agglomeration itself has posed problems in some Member States.

The overall approach to END implementation

- Reflecting the subsidiarity principle, there are wide differences in the approach to END implementation, with a combination of centralised and decentralised approaches, and wide divergence in action planning approaches.
- The administrative level at which implementation takes place (national, regional and local) also varies between agglomerations, roads, railways and airports.

Designation and delimitation of agglomerations, major roads, major railways and airports

- The transition to the definitive threshold of the END between R1 and R2 has had a material impact on the scope of END coverage for agglomerations, major railways and major roads.
- In most MS, there has been a significant increase in the number of SNMs to be produced and in the case of major roads and major railways, in the volume of noise mapping in km. There has likewise been a significant increase in the number of NAPs to be produced in R2.
- There were not found to be any significant problems in the designation of agglomerations, major roads, major railways and airports, since the thresholds themselves are clear.

- There remain practical challenges relating to the delimitation of administrative responsibilities for noise mapping within agglomerations between national bodies and local authorities in a small number of EU MS. The extent of the problem has been reduced in R2 compared with R1 in most but not all MS, as local authorities have gained experience in implementing the END and in overseeing noise mapping.

Noise limits and targets

- Although there are no common, EU-wide limit values in the Directive itself, national limit values – whether through binding or non-binding targets - were seen as helpful in many Member States since their exceedance was often the basis for prioritising noise mitigation and reduction measures.
- Mandatory noise LVs have been set in 21 MS, with non-binding targets in a further 4 MS[69]. However, the research identified limited evidence of the enforcement of LVs in either R1 or R2.

Quiet areas

- In R1, many MS made progress in the development of a national definition of quiet areas in open country and quiet areas in an agglomeration, supported by appropriate selection criteria to help designate such areas. However, in practice, few EU Member States have yet designated any quiet areas.
- In R2, the majority of MS have yet to designate any (END-related) quiet areas. However, those that have done so have increased the number of quiet areas significantly in R2 compared with R1.
- Whilst recognising the progress already made in the development of good practice guidance on quiet areas by the EEA, there is still a perceived need for the EU to provide further practical guidance as to the types of measures that could be implemented in practice, especially in relation to quiet areas in urban areas.

Strategic Noise Maps

- Overall, good progress has been made in carrying out strategic noise mapping over two rounds of END implementation, although progress still needs to be made by Member States to ensure that SNMs and population exposure data are reported to the EC on a timelier basis across EU-28.
- Data comparability between Rounds and different EU MS is likely to remain a challenge until SNMs are produced using the common noise assessment methods set out in the revised Annex II, Commission Directive (EU) 2015/996 from R3 (voluntary basis) and R4 (mandatory basis).
- Currently, data comparability between rounds is being undermined by differences in the methodology applied to producing noise maps, changes in the modelling software used and computation methods and the difficulty in obtaining reliable and consistent input data.
- Whilst some data has been produced on a comparable and consistent basis for the same source over two successive rounds, comparability is often limited, risking the misinterpretation of population exposure data when presented over consecutive rounds.

[69] Denmark has both binding and indicative values in place, depending on noise source.

- Experiences gained in noise mapping during R1 were seen as having strengthened the familiarity of CAs in coordinating noise mapping, although in both rounds, most CAs have outsourced mapping itself to specialist acoustics consultants with experience in noise prediction calculations on noise exposure and in the use of different national and interim methodologies.
- The EEA Good Practice Guide and national guidance documents has helped to inform the preparation of SNMs in many MS.
- However, in both Rounds, there have been frequent delays at least in some MS in preparing and submitting SNMs and these remain incomplete, particularly for some noise sources in R2. The problem of delays was recognised by CAs in the MS concerned.
- Although most countries have delivered at least some noise maps during R2, as in R1, in some MS, there have been significant delays in the development and submission of SNMs. These were attributed by the MS concerned to ongoing challenges relating to a lack of human and financial resources, and a lack of political will at local level to allocate resources to noise mapping. There was also some evidence of competing political priorities (such as air quality and climate change-related policy measures) for limited resources.
- In some cases, there were delays in budget being approved and made available for noise mapping purposes, due to the economic and financial crisis. Whilst the economic crisis may be over in many EU Member States, there are medium-term consequences, such as public sector budget cuts being implemented over a prolonged period of time, which have led to delays in getting R2 noise mapping underway in several Member States (e.g. EL, ES and PT).
- There remain administrative implementation challenges in some EU MS, such as overly complex administrative arrangements and division of competencies for noise mapping, especially within agglomerations. In some MS, especially those with a strongly decentralised implementation structure, many local actors are involved and there has sometimes been a lack of effective central coordination.
- The input data necessary for noise mapping was not always available either in R1 or R2, although there have been improvements in the availability of data in R2. This has implications for data comparability between MS. For instance, in some MS, data on the average number of people per dwelling is available, whereas in other cases, it is based on estimates produced by acoustics consultants. This impacts on the consistency and comparability of data.
- Almost all MS that have developed SNMs in both R1 and R2 made these available online. However, the delays in R2 have meant that some SNMs are still not easily accessible online by EU citizens and NGOs/ community organisations.

Noise Action Plans

- There have been delays in the submission of R2 NAPs in several MS. Reporting information on data completeness shows that NAPs are particularly incomplete for railways and airports.
- In the case of agglomerations, a particular problem was identified in EU Member States with a decentralised approach to END implementation. It was found that the more CAs and other public bodies that are involved in noise action planning, the more difficult it is to ensure effective coordination of noise action planning processes.
- The timescale of 12 months between the deadline for the submission of SNMs and the deadline for the submission of NAPs to the EC was widely viewed as being too short to allow sufficient time for liaison and discussions between different CAs involved in action planning, to carry out public consultations and to

take the feedback obtained through public consultation into account in NAP finalisation.

- Since the END is implemented under subsidiarity, there were found to be wide divergences in the approach to action planning between MS. For instance, there are significant differences in the length of NAPs and in their level of ambition and in the types of measures identified to promote noise mitigation, abatement and reduction, in the level of expenditure that the implementation of measures would require etc.
- Whilst in some MS, a strategic approach has been adopted to the development of NAPs, in others, there has been a more operational focus, through the development of very detailed NAPs.
- A number of weaknesses were also identified in NAPs. Many NAPs do not include cost-benefit information, even though this is listed in Annex V as information to be provided "if available" (minimum requirements for NAPs) under the 'financial information' section. Some NAPs include the projected costs, but contain no information about the expected benefits.
- Although national guidance has been produced in many EU MS, the lack of EU-level guidance on NAPs was seen as a shortcoming which if addressed could help to improve the quality of NAPs, especially in problematic areas such as the section on cost-benefit.
- There has been broad continuity in the types of measures identified in NAPs between R2 and R1. This was viewed as being appropriate, given the need for a long-term approach to environmental noise management and to effective practices in noise mitigation, abatement and reduction.
- The difficulty in identifying dedicated budget for noise mitigation and reduction measures was cited as among the main implementation challenges in implementing the measures set out in action plans.
- There was a recognition that public engagement in action planning through participation in public consultation processes remains a weak spot that needs to be improved in many EU MS.
- Many CAs interviewed stated that they had received very few or no public consultation responses. Consequently, they regarded the quality of input to strengthening NAPs as being ineffectual and the process as being ineffective.
- Whilst in some cases, it was made clear by CAs how consultation feedback had been taken into account, and whether this had influenced NAP finalisation, in many cases, NGOs and community organisations were unclear how consultation had been considered and whether it had any impact.
- More positively, there were at least some examples of the effective use of the results from public consultations in some EU MS (e.g. **FR, LU** and the **UK**, among others). Consultation feedback was often summarised either in the NAP itself or as an annex to the NAP, which over time should help to strengthen transparency and accountability.

3. EVALUATION OF THE END

This section sets out the rationale for carrying out a REFIT evaluation of Directive 2002/49/EC ("the END"), the evaluation's objectives, and methodological challenges. The findings from the assessment of the intervention logic underlying the Directive are set out. The assessment of key evaluation issues and the main findings in relation to *relevance, coherence, effectiveness, efficiency* and *EU added value* are then outlined.

3.1 The evaluation of Directive 2002/49/EC

3.1.1 Rationale for a REFIT evaluation of Directive 2002/49/EC

Through REFIT, the EC is undertaking systematic assessments of all EU environmental legislation in order to check its "fitness for purpose". In 2013, the EC announced in its Communication on Regulatory Fitness and Performance programme (REFIT)[70] that an **Evaluation of the Environmental Noise Directive** (Directive 2002/49/EC) or the "END") would be undertaken to assess the Directive's regulatory fitness. Such evaluations provide an evidence-based critical analysis of whether EU actions are proportionate to their objectives and delivering as expected. They cover environmental, economic and social aspects.

REFIT is part of the EU's **Better Regulation agenda** and its purpose[71] is to "cut red tape, remove regulatory burdens, simplify and improve the design and quality of the legislation so that EU policy objectives are achieved, and the benefits of EU legislation are enjoyed at lowest cost and minimum administrative burden, in full respect of the Treaties, particularly subsidiarity and proportionality".

REFIT also emphasises the importance of checking that EU legislation pursues policy objectives that could best be achieved at an EU level. The importance of identifying any possible gaps and loopholes, inconsistencies, uncertainties and ambiguities in EU legislation has also been stressed in earlier Communications on Better Regulation. These are important considerations when assessing the END.

In the May 2015 Better Regulation Package, the EC adopted a new Communication[72] which states that "applying the principles of better regulation will ensure that measures are evidence-based, well-designed and deliver tangible and sustainable benefits for citizens, business and society as a whole". The 2015 guidelines on Better Regulation[73] have also been taken into account in the development of this evaluation report, in particular "Chapter VI - Guidelines on evaluation and Fitness Checks".

The evaluation focuses on the period of implementation since the Directive's adoption until November 2015 and takes stock of the extent to which progress has been made towards the achievement of its objectives. However, some forward-looking 'prospective issues' as to how environmental noise policy could be further developed, and the legislation's efficiency and effectiveness improved in future arose and are also mentioned in the report.

In the Tender Specifications, the EC set out the key evaluation criteria and questions to be addressed. Further sub-evaluation questions were developed by the evaluation team. The amended list of evaluation questions is provided in Appendix G.

[70] Regulatory Fitness and Performance (REFIT): Results and Next Steps, COM(2013)685 final

[71] Communication on Regulatory Fitness and Performance Programme (REFIT) (COM(2014) 368 final)

[72] Better Regulation for Better Results - An EU agenda, COM(2015) 215 final, 19.5.2015

[73] http://ec.europa.eu/smart-regulation/guidelines/docs/swd_br_guidelines_en.pdf

3.1.2 Evaluation criteria

The key evaluation questions specified in the Tender Specifications were grouped around the core set of five evaluation criteria in EU guidance on evaluation[74]:

- **Relevance** - the extent to which the END's objectives remain pertinent to needs, problems and issues to be addressed;
- **Coherence -** whether the definitions in the legal text are coherent and the obligations clear, whether the articles in the Directive are consistent (**internal coherence)** and the extent to which the END remains coherent with other relevant EU legislation, notably the noise at source Directives (**external coherence)** and;
- **Effectiveness -** the extent to which the END's two objectives set out in Art 1(1) and 1(2) have been achieved to date, the speed of progress and any barriers to achieving objectives. The efficiency of management and implementation and reporting arrangements is also considered;
- **Efficiency** - the extent to which desired effects are being achieved at reasonable cost (i.e. determined through an assessment of the costs and benefits); and
- **EU added-value** - the value added of action at EU level that would be difficult or impossible to achieve through national level actions in the area of environmental noise alone.

In addition, the following issue is relevant across all evaluation criteria:

- **Fitness for purpose –** checking whether the END is fit for purpose and provides a "simple, clear, stable and predictable regulatory framework" is an important overarching issue within a REFIT context.

The evaluation questions were then further developed to determine appropriate sub-questions. The ordering of evaluation issues was revised to reflect the END's underlying intervention logic, starting with the more strategic issues of relevance and coherence, and moving on to the issues of efficiency and effectiveness, which have both an operational and a strategic perspective. The Directive's overall EU added value is then considered. A complete set of evaluation questions ("EQs") and sub-evaluation questions is provided in Appendix G.

It should be noted that in order to address the criteria of effectiveness, efficiency and EU added value, the analysis draws largely on the findings from the interview programme, the online survey and the quantitative case study research, whereas for the assessment of relevance and coherence, the research has necessarily drawn not only on stakeholder feedback but also to a larger extent on desk research. In particular, we have undertaken a review of relevant EU legislation on noise at source and other documentation. The bibliography consulted by the study team is provided in Appendix B. Stakeholder views on the intervention logic diagram were also sought through a validation workshop to discuss the evaluation findings held in September 2015.

[74] http://ec.europa.eu/smart-regulation/evaluation/docs/20131111_guidelines_pc_part_i_ii_clean.pdf

3.1.3 Methodological approach for the evaluation

A summary of the evaluation methodology was provided in Section 1.7.

In terms of the targeting strategy for stakeholder consultations, the objective was to ensure that across the different research methods and data collection tools, as wide a range of END stakeholders as possible were consulted. National CAs in all EU MS were targeted, not only to contribute to the completion of country reports (see Section 2), but equally, to feed into the evaluation. A contact database was developed of a wider range of CAs and other relevant END stakeholders. An invitation to complete the online survey was sent out.

In terms of the structure of the interview programme, the focus was on ensuring that a broadly representative range of stakeholders involved in END implementation were consulted, with a greater focus on CAs directly involved in reporting to the EC, and in strategic noise mapping and action planning but also other public authorities, for instance, those that provide input data to facilitate noise mapping, as well as NGOs and community organisations that have taken part in public consultations on NAPs. In order to ensure that the stakeholder consultations to inform the evaluation research were as inclusive as possible, following the validation workshop, written submissions on the working documents published were welcomed from both workshop participants and non-participant stakeholders unable to attend. Written responses were received from approximately 20 END stakeholders, and these were then analysed.

3.1.4 Methodological challenges in evaluating the END

Before outlining the findings, the main methodological challenges in evaluating the END and assessing its key achievements are outlined in the following table (see second column). In the third column, examples of ways in which these problems have been at least partially overcome is provided.

Table 3.1 - Methodological challenges in evaluating the END

Heading	Key issues	Overcoming challenges
Evaluability	• There are challenges in assessing the END's contribution to mitigating and potentially reducing the level of environmental noise and the adverse health effects of high levels of environmental noise since reducing environmental noise is not an explicit objective, but remains implicit in the recitals. Moreover, although measures are required to be included within noise action plans, implementing these is not mandatory. • Environmental noise at receptor is a MS competence under the principle of subsidiarity. Since the END has been implemented quite differently in different MS, this poses challenges in assessing the efficiency and effectiveness of its implementation overall at EU level. For example, in comparing administrative costs between MS, due attention needs to be paid to the corresponding implementation approach. Otherwise a	• Assessed progress towards a common approach, which although an intermediate, process-driven objective, is still an ambitious objective. • To some extent, the risk of direct comparison has been overcome by clustering groups of MS together that have adopted a similar approach to END implementation to compare "like with like".

Heading	Key issues	Overcoming challenges
	direct comparison could be misleading.	
Attribution	• In assessing the END's achievements, there is a need to consider the extent to which the costs and benefits incurred can specifically be attributed to the END, as opposed to other drivers, such as the existence of pre-existing national regulatory requirements. • Moreover, whilst some measures identified in NAPs have been specifically developed as a result of the END, in many cases, the primary driver of identifying funding for measures is not environmental noise but for instance air quality, road safety, planned transport or road infrastructure improvement. • Whilst there are evidently important secondary benefits for noise mitigation, abatement and reduction, this raises the question of what percentage of the cost and benefit should be attributed to the END and introduction of an action planning versus what would have gone ahead anyway. • The desk research and interviews showed that many measures included in R1 NAPs were planned before the END came into effect (e.g. long-term transport infrastructure upgrading).	Attribution issues factored into quantitative case study and CBA work. Sensitivity analysis was undertaken to assess how costs-benefit ratios would change under different modelling scenarios of 25%, 50% and 75% attribution effects. Attribution taken into account qualitatively through interviews when stakeholders were asked for their views as to whether measures could be attributed to the END either fully, partially or not at all.
Balance between quantitative/ qualitative evidence	• DG ENV put a strong emphasis on assessing the END's cost-efficiency through an assessment of the administrative costs and a review of the costs/ benefits of individual measures and an extrapolation to EU level through a CBA. • In assessing cost-effectiveness, however, various stakeholders stated that it is equally important to assess the benefits and impacts of the END qualitatively since a strict focus on quantifiable benefits (which cannot always be easily attributed to the END, see previous point) risks underestimating the benefits. • Examples were cited of the benefits of adopting a more strategic approach to managing environmental noise that extend beyond the quantifiable benefits.	Important that both quantitative and qualitative aspects are taken into account in assessing the Directive's achievements to date. The assessment of effectiveness and impacts provide selected examples of the non-quantifiable strategic benefits of the END.

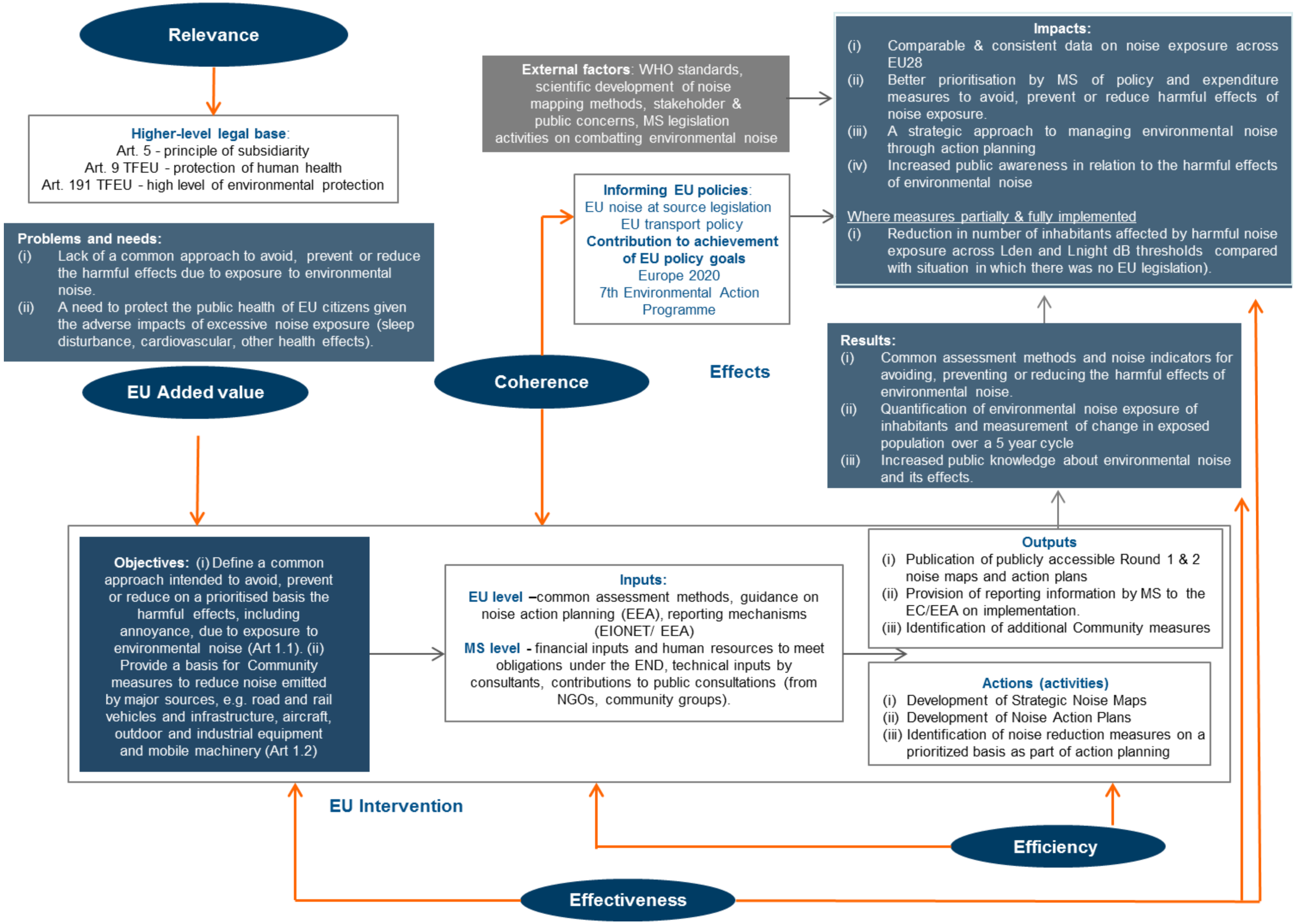
3.1.5 Intervention Logic

The purpose of assessing the "Intervention Logic" was to critically reconstruct the Directive's "theory of action" when it was adopted in 2002 and to ascertain whether the way in which the logic was meant to work actually works in practice in light of actual implementation experience. More specifically, the aims of logic mapping were to:

- Provide an analysis of the rationale for the Directive by identifying the needs, problems and issues that the END is seeking to address.
- Identify the END's objectives and the expected results (under a future scenario in which the Directive is fully and effectively implemented).
- Identify how EU intervention in the field of environmental noise relates to the evaluation criteria of *relevance, coherence, efficiency, and effectiveness* and *EU added value.*
- Assess the relationship between the Directive's objectives, inputs (human and financial resources), and how these translate into outputs, results and impacts.

The intervention logic diagram on the following page shows the inter-linkages between the Directive's two objectives, the implementation actions that MS must carry out (e.g. Strategic Noise Mapping, making information accessible to the public and Noise Action Planning) to contribute to the achievement of these objectives and the expected **outputs** (immediate outcomes), **results** (intermediate outcomes) and **impacts** (longer-term outcomes) if the Directive were to be fully and effectively implemented. As such, the schematic framework set out in the logic diagram is relevant to all evaluation criteria.

Figure 3.1 – Intervention logic diagram showing the theory of action of the END



As a reminder, the two core objectives of the END are set out in Art. 1(1) and 1(2) and are as follows:

- Art. 1(1) - Define a common European approach to **avoid, prevent** or **reduce** the effects of exposure to environmental noise harmful for health, which includes annoyance and to "preserve environmental noise quality where it is good".
- Art. 1(2) – Provide a basis for **developing Community measures to reduce noise emitted by major sources,** in particular road and rail vehicles and infrastructure, aircraft, outdoor and industrial equipment and mobile machinery.

Among the findings in respect of **relevance** were that the two objectives of the END described above remain highly relevant to identified needs. However, the objective set out in Art. 1(1) of defining a common approach to noise assessment methods and to measuring dose response relationships is of an **intermediate nature.** The END, then, stops short of establishing a strategic objective that the Directive's implementation should ultimately lead to, such as reducing environmental noise to alleviate the adverse public health impacts of high noise levels, although this is somewhat implicit in the recitals.

The second objective, **informing the development of EU source legislation**, also remains highly relevant since there remains a need to gather accurate and comparable population exposure data in order to facilitate evidence-based policy making for noise at source legislation.

Turning to **(external) coherence,** the END was therefore viewed as being strongly coherent with, and complementary to, EU noise at source legislation. Tackling noise at receptor and at source in parallel was viewed as remaining strongly coherent. There was broad consensus among stakeholders that:

- The END provides a strategic framework and common approach through which measures at local level can be taken to address noise at receptor.
- Source legislation has an important role to play in parallel since there is potential scope to reduce noise levels by a greater degree of magnitude than commonly possible through measures at receptor.

With regard to **(internal) coherence,** the coherence of the Directive's legal text itself was examined and the extent to which the requirements and definitions were seen to be clear.

Overall, the requirements and obligations set out in the END were found to be broadly consistent. However, there are some aspects of the legal text itself where END stakeholders perceived there to be a lack of clarity and this may serve to undermine the internal coherence of the legal text. Examples are:

- The definition of an agglomeration could be made clearer, and / or supported by further guidance from the EC, since some Member States have struggled with this concept.
- References in different articles of the Directive to the requirement to "draw up" an Action Plan, whereas elsewhere in the END, there is a reference to the adoption of Action Plans.

Turning to **effectiveness,** i.e. the relationship between objectives and outcomes, the diagram illustrates under the 'results' box the expected intermediate outcomes arising from the END's implementation. The desk research and interviews have confirmed that whilst significant progress has already been made towards a common approach, supported by a transition towards comparable data, completing the technical process of developing a common approach to noise assessment methods (Annex II) and to the development of revised dose response relationships (Annex III) is a long-term process reflecting its technical complexity. Indeed, most stakeholders commented that the process of moving towards a common approach will require a 20-25-year long-term commitment by the EU and the MS.

Moreover, the END has been effective in providing the basis for informing existing noise at source legislation. Indeed, population exposure data has already been produced and was regarded by EU policy makers as being useful, but its effectiveness is currently still limited by data comparability and incompleteness which has prevented it from being used more extensively.

The **efficiency** criterion in the diagram links the *"inputs",* which relate to the costs of implementing the END (administrative costs and the costs of measures identified in NAPs) and the actions required (i.e. the preparation of noise maps and action plans) to the *"outcomes"* in order to assess whether the benefits (outcomes) justify the costs (inputs). The findings from the assessment of administrative costs and in relation to the cost-effectiveness of measures were assessed through the CBA and case study research. The findings from the CBA have also shed light on the relationship between inputs and outputs, and are set out in Section 3.2.4.5 - Findings from the cost-benefit assessment (EQ13).

As far as **European Value Added** is concerned, i.e. the question if the END has triggered actions and delivered results which would not have been realised in its absence, the transition towards a common approach to common noise assessment across the EU is inherently European in nature. It would not by definition be possible to achieve what the END is trying to do through a purely national approach, since even if some MS already produced noise maps and monitored the problem prior to entry into force of the END, they did not do so on a common basis. The END therefore demonstrates strong added value. The intended logic when the END was adopted was that the END's implementation would eventually lead to the production of comparable data to inform EU noise policy in general and noise at source legislation in particular. During implementation, it has become apparent that whilst considerable progress has already been made, the full value of a European approach has not yet materialised, given that the timescale for full comparability will only be achieved for Round 4.

3.2 Key evaluation findings

In the subsequent sections, the different key evaluation criteria - *relevance, coherence, effectiveness (impacts), efficiency* and *EU added value* are assessed. The evaluative assessment draws on feedback received through the online survey, the interview programme, the validation workshop and the written responses received on the working papers produced for the workshop that summarised the evaluation findings. An overview of the approach to targeted stakeholder consultation, and the balance between different types of research inputs was described in the methodological overview in Section 3.2.4.5 - Findings from the cost-benefit assessment (EQ13).

3.2.1 Relevance

Relevance examines the relationship between objectives and identified needs. In a REFIT context, the Directive's continuing pertinence in light of developments in the 13 years since the END was adopted has been assessed. In analysing relevance, it is important to distinguish between the needs of different stakeholders since these differ between:

- **The needs of EU policy makers** responsible for noise at source policies who need reliable and ideally comparable population exposure data in order to determine the magnitude of noise at receptor and the (net) benefit of existing source legislation. Moreover, a robust evidence base is essential before existing source legislation can be made more stringent or new legislation can be proposed.

- **The needs of national policy makers** responsible for environmental noise policy at receptor, who appreciate the opportunity to benchmark population exposure data.
- **The needs of regional and local authorities –** who need to determine the scale of the problem in order to put forward appropriate noise reduction, mitigation and abatement measures at local level.
- **The needs of EU citizens** who require better information about the extent of population exposure and the adverse effects of high levels of noise.

The specific evaluation questions examined in relation to relevance were:

EQ1- Are the objectives of the Directive still relevant?

EQ1a - How far does the Directive meet identified policy needs (e.g. high levels of environmental protection, human health)?

This question assesses whether the END still meets the needs of EU policy makers in **preventing, mitigating and reducing the health effects of environmental noise**.

Among the feedback received was that collecting population exposure data by individual transport source remains highly relevant to EU and national policy makers firstly to address the problem of the lack of EU-wide comparable data. Secondly, the collection of exposure data through noise mapping remains essential because it enables EU and national policy makers to better assess the scale of the problem. This was seen by interviewees as an essential pre-condition for being able to then properly assess the magnitude of adverse health impacts of excessive noise exposure such as sleep disturbance, cardiovascular disease and other known effects on health and quality of life.

The **objective of Art. 1(1) of a "common approach"** to the assessment of environmental noise using common indicators remains highly relevant in the opinion of many END stakeholders. There is widespread acceptance among stakeholders at national level of the need to carry out strategic noise mapping to provide evidence of population exposure at both MS and EU level. However, not all stakeholders especially at local level fully recognised the importance of adopting a "common approach" to the assessment of environmental noise. This reflects the fact that harmonised data is predominantly needed for European/national strategic purposes rather than for local decision-making purposes. This view is common amongst stakeholders involved in local decision making and is more frequently encountered in those MS that have long-established national noise policies and legislation prior to the END, and in MS with existing procedures to remedy noise problems at the local level.

For instance, interviewees in **Denmark, France** and the **Netherlands** pointed to difficulties in persuading local authorities across the board to cooperate in a timely manner and to provide input data for noise mapping. Where the local authority was responsible for mapping, there were sometimes examples of them not producing noise maps at all, even if this was required. This was in turn linked to their perceptions of noise mapping as being costly with little practical benefit given a lack of dedicated budget to implement measures in many MS. However, this can be contrasted with larger city authorities, who viewed noise mapping as remaining highly relevant to their strategic policy making needs (for instance, in relation to urban development and planning, the creation of quiet areas, etc.).

Many stakeholders interviewed commented that although the objective of a common approach remains relevant, this is an **intermediate objective.** At the validation workshop, it was confirmed that the END's relevance is undermined due to the fact that it does not set out a clear longer-term public health-based objective against which to evaluate its "relevance" (e.g. "reducing the number of EU citizens exposed to environmental noise above dB threshold X"). This finding emerged from the desk research to assess the intervention logic, but was then subsequently confirmed through both the interview programme and validation workshop. Several workshop participants commented that whilst the END remains relevant, the focus is on the process (a "common approach"), with a lack of a clear strategic goal that would concentrate CAs' focus on what the Directive is ultimately trying to achieve.

The **implicit, longer-term objective of the Directive is to protect public health** (c.f. Art. 9, TFEU) and to ensure a high level of environmental protection (c.f. Art. 191, TFEU). Indeed, Recital 1 of the END states that *"It is part of Community policy to achieve a high level of health and environmental protection, and one of the objectives to be pursued is protection against noise. In the Green Paper on Future Noise Policy, the Commission addressed noise in the environment as one of the main environmental problems in Europe".* The data collected through noise mapping to date suggests that since a high number of EU citizens remain exposed to potentially harmful effects due to noise exposure at receptor, this implicit aim remains highly relevant.

The **objective of Art. 1(2) of providing a basis for developing Community measures to reduce noise emitted by major sources,** was viewed by most stakeholders (national, regional and local) as remaining highly relevant to identified needs. It was acknowledged that whilst environmental noise at receptor should be tackled through local level measures, such measures could be ineffective without additional controls over noise emitted by the major sources of noise, particularly given the growth in the number of such sources (e.g. increases in road traffic and aircraft movements). The collection of adequately harmonised and standardised data at EU level was regarded by the majority of stakeholders (85% - 90%) as being an important pre-requisite for strengthening the evidence base for reviewing existing EU noise at source legislation.

However, not all stakeholders were aware of the inter-relationship between strategic noise mapping under the END, data reporting requirements and the development of noise at source legislation (circa 15% were unaware). Several stakeholders expressed the view that the first objective of the END (Art. 1(1)) was the core objective, and viewed the requirement to report data as being secondary to the challenge of managing noise at local level.

There is some differences of opinion amongst stakeholders as to whether reporting data should be used primarily to influence noise at source legislation (Art. 1(2)) or should also be used to **make comparisons as to the acoustic conditions between MS** (Art. 11). There were concerns among some stakeholders that comparisons between MS would be inappropriate given that acoustic conditions vary widely, are local-specific and that the CNOSSOS-EU methodology, as set out in the revised Annex II (Commission Directive (EU) 2015/996) has not as yet been implemented so there is a lack of fully comparable data.

Accordingly, from a relevance perspective, several stakeholders noted that comparisons of changes in population exposure *between rounds* in a given EU country are more relevant than *cross-country comparisons* between EU MS. Some interviewees, especially from smaller MS such as **Luxembourg**, stated that care needs to be taken in presenting reporting EU-level data on population exposure since cross-country comparisons may not always be comparable. Moreover, the domestic media and local citizens may not have the full context to interpret the data. For instance, the Noise in Europe 2014 report that "In small MS like Belgium, Luxembourg and Malta, the share of quiet areas is very low and noisy areas represent a significant portion of the protected areas". According to an interviewee in Luxembourg, presenting Luxembourg as noisy due to high population exposure relative to its population size was viewed as not representing the situation in a proportionate manner.

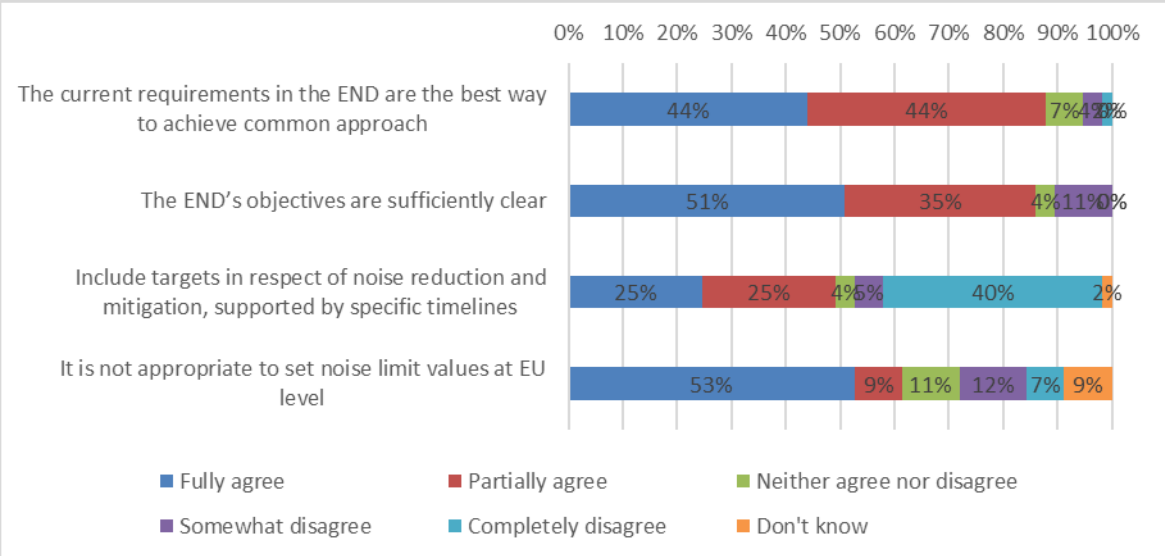
From an EU citizen's perspective, whilst noise mapping requirements and the collection of population exposure data over time is potentially very relevant to citizens' needs, the maps and data produced through the END are of a technical nature, and as such are not user-friendly in terms of citizens' understanding of what they depict.

It was observed by many stakeholders (particularly NGOs/ community organisations but also acoustics consultants) that the public does not generally understand the L_{den} and L_{night} indicators, which in turn undermines the relevance of noise maps published. Moreover, making noise maps available showing population exposure data by individual transport source was **seen as not reflecting citizens' actual experience of noise**, which is (i) cumulative across several transport sources and (ii) specific to living in a particular locality. Some stakeholders (interviewees, workshop participants) pointed to the low level of downloads of noise maps as being testament to this problem, which undermines the relevance of SNMs to EU citizens.

Although some health benefits will emerge from the END's implementation, since there is no mandatory requirement to implement measures, the full health benefits will only be delivered in a subsequent, currently unspecified, stage. This was viewed by some stakeholders as undermining relevance, although others argued that continuing to allow MS to determine national approaches to the development of measures to tackle environmental noise impact was in full accordance with subsidiarity.

Online survey participants were asked to comment on statements related to the appropriateness of the END's objectives. 88% of respondents either fully or partially agreed that the current requirements in the END were the best way to achieve the END's first objective of a common approach. Half the respondents also agreed that the Directive's objectives were sufficiently clear, while 11% somewhat disagreed.

Figure 3.2 – Given the END's objectives, how do you rate the following statements? (n=57)



Source: Online survey of public authorities

A number of public authorities interviewed maintained that the Directive's relevance could be strengthened if a holistic approach were to be adopted with regard to noise management, including an integrated approach that combines noise and other environmental issues, notably air quality. The scope for potential synergies between Noise Action Plans under the END and Air Quality Action Plans under the Air Quality Directive was also raised.

In summary, the key findings in respect of relevance were that:

- The first objective of the END remains relevant in the opinion of many END stakeholders, particularly those involved at a national level, who recognise the need for a "common approach" to the assessment of environmental noise.
- The collection of adequately harmonised and standardised data at EU level remains an important and relevant pre-requisite for strengthening the evidence base for reviewing existing EU noise at source legislation (the second objective).
- The importance of a "common approach" is not as well recognised in MS with pre-existing noise legislation and policies, or by stakeholders involved at a local level. This suggests that the EC's DG ENV (supported by the EEA) may need to strengthen communications with national stakeholders as to the importance of a common approach in leading to comparable data that can influence source legislation.
- The END's strategic relevance is being undermined by the lack of a strategic, longer-term objective not currently focussed on delivering longer term policy needs, such as the protection of public health. As the Directive currently stands, it only indirectly addresses environmental and health protection by seeking to influence noise at source legislation (Art. 1(2)), but relies on the MS to fund and implement environmental noise abatement and reduction measures at receptor. Although this is in line with subsidiarity and the respective competences of the EU and MS, there is a question as to whether it is sufficiently clear what the END is meant to achieve over the longer term.
- Overall, the two "objectives" specified in Art. 1(1) and Art. 1(2) remain pertinent to policy needs, problems and issues that the Directive was meant to address.

A further evaluation sub-question analysed under relevance was **EQ1a - How far is the Directive relevant to identified policy needs?** Since the previous question partly addressed this issue, the analysis provided below is restricted to the key points only.

The review of the intervention logic (see Section 3.1.4) found that the END has been designed in a way that is broadly relevant to meeting identified EU policy needs, which include ensuring high levels of **environmental protection and protection for human health.**

The assessment of the END's relevance to EU policy needs took into account the EU legal base, which is set out in primary legislation in the Nice Treaty. The END refers in recital 1 to Art. 175(1) of the Treaty (the Environment Title of the Treaty). This emphasises the importance of the subsidiarity principle. It states that:

"The Council, acting in accordance with the procedure referred to in Art. 251 and after consulting the Economic and Social Committee and the Committee of the Regions, shall decide what action is to be taken by the Community in order to achieve the objectives referred to in Art. 174".

Recital 7 emphasises that the rationale for the Directive is underpinned by the Treaty objectives of **achieving a high level of protection of the environment and of health** which will be:

"Better reached by complementing the action of the Member States by a Community action achieving a common understanding of the noise problem. Data about environmental noise levels should therefore be collected, collated or reported in accordance with comparable criteria. This implies the use of harmonised indicators and evaluation methods, and criteria for the alignment of noise-mapping. Such criteria and methods can best be established by the Community".

The primary EU legal base has evolved since the Directive was first adopted. The **Treaty of Nice has been replaced by the Treaty of Lisbon** which came into force in

December 2009. This means that the articles and terminology will need to be changed if the Directive is revised to be brought up to date in future. For instance, the Environment Title of the Treaty was formerly ex-Articles 174–176 TEC and these have now become Articles 191–193. On terminology, Community action should become 'EU action' and Community measures should be referred to as 'EU measures'. These are minor issues but worth pointing out since the legal base for the Treaty has evolved since the END was adopted. This issue is picked up in further detail under 'coherence'.

Overall, the research found that the END remains relevant to EU policy-making at a number of different levels:

- **Informing EU environmental noise policy and noise at source legislation** – although MS have competence in respect of environmental noise, the EC needs to gather data and reporting information to inform the development of new, and the revision of existing noise at source legislation, where the EU has legal competence. The focus on generating comparable data prepared using a common approach should help the EC to identify areas where it is best placed to play a coordination role and to take complementary action "to achieve a common understanding of the noise problem" (c.f. recital 7).
- **Informing EU**– the END is relevant in supporting EU legislation on noise at source by providing data on changes in population exposure over time and to determine appropriate baselines.
- **Developing a better understanding across the EU of the impact of environmental noise at receptor on human health**. There is a focus through Annex III on developing "assessment methods for harmful effects". This will require the development of European guidance on dose-response relationships (and it is planned that this will take into account WHO guidance and scientific and technical progress to assess the health effects). Until the scale of the problem and the health effects are more accurately assessed, the END cannot maximise its role in informing source legislation by providing a quantitative evidence base to do so.

The END was also found to be relevant to **national policy making**. Stakeholders commented, for instance, that the END was pertinent in the following ways:

- Collecting data on the number of exposed persons to high levels of noise provides an **appropriate baseline** that can be monitored on a consistent basis over five yearly cycles;
- This enables MS to **benchmark their performance** over time and to assess the effectiveness of any environmental noise policies and measures being adopted at national level. It potentially should also facilitate comparisons with other EU MS but this is presently limited due to differences in approaches to data collection and measurement (e.g. a combination of national and interim methods in Annex II) until Commission Directive (EU) 2015/996 that replaced Annex II has been fully implemented.
- Action planning was also viewed as being relevant to facilitating a benchmarking approach i.e. MS CAs can observe what types of measures are being used to tackle environmental noise in other EU MS.

It should be noted that the utility of data collected through the END in informing EU policy development on noise at source legislation and national environmental policy development is considered later in the report under "effectiveness".

3.2.2 Coherence

The following aspects relating to coherence have been examined through the research:

- **External coherence -** the coherence between:
  - The END and EU legislation on noise at transport source;
  - The END and other EU legislation that addresses noise; and
  - The END and national policy and legislation on environmental noise.
- **Internal coherence –** the extent to which the legislative text of the END is internally coherent e.g. clarity of the Directive’s legal text, definitions, consistency between articles and sub-articles and the requirements of MS CAs.

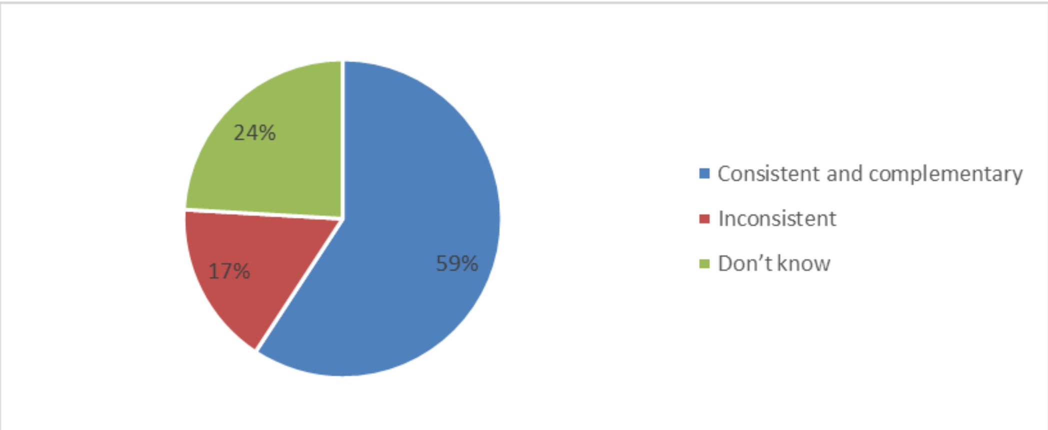
The assessment begins with a review of the findings in respect of ‘external coherence’.

3.2.2.1 Coherence of the END and other EU source legislation

EQ2 - How far is the Directive coherent and consistent with other EU legislation (e.g. noise at source legislation overall and source legislation by transport type i.e. automotive, railways, aviation)?

The extent of coherence between the END and EU noise at source legislation was examined. The survey results showed that the END is regarded as being consistent with, and complementary to other EU legislation by the majority of respondents from public authorities (59%).

Figure 3.3 – Which of the following statements best describes the relationship between the END and other EU noise legislation? (n=54)



Source: Online survey of public authorities

Only 17% stated that the legislation was inconsistent, which the interviews subsequently found was because not all END stakeholders are aware of the inter-relationship between the END and the importance of collecting population exposure data across the EU to inform the revision of existing and the development of new EU source legislation. The interview feedback broadly confirmed the findings from the online survey. The relationship between the END and noise at source legislation was seen as **symbiotic and mutually supporting** by the majority of stakeholders.

Most stakeholders were clear that source legislation is ‘top-down’ and plays an important role in tackling the problem, but stressed that it is equally important to address noise at receptor through local measures and to collect population exposure data to inform EU policy makers as to whether the net benefit of existing source legislation for different transport modes (e.g. roads, railways and airports) is sufficiently stringent.

A number of stakeholders mentioned that coherence between the END and source legislation could be further strengthened by ensuring that the END (and the data collected on population exposure through noise mapping) is more explicitly taken into account in revising EU source legislation.

However, the desk research and interviews with EU policy makers however found that the END has already been having an important effect on the revision of source legislation. For instance, in the past three years in particular, the END has been mentioned in the recitals of a number of different pieces of EU source legislation for different transport modes, especially legislation in the automotive and aviation sectors. Moreover, a number of impact assessments carried out in respect of revisions to EU source legislation in the automotive and railways sectors[75] have made explicit reference to the END as a strategic reference point. They have also highlighted the central importance of data on population exposure in informing what action should be taken. Reference should be made to the detailed mapping of references to the END in recent revisions of source legislation, as outlined in Section 3.2.3 - Effectiveness (and impacts), in particular EQ8 (which outlines key findings in relation to progress towards achieving the END’s second objective, which contains a summary mapping of relevant legislation and the extent of references to the END).

The evaluators however found that ensuring that all source legislation is more systematically and explicitly linked to the overarching framework provided by the END is a long-term process. It was observed as part of the legal mapping of relevant legislation (see Appendix C) that many pieces of noise at source legislation pre-date the END.

It will take **considerable time before all noise at source legislation is strategically aligned with the END**. Typically, EU source directives and regulations are only revised once every 10 – 15 years. Although some pieces of source legislation have been revised, many have not. Specific examples of EU source legislation that has been recently revised and has taken the END into consideration are provided under the “effectiveness” heading, when assessing progress towards the achievement of Art 1(2).

A minority of stakeholders interviewed argued that since source Directives contain Limit Values (LVs) for noise at source, the same principles should apply to noise at receptor. However, many stakeholders were against setting common EU level LVs, since whereas there is a logic to setting LVs for source legislation by transport mode, this cannot be said for noise at receptor, which demands local-specific solutions.

Several stakeholders expressed a strong view that noise is highly localised and tolerance and cultural acceptance of environmental noise varies between EU MS. Overall, there was wide divergence in stakeholder views in both the interviews and at the workshop as to whether common LVs should be introduced at an EU level.

There are however already national LVs in place in almost all EU MS that are determined under subsidiarity. It was emphasised at the workshop that the concept of limit values is treated differently in different EU MS. Whereas in some MS, LVs are treated as legally binding, in other countries, these are non-binding targets or aspirational goals. Further feedback on LVs is provided under Section 3.2.3 (effectiveness) and under future perspectives Section 4.2), where possible ways in which the efficiency, effectiveness and value added of the END could be strengthened in future are considered.

There may also be **efficiency savings resulting from the fact that SNMs and**

[75] See for instance Regulation 540/2014 on the sound level of motor vehicles and of replacement silencing systems, Major railways - Regulation 1304/2014 on the technical specification for interoperability relating to the subsystem rolling stock noise and Regulation (EU) No 598/2014 in respect of noise at airports.

population exposure data estimates are produced through the END. For instance, under the EIA Directive (85/337/EEC)[76], the data and information generated through the END may be useful for meeting the EIA requirements, for instance, in respect of a planned road, railways or airport upgrade or expansion of existing infrastructure, or a specific new transport infrastructure project. There are benefits in having SNM data since this provides a baseline against which the noise impacts of any future development / project that is subject to an EIA can be assessed. However, interviewees were not able to quantify the nature of these costs and benefits, other than that some form of assessment of noise levels would have to be undertaken anyway in the absence of the END as part of the EIA but relating to specific public and private projects.

Whilst having population exposure data by source was useful in not having to start assessing noise levels from scratch, it was also noted by interviewees that in most instances, "bespoke noise monitoring would need to be undertaken for the project". If SNM data cannot be used, because it is not sufficiently detailed to inform EIA work specific to particular projects, then this would limit the scope for cost savings. Noise monitoring within the EIA process is project-specific and would only cover the study area (or potentially only sensitive receptors within the study area). It was furthermore observed that the costs of noise monitoring/mapping for the purposes of EIA are not necessarily borne by the public sector.

They are borne by the project proponent who may be from the public sector, but could just as easily be a private developer. The END and the EIA are therefore largely mutually exclusive, other than the potential to use SNM data to inform the baseline. The END reporting and monitoring system could perhaps in future be upgraded.

EQ3 - Are there any specific legal gaps, overlaps and inconsistencies identified in the END and other EU legislation and between the END and national legislation?

Turning to the **coherence between the END and other EU environmental and spatial legislation which may impact on environmental noise**, most stakeholders did not report there to be any direct or indirect overlap or duplication.

A small minority number of stakeholders raised concerns about the risk of possible areas of overlap and duplication, but the examples these stakeholders provided suggest that their concerns stemmed from the specific way in which different Directives have been implemented at national level in their respective countries rather than suggesting overlaps or inconsistencies at European level.

There is, however, one instance where there may be such an overlap at European level: The industrial noise is covered within the scope of the END and industrial noise control also falls within the scope of the 2010 **Industrial Emissions Directive**[77], formerly the IPPC Directive. The Directive lays down rules on integrated prevention and control of pollution arising from industrial activities (including noise). Given the various stakeholder feedback received on this issue, the following paragraphs provide a more detailed discussion of this potential overlap and its implications.

The IED is based on several pillars, including an integrated approach that takes into account a number of environmental considerations, including noise.

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[76] The Environmental Impact Assessment or EIA Directive (85/337/EEC) has been in force since 1985 and applies to a wide range of defined public and private projects http://ec.europa.eu/environment/eia/eia-legalcontext.htm

[77] Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control) http://ec.europa.eu/environment/industry/stationary/ied/legislation.htm

Some stakeholders, especially in the UK but also in a couple of other EU countries argued that industrial noise does not belong in the END at all, since the Directive is primarily about the exposure of citizens to transport noise.

Whilst there are similarities in that the IED requires monitoring of industrial noise emissions (which implies mapping the nature and scale of the problem) as does the END (within agglomerations only), there are also key differences. For instance, the IED contains mandatory requirements on environmental inspections. Generally, stakeholders interviewed did not perceive there to be a problem of overlap. This was confirmed by workshop participants and written responses to the working papers.

This appears to have led to practical difficulties, at least in several countries within one Member State (the UK). For instance, several CAs involved in a group discussion on END implementation in the UK mentioned that there was perceived duplication between the noise mapping requirements under the END and those under the former IPCC (although this EU legislation has now been superseded by the IED). In **Scotland,** the requirements in respect of the former IPPC Directive have been incorporated into national legislation and a decision was taken to map industrial noise under the IPCC requirements rather than through the END. This has meant that as a consequence, industrial noise is not comparable between Rounds since in R1, all industrial noise in agglomerations was mapped whereas in R2, only IPPC-regulated industry was mapped.

Furthermore, a number of stakeholders in the **UK** that took part in a group stakeholder discussion questioned whether it is appropriate to map industrial sources of noise in the same way as for other sources since industrial noise is arguably different from other types of environmental noise. The stakeholders stated that it is not just a question of the dB(A) level but whether the noise is intrusive over the background level. Indeed, it was questioned whether it is appropriate for industrial noise to be covered through the END at all, given that it is already covered within the IED. The national CA for England commented that *"the IED provides a means for preventing excessive industrial noise at source. So this potentially overlaps with provisions in the END requiring MS to develop agglomeration action plans that include industrial noise sources".* This does however appear to depend on how the two Directives have been implemented and transposed into national implementing regulations.

In **Hungary,** on the other hand, (although feedback from some stakeholders suggests otherwise), the national CA did not perceive there to be an overlap between the END and the IED, commenting that *"Whilst noise is part of the definition of "pollution" and "emissions" in the IED, it does not contain any specific provision regarding strategic noise maps. Neither does the Gov. Decree, [which] only defines the cases when noise impact also has to be assessed besides other environmental impacts. The detailed rules for carrying out noise mapping of industrial sites are in the END/Noise decree, so there is no duplication*".

At the stakeholder workshop, most Member States did not view the inclusion of industrial noise within the END as a problem, and did neither believe that it was duplicative due to already being covered under other legislation such as the IED. However, two stakeholders from **Germany** believed that the END should focus on transport noise at receptor alone so as to ensure that the Directive's focus remains on tackling noise from different transport sources at receptor, and to ensure coherent links between the END and the Directives relating to addressing noise at transport-specific source.

A further area where there was a perceived risk of duplication was in the designation of quiet areas in agglomerations and open country under the END and the designation of protected areas under the **Habitats Directive**[78], the **Birds Directive**[79] and **Natura 2000**[80]. In a UK context, this issue was specific to provisions in the END regarding the identification/protection of quiet areas in open country. There are already several other existing policy mechanisms to designate areas of the countryside, both for conservation purposes and to protect it from incongruous development. For example, National Parks, Areas of Outstanding Natural Beauty, Sites of Special Scientific Interest and sites designated under the Habitats Directive already have special consideration in UK planning policies.

Although recognising that the designations made were being made for different reasons, the national CA in England considered it to be unnecessary to designate and protect the same area of land under more than one EU Directive (i.e. the END and the Habitats Directive. However, this concern does not appear to be shared in other EU MS.

It was pointed out at the workshop that END quiet area protection would need to extend beyond the boundaries of any designated area to encompass external noise sources that may adversely affect the protected area. There were differences of opinion as to whether this issue would be addressed by the other protected area designations.

Some feedback was also received about the need to strengthen the END's coherence with the INSPIRE Directive (2007/2/EC) which is concerned with Infrastructure for Spatial Information (SDI) in the EU. The purpose of the INSPIRE Directive is to improve the sharing of spatial information between public authorities and to improve the accessibility of information and data to the public. Schedule 3 of INSPIRE sets out requirements for noise and is concerned with achieving greater uniformity of data. Since INSPIRE was adopted after the END, there is a need to check whether the END is fully coherent with the requirements of INSPIRE to make information publicly accessible.

However, since the END is implemented under full subsidiarity, the lead responsibility of the Member States to ensure that END population exposure data is linked with other spatial datasets should be emphasised.

Interview feedback suggested that because noise is only mentioned briefly in the INSPIRE Directive in Annex 3, it is difficult for stakeholders to understand how INSPIRE should be applied in practice in the field of noise and to interpret what this means in terms of END data collection. Some interviewees pointed to a number of areas of INSPIRE that appear to be relevant to the END, such as the importance of improving accessibility to the public of the datasets produced through the END and linking these to available spatial datasets, and complying with a fully open access data policy. However, it was pointed out by other stakeholders that through the END, noise maps and population exposure data have already been made publicly available and accessible. In any case, it can be reasonably argued that, rather than representing an instance of duplication, the provision in the INSPIRE Directive and the END should be mutually reinforcing.

Moreover, the END Reporting Mechanism (see EQ12 in Section 3.2.4.4) has already been adapted to reflect INSPIRE. For example, the EEA Handbook[81] on the Electronic Noise Data Reporting Mechanism Relevant states that "*elements of the ENDRM have been formatted in a way that meets the requirements of INSPIRE. This includes the use of the ETRS89 geographical referencing system and the use of spatial metadata standards to*

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[78] http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm

[79] http://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm

[80] http://ec.europa.eu/environment/nature/natura2000/index_en.htm

[81] EEA Technical report No 9/2012, Electronic Noise Data Reporting Mechanism - A handbook for delivery of data in accordance with Directive 2002/49/EC

accommodate delivery of noise maps, source locations, agglomeration boundaries and action planning areas, including zones delimited as quiet areas. Importantly the reporting formats are designed to meet a minimum achievable standard which takes into account the diversity of approaches to managing spatial data which currently exists across MS".

Furthermore, the Reporting Mechanism also follows the INSPIRE Directive in relation to defining metadata, at least according to the EEA Handbook. *"The specified metadata standards for spatial data are those currently adopted by the EEA and proposed for future use within INSPIRE. They are based around a profile of ISO19115. The EEA standards will be regularly updated and the standards set by the INSPIRE directive will be followed. The standard for non-spatial data has been harmonised with the standard already used by Reportnet. This is based upon the widely used Dublin Core metadata standard".*

Notwithstanding, some stakeholders argued that the full potential of the data is currently being under-utilised since the data is not as yet systematically linked to other spatial datasets. However, other stakeholders argued that this is the responsibility of individual MS rather than the EC. END data has already been made widely available both through open access websites at national level and through EU level monitoring and reporting tools, such as the EEA's Noise Viewer available through the Noise Observation and Information Service for Europe (http://noise.eionet.europa.eu/viewer.html). Examples were also provided as to how public authorities in some countries have already used END data for their own purposes and integrated with other datasets, for instance, in relation to epidemiological studies.

In summary, from an 'external coherence' perspective, **the END is regarded as being broadly coherent with and complementary to** (with the possible exception of the issue of noise from industry) other EU legislation on noise. Although there could be a perceived overlap between the designation of quiet areas under the END and the designation of protected habitat areas, stakeholders do not generally perceive there to be a problem, with the exception of one Member State.

3.2.2.2 The relationship between the END and national noise policies and legislation

EQ4 - How does the Directive relate to national noise policies and legislation? Is it consistent and to what extent does it duplicate existing requirements?

It should be noted that detailed information on how the Member States have implemented the END (both the initial transposition and subsequent implementation) is provided in Section 2 (the implementation review) and in particular in the 28 country reports.

In EU countries where there is a pre-existing legal framework, such as the **UK,** the **Netherlands** and **Germany**, careful implementation has ensured that there were generally no inconsistencies between the implementation of the END and national legislation on environmental noise.

However, ensuring coherence with existing approaches has sometimes complicated END implementation from a practical perspective. For instance:

- In the **Netherlands,** protected areas in open country had already been defined in national legislation. Since the transposition of the END, there has been confusion among stakeholders about the difference and delineation of protected areas as defined in national legislation and quiet areas as defined in the END.
- In **England**, the potential use of END noise maps and action plans as part of the national policy planning and decision making processes remains a complex area, for instance in respect of the planning and development control system.

- **Denmark** and **Sweden** reported difficulties resulting from technical aspects of the changes in prediction methods (due to the introduction of the common assessment method) and an additional cost in future since they intend to implement Commission Directive (EU) 2015/996 but in parallel continue to report using the national method. Whilst this is their choice for national policy making purposes, it creates an inherent tension between EU and national reporting practices.

In EU Member States that did not have a pre-existing national regulatory framework on environmental noise prior to the END, the legislation appears to have been transposed correctly (at least by later on in R1 since some evidence of infringements was identified in the first implementation review but these have all since been resolved).

In **Latvia,** there has been a general effort to simplify environmental noise legislation. Rather than having several individual pieces of legislation, all noise-related legislation, including the national legislation transposing the END, has been combined into a single legal act. However, this then means that nuisance noise, which is outside the scope of the END, is within the same piece of legislation.

In **Lithuania,** as in many other EU MS, there is national legislation on environmental noise which incorporates receptor limit values. However, the fact that the END does not set out common EU-wide limit values was cited as being problematic for policy makers working on environmental noise issues because there is a tendency for domestic policy makers to consult EU legislation for guidance. Without any such receptor LVs, it is difficult to enforce national standards when these are exceeded. This appears to apply more in some new MS that have only had a legal framework to tackle environmental noise since the END was adopted.

In summary, the findings on coherence with national legislation are that:

- The END can be implemented in a way that is broadly coherent and complementary with pre-existing national policies and legislation on noise, but care has to be taken to avoid duplication and potential overlaps with existing national legislation; and

- The END provides evidence to support the development of future noise policies in those MS without extensive pre-existing policies and procedures, but it does not currently provide an alternative to the development of national policies and expenditure measures to manage, mitigate and potentially reduce environmental noise (as it only provides an intermediate step focused on a "common approach").

3.2.2.3 Internal coherence

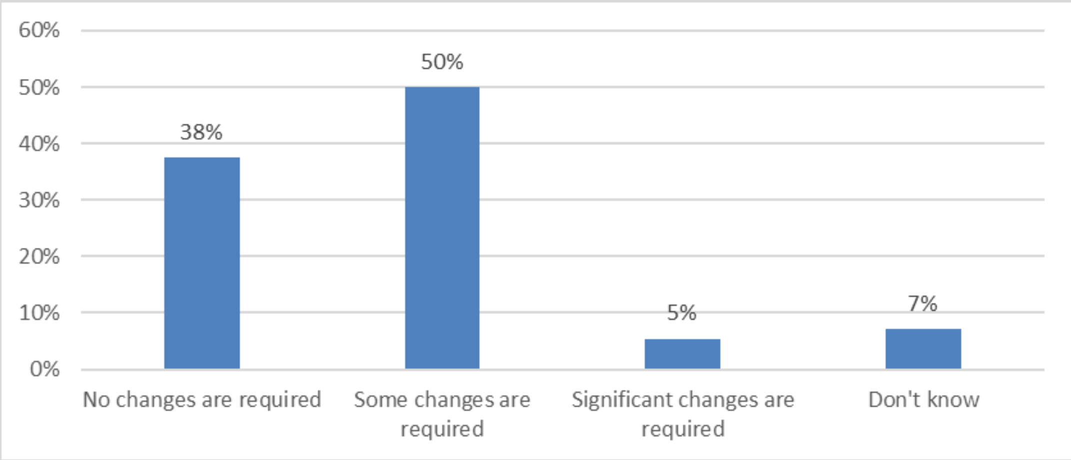
Introduction

The assessment of "internal coherence" required undertaking a detailed review of the Directive's legal text. The purpose was to assess the clarity of the definitions and obligations, and the degree of consistency between different articles / sub-articles. In addressing evaluation questions relating to internal coherence, it is important to emphasise that there are links between the implementation review and the evaluation, since through the implementation review, the outstanding implementation challenges were examined. For instance, Section 2.3.3 addresses the designation of agglomerations, major roads, major railways and major airports) and Section 2.3.5 outlines the difficulties encountered in respect of the "definition, delimitation and protection of quiet areas". Due reference should therefore be made by the reader of this report to these sections, since they provide supplementary information.

The internal consistency and coherence of the END

50% of public authorities responding to the online survey stated that in their view, at least some changes need to be made to the text of the END to strengthen its consistency, whilst another 5% believe that significant changes ought to be made.

Figure 3.4 – Please select one of the following options with regard to your views as to whether there is a need for any changes to be made to the current legislative text of the END (n=56)



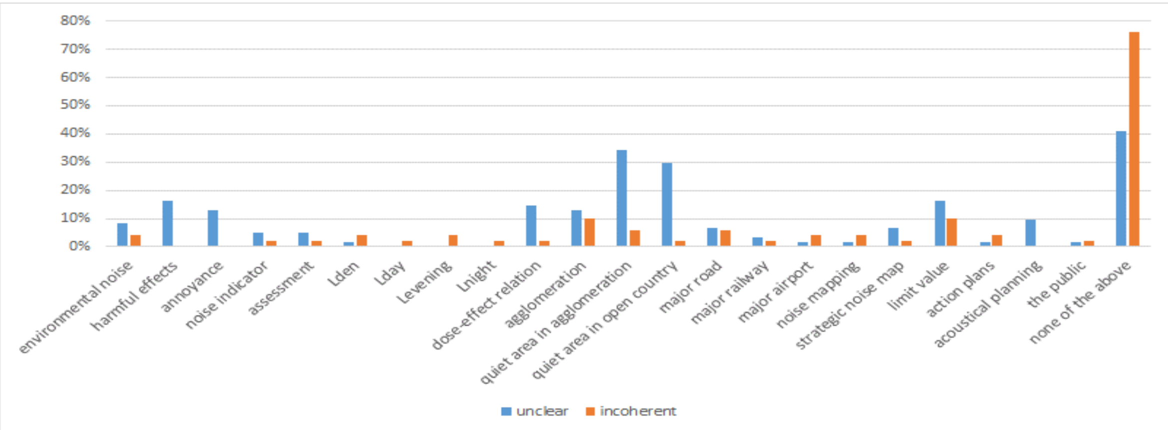
Source – online survey of public authorities

Whilst a small number of inconsistencies could be addressed, more substantive changes could make it more difficult to compare the results from noise mapping and population exposure data between rounds.

EQ5 - Are there any elements of the Directive (e.g. specific articles, definitions of key terms, requirements for public authorities) that are unclear? Are there any provisions that are obsolete and if yes, why?

Stakeholder perceptions as to the clarity of the legal text were examined through the online survey. 76% of respondents believe that none of the definitions in the END are inconsistent with other EU legislation while 40% believe that none of them lack clarity.

Figure 3.5 – Please indicate which of the Directive's definitions lack sufficient clarity (n=61) and which are inconsistent (n=50) with other EU legislation on noise?



Source: online survey of public authorities

The terms whose definitions appear to be causing greater confusion among some END stakeholders are 'quiet areas in agglomerations' mentioned by 35% of respondents, quiet areas in open country (30%), harmful effects (16%) and dose-effect relations (15%) have been cited most frequently as being unclear. The definition of an agglomeration was regarded as being unclear among 12% of respondents whilst 10% found the term inconsistent. Limit values were cited as being unclear by 16% of respondents.

Feedback through the interview programme suggests that whilst the majority of terms and definitions in the legal text of the END do not pose particular problems for END stakeholders, definitional problems and inconsistencies appear to be concentrated in a few areas. The specific definitions terms that have caused problems are now detailed. These draw on interview feedback and desk research. An important literature source was a Working Paper[82] by the Working Group – Assessment of Exposure to Noise (WG-AEN) which identified unclear or missing provisions.

- **Art. 1(1), a Common Approach -** the first objective of the END is to "define a common approach intended to avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to exposure to environmental noise".

A possible legal gap is the fact that the Directive does not explicitly describe how MS should prioritise the management of harmful effects. However, several MS have interpreted the words "intended to" and "on a prioritised basis" as being synonymous with the need to define and manage noise "hotspots".

The term "hotspots" is then interpreted differently across different MS, either as relating to those areas where the noise levels are highest, or to areas with the greatest number of exposed persons, or to a high number of exposed persons in the top dB threshold. There is confusion among END stakeholders as to how to go about prioritising noise and whether tackling hotspots is a formal requirement (which it is not since it is not mentioned in the legal text).

- **Art. 2 – Scope.**

Quiet areas - there is no explanation as to what types of 'Quiet Areas ' fall within the scope of the END nor of the criteria to be used to identify and assess what is a quiet area (although the EEA has already produced some very useful guidance in this regard and many MS have developed their own selection criteria). The interview feedback found that defining both quiet areas in open country and quiet areas in agglomerations was one of the areas that appears to cause the greatest problems, even if definitions are provided in Art 3 (l and m).

- **Art. 3 – Definitions.** A number of definitions appear to be causing ongoing interpretation challenges for END stakeholders. The main ones identified are:

Agglomeration (k) – although this term is defined in Art 3, in some EU MS, notably France but also elsewhere, the concept of an agglomeration at national level differs from that set out in the END, which has led to confusion and different interpretations.

Quiet areas in an agglomeration (l) and Quiet areas in open country (m) – since it is left up to the MS to determine the criteria for identifying and designating quiet areas, this appears to have created a lot of ambiguity and scope for differences in interpretation as to what a quiet area is, which means that approximately 30% of stakeholders interviewed said that they found the definition of a quiet area difficult to

[82] Working Paper on Directive 2002/49/EC in relation to the identification of provisions relating to Strategic Noise Maps which are unclear or missing, Working Group – Assessment of Exposure to Noise (WG-AEN).

understand. For instance, for quiet areas in open country, recreational activity is mentioned, but recreational activity is not within the scope of the END under Art. 2.

Major roads (n) - the END states that major roads include regional, national or international road, designated by the Member State, which has more than three million vehicle passages a year. However, regional and international roads lack any kind of definition.

Noise mapping (q) - means the presentation of data on an existing or predicted noise situation in terms of a noise indicator, indicating breaches of *any relevant limit value in force.*

Some stakeholders were confused by this definition since it was pointed out that it remains unclear whether 'Limit Value' refers to the statutory limits where action is obligatory if the limit is exceeded or does this refer to WHO guidance / good practice values or to non-binding targets. This lack of clarity could affect how SNMs showing exceedances are presented.

- **Art. 11(c) - Review and reporting and Annex I – noise indicators** includes references to "measurement" for the purpose of strategic noise mapping,

A number of stakeholders pointed out that using the term "measurement" implies that noise mapping can only be based on actual measurements, whereas in practice, noise assessment is usually based on modelling and prediction using specialist noise software. The term "assessment" would be more neutral. Given the current costs of long term noise monitoring in order to provide an average value over a 12 month period (L_{den}, L_{night}), the current widespread use of modelling and prediction is likely to continue.

- **ANNEX VI – Data to be sent to the EC** which is referred to in Art. 10. "For major roads, major railways and major airports, the total area (in km2) exposed to values of L_{den} higher than 55, 65 and 75 dB respectively".

It was pointed out in a working paper by the working group AEN[83](and at the validation workshop) that it is unclear whether this relates to the 55, 65 and 75 dB contours or contours for values between 55 and 65, 65 and 75 and greater than 75 dB. It was suggested that the standard parameters of 55-59, 60-64, 65-69 and 70-75 dB(A) should instead be used.

EQ6 To what extent is the Directive sufficiently clear in setting out the obligations of Member States at the level of (i) the Competent Authority and (ii) other stakeholders involved in national implementation?

The END is applicable to CAs and other stakeholders involved in national implementation. This includes for instance transport authorities responsible for roads and rail, airport operators and local authorities. A key issue explored through the research was how far the END sets out the obligations of END stakeholders involved in national implementation sufficiently clearly. The role of CAs was also examined, as well as the role of public authorities more widely, since some local authorities are not directly involved in END implementation as competent authorities, but may be asked to provide different types of input data, such as traffic data.

Among the findings from the research were that whilst the flexibility provided by the END is welcomed by most stakeholders, some interviewees noted that this may result in a lack of clarity, since the Directive is not prescriptive in setting out the obligations of different stakeholders in detail.

[83] WG-AEN working paper on missing and unclear provisions

A number of stakeholders commented that there are obligations in the legal text of the Directive that are ambiguous, either because it is not wholly clear whether they really constitute an obligation or because it is unclear how the obligation will be enforced.

One challenge relates to the lack of clarity as to what reporting information and data sub-national public authorities (including CAs responsible for mapping and action planning) must provide to the national CA responsible for collecting data. For instance, it is up to individual MS to provide national guidance on END implementation to ensure that all CAs involved in END implementation (and other public authorities responsible for the provision of input data and END reporting information) are clear about their respective responsibilities.

This means that the END does not place any specific obligations, for instance, on transport authorities, because there is no guarantee when transposing the END that the MS concerned would impose any specific obligations on transport authorities. Overall, this flexibility enables MS to determine the most appropriate implementation arrangements and to set the obligations that different CAs must fulfil in each EU MS.

Whilst this is consistent with subsidiarity, feedback in some MS (such as **Denmark, France** and the **Netherlands**) suggests that the lack of detailed requirements in implementation arrangements can cause difficulties in national implementation, with tensions between different levels of administrative responsibility (national, regional and local).

Examples were provided where local authorities have not complied with requests for information and data from the national CA about progress in carrying out strategic noise mapping and noise action planning or have only provided the requested information very late.

Since the END leaves administrative and reporting arrangements up to each MS, and the requirements of particular public authorities are not stipulated in the Directive, national CAs responsible for data collation sometimes felt that they had no sanction at their disposal to require administrative authorities at national and regional level to provide them with information.

Several interviewees mentioned that they found the text in Art. 7 unclear, in particular that *" strategic noise maps shall be reviewed, and revised if necessary, at least every five years after the date of their preparation".* Whilst it is clear that MS have the discretion to determine whether mapping should be undertaken if for instance there has been no change since five years earlier, stakeholders noted the absence of criteria or a definition to help determine what "if necessary" means in practical terms and to interpret when it should be applied.

Consequently, in theory, one MS may systematically undertake strategic noise mapping once every five years, whereas another may choose not to repeat some aspects of noise mapping, because of a perceived lack of sufficient change over a five year cycle to justify the additional costs, especially for road noise, where acoustics consultants interviewed pointed out that even a doubling of the level of vehicle movements on a road would only lead to an increase in noise levels of 3dB.

In **Latvia,** an example was given where a decision was taken to not repeat noise mapping in R2 since road traffic volumes for most major roads had not changed greatly, and noise levels were likely to be broadly unchanged. Whilst consistent with the concept of only repeating noise mapping if necessary, if replicated across the EU, there is a risk that if some MS decide to carry out noise mapping every five years, but others only do so once every ten years (on the basis that the mapping is not necessary, this could lead to challenges for DG ENV and the EEA in reporting on data completeness in road mapping. It may also lead to confusion among the public and users of noise maps.

In relation to 'quiet areas in open country', as noted in the implementation review, whilst it is clear that action plans in agglomerations should include consideration of quiet areas, this is less clear in respect of quiet areas in open country. The scope for divergence in interpretation was also stressed, since some national CAs stated that in their opinion the designation of quiet areas in open country is not mandatory in the Directive whilst others have interpreted the same text as a mandatory requirement. It was posited by some stakeholders that this could be due to different translations of the END in different languages leading to different interpretations of those sub-articles pertaining to quiet areas in open country.

With regard to **obsolete provisions,** Art. 7 (strategic noise mapping) refers to agglomerations with more than 250,000 inhabitants whereas the definition of an agglomeration refers to the definitive threshold of 100,000 inhabitants, so the reference to the higher threshold after 2005 could be deleted. As noted above, there are various references in the legal text to measurement which should be replaced with 'assessment' which is more neutral. Therefore, the word measurement is also obsolete. In updating the END at some future point, as noted earlier in assessing external coherence, since the legal base (the Nice Treaty) has evolved, and the Lisbon Treaty has come into effect, the term Community Actions and Community measures is obsolete because the correct terminology is now EU Actions and EU measures.

In conclusion, the END is drafted in a way that leaves broad flexibility under subsidiarity in its implementation by making the MS responsible for setting out their implementation arrangements, If however the Directive were to be reviewed in future, some stakeholders would be in favour of an approach that sets out the obligations of the MS in greater detail to improve the clarity of the requirements. Conversely, other national CAs were in favour of maintaining the status quo since this provides them with flexibility to determine national END implementation arrangements.

3.2.3 Effectiveness (and impacts)

3.2.3.1 Progress towards the first objective of the END – a 'common approach'

Overall progress towards a common approach is first examined (EQ7). The specific aspects of a common approach (noise mapping, information accessibility and noise action planning) are each then addressed in detail separately.

EQ7 - What progress has been made towards achieving the first objective of the END?

Introduction

The first objective of the END, as set out in Art. 1(1) is concerned *with 'defining a common approach intended to avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to exposure to environmental noise'.* Hereafter, the phrase "a common approach" is used as shorthand for this more detailed objective.

It is important to note that the two objectives of the END are **mutually supporting and reinforcing.** Although many environmental noise issues arise at local level and are specific to each MS, progress towards a "common approach" to the assessment of environmental noise through strategic noise mapping is a crucial step towards harmonising the data and enabling national-level data and information on population exposure by transport source to be collected at EU level. This is an important precursor if END population exposure data is to be utilised by EU policy makers to inform the revision of existing EU noise at source legislation, the second objective of the END.

Evaluation sub-questions addressed within this EQ

This EQ requires a complex assessment of a number of different issues, which have been divided up into different evaluation sub-questions, as follows:

- EQ 7a – What progress has been made in respect of Article 1(1) – strategic noise mapping?
- EQ 7b - What progress has been made in respect of Article 1(1)b - making information on environmental noise and its effects is made available to the public?
- EQ 7c - How much progress has been made towards Article 1(1)c - the adoption of Noise Action Plans by the Member States, based upon noise mapping results?
- EQ 7d - How effective have public consultations been in informing noise action planning processes and in the finalisation of NAPs?
- EQ7e -Has the speed of progress been in line with expectations?
- EQ7f - Has the Directive been adapted to technical and scientific progress? (See Appendix G).

Whilst most of these sub-EQs have been assessed in this section, due to space limitations, more technical issues, such as whether the Directive has been sufficiently well-adapted to technical and scientific progress, are assessed in Appendix G. This Appendix also considers some of the more technical aspects, such as the outstanding challenges to ensuring greater data comparability.

In assessing progress towards the objective of a "common approach", each of the specific actions mentioned in Art. 1(1) a – c needs to be considered, since these are the actions that collectively should have contributed to the achievement of a common approach:

Box 3.1 - Actions required to implement a 'common approach' under Art 1(1)

Art. 1(1a) - the determination of exposure to environmental noise, through noise mapping, by methods of assessment common to the Member States;

Art. 1(1b) - ensuring that information on environmental noise and its effects is made available to the public; and

Art. 1(1c) - the adoption of action plans by the Member States, based upon noise-mapping results.

3.2.3.2 Progress in respect of a common approach - Action 1a, 1b and 1c.

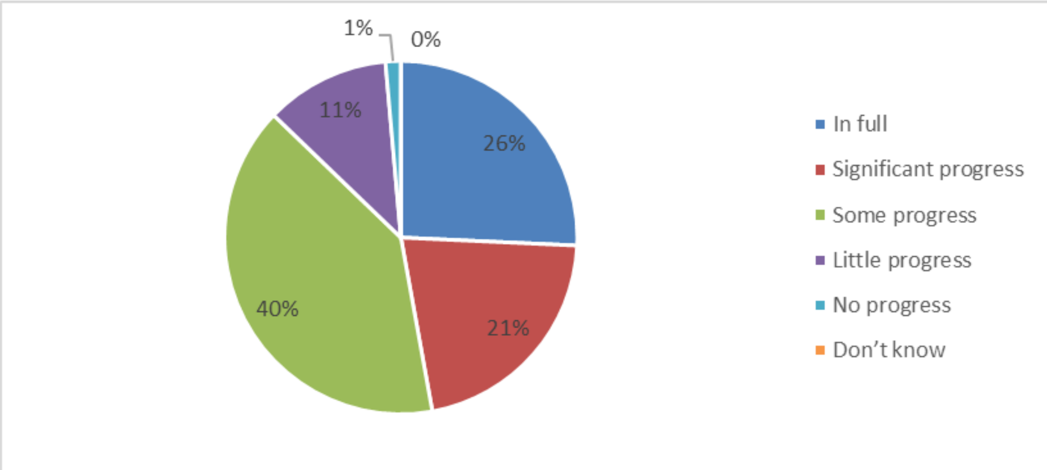
Many stakeholders viewed a common approach as being mainly relevant to strategic noise mapping and the collection of population exposure data (i.e. Action A). However, it is also important to assess the contribution of Actions B and C towards a common approach, even if under subsidiarity, there are differing implementation approaches.

For instance, the fact that all 28 EU MS go through the same process of producing noise action plans based on noise mapping results is an important element of a 'common approach'. Even if NAPs may differ widely in terms of the types of measures identified, whether they adopt a more strategic or operational approach, their length etc. the process of preparing NAPs is common in that all CAs must follow the minimum requirements for NAPs set out in Annex V, undertake a public consultation and make the draft and final NAPs publicly accessible.

The following questions address noise mapping, information availability for the public and noise action planning respectively i.e. relate to Art. 1(1a), 1 (1b) and 1 (1c) of the END.

Online survey respondents were asked for their perceptions as to the extent of progress in respect of the first objective of the END. Among the 70 public authorities that responded to this question in the online survey, 26% thought that the END has already achieved its objective of defining a common approach in full, whilst a further 61% believe that either "significant" or "some progress" has been made. Only 11% believe that little progress has been made (the interview feedback suggested that this was mainly to do with the comparability of noise exposure data).

Figure 3.6 - Assessment of progress towards the first objective of the END: a common approach - Article 1(1) - (n=70)



Source: Online survey of public authorities

It is important to set the online survey results in an appropriate context, since additional feedback was obtained through the interview programme on the extent of progress. Many stakeholders stated that whilst significant progress has been made, a fully common approach, in which comparable data is available, will take considerable time to achieve, since the CNOSSOS-EU methodology, as incorporated in Commission Directive (EU) 2015/996, will not be implemented across EU-28 until R4 in 2022.

EQ 7a – What progress has been made in respect of Article 1(1a)?

The summary findings are first presented, followed by an overview as to how CNOSSOS-EU was developed. A review of the extent to which progress made has taken into account scientific and technical 'state of the art' is then provided. In assessing progress, a distinction was made between the development phase of CNOSSOS-EU (2007-2015) and its future implementation (the pre-implementation phase in 2015-2017 and the implementation of Commission Directive (EU) 2015/996 which replaced Annex II, which will be on a voluntary basis in R3 / 2017 and be mandatory from R4 / 2022 onwards).

Key findings - strategic noise mapping through common assessment methods

The summary findings are that:

- END stakeholders recognised that considerable progress has been made towards the development of a common approach to noise assessment methods through the CNOSSOS-EU process.
- Progress towards the development of a common approach in this area was seen by most stakeholders as a major achievement compared with the baseline situation prior to the adoption of the END, when:
  - Most MS did not use a noise mapping based approach to model and manage environmental noise, and those that did tended to use a variety of different approaches and methodologies.
  - Even in those few MS that already undertook some form of noise mapping, many MS did not collect data on population exposure in 5 dB bands. Rather, a wide range of different assessment methods and noise indicators were used prior to the introduction of the EU-wide L_{den} and L_{night} metrics.
  - Moreover, there was no common assessment methodology at EU level, nor was any population exposure data collected.
- Most stakeholders agreed that the detailed technical approach developed in the 2012 publication on the CNOSSOS-EU methodology by the Commission's DG ENV and the JRC reflects scientific and technical progress and "state of the art" relating to each source.
- It has taken 8 years to develop common noise assessment methods through CNOSSOS-EU and to replace Annex II. This was an ambitious, technical and complex undertaking, and the process has therefore required significant time and resources. There was also a need to secure agreement with EU MS on finalising the technical characteristics of CNOSSOS-EU, which required coordination by the EC.
- It will also take some time before Commission Directive (EU) 2015/996 will be fully implemented, since there is a need to allow MS authorities' sufficient time to adapt to the technical and coordination challenges in moving from an interim to a harmonised EU-wide approach to noise mapping.
- Since the implementation of the CNOSSOS-EU methodology will not be mandatory until R4 (2022), this will limit data comparability between MS and rounds until such time as all MS have implemented a common approach. .
- Once fully implemented, the Commission Directive mentioned above should lead to harmonised and comparable data, although some END stakeholders expressed concerns about the need to further standardise input data to strengthen comparability.

In the following box, a summary overview of the development of the CNOSSOS-EU methodology and adoption of Commission Directive (EU) 2015/996 is provided:

Box 3.2 - Overview of the development of the CNOSSOS-EU methodology and adoption of Commission Directive (EU) 2015/996

The process of developing CNOSSOS-EU commenced in 2007. As required in Annex II of the END, the development of a common methodology for noise assessment was a technical process led by the EC (ENV and the JRC) in co-operation with the EU MS to facilitate the transition to a common method of undertaking strategic noise mapping. The development of CNOSSOS-EU was coordinated by the EC and undertaken in close liaison with the CNOSSOS-EU Technical Committee. Development and implementation has taken place over five phases: (1) a preparatory phase, (2) the establishment of technical working groups, (3) fine-tuning the text, (3) the development of reference codes (4)the pre-launch phase which requires national databases to be developed which are being integrated into the CNOSSOS-EU database and the implementation phase, which will involve the transition between the use of national and interim methods and the common EU noise assessment method to implementing the new Commission Directive (see below)...

In summary, the specific milestones that have been achieved to date are:

- The publication of the CNOSSOS-EU methodology (2012) setting out common noise assessment methods 84 and subsequent validation by technical experts to ensure that the method takes into account scientific and technical 'state of the art'
- The publication of Commission Directive (EU) 2015/996/EC in May 2015 establishing common noise assessment methods according to the END (replacing Annex II).

In Appendix G, a more detailed evaluative assessment and summary of technical aspects relating to CNOSSOS is provided. In particular, this provides an assessment of the following:

- The development of CNOSSOS-EU - and extent to which the common noise assessment method was adapted to technical and scientific progress;
- Outstanding challenges in implementing Commission Directive (EU) 2015/996; and
- Implementation challenges to ensure that the results of strategic noise mapping produce comparable data.

These are important aspects of the evaluation of the Directive, but since these issues are of a more technical nature, they are presented as an Appendix.

Delays in the submission of reporting data on SNMs and to the EC

In Section 2.3.7 (Strategic Noise Mapping), data from the EC's database on SNMs is presented. This showed that in a number of EU MS, there have been delays in the submission of reporting data and information in both R1 and R2. Whilst this is an important issue explored in detail in the second implementation review, since data not submitted represents an "implementation gap", the lack of a complete reporting dataset across the EU-28 is also relevant when assessing effectiveness, since this will have an impact on the achievement of the second objective of the END (as defined in Art. 1(2) informing the development of Community measures related to source legislation).

A small number of MS have delivered SNMs well after the reporting deadline has passed, such as CZ, EL, FR (especially agglomerations), MT, RO, and SI. Problems in the timely submission of reporting information and data were encountered in both R1 and R2. Possible explanatory factors for delays in reporting submissions were analysed in Section 2 (second implementation review) and are highlighted in the example on the following page:

[84] https://ec.europa.eu/jrc/sites/default/files/cnossos-eu%2520jrc%2520reference%2520report_final_on%2520line%2520version_10%2520august%25202012.pdf

Box 3.3 Delays in the submission of END reporting data and information

Delays in the submission of reporting data related to the END through the ENDRM were attributed to a number of issues, including:

1. The 12 months' timeframe between the submission of SNMs and NAPs. This was widely seen as too short to allow for the different steps involved in action planning to be completed, including public consultations and consultation with colleagues in other policy areas, .
2. In the context of the economic and financial crisis, national and sub-national budgets for noise mapping were often reduced and / or, there were delays in the necessary funding being made available to the relevant public authorities.
3. National CAs in some MS have found it difficult to ensure effective and timely coordination of other CAs nominated as mapping bodies at local level. This was especially the case in MS where a highly decentralised approach has been adopted to implementation (e.g. in FR and DE, there are many hundreds of mapping bodies in total).
4. There was a reluctance among smaller local authorities in some MS to commit funding to noise mapping unless dedicated budget from central government was made available for this purpose. This has led to major delays in the development of SNMs.
5. Some national CAs pointed to a lack of enforcement powers to compel other competent authorities at local and regional level to provide END reporting data on a timely basis. However, since the END is implemented under subsidiarity, it is up to MS to determine their own national implementation arrangements, including organising reporting procedures.

Moreover, comparability issues arise from the fact that data is aggregated at various levels for SNMs and NAP submission, as pointed out in Sections 2.3.7 and 2.3.8 respectively. For instance, it is currently not obligatory for MS to provide data on the number of agglomerations for which SNMs have been submitted. Rather, the EEA measures completeness based on the number of major roads, railways, and aircraft noise sources *within agglomerations* which have been mapped. For NAPs, on the other hand, completeness figures are available for agglomerations *as a whole*.

It was observed by a number of stakeholders interviewed that there is a **lack of an effective EU-level enforcement mechanism relating to tackling the problem of delays in national CAs meeting END reporting deadlines stipulated in the Directive**. Whilst infringement procedures could in theory be launched against particular MS, as demonstrated in Section 3.2.4 on administrative costs within efficiency (see EQ11a), some MS lack adequate human resources for END implementation. Moreover, according to the findings set out in EQ12, the Reporting Mechanism used by most EU MS, Reportnet, requires entering a lot of data and information in different data fields. Moreover, delays in making national budget available (sometimes attributed to the financial and economic crisis) have led to corresponding delays in procuring technical services to carry out noise mapping. In some MS, such as Luxembourg, the need for formal political approval was found to have added additional delays to the submission of reporting data to the EC and its publication and making accessible to the public.

Given the practical difficulties that MS have encountered in meeting the END reporting deadlines, the use of formal infringement proceedings may be too blunt an instrument to compel MS to meet their END reporting obligations on a timely basis.

The current absence of any penalties for delays in the submission of END reporting data may according to some stakeholders interviewed, mean that there is a lack of incentive to deliver reporting deliverables on time, which undermines the effectiveness of the END's implementation and the timely availability of data for EU policy making purposes (Art. 1(1)b) and for EU reporting purposes (Art. 11). Possible means of overcoming the lack of effective enforcement are considered under "prospective issues" in Section 4.3.

The quality of data collected through SNMs

The **quality of END data obtained through SNMs** from the MS through the ENDRM is an important issue relating to effectiveness, since this influences the utility of the data and ability to inform source legislation (Article 1(2)).

Several stakeholders pointed to a **lack of comparability in data between rounds**, for instance, due to changes between R1 and R2 in noise mapping methodology adopted for a particular SNM. This means that the data could be misinterpreted as signifying an increase (or decrease) in population exposure data when it is difficult to assert with certainty that the level of magnitude of change that occurred in the reporting database actually occurred.

In terms of the quality of information in the database of NAPs, even 15 months after the deadline for submission of NAPs, the Eionet database of NAPs only contained information for R2 from about half of MS. The situation has subsequently improved significantly, but well after the original reporting deadline.

The reporting mechanism is a **useful monitoring tool for the EC to identify what data is missing**, both in terms of data completeness (i.e. knowing which MS are behind in implementation and in submitting reporting information to the EC), but also in respect of the content of NAPs. The database contains some fields which are useful for shedding light on the extent to which minimum requirements for NAPs (as defined in Annex V) are being complied with. For instance, the NAP database for R1 shows that only a **small proportion of NAPs overall have provided detailed cost-benefit information about measures** as part of the financial information section of NAPs. Further good practice guidance could be issued to improve the treatment in NAPs of costs and benefits.

A further interesting issue raised was in relation to the **use of data gathered through Reportnet by the EEA and its presentation in official reports**. Since the Lden and Lnight indicators are assessed on the basis of estimates rather than actual noise measurements, some stakeholders were concerned that reporting data is presented as the number of persons actually exposed, whereas in fact, the data represents an estimate of the number of persons *potentially exposed*.

Firstly, estimates of population exposure through strategic noise mapping within the END are measured *outside* buildings, which does not take into account whether any mitigation measures have been implemented such as noise insulation of windows. Secondly, since L_{den} is an indicator based on an *average level of noise* over a 12 month period, the estimates are often based on computer-based modelling rather than on actual estimates.

In terms of the **quality of information in the database of NAPs**, even 15 months after the deadline for submission of NAPs, the EIONET database of NAPs only contained information for R2 from about half of MS. The situation has subsequently improved considerably (based on data available, but this is already well after the original reporting deadline.

Several issues were identified through desk research relating to the **assessment of completeness of data submission** carried out by the study team since it was necessary in carrying out the second implementation review to use the EC databases that contain data reported by the MS. This was supplemented by feedback from those directly involved in the process. Sometimes, completeness by km of major roads and major railways is specified in the metadata file, but this is only checked in case of doubts or problems with the data rather than systematically. In addition, **it is not entirely clear whether data submitted by MS on major roads and major railways refers only to those *within* or *outside* agglomerations, or both.**

The contractor supporting the EEA states that MS (and regions within MS) define agglomerations and major infrastructures differently, and have chosen different interpretations and a different scope for the reporting mechanism. In some cases, this information has been provided in the metadata files, but, again, this has not been checked in detail for all MS/regions reporting information. The relevant handbook for the Electronic Noise Data Reporting Mechanism (ENDRM)[85] does specify that reporting obligations are sub-divided into information required by major roads, major railways, major airports, and agglomerations, and separately for the four main noise sources within agglomerations, but does not clearly spell out whether the former should include major infrastructures within agglomerations, or not.

This means that any **completeness assessment for SNMs of major roads and major railways** remains imprecise and comparability across MS is limited. In order to get a more accurate picture of completeness of submissions, the reporting requirements and the reporting mechanism would have to be changed. Even then, though, there may be challenges for the EC in interpreting the completeness of SNMs since MS report differently on major roads and major railways. Whilst in some MS, such as the **UK**, noise mapping of major roads has covered the entire roads network through a single map, in other MS, such as **Poland,** SNMs have been produced on hundreds of road segments. In other MS, the mapping of major roads may cover multiple road sections. It is therefore difficult to determine at a given point in time, what percentage completeness has been achieved relating to the overall mapping requirements within the scope of the END in a given MS. The situation is similar in respect of major railways. However, the EEA and the contractor that supports the EEA in analysing the data have sought to adapt to the fact that different MS report differently.

Moreover, **submission completeness information for agglomerations is not collected at an aggregate level within each agglomeration** (see also Section 2.3.7) but separately for each of the major noise sources *within* agglomerations (road, railway, aircraft, and industrial noise). An overview of completeness at agglomeration level has been obtained for the country report as part of the implementation review. Indeed, an overview of noise map data for *all sources* in agglomerations on aggregate is foreseen Electronic Noise Data Reporting Mechanism (ENDRM)[86], so it should be feasible to also report on submission completeness at this level.

END stakeholders with strong knowledge of the databases commented that exposure data is **only reported by each transport source *within* agglomerations** i.e. the spreadsheet does not reveal how many people are exposed to noise outside agglomerations as a whole, or how many are exposed within agglomerations to any kind of noise. The only thing that can presently be derived is how people are exposed to road noise within agglomerations.

Checking the completeness of *noise maps and population exposure data* is part of the quality check performed by the EEA. In recent years, there has also been a quality check undertaken of data quality. If any major problems are identified, then the corresponding data is discarded from the assessment developed at an EU level. It would however be **very resource-intensive for either the EEA or the EC to check the quality of noise maps and accuracy of population exposure in detail**, given the many variables that are specific to how each SNM has been produced, and the changes that have taken place between rounds.

[85] Electronic Noise Data Reporting Mechanism A handbook for delivery of data in accordance with Directive 2002/49/EC. P. 10

[86] Electronic Noise Data Reporting Mechanism A handbook for delivery of data in accordance with Directive 2002/49/EC. P. 21

The evaluators note that it would also not be that feasible in practice either, since even within a given MS, there will be SNM-specific issues that influence the data, such as variations in input data, methodology, noise mapping software used and population density changes over time and the economic situation (which can have a significant impact on noise at receptor)87. The EEA could however play a role in checking the quality of population exposure data once Commission Directive (EU) 2015/996 has been implemented once there is greater consistency in terms of how the data is produced.

3.2.3.3 Progress in implementing Action 2 (Article 1(1b))

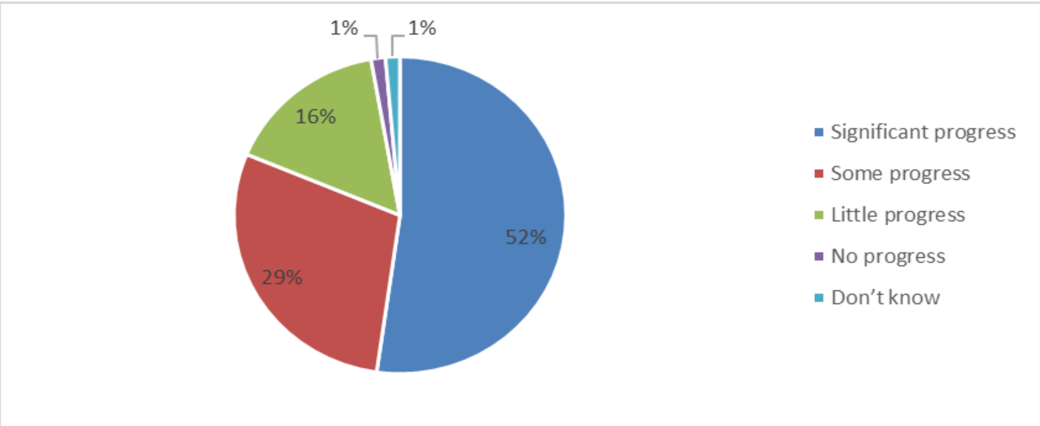
EQ 7b - What progress has been made in respect of Article 1(1b) - making information publicly accessible)

There are different aspects to Action B, "ensuring that information on environmental noise and its effects is made available to the public". This involves, in summary:

1. Publishing Strategic Noise Maps online at MS level;
2. Making population exposure data available at an EU level through the EEA's Noise Viewer;
3. Public consultation during the noise action planning process. Implicitly, Action B is linked to Action C, in that public consultation must take place as part of the preparation of NAPs. The draft NAP must be made available to the public in order that they can comment during the consultation process, and
4. Making final noise action plans publicly available.

Public authorities responding to the online survey were quite positive about progress made in making information publicly accessible in order to inform the public. 52% stated that significant progress has been made and 29% that some progress has been made. It is worth noting however that a significant minority (16%) expressed the view that little progress had been made (quite possibly, the focus in their response was on public consultations rather than making mapping results available, since there appears to be much less of an issue with the latter). The responses are shown in the figure below:

Figure 3.7 – Assessment progress towards making information available (n=69)



Source: Online survey of public authorities

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87 Examples were cited through the research from Scotland and Ireland where the economic crisis and reduction in construction-related road traffic was found to have influenced the level of population exposure by circa 15-20%.

The availability of Strategic Noise Maps and population exposure data

SNMs have generally **been made available online to the public, at least in 27 out of 28 EU countries**. However, during R2, there have been considerable delays in several EU countries in the development, finalisation and submission of R2 noise maps to the EC and EEA. There have been corresponding delays in making R2 SNMs available online in these countries at the same stage in the five year implementation lifecycle. Delays in the provision of accessible information to the public in R2 may undermine the effectiveness of making information available, since to be useful to inform noise action planning, this needs to be made available in a timely manner.

Noise mapping results and population exposure data have also been gathered by the EEA, and **EU-wide data has been made available through the EEA's Noise Viewer[88] tool.** This shows the number of exposed persons at receiver level by transport source. Among the feedback received through interviews on this tool were that it was useful that the data was made available through a single common repository at EU level.

However, as noted earlier, whilst population exposure data by individual transport source is useful for acoustics consultants and policy makers responsible for source legislation, it was not generally perceived by stakeholders interviewed as being that useful from a citizen perspective. This was due to the fact that whilst data on noise exposure by source is **technically useful and policy-relevant**, it is less effective in engaging with the public who do not see noise at receptor as being linked to individual sources but cumulative (i.e. the aggregation of noise from different sources). This issue is explored in greater detail above under the heading of Action A – strategic noise mapping.

The **potential risk of misinterpreting population exposure data** was highlighted in **Ireland**, where this issue has been overcome by producing a set of FAQs to explain the metrics used and to ensure that those using the data understand how L_{den} and L_{night} are calculated. For instance, it is made clear that these are not based on actual measurement at a specific point in time, but based on an average taken over 12 months.

According to a small number of END stakeholders, an issue that potentially undermines the usability and comparability of noise maps is that there remains **divergence in the presentation of colours used in noise maps to depict particular 5 dB(A) incremental bands**, *between* (and even *within*) some EU countries. However, other stakeholders saw this either as a minor issue, or not a significant issue at all.

An analysis of data completeness was provided in Section 2 (the implementation review). The **lack of data completeness undermines monitoring and reporting at EU level** and this may subsequently hinder the development of source legislation, which is partly dependent on EU-wide data being available on population exposure levels in an accessible form. Under Art. 11 - Review and reporting, the EC, supported by the EEA undertake to produce five yearly implementation reviews, to report on medium and long-term goals and on the protection of quiet areas in open country. If reporting information is not forthcoming from the MS, then this will clearly have **knock-on consequences for the utility of reporting information made publicly available at EU level.**

Among the reasons cited by MS for delays in R2 were: a general lack of human and financial resources, the short time span between the deliverance of SNMs and NAPs (12 months), which was viewed in the great majority of MS as being too short to allow sufficient time for public consultation, and to allow for Noise Action Plan revision to take consultation into account prior to finalisation deadlines. The second implementation review found for instance that there appear to be particular problems in respect of data completeness for R2 NAPs for airports and agglomerations.

[88] http://noise.eionet.europa.eu/

Ensuring that a complete set of comparable SNM are available will be increasingly important in future rounds in helping EU policy makers responsible for noise at source legislation to set baselines. Therefore, unless the issue of the timely provision of reporting information (SNMs and NAPs) is improved during the remainder of R2 and subsequent rounds, this may undermine the overall effectiveness of END implementation.

A further aspect of making information publicly accessible is **informing the public about the development of noise action plans during public consultation processes.** This is examined in the next sub-section, which deals with Action C – the process of drawing up NAPs.

The main findings are that:

- The majority of SNMs and NAPs have been made available online. However, in R2, there has been a less systematic effort by CAs in some MS to ensure that maps, exposure data and action plans are made available online in a sufficiently timely manner.
- Several stakeholders suggested that more could be done to strengthen the user-friendliness of noise maps and the presentation of population exposure data. For instance, developing aggregate maps across several sources to show the cumulative impact of noise in a particular area was suggested as one means of strengthening interest in environmental noise issues and improving public engagement.

3.2.3.4 Progress on Action 3 - Article 1(1c)

EQ 7c - How much progress has been made towards Article 1(1c) - the adoption of Noise Action Plans based on noise-mapping results?

Introduction

Art. 8 of the END sets out the detailed requirements in respect of the development of NAPs. CAs have to draw up NAPs based on noise mapping results. NAPs must contain measures to address noise issues and their health effects for major roads, railways, airports and agglomerations. The END requires that the public shall have the opportunity to comment on proposals for action plans and the possibility to participate in the elaboration and reviewing of the action plans.

It is important to stress that a common approach in the context of noise action planning is quite different to that required for strategic noise mapping. Whereas noise mapping under the END is concerned with the technical harmonisation of noise assessment methods, since comparable data is essential to inform source legislation, a common approach to action planning relates only to the procedure of preparing action plans, holding public consultations and identifying noise mitigation, abatement and reduction measures (Art. 8) and respecting the *Minimum Requirements for Action Plans (Annex V).* The content of NAPs and the measures selected are at the discretion of MS CAs.

Key findings – progress in respect of noise action planning

Overall, considerable progress has been made in respect of the development of NAPs over a five year cycle, although as explained in the implementation review (see Section 2.3.8), data completeness information available from the EIONET reporting system shows that there have been problems in several EU MS due to the delayed submission (and in some cases, the lack of the preparation) of NAPs in both R1 and R2.

There is **considerable divergence between MS** with regard to the approach to the development of NAPs, in terms of their content, the types of measures adopted, and the types of financial information on the costs and benefits of the NAP's implementation are provided. The length also varies considerably. Whilst this fully respects subsidiarity, from an evaluation perspective, this complicates an assessment of what has been achieved since the approaches being adopted to action planning are very different between MS.

The number of NAPs varies significantly between EU MS from one per source (e.g. the **UK / England**) to hundreds of NAPs, in the case of **France,** and even thousands in the case of **Germany,** because action planning is carried out not just at the level of agglomerations, but also by local authorities *within* agglomerations which under the national implementation system must each produce their own NAP. The number of NAPs varies, since according to national federal law in Germany, communities are responsible for action planning, which leads to one NAP per community (in instances where there is a minimum of one source (e.g. major road, major railways of aircraft noise) that exceeds Limit Values defined / suggested by the community itself. An exception is for aircraft noise, since LVs are defined by the German Fluglärmgesetz.

There are also divergent approaches across different MS in terms of how END CAs viewed the purpose of action planning. Some MS saw the purpose of preparing NAPs as being to set out a **strategic approach to noise management**, with detailed aspects of implementation determined later on in other national noise policy or strategy documents. Conversely, in other EU MS, **operational aspects** have been emphasised and greater detail has been provided as to how operational measures will be implemented. Indeed, some NAPs were identified that run into hundreds of pages (e.g. in **RO, ES**).

As described in detail in the implementation review, differences were identified in the approach between EU MS to the development of NAPs in terms of the **types and number of measures** included in NAPs. Examples of differences in approaches to the development and implementation of NAPs are provided in the second implementation review (see Section 2.3.8), which also identifies the most common types of measures mentioned, such as installing noise barriers, land use planning, other technical measures and the use of incentives.

Since differences in implementation approach are a factor that influences the overall effectiveness of noise action planning, a recap is provided below:

- Whereas some MS identify a "long-list" of possible future measures (only some of which are ever likely to go ahead), other MS are only able to mention measures where budget has already been earmarked.
- Some MS put a strong focus on measures that require expenditure for environmental noise mitigation, abatement and reduction, others focus on a combination of measures that expenditure and non-expenditure measures. Other interviewees stated that some NAPs do not include any expenditure measures at all since there is no budget available to address environmental noise at receptor.
- Some local authorities were reluctant to include expenditure measures in NAPs unless there was a firm undertaking from other relevant public authorities and funding bodies to support the measures mentioned, since otherwise they would face pressure from local communities to identify budget for measures.
- Several stakeholders mentioned that although there were many measures identified in R1 NAPs, due to the global economic and financial crisis, expenditure measures were often unlikely to go ahead due to budgetary constraints in R1. This was not expected to change greatly in R2.

The research found that EU MS generally **appreciate the flexibility to develop NAPs that reflect their own vision as to how a NAP should be drawn up**. Moreover, this is in line with subsidiarity principles and because a 'one size fits all' approach would not work, since environmental noise is widely acknowledged as being an issue best addressed locally.

The diversity in approaches to noise action planning, and the absence of reporting information at EU level as to whether measures in NAPs have been implemented, has made it difficult to assess what contribution measures have made, other than through a case study approach. In order to overcome this problem, 19 case studies were carried out to identify examples of NAPs where measures identified in R1 NAPs went ahead and were completed. Reference should be made to the cost-benefit findings set out in the section dealing with efficiency (see Section 3.2.4.5 - Findings from the cost-benefit assessment (EQ13) and the complete case study analysis provided in Appendix F.

Although the cost-benefit work has mainly informed the assessment of the efficiency criterion, at least as a proxy, it has also shed light on some aspects of effectiveness. For instance, in selecting 19 "test cases" at EU level, it was **challenging to identify R1 measures where at least one expenditure measure had been fully implemented across a large number of NAPs in Europe.** This was confirmed through the interview feedback. Although there are measures that have already been implemented through the END in R1 and during the first half of R2, there are equally more NAPs where no expenditure measures have been fully implemented at all and those where measures are beginning to be funded.

This reflects a number of factors, such as budgetary limitations in implementing spending measures due to the impact of the crisis, the long-term nature of the implementation of measures, since budget has to be identified and in some cases, the timescales involved in planning for upgrading transport infrastructure are measured in terms of one – two decades rather than in five yearly cycles. Less positively, some stakeholders were of the view that in some MS, the lack of spending measures was indicative of a lack of sufficient commitment at national level to reducing noise at receptor.

The **wide divergence in approaches to the development of NAPs makes it difficult to assess which expenditure measures identified in NAPs have actually been implemented**. Although Annex V sets out the minimum requirements for inclusion in NAPs and requires MS to include within action plans "provisions envisaged for evaluating the implementation and the results of the action plan", in practice, there is often a lack of information as to what has been implemented and achieved in the previous five years through a NAP.

Although in theory, under the minimum guidelines set out in Annex V, NAPs are meant to include information on "provisions envisaged for evaluating the implementation and the results of the action plan" in their NAP, in practice, **only a small proportion of NAPs appear to currently include a clear update on what were the main achievements during the previous five yearly implementation round.**

Since there is no monitoring data as to which measures have been implemented and their actual as opposed to projected costs in the previous round, it would consequently be difficult to assess the impact of the implementation of individual measures within NAPs without a case study approach. This suggests that monitoring of NAP (and in particular measure implementation) needs to be strengthened in future rounds, an issue explored under 'prospective issues'.

Overall, stakeholders were positive about the benefits of an action planning approach, which included:

- **A more strategic approach to noise management** – in MS that had pre-existing national legislation on environmental noise, it was observed that the END had made them address noise at receptor more strategically, due to the need to prioritise resources to address noise.
- **Greater prioritisation of resources on noise abatement and reduction** - for instance through approaches that have defined noise "hotspots". Whilst a "hotspot"

approach is not compulsory, MS commonly have limited resources to tackle environmental noise. They often therefore prefer to target measures at those areas where noise exposure is greatest or the highest number of people are affected as part of a process of prioritisation based on noise mapping results.

Challenges in ensuring that NAPs are submitted on time

Whilst the evaluators understand that the EC was able to take a more robust approach in relation to ensuring transposition wherever MS had incorrectly transposed the END during the early stages of implementation, there is a lack of a suitable instrument, such as imposing small financial penalties to help enforce the END's requirements in relating to reporting requirements in respect of SNMs and NAPs. The research findings suggest that there has been **weak enforcement of the requirements in the END in relation to the timely submission of NAPs.** Whilst in theory, infringement proceedings are an instrument available to the Commission if reporting delays take place, in practice, the EC appears to have been reluctant to take this course of action. Indeed, given the budgetary pressures faced by many of those working in the environmental noise field at national level, it might be argued that infringement proceedings for transmitting reporting information late would be too blunt an instrument. There is however a lack of alternative sanctions available at EU level to ensure that MS comply with their reporting obligations under Art. 10.

A further observation was made during the interview programme by external stakeholders that unlike for SNMs where there is more dedicated resource, there currently appears to be a **lack of available resources at EU level to monitor and check the quality of NAPs.** It was not possible to obtain the EC or EEA's views on whether resourcing levels are sufficient however, since the EC did not want to risk influencing or biasing the external evaluation of the ENDRM.

Examples were provided of NAPs that do not fully comply with the minimum requirements set out in Annex V of the END. However, the evaluation team noted in reviewing the legal text of the END that no penalties are applicable if MS do not fully comply with Annex V. This means that whilst overall, many NAPs appear to be of adequate quality, given differences in approach, there are wide differences in the content of NAPs. It was also noted by the evaluators in seeking to identify suitable case studies where measures had been fully implemented in R1 that the EIONET database of NAPs suggests that most NAPs do not include cost-benefit information about proposed measures under the financial information section. The desk research found that where such estimates are included, they often relate to the costs, rather than the benefits. This suggests a need for further guidance as to how to assess the costs and benefits. This was reiterated by END stakeholders through the interview programme.

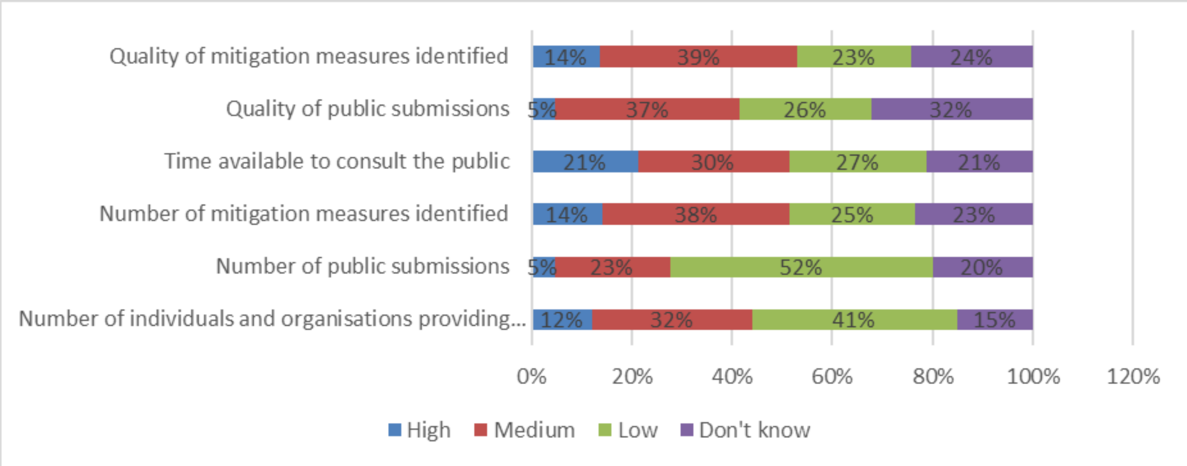
3.2.3.5 Public consultations

EQ 7d - How effective have public consultations been in informing noise action planning processes and in the finalisation of NAPs?

Under Art. 8 of the END, public consultations are required as part of action planning processes. Art. 8(7) states that "*Member States shall ensure that the public is consulted about proposals for action plans, given early and effective opportunities to participate in the preparation and review of the action plans, that the results of that participation are taken into account and that the public is informed on the decisions taken. Reasonable time-frames shall be provided allowing sufficient time for each stage of public participation".*

Respondents to the online survey for public authorities were asked how they would rate the Directive's impact so far on different aspects of the public involvement in the development of NAPs, including views on the number of individuals and organisations providing input, whether consultation had increased the number of mitigation measures identified and strengthened the quality of mitigation measures put forward in NAPs, and whether sufficient time was available for the consultation process. The results are set out in the following Figure:

Figure 3.8 – How would you rate each of the following aspects? (n=65)



Source: Online survey of public authorities

The survey responses suggest that public consultation can have a positive impact on strengthening the quality of mitigation measures identified. The quality of submissions from the public appears to vary significantly *between* and *within* EU MS since 37% assessed the quality as high (and 5% very high), but 26% of respondents stated that in their view, the quality of submissions was low.

Less positively, a problem identified in some MS, regions and localities was the lack of interest in public consultation processes relating to noise action planning under the END. In the online survey, in relation to the total number of submissions received, 52% stated that the number was low. However, 23% stated that the number received was medium and only 5% high. In terms of the number of individuals and organisations providing input, which extends beyond providing a written response alone, and may include, for instance, taking part in public meetings relating to the draft NAP, or in a consultation committee, the position was somewhat better with 12% of respondents noting a high level of contribution, 32% a medium contribution. However, 41% of respondents attested to a low level of contribution.

These findings were confirmed through the interviews, which found that although in some countries, there was an adequate level of interest in public consultations, there was often a lack of public engagement. However, in some EU Member States, there has been very active engagement by the public/ interested stakeholder organisations in responding to consultations. Nevertheless, some examples were identified of instances where a very significant number of consultation responses were received. For instance, in Germany, for the Berlin agglomeration, NGOs were very active in promoting participation in public consultations on NAPs.

Box 3.4 Example of active participation in consultation from Germany

According to an NGO taking part in the stakeholder workshop on the evaluation in September 2016, more than 3000 individual responses were received to a consultation on the NAP in R2, the majority from individual citizens.

In R1, through the public consultation, 417 responses were received from individual citizens, public sector bodies and institutions and other organisations. The published NAP includes a chapter explaining how the public consultation was carried out and explaining the process, and then sets out the results from the public consultation[89].

The consultants found that the goals and objectives set out in the NAP were generally accepted by stakeholders. Whilst 106 agencies and organisations deal especially with the recommendations for measures, the private statements mostly point out the local situation experienced and demand further going measures. The consultants evaluated the responses by theme. The following were identified:

- Demand for further T-30 road sections in the major traffic net, especially at night
- More traffic controls by the police to reduce malpractice leading to high noise exposure, for instance, speeding and also driving with manipulated exhaust systems
- Better, less noisy traffic management, for instance, with a better coordination of traffic lights
- Noise protection measures in the urban expressways, for instance with low noise asphalt and noise barriers
- Less noisy vehicles, especially buses and lorries
- Measures to reduce noise from railways, especially on the freight rail stretches
- Measures to reduce aircraft noise.

The results were reported back to some of the institutions and organisations that participated at the 6th Forum for Noise Reduction Planning held in October 2008. However, the consultants also point out that a significant percentage of the objections raised in response to the public consultation were against the extension of Schönefeld Airport, which is a separate issue from a NAP and subject to its separate planning application procedures.

In the view of the evaluators, the above example can be regarded as a good practice since there was (i) an active effort to promote participation (ii) a large number of responses were received which demonstrates engagement and (3) the consultants assisting the CA have provided a clear explanation of the role of the consultation in informing the NAP's finalisation (4) a distinction was made between analysing individual and organisational responses and (5) the scope of public consultation in relation to NAPs was made explicitly clear i.e. to identify suitable mitigation measures and confirm the broad objectives are appropriate.

Source: feedback at workshop from NGO and R1 published NAP.

It is also important to note the findings from the online survey in respect of the amount of time available to carry out public consultations within the context of action planning processes. There was a relatively even split between those END stakeholders that thought that there was a lot of time to carry out public consultations (21%), sufficient time (30%) and insufficient time (27%). This finding was corroborated through the interview programme and the discussions held at the workshop, where stakeholders stated that the timeframe between the finalisation of SNMs and of NAPs (12 months) is too short. Detailed feedback on this issue is provided in the second implementation review (see Section 2.3.8 on NAPs and the five yearly END cycle).

Among the main findings in respect of public consultations that emerged through a combination of the online survey (as per the above figure) and the interviews were that:

- There was a general problem with the **lack of interest in public consultation,** particularly during R2, where there was evidence of less interest compared with the previous round, casting doubt as to the effectiveness of consultations within action planning processes, at least in some EU MS.

[89] http://www.stadtentwicklung.berlin.de/umwelt/laerm/laermminderungsplanung/download/laermaktionsplan/noise-reductionplan_berlin.pdf

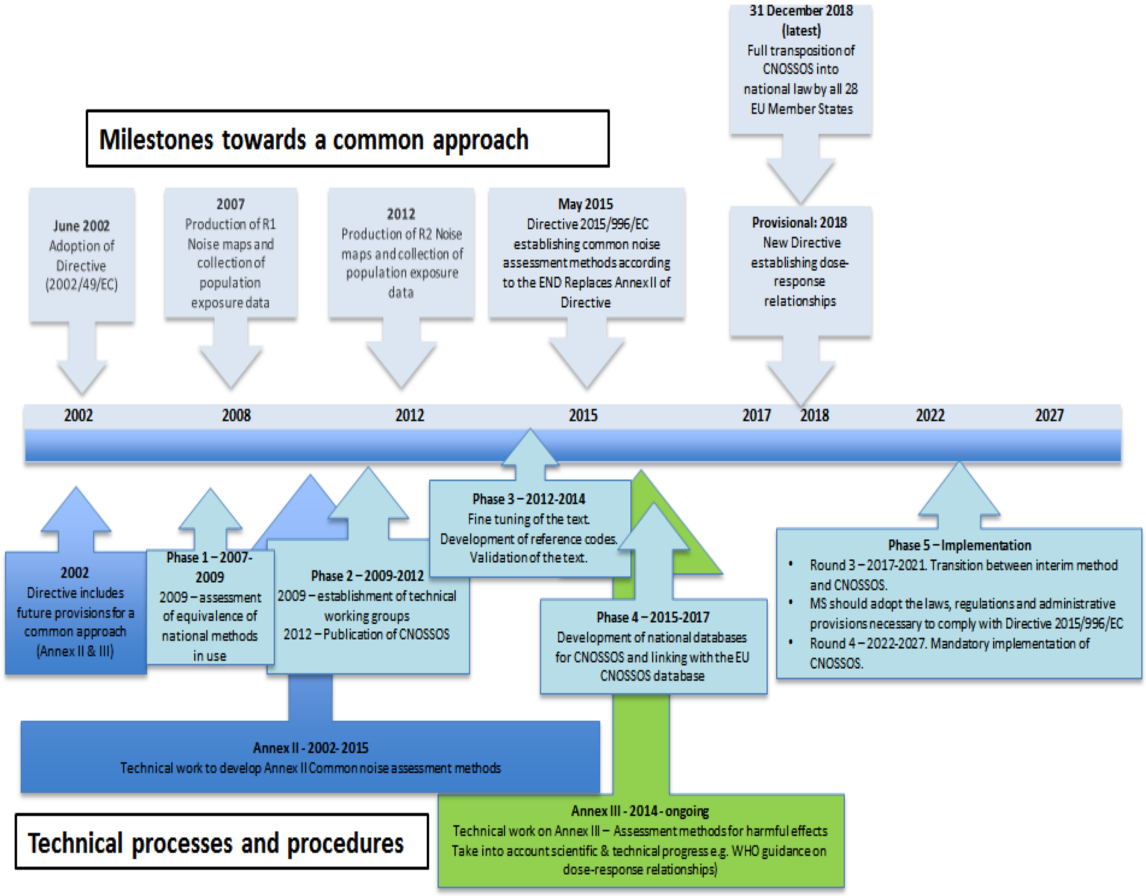
- Some CAs – especially at the local municipal level - expressed frustration that despite their efforts to actively promote public participation in public meetings and events, it had been **difficult to persuade the public to take part in public consultations on NAPs** even where events had been widely publicised in advance of the open meetings.
- According to some NGOs and community organisations interviewed, a further problem was that consultation feedback that they had provided in R1 NAP development had seemingly **not been taken into account**, **making them less likely to participate in R2 consultation processes**.
- There were consequently concerns among NGOs and local community organisations interested in environmental noise as to the overall effectiveness of public consultation. However, some CAs also recalled that sometimes suggestions from NGOs and the public are considered, but it is not always possible to implement suggestions. There is in particular often a lack of budget.
- The time allocated for the public to respond was found to typically **vary between four and twelve weeks**. However, a small number of examples of bad practice were identified where NGOs taking part in noise consultation committees had been asked to comment on NAPs at very short notice. This did not leave them sufficient time to submit a quality response to inform NAP finalisation.
- It was seen as important by CAs and NGOs and local community groups to allocate sufficient time for holding consultations. Since many individuals participate in such activities on a voluntary basis, it takes time for them to form a constructive, collective response.
- Some CAs made it clear that **the number and quality of submissions** received in response to public consultations were **often not rated very highly.** This may partly explain the practical difficulties that CAs may face in demonstrating how they have taken consultation feedback on board. However, receiving a low number of consultation responses was not the case in all EU MS. For instance, Germany, reported a strong response rate to END public consultations.
- The contributions made by stronger NGOs and community groups with the **necessary technical capacity** much more useful to action planning authorities than contributions from individual citizens, which were often either of low quality or difficult to integrate into NAPs. This suggests that **targeted consultations can be more effective** than aiming for a large consultation response, where the quality and utility of submissions is much more uncertain.
- A number of END stakeholders stated that consultation within the END would be more effective if CAs viewed consultation with local communities as an **ongoing exercise rather than a one-off consultation** during the period prior to NAP finalisation. Some airports operators have adopted this approach under the END, and stated that it had been effective in building community engagement.
- The results of public consultations relating to draft NAPs have generally been **made available to the public by publishing them online** and / or by incorporating consultation responses directly into draft action plans.
- However, the emphasis has tended to be on ensuring that **summaries of consultation feedback** were published, rather than making information available on how consultation feedback had been taken into account in the finalisation of NAPs.

EQ7e -Has the speed of progress been in line with expectations?

Achieving a common approach will require **a long-term commitment** on the part of the EC in their coordination role, working in conjunction with international partners, notably the WHO, which is developing common methods for assessing the harmful effects of noise by establishing revised source-specific dose response relationships.

It will also require long-term commitment by the EU MS who are required to make the transition from national and interim methods to common assessment methods under CNOSSOS[90] by R4. In the following diagram, an overview of the estimated timeline and the trajectory towards a 'common approach' is provided in the following diagram.

Figure 3.9 - Trajectory towards a 'common approach'



Source: Interpretation by CSES and ACCON of current estimated timescales

The purpose of the above diagram is to demonstrate the **long-term nature of realising a 'common approach' in respect of noise assessment methods (Annex II) and dose response relationships (Annex III).** The milestones towards a common approach are set out in the upper part of the diagram whilst the technical processes and procedures involved are outlined in the lower part. It should be emphasised however that **the Directive does not stipulate any timescales by which particular steps towards a common approach have to be developed and implemented.** Whilst some timings outlined in the diagram above are based on the actual timeline (e.g. the preparatory stages of CNOSSOS-EU and the publication of the revised Annex II), the timeline for Annex III (to assess the harmful effects of noise) is only an estimate.

The diagram shows that replacing Annex II with common assessment methods through CNOSSOS-EU was a process that has already taken 8 years of continuous work leading up to the adoption of Commission Directive (EU) 2015/996/EC (establishing common noise assessment methods according to the END). Implementing the revised Commission Directive that replaces Annex II will take several years, since there is first a need to develop national databases and then to link these to the CNOSSOS-EU database. Even though there is no formal timetable in the Directive, several preliminary

[90] The methodology for Common Noise Assessment Methods in Europe that was developed by the European Commission, supported by technical experts between 2009 and 2015.

observations can be made in respect of the timeline towards a 'common approach', drawing on the interview feedback and on discussions with the EC.

Timeline for the revision of Annex II (common assessment methods)

- CNOSSOS-EU will be implemented on a voluntary basis by some MS in R3, but will only be mandatory in R4. This will mean that fully comparable data across the EU to inform EU source legislation will not be available until 2022 (R4). Fully comparable data between rounds will therefore not be available until 2027 (when R5 population exposure can be compared with R4).
- The development of CNOSSOS_EU – and its subsequent implementation – has taken longer compared with the expectations of some stakeholders interviewed.
- However, this reflects the complex and technical nature of the steps needed to replace Annex II, the requirement to take into account technical and scientific 'state of the art' and the need to allow sufficient time for MS to make the transition from using national and interim methods to producing population exposure data using a common method.
- Although some MS would have preferred to have gone ahead and implemented CNOSSOS-EU earlier (i.e. in R3), others wanted to delay its full implementation, so as to allow them sufficient time to adapt national and / or interim methods to noise mapping and to allow for testing before full implementation.

Timeline for the revision of Annex III (Assessment methods for harmful effects)

- Annex III of the Directive requires Member States to assess the health effects of environmental noise in combination with noise exposure data. However, to date and presently, MS are able to use whichever method they wanted.
- Work is ongoing at an EU level to revise Annex III of the END to facilitate the assessment of dose response relationships. This work already commenced in 2014, and some progress has already been made in strengthening common assessment methods for assessing the health effects of environmental noise.
- However, a Directive establishing dose-response relationships to support the END (to replace the current Annex III) is expected to be ready in approximately 2018. This is a provisional estimated timeframe, since no formal timeframe defined in the END itself. This estimate takes into account the delay in the finalisation and publication of the WHO guidelines to assess the health effects of noise of 18 months compared with the original timetable. Although the development of Annex III to assess health effects may be available prior to R3 implementation, it may not be available in sufficient time, but will in any case subsequently allow for the assessment of health effects in R4 and beyond.
- From such time as when the new Annex III will be adopted, MS may use the new methods.
- Once data on population exposure is available (i.e. data from noise maps and data on exposure after an intervention), calculating the health effects is expected to be relatively straight forward by the EC, since it can be produced in an Excel sheet.

EQ7f - Has the Directive been adapted to technical and scientific progress?

The issue as to how far particular aspects of END implementation, notably the development of common noise assessment methods through CNOSSOS-EU have been well-adapted so as to reflect technical and scientific progress is an important question. However, since the issues involved are of a detailed and technical nature, the research findings are set out in Appendix G. Related issues, such as outstanding challenges in strengthening the comparability of data are also considered.

3.2.3.6 *Progress in achieving the END's second objective*

EQ8 - What progress has been made towards achieving the END's second objective?

Introduction

- The second objective of the END – **as set out in Article 1(2) - Providing a basis for developing Community measures to reduce noise emitted by the major sources**– relates in particular to road and rail vehicles and infrastructure, aircraft, outdoor and industrial equipment and mobile machinery (c.f. Art. 1(2). This was recognised by many stakeholders interviewed as being complementary to the first objective, since **measures at receptor alone cannot solve Europe's environmental noise problem**.

The complex interplay between the achievement of the END's first and second objectives was emphasised since the process of measuring the scale of the problem through noise mapping to capture population exposure data and changes over time noise is a crucial pre-requisite before noise at source legislation can be reviewed and strengthened. This explains why noise maps are produced by individual transport source so that EU policy makers can assess the net benefit of requirements set out in transport-specific source legislation.

In assessing the degree of influence of the END on noise at source legislation, a distinction is needed between the influence of the END on the revision of **existing EU noise at source legislation** and the extent to which the END has informed the development of **new source legislation.**

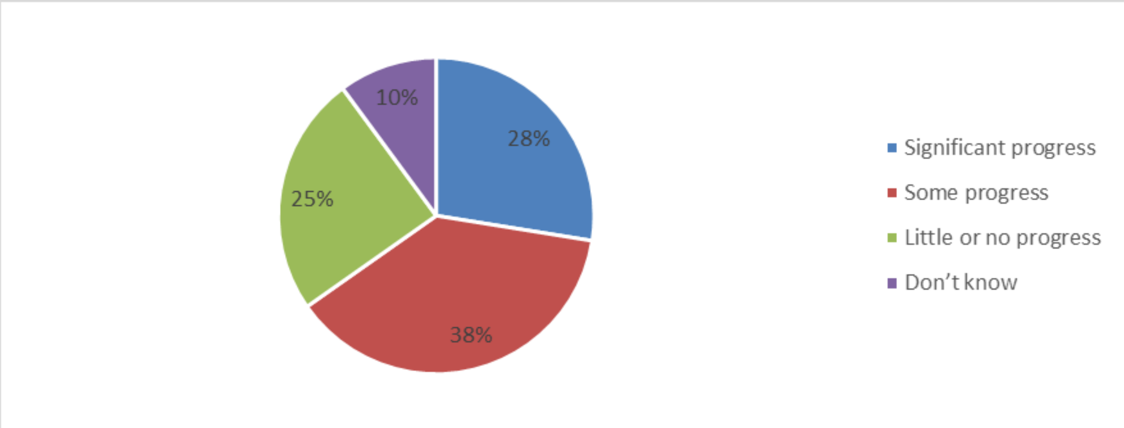
Analysing the impact of the END on source legislation also requires an understanding of EU legislative-making processes and the timescales for the revision of such legislation. Since **source legislation is typically only revised once every 10-15 years**, it will therefore take considerable time before the END influences all source legislation. There was already a substantial body of EU legislation in place prior to the adoption of the END. For instance, there has been legislation on noise at source in motor vehicles since 1970 (Directive 70/157/EEC). EU legislation has been in place in respect of aircraft noise since the early 1990s (Directive 92/14/EEC), based on ICAO standards, although this has recently been updated. Whereas some EU source legislation has not yet been updated since the END was adopted in 2002, other pieces of source legislation have been updated relatively recently, with evidence of strong influence of the END.

In order to assess the extent to which the END has informed source legislation, an extensive mapping of relevant EU legislation was undertaken (see Appendix C). Selected examples of pieces of source legislation that have been revised more recently, and where the END has influenced the legislative formulation process are outlined later in this sub-section.

Key findings - progress towards achieving the END's second objective

Through the online survey, respondents' views were solicited as to the extent of progress towards the second objective of the END. Most stakeholders had a positive opinion about progress. A combined total of 66% thought that either 'some progress' or 'significant progress' had been made, although 25% stated that little or no progress has been made.

Figure 3.10 – Progress towards END objective 2: providing a basis for developing Community measures to reduce noise emitted by major sources (n=69)



Source: Online survey of public authorities

However, caution is needed in interpreting the results, since most END stakeholders are not familiar with the detailed mechanics of EU policy-making processes that inform the revision of EU source legislation. Therefore, in order to assess progress in informing source legislation, interviews were carried out with different Directorate Generals (e.g. DG GROW and MOVE) responsible for noise at source legislation across different transport modes. In addition, the 2004 report to identify existing source legislation was reviewed, since this addressed the requirement in Art. 10(1) for the EC to review existing source legislation and to identify new legislation if necessary (see Appendix C).

Whilst some END stakeholders stated that population exposure data was already 'good enough' to be used by EU policy makers responsible for source legislation, others were concerned that the data is not comparable since the EU is still in the process of harmonising noise at receiver data until CNOSSOS-EU is fully implemented.

Through the evaluation research, the extent to which the END has already influenced and informed source legislation was assessed. A number of positive examples were identified as to how data collected through the END has influenced EU policy makers in the revision of recent source legislation, although there remain concerns about data quality, completeness and comparability among source policy makers.

Through the interview programme, EU policy makers from different responsible EC Directorate Generals (e.g. DG MOVE, DG GROW) mentioned a number of positive aspects to the END:

- The Directive provides an important strategic reference point for EU policy makers responsible for EU source legislation.
- References have been made in the recitals of revised source legislation and in impact assessments to the END's relevance in tackling environmental noise at receptor to complement source legislation.
- The emphasis in the recitals of the END on promoting high levels of protection of human health (a key EU policy objective stemming from the EC Treaty base) and on the potential adverse health effects of high levels of environmental noise has been referred to in the recitals of revised source legislation.
- The emphasis on assessing the extent of environmental noise at receptor through five yearly collection of changes in population exposure data and in measuring the health effects was seen as providing essential information to source policy makers to

assess the (net) benefits of existing source legislation, which is an essential starting point before more stringent limits could be considered.

Source-specific examples as to how the END has influenced the recent revision of different source legislation are now provided grouped by transport source. The focus is on the legislation affecting the automotive and railway sectors, as well as on aircraft noise, since these have been updated in the past two-three years, and the END has been in a position to influence EU legislative revision processes:

Table 3.2 – EU legislation tackling noise at source – selected examples of the influence of the END

Transport type and name of legislation	Description	References to END and other relevant references
Automotive Regulation 540/2014 on the sound level of motor vehicles and of replacement silencing systems, and amending Directive 2007/46/EC and repealing Directive 70/157/EEC	The Regulation aims to improve environmental protection public safety, and quality of life by reducing major sources of noise caused by motor vehicles. It sets out the administrative and technical requirements for the EU approval of all new vehicles of certain categories with regard to their sound level and for the EU approval of replacement silencing systems and related components. The regulation sets noise-limit values for the different vehicle categories and a timeframe for implementation.	Recital 1 refers to providing for a high level of environmental protection and to a better quality of life and health. Recital 3 states that traffic noise harms health in numerous ways. "The effects of traffic noise should be further researched in the same manner as provided for in Directive 2002/49/EC". Recital 13 points out that "noise is a multifaceted issue with multiple sources and factors that influence the sound perceived by people and the impact of sound upon them. Vehicle sound levels are partially dependent on the environment in which the vehicles are used, in particular the quality of the road infrastructure, and therefore a more integrated approach is required. **Directive 2002/49/EC requires SNMs to be drawn up periodically** as regards, inter alia, major roads. **The information presented in maps could form the basis of future research work regarding environmental noise in general, and road surface noise in particular, as well as best practice guides on technological road quality development and a classification of road surface types, if appropriate.** Recital 21 - Vehicle sound levels have a direct impact on the quality of life of Union citizens, in particular in urban areas in which there is little or no electric or underground public transport provision or cycling or walking infrastructure. Also references the objective in the 6th EAP of **substantially reducing the number of people regularly affected by long-term average levels of noise, particularly from traffic.**
Automotive The European Tyre Labelling Regulation (EC/1222/2009)	The Regulation introduced labelling requirements for tyres. The external rolling noise of tyres is one of three types of information that must be displayed.	Recital 8 - states that traffic noise is a significant nuisance and has a harmful effect on health. Regulation (EC) No 661/2009 sets out minimum requirements for the external rolling noise of tyres. Technological developments make it possible to significantly reduce external rolling noise beyond those minimum requirements. To reduce traffic noise, it is therefore appropriate to lay down provisions to

Transport type and name of legislation	Description	References to END and other relevant references
		encourage end-users to purchase tyres with low external rolling noise by providing harmonised information on that parameter". Recital 9 - the provision of harmonised information on external rolling noise would also facilitate the implementation of measures against traffic noise and contribute to increased awareness of the effect of tyres on traffic noise **within the framework of Directive 2002/49/EC relating to the assessment and management of environmental noise.** Art 1. – The aim is *inter alia* to promote low noise levels in tyres.
Major railways Regulation 1304/2014 on the technical specification for interoperability relating to the subsystem rolling stock noise amending Decision 2008/232/EC and repealing Decision 2011/229/EU2	Sets technical specifications for interoperability of rolling stock of the trans-European conventional rail system, including requirements relating to noise emission limits.	Recital 6 - an analysis should be made with a view to reducing noise emitted by existing vehicles while taking into account the competitiveness of the rail sector. It concerns especially freight wagons and is important in order to increase acceptance of rail freight traffic among the citizens.
Major railways Regulation (EU) 2015/429 setting out the modalities to be followed for the application of the charging for the cost of noise effects of freight rolling stock	Sets out the modalities to be followed for the charging of cost of noise effects caused by freight rolling stock whereas charges are commensurate with noise levels.	The White Paper 'Roadmap to a Single European Transport Area — Towards a competitive and resource efficient transport system' (2) indicated that 10 % of the EU's population is exposed to significant noise pollution from rail transport, in particular freight. Noise is a localised externality, affecting people living close to railway lines. Its reduction is the most cost-effective at the source, where the noise is produced. The replacement of cast iron brake blocks with composite brake blocks can bring noise reductions of up to 10 dB. Therefore the support of the retrofitting of wagons with the most economically viable low-noise braking technology available should be encouraged and pursued.
Airports Regulation (EU) No 598/2014 of the European Parliament and of the Council of 16 April 2014 repealing Directive 2002/30/EC	The establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Union airports within a Balanced Approach	Some similarities with the END in terms of the Directive's scope. Like the END, the Regulation only applies to Member States in which an airport with more than 50000 civil aircraft movements per calendar year is located. The END is also referenced in the recitals. Recital 9 - "While noise assessments should be carried out on a regular basis in accordance with Directive 2002/49/EC, such assessments should only lead to additional noise abatement measures if the current combination of noise mitigating measures does not achieve the noise abatement objectives, taking into account expected

Transport type and name of legislation	Description	References to END and other relevant references
		airport development. For airports where a noise problem has been identified, additional noise abatement measures should be identified in accordance with the Balanced Approach methodology. Noise-related operating restrictions should be introduced only when other Balanced Approach measures are not sufficient to attain the specific noise abatement objectives". Recital 11 – "the importance of health aspects needs to be recognised in relation to noise problems, and it is therefore important that those aspects be taken into consideration in a consistent manner at all airports when a decision is taken on noise abatement objectives, taking into account the existence of common Union rules in this area. Therefore, health aspects should be assessed in accordance with Union legislation on the evaluation of noise effects". Recital 12 – Noise assessments should be based on objective and measurable criteria common to all Member States and should build on existing information available, such as information arising from the implementation of Directive 2002/49/EC. EU MS should ensure that such information is reliable, that it is obtained in a transparent manner and that it is accessible to CAs and stakeholders. CAs should put in place the necessary monitoring tools.

The extensive references to the END in recently revised source legislation outlined in the above table show that the END has already had an impact on influencing the development of policy thinking across different transport modes, for instance, the references to the health effects of environmental noise and to the possible future use of END data to inform mitigation and abatement measures.

The extent of influence of the END on existing source legislation was also found to be dependent as to whether source legislation has recently been revised and updated. Legislation is commonly updated only once every 10-15 years so it will take time for the complete body of EU source legislation to go through legislative revision processes.

A contrast can be drawn between the **policy rationales cited for source legislation for different transport sources**. In the case of the automotive and aviation sectors, **the recitals to** source legislation mention the need to ensure high levels of protection of human health and mention the need to minimise the adverse effects to human health of high levels of environmental noise. Conversely, in the case of railways, because TSIs (Technical Specifications for Interoperability) are standards primarily concerned with technical harmonisation within the internal market, the policy rationale is centred on **strengthening the rail sector's competitiveness** and on **ensuring a level playing field within the internal market**.

However, some stakeholders interviewed noted that whilst the **need to protect human health is mentioned in the recitals**, the revision of the legislation, in particular the development of limit values for aircraft noise, road vehicle and tyre noise limits appear to have **mainly been driven by discussions with industry, rather than being primarily influenced by health protection considerations.** This was somewhat difficult to assess through the evaluation.

Feedback from the interview programme as to how far the END has influenced source legislation, and the extent to which this might be enhanced in future, once fully comparable data is available is available, is now examined.

In the **railway sector**[91], EU policymakers stated that the existence of the END and an emerging evidence base through noise mapping and population exposure data had played a positive role in strengthening attention to noise mitigation at source through Technical Standards for Interoperability (TSIs). The scale of ambition for the scope of source legislation had also increased at DG MOVE. Whereas previously, for example, the focus was only on ensuring that new rail wagon fleets met the more stringent standards, but these only accounted for some 10-15% of total rolling stock, a TSI was adopted in 2014 to extend the scope to existing rolling stock, which will have a much more significant positive benefit in reducing railway noise.

In a recent impact assessment to consider the possibility of extending a TSI on railway noise from new wagons to existing rail wagon fleets, among the policy options considered was a scenario in which the END were to be further strengthened in future by imposing common limit values at EU level for all sources. Whilst it should be emphasised that there was no support for a common LV to be applied across all transport sources among END stakeholders interviewed, in the IA exercise, this option scored well in the impact assessment in terms of potentially meeting the policy objective of reducing noise from railways whilst not penalising the competitiveness of the railways sector compared with other transport sources.

Only limited feedback was received from END stakeholders on the extent of contribution of the END to influencing source legislation for the reasons explained earlier. However, the feedback corroborated the messages from EU policy makers, that the END has provided an impetus to revising source legislation. An acoustic consultant in the UK commented for instance that the "simple existence of the END has caused decision makers and those responsible for transport sources to consider noise more than would otherwise have occurred. For example, the existence of the END has caused the rail industry in Europe to look at regulating the source noise of trains through their TSIs".

In the **automotive sector,** Regulation 540/2014 on the sound level of motor vehicles explicitly mentions the potential value of population exposure data in helping to develop a better understanding as to how road noise in particular impacts on health and how it might be reduced in future. It also stresses the role of the END in helping to develop best practice guidance on improving road quality and on the classification of road surface types, which could make a significant contribution to reducing noise at source.

Furthermore, the END also provided a strategic backdrop to the adoption of the **European Tyre Labelling Regulation (EC/1222/2009)**. This introduced more stringent limits for European tyres for the labelling of rolling resistance and external noise. Explicit reference was made to the END in the impact assessment[92]. “A labelling scheme for external rolling noise may also contribute to awareness-raising, which is one of the objectives of Directive 2002/49/EC on environmental noise”.

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[91] An example is the TSI on the interoperability of new rolling stock.

[92] Impact assessment on the labelling of tyres, SEC 2008 2860, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SEC:2008:2860:FIN:EN:PDF

An interview with an EU Industry Association confirmed that the END has had a positive influence on the development of the European Tyre Labelling Regulations.

However, the industry association expressed concerns that manufacturers faced additional substantive compliance costs in meeting the requirements (e.g. redesigning tyres) whereas there is research that suggests that laying quiet road surfaces may potentially have a greater impact than making tyres quieter. There was a concern that there needs to be a fair sharing of the administrative burdens and costs between noise at source and noise at receptor.

Industry associations expressed concerns about the need to ensure an appropriate sharing of the burden between industry, which is affected by noise at source legislation, public authorities, responsible under the END for tackling noise at receptor and other actors, such as road construction companies[93].

In the **aviation sector**, the recent adoption of Regulation (EU) No 598/2014 of 16 April 2014 repealing Directive 2002/30/EC makes explicit reference to the END in the recitals and emphasises the importance of a balanced approach to noise mitigation (as advocated by ICAO). It explicitly mentions in the recitals the adverse health effects of environmental noise and raises the possibility of using information arising from the implementation of Directive 2002/49/EC.

Lastly, although the END has clearly had a positive influence already in the revision of some pieces of source legislation, it should be recalled that there are many other factors that will influence the revision of existing, and the development of new source legislation besides the END. Examples are industry viewpoints on what realistic source limits might be achieved by particular dates during the policy development process, and how new possible limit values on noise at source compare with current levels.

Conclusions - informing source legislation to date

- Overall, the END appears to have had a positive influence on informing the revision of existing EU legislation on noise at source and in the development of new Technical Specifications for Interoperability (TSIs);
- The END has been explicitly referenced in the recitals of a number of different pieces of source legislation[94] in the automotive, railways and airports sectors and in the impact assessment accompanying these legislative proposals (see legal mapping), with evidence of much greater attention to environmental noise in the legislation in the past three years;
- Due allowance should also be made of the fact that it will take time for the EU legislative review cycle in respect of other source legislation to be completed, since source legislation is typically only reviewed and revised once every 10-15 years.
- However, since complete and comparable END data produced on a common basis was not available, data has not yet been used to inform the revision of key aspects of source legislation, notably the review of existing limit values and establishing whether or not these should be made more stringent; and

[93] It was noted that whilst tyre manufacturers are subject to noise at source legislation, road construction companies are able to decide whether to lay quiet road surfaces or to take noise into account from the outset of the road design process without any mandatory requirements.

[94] See Regulation (EU) No 598/2014 (noise-related operating restrictions at Union airports), Regulation (EU) 2015/429 setting out the modalities for the application of charging for the cost of noise effects of freight rolling stock, Regulation 1304/2014 on the technical specification for interoperability relating to the subsystem rolling stock noise, Regulation 540/2014 on the sound level of motor vehicles and of replacement silencing systems (automotive)

Contribution to informing source legislation in future

EU policy makers interviewed noted that in future, population exposure data collected at EU level through the END was likely to be **increasingly important.** Whilst such data can in theory already be utilised, it was noted by officials from DG GROW that ensuring data completeness and comparability are crucial precursors to being able to use the data more extensively in impact assessments, for instance, to help to justify making limit values more stringent.

The END is also likely to continue to play a crucial role at the impact assessment stage, especially since the Impact Assessment procedure has recently been further strengthened. In particular, in June 2015, the Impact Assessment Board was replaced by the **Regulatory Scrutiny Board**[95]. Since this will lead to closer scrutiny of proposed EU legislative changes (through continued internal scrutiny, but also the introduction of external scrutiny), policy makers reviewing source legislation will need to ensure that their impact assessment includes data to support any proposed changes to limit values.

Therefore, for the future, it can be concluded that population exposure data is likely to be used more extensively to help establish the baseline situation in respect of noise at receptor and to shed light on the net benefits of existing source legislation.

3.2.3.7 *Impacts of the END's implementation*

The quantitative benefits relating to the implementation of individual measures identified in NAPs under the "efficiency" section have fed into the cost-benefit assessment. However, the impacts of the END's implementation to date that can be assessed qualitatively are considered under the 'effectiveness' criterion. Stakeholders interviewed pointed out that the END has achieved benefits of a more strategic nature relating to environmental noise management that extend well beyond the individual measure level.

EQ9 - What are the main impacts of the Directive?

Among the sub-questions considered were:

- EQ9a How far has the Directive achieved any significant changes (positive or negative)?
- EQ9b Has the Directive contributed to ensuring that by 2020 noise pollution has significantly decreased?
- EQ9c Can any unexpected or unintended consequences be identified?
- EQ9d. To what extent can these be quantified?

EQ9a How far has the Directive achieved any significant changes (positive or negative)?

Several interviewees stated that the benefits of the END should not only be assessed quantitatively at the measure level (here, reference should be made to the cost-benefit assessment in Appendix D), but should also be assessed qualitatively at a strategic level through the effectiveness evaluation criterion.

A further issue raised at the validation workshop was that it is too early to assess many benefits, given the long-term nature of tackling noise at receptor, the types of measures envisaged in NAPs, and budgetary restrictions due to the global economic and financial crisis in many EU MS in R1. Notwithstanding these challenges, a number of stakeholders

[95] http://ec.europa.eu/smart-regulation/impact/iab/iab_en.htm - the Regulatory Scrutiny Board provides a central quality control and support function for Commission impact assessment and evaluation work. It was set up on 1 July 2015 and replaced the Impact Assessment Board.

observed that the implementation of the END has had different types of positive impacts on the management of transport noise across the EU. These are now summarised.

Awareness-raising and coordination across different policy areas

- The END has promoted a more strategic approach to environmental noise management, mitigation and reduction through an action planning approach;
- The END has helped to strengthen the visibility of environmental noise and the adverse health effects of high levels of noise (at receptor). Consequently, there is now greater political attention to the issue of environmental noise and the link with public health in all MS (and to some extent globally);
- Heightening awareness among other policy makers (e.g. transport planning, infrastructure development, urban development and planning) about the importance of building in environmental noise mitigation and abatement from the outset of the legislative-making, policy-making and programme design process
- Strengthening coordination and cooperation between civil servants responsible for environmental noise and other policy areas. This was widely seen as vital since expenditure measures that help to reduce noise pollution are often primarily driven by other drivers, such as air quality, road safety, urban development;
- The END has promoted "joined-up" working between different stakeholder organisations, often with contrasting roles and responsibilities e.g. noise-making (roads authorities) and noise-receiving (housing and planning authorities) responsibilities and wider stakeholders responsible for public health (**NL, IE, UK**).

A common noise assessment framework

- The END has created a common reference framework for assessing noise using common noise assessment methods across EU-28. Putting in place two common EU-level noise indicators (L_{den}, L_{night}) for the purposes of implementing the END has had a positive impact in strengthening the comparability of data, since previously different types of noise indicators were used in different MS;
- The development of the CNOSSOS-EU methodological framework and the subsequent adoption of Commission Directive (EU) 2015/996[96] of 19 May 2015 is a major achievement that took into account scientific and technical progress, as well as state of the art.

The development of noise maps and gathering of population exposure data over time series to facilitate policy-making.

- The END has made information on the level of noise exposure (from road and rail in particular) available to many EU citizens who previously had little or no access to information of this type, although very few citizens are presently accessing noise maps or population data (a reflection of the lack of cumulative maps to show the actual situation as experienced by residents);
- For EU policy makers, the noise maps provide population exposure data by source, which is useful for assessing the effects of existing source legislation and for considering its potential revision;
- For national and sub-national policy makers, the maps and exposure data provides objective support to help prioritise environmental noise interventions.

[96] Commission Directive (EU) 2015/996 of 19 May 2015 (establishing common noise assessment methods according to Directive 2002/49/EC)

Strengthening assessment methods to quantify the health effects of noise

- The END has made noise data available that has provided a means for monetising the impact of noise, for determining the overall environmental burden of disease, and to facilitate several epidemiological studies on noise and health that would have been prohibitively expensive and perhaps impossible to undertake otherwise.

The prioritisation of noise

- In addition to focussing attention on areas that have the highest levels of noise exposure, noise mapping through the END has promoted greater interest among national policy makers in the high numbers of people exposed to low to medium levels of noise;

Quiet areas and the preservation of noise quality where it is good

- There has been growth in interest in the protection of quiet areas, and in more nuanced approaches to protecting special acoustic environments, to protecting tranquillity and to the emergence of soundscape as an important issue; and
- However, the lack of designation of quiet areas to date in many MS has undermined progress in preserving noise where it is good.

There was only limited feedback on negative impacts, since most negative points related to outstanding implementation challenges. Those raised were that:

- A small number of stakeholders were concerned that the costs of strategic noise mapping could divert resources away from environmental noise mitigation, abatement and reduction measures. However, balanced against this was evidence that the full benefits of strategic noise mapping will only be realised over the longer term, especially insofar as informing source legislation is concerned.

EQ9b Has the Directive contributed to ensuring that by 2020 noise pollution has significantly decreased?

Methodological issues – assessing the END's contribution to reducing noise pollution

In addressing this question, it is important to recall the evaluability challenges in assessing the END's contribution to objectives that are not explicitly set out in the legal text of the Directive (see intervention logic, Section 3.1.4).

Since the END's first objective is to define a common approach, it is difficult to assess the END's contribution to reducing noise pollution in the EU at receptor, since there is **no explicit mandatory requirement to reduce noise or to implement measures** identified in NAPs. Assessing the contribution of the END is further complicated by the fact that **there is no systematic reporting at EU level as to which measures included within NAPs have – and have not – been implemented.** A final methodological challenge is that since many measures within NAPs take considerable time to implement, many workshop participants were of the opinion that it is too early to capture the totality of measure-level benefits over the lifetime of measure implementation (since the benefits often considerably lag the costs).

It was noted that it is difficult to attribute the benefits achieved at the measure level solely to the END, since these were often driven by other policy needs (e.g. road safety, air quality, transport infrastructure planning), but with important secondary benefits in terms of contributing towards the mitigation and / or reduction of environmental noise. Moreover, many of the R1 measures identified were already planned before the END was adopted, at least those measures in Germany, which also raises attribution issues.

The question of attribution is addressed in detail earlier in the efficiency section in further detail.

Cost-benefit benchmarks and the distribution of benefits

The work carried out to develop **cost-benefit benchmarks** draws on the study team's extensive knowledge across different EU MS as to what level of noise reduction can be expected from particular types of measures. This has strong potential to help CAs to develop a better understanding of the magnitude of benefit from the different types of measures.

The effectiveness of measures can be assessed through a review of the level of noise reduction achieved, information which is generally included in the NAPs. Estimates of the level of noise reduction can be applied in situations where the NAP does not contain sufficiently detailed data. Therefore data from similar cases was evaluated and applied to the specific case. As a result, generally accepted average noise reduction levels are available for each measure, as shown in the following table.

Table 3.3 - Benchmarks for the order of magnitude of dB reduction for common measure types

No.	Measure	Effectiveness (reduction of noise level)
1	Rehabilitation of roads / Low noise road surfaces	L_{den}/night = -4 dB(A)
2	Speed reduction	L_{den}/night = -2 dB(A)
3	Speed control	L_{den}/night = -1 dB(A)
4	Re-distribution / Reduction of number of heavy trucks	Reduction of affected residents by 20 %
5	Barriers / Walls	L_{den}/night = -3-4 dB(A)
6	Embedded tracks for trams	L_{den}/night = -3 dB(A)
7	Acoustical grinding of tracks	L_{den}/night = -4 dB(A)
8	Vegetated tram tracks	L_{den}/night = -2 dB(A)

Source: ACCON – notes, the values are generally accepted estimates.

Work has been carried out to determine the number of residents with reduced noise exposure across the 19 selected test cases (see Appendix F). The test cases consider changes across at least four 5 dB noise intervals. It could be that there simply are no changes at the lowest or highest intervals. In addition to this information, most NAPs provide an estimate of the expected reduction of noise in dB (A). Using this information, the affected residents are reassigned to lower noise classes according to the specific reduction of the measure. The following example shows the approach applied for a reduction of 2.5 dB (A) (L_{den}):

Table 3.4 – Example as to how the benefits of END measures lead to reductions in noise pollution distributed across 5dB thresholds

Noise level class	Residents without measure	Residents with measure	Comment
<50	1,000	1,000	All residents below level of 50 dB (A).
50-54.9	0	500	Reduction of 2.5 dB(A) results in **shift** of 50 % residents to the lower 5 dB(A) noise-class, whereas the remaining 50% **remain** in the 5 dB(A) noise-class.
55-59.9	1,000	1,750 + 500	
60-64.9	3,500	1,500 + 1,750	
65-69.9	3,000	750 + 1,500	
70-74.9	1,500	750	
>75	0	0	No residents in this class.
Total	10,000	10,000	All residents benefit from the measure.

In the above example, it was assumed that all residents in the case study area who are adversely affected by noise experience a reduction in noise exposure due to the measure being implemented. This effect is expected from measures such as speed reduction, noise optimized surfaces or embedded tracks for trams. In other cases only selected residents from a case study area may benefit from the measure e.g. insulation of windows through noise proofing.

It is difficult through noise mapping to measure changes in noise exposure as a result of sound-proofing measures since there is usually no data as to where the specific beneficiaries of such measures reside. This is because they will still appear in noise maps as being resident in areas with high noise levels, even if measures have been taken to mitigate noise in their specific dwelling.

Quantitative work carried out for the test cases provides a bottom-up assessment of the level of reduction of noise in 19 cases. The CBA then provides an extrapolation based on this data as to the contribution of the END overall. Due to the limited amount of data, the 19 cases had to be selected on the basis of data availability, rather than how representative they may be of the EU-wide situation. Adjustments have therefore been made where considered necessary.

How far have measures in the NAPs actually gone ahead? A lack of reporting data

There is a mixed picture in terms of whether spending measures identified in NAPs have actually been implemented. The economic downturn from 2007 may have, at least in part, reduced the ability of responsible authorities to implement all of the measures identified in their NAPs. Information from stakeholders has, however, confirmed that many measures were still implemented. For instance, public authorities in the Netherlands confirmed that they had spent several million EUR on quieter road surfaces in some cities. In the UK, the major airports, such as Heathrow and Gatwick are expected to spend several million EUR on the noise insulation of windows over a 5 year period.

Such examples, when combined with the examples of completed measures from the 19 test cases (see Appendix F and the findings from the case studies, a summary of which has been incorporated into the efficiency section within the CBA), demonstrate that at least some measures have gone ahead. It can reasonably be assumed that the END has made a positive contribution to reducing noise pollution on the basis that many measures have gone ahead, and this can at least in part be attributed to the END. The significance of this contribution is examined below.

Extent of contribution to noise reduction – experience from the case studies

The points identified above mean that at this stage in the END's implementation lifecycle, some speculative assumptions are required, albeit based on the interview feedback, as to what magnitude of reduction in the level of persons exposed has been achieved to date. Since there is no systematic measure-level reporting information available as to which NAP measures were implemented in full, partially or not at all, the level of reduction in persons exposed has been assessed based on the case studies.

Although there are uncertainties due to there being no formal mechanism for collecting or reporting of information on progress with respect to the implementation of measures, the test cases provided evidence that while some measures had gone ahead and been implemented as planned in R1, others had not gone ahead, either due to budgetary constraints, or the fact that some NAPs adopted a 'long list' approach in which only some measures are ever likely to be implemented.

The most commonly applied expenditure measure in the case of airports was the insulation of windows (this was also the measure incurring the greatest capital expenditure) In the case of major roads, the laying of quiet road surfaces and the installation of noise barriers was the most commonly applied expenditure measure. However, other types of measures which may not require much, if any expenditure, such as the introduction of speed reductions and speed controls, will also have had a positive impact on reducing noise.

Estimates of the level of reduction in population exposure are now provided. The cost-efficiency of measures is examined in EQ13, where the focus is on the degree to which noise measures have contributed to noise reductions and whether the benefits justify the costs.

The implementation of measures identified in the test cases was found to have made a **positive contribution to reducing noise pollution**. The table below provides an indication of the reduction in number of people affected by each of annoyance and sleep disturbance across the 19 case studies and for each noise source. Note that these estimates are not extrapolated, but represent an aggregate of the benefits over all the 19 test cases. As such, they do not reflect the full extent of the beneficiary population from the measures identified in the action plans as noise reductions were only estimated for a limited number of measures, since data is not available for all measures, and not all measures in the NAPs included within the case study selection have yet gone ahead. However, many of the measures are still underway and therefore the figures below represent the size of the beneficiary population in future (i.e. once the measures considered have been fully implemented).

Table 3.5 - Change in the size of the population exposed to noise due to case study measure implementation

Change in the size of the population:	Major roads (n=2)*	Major railways (n=2)	Major airports (n=5)	Agglomerations (n=6)
Annoyed	40,777	7,924	27,356	74,440
Highly annoyed	18,685	3,256	12,833	38,859
Sleep disturbed	22,037	2,228	19,593	38,479
Highly sleep disturbed	10,044	1,020	12,312	18,710

* n = number of case studies from which the estimates are derived

These estimates suggest that the benefits from efforts to reduce noise from all sources across the EU-28 are likely to be substantial, even if only a proportion of the total benefits can be attributed to the END

Conclusions – contribution of the END to noise reduction and the 2020 targets

- The END has already begun to make a positive contribution to reducing noise, although fewer R1 measures went ahead than expected due to the global economic and financial crisis which affected budgets severely in many EU MS.
- At an EU level, the absence of reporting data on measure implementation across the EU as a whole means that it is not possible to quantify the contribution of the END to noise reduction precisely.
- Nevertheless, the cost and benefit benchmarks derived through this study by type of intervention (e.g. noise barrier, quiet road surface, speed reduction / traffic calming measure, etc.) should help to strengthen the assessment of the extent of contribution of the END in future.
- The findings from the test case data suggest that END measures have made a valuable contribution to reducing population exposure. It should, however, be noted that for some types of measures, the net benefit cannot fully be assessed in subsequent mapping rounds because of the way in which population exposure is measured (e.g. noise insulation of windows may not show up in noise maps which measures noise outside rather than inside buildings).
- However, some adjustments can be made in carrying out mapping in order to take measure implemented into account based on the size of the insulation programme/ no. of dwellings that benefited from a particular measure.
- Although some measures have not yet been implemented and some are still underway, the benefits may not be realised for a few years. However, it can be assumed that the measures will be implemented (or at least get underway) by 2020 and the over-estimation of benefits by this date may be counter-balanced by the fact that we neither include benefits for the measures for which no cost data was available nor the value of benefits associated with those that only suffer from low or moderate sleep disturbance and annoyance.

EQ9c Can any unexpected or unintended consequences be identified?

EQ9d. To what extent can these be quantified?

NGOs and community organisations broadly welcomed the introduction of the END as having strengthened the political visibility of and the degree of policy attention to environmental noise. However, some such organisations interviewed were concerned about the potential unintended consequences, such as the **risk that the costs of noise mapping might displace funding** that would otherwise have been used directly for noise mitigation, abatement and reduction measures. However, the costs of END implementation have been estimated by national CAs under the efficiency criterion (see Section 3.4.2, which quantifies the estimated administrative costs of END implementation in each EU MS).

Since according to cost benchmark data provided by acoustics consultancies, the total average costs per affected inhabitant are typically around €1.50 to €2.00 (and about half that for the total population), this does not suggest that the costs associated with implementing the END have displaced funding intended for mitigation measures. Conversely, although some non-spending measures have been adopted, implementing noise mitigation measures is often considerably more costly than the administrative costs, which are marginal compared with the substantive costs of measure implementation.

Some public authorities expressed a similar concern about the costs of mapping and whether there was a risk that if noise mapping goes beyond its original strategic function and becomes more detailed, then the costs will detract from noise reduction measures. This comment related specifically in relation to the future implementation of Commission Directive (EU) 2015/996. However, most stakeholders interviewed did not view the mapping requirements as being too detailed (although this was contingent on how the particular EU MS had decided to organise noise mapping since the level of administrative burden was perceived to be greater when noise mapping was carried out for too small administrative units

An unforeseen impact of the END was the use of **noise map** data by stakeholders outside those directly involved in implementing the END. For example, noise mapping data is being used for research purposes, particularly in large scale epidemiological studies, sometimes funded by the EU itself. Similarly, noise map data is being used in some MS for land use planning purposes, assisting in decision-making on future land use, particularly for new transport infrastructure and new noise sensitive development.

Several respondents raised concerns about END data being used beyond what it was originally designed for, expressing concern that **the consequences of any assumptions and limitations were not always appreciated, or even brought to the attention of the end user**.

Another positive, probably unexpected consequence of END is that Europe is perceived to be at the forefront of **strategic noise management across the world**. Evidence from international acoustics conferences and social media discussions suggests that many other MS are looking to the EU (and WHO Europe) to take the lead in highlighting noise as a public health hazard and to find ways to tackle the issue in the future.

There are a wide variety of different types of **Noise Action Plans** being prepared by MS. It is not clear whether this is an intended or unintended consequence. The flexibility available in END appears to allow MS to decide whether to prepare strategic action plans containing long-term policies and tentative measures, or whether to prepare detailed local action plans with specific timetables and costed noise management interventions.

There was some concern when the END was adopted that **publishing NAPs** may have increased public expectations for noise control interventions at a time when resources are scarce. The research identified that this was a problem in some MS. For instance, in **France,** evidence emerged of a reluctance among some local authorities at the *commune* level to publish NAPs unless measures had a dedicated budget allocated. Otherwise, there was a perceived risk that this would create a reasonable expectation among citizens that the actions identified would be implemented.

However, it was not considered realistic for most expenditure measures to be implemented, since local authorities responsible for action planning had almost no budget to deliver and implement measures in agglomerations. There was even a reluctance among some communes to publish noise maps with population data on the number of persons exposed at particular dB thresholds, again for fear that this would create an expectation for follow-up actions, one that there was no budget to support. However, the evaluators note that lack of budget among public authorities is not a reason to hide health-related information from citizens.

The situation was very different however for major roads and major railways, since these are a national competence under the Ministry of Infrastructure (implemented on a regional basis by departmental representatives from the Ministry), and the French state pays for both the development of SNM and identifies funding for measures.

The END is not prescriptive about the identification and management of **quiet areas**. Indeed one view expressed by several respondents was that the original intention of END was to discourage a noise problem being moved from one location to another e.g. by moving flightpaths, or perhaps by creating a bypass. It could be argued that the widespread interest in quiet areas, in the protection of tranquillity and in the **rapidly developing field of soundscape research is an unexpected, perhaps positive outcome of the END**. In several MS the benefits of a good acoustic environment are now recognised and are beginning to be protected, in addition to ongoing efforts to reduce the adverse impacts of noise. At the same time, respondents have expressed concerns that measures to identify and protect Quiet Areas may constrain the future use of that land for other purposes.

There were also concerns that designation as a Quiet Area, on the sole issue of low noise levels alone, would not properly take into account the other uses of the area such as for exercise, for recreation, music and other cultural festivals etc. There are wider concerns that formal identification of land as a Quiet Area might constrain future industrial, commercial or transportation development in the vicinity of a Quiet Area in a way that does not properly take into account the wider benefits of the proposed development. These are important concerns relating to the future consequences (both intended and unintended) of designating Quiet Areas. Whether these issues were wholly anticipated at the outset or not, they partly explain why relatively few Quiet Areas have been formally identified to date.

One of the perceived weaknesses of the END, according to some of the stakeholders interviewed (e.g. in NL, IE, the UK) was that the END appears to treat noise in isolation of **wider social, economic and other environmental factors**. For example, the need to provide additional housing needs to be balanced against any possible adverse effects of outdoor noise. In addition, the Directive itself does not make specific reference to the need to achieve synergies with other environmental issues such as the interface between noise action planning and the development of air quality action plans.

Lastly, some potential consequences of the END when the Directive was initially adopted have turned out to be unwarranted. For instance, there was a concern that publishing noise maps might affect property prices. However, no evidence could be obtained that this was the case either in R1 or R2 in any EU MS.

EQ10 - How have the provisions of the Directive been accepted by the stakeholders? In particular, how have each of the following END provisions been accepted?

a) Noise measurement through a system of common indicators and a common methodology (CNOSSOS-EU);

b) Noise mapping;

c) The preparation of action plans;

d) Information and consultation of the public; and

e) Reporting to the EC and reporting by the EC under Art. 11.

Some feedback was received in respect of the extent of acceptance by stakeholders of the different actions. It should be noted that this question is of a cross-cutting nature, and has therefore been addressed in greater detail in both the implementation and evaluation parts of the report under the respective headings relating to these actions.

Overall, the main finding was that the three actions required under the END set out in Art. 1(1a, 1b and 1c) of the Directive (noise mapping, information and consultation with the public and action planning) are **widely accepted by stakeholders.**

a) Noise measurement through a system of common indicators and a common methodology (CNOSSOS-EU)

As detailed under 'effectiveness' (progress towards a common approach), the introduction of **common EU-wide noise indicators** (L_{den} and L_{night}) through the END has been broadly welcomed by stakeholders since it provides a common basis for collecting population exposure data across the EU. Although some MS continue to use additional noise indicators, stakeholders viewed the use of two key metrics as being an effective means of establishing the baseline situation across EU-28 and the reporting on this in five yearly cycles.

The CNOSSOS-EU process leading up to the development of a **common assessment methodology** at EU level was accepted by the majority of stakeholders in the field of environmental noise. However, as detailed in Section 2.3.7 (strategic noise mapping) in the implementation part and in Section 3.2.3.2 (effectiveness), some MS were reluctant to relinquish their own national and interim assessment methods used under Annex II even if they accepted the usefulness of CNOSSOS-EU for reasons of comparability. There were concerns about whether the new common approach would deliver improved data compared with existing methods in some of the Scandinavian MS.

The fact that the costs of noise mapping were found to have diminished in most EU MS between R1 and R2 may indicate that the **costs are likely to become more acceptable to stakeholders over time,** especially as the full benefits of the legislation's implementation begin to materialise and become more visible (e.g. the use of data by national authorities for benchmarking purposes and EU policy makers).

b) Strategic Noise Mapping

Whilst there was acceptance that producing data based on common noise assessment methods was essential to inform source legislation, there were different levels of acceptance among public authorities of the costs involved, depending on how useful different public authorities found the maps and the exposure data. As noted earlier in the sub-section on the 'utility of END data' within EQ7(a), whilst national and regional CAs and those in larger cities appreciated having access to the population exposure data produced through the END, some local authorities in localities with a small population and in rural areas were sceptical whether noise mapping justified the costs.

This appeared to reflect a misperception among local authorities about the purpose of data collection under the END, which is primarily concerned with ensuring that EU-wide data is produced on a common basis so as to inform source legislation. Whilst the data is useful for many different purposes even in remote and rural locations, such as providing an overview of the baseline situation and helping to identify mitigation priorities, the EU-level focus may not be clear to all stakeholders.

Since the research has shown that the costs per affected inhabitant and the costs per inhabitant among the total population of strategic noise mapping are low, it is also worth pointing out that perceptions of costs also vary depending on national arrangements to fund noise mapping. In **France**, for example, although the state pays for noise mapping for railways and major roads, local municipalities must pay for noise mapping within an agglomeration out of their general budget. Therefore, although the costs may be low in absolute terms, the costs are perceived as being high in a small commune where budget for noise mapping has to come from the general budget and there is no dedicated state funding provision made available.

c) The preparation of Noise Action Plans

There was also acceptance of the need for an **action planning approach**. As detailed earlier, stakeholders accept the need for a common framework at EU level, but with significant flexibility afforded to the Member States under subsidiarity as to how to develop action plans. For example, an airport operator that took part in the workshop stated that even were the END to be repealed, they would continue engaging in action planning on a five yearly cycle because it provided a mechanism through which they could communicate with external stakeholders and bring together all noise-related actions into a single document. This helps to demonstrate that many stakeholders value the more strategic approach that a five yearly action planning cycle through the END brings. This was confirmed for example not only through the interview programme with CAs, but also in the written submissions received from stakeholders in response to the publication of the September 2015 Workshop Working Papers[97].

d) Information and consultation of the public

There was broad acceptance of the need to **carry out public consultations** and to keep the public informed about the results of noise mapping and action planning processes. However, as detailed in Section 3.2.3.5 on public consultations, there were concerns among some END stakeholders that consultation could be made more effective by targeting only those stakeholders that are well-informed and able to contribute to strengthening action planning. There was a view that whilst informing the public is useful from an awareness-raising perspective, without a more focused process, it is less likely to result in meaningful feedback that can be used to strengthen the quality of both NAPs and the mitigation measures identified within NAPs.

e) Reporting to the EC by the Member States and reporting by the EC under Art. 11.

With regard to **information and reporting requirements under the END,** although there was broad acceptance that data had to be submitted, there were concerns among some stakeholders about the 12 month timescale between the submission of reporting information on noise maps and population exposure and the submission of NAPs. The main issue identified was therefore not the type of reporting information, but rather Member State-specific issues as to whether they could deliver the required reporting information by the deadlines stipulated in the Directive.

[97] http://ec.europa.eu/environment/noise/evaluation_en.htm

Most MS were content with the guidelines and reporting templates for the Reportnet system to capture reporting information relating to compliance with the Directive. The reporting system was felt to be proportionate and was viewed as being user-friendly.

However, a number of stakeholders expressed the view that reporting information requested by the EEA has sometimes gone beyond what is implied by strategic noise mapping in the Directive itself. An example provided was that in Annex VI, population exposure data by noise class is required in the hundreds only, but since many MS have reported on the precise number of inhabitants affected in each 5dB noise class, other CAs have now been asked to do likewise in reporting on population exposure data by the EEA. This was seen by some stakeholders as going beyond the concept of *strategic* noise mapping.

3.2.4 Efficiency

Efficiency can be defined as the extent to which the desired effects are being achieved at a reasonable cost. It provides an assessment of the relationship between the resources deployed (inputs, measured in terms of human and financial resources) and the results that have been achieved (*outputs, results* and *impacts*).

In this section, a number of different issues related to the efficiency evaluation criterion are considered, namely:

- Methodological issues in assessing the efficiency and cost-effectiveness of the END (see Section 3.2.4.1).
- An assessment of the findings in respect of the administrative costs of END implementation at EU and national level (see EQ11 in Section 3.2.4.3);
- An examination of alternative ways of reducing the level of administrative burdens from END implementation, and possible means of simplifying the END (see EQ11c);
- An assessment of the efficiency of END Reporting Mechanism (see EQ12 in Section 3.2.4.3);
- A detailed summary of the findings from the cost-benefit assessment (CBA) in relation to the substantive compliance costs of implementing measures (see EQ13 in Section 3.2.4.5); and
- Overall findings in respect of efficiency.

It should be noted in relation to the CBA that the detailed methodology underpinning the CBA findings is presented in Appendix D. The measure-level assessment of costs is set out in the case studies in Appendix F. These take into account the substantive compliance costs of measure implementation as well as administrative costs and provide the basis on which the extrapolation is based.

3.2.4.1 Methodological issues – assessing the efficiency and cost-effectiveness of the END.

The exact nature of the relationship between the costs of END implementation and the benefits is difficult to determine and depends largely on the extent to which costs and benefits can be quantified and compared on a like-for-like basis. It is important to note that the overall cost-effectiveness of the END should be assessed by comparing the level of administrative costs with the benefits and impacts of the END, which include some that can be quantified (measures), but many that are either difficult to quantify or intangible in nature, such as the strategic benefits of noise mapping and action planning as part of a five yearly cycle.

A quantitative assessment of aspects of the Directive’s efficiency was possible through a separate assessment of the costs and benefits of noise mitigation, abatement and reduction measures *(see Section 3.2.4.5 - Findings from the cost-benefit assessment).*

While the case studies and the CBA extrapolation provide a useful proxy for efficiency, measure implementation is only one aspect of cost-benefit, and does not capture the totality of benefits.

An assessment of the efficiency of the Directive also needs to consider qualitative benefits (such as a more strategic approach to managing environmental noise, and the promotion of more joined-up working between different government Ministries in respect of environmental noise mitigation and planning). These can only be compared with the costs by making an evaluative judgement as to whether the costs are proportionate compared with the benefits, many of which are of a difficult to quantify, or intangible nature, but which should nevertheless be considered in assessing the EN's overall cost-effectiveness[98].

An additional methodological issue is the fact that the Directive's full cost-effectiveness cannot yet be assessed since it is too premature to do so. Linked to this, cost-effectiveness can reasonably be expected to evolve over time as the Directive becomes better embedded and as the quality and comparability of noise maps and population data improves. For example, the development of common assessment methods through CNOSSOS-EU was resource-intensive at EU level in the early years of its development. It will then require investment by MS to make the transition from national and interim methods to producing noise maps and exposure data based on Commission Directive (EU) 2015/996. This will take place either in Round 3 (on a voluntary basis) or in Round 4 (mandatory). However, assuming that this leads to improved data comparability between Rounds and between MS, this should contribute to strengthening the cost-effectiveness of the Directive in future, since comparable data will be crucial to the achievement of the Directive's second objective (Article 1(2)) of providing a basis for Community measures i.e. informing source legislation.

3.2.4.2 *The administrative costs of END implementation at EU and national level*

EQ11 - How far are the administrative costs of END implementation proportionate?

Introduction

The steps taken to address this EQ were to:

- Gather data on the administrative costs of END implementation at the EU and national levels across EU-28 for each five yearly reporting round;
- Aggregate and analyse the data collected in order to identify the range of administrative costs, and to ascertain the average and median costs;
- Compare the evolution in administrative costs between R1 and R2;
- Compare differences in the level of administrative costs across EU-28 MS, and assess the reasons for any differences; and
- Assess the proportionality of the costs compared to the potential benefits through an evaluative judgment of cost-effectiveness.

[98] See page 46 of the IA guidelines - http://ec.europa.eu/smart regulation/impact/commission_guidelines/docs/iag_2009_en.pdf. This states that: Cost effectiveness analysis: one advantage is that this does NOT require exact benefit measurement or estimation. "It is an alternative to cost-benefit analysis in cases where it is difficult to value benefits in money terms.

The administrative costs of END implementation at EU level

The EC incurs administrative costs in coordinating the reporting and monitoring of END implementation at the European level. These relate, for instance, to collecting data on END implementation (Art. 10) in the form of a relational database of SNMs and NAPs and to meeting the EC's formal monitoring and reporting obligations (Art. 11). An explanation of the specific tasks and activities involved in EU-level aspects of the Directive's implementation was provided in Section 1.5.2 (the role of the EC in END implementation).

The estimated costs incurred at EU level for the EC in coordinating the implementation of the Directive and in carrying out its monitoring and reporting responsibilities (assisted by the EEA) are now provided, to the extent that data was made available.

According to the **EC's DG ENV**, the average administrative costs for the EC of implementing the END are estimated to be €165,000 /year between 2002 and 2013 and €297,000 /year for 2014 and 2015. These estimates include staff costs, attending meetings and missions. The total costs since the END's inception are an estimated €2,574,000. These costs relate to the direct costs of implementing the END.

The EC's **JRC** was involved in the early stages of END implementation (in particular, assisting with the technical process leading to the publication of the CNOSSOS-EU methodology in the 2009 – 2014 period relating to common assessment methods). Although cost data was requested from the JRC, no data was made available in respect of the costs relating to the joint development of the CNOSSOS-EU methodology with DG ENV. In the CBA assessment (see EQ13), assumptions have been developed with regard to the level of staff costs involved (estimated at 0.50 FTEs over a 4 year period of development of CNOSSOS-EU from 2009-2012). It should be noted that the JRC no longer has a role in END implementation.

The **EEA** plays an important supporting role in assisting the EC with some delegated tasks relating to its reporting responsibilities in respect of Art. 11 (Review and reporting) of the Directive. The EC collects strategic noise maps and population exposure data from MS based on information submitted via the EEA's EIONET Reportnet system through a centralised database of SNMs. The EEA then supports the EC in making noise maps and population exposure data accessible online through the EIONET website via the Noise Viewer (www.noise.eionet.europa.eu/). In addition, its staff undertake a quality check to ensure that SNMs meet minimum defined quality parameters.

The EEA noted that the level of human resources increased when reporting obligations commenced in 2005. Data on the actual (financial) costs of the EEA's work on the END are available for the period 2008-2015, whereas the level of human resource input to END implementation by the EEA can only be estimated. Overall, between 2002 and 2015, according to the EEA, costs incurred related to the END were in the order of €1,815,000. There are some uncertainties around this figure, since some data-related reporting has to be carried out anyway for the EEA's broader environmental reporting tasks across EEA33. It is difficult to attribute all the costs directly to the END since the EEA's work on the END also helps in reporting on the state of the environment across a broad range of areas, such as noise and air pollution.

The administrative costs of END implementation at MS level

In this sub-section, the following issues are addressed:

- Explanation of the way in which data on administrative costs at the MS level was collected (and the identification of any data gaps).
- Methodological issues and challenges in estimating administrative costs.
- The costs per capita of strategic noise mapping and action planning.

- An assessment of administrative costs, supported by detailed examples from the MS.
- Human resources allocated to END implementation.
- Trends in the evolution of administrative costs between END rounds.
- Assessment as to whether the costs of END implementation are proportionate.

Approach to data collection on administrative costs and any data gaps

Administrative costs data has been collected in two ways through the study research:

- Data collected through the second implementation review. Data was obtained from 23 national CAs on the estimated administrative costs of END implementation.
- Data collected from acoustics consultancies, which provided supplementary cost benchmark data.

It should be noted that even in MS where national CAs provided at least some data, there remain data gaps since some MS only provided partial data relating to the human and financial resources associated with END implementation at the national level. There were found to be differences in the estimates of the level of administrative costs between those provided by national authorities and the cost benchmarks provided by industry (i.e. acoustics consultancies engaged in producing SNMs and / or supporting public authorities with action planning processes).

Since acoustics consultancies deliver contracts directly for END competent authorities in the public sector, industry data may arguably be more likely to be accurate in estimating the direct financial costs, whereas public authorities are likely to be better placed in estimating the level of human resources required to produce SNMs and NAPs.

The estimated costs by national CAs were acknowledged as being an under-estimate in some EU MS, due to the difficulty in estimating the costs at local and regional levels since there may be many competent authorities involved. In addition to CAs, a wider range of public bodies may contribute indirectly to END implementation (but not be noise action mapping or noise action planning bodies themselves, for instance, through the provision of input data to assist in the noise mapping process). These issues are explained in more detail in the section that follows.

Methodological issues – estimating administrative costs

The following methodological observations can be made in relation to the assessment of administrative costs.

A distinction was made between the *one-off* costs associated with END compliance (such as the purchase of IT equipment and noise modelling software licenses) and the *recurring* costs incurred in each five yearly implementation cycle associated with noise mapping and action planning, such as the costs of procuring external noise mapping services, the human resources required to prepare a NAP (and to undertake a public consultation and analyse the feedback).

Generally, one-off costs were associated with R1 implementation, although some further one-off costs can be expected when Commission Directive (EU) 2015/996 has been implemented, since this will require further expenditure to make the transition from national and interim methods to producing noise mapping data on a common basis. However, the focus of the data and analysis presented in this section is on the costs already incurred.

There were practical difficulties for CAs in estimating the level of human resources devoted to implementing the END. Many CAs were not able to provide data on regional and especially local level implementation, due to the fragmented nature of collecting (and/ or estimating on a top-down basis) such data. It was difficult for them to do so because the data is dispersed amongst so many local authorities. Moreover, there is no requirement in the END to collect such monitoring data, therefore, estimating the data retrospectively to help inform this evaluation study has proved challenging. It was especially difficult to quantify costs in EU MS that have adopted a more decentralised approach. Difficulties were also identified by many CAs in estimating the number of FTEs in their MS that work on END implementation overall. Among the complexities are that especially in agglomerations, staff working on END implementation may only spend 5-10% of their time on the END (concentrated in the first and second years of each five year implementation cycle i.e. on noise mapping and action planning respectively).

Furthermore, interviewees in national CAs stated that even though they were in touch with their counterparts at regional and local level, it was difficult to estimate how many FTEs were involved in total, since many different organisations are commonly involved (across different sources, and both within and outside agglomerations. For instance, within a typical agglomeration, there may be several local municipalities involved in noise mapping, but often the civil servants concerned only spend a small proportion of their time on the END.

Furthermore, in many MS, a large number of different organisations are involved in END implementation, such as CAs carrying out noise mapping and action planning, but also public authorities involved indirectly, for instance, in providing input data and other information to CAs responsible for noise mapping. This complicates the coordination of data collection on costs, since national CAs were often unable to obtain this data.

Cost data was especially difficult to obtain from local municipalities involved in noise mapping and action planning within agglomerations and from public authorities that play an important but more limited role in providing data to facilitate strategic noise mapping. In some cases, municipalities were simply unable to estimate the level of financial or human resources involved, since this data had not been monitored or kept on a disaggregated basis (indeed, there is no requirement to do so under the Directive). Nevertheless, useful data estimates were obtained from some municipalities. Where only partial data was received at local level, an attempt has been made to scale up the data wherever possible, according to the total number of municipalities involved. However, in EU MS that have a highly decentralised approach to END implementation, it was sometimes difficult for them to estimate how many different bodies were involved in activities relating to the END.

EQ11a – How far do administrative costs differ between Member States and between Rounds?

A key question examined relating to administrative costs was how far such costs differ between EU MS. Once examples of differences in cost have been identified, possible factors that may help to explain these differences were then identified and analysed.

The starting point was to review the variances in administrative cost data collected through the study between MS. The table on the following page provides an overview of data gathered from 23 EU MS that responded to a request by the evaluators to provide data in respect of administrative costs. The data was disaggregated by Round (subject to data availability) in order to assess the evolution in costs over time. Data estimates have been provided for financial resources (in €) and human resources (in Full-Time Equivalents, or FTEs). Where this was possible based on the data received, the figures distinguish between the costs related to noise mapping (NM), action planning (AP), and the total costs. It should be noted that this data was received from national Competent Authorities and may thus in some instances exclude resources spent by sub-national CAs or other public authorities on END implementation. As a consequence, the actual resources spent on END implementation may be higher than the figures in the table suggest.

Wherever ranges are provided, this is based on estimates made by Competent Authorities or relates to the fact that various figures have been given by different sources. These limitations notwithstanding, these figures provide a useful source to draw some conclusions on the cost of END implementation.

Table 3.6 – Human and financial resources devoted to END implementation in Round 1 and 2 (N = 23 EU MS)

MS	Type of resources	Round 1	Round 2
BE	**FTE**[99]	7.8	6.6
	Budget	€ 4,006,144 (NM both Rounds) € 1,861,500[100] (AP R1)	
BG	**FTE**	No data[101]	3.65 - 5.63
	Budget	€ 463,026 (NM) € 66,155 (AP)	€ 1,216,829 (NM) - € 900,000 out of which paid to external consultants € 106,289 (AP)
CY	**FTE**	No data	0.35
	Budget	€ 348,555	€ 315,000
CZ	**FTE**	No data	> 2.8 (NM & AP) 35[102]
	Budget	No data	€ 1,699,409[103] (NM) > € 159,969 (AP) Total: > € 1,859,378
DE[104]	**FTE**	No data	196
	Budget	€ 11,100,000 (NM) € 11,400,000 (AP)	€ 9,200,000 (NM) € 23,500,000 (AP)
DK	**FTE**	0.1-0.5	0.1-0.5
	Budget	€ 60,000 (NM & AP)[105] ~ € 60-70,000 (NM)[106] ~ € 18-20,000 (AP)[107] ~ € 100,000 one-off + 80,000 p.a. (NM)[108] Total: > € 644,000	€200,000-€250,000 (NM & AP)[109] €80,000 p.a. (NM & AP)[110] Total: ~ 625,000
EL	**FTE**	No data	€ 5,500,000
ES	**FTE**	No data	No data
	Budget	~ € 3,825,000 (NM)[111]	~ € 3,739,906[112]
FI	**FTE**	0.65	1.5
	Budget	€ 481,000 (NM)	€ 1,021,000 (NM)

99 Excludes resources required to action plan mitigating measures
100 Flanders only. No data available for Brussels. No action plans have been completed in Wallonia.
101 Although no data could be provided, the CA commented that the FTE in R2 was lower than in R1
102 17 internal + 36 external = 63 (no. of staff (NM & AP).
103 Only for agglomerations (Ostrava, Plzeň, Ústí nad Labem – Teplice, Liberec, Olomouc); for the Václav Havel airport and for major railways
104 agglomerations only
105 Copenhagen airport
106 Major roads only
107 Major roads only
108 Municipalities
109 Major roads only
110 Municipalities only
111 Major roads only
112 Major roads only

MS	Type of resources	Round 1	Round 2
		€ 258,000 (AP)	€ 500,000 (AP)
FR	**Budget**	€ 4,000,000 (NM)[113] € 700,000[114] Additional bottom-up estimates > € 5,000,000 paid to external consultants (NM) €2,500,000 (for the Paris agglomeration alone)[1]	No data was available for FR as a whole. €2,500,000 (NM) for Ile de France and Paris agglomeration. >€2,000,000 (NM & AP) – note, this relates to additional central government funding made available for completion in 500 of the outstanding *communes* municipalities.
HR	**FTE**	N/A (Croatia was not subject to R1 of noise mapping and action planning)	0.84-0.87
	Budget	N/A (Croatia was not subject to R1 of noise mapping and action planning)	€ 564,000 (NM) € 119,000 (AP)
HU	**FTE**	No data	44.66[115]
	Budget	€ 2,615,412[116] (NM + AP)	Total: € 2,887,741 (NM + AP)
IE	**FTE**	>1[117]	>0.78[118]
	Budget	> € 565,000 (NM) > € 64,372 (AP)	€ 1,137,506 (NM)
LT	**FTE**	3.5	1.25
	Budget	€ 132,311 (NM)[119]	€ 600,093 (NM)[120] ~ € 170,000 (NM)[121] € 50,814 (NM)[122] > € 120,035 (AP)[123] € 53,201 (AP)[124] € 44,000 (AP)[125] Total: >€1,038,143
LV	**FTE**	12.2 (NM & AP)	10.5 (NM & AP)
	Budget	€ 322,000 (NM) € 197,000 (AP) Total: € 519,000	€ 170,905 (NM) € 82,558 (AP) Total: € 253,463[126]

[113] Major roads
[114] Major railways
[1] Note – this data estimate was provided by an END stakeholder, and not an official source. It is based on bottom-up estimates with regard to the number of noise mapping bodies contributing to mapping in agglomerations (240) and the average costs of using an acoustics consultancy to produce the noise maps.
[115] This number includes 32 FTEs amongst local authorities.
[116] Only for Budapest agglomeration
[117] National CA only
[118] National CA only
[119] Major roads only
[120] Agglomerations only
[121] Major railways
[122] Major roads
[123] Excluding all but one agglomeration, so actual cost could potentially be much higher
[124] Major roads only
[125] Major railways only
[126] Including one-off costs at airport

MS	Type of resources	Round 1	Round 2
MT	FTE	1.2	0.1
	Budget	€ 70,000	€ 55.000
PL	FTE	0.8-1.8	2.9-3.6
	Budget	No data	> € 2,815,000 (NM)
PT	FTE	> 6.3-6.5[127]	> 3.3[128]
	Budget	> € 1,350,878 (NM)[129] > € 436,100 (AP)[130] Total: > € 1,786,978	> € 1,605,825 (NM)[131] > € 528,910 (AP)[132] Total: > € 2,134,735
RO	Budget	€ 2,673,223 (NM)	
SE	Budget	No info	€ 2,150,000 (NM + AP)[133]
SI	Budget	€ 63,000[134]	No data
SK	FTE	0.01[135]	0.01[136]
	Budget	€ 2,650,000 (NM) [137] € 334,000 (AP)[138] Total: € 2,984,000	€ 3,030,000 (NM)[139]
UK	FTE	13.2	7.8
	Budget	€15,400,000 (NM)[140] € 5,600,000 (AP) Total: € 21,000,000	€3,500,000[141] (NM) € 700,000 (AP) Total: € 4,200,000
Sum 23 MS	**Budget**	**Total: € 75,768,993**	**Total: € 75,789,674**

Source: own analysis based on administrative costs data provided by national CAs and occasionally supplementary sources. The national CAs have in some cases consulted with a range of other CAs in order to estimate costs.

Given the methodological challenges in estimating FTEs explained earlier, an estimated range was sometimes provided for the number of staff involved in END implementation. Furthermore, in some MS, although the national CA was the main source of data, data was received in respect of the estimated number of FTEs from different sources, including contributions by other CAs and the country report experts. Some MS were unable to estimate the number of FTEs and could only provide details for staff that worked on the END for at least some of their time, since they were unfamiliar with how to estimate FTEs.

In the column estimating FTEs, in several instances, the number of FTEs relates to the national CA only, since they were not always able to quantify how many FTEs were involved at local and regional levels of governance, especially when multiple organisations were involved in MS that have adopted decentralised implementation approaches.

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127 Excluding agglomerations other than Lisbon
128 Excluding all agglomerations
129 Excluding 65% of major roads; including action planning for airports
130 Excluding 65% of major roads
131 Including €931,780 budgeted for major roads; including action planning for airports; excluding agglomerations, 65% of major roads
132 Including € 430,910 budgeted for major roads; excluding 65% of major roads
133 Agglomerations only based on scaling-up the detailed estimated costs provided by one out of 13 municipalities.
134 Only Ljubljana agglomeration
135 Airport only
136 Airport only
137 Excluding airport and major rail
138 Major roads only
139 Excluding airports
140 Note: an exchange rate of €1.40/ £1 was applied in both R1 and R2 since the original figures were provided in £'s for both rounds.
141 Idem.

The data provided by MS in Table 3.6 is heterogeneous partly because of challenges in collecting reliable data estimates since no monitoring data of administrative costs was collected, but equally because EU MS devote differing levels of financial and human resources to the END. Secondly, there are difficulties in comparing the level of financial and human resources allocated by national CAs across different EU MS due to wide differences in implementation approaches. Thirdly, there are uncertainties with regard to the reliability and comparability of the data collected. Although the evaluation scope covers the period 2002-2015, more recent data relating to R2 implementation is likely to be more reliable, since it was more difficult for CAs to obtain R1 cost data dating further back in time (e.g. due to staff changes, the absence of an obligation to monitor such costs in the END monitoring and reporting system).

These limitations notwithstanding, as shown in Table 3.6 above, the **administrative costs** of implementing the END were found to have remained stable between rounds with €75.8m being spent in each by 23 EU MS who provided data. By comparing the values in the table to the total population of the countries, one can calculate the average cost per capita for each Round based on the sample of 23 Member States. This can then be extrapolated to the EU level by multiplying the average with the total population of the EU28. The corresponding figures are €80.3m (R1) and €107.4m respectively (R2), showing an increase in cost in R2. However, it should be recalled that there has been an approximate doubling of noise mapping and action planning requirements in R2 due to the transition to the definitive END thresholds. The modest increase in costs suggests reductions in the costs of procuring external noise mapping services and the absence of one-off costs in R2. If such cost savings had not incurred, the substantial increase in the amount of mapping and action planning required in R2 compared to R1 should have resulted in a much starker increase in the overall cost.

The costs per capita of noise mapping and action planning

A more meaningful comparison of costs necessarily takes into account the costs *per capita,* using the total population in each MS as a basis rather than only the population affected by noise, since measures are ultimately paid for by the public sector from tax revenues[142]. The table below compares the costs *per capita* of noise mapping and action planning for a sample of MS for which this data was made available in Round 2. The data should be broadly representative, since it includes both large and small MS and MS with different approaches to END implementation. The table focuses on R2 costs only since the cost estimates for R1 may include distorting one-off costs and are thus less instructive in terms of assessing the longer-term five yearly implementation costs[143].

[142] Source: http://ec.europa.eu/eurostat/statistics-explained/images/7/7a/Demographic_balance%2C_2014_%28thousand%29_YB15_II.png

[143] Croatia is an exception since it did not participate in R1.

Table 3.7 – Administrative cost of noise mapping and action planning per capita in sample of Member States (total Round 2 costs)

Member State	Noise mapping cost in € per capita[144] rounded in R2	Action planning cost in € per capita rounded in R2
Bulgaria	0.17	0.01
Croatia	0.13	0.03
Czech Republic	0.16	0.02
Finland	0.18	0.09
Germany	0.11	0.29
Latvia	0.09	0.04
Lithuania	0.28	0.07
Poland	0.07	no data
Portugal	0.15	0.05
Slovakia	0.56	no data
United Kingdom	0.05	0.01
Average (arithmetic mean)	**0.18**	**0.06**
Median	**0.15**	**0.03**

Source: own calculations based on cost data provided by national CAs set out in Table 3.6. The focus is on R2 since cost data estimates for R2 are likely to be more reliable than those that date back a considerable time period.

As the table above shows, even when population size has been taken into account, the **relative costs of producing SNMs and NAPs varies considerably between MS**. Whilst the average amount spent per capita on noise mapping in R2 was €0.18, the respective figure was only €0.05 in the **UK** but as high as €0.56 in **Slovakia**. Using the median, which is less sensitive to outliers, the amount goes down to €0.15. Both values are considerably higher than the amount spent on action planning on average, which amounts to €0.06, with a median of €0.03. The values here range from €0.01 in **Bulgaria** and the **UK** at the bottom to €0.29 spent in **Germany**.

Within the sample of cost data / capita presented in the table above, **Germany** not only spent the highest amount on action planning in R2in absolute terms, but also in relation to its total population. Indeed, expenditure in Germany on action planning is higher than that of the MS with the lowest expenditure/ capita, **Bulgaria** and the **UK**, by a factor of 29. However, it should be noted that the level of costs is strongly correlated with the implementation approach. A contrast can be drawn here between the **UK** (specifically **England**) and **Germany**.

In addition to the above data, the national CAs in France and in Germany provided benchmark estimates of the costs of noise mapping for the population exposed to noise (affected inhabitants) and in relation to the costs of mapping for different sources. This additional information provides useful cost benchmark data and is presented below:

[144] Note – the per capita estimates are based on the total population using Eurostat figures (since the costs are incurred by each MS/ society as a whole whereas the benefits are accrued by the affected population).

Table 3.8 – Noise mapping costs in France

Source type	Average costs
SNMs for major roads	Average cost of noise mapping € 150 / km
SNMs within agglomerations	Average cost of € 0.75 / per capita.
NAPs within agglomerations	Average cost of € 0.84 / per capita.

Source: French national CA

Table 3.9 – Noise mapping costs in Germany

Mapping target	Round 1	
	Cost per affected resident	Overall cost
Agglomerations	0.64 €	0.19 € / resident
Major roads	2.58 €	272 € / km
Major railways	1.13 €	1077 € / km
Airports	0.91 €	304 € / km² area

Source: "LAI Erfahrungsbericht Stufe 1"

The only data directly comparable between the two countries shows that cost of noise mapping per affected inhabitant was slightly higher (€ 0.75) in France than in Germany (€ 0.64). The € 0.19 figure for mapping in German agglomerations in Round 1 can be compared to the figure of € 0.11 for noise mapping *overall* in Round 2 (see next table 3.), indicating a significant cost reduction between Rounds.

Both the French and the German figures show that the cost per capita (*affected* population) is considerably higher than the cost per capita (*total* population). This has been confirmed by figures provided by acoustics consultancies working in various Member States which are €1.50–€2.00 for software and hardware purchases by the Competent Authorities, and the activities of noise mapping, action planning and public consultations combined. This excludes the cost of noise abatement, mitigation and reduction measures. The cost of strategic noise mapping alone is estimated by industry experts to amount to €0.50-1.00 per *affected inhabitant*. The difference can be explained by the fact that these industry figures relate to *per capita (affected population only)*. It seems pertinent to focus on the *per capita (total population)* figures presented in the Table 3.7 earlier when assessing the administrative cost of END implementation. The reason is that the administrative cost of END implementation is ultimately incurred by the public sector as a whole, and thus by the tax payers and society in each country, whereas the benefits are only accrued by the *affected* population.

Assessment of administrative costs – detailed examples from the Member States

A more detailed assessment of administrative costs, and of differences between EU MS, is now provided. The focus is on the costs of both strategic noise mapping and action planning. No disaggregated data was made available on the costs (in terms of time) of providing reporting data and information to the EC.

Notwithstanding the various limitations and caveats relating to the cost data outlined in the section above on methodological challenges, a number of general trends can be observed based on an analysis of the administrative cost data provided by 23 EU MS.

The **costs of strategic noise mapping were lower in R2 than in R1** in at least several EU MS, despite an increase in the volume of noise mapping due to the transition to the definitive phase of END implementation from R2 onwards.

Typically, in the implementation of EU legislation, costs may be expected to diminish over time as those required to implement the legislation (and / or those subject to the legislation) become more familiar with the requirements and as MS implementation processes and procedures are developed and become embedded. In the case of the END, a key research issue explored was how far there appears to have been a reduction in costs between Rounds reflecting the absence of one-off costs in R2 relating to the activities specified in Article 1(1a, 1b and 1c) i.e. of strategic noise mapping, making information accessible and noise action planning respectively. There were found to have been reductions in costs due to economies of scale in the procurement of noise mapping and other technical services.

A reduction in costs was observed for instance in several MS (e.g. **BE, BG, CY, LT, LV** and the **UK**). Indeed, the costs of R2 noise mapping were sometimes less than half the equivalent incurred in R1. This was attributed to a number of factors, such as:

- Greater familiarity among CAs in procuring noise mapping services with the previous results of noise mapping.
- Strengthened ability among CAs to define their technical procurement needs leading to cost-savings.
- Greater competition among acoustics consultancies.
- General downwards pressure on noise mapping costs due to budgetary pressures linked to the aftermath of the economic and financial crisis.

Due caution is however needed in interpreting the evolution in cost data between Rounds in some EU MS. For instance, although the costs of noise mapping in the **UK** decreased by approximately four times between R1 and R2, this only partly explained by efficiency savings (e.g. learning from R1 implementation experience, the absence of one-off familiarisation costs). The main reason for the decline however was that there was a change in the approach to noise mapping between rounds, with greater centralisation of noise mapping (England only), which has led to economies of scale.

Conversely, in other EU MS (e.g. **DK, FR, LT, SK**), the costs actually increased between Rounds. Specific examples identified are that:

- In **Denmark**, the costs of noise mapping were only marginally higher in R2 than in R1 for agglomerations, but almost four times higher for major roads, reflecting the increase in the length of roads that have to be mapped.
- In **Slovakia**, there was a small increase in the costs of noise mapping from €2.65 million in R1 to €3.03 million in R2.
- In **France,** although no country-wide data was available for R2, the estimated costs of noise mapping at the level of agglomerations suggests that there has been a significant increase in costs between Rounds, due to the change in END thresholds.
- In **Lithuania**, the costs increased from €132,311 in R1 to €1,037,693 in R2. However, it was not possible to obtain complete data for the costs of R1 noise mapping, since the costs were not readily obtainable through public procurement databases, unlike for R2, where detailed data was provided.

In MS where there has been a cost increase between Rounds, this was generally attributed to the **significant increase in the volume of noise mapping required under the definitive END thresholds** applicable from R2 onwards. A detailed breakdown of the number of SNMs and NAPs required in R2 compared with R1 was provided in Section 2.3.7 and 2.3.8 as part of the second implementation review. This showed for instance a threefold increase in the number of agglomerations within scope.

In some EU MS, the budget originally committed was higher than that actually used. For example, in **Croatia,** the budget allocated for R2 noise mapping was €788,000 while only €564,000 was in fact spent. Conversely, the opposite was true in other cases. For example, in the state of Bavaria in **Germany,** the budget spent was €1,299,000 for noise mapping in R2 as opposed to an allocated budget of only €360,000. In **Poland,** the contrast was even starker (€125,000 allocated vs. €2,815,000 spent).

Expenditure on producing SNMs across MS exceeds expenditure on the development of NAPs. For example, in **Croatia,** the difference in R2 is € 564,000 for SNM vs. €119,000 for action planning. In **Denmark,** the difference in expenditure in R2 was €150,000 vs. €50,000. An exception is **Germany,** where the cost for noise mapping amounted to €9,200,000 in R2, as opposed to €23,500,000 for action planning. However, it should be emphasised that this relates to the costs of action planning processes (including organising public consultations) rather than to the costs of measure implementation, which although voluntary, is likely to be at least ten times the estimated administrative costs.

The **level of financial resources allocated to END implementation was found to vary significantly.** For example, in Germany, in R2, €9.2 million was spent on strategic noise mapping and €23.5 million on action planning. This contrasts with €2.82 million on developing SNMs in **Poland** in R2, and a much lower budget allocation in smaller MS (e.g. €170,905 for **Latvia**).

Human resources allocated to END implementation

Likewise, the **level of human resources allocated to END implementation was found to vary greatly between MS**, measured in terms of the estimated number of FTEs working on END implementation. The data was less complete than for financial resources, and sometimes only relate to the human resources available to national CAs, rather than to all CAs. As noted earlier, this is due to the difficulties experienced by national CAs in estimating the level of human resource inputs for all CAs and public authorities involved in END implementation.

Nevertheless, it can be observed that the level of human resources devoted to implementing the END at national level is quite low in many EU MS. Moreover, in several instances, resourcing was found to have been significantly reduced between rounds. For example, in **Lithuania**, whereas in R1, there was a small team of 3.5 FTEs working on the END at national level, there are only 1.25 FTEs working on the END, even though the volume of work has increased (for instance, END coverage has increased in R2, such that the number of agglomerations within the END threshold increased from 2 to 5).

In **Malta,** the number of FTEs working on the END was reduced from 1.25 FTEs in R1 to 0.1 FTEs in R2, although most of the work is being carried out by external consultants. In **Romania,** although no data estimates were provided, it was mentioned by an interviewee that there is only 1 FTE responsible for reviewing all the SNMs and NAPs produced across Romania and for reporting to the EC, which means that human resources are constrained. In **Portugal,** there was a reduction from 6.5 FTEs to 3.5 FTEs between Rounds, which was attributed to the budgetary crisis which also led to delays in getting noise mapping underway.

The reasons for the reduction in human resources were explored through the research, in particular through the interviews with national CAs. The research found that the reduction in human resources was partly due to the fact that there were no longer one-off familiarisation and upfront costs associated with the earlier stages of the END's implementation. Although there has been a reduction in human resources in some MS, it was pointed out by national CAs interviewed in some MS that during R1, more staff were needed to work on END implementation compared with R2, given the challenges of implementing the legislation for the first time (e.g. familiarisation with the information obligations under the Directive, additional time to define external technical assistance needed to produce SNMs). A further factor was the economic and financial crisis, which had led to budgetary pressures in several EU MS that have affected staffing levels (e.g. **ES, PT and LT)**.

Moreover, the picture across EU-28 in terms of human resource levels was found to be quite varied, since in other EU MS, there was found to be a comparatively high level of human resources allocated to END implementation both in R1 and R2. However, direct comparisons between MS are difficult to make, since this depends on the overall approach to END implementation, and whether there have been any changes in this regard between Rounds. An important determinant of costs was whether the administrative system for implementing the Directive is centralised, decentralised or includes elements of both. For instance, in **Germany,** although there were estimated to be 196 FTE working on the END, a decentralised approach to END implementation has been adopted across 16 Länder at the state level. As noted earlier, Germany moreover has many different CAs involved in noise mapping and action planning at the local level for agglomerations. In **Finland,** an increase in resources at national level to the END was also noted, from 0.65 in R1 to 1.5 in R2.

The data collected suggests that overall, in many EU MS, there are **fewer public officials within CAs working on END implementation in R2 compared with R1**. Although the level of resourcing is entirely at the discretion of MS since the END is implemented under subsidiarity, as noted above, several instances of reductions in staffing levels devoted to END implementation were identified between R1 and R2. An issue was raised by interviewees from CAs in several EU MS as to whether sufficient resources are being made available for END implementation at national level. Some officials questioned whether this may risk undermining the effectiveness of END implementation in their MS in future rounds. In particular, if only one or two members of staff are involved, it was noted that there could potentially be challenges in retaining institutional memory. The concern was that if particular staff with END experience leave, then there will be problems in retaining sufficient knowledge and experience within CAs to ensure effective coordination and timely reporting of SNMs and NAPs to the EC at national level.

In EU MS that have adopted a decentralised approach to noise mapping and action planning as part of END implementation (Article 1(1)), such as **France** and **Germany**, the administrative costs were found to be relatively high in terms of the number of FTEs that are required to implement the END, especially in agglomerations. For instance, in France, although accurate data relating to the level of human resources involved was difficult for the CA to estimate, since the implementation approach involves producing a very large number of SNMs for agglomerations, it can reasonably be assumed that the human resource requirements in public administration are correspondingly high.

Other types of cost issues were also considered through the research, such as whether a comparison of the costs of undertaking strategic noise mapping in-house by CAs directly could be made with the costs of outsourcing the development of SNMs externally to acoustics and spatial data consultants.

Box 3.5 - The costs of producing SNMs in-house vs. externally

In most MS, the function of carrying out noise mapping has been carried out by external acoustics and spatial data consultants. It is therefore difficult to compare the costs of in-house and external solutions.

Limited data was however obtained from **Ireland** with regard to the costs of undertaking noise mapping internally. This showed that carrying out noise mapping internally was still quite costly, but probably cheaper than outsourcing the function (the cost was estimated as €300,000 in R1 and €400,000 in R2. This included both the one-off costs of purchasing software and IT equipment and the human resources needed to produce SNMs.

However, according to an interviewee from Dublin City Council, an advantage of carrying out noise mapping in-house was that in R2, Dublin City Council were able to provide support and guidance for the other new agglomeration in Ireland (Cork) in R2. In addition, the same local authority was able to produce all the noise maps required within the Dublin agglomeration on behalf of three other local authorities.

A key finding was that even when SNMs are produced in-house by CAs nominated as mapping bodies, there can be significant costs of producing SNMs (e.g. acquiring GIS data, the purchase of modelling software to calculate population exposure).

The evolution of administrative costs between END rounds

Through the research, the extent to which there were changes between R1 and R2 in the level of administrative costs was explored. A reduction in the level of administrative costs was identified between R1 and R2 in many, but not in all EU MS. The reasons for this cited by stakeholders interviewed were that:

- R1 was more costly, since there were **one-off costs** such as familiarisation with the legislation and the requirements for CAs, managing the procurement process and defining noise mapping needs in procurement procedures for the first time, and setting up MS-specific administrative systems and processes for data collection and information and reporting to the EC. In instances where SNMs have been produced in-house, examples of one-off costs identified were purchasing noise mapping software licenses and IT systems.
- In R2, there was **greater familiarity among CAs with the process** and the requirements involved in producing SNMs and NAPs, which led to some cost savings.
- However, there are also **recurring costs** in each noise mapping round, such as the procurement of external technical expertise to produce SNMs and other technical support from consultants. GIS data purchases are also likely to be recurring.
- There was an overall **increase in the number of CAs involved in END implementation in R2** due to the shift from the transitional to the definitive END thresholds between R1 and R2.
- Whilst an increase in the volume of mapping has led to increased costs, CAs involved in R1 have gained a lot of experience, and this has helped to keep the costs down. There was evidence that CAs involved in R1 shared their experiences with those that only became involved in END implementation for the first time in R2.
- The **economic and financial crisis has had an impact** in reducing noise mapping costs between Rounds. Since there was less budget available for SNM in many EU MS in R2, the level of costs has been reduced. Some MS faced particular budget constraints in R2 in procuring SNM services (e.g. ES, LV, LT and PT).
- It was noted in several MS in Central, Eastern and Southern Europe, that the **actual budget committed for noise mapping was often lower than the initial allocation**. This reflected strong competition in public procurement contests among acoustics consultancies. In Western Europe, there was also evidence of greater competition in R2 and of the maturation of the market.

EQ11b - What factors cause the greatest administrative burdens?

The extent to which CAs perceived there to be onerous administrative burdens associated with compliance with the END depended to a large extent on whether or not dedicated state budget had been made available to CAs especially for the purposes of commissioning SNMs.

The data presented above showed that **the *costs of strategic noise mapping* are low.** The estimated costs were based on cost benchmark data provided by national CAs and were accepted as being low in relation to the *costs per capita* among the *total* *population* (see previous table, which indicated costs ranging from €0.05 to €0.56/ capita). The estimated costs per *affected inhabitant* based on data provided by acoustics consultancies during the course of the evaluation were also low, with the estimated costs ranging between €1.50 and €2.00, but this includes noise mapping, action planning and holding public consultations. Although these costs were considered to be low in absolute terms, **the extent to which SNMs are funded by central government has a significant influence as to how administratively burdensome** the costs of noise mapping and action planning are perceived to be among CAs and wider END stakeholders. This was particularly found to be the case at local level within agglomerations.

For instance, in **France** at local authority level, *communes* are not allocated specific budget from central government for noise mapping, but rather SNMs must be paid for out of a given commune's general budget. In R2, partly as a consequence of the lack of budget, only 20% of *communes* have approved and published SNMs (according to an interview with the national CA, as at mid-2015). Conversely, in relation to noise mapping of major roads and major railways in France, since in each *département,* there is a departmental representative from the State services with a dedicated budget for undertaking noise mapping, there have been no such delays. The fact that there are no implementation gaps in respect of SNMs for major roads in France, whereas there are significant gaps for agglomerations illustrates that the pace of END implementation is linked to whether MS have made the necessary dedicated budget available in the first place.

Although mapping costs per inhabitant in **France** were not seen as especially high, the number of CAs involved, and the focus on mapping very small administrative units was seen by some stakeholders interviewed as being fragmented and inefficient. For instance, it was pointed out that for the Paris agglomeration, rather than there being a single SNM covering the city (or dividing the city into a small number of different SNMs), each *commune* instead produces a separate SNM, which means that across Paris (and parts of the wider Ile de France region that are part of the wider Paris conurbation), there are 240 local authorities involved in producing separate SNMs.

In **Germany**, also, since noise mapping in respect of agglomerations takes place at a localised level of administration, this was cited as one of the reasons for the high levels of costs, due for instance to the requirement for many different local authorities designated as CAs to learn about noise mapping, the procuring of many, very small-scale SNMs which can lead to inefficiencies, and once the SNMs have been developed, a requirement for extensive coordination to produce a combined SNM.

In contrast, in the **UK** (**England)**, a dedicated budget was made available in both R1 and R2 for noise mapping in respect of the implementation of the END. However, since major airports are privately owned, a decision was taken that airport operators were required to pay their own costs. There have only been minor delays in the submission of all reporting information in the **UK,** which contrasts with the above example for **France,** where major delays and incomplete reporting submission can be discerned in the EC reporting databases.

A further finding was that the **administrative costs of noise mapping were found to significantly exceed the costs associated with noise action planning activities (i.e. under Art. 1(a) and Art. 1(c) respectively).** However, it is important to note that the data is somewhat misleading in that the costs of action planning presented in this sub-section to address EQ11 only take into account the administrative costs associated with the process of developing a NAP, as opposed to the substantive costs of measure implementation, which are more significant by a factor of 10:1 (these are presented in our assessment of EQ13, the CBA later in Section 3.2.4.3).

An issue raised in relation to perceptions of administrative costs is that there is a potential double layer of costs in that noise mapping is required for the END but further, more detailed noise mapping may be required depending on the prevailing national planning requirements in the MS concerned. Conversely, other stakeholders stated that whilst this might be an additional cost for the MS concerned, it **does not represent an additional layer of costs attributable to the Directive**. If the MS concerned has specific additional national requirements, this is the prerogative of the MS concerned since environmental noise policy is a national policy domain, and any such requirements are outside the scope of the END.

A further issue related to costs raised by a small number of interviewees was that when proposed mitigation measures identified in NAPs are being considered, then more detailed noise mapping and impact assessment is often required in order to justify the spending decision. Arguably, such costs do not relate to the END itself, but since the measures are often identified across other policy areas (e.g. transport planning, infrastructure development, land use planning) they depend on how extensive the culture of regulatory impact assessment is in the MS concerned.

Where **dedicated budget for noise mapping was made available**, there have been fewer delays and problems than in MS or regions where local authorities have been required to find the budget for noise mapping and they therefore had to identify resources out of their general budgets (where there are many competing budgetary priorities).

EQ11c – How far are the administrative costs of END implementation proportionate?

The extent to which the costs of END implementation are proportionate was examined through the analysis, taking into account the data collected on administrative costs and the findings from the assessment of this data, as presented above in EQ11a.

In order to assess this sub-EQ, it is first necessary to define in broad terms what is meant by "proportionate" costs. This relates to:

- Perceptions among END stakeholders at national level as to whether the costs of undertaking the activities required under Art 1(1)a-c (i.e. noise mapping, action planning, including public consultation) are proportionate.
- An assessment as to whether the administrative costs are proportionate relative to the ambitious objectives that the END is trying to achieve.
- An assessment as to whether the administrative costs are proportionate relative to the benefits

Assessing the first and second points was based on a combination of desk research and data collection on costs and interviews to obtain stakeholder views as to whether these can be considered to be reasonable. The extent to which the costs are proportionate to the benefits is examined through EQ13 (cost-benefit assessment). This focuses on the substantive compliance costs of implementing noise measures identified in NAPs as a proxy for efficiency, but also takes into account administrative costs.

It should first be recalled that the **costs are difficult to compare between EU MS due to the fact that different countries have adopted different implementation approaches** to noise mapping and action planning. This affects both the level of costs and perceptions as to whether the costs of implementing EU legislation are proportionate. For instance, the data presented earlier for France and Germany points to higher costs per capita and affected person in EU MS with decentralised implementation approaches (see tables 3.7 and 3.8). The interview feedback found that especially at local level, some CAs perceived the administrative costs to be quite high. For instance, in **Germany**, a decentralised approach was adopted to noise mapping and action planning within agglomerations, with many different bodies involved in commissioning noise maps relating to small administrative units. There consequently appeared to be more limited scope to derive cost savings through economies of scale compared with MS that have adopted a more centralised approach to noise mapping, and / or that carry out mapping at a higher level of administrative unit.

In terms of whether the costs were seen as proportionate by END stakeholders, **most stakeholders interviewed viewed the costs as being reasonable**. The costs, *per capita* and *per affected inhabitant*, were generally viewed as low by END stakeholders. However, it was noted by some local authorities interviewed that when costs are assessed at the aggregate level, rather than per capita or per affected inhabitant, these can be seen as administratively burdensome by some public authorities, but this depends on the budgetary arrangements put in place by the particular Member State concerned.

It is important to distinguish here between **the actual costs and the perceptions as to whether these costs are high or low** (which is highly subjective among END stakeholders). The cost of noise mapping may be low in absolute terms, but a small municipality with limited budget for instance may perceive them to be high. For instance, in **France**, at municipality level, there is no dedicated state funding available for noise mapping within agglomerations, and the funding therefore has to come out of the general budget of *communes*. Similarly, in other EU MS, such as **Spain** and **Portugal**, although it was acknowledged that the per capita and costs per affected person) of noise mapping are low, in the context of the economic and financial crisis, there have been major funding constraints in R2. In other words, views on whether the administrative costs of END implementation are proportionate were found to be subject to change over time, depending on the prevailing situation in terms of public sector budgetary availability more generally.

A view among some NGOs was that the costs of strategic noise mapping, whilst low in per capita terms, can be significant in aggregate, especially when such mapping is carried out by local municipalities with limited resources. There was a concern that investing increased funding in noise mapping compared with the pre-existing situation might risk displacing funding that could otherwise have been used for noise mitigation, abatement and reduction measures. However, this was not borne out by the evidence. Since the average costs per inhabitant affected by noise of producing SNMs range from €0.05 (under a highly centralised approach to noise mapping) to €0.56, the research did not find evidence that this would make a significant difference to funding availability for measures to address noise at source at local level.

The evaluators also note that when assessing the proportionality of costs, it is important not to overlook the broader function of END data collection relating to the END's second objective, of ensuring that the necessary data is collected to that EU policy makers responsible for source legislation can make better informed decisions with regard to limit values at receiver in future. The interviews suggested that at least in some MS, CAs tend to perceive costs from the perspective of the utility of SNMs and population exposure data for their own country's perspective alone, and do not necessarily take into account in commenting on the costs of END implementation the fact that the data is used for EU policy-making.

Overall findings – administrative costs

Among the findings that can be drawn in relation to the assessment of cost data are that:

- The costs of strategic noise mapping were generally lower in R2 than R1. However, this was not the case in all MS, since some estimated that they had incurred additional costs in R2, due to the expansion in the scope of END coverage due to the transition to using the definitive END thresholds.

- There were found to be wide differences in costs between MS, reflecting the fact that the Directive is implemented under the subsidiarity principle, with varying approaches in terms of how noise mapping and action planning are carried out (e.g. centralised, decentralised, combination of the two).
- Significant variations in costs between EU MS were found to depend on further factors, such as population size and the geography of the MS concerned (e.g. which impacts on the length of the major roads and major railways network).
- More generally, different MS have allocated differing levels of human and financial resources to END implementation depending on the degree of political priority given to environmental noise in the MS concerned, how far the economic and financial crisis has curtailed the national, regional and local budget for END implementation, etc.
- At the level of the EU overall, in assessing administrative costs, efficiency cannot be assessed through a simple input-output relationship, since the relationship between administrative costs and outputs is not linear.

It is nevertheless helpful to have collected data on the (estimated) administrative costs of END implementation at national level since such data has never previously been collected. The data collection and analysis has been useful in the following ways:

- Although data hasn't been provided right across EU-28, there is a sufficiently representative sample of administrative costs data to develop cost-benchmark data (e.g. cost per capita, cost per affected inhabitant) that will be useful to inform EC policy development and future evaluation work.
- Administrative costs data has been fed into the CBA in order to assess the cost-effectiveness of measures, relative to the health and other benefits of the END.
- Administrative costs data would ideally have been more reliable and comparable. However, this would imply strengthening monitoring data to assess the evolution in the administrative costs of END implementation over time. Such data would be useful for MS national CAs (for benchmarking purposes) and for the EC (assessing the overall costs of the END vs. the benefits). This would be especially useful in facilitating future evaluation work to assess the full costs and benefits of the END.
- There is clearly a trade-off between the need to be able to evaluate what the Directive has achieved and monitoring the costs of its implementation, whilst at the same time ensuring that MS' administrative costs relating to reporting are proportionate.
- One possible solution might be to remind national CAs and their local and regional counterparts that periodically, evaluations will take place and they ought to retain some basic information and data about the approximate costs. This would then allow the evolution in costs over time to be better monitored and assessed.

Among the overall findings in relation to the proportionality of costs are that:

- Stakeholders generally acknowledged the costs of END implementation as being proportionate to the level of ambition of the END's objectives and not disproportionately burdensome.
- Stakeholders acknowledged that the *costs per capita* of strategic noise mapping are low both relative to the affected population and the total population. The average benchmark costs of noise mapping across a group of countries that provided costs data are €0.18 / capita (with a median of €0.15) and action planning costs of €0.06 / capita (and a median of 0.03). The costs per affected person (in areas within the scope of the END) were higher, but are also low.
- Although less robust data was available on the costs per capita for action planning (excluding measures), the costs of producing NAPs and holding public consultations, were also found to be low, and were broadly accepted as proportionate by stakeholders relative to the objectives of the END (and the scale of the societal and

health challenges).

- Some stakeholders were concerned as to whether the level of administrative costs was proportionate in countries where there were budgetary pressures linked to the economic and financial crisis. However, this was more due to a lack of funding available generally for environmental noise due to pressures within public budgets than noise mapping being seen as prohibitively costly.

3.2.4.3 The simplification of administrative requirements

EQ11d Can the Environmental Noise Directive overall, or the administrative requirements specified within the legal text be simplified?

Stakeholders were asked for their views as to how the END might be simplified.

There were only a few suggestions as to the possible **simplification of administrative requirements** within the Directive. This perhaps reflects the fact that there was a high level of acceptance of the core activities of the END relating to strategic noise mapping and collecting data on noise exposure and in respect of noise action planning. The following suggestions made were for instance:

- There may be scope for greater synergies (and ensuring greater consistency) between NAPs produced under the END and Air Quality Plans prepared through the Air Quality Directive. According to some stakeholders, this could potentially reduce costs or at the least, allow potential cost synergies to be further explored and if some are identified, exploited.
- However, the stakeholders concerned were unable to quantify the potential level of efficiency savings, since the suggestions as to how efficiency savings might be achieved were insufficiently detailed.
- A further means of simplifying the Directive would be to review the existing objectives and to consider making it clearer what the END's final objective is. This would then make it more feasible to identify, standardise and specify the data requirements that will be necessary to deliver on that objective.

Although there was not much feedback relating to the potential scope for simplification, suggestions were made by CAs and other interviewees with regard to how the legal text of the Directive could be improved to strengthen its coherence and the perceptions of a lack of clarity in some articles and sub-articles within the text.

Undertaking a review of the legal text in future could help to address minor inconsistencies in the text and would help to eliminate or reduce perceived ambiguities and further limit the scope for differing interpretations, thereby strengthening the efficiency of implementation.

Using the terminology associated with the Standard Cost Model[145], eliminating ambiguities has the potential to reduce the administrative costs associated with meeting particular administrative requirements in the Directive and information obligations linked to these. In the case of the END, this relates to the submission of reporting data on SNMs / population exposure and the submission of NAPs. Specific examples were provided earlier in the report of requirements and definitions that CAs found had created ambiguities or uncertainty (see the second implementation review, which includes an assessment of stakeholder views on the coherence of the Directive's legal text and also Section 3.2.2 - coherence).

[145] http://ec.europa.eu/smart-regulation/guidelines/tool_53_en.htm

For example, feedback from stakeholders suggests that there is a need to review and possibly clarify further certain definitions used in Art. 3 of the Directive (definitions), such as Art. 3(k) "agglomeration", Art. 3 (l) and Art. 3 (l) "quiet area within an agglomeration" and Art. 3 (m) "quiet area in an open area". The research also identified examples within the END where stakeholders perceive that further clarification is needed. For instance, there was an issue as to whether the formal requirement in the END is to draw up a NAP (Art. 8) or to adopt a NAP (Art 1(1c)). A further issue is the requirement in Art. 7(5) that "strategic noise maps shall be reviewed, and revised if necessary, at least every five years after the date of their preparation. The use of the terms "revised if necessary" was viewed as too ambiguous by several interviewees, who suggested that it was unclear what this actually meant in practice.

This requirement could relate to having to carry out noise mapping again subject to a certain level of change in the level of noise occurring between Rounds across the defined 5dB thresholds, or a change in the level of exposed population over the five year SNM cycle. Or it could simply be intended to be left to the discretion of the MS concerned under subsidiarity. This was also mentioned at the workshop by a small number of participants as an area needing further clarity.

Some CAs stated that providing further interpretation guidance as a supporting document to the Directive would help them to minimise the amount of time that they have spent since the Directive's adoption in interpreting what is meant by particular articles within the END. Some CAs commented that as a result of perceived ambiguities and uncertainties over the precise requirements, they had had to spend a lot of time discussing particular issues with stakeholders at national, regional and local level in their MS.

It was however difficult for stakeholders to quantify the magnitude of time savings of such simplification measures and clarifications as to the meaning of particular articles, sub-articles and definitions.

3.2.4.4 Efficiency of the END Reporting Mechanism

EQ12 - Is the END Reporting Mechanism efficient?

This EQ required an assessment of the efficiency of the END Reporting Mechanism ("ENDRM") and of the process of reporting by the EU MS to the EC, and the IT tools and shared information infrastructure available to MS CAs to provide reporting information to the EC. A summary of reporting and information requirements on END implementation is provided in the table on the following page.

Table 3.10 - Reporting by the Member States and the Commission under the END

Article 10 - Collection and publication of data by Member States and the Commission

- Art. 10(2) - the Member States shall ensure that the information from SNMs and summaries of the action plans as referred to in Annex VI are sent to the Commission within six months of the dates laid down in Articles 7 and 8 respectively.
- Art. 10(3) - the Commission shall set up a database of information on strategic noise maps in order to facilitate the compilation of the report referred to in Article 11 and other technical and informative work.
- Art. 10(4) - every five years, the Commission shall publish a summary report of data from strategic noise maps and action plans. The first report shall be submitted by 18 July 2009.

Article 11 - Review and reporting

- No later than 18 July 2009, the Commission shall submit to the European Parliament and the Council a report on the implementation of this Directive (and every five years thereafter).

Note – the first implementation report was actually finalised in 2010 and published in 2011. The second implementation report is scheduled to be published in 2016.

Reporting on END implementation at EU level is clearly dependent on the smooth and efficient transfer of data and information to the EC. In order to ensure data comparability, the way data is submitted by MS to the EC should be as consistent as possible. The EC is supported in carrying out the collection of reporting data by the EEA, to whom specific tasks have been delegated. In order to ensure data comparability, the way data is submitted by MS to the EC should be as consistent as possible. The focus was therefore on assessing how efficient the current IT system and associated online data completion processes within Reportnet are relating to the transmission of noise data and information by MS CAs to the EC.

The focus of the analysis in this section is therefore not on other reporting-related issues that are important from an effectiveness perspective, such as the timing of reporting and outstanding data gaps in the EC databases (see Sections 2.3.7 and 2.3.8 in the second implementation report), the quality and utility of the data reported by MS and the way in which the data has been used and reported by the EC (see EQ7a, Section 3.2.3 under effectiveness and Appendix G, outstanding challenges in implementing the revised Annex II). These crucial issues are addressed elsewhere in the report as per the section references above. The linkages between the efficiency and effectiveness of the ENDRM should be noted.

Introduction – the END Reporting Mechanism (“ENDRM”)

Prior to analysing feedback from national CAs in relation to this EQ, it is important to provide an overview of the way in which the ENDRM operates, and the different possibilities in respect of the submission of SNMs and NAPs under the reporting mechanism.

Table 3.11 END requirements and END reporting mechanisms

Aspect of the END Reporting Mechanism (ENDRM)	Description
EIONET **https://www.eionet.europa.eu/**	The EIONET is a partnership network set up by the EEA, consisting of National Focal Points in each MS across EU-28 and the EEA cooperating MS (5). EIONET is used as a mechanism to collect different types of environmental information, including reporting noise data and information under the END. Whereas formally the END's scope applies across EU-28, the EEA's Eionet extends to a wider grouping of 33 countries (including EU-28 and 5 cooperating countries). All EU-28 MS must report on the data required in the END. However, in addition, any EEA Member Countries and cooperating countries that are not EU members can report on a voluntary basis.
Reportnet http://www.eionet.europa.eu/menureportnet	Reportnet is a reporting platform and EEA information system for the electronic submission of data and information. Although Reportnet was set up by the EEA for other environmental reporting purposes[146], it has subsequently been adapted and tailored for electronic noise data reporting purposes under the END. The EC has formally stated a preference for the use of Reportnet in the delivery of data relating to Directive 2002/49/EC. In order to satisfy the reporting obligations, a letter of confirmation must also be sent by the MS' Permanent Representation to the Secretariat General of the Commission stating that the upload to Reportnet has taken place. The data delivered through Reportnet feeds into a relational database that collates data through the Reportnet and other submission mechanisms allowed under the ENDRM (such as by email and even submitting SNMs / NAPs in hard copy should they so choose). It is recommended, but not obligatory, that MS should report data and information through Reportnet.
The END databases of SNMs and NAPs http://cdr.eionet.europa.eu	Two relational databases were developed in Excel in 2007 to collate reporting information and data on SNMs and NAP summaries submitted by the MS. The ENDRM database has been designed as a relational database for data delivered through Reportnet. Data uploaded into Reportnet feeds into the Central Data Repository ("CDR"), which contains the two relational databases.
Alternative mechanisms for submitting reporting END data and information	There are a number of different mechanisms for MS CAs to submit reporting data and information to the EC. MS can either submit via the Reportnet electronic data transmission system, the EIONET, or alternatively, directly to the EC via email with SNMs and summaries of NAPs attached.

Reportnet is linked to the EIONET network of MS authorities that is involved in wider environmental reporting activities. Reportnet is part of an integrated approach to environmental reporting, since national CAs responsible for other EU environmental Directives also use the Reportnet in order to meet their reporting obligations under other Directives.

The way in which specific reporting mechanisms to meet the requirements of the END under Art. 7(1) (Strategic noise mapping) and Art. 8(1) (Action plans) are now described in the following table. Since the timings of the reporting procedures and data flows differ, it is important to explain how the reporting procedure and quality review process differs for SNMs and NAPs:

[146] Reportnet provides an existing framework for the reporting of environmental data flows, such as those required by relevant air quality and water framework directives and through the END.

Table 3.12 - END requirements and how this relates to the ENDRM

END requirement	Reporting procedure and quality review
Strategic Noise Maps (SNMs) **Article 7(1) Strategic noise mapping**	SNMs are usually submitted via the Reportnet system. An official notification is sent to the EC indicating when MS have delivered SNMs. Population exposure data submitted via Reportnet is initially analysed for administrative compliance purposes by the EEA on behalf of the EC. The content of the data is then analysed to produce an EU-level assessment of the 'quality of the acoustic situation in the EU' as required in Art. 11(3), through the Noise in Europe report. Data and information on SNMs and in respect of population exposure is disseminated via the Noiseviewer (http://noise.eionet.europa.eu/) which is administered by the Noise Observation and Information Service for Europe maintained by the EEA and the European Topic Centre for Air Pollution and Climate Change Mitigation (ETC-ACM) on behalf of the EC. The latest information available in the Noise Viewer has been quality-checked by the EEA. This includes population exposure data and noise contour data and maps.
Noise Action Plans (NAPs) **Article 8(1) Action plans**	An official notification is sent by the EEA to the EC indicating the timescale when MS have delivered NAPs. Through the CDR within the Reportnet system, a record of the NAP summaries that have been submitted is collated. The EC analyses data completeness in respect of NAPs.

Summary of Division of Administrative responsibilities

In order to assess the efficiency of the Reporting Mechanism, it is necessary to describe how the ENDRM works and the shared IT infrastructure that supports it, but also the **division of administrative responsibilities for collating reporting data through the ENDRM.** As noted earlier, the EC is formally responsible for the collation of END reporting data under Art. 10 and for reporting on this data in five yearly reports (Art. 11). Since 2005, the EC has in practice delegated certain tasks relating to the collation of END reporting data to fulfil the requirement set out in these articles to the EEA. Accordingly, the EEA was responsible for the development of templates for MS CAs as to how to complete reporting information and for the development of guidelines as to how to submit information on SNMs and summaries of NAPs via the Reportnet, and how to access the **Central Data Repository** ("CDR"). The EEA is supported by an independent contractor with regard to data completeness and compliance verification.

The EEA undertakes a quality-check in respect of SNMs and population exposure data submitted by MS CAs in order to ensure that the data complies with the Directive's requirements, and that SNMs meet minimum quality standards. An internal manual has been developed setting out the internal rules for undertaking a quality check of SNMs and population exposure data to ensure coherence and consistency between the data and information delivered by each EU MS. The EEA also deals with the spatial data submitted (noise contour maps and the location of noise sources).

It is important to describe how the ENDRM has evolved since the first reporting deliverables had to be reported by EU MS from 2005 onwards[147]. The operational aspects of the ENDRM – and the IT infrastructure to support END data and information submission - have been developed over time. For instance, internal procedures were developed for checking the quality of data (see the above description under 'administrative responsibilities'), dataflows relating to the ENDRM have been clearly defined and templates have been developed, initially in 2006 through a consultancy

[147] In 2005, the information collated related to informing the EC about which sources would be mapped, and subsequently, data in respect of R1 SNMs and NAPs was collected in 2007 and 2008 respectively.

project and subsequently updated in 2011 by the EEA. It should be noted that the focus is on describing the Reportnet system, since this is the Reporting Mechanism that the EC formally recommends and most MS CAs use.

In 2012, the EEA published a *Handbook for delivery of data in accordance with Directive 2002/49/EC*[148]. This provides a description of the Reportnet Electronic Noise Data Reporting Mechanism, summarises the END reporting obligations relating to particular articles and sub-articles and outlines the structure of the data flows. Examples of schema templates for national CAs, and a description of how the ENDRM feeds directly into the CDR database in order to aggregate data submitted by the MS are also provided. In the handbook, the EEA has developed a number of different schemas and templates for reporting in different formats to capture the main data and information from the processes of strategic noise mapping and action planning. These include:

- Tabular data in xml, spreadsheets (Microsoft Excel) and/or databases;
- Geographic information;
- Web forms and written reports;
- Metadata.

The EEA Handbook states that *"where appropriate, data formats and specifications for the ENDRM templates have been harmonised with those of existing environmental reporting obligations reported through Reportnet".*

The arrangements for the **uploading of data and information through the ENDRM and its subsequent transmission to the EC** are now set out. In order to facilitate the uploading of data through Reportnet, there are two levels of predefined folders. The first level (under EU obligations) is entitled 'Environmental Noise Directive'. In the second level, there is a folder relating to each data flow (e.g. SNMs, NAPs). Summaries of NAPs are also collected through the Reportnet system.

Based on the data provided through the Eionet on SNMs and NAPs, the first Noise in Europe Report[149] was published by the EEA in 2014. NAPs submitted through Reportnet are compiled by the EEA and a process has been developed that focuses mainly on checking compliance (e.g. with the minimum requirements set out in Annex V). The QC results are reported to the EC.

Data completeness is currently checked by the EEA against the END requirements and takes into consideration as far as possible how the data has been submitted. This is especially relevant for major roads and major railways, where **MS report quite differently depending on how they have chosen to carry out strategic noise mapping**. The geographic scope of coverage varies significantly. Taking major roads as an example, MS report differently, some on entire road networks, whilst others on multiple and / or individual road segments.

There are two ways that MS report data on population exposure for major roads and major railways:

- **Per segment** - then any missing segments can be identified by comparing these to the sources declared on which MS intend to report.
- **Per reporting entity -** this corresponds to a country or a region (depending on how the country decided to report the data). In such cases, this is a single value and is assumed to cover all the segments declared as noise sources.

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[148] Technical Report for an Electronic Noise Data Reporting Mechanism http://www.eea.europa.eu/publications/noise-handbook/at_download/file

[149] http://www.eea.europa.eu/publications/noise-in-europe-2014

The EEA takes into account the percentage of inhabitants covered in the data completeness statistics wherever possible (i.e. for agglomerations).

Data and reporting information outputs

The **data and reporting information outputs** collected by the EEA on behalf of the EC for END reporting purposes are summarised in the box below. This includes not only END data and information, but a number of other areas of information and data collection that help to monitor the Directive's implementation. These provide information relevant to five yearly reporting on implementation, and include:

Box 3.6 - Outputs from the ENDRM at EU level

- Noise Directive DF0: Definition of reporting structure
- Noise Directive DF1_DF5: Report on all major roads, major railways, airports and agglomerations
- Noise Directive DF2: Competent bodies
- Noise Directive DF3: Limit values in force report
- Noise Directive DF4_DF8: Strategic noise maps report
- Noise Directive DF6_DF9: Noise control programmes
- Noise Directive DF7_DF10: Action plan summaries

Reference should also be made to Section 2.3.7 (SNMs) and 2.3.8, which makes extensive use of the data contained in DF4_DF8 and DF7_DF10 respectively.

Data and information on the latest reporting position in respect of data completeness pf SNMs is periodically made available online by the EEA in Excel form. Noise mapping results collected by the EEA through Reportnet are published online on the Eionet website using the **Noiseviewer tool** since 2009 (noise.eionet.europa.eu/), which is used as a mechanism for the dissemination of data and information on population exposure. The above deliverables are also crucial for END reporting at EU level, in particular for the EC, which is responsible for reporting on the Directive's implementation once every five years.

All reporting information submitted by MS corresponding to NAPs for R1 and R2 submitted by 30/06/2015 were compiled and can be reviewed in the Access database published. In the case of R1, it consists of the links in Reportnet where the information is submitted, and for R2, all the information submitted through the web forms and have been compiled in table form. Coverage files are also available.

Desk research to assess the efficiency of the ENDRM

As part of the evaluation, an assessment has been carried out of the ENDRM which has focused on the Reportnet online reporting tool since this is the primary transmission mechanism for submitting reporting data and information. The EEA Handbook on the END reporting tool was also reviewed, as well as visualisations of the different reporting templates. In addition, the Excel databases themselves have been reviewed by our team and used during the study, for instance, to assess data and information completeness in respect of SNMs and NAPs (see Section 2.3.7 and 2.3.8) and to ascertain the extent of availability of data and information on the estimated costs and benefits of measures implemented which were used to select case studies for the CBA (see Appendix F for the case studies). Reference should also be made here to some of the weaknesses in the coherence of the data being collected, especially on agglomerations, which are examined under the effectiveness section (see the sub-heading on the "quality of data" EQ7a Section 3.2.3.2).

The desk research and interviews found that among the **advantages of the Reportnet adapted** for electronic reporting purposes for the END are that:

- Reportnet is based on a common EU-wide reporting and information system, supported by common templates, which is necessary to collect information and data on a common basis, which is essential for meeting the second objective of the END (Art. 1(2)).
- The use of Reportnet by most MS under the END helps to promote an integrated approach to environmental reporting, since national authorities are using Reportnet as the reporting system to submit data and information to the EC in respect of other environmental Directives. For instance, national CAs can use their Eionet username in order to access the CDR within the Reportnet. Using the same system to report on different Directives is more efficient than developing different IT systems for different Directives.
- The use of Reportnet by the majority of MS since 2009 has helped to strengthen the efficiency of END reporting, since there would be inefficiencies if MS used different methods of submitting SNMs and NAPs (e.g. due to the need for manual data entry).
- The reporting system is transparent. The fact that there is a shared information infrastructure across MS means that once uploaded, the data is directly linked to the CDR.
- The principles set out in the EEA handbook, such as those relating to the use of relational database principles in structuring the electronic mechanism for END reporting are sound.
- The Central Data Repository (CDR) is able to update reporting information in real-time, and also has the capability to aggregate information from across EU-28. Setting up the database to do this automatically has been time saving.

In the early stages of END implementation, it was common for different MS to submit reporting data and information through different mechanisms, not only **Reportnet, but also the EIONET** or **directly to the EC via email and even in hard copy**. Since 2009, however, the EEA has recommended that MS should transmit reporting data and information electronically through a single mechanism, the Reportnet portal, which is based on a **shared information infrastructure.** However, MS may also submit completed SNMs and NAPs through another mechanism if they so wish. Members of the EIONET have common access to Reportnet. Following the submission of END data delivery by individual MS using a country code, this data is linked to the **Central Data Repository ("CDR"),** which collects all the data and information submitted by MS to provide.

The complete picture in terms of the preferred Reporting Mechanism that particular MS are currently using was difficult to ascertain across all EU-28, since **some MS have not yet submitted SNMs and NAPs in R2**. According to a an online survey response by a relevant stakeholder, **Reportnet has been used by the majority, but not all Member States to report requested END data**. The evaluation team was not able to interview either the EEA or the EC (due to concerns about avoiding bias during the evaluation process) to check the principle delivery mode, but our understanding from the interview programme is that the Reportnet has been used more frequently than other delivery mechanisms.

The EEA handbook emphasises a number of common sense principles that ought to strengthen the reducing repetition through the **use of relational database principles.** These include:

- Adopting formats which best suit the type of information to be reported;
- Ensuring consistency of reporting formats between successive reporting rounds;
- Adopting formats which are in line with existing EEA/EC reporting approaches.

The evaluators found that **these principles are sound and have helped to maximise the efficiency of the Reporting Mechanism**. They are important in avoiding unnecessary repetition and / or inconsistency in data and information reporting processes and procedures.

The two databases that collate reporting data and information submitted by the MS to the EC were developed in Excel. MS are able to enter data in a more complex relational spreadsheet if they so wish using Reportnet. The possibility of using Access was raised by an EC official as the number of data points in the two END databases within the CDR increases, it may be more efficient to transfer the END reporting databases from Excel into an Access database. However, whilst Access is a useful tool for managing large contacts databases and for storing qualitative information (such as NAP summaries), Excel is better for storing large quantitative datasets on SNMs and population exposure data. The data can also easily be analysed using other statistical software. A further supporting factor for not changing the format is that MS submit in Excel and Word templates which was purposely designed to be compatible with the software that MS most commonly use. In our view, the **use of Excel is 'fit for purpose'.**

Moreover, whilst Excel can be used to store the data and information, it can be analysed in any software format by the EU (assisted by the EEA). Some data and qualitative information is already being stored in Access, such as NAP summaries by the contractor assisting the EEA.

The ability to load information by different informational levels by country appears to be an efficient way to structure the data and information.

The research found that the ENDRM is generally efficient, but that **there are also some drawbacks and disadvantages of the Reporting Mechanism** as it currently operates. According to the research:

- There is presently no collection of measure-level data on the implementation information / updating of the ex-ante cost data projections presented in NAPs.
- Some of the graphs in the Handbook on data models can't be easily read since they are of low resolution. However, MS CAs ought to have access to the original graphs and templates directly through the Reportnet.
- A further issue relates to the extraction of EU-level synthesis data and information through the database. In the course of this evaluation, the evaluators have found that although it is possible to obtain an EU-level overview of data completeness in respect of SNMs relatively easily, it is more difficult to extract information on data completeness on NAPs.
- The requirement to **submit a letter from the Permanent Representation to inform the EC of the formal delivery of SNMs and NAPs seemed overly bureaucratic** to some END stakeholders. If the electronic END reporting and information system works efficiently, it could be reconfigured to provide automatically generated emails informing that particular data has been uploaded. However, balanced against this, whilst in an ideal world, most data would be submitted for the same MS and the same source at the same time, in practice, SNMs and NAPs are often completed at different times and are therefore often uploaded into the system in different time periods.

- In MS that have adopted a decentralised approach and / or those in which MS have decided to produce many SNMs and NAPs relating to smaller administrative units (e.g. DE, FR, NL), it has proven more difficult to synchronise the submission of reporting data and information. This may make it more difficult for the EC to gain an overview of the latest position on reporting completeness, since reporting information and data is more likely than under a more centralised system to be submitted at different points in time. The involvement of the Permanent Representation in the formal submission process appears to be an unnecessary additional step since END reporting information and data should already be available to the EC in the database in real time. This requires coordination between the Permanent Representation and the national CA on each occasion that SNMs and data and NAP summaries are uploaded.

Feedback on the ENDRM from interviewees

A number of issues were identified in relation to the ENDRM through the interview research.

Overall, Reportnet was viewed as being a reasonably efficient mechanism for the submission of reporting data. However, there were aspects of the mechanism that it was felt could be improved, such as:

- The need to strengthen the user-friendliness of the reporting mechanism;
- The need to streamline and/ or simplify reporting procedures;
- The problem that it can take a lot of time and resources to upload END reporting information, especially summaries of action plans since there are many different data fields and the civil servant uploading data must familiarise themselves with the data codes.

The above issues are now explored in further detail.

The ENDRM was seen as not being sufficiently user-friendly by national CAs in several EU MS. For instance:

- A CA from **Cyprus** regarded the ENDRM as not particularly user-friendly due to the amount and type of information to be entered. The Department of Environment expressed the interest to attend some training sessions to be organised by the EEA.
- A CA in **Denmark** did not regard it as very user-friendly either and noted that staff changes at national level within CAs can makes it harder to understand the technical functionality of the EIONET and Reportnet, undermining continuity of the ENDRM from a MS perspective.
- A CA in **Portugal** commented that the ENDRM is not very user-friendly because it has got many requirements in terms of codes, such as codes for road sections and file codes, and the codes have changed over time, for instance in the Guide on the use of the ENDRM issued by the EEA.
- The lack of user-friendliness was also pointed out by an **Estonian** CA who stated that it was not clear to them what kind of information they were expected to report and who indicated that they received feedback on being non-compliant even though they had entered data using the ENDRM.
- Similarly, a stakeholder in **France** was not clear about what kind of information was expected under the ENDRM and claimed that the understanding of this varied between Member States.
- Some CAs were unclear as to whether the complete NAP or only the summary had to be submitted to the EC. Although the Directive is clear in this regard that only the summary is required for reporting purposes, there were concerns that MS may produce and submit a summary of the NAP before the complete NAP has been finalised or adopted at MS level. This could undermine the efficiency and effectiveness of reporting since the data would not be as reliable as presumed.
- Part of the confusion may arise because the content of complete R2 NAPs (and the summaries, where available) that were available by 2013 were taken into account by the EEA when data for the Noise in Europe Report was compiled.

Further feedback is now examined. It was regarded as being **overly time consuming to submit some END reporting information.** For instance, in the UK, the national CA for England commented that action plan summaries can be extremely time-consuming to complete. "Separate web fields need to be completed online for each area of required information – England alone has 65 agglomerations, which means that almost 1000 fields have to be completed. Some suggestions were also made as to how the transmission of reporting data and information might be further improved by the same CA in a consultation response to the EC's Open Public Consultation (OPC) on the END. These are set out in EQ20, which highlights suggestions made to help simplify the reporting mechanism.

Some positive feedback about the ENDRM was also received. For instance, in **Spain,** a CA commented that the ENDRM is a good system because data is provided in the same format across the EU. It was also noted by the Spanish CA that the reporting system has been improved over time. It was however stated that there remain some problems with the reporting system in that mapping units that use the same code produce an error code.

With regard to the availability of guidance, the **Finnish** and **Hungarian** CAs stated that guidance provided by the EEA and EC on reporting was sufficient and that they had no issues with the Reporting Mechanism itself. However, the CA in **Cyprus** pointed to a need for training.

The national CA in **Romania** stated that it had taken them a very long time to upload the data and information required for reporting purposes and also to check the data first produced by external consultants before uploading the data. However, the general perception was that the amount of time to submit END reporting data and information to the EC was proportionate. The challenge is not the time to upload and submit the data, but the process leading to the production of the SNMs, population exposure and NAPs in the first place.

An END stakeholder who has worked on the Eionet reporting system noted that *"since the END is concerned with data and information flows, information should be better linked so that it adds value to the END process. The reporting of END data should create relational databases rather than only statistical tables".* However, the EEA notes in its handbook that the two databases in respect of SNMs and NAPs are relational and this was confirmed by another interviewee. However, some MS have only been completing the basic excel template and not the more advanced excel sheets that are relational. There was some feedback from stakeholders that the databases would be more efficient and effective if they were fully relational.

Some MS expressed the view that the information and data requested by the EEA sometimes appeared to be more detailed than was stipulated in the Directive. An important observation was made by the authorities in the **UK** in relation to reporting requirements more generally. The CA with overall END reporting responsibility stated that it wasn't always clear whether reporting requirements under the END correspond only to the END's legal obligations. It was suggested that "Reporting should directly relate to the legal requirements of the Directive and the links to the legal requirements should be made clearer". A further concern in the UK was that "Guidance or voluntary reporting are sometimes expected of MSs in the same way as mandatory information". The national CA in the **Netherlands** also maintained that the reporting requirements under the mechanism itself are more detailed than the reporting obligations that can be derived from the Directive itself.

In the view of one interviewee involved in the ENDRM, however, the request for more detailed reporting information from MS is perhaps not surprising, however, given that the Directive summarises the types of information and data that needs to be submitted and associated timelines, whereas the EEA Handbook on Reporting translates these broader requirements into more detailed operational guidance relating to Data Flows.

A further important issue raised was that although the database provides a "real-time" snapshot of data completeness, the research found that information on data completeness is somewhat partial due to the lack of timely and standardised reporting by all EU-28 MS. The Central Data Repository database generates information on the total number of SNMs submitted only, but not on the percentage population already covered. This makes it difficult for the EC to produce and obtain an accurate picture in respect of data completeness. This issue could be addressed by the MS directly by ensuring that they report on time by the due submission dates, although it could also help to standardise END reporting approaches in future.

An example where MS supposedly reported at a more detailed level than required by the END was that Annex VI requires the number of persons exposed by 5dB threshold to be quantified rounded to the nearest hundred. In practice, however, some MS report on the precise number of inhabitants and this was perceived by a few stakeholders as going beyond the concept of a strategic approach to noise mapping. However, it was clarified that this was based on a misunderstanding of the requirements and in fact, exposure data to the nearest hundred is acceptable for END reporting purposes.

In terms of the *type of information* required to be submitted, an interviewee that has worked on the END reporting system commented that the current reporting for SNMs does neither require MS to provide exposure data for major roads and major railways by km of coverage within END scope, nor at segment level. Rather, it only requires data at the country level – although some MS still provide completeness at segment level on a voluntary basis (for further information, see section 2.3.7). In practice, the EEA assumes that data for major roads and railways correspond to the whole country and is thus complete wherever MS submitted *some* data for their countries.

An important piece of feedback received in **relation to ways in which the databases linked to the ENDRM could be improved in terms of the types of data being collected** was as follows. "Mapping agglomerations and major sources results in arbitrary inclusion of EU citizens. The agglomeration 'receptor' assessment and major source 'source apportionment' assessment are also different types of assessment – the results of which have different definitions and should be interpreted separately. To solve this assessment complexity and to include all citizens, one approach might be to map the whole country in detail, and to extract from that the data required to be reported to Europe. By extension, another approach could be to map the whole of Europe in detail and extract from that dataset whatever data the Commission or a particular MS might require for their own particular purposes".

A further aspect of END reporting that received comments from several national CAs was the **timing of reporting requirements**. Currently, there is a requirement to inform the EC as to **which major noise sources are going to be measured and reported on 2 years ahead**. For instance, in R2, the notification had to be made by 30/06/2010, whilst the deadline for finalising noise maps was 30/06/2012. EU MS then have 6 further months during which they must report the noise mapping results to the EC, which means that the official deadline for submitting SNM for R2 is 31/12/2012.

The concern from a reporting perspective among some MS stakeholders was that there could be changes in the intervening period meaning that what is actually reported may differ from what was originally meant to be reported, and that this could be interpreted as non-compliance. However, the EC made clear that they always take such factors into account when assessing the completeness of reporting information.

An issue raised by some END stakeholders was that MS have to provide reporting data to the EEA on SNMs by a specific cut-off date which could lead to a misleading picture of the completeness of reporting information on the implementation situation across EU-28. The concern was that since many MS have encountered difficulties in meeting the 12 month deadline between the submission of SNMs and NAPs, there is a risk that some MS will miss the cut-off dates for data analysis. This means that the data may show considerable outstanding implementation gaps, but at least some of those MS may be very close to completing the mapping process and to submitting data.

However, the EEA noted that collecting population exposure data is necessary for EU-level END reporting purposes, such as informing the preparation of the technical reports on the first and second implementation reports of the END and the Noise in Europe report, 2014. Since 2007, there has been a cut-off date agreed annually. The dates are set were well after the legal reporting deadline stipulated in the Directive. The EEA produces annual updates of END reporting information, in order that they have an overview of the state of play in implementation at European level. There has accordingly been a cut-off date every year. For instance, in the case of the information included in the Noise in Europe Report, this was 8 months after the formal deadline by which time MS should have reported to the EC. The most recent cut-off dates from when R2 SNM were meant to be available are 28 August 2013, 10 June 2014 and 30 June 2015. Moreover, in recognition of the fact that some MS have been very late in their reporting submissions, data completeness of SNMs has been analysed in R2 one year after the original cut-off date so that a more up to date picture could be obtained.

Another issue raised by many stakeholders related to the **timeframes for reporting**, which effects both the efficiency and effectiveness of the overall reporting system. A number of EU MS stated that the deadlines for the submission of reporting data and information in respect of action plans is unrealistic (12 months after the submission of SNMs) to allow time for action planning processes (including public consultation).

Lastly, it should be noted that following the transmission of END data, it is important that the **data is scrutinised from a quality and utility perspective**. One stakeholder closely involved in the mechanism commented that "Reportnet data tends to be analysed from the point of view of compliance rather than for its content and value". Reference should be made here to the section on effectiveness, which examines the utility of END reporting data under EQ7a.

Challenges in the collation and coordination of data collection at national level

Although not part of the ENDRM itself, the data available in the database at any particular cut-off point in time is clearly strongly impacted by any delays in producing SNMs and NAPs and also by challenges in collating data at national level. Issues relating to delays in the submission of SNMs and NAPs are explored in detail in Sections 2.3.7 and 2.3.8.

Some stakeholders pointed to difficulties in **ensuring effective coordination in data collection at MS level.** These were seen as having contributed to delays in the timely submission of reporting information and data to the EC. Since the Directive does not set out reporting obligations at sub-national level, some national CAs (e.g. Denmark, France and the Netherlands), perceived that they did not have sufficient enforcement powers under the END to compel local authorities to provide the necessary reporting information and data needed at national level in order to report to the EC (SNMs) and the EC (NAPs) on time even if those administrative bodies had been designated within the national implementation system as CAs. This has led to additional delays in the submission of a complete set of national reporting data to the EC.

However, the EC responded that since the END is implemented under subsidiarity, it is the responsibility of Member States to develop their own administrative arrangements, including arrangements for meeting their reporting obligations/.

Simplification of reporting requirements

A number of suggestions were received as to how the reporting process could be made simpler and less onerous. These are set out in our response to EQ20 (How could the ENDRM be made more efficient?). Key findings – efficiency of the ENDRM

- Although the majority of MS are already using the Reportnet system, the efficiency of the collation of END reporting data could be improved if all EU MS were to use Reportnet (since the shared information system is linked to the CDR which automatically enters data in a way that can be aggregated.
- Most national CAs were satisfied with the guidelines produced by the EEA as to how to use the Reportnet[150] system.
- There was however feedback from many EU MS that the user-friendliness of Reportnet needs to be further improved, with some indications that the information requirements are not always sufficiently clear.
- However, not all stakeholders agreed. Some national CAs stated that the ENDRM was relatively easy to use and to upload the END reporting data and information.
- Reportnet has been efficient in enabling the EC to report on its monitoring and reporting obligations under Art. 11 and in developing an electronic database of information on SNMs, as required under Art. 10 (3). However, there are aspects of data capture, especially in relation to agglomerations, that need to be strengthened.
- The requirement to send a letter to the Permanent Representation appears to be an unnecessary additional step in the process that makes it less efficient, but eliminating this step would require automatic email alerts to be set up to inform the EC about data and information submissions by a particular national CA.
- Steps clearly need to be taken to ensure more timely reporting *(see effectiveness)* since having an efficient reporting system without sufficiently comprehensive data in it undermines the efficient and effective implementation of the Directive.
- However, this cannot be achieved in isolation from the need to consider whether the current timescales stipulated for reporting data and information through the ENDRM for NAPs in particular is appropriate, given that in the second implementation review, many stakeholders stated that the timeframe of 12 months between the submission of SNMs and NAPs was unrealistic.

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[150] http://www.eionet.europa.eu/reportnet - Data Exchange Modules (DEMs) are used to collect and validate data delivered by the countries. Most DEMs are Excel templates that are converted to XML by CDR. Others are completed in online webforms.

3.2.4.5 *Measure-level assessment of costs and benefits*

It is possible to conduct a methodologically robust EU-wide CBA of the implementation of the END, but not a precise one at the present time. This is largely because many of the measures identified in Noise Action Plans (NAPs) have either not yet been implemented or were already underway before the NAPs were produced and thus cannot necessarily be attributed to the END. A more detailed discussion of the approach to, and limitations of, the CBA is presented in Section 3.2.4.5 and in Appendix D.

It is also possible to derive a very broad indication of the relative costs and benefits of implementation of the END for typical measures (or packages of measures) relevant to agglomerations and major roads, major rail and airport infrastructure in such a way that also satisfies the requirements of Art. 11 (3) Review and Reporting of the END which states that "*the report shall include a review of the acoustic environment quality in the Community. […] The reduction of harmful effects and the cost-effectiveness ratio shall be the main criteria for the selection of the strategies and measures proposed*".

It is necessary to distinguish between 'soft' strategic measures (for instance, town and traffic planning) and 'hard' (engineering) measures at noise hotspots (areas where limiting values are exceeded). The latter have comparatively high noise reduction potential but also vary significantly in terms of their costs. Typical noise reduction potentials of common measures for road traffic noise are shown in the following table:

Table 3.13 Measures – and levels of Noise Reduction / Effect

Measure	Potential Noise Reduction / Effect
Low noise road surface	Max. 4-5 dB(A)
Speed reduction (e.g. from 50 → 30 km/h)	2-3 dB(A)
Reduction truck traffic (e.g. Truck routing)	4-6 dB(A) (reduction by 50 % and high rate of heavy trucks on total traffic)
Walls, barriers, tunnels, etc.	Maximum 10-20 dB(A)
Passive Noise protection (windows, ventilator)	Healthy living and sleeping conditions within buildings, approx. 15 dB reduction through closed window compared to a canted window.

Source: ACCON

In order to assess the net benefits of END implementation, reference is made to good practice in noise action planning and specifically those measures that have demonstrably positive Net Present Values (or a cost-benefit ratio less than 1).

The effects of implemented measures vary depending on factors such as:

- The boundary conditions such as number of affected persons by noise from each of road, rail and air (within and outside of agglomerations); and
- Source-specific factors (e.g. background noise, composition of traffic or geometrical considerations).

The costs of any particular measures also vary by location and are influenced by factors such as regional differences in the costs of labour and materials and other geographical and technical factors (e.g. topography, need for and costs of obtaining planning consents, etc.).

As a result, the cost-benefit-ratio may also differ between places. Nevertheless, even unrepresentative samples (drawn from the suite of 19 test cases) of investigated cost-benefit ratios for typical measures or combinations of measures, and assessed over a 25 year timeframe (2002-2026), show clear tendencies with regard to the overall economic benefit. For instance, the detailed CBA assessment (and supporting methodology) provided in Appendix D shows that:

- The cost-benefit ratio of various programs for **improvement of windows at three major airports** (Frankfurt, Stuttgart and Vienna) vary between 1:3.7 and 1:9.2 with an average ratio of 1:3.8.
- The implemented noise reduction measures (mainly barriers and walls) at all **major railways in Austria** between 2008 and 2013 (R1 and R2 Strategic Noise Mapping) show a cost-benefit ratio of 1:5.7
- The implementation of similar combinations of measures at **major roads in Austria** results in a cost-benefit ratio of 1:8.1.

It is further assumed that the more measures with cost-benefit ratios greater than 1 are implemented, the more effective is the END and the associated benefits in terms of reductions in harmful levels of noise and improvements in health outcomes. The transition to common assessment methods by implementing Commission Directive (EU) 2015/996 from R4 onwards should make it easier to quantify the health effects of noise reduction, which in turn will allow for a better appreciation of the benefits of noise mitigating measures as contained in NAPs. Reference should be made to the subsequent sub-section, where the findings from the cost-benefit assessment is set out in further detail. The methodological approach to the CBA is summarised in detail in Appendix D.

3.2.4.6 *Measure-level assessment of costs and benefits*

It is possible to conduct a methodologically robust EU-wide CBA of the implementation of the END, but not a precise one at the present time. This is largely because many of the measures identified in Noise Action Plans (NAPs) have either not yet been implemented or were already underway before the NAPs were produced and thus cannot necessarily be attributed to the END. A more detailed discussion of the approach to, and limitations of, the CBA is presented in Section 3.2.4.5 and in Appendix D.

It is also possible to derive a very broad indication of the relative costs and benefits of implementation of the END for typical measures (or packages of measures) relevant to agglomerations and major roads, major railways and airport infrastructure in such a way that also satisfies the requirements of Art. 11 (3) Review and Reporting of the END which states that "*the report shall include a review of the acoustic environment quality in the Community. […] The reduction of harmful effects and the cost-effectiveness ratio shall be the main criteria for the selection of the strategies and measures proposed*".

It is necessary to distinguish between 'soft' strategic measures (for instance, town and traffic planning) and 'hard' (engineering) measures at noise hotspots (areas where limiting values are exceeded). The latter have comparatively high noise reduction potential but also vary significantly in terms of their costs. Typical noise reduction potentials of common measures for road traffic noise are shown in the following table:

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Passive Noise protection (windows, ventilator)	Healthy living and sleeping conditions within buildings, approx. 15 dB reduction through closed window compared to a canted window.

Source: ACCON

In order to assess the net benefits of END implementation, reference is made to good practice in noise action planning and specifically those measures that have demonstrably positive Net Present Values (or a cost-benefit ratio less than 1).

The effects of implemented measures vary depending on factors such as:

- The boundary conditions such as number of affected persons by noise from each of road, rail and air (within and outside of agglomerations); and
- Source-specific factors (e.g. background noise, composition of traffic or geometrical considerations).

The costs of any particular measures also vary by location and are influenced by factors such as regional differences in the costs of labour and materials and other geographical and technical factors (e.g. topography, need for and costs of obtaining planning consents, etc.).

As a result, the cost-benefit-ratio may also differ between places. Nevertheless, even unrepresentative samples (drawn from the suite of 19 test cases) of investigated cost-benefit ratios for typical measures or combinations of measures, and assessed over a 25 year timeframe (2002-2026), show clear tendencies with regard to the overall economic benefit. For instance, the detailed CBA assessment (and supporting methodology) provided in Appendix D shows that:

- The cost-benefit ratio of various programs for **improvement of windows at three major airports** (Frankfurt, Stuttgart and Vienna) vary between 1:3.7 and 1:9.2 with an average ratio of 1:3.8.
- The implemented noise reduction measures (mainly barriers and walls) at all **major railways in Austria** between 2008 and 2013 (R1 and R2 Strategic Noise Mapping) show a cost-benefit ratio of 1:5.7
- The implementation of similar combinations of measures at **major roads in Austria** results in a cost-benefit ratio of 1:8.1.

It is further assumed that the more measures with cost-benefit ratios greater than 1 are implemented, the more effective is the END and the associated benefits in terms of reductions in harmful levels of noise and improvements in health outcomes. The transition to implementing Commission Directive (EU) 2015/996 should make it easier to quantify the health effects of noise reduction, which in turn will allow for a better appreciation of the benefits of noise mitigating measures as contained in NAPs. Reference should be made to the subsequent sub-section, where the findings from the cost-benefit assessment is set out in further detail. The methodological approach to the CBA is summarised in detail in Appendix D.

3.2.4.7 Findings from the cost-benefit assessment

EQ13 - To what extent does the Directive demonstrate cost-effectiveness based on an assessment of the costs and benefits to date?

The efficiency of the END at EU level was assessed using information from 19 test cases to populate a cost-benefit analysis (CBA) framework. These test cases provide a broad indication of the relative costs and benefits of END implementation in specific agglomerations and for specific roads, railways and airports. The test case findings were then extrapolated to give a picture of the order-of-magnitude costs and benefits of END implementation at the EU level. The primary criterion for the selection of test cases was the availability of data necessary to support the CBA.

Nevertheless, in several cases, the data was either incomplete or not comparable. In these instances costs were estimated based on professional judgement and knowledge of similar agglomerations and major infrastructure elsewhere across the EU-28 MS (EU-28). The specific sources of all costs (actual and estimates) are identified for each test case in Appendix L.

The scope of the CBA is described in detail in Appendix D. In summary, it covers:

- Direct **administrative compliance costs** relating to the implementation of the END, such as the preparation of strategic noise maps and the development of noise action plans (including making provision for public information and consultation);
- The **substantive compliance costs** associated with implementing the measures identified in the Noise Action Plans; and
- The benefits to those experiencing a reduction in noise levels expressed in relation to improvements in three health endpoints: annoyance, sleep disturbance and cardiovascular disease.

Note that costs are only included for those measures for which information on costs and number of people affected is available (from the NAPs, personal communications, other secondary sources or professional judgment) and for which it is possible to determine the number of beneficiaries (i.e. the number of people who benefit from reduced noise as a result of the measure or a package of measures). While estimates of beneficiaries can be made for individual measures, it is not possible where cost information is only provided for groups of measures (unless specifically stated in the NAP).

In addition to producing case studies to obtain data on investment by MS in noise mitigation measures, some limited further data was obtained through discussions with national CAs. For instance, in France, the END was found to have increased the visibility of environmental noise and there is additional resource devoted to tackling the problem at national level across different sources, as described below.

Box 3.7 - Estimates of the substantive costs of END implementation in France

Substantive costs of noise measures

France was one of the few MS able to provide national level data on its expenditure on implementing noise mitigation and reduction measures mentioned in NAPs. Among the expenditure measures implemented are improvements to road infrastructure and replacing with quieter road surfaces, soundproofing and window insulation measures for households affected by noise. Examples of the level of annual expenditure provided per annum were:

<u>Major roads</u> - €100 million per year on quiet roads and other noise mitigation measures. €50 million / annum of the budget comes from the French state and €50 million from the communes.

<u>Aircraft noise</u> **-** €50 million. The budget is devoted to soundproofing and window insulation measures for people affected by aircraft noise.

The importance of including **low-cost and no-cost measures** was also emphasised, such as:

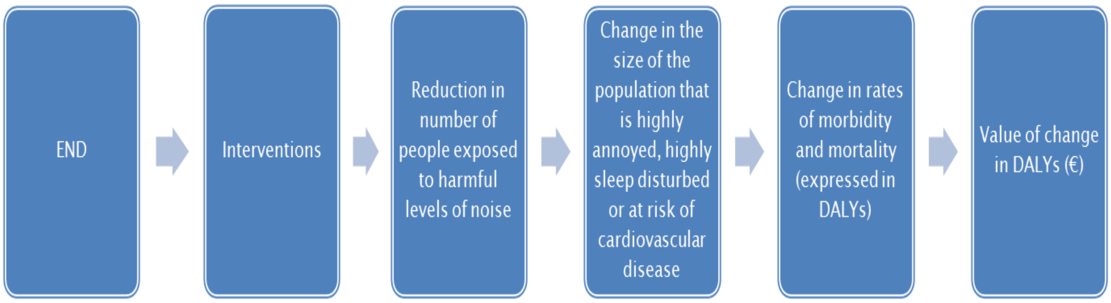
Taking environment noise into account in the planning and urban development process. Examples were not ensuring that the planning guidelines do not allow building new residential housing too close to airports.

Integrating noise mitigation into design principles from the outset – e.g. in building design, ensuring that new house construction is more noise conscious for instance, by putting bathrooms and bedrooms away from the façade facing major roads.

Source: interview with the French national Competent Authority

In order to help define the CBA framework, an impact pathway or logic chain was developed (see Figure below). This provides a structured and transparent way of linking the sequence of events between implementation of the END and the outcomes or impacts that can be valued in monetary terms, and the assumptions that may be implicit within that.

Figure 3.11 - The impact pathway



Thus, it is assumed that the introduction of the END has supported a number of activities or interventions including strategic noise mapping, noise action planning (both compliance activities) and, following these, the implementation of a range of measures to reduce harmful levels of noise. While the implementation of measures is not specifically mandated by the END, there is an implicit assumption or reasonable expectation that the measures identified in the Noise Action Plans (NAPs) will be implemented. Indeed, the implementation of many of these measures is already underway and some have already been completed.

The implementation of these measures in turn contributes to a reduction in the number of people exposed to harmful levels of noise. The benefits are considered in terms of a reduction in the burden of disease caused by environmental noise.

These are quantified using published disability weights (DWs) to arrive at a standard health metric expressed in terms of disability-adjusted life years (DALYs) and valued in terms of the value of a life year (VOLY).

DALYs indicate the estimated number of healthy life years lost in a population from premature mortality or morbidity, i.e. the health burden. The DALY is calculated as the weighted sum of years of potential life lost due to premature mortality and the years of productive life lost due to disability.

The recommended values for DWs for various disease states are set out in WHO (2011) and have been used to support this CBA. The specific values that have been used in the analysis for sleep disturbance and annoyance are shown in Table 3.15.

Table 3.15 - Disability weights used in the analysis

Health endpoint	Recommended Value	Low	High
Sleep disturbance	0.07	0.04	0.10
Annoyance	0.02	0.01	0.12

Note, however, that there are no published disability weights applicable to the low and moderately annoyed and sleep disturbed populations. As a result, the CBA only considers the value of changes in the highly annoyed and highly sleep disturbed populations.

In line with the approach presented in WHO (2011), we make use of WHO health statistics[151] for estimates of the DALYs relating to cardiovascular disease (acute myocardial infarction and hypertension) in each MS. As DALYs for myocardial infarction are not published, we applied the values relating to ischaemic heart disease. Thus, for the sake of DALY calculation, we assume that road traffic noise has a similar impact on all ischaemic heart disease as on myocardial infarction.

For the purpose of this CBA, the VOLY is taken as €110,987. This is the same as that used in the CBA of the Air Quality Package for Europe[152], adjusted to 2014 prices using the Eurostat GDP deflator. This value has been applied across all MS as it was considered neither practically possible nor politically appropriate to use different values and also because there is also the practical challenge of getting such values from MS. Sensitivity tests were also run using the lower- and upper-bound estimates (with a range from €67,163 to €154,812) provided by the EC as having been used in other impact assessments.

Sensitivity analyses have also been conducted to test how the outcomes may differ under a range of different assumptions regarding the extent (from 25-100%) to which the measures can be attributed to END. The efficiency of measures is then assessed using typical decision criteria – in this case, net present value (NPV) and cost-benefit ratios. Costs and benefits are assessed over a 25-year period (2002 to 2026) and discounted using the 4% social discount rate recommended by the European Commission. All values are expressed in 2014 prices.

The specific steps undertaken to quantify the costs and benefits and the overall net present value (NPV) of typical measures implemented as a result of the END are described in detail in Section 3 of Appendix D. This should be read in conjunction with Appendix E (Methodology for the case studies), Appendix F (Test case summaries) and Appendix L (Input data sheets) for a more complete understanding of the methodology, data inputs and analysis of test case data that is presented in summary form below.

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[151] WHO (2014) Health Statistics - Environmental Burden of Disease (2012). Online at http://www.who.int/healthinfo/global_burden_disease/estimates/en/index2.html

[152] EMRC (2014) Cost-benefit Analysis of Final Policy Scenarios for the EU Clean Air Package Version 2 Corresponding to IIASA TSAP Report 11, Version 1 March 2014 [online] available at http://www.iiasa.ac.at/web/home/research/researchPrograms/MitigationofAirPollutionandGreenhousegases/TSAP_CBA_corresponding_to_IIASA11_v2.pdf

Limitations of the analysis

There are a number of factors that limit the reliability of the EU-wide assessment of costs and benefits and therefore the results need to be treated with caution. In particular:

- The total cost and benefit estimates are partial.
  - They do not include the costs and benefits associated with measures to reduce harmful levels of noise in agglomerations. This is because the data pertaining to agglomerations across the 10 test cases examined was largely incomplete and not considered sufficiently reliable to support a robust extrapolation. The cost-benefit analysis of agglomerations was therefore limited to an analysis of the costs and benefits of typical measures applied in agglomerations.
  - They only cover a subset of the total range of measures identified in MS' NAPs. Only those measures for which reliable and comparable cost and benefit information was available were included.
- The benefit estimates are understated.
  - They only account for the benefits associated with noise reductions amongst the highly annoyed and highly sleep disturbed populations. They do not consider the benefits to those that experience low or moderate levels of sleep disturbance and annoyance. This is because there are no published disability weights applicable to the low and moderately annoyed and sleep disturbed populations. Alternative approaches using revealed or stated preference approaches, and which would capture the effects of transportation noise on low, moderately and highly affected residents were considered but themselves suffer from a number of limitations (see Box 1 in Appendix D). Not least of all, the values of willingness to pay for reductions in noise levels derived from these approaches exhibit a wide range and are thus considered less reliable for the purposes of extrapolation.
  - The benefit estimates also do not include the potential gain in property values as a result of reduced noise. Studies suggest that a 1 dB increase in noise levels can reduce house prices by between 0.08 and 2.22% depending on the noise source. These values are, however, likely to already reflect perceived amenity effects of annoyance and sleep disturbance[153]. Including changes in property values alongside the values attributed to changes in each of the three health endpoints in the analysis would therefore result in some degree of double counting.
  - They do not include the benefits in the form of cost savings from a reduction in hospital admissions (costs borne by individuals) and lost productive days (costs to employers). These are nevertheless likely to be small in relation to the value of avoided DALYs.
  - In contrast, while some of the measures included in the assessment have not yet been fully implemented, the benefits estimates are calculated assuming that the measures have been fully implemented. The benefits associated with some measures are thus somewhat overstated.
- The cost estimates, particularly in relation to roads and airports) are understated.
  - The indirect costs of measures (such as increases in transport costs and greenhouse gas emissions as a result of changes to routes, etc.) are not

[153] Bristow, A.L. and Wardman, M. (2015) Comparing noise nuisance valuation estimates across methods, meta-analysis, time and space. Paper presented at the 22nd International Congress on Sound and Vibration (ICSV 22), Florence, Italy, 12-16 July 2015.

included. These are nevertheless likely to be low relative to the direct costs of measures.

- The **test case costs and benefits are not necessarily representative** of the situation across the EU and the extrapolation was performed using a limited sample.
- **The degree to which costs and benefits can be attributed to the END is partly unknown.** For example, some of the measures that have been included in the analysis began to be implemented before the first round of NAPs were published and there may also be other reasons (unrelated to the END) why noise levels have diminished in certain areas (e.g. changes in the road network, or infrastructure upgrades). In the absence of any quantitative evidence relating to the effects of other (non-END) interventions, various assumptions have been made around the extent to which the costs and benefits of measures can be attributed to the END.

- In particular, the analysis assumes that the degree of attribution is lower in those MS in which noise legislation was in existence prior to the introduction of the END (assumes only 50% attribution in the base case) and that the benefits are highest in situations where no previous noise legislation existed but where a NAP has been produced. The specific levels of attribution that have been applied in the analyses are set out in the sections relating to each of airports, roads, railways and agglomerations that follow. While different assumptions about the level of attribution have been tested in the sensitivity analyses, the assumptions that have been applied were formulated for the purposes of illustration only using professional judgement and may not accurately reflect the actual situation.

It is also important to note that there are a number of potentially important effects that the CBA does not consider. There are various reasons for this including difficulties in establishing reliable estimates of the impacts[154] and the potential for double counting. Some of these effects include:

- The influence of the END on **land use planning and residential development.** This is because it is not possible to place a monetary value on the contribution of the END to land use planning in such a way that it could be incorporated into the CBA. There is nevertheless evidence to suggest that noise concerns, driven by the END, are relevant to the siting and design of new developments. For example, Planning Practice Guidance and Planning Advice Notes issued by the Governments of England and Scotland respectively promote the appropriate location of new potentially noisy development, and a pragmatic approach to the location of new development within the vicinity of existing noise generating uses, to ensure that quality of life is not unreasonably affected and that new development continues to support sustainable economic growth.
- The effects of the END on direct, indirect or induced **employment.** Again, it is not straightforward to quantify the contribution of END to employment in monetary terms. It is nevertheless likely that there will have been some employment gains in terms of the specific requirements of the END in relation to preparation of strategic noise maps and action plans, as well as in the design and implementation of noise-reduction measures.
- The impacts of measures such as changes in flight paths, ascent/descent rates and scheduling on **greenhouse gas emissions and air quality**. While it is theoretically possible to calculate the additional air miles (and hence emissions and impacts) accrued as a result of changes in flight paths and scheduling, this would necessitate the collection and analysis of a number of additional datasets from across the test

[154] In this case, the effort applied was proportionate to the estimated magnitude of the impact, outcomes at stake and resources available. Impacts were excluded from the analysis in cases where the level of effort required to generate quantified estimates was considered disproportionate to the importance of the impact relative to other impacts.

cases. This was not considered proportionate to the outcomes at stake and the time available.

The quantitative analysis also does not consider other relevant benefits of the END in relation to:

- **Raising awareness of and stimulating discussions around environmental noise as an issue.** Data from noise mapping has supported assessments of the effects of changes in environmental noise on health, productivity and ecosystem services which in turn have been used to influence decision-makers.
- **Generating large and consistent datasets on noise** (through SNMs) that have been invaluable in advancing research on the effects of noise on health and productivity.
- **Supporting actions in other areas** (e.g. development of technical standards, emission levels and other Directives) that have a positive effect on noise levels, unless these can be explicitly linked to the END.

A summary of the 19 test case findings for each of major airports, roads, railways and agglomerations is provided below. The results presented in the tables below represent a situation in which 100% of the costs and benefits can be attributed to END implementation, unless otherwise stated. Benefit estimates are also presented in terms of central (base case), low and high values which are summarised in the table below. The low and high values represent the end point of the range in which the actual values are expected to lie and reflect differences in underlying assumptions regarding the value of a life year (VOLY) and the disability weights for each of sleep disturbance and annoyance.

Table 3.16 - Parameters used for sensitivity testing

	Base case	Test 1 (Low / worst case scenario)	Test 2 (High / best case scenario)
Disability weight for annoyance	0.02	0.01	0.12
Disability weight for sleep disturbance	0.07	0.04	0.1
VOLY	€110.987	€67,163	€154,812

Airports

The test cases covered five airports:

- Glasgow (United Kingdom)
- Stuttgart (Germany)
- Athens International (Greece)
- Vienna International (Austria)
- Frankfurt (Germany)

For the purposes of extrapolating the test case data across all major airports, the costs and benefits of each of the five test cases have been applied to other airports across the EU using information on both the airport size (total annual air traffic movements and size of the population exposed to harmful levels of noise (> 55 dB L_{den}). For each class, the average (median) size of the population exposed to noise levels exceeding 55 dB L_{den} was estimated using information from the EIONet database. All EU-28 airports that are required to report and for which data exists have been classified into one of the size bands shown in Table 3.17 below. The table also shows which of the test cases correspond to each class.

So, for example, Glasgow is taken to be broadly representative of all airports with fewer than 100,000 air traffic movements per year although, where considered necessary, further adjustments have been made (see Appendix D) to the test case data prior to extrapolation to account for any known anomalies (e.g. maturity in addressing noise issues or location) that may determine whether or not the test case estimates can be considered representative of other airports of that size.

Table 3.17 - Classification of test case airports by size

Airport	Representative of airports with annual air traffic movements
Glasgow	<100,000
Stuttgart	100-150,000
Athens	150-200,000
Vienna	200-250,000
Frankfurt	>250,000

For each test case, the number of people exposed above 55 dB L_{den} is used to derive per person estimates of costs and benefits. It is important to note that this cost or benefit per person is not the cost or benefit per single beneficiary of the noise reduction measures; rather, it is an averaged cost or benefit that considers both those people that benefited from the noise reduction measures and those that did not. The average benefit per person is therefore simply an indicator of the performance at airport level. Neither is it an assessment of the effectiveness of specific measures (i.e. the value of the benefit derived by those that directly benefit from the measure), as the beneficiary population is a subset of the total population affected by noise.

On the basis of the test case data, the discounted **administrative costs** of END implementation (noise mapping, consultants, etc.) vary between €52,000 (at Athens airport) and almost €3 million (at Frankfurt airport). The variation in costs can be explained, at least partly, by the level of effort (including extent of public consultation) invested in preparing the NAPs. For Vienna airport, for example, the NAP is a relatively simple document prepared by a single person over a short period of time. However, in other cases (e.g. Frankfurt), the process of preparing a NAP is an extensive exercise involving multiple people (which may include consultants) and public consultation. The cost per affected person has also been calculated using information on the total population exposed to noise levels in excess of 55 dB L_{den} before the implementation of measures.

The range of measures implemented across airports is quite similar and includes a mix of operational changes, flight time restrictions and noise insulation measures (sound proofing and ventilation). However, the **costs of measures** published in the NAPs vary significantly. There are a number of possible explanations for this. First, in some EU MS, the costs of measures are estimated on the basis of all measures that could potentially be implemented while in others the costs relate only to those measures for which a specific budget has already been allocated. Second, the costs are likely to vary by the size of the population affected: the larger the total number of households affected, the greater expenditure is to be on sound-proofing measures (one of the most commonly applied measures to reduce noise from airports). And third, some airports (more than 15) will have introduced noise reduction measures some time ago in response to national legislation and can now only make marginal improvements while others will be starting from a completely different base.

Moreover, the costs presented in the test cases are not directly comparable because they cover different measures (e.g. Stuttgart only includes costs of soundproofing measures) while in others (e.g. Vienna) they are relatively complete. The actual costs of measures were not available for Glasgow or Athens and therefore these costs were estimated using secondary information (e.g. the Glasgow Airport Master Plan) and assumptions made on the basis of professional judgement (e.g. it is assumed that only 0.5% of the total costs of improvements at Glasgow Airport are related to measures to reduce noise levels).

The table below shows the costs associated with each of the test case airports.

Table 3.18 - Summary of costs of END implementation for major airports (test cases)

	Glasgow	Stuttgart	Athens	Vienna	Frankfurt
Size (ATMs, 2014)	83,999	127,678	154,530	249,989	469,026
Representative class	< 100,000	100-150,000	150-200,000	200-250,000	>250,000
Population exposed to noise > 55 dB L_{den}	68,800	44,200	14,970	12,300	238,700
Costs of END implementation (administrative costs)					
Total costs of implementation (€)	101,127	120,362	51,776	70,367	2,600,849
Cost per affected person (€)	1.47	2.72	0.80	5.72	10.90
Costs of measures					
Total costs of measures (€)	287,759	54,366	523,979	21,965,699	12,449,063
Cost per affected person (€)	4.18	1.23	8.14	1,785.83	52.15
Total costs (€)	**388,886**	**174,728**	**575,755**	**22,036,066**	**15,049,912**
Total costs per person (€)	**6**	**4**	**9**	**1,792**	**63**

For the purposes of extrapolation, the test case estimates have therefore been adjusted to take account of:

- The reliability and completeness of the data in the test case (e.g. whether the costs have been obtained from primary sources, published information or estimated using secondary data and whether they cover the costs of all measures are only a selection of measures);
- The relative size (in terms of aircraft movements per year) of each of the test case airports in relation to other airports within that size band;
- The characteristics of the test case airport to which they apply (e.g. number of runways and density of surrounding population) relative to a 'typical' airport within the corresponding size band; and
- The extent to which the public was consulted in the development of the NAPs for each of the test case airports (where known) as this has a bearing on the administrative costs.
- The administrative costs of END implementation are assumed to be the same for all airports and are estimated to be around €5 per noise-affected person. This is slightly higher than the median of the test case values but accounts for the fact that the per person costs at Glasgow and Stuttgart Airports are likely to be lower than at other airports as the total costs are spread across a much larger population while the opposite is true of Frankfurt airport.

For the costs of measures, the average (€919) of the estimates from the Vienna (€1,785) and Frankfurt (€52) test cases has been used. The Vienna and Frankfurt costs estimates are considered to be the most reliable as they are based on published information and cover a range of typical measures implemented at airports. The costs of measures for all the other airports are either incomplete (they cover only selected measures) or have been derived from secondary information. The per person estimates have then been scaled up to provide estimates of the total costs of measures based on the median size of the population exposed to noise levels exceeding 55 dB L_{den} for all airports in each size band.

A further distinction is then made between those airports that had noise legislation prior to the introduction of the END and those that did not. For those airports with pre-existing legislation, it is assumed that some of the costs of measures would have been incurred anyway in order to comply with domestic regulatory requirements. It is thus assumed that only 50% of the total costs can be attributed to END for airports within MS that had noise legislation prior to the introduction of the END.

Finally, the adjusted costs are extrapolated across all EU-28 airports by assuming that all the airports within each size band will incur the same costs as the model or representative airport. The total cost for the representative airport (for each of without and with pre-existing noise legislation) is then multiplied by the total number of airports within that size band to provide an indicative cost across the EU-28 major airports for which exposure data was available.

The analysis was then further refined to take account of the status of NAPs for each of the major airports. It is assumed, for example, that in the case where an airport has not produced a NAP, then it should also be attributed a lower level of costs (and benefits). In effect, the absence of a NAP is taken to indicate that the implementation of noise-reduction measures is not necessarily driven by the END; it may, however, be driven by pre-existing legislation or other factors (e.g. pressures from the local community or other interest groups). As such, the costs and benefits associated with the implementation of measures are likely to have been incurred regardless of the END.

Similarly, for airports in MS with no pre-existing noise legislation but where a NAP has been produced, then it is assumed that 100% of the costs (and benefits) can be attributed to the introduction of the END. For those airports with pre-existing legislation, it is assumed that some of the costs of measures would have been incurred anyway in order to comply with domestic regulatory requirements. It is assumed that only 50% of the total costs can be attributed to END for airports within MS that had noise legislation prior to the introduction of the END. The specific factors that have been used to attribute costs to END for each major airport type within each band are shown in Table 3.19:

Table 3.19 - Factors used to attribute costs to major airports in the base case

Status	%
No legislation, NAP	100
No legislation, no NAP	25
Legislation, NAP	50
Legislation, no NAP	50

Similar to the approach described above, the costs for each model/representative airport are then multiplied by the number of airports within that category, (taking account of both NAP status and whether or not the airport is within a MS with pre-existing noise legislation. The resulting estimates are shown in Table 3.20 below.

Table 3.20 - Total costs of END implementation for major airports across the EU

Airport size	< 100,000	100-150,000	150-200,000	200-250,000	>250,000	Total
No. of airports within class without pre-existing legislation and with a NAP	1	-	1	1	1	4
Total costs (€, millions)	2.77	-	9.42	8.13	1	21.25
No. of airports within class without pre-existing legislation and with no NAP	9	2	1	1	2	15.00
Total costs (€, millions)	24	2	0.0	11	12	49.50
No. of airports within class with pre-existing legislation and with a NAP	9	5	5	2	4	25
Total costs (€, millions)	2	29	21	2	110	164.29
No. of airports within class with pre-existing legislation and with no NAP	18	4	4	1	3	30
Total costs (€, millions)	25	34	82	14	48	202.59
GRAND TOTAL (€, millions)	54.33	65.05	112.52	35.46	170.27	437.63

The benefits associated with the implementation of noise reduction measures are driven largely by the change in the size of the exposed population and will therefore be more significant for those airports that have higher populations exposed to higher levels of noise and where measures to reduce harmful levels of noise have been introduced under the END.

It is important to note that data from Strategic Noise Mapping (SNM) does not reflect the effects of sound-proofing measures. This is because noise measurements are taken at the external façade of buildings and thus do not take account of the reduction in indoor noise levels that would be obtained as a result of sound-proofing. Where necessary (i.e. where the change in the size of the exposed population is based on SNM data, the benefit estimates have been adjusted (by setting the population exposed to night-time levels in excess of 50 dB L_{night} after measures to zero) to take account of the reduction in indoor noise levels and thus sleep disturbance results.

On this basis, the discounted total benefits over a 25-year assessment period range from €37 million at Stuttgart Airport to €1,046 million at Frankfurt airport – see Table 3.21 below. On a per person basis, and using the available test case data, the benefits range from €84 at Stuttgart to €495 at Glasgow.

Table 3.21 - Summary of benefits of END implementation for major airports (test cases)

	Glasgow	Stuttgart	Athens	Vienna	Frankfurt
Size (Total air traffic movements, 2014)	83,999	127,678	154,530	249,989	469,026
Representative class	< 100,000	100-150,000	150-200,000	200-250,000	>250,000
Population exposed to noise > 55 dB L_{den}	68,800	44,200	64,364	12,300	238,700
Health benefits of END implementation					
Total benefits (€, millions) - central values; 100% attribution	340	37	107	54	1,046
Benefit per person (€, millions) - central values; 100% attribution	494.62	83.72	166.25	442.98	438.07
Total benefits (€, millions) - low values; 100% attribution	121	1	50	3	431
Benefit per person - (€) - low values; 100% attribution	1,763.08	27.92	783.38	230.51	1,807.24
Total benefits (€, millions) - high values; 100% attribution)	1,371	8	236	49	2,702
Benefit per person - (€) - high values; 100% attribution	19,920.48	183.74	3,668.93	4,007.73	11,321.07

For the purposes of extrapolation, we have used the median value of the central, low and high values (€4,380.69, €783 and €4,008 respectively) of the benefits per person across the five test case airports.

Similar to the approach used for the cost estimates, the per person benefit estimates are then scaled up to derive an estimate of total benefits based on the size of the median population exposed to noise levels in excess of 55 dB L_{den} for all airports within that size band (and for which data was available) and taking account of whether or not airports are located in MS with pre-existing noise legislation. The attribution factors applied within each of the scenarios are set out in the table below.

Table 3.22 - Attribution factors for estimating benefits from major airports

	Scenario		
	Low (Worst case) (% attribution)	Base Case (% attribution)	High (Best case) (% attribution)
No pre-existing noise legislation	50	50	100
Pre-existing noise legislation	25	50	100
Values	Low	Central	High

Note that the median exposure values for airports with more than 250,000 air traffic movements (ATMs) are likely to be skewed heavily by the presence of Heathrow Airport within this class. More people are affected by noise at Heathrow than at any other major European airport.

More than three times as many people fall within Heathrow's 55 L_{den} contour than at Frankfurt, which has the second highest number of people exposed to noise at this level[155]. The total benefits for airports within the > 250,000 size band may thus be somewhat exaggerated, particularly for those airports within fewer than 400,000 air traffic movements per year.

The benefits per airport in each size category are then extrapolated across all EU-28 airports by multiplying the total benefits in each size band and under each scenario by the total number of airports in each category, and accounting for whether or not each of the major airports had NAPs in place. It is assumed that where a major airport is located in a Member State that had no pre-existing noise legislation and the airport has produced a NAP, then 100% of the benefits can be attributed to END. In contrast, where there is no pre-existing legislation and no NAP, then only 25% of the benefits are attributed to the END. This is considered a conservative assumption as it is possible that no measures have been implemented at airports for which neither domestic noise legislation nor NAPs exist. The EU-wide figures are discussed further under the Aggregate Assessment heading and are shown in Table 3.29 (base case), Table 3.31 (worst case) and Table 3.32 (best case).

Major roads

The test cases covered major roads in two MS:

- Austria (2,500km)[156]
- Greece (75km – the Attica Tollway)

These test cases were selected on the understanding that it would be possible to obtain relevant information on noise exposure, the direct costs of END implementation and the costs of measures and because they are sufficiently different that they could illustrate the range within which the costs and benefits of other major roads across the EU-28 are most likely to lie. It is important to note that the per person costs and benefits are calculated as the total costs and benefits divided by the whole of the population affected by noise levels greater than 55 dB L_{den} and not just the beneficiaries of noise reduction measures.

The Attica Tollway serves as a ring road for the greater metropolitan area of Athens and, as such, the population density along the road is relatively high. By contrast, the major roads in Austria traverse much of the country and pass through both highly populated and less populated areas. In order to improve the reliability of the extrapolation, estimates of the administrative costs from the two test cases was supplemented by information that was collected at a Member State level to support the implementation review (see Section 3.2.4.2) and which was comparable to the test case data (in terms of coverage or unit of analysis) and thus could be easily incorporated into the CBA. In this light, suitable supplementary information on administrative costs and measures was available from France, Spain and England (within UK) only.

The table below shows the costs estimates for each of the test case roads, as well as the supplementary cost information.

155 http://www.aef.org.uk/issues/aircraft-noise/

156 Note that although the total length of major roads reported in the EIONet Database is over 5,000 km, the test case only considers those roads that fall under the responsibility of the national authority. Roads that fall under the responsibility of federal authorities were not included in the test case.

Table 3.23 - Costs of END implementation along major roads (test cases)

	Austria	Greece	Spain	France	UK (England only)
Total length of road	2,500	70	19,552	24,972	25,472
Total population affected by noise (before measures)	591,001	28,000	1,243,600	3,492,200	5,704,000
Average population density (people per km)	236	400	64	140	224
Costs of END implementation (administrative costs)					
Total costs of implementation (€)	1,004,838	40,938	3,739,906	4,000,000	117,720.60
Total implementation costs per km (€)	401.94	584.83	191.28	160.18	4.62
Cost per affected person (€)	1.70	1.46	3.01	1.15	0.02
Costs of measures					
Total costs of measures (€)	146,579,116	63,602,648	178,335,906	178,335,906	62,470,750
Total costs of measures per km (€)	58,632	908,609	9,121	7,141	2,453
Cost per affected person (€)	248.02	2,271.52	143.40	51.07	10.95
Total costs (€)	**147,583,954**	**63,643,586**	**182,075,812**	**182,335,906**	**62,588,471**
Total costs per km (€)	**59,034**	**909,194**	**9,312**	**7,302**	**2,457**
Total costs per person (€)	**250**	**2,273**	**146**	**52**	**11**

As can be seen from the table above, the total costs of END implementation (administrative costs plus costs of measures) vary substantially, ranging from €2,453 per km in England to over €900,000 per km in Greece. When considering the average population density along major roads, the costs range from around €11 per person per km in England to over €2,200 per person per km in Greece. These costs are not, however, strictly comparable as they:

- Cover different packages of measures. For example, the Greek test case considers only the costs of a noise barrier while the Austrian test case considers a range of measures including implementation of barriers, walls and/or passive noise protection.
- Apply to different lengths of roads and population densities along the road. For example, the average number of people per km of road is almost twice as high in Greece as it is in Austria.

The differences in costs are also likely to reflect, at least to some extent, the different stages that these MS are at in terms of addressing road traffic noise and therefore what levels of expenditure are still required to reduce exposure of the population to harmful levels of noise. The test case cost data was then scaled up to an EU level taking account of:

- The total length of major roads in EU MS with more than 3 million vehicle movements per year;
- The availability of information on road noise exposure in those MS that are required to report on road noise;
- The average density of the population per km of road, grouped into four broad classes;
- The median size of the population exposed to noise levels higher than 55 dB L_{den} and 50 dB L_{night} within each class;
- Whether or not each of the MS within that class had pre-existing noise legislation. The same assumptions as those used for the analysis of airports (see Table 3.22) were applied in relation to levels of attribution; and
- The range of costs (low, medium and high).

The benefits of END implementation along major roads are estimated in respect of changes in the number of people exposed to harmful levels of noise as a result of the implementation of noise abatement measures and the associated improvements in health. For each test case, the total benefits were estimated for a central (most likely) scenario and by varying the parameters to provide the extent of the range in which the value of benefits could potentially lie. The table below shows the estimated total benefits and average benefits per person assuming 100% attribution and using central estimates for disability weights and VOLYs.

Table 3.24 - Benefits of END implementation for major roads – test case summary

	Austria	Greece
Benefits (€, millions), assuming 100% attribution and using central estimates for disability weights and VOLYs	1,267	176
Average benefit per person (€)	2,144	6,303

Using the same approach as for the cost estimates, the test case benefit estimates have been scaled up on the basis of the total length of major roads across the MS for which exposure data was available[157] and accounting for differences in average population density along major roads in different MS, whether or not each MS had pre-existing noise legislation and the proportion of major roads in each MS that are covered by NAPs. The outcomes of the extrapolation are discussed further under the Aggregate Assessment heading and are presented in Table 3.29 (base case), Table 3.31 (worst case) and Table 3.32 (best case).

[157] The estimate does not include Estonia, Cyprus, Slovenia, Hungary and Czech Republic as there was no data available for these Member States.

Railways

For the purposes of the evaluation, two major railways were selected as test cases for analysis. These were selected on the basis that information on costs and benefits (in terms of changes in the number of people exposed to noise from rail traffic) was available. The two test cases were:

- Austria's national rail network, covering some 2,218 km; and
- Two sections (506 km) of railway running through hotspot areas (Malacky and Plavecky Strvtok) in Slovakia. Malacky is an important regional transport hub connected to a highway and national road that services the capital, Bratislava. The train line, which connects Bratislava and the Czech Republic, traverses the city.

Similar to the approach used for airports and major roads, the costs and benefits of END implementation within each of the test cases was used to estimate the average costs and benefits per person for the population exposed to noise levels higher than 55 dB L_{den}. As noted previously, the per person costs and benefits are calculated as the total costs and benefits divided by the whole of the population affected by noise levels greater than 55 dB L_{den} and not just the beneficiaries of noise reduction measures.

The total costs (i.e. costs of compliance plus costs of measures) of END implementation per kilometre are broadly similar for each of the test cases: Slovakia (€6,629 per km) and Austria (€8,944 per km). They are not, however, strictly comparable as they:

- Cover different packages of measures. The Slovakian test case considers only the costs of a noise barrier while the Austrian test case considers a range of measures including implementation of barriers, walls and/or passive noise protection.
- Apply to different lengths of railways and population densities along the railway. The average number of people per km of rail track is approximately 14 times higher in Austria (437) than it is in Slovakia (32) and the number of people per kilometre exposed to noise levels in excess of 55 dB L_{den} is 26 times higher in Austria than it is in Slovakia.

The cost estimates per km have therefore been adjusted to make them more comparable with the benefit estimates by taking account of average population density in each case. On this basis, the costs per person are €20 in Austria and €205 in Slovakia.

The table below shows the costs and benefits respectively for each of the test case roads, as well as some supplementary cost information available from France.

Table 3.25 - Present value costs of END implementation along major railways (test cases)

	Austria	Slovakia	France
Total length of railway (km)	2,218	506	7,239
Total population along length of railway	968,877	16,400	1,018,800
Average population density (noise-affected people per km)	437	32	141
Costs of END implementation (administrative costs)			
Total costs of implementation (€)	487,155	22,689	672,408
Total implementation costs per km (€)	219.64	44.84	92.89
Cost per affected person (€)	0.5	1.38	0.66
Costs of measures			
Total costs of measures (€)	19,350,869	3,331,587	700,000

	Austria	Slovakia	France
Total costs of measures per km (€)	8,724	6,584	97
Cost per affected person (€)	20	203	0.69
Total costs (€)	**19,838,024**	**3,354,276**	**1,372,408**
Total costs per km (€)	**8,944**	**6,629**	**190**
Total costs per person (€)	**20**	**205**	**1.35**

The test case cost data was then scaled up to an EU level taking account of:

- The total length of railways in EU MS with more than 60,000 passages a year;
- The availability of information on railways and noise exposure in those MS that are required to report on railway noise;
- The average density of the population per km of road, grouped into four broad classes;
- The median size of the population exposed to noise levels higher than 55 dB L_{den} and 50 dB L_{night} within each class;
- Whether or not each of the MS within that class had pre-existing noise legislation. The same assumptions as those used for the analysis of airports were applied in relation to levels of attribution; and
- The range of costs (low, medium and high).

As with major airports and major roads, the benefits of END implementation along major railways are estimated in respect of changes in the number of people exposed to harmful levels of noise as a result of the implementation of noise abatement measures and the associated improvements in health. In particular, the benefits are expressed in terms of the reduction in QALYs relating to the decline in noise-related annoyance and sleep disturbance. There are no reliable dose-response relationships for cardiovascular diseases (acute myocardial infarction and hypertension) for railway noise.

For each test case, the total benefits were estimated for a central (most likely) scenario and by varying the parameters (relating to disability weights and the VOLY) to provide the extent of the range in which the value of benefits could potentially lie. The table below shows the estimated total benefits and average benefits per person assuming 100% attribution and using central estimates for disability weights and VOLYs.

Table 3.26 - Benefits of END implementation for major railways – test case summary

		Austria	Slovakia
Low (worst case)	Benefits (€, million), assuming 100% attribution and using low estimates for disability weights and VOLYs	38	16
	Average benefit per person (€)	39	959
Central (base case)	Benefits (€, million), assuming 100% attribution and using central estimates for disability weights and VOLYs	116	47
	Average benefit per person (€)	121	2,899

		Austria	Slovakia
High (best case)	Benefits (€, million), assuming 100% attribution and using high estimates for disability weights and VOLYs	626	199
	Average benefit per person (€)	646	12,158

Using the same approach as for the cost estimates, the test case benefit estimates have been scaled up on the basis of the total length of major railways across the MS for which exposure data was available[158], and accounting for both differences in average population density along major railways in different MS and whether or not each MS had pre-existing noise legislation. The resulting benefits estimates under each of the base case, worst case and best scenarios are shown in Table 3.29, Table 3.31 and Table 3.32 respectively.

Agglomerations

For the purposes of the evaluation, 10 agglomerations were selected as test cases for analysis. These were selected on the understanding that information on costs and benefits (in terms of changes in the number of people exposed to noise from all transportation sources within agglomerations) was readily available, either from the published NAPs or directly from the relevant authorities and other published sources.

The information obtained was, however, incomplete and was not sufficiently comparable across the test cases to support a reliable extrapolation. More specifically, the test cases varied widely with respect to:

- The **types of measures implemented**, the degree of implementation of measures and the number of affected persons exceeding limit values (which are country specific);
- The **sources of environmental noise** (some are affected by road, railway and airport noise while others only by one or two principal sources of noise).
- The **extent to which cost and benefit information was available** for the principal noise sources. For instance, while Nuremberg is affected by noise from roads, railways and airports, it was not possible to determine the combined effects (costs and benefits) of measures to address noise from these sources. Separate analyses were conducted for individual measures implemented in each of the test case agglomerations. These are detailed in Appendix F. Note that information on the costs and benefits of noise-reduction measures in Athens was not available and therefore cost-benefit ratios are only reported for nine of the ten agglomerations.

This is compounded by further challenges in that the agglomerations that are required to report under the END, all differ with respect to:

- **Population size and density**. This has a bearing on the cost-effectiveness of measures, particularly measures of a 'public good' nature (i.e. where the benefits of a measure extend beyond the specific population for which the measure was intended (non-excludable) and where there is no incremental cost of providing the measure to others (non-rivalrous);

[158] The estimate does not include Estonia, Cyprus, Slovenia, Hungary and Czech Republic as there was no data available for these Member States.

- **The principal sources of environmental noise**. While road traffic noise is common to all agglomerations; noise from railways and airports does not apply to all agglomerations;
- The **completeness of information** on the size of the population exposed to harmful levels of noise (> 55 dB L_{den} or 50 dB L_{night}), particularly in relation to noise from airports.

For this reason, rather than extrapolating from the agglomeration test cases, an indicative assessment of the efficiency of END implementation within agglomerations is made by considering the cost-benefit ratios associated with specific measures that were identified in the NAPs for each of the test cases and for which cost and benefit data exists. These measures may be considered typical of the range of measures implemented in agglomerations. It should be noted, however, that the per person costs and benefits are calculated according to the number of direct beneficiaries of the measure rather than according to the total number of people affected by noise levels exceeding 55 dB L_{den} as in the analyses for airports, roads and railways.

The resulting cost-benefit ratios for each of the measures in each test case are summarised in the table below. The costs shown in the table relate to the costs of measures only. The administrative costs associated with END implementation in agglomerations are small relative to the costs of measures (typically no more than around 3% of total costs) and would therefore have a negligible effect on the overall cost-benefit ratios. From the table, it can be seen that the spread in cost-benefit ratios is large, ranging from a situation in which costs appear to exceed the benefits for noise barriers in Munich (1:0.3) to a ratio of 1:14,335 for speed enforcement in Augsburg. Overall, measures to reduce the speed of road traffic and to reduce the numbers of heavy road vehicles appear to be the most cost-effective.

Table 3.27 - Cost-benefit ratios for individual measures in each test case agglomeration

Overview CB-Ratios	Noise source to which the measure applies	Augsburg	Munich	Nuremberg	Essen	Düsseldorf	Malmö	Bucharest	Bratislava	Helsinki
Noise proof window campaign	Roads Rail	1:11	1:8	1:14	1:25	1:18	1:15	-	-	-
rehabilitation of roads/low noise road surfaces	Roads	1:4	1:16	1:21	1:10	1:8	-	1:3	1:10	-
Speed reduction (speed limits)	Roads	1:119	1:335	1:301	1:112	-	-	-	-	-
Speed control (enforcement)	Roads	1:14,335	-	-	-	-	-	-	-	-
re-distribution /reduction of number of heavy trucks	Roads	-	-	-	1:6321	-	-	-	-	-
Barriers/walls	Roads	-	1:0.3	-	-	1:5	-	-	1:7	1:1.2
Embedded tracks for trams	Light rail (tram)	-	-	1:6	-	1:3	-	-	-	-

Overview CB-Ratios	Noise source to which the measure applies	Augsburg	Munich	Nuremberg	Essen	Düsseldorf	Malmö	Bucharest	Bratislava	Helsinki
Acoustical grinding of tracks	Rail / tram	-	-	1:74	-	-	-	-	-	-
Vegetated tram tracks	Light rail (tram)	-	1:1	-	-	1: 1	-	-	-	-

Administrative costs at EU level

In addition to the costs incurred at Member State level, the costs of administration, reporting, research and evaluation at the supra-national level (i.e. by the European Commission, European Environment Agency and Joint Research Centre) also need to be taken into account.

The costs (undiscounted) incurred to date (2002-2015) for each of the implementing authorities at European level are shown in the table below:

Table 3.28 - Costs of END implementation at supra-national level

	Staffing costs	Other costs (e.g. of meetings, missions, etc.)	Total costs
European Commission's DG ENV[159]	2,112,000	462,000	2,574,000
European Commission's Joint Research Centre (est.)	not provided	not provided	93,333
European Environment Agency	not provided	not provided	1,694,000

Aggregate assessment

Combining the information on administrative costs incurred at the EU level and the extrapolated values derived from the test cases, it is possible to provide an indicative assessment of the overall efficiency of the implementation of the END. The overall findings in the base case are summarised in the table below. The costs incurred at EU level relate to the discounted costs associated with administration, management and monitoring of implementation of the END by the European Commission's DG ENV and the European Environment Agency. While the Joint Research Centre is part of the European Commission, this information was available separately and therefore has been presented as such.

The present value costs for each of major airports, major roads and major railways encompass both administrative costs (at MS level) and costs of measures. These costs also account for the status of NAP implementation (i.e. differentiating between those Member States who have completed, or at least partially completed their NAPs and those

[159] Note that costs here exclude the costs of the Joint Research Centre (JRC) which is part of the European Commission. These are presented separately below.

who have not). A summary of the assumptions governing the level (%) of attribution of the total estimated costs and benefits in each of the base case (central), worst case and best case scenario are set out in Table 3.30.

Note that aggregate cost-benefit ratios have not been calculated for agglomerations as the test cases did not provide a sufficiently representative sample from which to extrapolate. However, the test case data and the cost-benefit analyses for a range of typical measures employed in agglomerations (see Table 3.27), suggest that the benefits of measures to reduce noise in agglomerations substantially outweigh the costs although the ratios vary significantly between measures.

Table 3.29 - Aggregate assessment of costs and benefits at the EU scale under the base case (most likely) scenario

	Total present value costs (€, million)	Total present value benefits (€, million)	Net present value (€, million)	Cost-benefit ratio
Administrative costs incurred at EU level	3	-	-	-
Major airports	438	2,854	2,416	1:7
Major roads	667	24,248	23,581	1:36
Major rail	82	7,317	7,235	1:89
TOTAL	1,190	34,418	33,228	1:29

Table 3.30 - Percentage of costs and benefits attributed to END in each scenario for major airports, major roads and major railways given Member States' status in terms of pre-existing noise legislation and NAP completion

	% costs and benefits attributed to END					
	Worst case scenario		Base case (central) scenario		Best case scenario	
	Costs	Benefits	Costs	Benefits	Costs	Benefits
No pre-existing legislation; NAP submitted/underway	100	50	100	100	100	100
No pre-existing legislation; no NAP	25	25	25	25	25	25
Pre-existing legislation; NAP submitted/underway	50	25	50	50	50	100
Pre-existing legislation; no NAP	50	25	50	50	50	100
Cost / benefit values	Low		Central		High	

Note that the benefits (and costs) are assessed over a 25-year assessment period and the analysis assumes that the same level of benefits will be delivered year-on-year from the time the expenditure on measures was made until the end of the assessment period. Shortening the assessment period, and thus the flow of benefits relative to the costs, will substantially reduce the Net Present Value (NPV). For example, if the assessment period were reduced to 18 years such that the effects of measures only endure for 5 years after the final year of investment, rather than the current 12 years, the NPV for major rail in Austria almost halves. It is likely that, at least in some cases, reducing the flow of benefits would result in negative NPVs and cost-benefit ratios.

Under the assumptions used in the base case scenario, the aggregate cost-benefit ratio (i.e. at the EU-level), excluding agglomerations, is 1:29. This implies that every €1 invested in efforts to address noise issues across the EU, yields around €29 worth of benefits. However, it is important to recall that the cost and benefit estimates are partial (they do not cover every single measure identified in NAPs), the benefit estimates are understated (they only account for highly annoyed and highly sleep disturbed populations) and the extent to which costs and benefits of measures can be attributed to the END is unknown.

Notwithstanding these limitations, the outcomes suggest that the END is efficient overall when the benefits of measures implemented to reduce noise levels are considered. The NPV is positive under all scenarios (base case, best and worst case) and only negative for airports and roads under the worst case scenario.

The corollary of this is that if the END did not exist, it can be assumed that some noise mitigation measures would still go ahead anyway because measures identified in NAPs were driven by national regulations or there were other primary regulatory drivers, such as introducing speed limits to help reduce pollution and comply with air quality limits. However, at least some measures would not have been identified and / or already implemented had it not been for the existence of the END. There would therefore have been a higher number of exposed persons to environmental noise, with significant implications for the health and well-being of those affected by noise as a result.

The worst case scenario (see table below) is modelled using the highest cost estimates and the lowest benefit estimates where the benefit estimates are in turn based upon the low values for the disability weights, VOLY and assuming that only 25% of the benefits can be attributed to the END in the case that noise legislation within the MS pre-dated the introduction of the END. The benefits are, however, understated (for the reasons cited above) and thus the probability of such a situation actually arising is considered to be low and, for airports at least, the benefits may at least equal the costs.

Table 3.31 - Aggregate assessment of costs and benefits at the EU scale under a worst case scenario

	Total present value costs (€, million)	Total present value benefits (€, million)	Net present value (€, million)	Cost-benefit ratio
EU level	3			
Major airports	438	276	-161	2:1
Major roads	28,961	5,971	-22,989	5:1
Major rail	1,417	2,238	820	1:2
TOTAL	12,426	9,471	-2,955	1:0.76

In contrast, the best case scenario is modelled using the low cost estimates and high benefit estimates and assumes that 100% of the calculated benefits can be attributed to the END except for those MS in which there was no noise legislation prior to the introduction of the END and where no NAP has been published. As may be expected, under the best case scenario, both the NPV and cost-benefit ratios are positive (see Table below), with a return on investment of approximately €327 for every €1 spent (excluding agglomerations). However, under a worst case scenario, only expenditure on measures to reduce noise from railways yields a positive NPV and cost-benefit ratio.

Table 3.32: Aggregate assessment of costs and benefits at the EU scale under a best case scenario

	Total present value costs (€, million)	Total present value benefits (€, million)	Net present value (€, million)	Cost-benefit ratio
EU level	3	-	-	-
Major airports	438	4,915	4,477	1:11
Major roads	38	126,540	126,503	1:3341
Major rail	3	26,004	26,001	1:9474
TOTAL	481	157,459	156,977	1:327

3.2.4.8 Conclusions - efficiency

Since it is not possible to assess the END's efficiency through a straight forward input-output relationship (for reasons explained at the outset of the efficiency section (see "methodological issues in assessing the efficiency and cost-effectiveness of the END"), efficiency has instead been assessed by means of a cost-benefit analysis (CBA) that includes the costs and benefits of measures identified in NAPs to reduce harmful levels of noise.

However, stakeholders have different opinions as to whether noise management measures should be factored into the CBA of the END, since these are not a specific requirement of the Directive. A strict assessment of the efficiency of the END would therefore be limited to a comparison of the direct compliance costs (i.e. noise mapping, preparation of action plans and reporting) and the qualitative benefits that arise from these activities (e.g. raising awareness of noise as an issue, generating large and consistent datasets on noise (through SNMs) that are valuable for advancing research on the effects of noise on health and productivity, and supporting actions in other areas (e.g. development of technical standards, emission levels and other Directives) that have a positive effect on noise levels.

Stakeholders generally agreed that the magnitude of benefits from END implementation should increase over time, for instance in terms of the utility of data collected at EU level as this becomes more comparable through the implementation of CNOSSOS-EU (which will be voluntary in R3 and mandatory in R4 It is not possible to quantify these benefits in monetary terms and therefore the assessment was extended to account for the implicit objectives of the END, i.e. to reduce exposure to noise, by considering the costs and benefits of noise reduction measures.

- Whilst assessing the cost-effectiveness of individual / groups of measures in NAPs will provide useful cost-benefit data, it should be recalled that this can only be considered as an indirect indication of the END's efficiency, because the END only requires the drawing up of a NAP but does not formally require measure implementation (even if this is implicit).
- Measure-level costs and benefits could therefore be classified as indirect costs (and benefits) rather than direct compliance costs. Nevertheless, establishing cost-benefit ratios at the measure level is useful in order to help persuade MS of the scale of benefits of implementing expenditure measures relative to the costs and to the evaluation question as to how far the END has contributed to reducing the problem of environmental noise by 2020.
- The costs of implementing noise abatement, mitigation and reduction measures identified in NAPs as part of noise management are likely to significantly exceed the administrative costs of complying with END, particularly since in many MS, the latter have declined between R1 and R2, since there are no longer the initial one-off costs associated with introducing new EU legislation.

- Overall, the END appears to be cost-effective in that the benefits are likely to outweigh the costs over time. However, there are problems in assessing the benefits at this early stage of measure implementation, given the long-term nature of many noise mitigation programmes and measures.
- Whereas the costs of many noise mitigation and abatement measures arise in the early years of measure implementation but may extend over the full implementation lifecycle, the benefits arising may only fully materialise after the end of the implementation and are likely to extend for many years into the future.
- The percentage of R1 NAPs that include "fully implemented" measures at this stage in the END implementation lifecycle is relatively low. This could arguably be expected as the NAPs are outlining a course of action to address noise over the coming 5 years, and many measures extend beyond a single round into the subsequent round.
- The implication of this for the CBA extrapolation work to the EU level is that it is difficult to know how many measures were actually implemented across the EU-28 since no systematic monitoring of whether measures in NAPs are partially or fully implemented, or not implemented at all, is carried out. Some measures are identified in the NAPs as already underway or completed, while others are only planned.
- There appears to be a favourable benefit-cost ratio for most types of noise mitigation measures, but there is considerable variation in the level of benefit, depending on whether a worst-case or best-case scenario is applied.
- As noted earlier, the level of benefit is strongly dependent on discounting to take the extent of attribution into account. Determining an appropriate attribution ratio is not straight forward due to the particular nature of the END, which is dependent on MS implementing measures at national, regional and local level through NAPs but using national funding sources. There is a perception that many measures have at least some form of national dimension, and some measures may pre-date the END.
- Although the benefits will only be realised in full after 2017, it is not uncommon that the cost curve in implementing new legislation is centred on the initial stages of implementation (including one-off costs) whereas the benefits of bringing about a common, harmonised approach to noise mapping through a common assessment method will only fully materialise over the longer term.
- The administrative costs of END implementation have typically declined considerably in R2 compared with R1. This was found to be partly due to the economic crisis and associated budget cuts, but equally due to one-off, upfront costs of END implementation, which tend to be higher than recurring costs such as the procurement of external technical expertise to produce Strategic Noise Maps and other technical support from consultants.
- The reporting mechanism for SNMs – set up by the EEA in close conjunction with the EC - was generally regarded as being efficient and effective, although the quality check by the EEA could perhaps be extended to include NAPs.
- It is difficult to draw strong conclusions about the cost-benefit ratio of the END at EU level based on test case estimates.
- While the test case findings suggest that the benefits of END implementation exceed the costs of measures for all noise sources, and under a range of scenarios, the costs and benefits per person vary significantly and will depend on a number of factors including population density, background noise levels, traffic composition and the degree of maturity in addressing noise issues (which in turn will influence the selection of measures and background noise levels).

- Taking account of the data limitations and the assumptions applied, the total present value costs (including costs of implementation linked strictly to the END as well as costs of measures) across the EU-28 (excluding agglomerations) range from around €480 million to €30.8 billion over a 25-year period while the total present value of benefits (again excluding agglomerations) range from around €8.5 billion to €157 billion.

- Although it was not possible to evaluate the efficiency of END implementation in agglomerations in the same way, the analysis of the relative costs and benefits of a number of typical measures suggests that the benefits of END implementation are likely to significantly outweigh the costs even though the cost-benefit ratios vary widely between measures. For example, the of noise barriers along roads in Munich appear to exceed the benefits by a ratio of 1:0.3, while speed enforcement measures on sections of roads in Augsburg have very low costs in relation to the benefits with a cost-benefit ratio of 1:14,335. Overall, and on the basis of the available information, measures to reduce the speed of road traffic and to reduce the numbers of heavy road vehicles in agglomerations appear to be the most cost-effective.

More broadly, there are several key lessons learned from this study relating to how to **improve the assessment of the efficiency of the END in future evaluations**. These are summarised in the Box below and are important to keep in mind in reviewing the section on the efficiency of the END:

Box 3.8 - Assessing the efficiency of the END – lessons learned through the evaluation

- Since measures are not obligatory, but only voluntary, this raises a question as to whether the most appropriate way to measure the Directive's cost-effectiveness is through a measure-based approach.
- Not all NAPs include spending measures and where these are included, they may not be sufficiently detailed to allow for a reliable estimation of the associated benefits.
- There are many NAPs across EU-28 where measures may have gone ahead, but there is no reliable data on these. This raises an issue as to the need to strengthen monitoring and reporting as to whether measures identified in NAPs have actually gone ahead (and if yes, which measures and whether this was in full or partially).
- Evidence was identified during the selection of suitable NAPs for the case studies, no spending measures have actually take place at all yet in the case of many NAPs, especially within agglomerations, where local authorities often do not have either the budget or the decision-making and spending powers to go ahead with measures identified.
- Stakeholders also emphasised that qualitative factors should also be taken into account in assessing cost-effectiveness, not least because many of the benefits of the END are not possible to quantify, such as promoting a more strategic approach to environmental noise management, encouraging joined up working across different Ministries on noise at receiver-related issues across different policy areas and sources.

3.2.5 European Added Value (EAV)

The assessment of European Added Value (EAV) considered how far the END has added value and contributed to the achievement of objectives over and above what could have been achieved at national level alone. The counterfactual, i.e. what would have happened in the absence of the END, and what would happen if the END were to be repealed in future, was also considered.

3.2.5.1 Overall European Added Value of the END

Introduction

The added value of a European approach to the management of environmental noise is linked to the issue of the different competences of the EC and MS respectively. To recap, whereas the MS have competence for tackling environmental noise at receptor and for END implementation at national level, in line with subsidiarity principles, the EC is responsible for ensuring the effective coordination of END implementation and for monitoring, reporting and data collection. In addition, the linkages between EU-level data collection on population exposure through noise mapping within the END and informing European noise at source legislation should also be recalled.

Among the implications of implementing the END under subsidiarity are for instance that the Directive does not set limit values at receiver, but instead leaves the decision as to whether to set binding or non-binding LVs to the discretion of the MS, who are also responsible for enforcement, wherever these are binding.

3.2.6 EQ14 - What has been the overall EU added value of the Environmental Noise Directive?

In assessing this EQ, it has been important to compare the baseline situation before the END was adopted with the situation now. In this regard, among the sub-questions that were analysed are:

- **EQ14a -** To what extent did EU Member States have environmental noise legislation in place to address noise at receptor prior to the END?
- **EQ14b -** To what degree were EU MS already carrying out noise mapping prior to the END and how far were mitigation measures already in place? Have these been continued under the END and if yes, on the same scale, a lesser or greater scale?
- **EQ14c -** If particular MS already had mitigation measures at receptor in place, how far, if at all, has there been a change in the level of attention among policy makers and politicians, the budget allocated and types of measures being supported?

The above issues are now examined in further detail.

EQ14a - To what extent did Member States have environmental noise legislation in place to address noise at receptor prior to the END?

Firstly, the END has added value by putting in place a common legal framework across the EU. Many MS did not have national environmental noise legislation prior to the adoption of the END, and its transposition into national legislation. Several respondents to the online survey pointed out that the revision and adoption of Annex II encourages commonality between national approaches while still respecting the principle of subsidiarity.

In many new MS (e.g. **EE, LV, LT, RO, SK and SI),** the existence of an EU Directive on environmental noise has added value, since the transposition of the Directive into national legislation represented the first time that there was environmental noise legislation requiring noise mapping and action planning. Although some MS already had some form of environmental noise regulation (sometimes even stemming back to the Soviet period e.g. in Lithuania), in other MS, the development of national implementing legislation transposing the END was the first time there was any national legislation on environmental noise (see Section 2.3.2 Pre-existing legislation - where a more detailed assessment of the legal baseline situation is provided).

This has resulted in environmental noise being put on the domestic political agenda for the first time, or at least increasing its perceived importance. The Directive has also made a significant positive contribution by **raising awareness among national, regional and local policy makers, politicians and the wider public** about the nature and extent of the problem. This was considered particularly important by some stakeholders against the background of budgetary cuts following the financial crisis which made it harder for policy makers to 'ring-fence' environmental budgets. Moreover, the data collected as a result of the END enables prioritisation of the most cost-effective measures.

There are however quite a number of EU MS whose noise legislation dates as far back as the 1970s, 1980s and the 1990s (**i.e. DE, DK, FI, FR, IE, IT, LU, NL, PL, PT and the UK)**. A minority of stakeholders in these MS maintained that value added has been limited with regard to noise mitigation since national legislation on environmental noise already required some mitigation and reduction initiatives. However, most interviewees acknowledged that the main benefit of the END was in promoting a more "common approach", in particular to noise mapping using common assessment methods.

The requirement to produce SNMs using the L_{den} and L_{night} indicators was recognised as having helped to make population exposure data more comparable in Europe. A stakeholder in Germany from an NGO commented in relation to the END's added value that "European Added Value is especially high for MS which did not have a corresponding national policy.

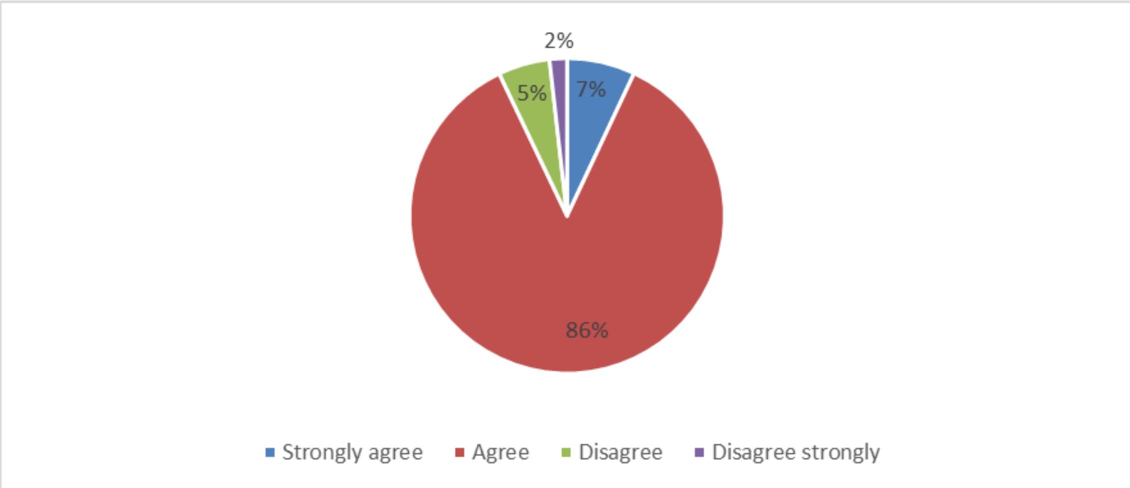
But even for MS that already had a well-developed national noise control policy, there are considerable improvements due to the implementation of the END". Among the examples cited where the END has made a difference compared with the pre-END national approach was in **strengthening information availability to the public**. The NGO commented that "Art. 9 of the END has contributed considerably to strengthening awareness about noise. Noise nowadays gets a lot more attention in the media. Citizens participate in discussions on NAPs. For instance, in Berlin 3,000 proposals from citizens contribute to the preparation of the Noise Action Plan 2013 and the draft NAP of Sept. 2012 for Frankfurt Airport received 11,000 statements from the public.

Moving towards a common approach based on common noise assessment methods is an inherently European endeavour. The majority of stakeholders interviewed agreed that a common approach facilitates the ongoing monitoring of the effects of existing source legislation with a view to their possible revision in future. This would not be possible through a purely national approach since noise maps and population exposure data need to be produced on a common basis to ensure that comparable data is available to EU policy makers. Since almost all stakeholders agreed that source legislation has equal, if not greater potential to reduce high levels of environmental noise compared to legislation dealing with noise at receptor, it was acknowledged that the END was crucial.

Whilst prior to the END, some MS already produced noise maps, they used different noise indicators to do so across different transport sources and differences in the metrics were utilised between MS. The baseline situation before the END is examined in further detail later in this section.

The results from the online survey confirm that most stakeholders perceive the END as demonstrating strong EAV. Overall, 86% of respondents to the survey of public authorities agreed with the statement that the Directive has added value to what MS were already doing (and 7% strongly agreed), whilst only 7% disagreed (or disagreed strongly).

Figure 3.12 – To what extent do you agree with the statement that the Environmental Noise Directive has added value to what Member States were already doing? (n=57)

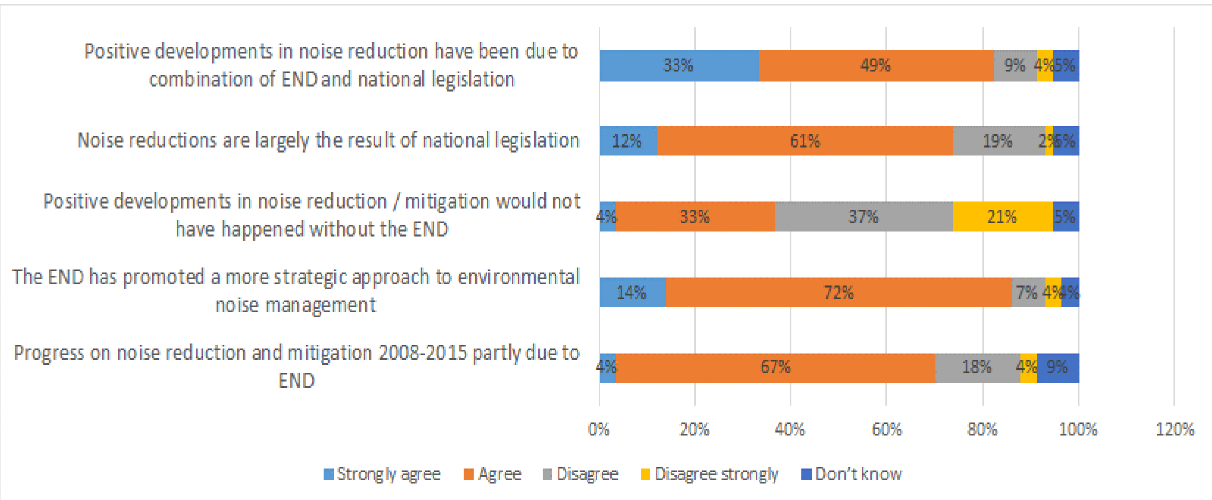


Source – Online survey of public authorities

Most participants agreed that the END in combination with national legislation has triggered positive developments in noise reduction. However, 61% of respondents agreed and a further 12% strongly agreed that progress in noise reduction was primarily the result of what EU MS were already doing rather than EU legislation in the field of environmental noise.

The interview programme found that the small number of stakeholders that were less positive about EU value added tended to be from MS where there was already existing legislation before the END. A similarly high percentage of respondents acknowledged that the END had at least partially contributed to noise reduction.

Figure 3.13 – Please rate the extent to which you agree with the following statements (n=57)



Source – Online survey of public authorities

Whilst acknowledging that considerable progress has been made towards a common approach at European level, many stakeholders commented that the timescale for its implementation is longer than they originally anticipated. A common expectation among interviewees was that the revised Annex II would be implemented by R3 but Commission Directive (EU) 2015/996 will not in fact be implemented across EU-28 until R4.

As noted earlier, the additional 5 year timeframe means that whilst data produced on a fully common basis will be available in R4, fully comparable noise exposure data produced using the CNOSSOS-EU methodology under the revised Annex II *between Rounds* will only be available in R5). The full value added of the END will only be manifested over the medium term. However, many stakeholders interviewed stressed that the progress already made in collecting EU-level data should already be good enough to inform source legislation. This was reiterated by several stakeholders at the validation workshop held in September 2015.

The EAV of a "common approach" to strategic noise mapping based on common assessment methods was however questioned by a few stakeholders. Some MS will continue using their own noise mapping methods in addition to CNOSSOS-EU and this may lead to confusion amongst the public (raised by a CA in **Belgium** responding to the online survey, but also by the CAs in **Denmark** and **Sweden**, who have decided to continue using the Nord2000 method for national reporting purposes, in parallel with the revised Annex II.

Through the interview programme, further feedback was obtained which found that the END has generated EAV in a number of ways, for instance by:

- Providing an important input to establishing baseline data on population exposure across 5dB thresholds, and ensuring longitudinal monitoring of changes in population exposure on a five yearly basis. This was viewed as being crucial to informing the development of new, and the revision of existing source legislation.
- Harmonising noise metrics through the use of the L_{den} and L_{night} indicators;
- Raising awareness among the public and putting environmental noise on the policy agenda in EU MS that did not previously have noise control legislation.
- In EU MS that already had noise legislation, awareness among the public has still been raised significantly in some MS, since public information accessibility was less of a priority in national legislation, pre-END, with a lack of universal access to those limited noise maps produced.
- Raising the visibility of environmental noise issues in other policy areas, even in countries where there was existing legislation, due to the fact that action is more likely to be taken when a European Directive has been put in place;
- Higher political attention to environmental noise, with additional (external) pressure on national governments to produce action plans and to implement measures to tackle noise. Several examples were provided where it was politically easier to increase expenditure on noise mitigation and abatement thanks to the existence of EU legislation; and
- Introducing a degree of accountability and benchmarking as to what national authorities are doing to mitigate noise

EQ14b - To what degree were EU Member States already carrying out noise mapping prior to the END and how far were mitigation measures already in place? Have these been continued under the END and if yes, on the same scale, a lesser or greater scale?

The evaluation research also examined the baseline situation across the EU prior to the END by transport source, in particular, whether noise mapping already took place, and if so, which metrics were used and whether national computation methods for assessing noise had already been developed prior to the END. This was useful in shedding light on how far the END has made a difference compared with what national policy and regulatory actions were already taking place.

Baseline situation vs. current situation

(i) Baseline - noise assessment methods

With regard to **noise assessment methods**, prior to the END's adoption in 2002, there were several **different national computation methods** which did not allow for an EU-wide comparability of data. Several examples are mentioned in the analysis below, whose purpose is not to provide an exhaustive mapping of the historical evolution and use of national methods in different countries, but rather to highlight the fact that there were many different national-specific approaches in place prior to the END.

During the early years of the Directive's implementation, MS that previously had no national computation methods used a number of different interim computation methods[160] in the period leading up to the development of CNOSSOS-EU for the determination of L_{den} and L_{night} for road traffic, railway noise, aircraft and industrial noise respectively. The END has introduced a common, harmonised approach through a complex and technical process of ensuring that CNOSSOS-EU reflected technical and scientific state of the art in noise assessment methods by source, and that interim methods used during the initial period of END implementation had national equivalence.

In particular, the END has required MS to **carry out technical work to convert national noise calculation methods by transport source to reflect the common European L_{den} and L_{night} END indicators.** For instance, in the **UK**, technical studies were undertaken to ensure that existing noise calculation methods and indicators used for assessing road noise were converted into those set out under the END[161]. Similarly, in **Denmark**, prior to the END, noise mapping across all sources was only calculated based on noise exposure as LA_{eq}, i.e. 24-hour equivalent values. In order to implement the Directive, national guidelines were adopted and L_{den} and L_{night} were then used for the preparation of the noise maps.

A clear added value of the END is that it has helped to **harmonise metrics across the EU for each type of noise source**. When the END was adopted, this was expected by noise stakeholders to be a positive aspect of the END compared with existing national approaches. The interview and workshop feedback suggests that using common indicators to produce data on a common EU-wide is indeed widely accepted as a benefit and added value of the Directive, albeit one that will take time to fully be realised.

[160] EC Recommendation of 6 August 2003 concerning the guidelines on the revised interim computation methods for industrial noise, aircraft noise, road traffic noise and railway noise, and related emission data.

[161] Converting the UK Traffic Noise Index L10,18h to EU Noise Indices for Noise Mapping, TRL Project report PR/SE/451/02, 2002; and Defra, Method for Converting the UK Road Traffic Noise Index LA10,18h to the EU Noise Indices for Road Noise Mapping, st/05/91/AGG04442, 24th January 2006.

(ii) Baseline – extent of mapping and noise mitigation measures across different transport modes

The 'baseline situation' across different transport modes in terms of whether noise maps were produced and mitigation measures were in place prior to the END is now considered. The baseline situation has been defined for the purposes of this study as pre-2002 in general, but pre-2007 in the case of R1 noise maps, and pre-2008 in the case of R1 NAPs.

In EU countries that already had national legislation regulating aircraft noise and noise from airports prior to the END, some **major airports** already produced noise maps prior to the END. However, according to some stakeholders, the reason that some countries carried out noise mapping of airports was that airport operators were required to submit noise maps as part of planning applications for airport expansions to meet passenger growth. Noise maps were also produced pre-END in some EU countries to meet national regulatory requirement and/ or to provide factual information for the purposes of discussions with local communities about the nature and extent of the problem, and where noise insulation schemes were in place.

However, the **noise maps that existed pre-END were prepared using different metrics**, and indeed, some national indicators continue to be used for national policy-making and reporting purposes alongside L_{den}. For instance, in the **UK**, noise maps for airports were produced prior to the END using 57 dB L_{eq} contours to assess noise annoyance. The Department for Transport developed a methodology in the mid-1980s based on the findings from an expert study for assessing the current and future impacts of aircraft noise by determining the area exposed to average sound levels of 57dB(A) or more between 7am and 11pm. However, this indicator was viewed by NGO stakeholders interviewed as not measuring noise exposure sufficiently accurately.

Nevertheless, the Aviation Policy Framework (APF) in the UK states that the Government 'will continue to treat the 57dB LA_{eq},16h noise contour as the average level of daytime aircraft noise marking the approximate onset of significant community annoyance'. It also recognises that 'this does not mean that all people within this contour will experience significant adverse effects from aircraft noise', 'nor does it mean that no-one outside of this contour will consider themselves annoyed by aircraft noise'.

For reporting purposes under the END, noise maps for airports must now use L_{den} when drawing up noise maps. According to interviews with several NGOs, the fact that SNMs are produced using common noise metrics across the EU is beneficial since it was viewed as more accurately reflecting actual experiences of noise levels experienced by communities, thus adding value to what had been done in the UK prior to the END. Some airport operators interviewed also stated said that they accepted the common reporting requirement using the L_{den} indicator and that there were advantages in everyone using the same indicators across the EU.

Whilst many major airports already had some form of noise mitigation and abatement measures in place before the introduction of the END, this was usually done ad hoc or in piecemeal fashion rather than through a systematic action planning approach. Although many airports already engaged with communities on environmental noise prior to the END (especially in countries that already regulated aircraft noise such as Germany and the UK), the fact that there is a formal requirement to inform the public and to make information accessible across all 28 EU MS was viewed as being positive. A major airport operator in the UK commented that action planning was a useful discipline in itself, given its five yearly cycle for reporting back internally to management and different divisions as well as externally to the local community and wider stakeholders on their activities

Turning to **major roads,** some countries undertook noise mapping prior to the END. For instance, the Portuguese Noise Pollution Act of 2000 requires the national road authority, the IEP (Instituto das Estradas de Portugal), to produce noise maps in respect of major roads. The decision to produce noise maps in **Portugal** was to anticipate the planned introduction of future EU legislation[162]. In a number of other countries, different methods for carrying out noise mapping were also developed before the END, such as the Nord 2000 model for mapping noise for major roads and major railways in **Denmark**[163]. Noise maps also produced in France prior to the END (see French national computation method **'NMPB-Routes-96 (SETRA-CERTU- CERTULCPC-CSTB).** In the **UK,** work took place much earlier than the END to develop calculation methods for assessing levels of road traffic noise through the CRTN method in 1988[164], which replaced an earlier 1975 version, even though strategic noise maps were not produced until later.

A further issue examined was whether there were already any strategic action planning type approaches in place prior to the END with regard to road noise. In most EU countries, environmental noise was already being considered, but has become more visible in road transport planning and in strategic policy making post the END.

For instance, in **Denmark,** prior to the Directive being fully implemented (since the first NAPs were not produced until 2008), a Road Noise Strategy was adopted in 2003, which runs until 2020. This had already triggered the development of municipal noise mitigation plans and the adoption of noise-reducing asphalt. The Environmental Protection Agency has set recommended limit values for noise from road traffic in connection with planning and projecting of new residential areas along busy roads and new constructions or renovation of existing major roads have to be insulated to mitigate noise pollution. The Road Noise Strategy was evaluated in 2010. The evaluation showed that most government initiatives had been implemented or were being implemented.

However, even after implementation of many measures, as many as 785,000 homes were still affected by road noise above the recommended limit value – almost one in every three homes in Denmark. This example shows the **difficulty in clearly identifying measures that were put in place pre-END and those that are explicitly due to the END.** Many national measures are part of a continuum, given the long-term nature of transport infrastructure planning and noise mitigation and abatement measures.

As far as **major railways** are concerned, the RMR noise computation method in the Netherlands was developed in the mid-1990s, prior to the END, and was identified in the EC Recommendation of 2003 as the main recommended interim method. Other examples of national computation methods that pre-date the END include the Nordic Rail Prediction Method for Trains (1996) and the Calculation of Railway Noise 1996 (UK).

However, generally speaking, before the END was adopted, there was much less noise mapping of railways compared with other transport sources. This partly reflects the differing baseline and the lack of national regulation of railway noise in most EU countries. An exception was in **Austria,** where noise maps were used to assess the effectiveness of pre-existing noise protection measures for the reduction of noise from railways under the *Ordinance for the Protection from Noise from Railways*. The objectives and measures of such pre-existing and ongoing programmes for noise control have been integrated into action plans developed under the END.

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162 http://www.conforg.fr/internoise2000/cdrom/data/articles/000865.pdf

163 Traffic Noise prediction with Nord2000, Danish Ministry of Transport.

164 Department of Transport publication, 'Calculation of Road Traffic Noise (CRTN)', 'Department of Transport – Welsh Office, HMSO, 1988 ISBN 0115508473;

An interviewee in the railways sector in **Ireland** suggested that there was less interest in noise mapping or action planning in railways historically because in many countries, the railway infrastructure network was already developed decades ago without many new tracks being installed which could have caused concerns among nearby residents. Moreover, the level of train passages per year varies a lot less than the level of vehicle passages per year for major roads and aircraft movements in major airports. It was posited that there was historically less pressure on national railways to produce noise maps since there was less affected population. However, the situation has changed partly because the END came into effect making noise mapping obligatory and also due to the increased number of complaints about railway noise, reflecting land-use trends towards allowing more residential housing to be built in closer proximity to railways than was the case pre-END.

In terms of noise mitigation and abatement measures pre and post the END, before the END was introduced, only a few countries, such as **Germany** and **Austria,** had national mitigation measures in place. However, since the END was adopted, such measures have continued, reflecting their long-term nature. For instance, as shown in the following example, many programmes to mitigate railway noise require a commitment of 20-30 years, for instance, to address rolling noise and retrofit wagons. They also require significant investment over time, rather than a one-off budget allocation.

Box 3.9 Reducing railway noise in Germany – a 25 year programme

In **Germany**, a national action programme to reduce railway noise was already in place to reduce noise prior to the END through the German railway Deutsche Bahn (DB). The long-term goal is to cut rail noise emissions between 2000 -2020 by half, i.e. a noise reduction of 10 dB(A). Some measures came into effect well before the END, including tackling noise at source. For instance, new cars purchased by DB Schenker Rail since 2001 come equipped with another type of quiet brakes, K brake blocks.

However, other measures are more recent and have been mentioned in NAPs, even if they are regarded as national measures. For instance, in June 2013, DB approved the conversion of freight wagons to use LL brakes (quiet brakes that can be installed in existing vehicles). All old freight cars are being retrofitted with quieter brake blocks, which reduce the rolling noise of wagons to half that of conventional cast iron brakes. The estimated cost of a national programme to reduce railway noise by half was €100m per year for the duration of a 25 year noise-reduction programme. The potential total costs of measures for retrofitting alone are €300m to convert the 180,000 wagons that are eligible to be retrofitted with new, quieter brakes. The current number of wagons retrofitted is only 6,350.

Similarly, there is also a **problem in differentiating between measures that are national and those that have a European dimension** and are seen as having taken place as a result of the END. It is often difficult to / identify a precise division point between measures that pre-date the END and ongoing measures implemented in R1 and R2 since many measures are of a long-term nature.

In the **Netherlands**, for instance, in the railway sector, noise abatement legislation has been in place since 1987. Some mitigation measures were already in place prior to the END. However, END implementation has also coincided with greater levels of investment in rail noise mitigation and reduction. In 2008, for instance, noise differentiated track access charges were introduced. The bonus is fixed at € 0.04/ wagon-km and is applied to both passenger and freight vehicles with a maximum of € 4,800 over two years. Studies and pilot projects have been launched to test composite brake blocks and noisy trains will be prohibited from 2015.

Within **agglomerations,** before the END, most countries did not produce noise maps for agglomerations as an administrative unit, since there was no common definition of what constitutes an agglomeration, which was interpreted differently in different EU countries. However, some cities did produce noise maps using a variety of national-specific metrics. However, momentum towards noise mapping in urban areas was found to have been largely prompted by the END.

As noted under road noise, in **Portugal**, the Portuguese Noise Pollution Act of 2000 required local authorities to draw up noise maps in in large urban areas. Prior to the END, in **Greece,** the Ministry of the Environment prepared noise maps for all cities in Greece with populations with more than 50,000 For Athens, information from the early 2000s suggests a noise map was prepared every 10 years: 1977, 1987 and 1997.

A 2007 map was not prepared however due to the introduction of the END. These were based on data and information provided by the Greek National Statistical Census Bureau (for example, building block maps, the number of residents per building block, etc.) and parameters such as L_{max}, L1, L10, L50, L90, L95 and L_{eq} were measured. L_{den} and L_{night} L_{den} and L_{night} calculations required under the END were not undertaken and therefore the noise maps prepared as part of R1 (2006) were developed using different assessment tools.

With regard to mitigation measures within agglomerations, in some countries, there were already measures in place to tackle noise prior to the END, but the END promoted a more integrated and systematic approach to noise mitigation and abatement that covers several transport sources as well as industrial noise.

The END has also added value by **strengthening information accessibility to the public.** This has also promoted greater transparency, notwithstanding the challenge of encouraging more citizens to show interest in and download the noise maps. For example, in the **UK,** prior to the END, noise maps were only produced for airports and mapping was produced by the CAA. Noise mapping was not produced systematically for other sources. When it was produced for roads and for urban areas/ agglomerations, this was mainly because some Local Authorities needed specific local mapping/prediction results for local development control purposes. Although noise maps produced for airports were made available to the public, noise mapping results for other sources, if these were produced at all, were not made widely available.

Findings – comparing the baseline with the current situation

The END represents an important step forward towards a harmonised mapping approach using common metrics for the first time. Without the END, there may have been noise maps available which were useful for national, regional and local decision-making purposes, but there would not have been noise maps produced using common metrics across the EU and the requirement to provide statistics related to the affected population.

- Prior to the END, there were many different national noise indicators. Post-END, only two common indicators are in use (L_{den} and L_{night}), which has added value by enabling noise maps to be produced on a common basis using harmonised metrics across all EU MS;
- Prior to the END, there were many different national computation methods for assessing road traffic noise, aircraft noise, railway noise and industrial noise. The END has added value by bringing about a common approach to noise assessment methods through the CNOSSOS-EU process. Even if this has taken a long time to develop, reflecting the scientific and technical complexity, this will inform source legislation in a way that would not have been possible without the END;
- EU added value will however only be fully achieved once Commission Directive (EU) 2015/996 has been implemented and more comparable data is available to measure changes in population exposure between rounds.
- It is difficult to distinguish clearly between noise mitigation, abatement and reduction measures that pre-date the END, and those put in place after the END came into

effect. This is due to the long-term nature of many noise reduction measures, some of which take 20-25 years to implement.

- It is likewise difficult to distinguish between national measures and those that can be considered as having been implemented through the END. If measures pre-date the END, and have been continued, they are likely to be viewed as being national in character, although stakeholders recognised that through action planning, the END provides a framework through which nationally financed measures are implemented, where such funding is available.

3.2.6.1 Added Value of the END - measures implemented through NAPs

In the previous sub-section, we considered how far the END has brought about changes compared with the baseline situation. In this sub-section, a further issue related to added value is the extent to which once the END came into effect, with the first NAPs adopted in 2008, the measures implemented identified in NAPs went ahead specifically due to the END, or would have gone ahead regardless, for instance because:

- There were existing national legislative requirements;
- The measures were planned before the END was adopted because many noise reduction programmes include a series of measures over a 20-30 year time horizon; and
- There were other primary drivers, for instance in cases where environmental noise reduction was a secondary (but still important) objective for measures going ahead (e.g. when the primary driver was air quality, road safety etc.).

Among the feedback was that some stakeholders stated that many measures would have gone ahead irrespective of the END, because there were other primary drivers of measures (e.g. strengthening air quality, improving road safety, pre-planned infrastructure upgrades) that have important secondary effects in contributing to noise reduction.

In R1, for instance, stakeholders in several countries indicated that many measures were already planned before the END came into effect but were mentioned in R1 NAPs as END measures. Examples were identified for instance in the railways sector in **Austria,** and across all sources in **Germany,** where compared with other countries, there was greater scepticism among many stakeholders interviewed as to whether measures could be attributed at all to the END.

Since many measures are nationally-financed, it is perhaps not surprising that many stakeholders view **measures in NAPs as being of primarily national character, and only partially influenced by the END**, given that the function of noise action plans is to bring together measures and initiatives across many different policy areas (e.g. planning, public transport, road infrastructure development) into a single document. The added value from a national perspective, as explained earlier under impacts (see section 3.2.3.7 - Impacts of the END's implementation), is that action planning promotes a more strategic approach to environmental noise management. It does not necessarily change the types of measures being supported.

It is also important to note that an exclusive focus on the source of financing of measures risks underestimating the added value of the END, since it does not in itself foresee a budget for funding noise mitigation measures. As a consequence, measures will inevitably be funded at national level, but may nevertheless have been triggered by action planning as prescribed by the END.

The online survey asked respondents for views as to what percentage of measures were driven by national legislation and would thus have gone ahead anyway. The findings were that 38% of respondents stated that between 75% and 99.9% of actions had already been in the pipeline anyway and probably would have gone ahead without the

END. Another 20% confirmed this for between 50% and 74.9% of actions in their countries.

This shows that the added value of the END in terms of promoting new concrete actions and measures is somewhat limited, again reflecting the fact that NAPs only need to be drawn up but measures contained therein not necessarily been implemented. This was confirmed through the interview programme. In many cases (for example, in **DK, DE and in NL),** it was difficult for END stakeholders to distinguish clearly between measures that would have gone ahead anyway since they were already envisaged at national level to meet national regulatory requirements and measures that have been supported specifically because of the END as a direct consequence of the development of NAPs. This is however a matter of perception. Even though national legislation might be the original driver, the measures themselves are mentioned in NAPs so there is no reason why they cannot also be considered as directly contributing to the objectives of the END.

The END has added value by encouraging EU MS to implement measures identified in NAPs, although there remains a problem that in the view of some stakeholders that the legal requirements are not stringent enough to require MS to implement noise control measures or to tackle noise at source.

Looking overall, as commented by an acoustic consultant, one issue appears to be that “some MS have followed the letter of the law, whereas others have followed the spirit of the law”. The absence of legal compulsion in respect of measure implementation may undermine the coherence between MS and the effectiveness of the END’s implementation, since some MS are not tackling the problem actively at receptor through expenditure measures, whilst others are doing so.

While it is not compulsory to implement expenditure measures under the END, as detailed in Section 2.3.8 (Noise Action Plans), it is strongly implied under Art. 8 that action planning authorities should identify measures in their NAPs. The research showed that whilst some MS intended to implement measures, but have not done so due to budgetary limitations, others have implemented measures to tackle noise at source in R1 and R2. Examples of R1 measures that have been implemented were identified through the 19 case studies (see Appendix F – test case summaries).

In larger MS, such as **France, Germany** and the **UK,** there are different approaches to the identification and implementation of noise measures among different types of CAs and levels of governance (national, regional and local). In **Germany,** whilst there is typically a long list of measures is provided in NAPs, few measures have actually been implemented. The baseline situation should also be taken into account when assessing how far MS have invested in noise mitigation, abatement and reduction measures during R1 and R2 implementation.

Ireland mainly implemented non-expenditure measures in R1. However, it was noted that in respect of roads, the quality of the road network infrastructure is better than in many other EU countries. Before the END’s adoption, during the economic boom, an interviewee stressed that significant investment had been made in developing a new motorway network in the 1990s. Since this was developed with quieter road surfaces than the comparable motorway networks in most other EU MS, which are typically much older, there has been less tendency to focus on quiet road surfaces.

In the **Netherlands**, for instance, the Dutch CA stated that even 13 years after the adoption of the END, noise-reducing measures tend to be implemented as a result of national legislation rather than the END. The same point was raised for instance in **Germany** and the **UK**, particularly in respect of noise regulations concerning airports. Even so, a number of public authorities interviewed (e.g. **Sweden**) stated that the END reinforces existing measures and initiatives at national level.

The question of EAV also raises the issue of **subsidiarity** – which activities are better carried out by individual MS and which should be undertaken either at European level, or with a stronger European dimension. The non-enforceability of noise-reducing measures under the Directive (Art. 1(c): "with a *view to* preventing and reducing environmental noise where necessary" [own emphasis]) implies that such enforcement is left to MS. This, according to some stakeholders (e.g. DK), makes it harder to assess the impact of the Directive since there is scope for flexible implementation by MS. For example, some MS have binding noise limit values while others do not (see also Section 2 - implementation report). The subsidiarity principle is also relevant when it comes to noise limit values and specific measures given the different perception of noise between the different cultures in Europe.

Similarly, there is also the view that the Directive's added value is diminished in the absence of an ultimate purpose, which a small number of stakeholders regarded as insufficiently defined. Overall, there is a clear affirmation amongst public authorities responding to the survey as to the added value of the Directive.

Ninety-three per cent of respondents agree with the statement that the Directive has added value to what MS were already doing. If measures pre-date the END, and have been continued, they are likely to be viewed as being national in character. Although some stakeholders recognised that the END provides an overarching framework through which environmental noise measures across different sources can be identified through an action planning approach, since these are implemented using national funding, it makes it more difficult to convince stakeholders that measures can be solely attributed to the END.

3.2.6.2 The EAV of the END through volume effects, scope effects, demonstration effects and process effects

A number of different types of effects have been identified through the research as part of the assessment of the END's EAV, such as: (1) Volume effects (2) Scope effects (3) Demonstration effects and (4) Process effects. These types of effects have been identified in previous evaluations to assess the EAV of EU policies and legislation. In the context of the END, the way in which these concepts might be interpreted is now explained:

Box 3.10 Typology of effects – the volume, scope, demonstration and process effects of the END

Volume effects – the extent to which the existence of the END may have had a catalytic effect in particular EU countries by increasing the funding allocated to environmental noise mitigation, abatement and reduction programmes and measures compared with equivalent national programmes prior to the END.

Scope effects – the extent to which the END may have encouraged greater consideration of environmental noise mitigation issues in national policymaking and in the design of relevant national, regional and local spending programmes directly related to addressing environmental noise at receptor and in other policy areas (e.g. transport, infrastructure development/ planning, urban development/ planning, air quality), wherever there is potential to contribute to noise reduction through secondary effects.

Demonstration effects – the degree to which the END has had positive catalytic effects by demonstrating the effectiveness and added value of investing in noise mitigation, abatement and reduction through NAP measure implementation in R1 and in R2. The fact that some countries have devoted significant expenditure through measures identified in NAPs to reducing noise may have positively influenced attention to noise mitigation in other countries at national, regional and local levels, for instance, in determining policy approaches, spending decisions and the degree of visibility given to noise mitigation at receptor.

Process effects – under Art.1 (1a, 1b and 1c), the END requires strategic noise mapping, making SNMs and population exposure publicly available, and the development of action plans (with public consultation an integral part of the NAP finalisation process). The regular discipline of carrying out these activities every five years in liaison with national noise stakeholders and communities may have 'process effects' such as fostering a more rigorous and systematic approach to strategic noise management across the different sources than was the case pre-END, even in countries that already had environmental noise legislation.

The different types of effects are now examined in further detail and where appropriate, examples of these effects are provided:

Volume effects – the END was found to have had a catalytic effect in some EU MS by increasing the scale of funding invested in noise mitigation, abatement and reduction programmes and measures compared with equivalent national programmes prior to the END ('volume effects'). The END has also sometimes supported the putting in place of new programmes and measures at national, regional and local that were at least partly inspired by the existence of the END. In EU MS that did not previously have environmental noise legislation, a noise budget has been created for the first time. It is worth mentioning that this has happened at least in some EU MS against a backdrop of reduced public sector funding in most of EU-28.

As noted earlier, however, there are challenges in quantifying the extent to which programmes adopted after the END came into effect can be directly attributed to the END, partly because many programmes are of a long-term nature, and measures supported within them are part of a continuum which requires long-term policy planning and expenditure decisions, which means that the true extent of the END's impact is difficult to ascertain at this point in time.

In some EU MS (at least in the short term), there has been increased expenditure on noise mapping and reduced expenditure on noise mitigation and reduction, although given the long-term nature of expenditure commitments relating to the implementation of many noise measures, over time, the majority of expenditure in the great majority of MS is expected to be on noise mitigation, abatement and reduction measures (i.e. substantive compliance costs) rather than on noise mapping (which forms part of the administrative costs. Theoretically, if MS are spending more on environmental noise mitigation, there may be a corresponding reduction in budget in other areas (depending on priorities), although no evidence was found through the evaluation research that this is the case. Overall then, there is a mixed picture in respect of 'volume effects', with some MS attesting to an increase in resources for noise mitigation, whilst others stated that there has not been much of a change in the level of expenditure on noise mitigation at national / regional level since the END came into effect.

Examples were identified where the existence of the END has strengthened the visibility of environmental noise among policy makers and this had led to **additional funding being made available within transport infrastructure programmes through dedicated budget** (e.g. in the **UK** and **France**). It was noted that since the Directive was adopted, it has become easier for environmental noise policy officials to engage with their colleagues across different policy areas, for instance with planners responsible for long-term transport infrastructure planning, and officials responsible for urban development and planning.

Although it was made clear that whilst some expenditure programmes, such as transport infrastructure development programmes, would often have gone ahead anyway, the END has helped to ensure that environmental noise mitigation is taken into account more closely. For instance, in the **UK**, although noise mitigation was an issue that Highways England would have taken into account anyway, there appears to have been more explicit consideration for tackling noise at receptor than would have otherwise been the case, as demonstrated in the following case study on the Roads Investment Strategy 2015-2020.

Table 3.33 - Case Study - Roads Investment Strategy

Case study title:	The 'Road Investment Strategy' (RIS) , UK 2015-2016 to 2019-2020
Member State:	UK (England)
Measure description and Implementation bodies	Highways England is responsible for the Strategic Road Network (SRN) in England, which covers the busiest roads. Since most motorways and all-purpose trunk roads were planned and developed between the 1930s and 1960s, many are no longer fit for purpose. In the decades that followed, traffic volumes have grown and today there are more than four million vehicles on the SRN per day. Investment has not kept pace with demand and network quality has declined. In response to these challenges, the 'Road Investment Strategy' (RIS) sets out a long-term programme for motorways and major roads with the funding needed to plan ahead effectively. The RIS is a multi-year investment plan to improve the network and create better roads for users. The first RIS will require investment of €21.28 billion (£15.2 billion) invested over the next 5 years in over 100 major schemes to enhance, renew and improve the network. The Highways Agency recognises that "there are problems such as noise and poor air quality, especially at hotspots located across the roads network". The RIS therefore incorporates a dedicated programme through an Environment Fund. Within this, funding is earmarked for noise mitigation and abatement. Examples of specific measures include retrofitting the SRN with low-noise surfacing, the creation of new bypasses and de-trunking of old roads, improving conditions for walkers and cyclists to encourage greater non-road usage, etc. Moreover, all new and improved roads across the SRN now use low noise road surfaces to reduce the noise made by vehicles.
Budget	Within the RIS, €420 million (£300 million) has been ring-fenced in an Environment Fund to deliver improved environmental performance across carbon, noise, water, biodiversity, landscape and cultural heritage. Within that budget, €105 million (£75 million) has been set aside for noise mitigation impacts over the next 5 years.
Type of effects	Volume effects (increased dedicated expenditure for noise mitigation) and scope effects (expenditure now targeted specifically at "Important Areas", which is a concept introduced in the UK that is driven by the END mechanism of using noise mapping to identify those areas where noise is greatest / and / or the number of affected people is significant.
Results / impacts	Results • Rolling out dedicated noise mitigation and abatement measures such as quiet road surfaces across 100 road schemes. • The RIS should benefit up to 250,000 people by reducing the noise impact of England's motorways and major roads. Impacts • An ambitious target is set out in the RIS that by 2020, the UK road network should be a better neighbour to communities, with over 90% fewer people impacted by noise from the SRN.
Attribution effect/ impact of the END:	The investment strategy covers updating large parts of the UK network for logistical and economic reasons and would have existed without the END. However, it was recognised that the environmental impacts – including noise - needed to be taken into close account in implementing the strategy. The END was regarded as having been useful in influencing decisions about how and where noise mitigation funding should be spent. For instance, Highways England is currently focusing on END-defined Important Areas which were prioritised through strategic noise

Case study title:	The 'Road Investment Strategy' (RIS) , UK 2015-2016 to 2019-2020
	mapping for mitigation measures. The national authority in England commented that the END had encouraged Highways England to give greater consideration to incorporating noise mitigation and abatement in the Road Investment Strategy than would otherwise have been the case.
Monitoring / evaluation	Too early to monitor the RIS's implementation, since it only started in 2015.
Further information	https://www.gov.uk/government/collections/road-investment-strategy

Source – UK research team and CSES analysis of information on the treatment of noise in the RIS, interview with Defra and email contact with Highways Agency.

In **France,** the national CA also mentioned that additional funding had been made available for noise mitigation and abatement through national funding programmes since the END was adopted. According to an interviewee, several hundred million EUR has been devoted to noise mitigation, mainly through annual expenditure of some 100m EUR on upgrading parts of the national road network with quieter road surfaces.

With regard to **scope effects**, some evidence was found of instances where the END has promoted a more visible focus on noise mitigation, abatement and reduction than was the case previously both in overall policy terms at the national level, and in respect of some national spending programmes (e.g. urban infrastructure development, road infrastructure planning). Noise at receptor has moreover been considered more prominently than was the case pre-END in several countries.

For instance, in **Ireland**, consideration of noise mitigation in road infrastructure development has been mainstreamed from the outset). In the **Netherlands,** public authorities at the city level in particular within agglomerations attested that there had been a significant increase in funding for noise mitigation, suggesting strong scope effects compared with the baseline even though there was already well-established national legislation. Conversely, this was not the case in other EU countries. For example, many stakeholders in **Germany** responding to the online survey did not think that the END had made any difference, since long-term mitigation programmes have been continued anyway and many measures have not gone ahead at all due to a lack of budget and the fact that local authorities responsible for preparing NAPs may identify measures which are more of a wish-list than a reality because spending bodies have not authorised the expenditure that would be required within their strategic planning and budgeting.

The onset of the economic and global financial crisis was found to have severely limited the scope to increase funding for environmental noise mitigation in some countries, such as **Italy, Spain** and **Portugal**. This was also the case in some of the newer MS such as **Latvia** and **Lithuania**. The research showed that several EU countries had intended to increase funding for noise mitigation measures when NAPs were prepared, but were unable to do so in practice, and had had to scale back their initial ambitions due to budgetary crises at national and regional level, which in turn had led to a lack of funding for noise mitigation (and in some cases, also for mapping).

The picture in respect of scope effects is likewise somewhat nuanced. Although several countries were identified where the END appears to have had a positive effect in strengthening the scope of noise mitigation measures by encouraging consideration of noise at receptor in policy and spending planning in other areas, there were equally other countries where the scope of noise reduction measures has not increased, in many instances due to lack of budget and/ or coordination with relevant spending bodies.

The END was also found to have had some positive **demonstration effects**, where measures have gone ahead and been implemented, and this may have had a catalytic effect in encouraging other MS to identify budget for and to implement similar types of measures. However, less positively, the research found that only a small percentage of R1 NAPs have fully implemented measures requiring expenditure (e.g. noise barriers, quiet road surfaces). This was partly due to the economic and financial crisis with more limited budgets (which has continued into R2 implementation). However, equally, stakeholders pointed to the long-term nature of the noise mitigation cycle and associated planning. This means that there is scope for the magnitude of such effects to increase in the latter stages of R2 implementation and in subsequent rounds of NAP implementation. The scope to use the case studies undertaken as part of this study (see Appendix E) to strengthen the evidence base as to the nature and magnitude of effects of different types of measures should also be emphasised.

The interviews suggest that the END has had a positive demonstration effect by encouraging at least some MS to engage in comparative benchmarking, for instance, to compare action planning approaches and also the types of environmental noise mitigation, abatement and reduction measures identified in NAPs in other MS.

Moreover, at the validation workshop to discuss the evaluation results, it can be noted that there was strong interest among participants in obtaining the country reports so as to be able to compare different national practices with regard to setting national limit values at receptor, whether these are binding and how these are enforced. This suggests that there is continued scope to strengthen the role of information exchange between MS through the data and information produced through the END in future. The Commission's important reporting role on END implementation is also important to mention here, since it has a role in serving as a conduit to disseminate information and knowledge about which types of mitigation measures, policies, practices and approaches are effective.

Since under subsidiarity, the END does not adopt a prescriptive approach there are advantages in promoting opportunities for exchanges of experiences and practices between END stakeholders so as to facilitate benchmarking between countries and to strengthen areas of weakness in END implementation, such as enforcement at national level, and good practice in the designation and crucially in the implementation of quiet areas. In other policy areas, this type of approach has been termed an "Open Method of Coordination".

A practical example of how national CAs are already learning from one another is that a combination of EU and national good practice guidance on different aspects of END implementation (e.g. on quiet areas, noise mapping and action planning) has sometimes been used by MS that do not yet have any national guidance of their own as the starting point for the development of such guidance.

In conclusion, it will take time for the 'demonstration effects' of measures implemented through the END to fully materialise, but the cost-benefit benchmarks and estimates of the corresponding health effects will provide useful data that the MS can use for their own benchmarking purposes to help determine how resources should best be spent to address the areas for priority action identified through noise mapping. For instance, cost- benefit benchmarks could be utilised in future to better prioritise spending so as to maximise reductions in the noise-exposed population.

Lastly, the research identified evidence of **'process effects'**, whereby the END was acknowledged as having promoted a more systematic approach to strategic noise management than was the case pre-END, even in countries that already had environmental noise legislation. For instance, before the END in some countries, noise mitigation strategies had been prepared on an ad hoc basis for particular sources or in larger cities. Likewise, SNMs had also been prepared, but these were neither available for all transport sources nor made available to the public systematically. By ensuring that CAs responsible for strategic noise mapping and action planning across the EU are part of the same five year strategic planning processes, the END has added value. This was confirmed for example by some airport operators, who stated that they had built five year strategic planning as part of the END into their management decision-making processes, and this was not something that they would change, even if the END were to be repealed.

There were however questions raised by many END stakeholders as to whether the process could be made more effective by extending the 12 months' timeframe between SNM and NAP submission, but this is addressed under effectiveness rather than added value.

3.2.6.3 Action at EU level – survey findings

EQ15 - Do the issues addressed by the Directive continue to require action at EU level?

The feedback on the online survey indicates that there is strong support for continued action at EU level**.** In response to the question *when approximately do you expect the objectives of the Directive to be fully achieved at EU level?* The majority of public authorities could either not make an estimation or estimate END objectives will not be achieved before 2020. This was particularly the case for the objective relating to laying the basis for future legislation, where 91% of public authorities could either not estimate a completion year or believed it would be 2020 or later. Sixty per cent of public authorities also believe it will be 2020 or after until the objective relating to the development of a "common approach" will be achieved.

Table 3.34 – Estimated timeframe for the full achievement of END objectives (%) (N=57)

	2015	2016	2017	2018	2019	2020	After 2020	Don't know
a) Relating to the development of a common approach (Art 1(1))	0	0	19	5	5	11	35	25
b) Relating to laying the basis for future legislation (Art 1(2))	0	0	5	0	2	7	32	54

Source: Online survey of public authorities

The table above indicates that greater progress has been made in respect of the achievement of the first objective of the END than the second. This is perhaps not surprising since a common approach to noise assessment methods, with comparable data, is a prerequisite before policy makers interviewed appear likely to use END data fully to inform source legislation.

In terms of feedback on anticipated timescales, the majority of public authorities estimated that the END's objectives will not be achieved before 2020. Sixty per cent of public authorities believe a common approach to noise assessment methods and to assessing the harmful effects of noise will be realised either in 2020 or later.

Many stakeholders interviewed stated that the full added value will only materialise in subsequent reporting rounds, due to the need for sufficient time to implement harmonised noise assessment methods through Commission Directive (EU) 2015/996. The second objective of the END of laying the basis for future source legislation has not been realised within the timeframe of this REFIT assessment. 91% of public authorities could either not estimate a completion year or believed it would not be before 2020 or later. This reflects the longer timeframe involved in achieving comparable and comprehensive data through a common approach before the data is fully able to inform EU source legislation.

3.2.6.4 Further enhancement of the European added value

A further question analysed was:

EQ16: Are there any ways in which the European added value of the END could be further enhanced?

A number of suggestions were made as to how the END might be enhanced. In this section, examples of stakeholder feedback are provided, but since the future of the END relates to 'prospective issues' suggestions on possible ways forward to enhance the effectiveness and value added of the END are set out in Section 4.2 (Future Perspectives). The main feedback was that:

- Maximising the END's value added is dependent on the revised Annex II, Commission Directive (EU) 2015/996 being implemented, since using the CNOSSOS-EU common assessment methodology is crucial to achieving more comparable data, which in turn is essential to maximise the utility of END population exposure data for EU policy makers responsible for (transport) source legislation;
- Delays in the submission of R2 SNMs and exposure data to the EC need to be overcome, since data gaps in some EU countries will undermine the establishment of a clear baseline against which progress in reducing noise pollution can be assessed. In particular, the lack of complete data, as well as the lack of comparable data may limit the contribution to reviewing current LVs for existing source legislation.
- It was suggested that MS could be required to implement noise mitigation measures rather than only to produce NAPs and identify measures. The legal text currently stops short of compelling countries to implement measures. Various stakeholders are of the view that the added value of the Directive could be strengthened, for example, by putting a stronger emphasis on noise mitigation.
- There were mixed views as to whether introducing EU receptor-based noise limit values would be appropriate. Amongst some stakeholders, environmental noise at receptor was viewed as a domestic issue best tackled at local level, making it difficult or impossible to implement a harmonised approach. However, opinions were divided on this issue among stakeholders and some stakeholders support the introduction of common, source-specific EU-level limit values.
- There was strong support for setting broad, non-mandatory targets for noise reduction either at an EU level or specific to individual MS depending on their relative baseline situation. Several EU industry associations (and some national CAs interviewed) pointed out that added value could be strengthened by providing EU funding to support for MS to co-finance noise mitigation and abatement measures. However, it is unclear which EU funding source could be used.
- According to a number of stakeholders, added value could be strengthened by providing guidance and more detailed specifications for quiet areas in future. However, there was limited support for this suggestion among workshop participants, since most MS appreciated the flexibility of not having a too prescriptive approach to quiet areas, although they would like EU practical guidance on how to implement the concept.

EQ17 - What would happen if the END were to be repealed?

This question builds on a 'counterfactual' scenario in which the END were to be repealed. The main source of information is the validation workshop, and the evaluator's assessment based on carrying out detailed discussions with more than 100 END stakeholders, since an EQ was not originally included within the evaluation's scope.

Notwithstanding the limitations linked to attribution in countries that already had environmental noise legislation, it can reasonably be assumed that if the END were to be repealed, then **MS would largely revert to using their own national methods of noise mapping and action planning**, perhaps with the exception of Scandinavian countries who would continue to use the Nordic 2000 model across several countries.

Another point is that if the END were repealed, there would be **no common, harmonised approach to producing population exposure data**. This would make it more difficult for EU policy makers responsible for source legislation to assess the net effect of existing source legislation by providing data across the EU on noise at receptor (notwithstanding the comparability issues which mean they are not yet using the data). This in turn would also make it more difficult to assess the negative health effects of environmental noise at EU level, or to assess the positive health impacts arising from reductions in noise levels through measure implementation.

Countries facing severe budgetary constraints may decide to drop noise mapping and action planning altogether, or to update noise maps and action plans less frequently (e.g. once every 10 years). In the absence of an EU legal framework, MS would have fewer incentives to implement measures identified in NAPs, since they would not be benchmarked against other MS. Of course, some countries may continue to produce noise maps, but it is unlikely that this would be the case across EU-28 as a whole.

In general, it can be surmised that **environmental noise would become less of a priority among national policy makers vis-à-vis other environmental concerns** such as air and water quality, or climate change. The resulting adverse effects on public health for the population affected by noise pollution can be inferred from the Noise in Europe Report, 2014.

The assumptions produced as part of the CBA produced for this evaluation suggest a positive benefit-cost relationship in respect of measures implemented through NAPs. If the END did not exist, it can be assumed that some noise mitigation measures would still go ahead anyway because measures identified in NAPs were driven by national regulations or there were other primary regulatory drivers, such as introducing speed limits to help reduce pollution and comply with air quality limits. However, **at least some measures would not have been identified and / or already have been implemented had it not been for the existence of the END.** There would therefore have been a higher number of exposed persons to environmental noise (see EQ9b - Has the Directive contributed to ensuring that by 2020 noise pollution has significantly decreased?).

Since the END puts a strong emphasis on a **more strategic approach to noise management**, in the absence of the END, there is a clear risk of returning to an approach to **noise management that was less anchored in a strategic planning approach,** and where if there were no EU legislation in place, it would be more difficult for national policy makers responsible for environmental noise policies to secure the buy-in of their colleagues in other relevant policy areas.

The interviews suggested that even if there was national legislation in place beforehand, it was more difficult for civil servants working on environmental noise issues to secure dedicated funding for noise mitigation before the END. The fact that there is a Directive, has, as noted earlier, put noise on the domestic agenda in a way that would diminish if the END were repealed.

The cost-benefit assessment (CBA) in Section 3.2.4 under efficiency showed that many of the positive health effects and long-term benefits are likely to take time to fully materialise. Since the sustentative costs incurred by MS in respect of END measure implementation are mainly incurred upfront, yet the benefits are likely to occur over a much longer time horizon (up to 25 years), it does not seem advisable to repeal the Directive, when the main benefits of measures have not yet been realised. Of course, some benefits will still accrue once the money has been spent on measure implementation, but not all benefits would arise and there is a strong risk that some measures planned under the END would not be prioritised if the Directive was repealed.

Overall, since there are benefits of the END in fostering a common approach at European level that would not otherwise occur in the absence of an EU-wide common approach to data collection, and considerable further benefits as a result of additional noise mitigation measures that may not have occurred in the absence of the END, repealing the Directive would not be appropriate, on the basis of the evidence presented in this report.

Key findings - European Added Value (EAV)

In summary, a number of findings can be made in respect of EAV.

Overall

- The END demonstrates strong EAV because it has put in place a common EU legal framework for the first time. Moreover, at a national level, approximately 15 MS did not have environmental noise legislation prior to the END's adoption;
- The Directive has made a significant positive contribution to putting the issue on the domestic and EU-level political agenda, and in raising awareness among policy makers and the wider public;
- A minority of stakeholders maintain that added value has been limited given that there was already existing national legislation on environmental noise and mitigation, abatement and reduction initiatives in place prior to the END;
- The distinction between national measures and those that can be considered as having been implemented through the END (albeit using national funding, given that the END lacks its own budget) is arbitrary, since many noise mitigation and abatement programmes are of a long-term nature.

Absence of the END

- Without the END, there may have been noise maps available in some countries that were useful for national, regional and local policy and decision-making purposes, but there would not have been noise maps produced using common metrics across the EU to inform source legislation.
- In instances when noise mapping was carried out prior to the END, this was often in the context of land-use planning, for instance, proposed housing developments in proximity to major transport infrastructure and airport expansions or due to national regulations
- Post-END, noise mapping for national purposes, such as land-use planning sometimes still relies on national methods and descriptors where these relate to national legislation or adherence with specific guidance documents e.g. WHO, National Standards etc.
- However, a clear added value of the END is that mapping was not required in most MS prior to the END. This meant that there was a lack of population exposure data collected systematically by source in most MS, and certainly across the EU as a whole. Since such data is necessary to assess the health effects of high levels of

noise at both national and EU level, the data collection process provides vital data collected on a common basis and which was not previously available.

- In countries where there was previously no environmental noise legislation, it is unlikely that there would have been as much focus on noise mitigation, abatement and reduction measures, since there would not have been any legislation to encourage public authorities to identify and implement measures.

- Although there may have been some measures where there are noise mitigation benefits but other primary drivers (e.g. road safety, planned transport infrastructure development), it is unlikely that there would be dedicated noise mitigation, abatement and reduction measures in at least some countries that no such legislation prior to the END.

- In those MS that already had such legislation, had the END not existed, there would have been fewer differences, in that MS with a long-established regulatory framework have typically allocated funding to noise reduction and mitigation both pre-END and post-END. Nevertheless, the fact of having a European Directive in place was found to have led to the heightened the visibility of environmental noise. Given this, in the absence of the END, there would have quite possibly been lower expenditure available for environmental noise mitigation.

3.3 Questions on Future Perspectives

Although most aspects of the evaluation are retrospective, a number of forward-looking questions were posed in the Tender Specifications for this study. The detailed responses to these questions are now set out. It should be noted that in addition, in assessing the previous 17 EQs and sub-EQs, the analysis has suggested a number of possible ways forward to strengthen the relevance, coherence, efficiency, effectiveness (and impacts) and the European Added Value of the END. Suggestions in this regard are set out in Section 4.3 (Future Perspectives).

EQ18 - Is the scope of the Directive (as laid down in Art. 2) appropriate or does it need to be modified?

This is mainly a coherence question. However, there is a future-oriented issue as to whether the END's current scope as set out in Art. 2 is sufficient and appropriate.

The scope of the END was found to be broadly appropriate. However, some stakeholders questions why schools and hospitals are mentioned when they are not addressed elsewhere in the END. The broader issue of the END's scope also relates to Art. 3 and was already addressed in the analysis of relevance (see Section 3.2.1). It is made clear that many END stakeholders do not think that the scope is sufficiently ambitious since it focuses on the process of achieving a common approach and not yet on setting out a clearer long-term objective, such as a target for the "percentage reduction in the number of people exposed to potentially harmful effects of noise above a specific dB threshold". A further issue is that in defining quiet areas in open country in Art 3(l), recreational activities are referred to, but these are not mentioned anywhere else in the Directive

EQ19 - Are there gaps where further EU noise legislation is required in order to achieve the objectives of the Directive?

The research did not identify any areas not already covered where new EU legislation on noise at source could be required in order to achieve the END's objectives. This was confirmed through a detailed legal mapping assessment of existing EU source legislation across the different relevant transport sources (see Section 3.2.3.6 and EQ8 - What progress has been made towards achieving the END's second objective?).

Rather, as detailed in the section dealing with external coherence, the main role of the END is to inform *existing* source legislation through the collation of the results reported by EU MS through strategic noise mapping and through the provision of population exposure data.

EQ20 - How could the reporting mechanism be improved?

In EQ12, the efficiency of the END reporting mechanism ("ENDRM") was examined. In EQ20, ways in which the ENDRM might be further strengthened and its efficiency improved in future are considered, along with possible means of simplifying reporting requirements and enhancing use of open data already made publicly available.

It should be noted that these suggestions draw on the interview research, the open responses to the online survey and on the responses to the OPC on the evaluation. In addition, they rely on the evaluation team expert's judgement having conducted a desk research-based review of END reporting data and information currently available, the two databases on SNMs and NAPs and of the EEA Handbook since this sets out the structure of the ENDRM and Data Flows.

Firstly, MS are **currently able to submit reporting information through any delivery mechanism they wish**. Whilst the majority of MS are using Reportnet, this is not the case in all MS. Some national CAs appear to prefer to send NAPs directly to the EC in hard copy. At least in one MS, the formal submission of reporting information was made by the permanent representation in Brussels rather than by the CA directly, accompanied by a covering letter. In the evaluation team's view, it would be more efficient to restrict the ENDRM to a single mechanism, the Reportnet. The rationale is that there are advantages in having a common shared information infrastructure since the data and information reported by the MS is automatically updated in the linked CDR, which would mean that reporting data could be aggregated in real-time.

The EEA Handbook for the delivery of data in accordance with Directive 2002/49/EC makes clear that *"To maximise inter-comparability and harmonisation between MS, a fixed common format for reporting is necessary".* Any data not submitted via the Reportnet electronically would therefore have to be re-entered manually which would slow down the reporting process and be less efficient than having MS input the information and data with this then being collated automatically in the CDR.

Moreover, given the difficulties that have been encountered in the lack of timely submission of reporting data and information by some MS in both R1 and R2, **gaps could be identified more easily if Reportnet were to be used as the single END Reporting Mechanism.** Since all MS have access through the EIONET to the Reportnet, this should not cause CAs any particular problems, other than ensuring that they make sufficient human resources available to upload and submit the data and information.

It is appropriate that MS should submit electronic versions to the EC, and **avoid sending hard copies unless the electronic version has already been sent** (and the hard copy is a courtesy duplicate copy for the EC). Submitting in hard copy only is not in the views of the evaluators appropriate, since the data and information would then need to be reinputted manually by the EC (or the EEA or their contractors on behalf of the EC) into the CDR so that the data can be aggregated at an EU-28 level.

Moreover, since SNMs and population exposure data has to be made publicly accessible not only at the MS level, but also at the EU level through the EEA's Noiseviewer tool, streamlining the reporting process so that all MS submit electronically through Reportnet would help to strengthen efficiency by further automating the process.

Secondly, suggestions were made as to how to simplify the process of transmitting reporting data and information to the EC through Reportnet. In the **UK**, for instance, it was suggested by the national CA in their submission to the OPC for the UK that the ability to upload **pre-completed Word documents (or similar) instead would be much simpler than completing online forms** and would still meet the legal obligation (c.f. Data Flow 6_9[165] and Data Flow 7_10[166]). It was however noted that some information submitted via spreadsheets uploaded by national CAs is already used directly by the EC for reporting population exposure assessment (Data Flow 4_8[167]). This was viewed as being welcome since the data could be directly used by the EC without having to be re-entered by the national CA. It was posited that this approach could be extended to other forms of reporting. However, whereas data in Excel can be used directly by the EC for END reporting purposes, if MS were to submit information in Word instead of via the data fields in the ENDRM, this would still require data entry by the EC (assisted by the EEA). There are two alternative options:

- Simplify and / or reduce the number of data fields that MS have to input into the reporting system.
- Allow MS to submit some reporting information in standard Word templates using a common format and ensure that the EEA is allocated resources to transfer this reporting information into the Reportnet's CDR directly.

In the view of the evaluators, either of the above approaches could help to reduce administrative reporting burdens but the latter is predicated on the EC making the necessary resources available to coordinate the transfer of information and data from Word to its own databases. Arguably, one advantage of the latter approach is that if the EEA were delegated responsibility by the EC for transmitting any reporting data submitted in Word templates into the database, this could be built into a data quality and consistency check of the reporting information provided.

A further suggestion made by a national CA in the **UK** related to the possibility that **the EC (supported by the EEA) could make greater use of open data that is already publicly available** since some MS have a strong open access data policy and publish all the END information that has to be reported online in the public domain. However, whilst this is a useful suggestion, there may be practical difficulties. Many MS do not publish all reporting information on SNMs and NAPs via a single portal, especially in the case of MS that have adopted a decentralised implementation approach. For example, **France** does not appear to have a single portal but rather individual CAs publish NAPs and SNMs online. Also, if the EC was reliant on gathering data via online portals, all MS would need to ensure that the data were readily available via a single online portal and this would also require the EC (or EEA on its behalf) to be allocated sufficient resources to collect and enter END data and information manually.

The question of open data more generally also relates to information accessibility (EQ7b). Overall, gathering data directly from open source databases and websites is a viable option in future, but only if all EU MS get their act together in terms of making all the data and information available on a timely basis ideally accessible via a single portal that the national CA coordinates and updates regularly. Unless this is the case, it will not be possible to avoid the need for MS to input the same data via the Reportnet.

Thirdly, there were found to be **some weaknesses in END reporting data and information** in respect of **SNMs and exposure data within agglomerations**. In particular, in the current database, data is collected in respect of transport sources *within* agglomerations, but not in respect of agglomerations *overall*.

[165] DF6_9: Noise control programmes for major roads, railways, airports and agglomerations
[166] DF7_10: Noise action plans for major roads, railways, airports and agglomerations
[167] DF4_8: Strategic noise maps for major roads, major railways, major airports and agglomerations

Moreover, completeness information for major roads and major railways is only collected at country (and sometimes at segment) level, but not by km of major roads and railways within scope of the END. In future, an interviewee involved in analysing the data submitted by MSs suggested, it could be "necessary to evaluate the completeness of major road and major railway network at the segment level, which would provide a completeness value closer to the current reality".

This would however necessitate changes to the reporting requirements of the END, but the ENDRM itself would not need to be changed. This is dependent on clarifying and interpreting in relation to the expectations of the EC and the MS concerning how important it is to have a 'real-time' picture of compliance. If MS submitted all reporting information and data on time then spending resources to assess data completeness would be a much less important priority. An even more refined picture would be available if MS submitted coverage data for major roads and major railways by km covered within END scope.

Another way to improve the kind of data and information reported on SNMs would be to clarify that information on major roads and major railways completeness should only look either at road and railway segments *inside* or *outside* of major agglomerations, or *both*. **Currently, this has not been systematically clarified across all MS, thus impairing data comparability.** The ENDRM handbook could be updated to this end.

Fourthly, one of the aspects of the ENDRM that could potentially be improved is that the Reporting Mechanism should be tweaked so that it provides an **early warning system for the EC to flag up a situation where MS have missed the formal cut-off dates for the submission of reporting data and information stipulated in the Directive**. Likewise, if within specified periods of the formal reporting period, data completeness remains lower than anticipated, this could **trigger an alert sent to both the EC and the MS concerned, so that there is a formal mechanism for ensuring that both parties are aware when data has not been submitted**. Contact could then be made with the MS concerned to establish (i) what are the reasons why the data has not yet been submitted (ii) which remedial actions the MS proposes to take to address the problem and (iii) by when the MS intends to provide the END reporting data and information.

A **written explanation for the delays from the national CA could be required in a future possible revised Directive by the EC within a specified timeframe.** There is of course a need here to refer to the findings in respect of effectiveness (EQ7a) relating to progress in respect of Article 1(1a) strategic noise mapping, and the second implementation review (Section 2.3.7), which identified delays in some MS in both Rounds in the submission of reporting data and information to the EC.

However, before making any such changes to the Reportnet reporting system that could require MS to report more promptly on any challenges that they have encountered in meeting the deadline, it is important to acknowledge the challenges identified earlier in the report relating to the timeline for the submission of NAPs. In Section 2.3.7 and 2.3.8, it was noted that most MS found that the 12 month period between the formal submission of SNMs and NAPs is too short to allow sufficient time for action planning and consultation processes. Indeed, action planning methodologies themselves were found to be incompatible with a 12 month timeframe (e.g. in Germany among local municipalities). This suggests that the timeliness of reporting could be improved by making the timeframe for reporting submissions more realistic in the first place, perhaps by extending the submission period to 18 or even 24 months instead of the current 12 months.

Fifthly, in EQ12, a description of the way in which the Reporting Mechanism operates, including Data Flows and how the relational databases in the CDR are linked to Reportnet has been provided. Generally, the ENDRM was found to work efficiently. However, **it was identified that presently no monitoring data is collected in relation to the implementation of measures foreseen in NAPs**. Such data would be useful in order to be able to better ascertain whether MS have implemented particular measures identified in NAPs in full or partially, and the actual costs as opposed to the projected, which may differ significantly.

This could provide **important data and information for future cost-benefit assessment work**, which is presently dependent on ex-ante projections before measures are implemented set out in NAPs at the outset of each Round and case study work, which requires external consultants. Although in theory, such information should already be included within NAPs (i.e. as part of Annex V setting out the minimum requirements for NAPs), in practice, this was rarely found to be the case.

An alternative approach would simply be to **collect data on measure implementation directly from CAs through Reportnet.** Since the number of measures per NAP that actually go ahead is relatively low, this would not be that burdensome per NAP, although it could cause greater administrative burdens for those MS that have adopted a highly centralised approach and have to produce many NAPs overall. If such monitoring data were to be collected, it would provide a more comprehensive picture as to which measures have been supported, and the magnitude of impacts (i.e. the extent of the END's contribution to reducing noise which although not an explicit objective, is implied in the recitals).

Sixthly, the interview feedback also revealed **differences in the level of understanding about particular aspects of the reporting system**, such as whether national CAs should send complete NAPs or only summaries. Whilst the Directive clearly states only a summary as a requirement, there is uncertainty as to what constitutes the formal submission of a NAP. Some interviewees also noted that the current approach raises the problem that some MS may submit a summary of a NAP but then have not actually finalised, adopted in their MS or published the NAP online. This has the potential to create material uncertainty with regard to data completeness figures. One possibility could be to **organise a training session for relevant MS authorities by the EC** (supported by the EEA) so that national CAs have a better understanding as to how the reporting system works, the precise deliverables/ outputs that should be submitted etc. This could be repeated periodically (e.g. once every three years) to allow for the fact that there may be staff turnover changes within national MS CAs.

A further point was that there is a question mark as to **whether it is really necessary to involve the Permanent Representations in Brussels** to inform the EC by letter that NAPs and SNMs have been submitted. If all MS were to utilise the Reportnet instead, and use electronic submission of data, then the EC could be automatically informed through an email alert to inform the EC that particular SNMs, NAPs or a complete dataset of SNMs and NAPs has been uploaded by a particular MS (since country codes are used to upload the information). Otherwise, there is a risk of compartmentalisation of information regarding the timing of submissions, which emerged from the research in relation to the extent of coordination between the EC, the EEA and their contractors. Email reminders could also be used ahead of reporting deadlines to remind the particular MS concerned of an imminent reporting submission deliverable.

A penultimate point based on the data collection and analysis carried out for the implementation review is that the **extraction of data and information from the database for users at EU level** could be improved. Although the CDR provides a useful mechanism for aggregating the data, it was found to be difficult to easily extract information on at an EU-aggregate level for NAPs in particular.

Lastly, as the quantity of data in the database increases in size over successive END implementation rounds, this raises the question as to whether the EC should consider using **more sophisticated software in order to analyse the data, such as STATA (http://www.stata.com/) or SPSS**.

Previous experience in managing large datasets suggests that Excel is efficient as a mechanism for collating and storing data. However, for the data analysis stage, there could be advantages in using software with more sophisticated analytical capabilities. For instance, there is the possibility of analysing any duplicate entries in a more sophisticated way than would be possible using Excel, which only has limited duplicate analytical tools.

4. KEY EVALUATION FINDINGS, CONCLUSIONS AND FUTURE PERSPECTIVES

4.1 Key Evaluation Findings

The Terms of Reference for this evaluation included a list of evaluation questions to be addressed. Detailed answers to these questions have been provided through the analysis contained in Section 3. Additionally, several more technical questions ("EQs") relating to the achievement of common assessment methods taking into account scientific and technical progress are provided in Appendix G. In Section 4, a summary of the conclusions to each of the EQs[168] is provided.

These answers draw on the evidence and analysis presented throughout the report, particularly the summary of evaluation findings in respect of to each EQ.

Relevance

EQ1 - Are the objectives of the Directive still relevant?

The evidence suggests that the objective of Art. 1(1) of a "common approach to the assessment of environmental noise using common indicators" remains highly relevant to identified needs. However, a 'common approach' is an intermediate objective and the END does not presently set out a clear longer-term public health-based objective against which to evaluate its "relevance". Whilst improving health is implicit in the END, it could benefit from being made more explicit (e.g. "reducing the percentage of EU citizens exposed to environmental noise above dB threshold by a target of X %").

The second objective of the END (Art. 1(2)) of 'providing a basis for developing EU measures to reduce noise emitted by major sources' also remains highly relevant to identified needs. There is evidence to suggest that in order to address the problem of environmental noise and its health effects effectively, action needs to be taken at both source and receptor in parallel. Moreover, the absence of population exposure data based on noise mapping results prior to the END meant that policy makers responsible for source legislation had no clear source-specific baseline data on which to monitor the scale of the problem at receptor (and to assess the net contribution of source legislation). The collection of population exposure data on an EU-wide basis also remains strongly relevant given the importance of strengthening the accuracy of the assessment of the adverse health effects of noise at receptor, without which it would be more difficult to (i) strengthen source legislation and (ii) persuade national policy makers and funding bodies to invest in measures to mitigate and reduce noise at source.

EQ2 – How far is the END coherent and consistent with other EU legislation on noise (e.g. noise at source legislation (including by transport type i.e. automotive, railways, aviation)?

The research has shown that the END is acknowledged as being consistent with, and complementary to, other EU source legislation by the majority of stakeholders. Only a minority stated that there were inconsistencies between the END and other legislation. The evidence gathered through the research found that the relationship between the END and noise at source legislation is consistent, with wide acceptance of the mutually supporting nature between legislation at source and receptor. However, not all END stakeholders were aware of the inter-relationship between the END and EU source legislation.

[168] It should be noted that the order of the evaluation questions has been restructured during the assignment to address the main issues in a logical structure under each evaluation criterion.

Ensuring consistency is however an ongoing process related to the updating of existing EU legislation. For instance, several key Directives in the automotive and aviation sectors and Technical Standards for Interoperability (TSIs) in the railways sectors have been revised in the past three years, and the process of strengthening consistency and coherence between different pieces of legislation is therefore already relatively well advanced, with explicit references to the END and the potential utility of population exposure data in the recitals of updated source legislation. There were however some issues relating to the need to strengthen consistency between the END and source legislation in the case of those Directives that date prior to the END's adoption. The review of existing EU noise at source directives and regulations found that these are typically only revised once every 10 – 15 years. It will consequently take considerable time before all noise at source legislation is fully strategically aligned with the END.

Coherence

EQ3 - Are there any specific legal gaps, overlaps and inconsistencies identified between the END and other EU legislation?

The research found strong coherence between the END and other EU environmental legislation, with no evidence of duplication and minimal overlap.

The only area where there was some concern about overlap related to the mapping of industrial noise within agglomerations, since this falls within the scope of the END but industrial noise control also falls within the scope of the Industrial Emissions Directive (formerly the IPPC). However, this was mentioned by a minority of stakeholders and the majority of stakeholders did not see this as duplicative. The issues identified appear to relate to practical implementation issues, such as ensuring clarity as to which industrial sites should be mapped under the IPPC and which under the END, rather than to actual duplication *per se.*

There was however evidence of a need to undertake a legal review exercise in future to update the END so as to reflect the broader EU legislative developments that have taken place since the Directive was adopted. For instance, the INSPIRE Directive was adopted after the END but has implications for some aspects of END implementation, such as encouraging EU MS to go beyond simply making information accessible to a more active open data policy (this could also potentially bring about efficiency savings in future).

However, since the END is implemented under subsidiarity, responsibility lies not only with the EC (ensuring that the complete dataset is made available so that it can be integrated into spatial datasets) but also with the MS. Since environmental noise (at receptor) was widely acknowledged as an issue best addressed at local level, it is individual MS' responsibility to ensure that END population exposure data is made readily available to EU citizens and other relevant stakeholders and where appropriate, linked to other spatial datasets as part of the INSPIRE process.

A further issue identified in relation to the need for updating the END was that since the Directive was adopted, the Lisbon Treaty came into effect (1 December 2009). Some wording changes will be necessary when the legal text of the Directive is updated in future. However, the changes required are expected to be relatively minor, such as ensuring that references are referring to the EU rather than to the Community.

A gap in the Directive as it currently stands is that Art. 1(1) is concerned with *defining* a common approach. Clearly, in order for the Directive to be effective, there is a need to go beyond defining to actually implementing a common approach (at least in respect of the collection of comparable data based on common assessment methods). The objective of "*defining* a common approach' is more appropriate for the early stages of END implementation (the first five to ten years), rather than to the objective over the longer-term (ten to twenty years) of having a fully common approach with comparable data able to influence source legislation and ensuring that a comparable and robust dataset is available between rounds on the basis of which MS can take action on a prioritised basis.

EQ4 - How does the Directive relate to national noise policies and legislation? Is it consistent and to what extent does it duplicate existing requirements?

National noise policies and legislation were found to be consistent with the END, at least now that national legislation has been amended as part of the END transposition process in those EU countries that had pre-existing legislation on environmental noise. . . In such countries, there was a need to ensure appropriate alignment between the END and pre-existing national legislation.

From a MS perspective, beyond the immediate transposition phase, ensuring coherence has sometimes led to practical complications in END implementation by national CAs. Although most issues have now been resolved, there are ongoing challenges for some MS, such as the need to produce data and to report to the EC based on a common assessment method and the L_{den} and L_{night} metrics, whilst at the same time continuing to produce data using national computation methods and noise indicators for national reporting purposes. However, this problem was specific to a few countries, such as in Scandinavia (Nord 2000) and in the UK (where noise maps based on LEQs are still required for national reporting purposes for major airports). This problem was however confined to a few countries. Most countries already report only in L_{den} and L_{night} for both national and END reporting purposes or are planning to do so as part of the transition to implementing the CNOSSOS-EU methodology through Commission Directive (EU) 2015/996.

EQ5 - Are there any elements of the Directive (e.g. specific articles/ sub-articles, definitions of key terms, requirements for public authorities) that are unclear? Are there any provisions that are obsolete and if yes, why?

Although a review of the legal text of the Directive found it to be broadly consistent, specific examples were identified where particular aspects of the END were either seen to be inconsistent, or where the terms and definitions used were regarded as requiring further clarity. These are however based on the perceptions of END stakeholders overall, which includes the views of local authorities that may be less familiar with the intended meaning of EU legal texts. The perceived problems were found to be concentrated in a few areas, such as within Art. 3 (definitions). For example, the definition of an agglomeration, a quiet area in open country and a quiet area in an agglomeration were found to have led to the most common interpretation and definitional problems.

A number of END stakeholders stated that greater clarity would be helpful in interpreting the requirements in the END. Among the examples where further EU guidance would be appreciated is in determining how MS should (1) prioritise the management of harmful effects (2) select quiet areas in both urban areas and in open country (3) shed light on what is meant by the term to undertake noise mapping once every 5 years if necessary. This could be achieved through the issuing of non-binding guidance to support the END's implementation by the EC (or the EEA).

Whilst it is clear that measures should be included within NAPs, different MS have interpreted differently whether they are actually required or expected to implement measures. This is a good example of the difference between the legal requirement themselves, where it is clear that the implementation of noise abatement, mitigation and reduction measures within NAPs are only voluntary and practical interpretation difficulties, such as competent authorities gaining the impression that they have to implement measures, where translations of the legal text into another language may result in different interpretations and understandings of the requirements. Here, it is worth referring back to the earlier point raised under 'relevance' that some confusion reigns among some END stakeholders because the END includes an implicit reference in the recitals to reducing noise, but there is no explicit objective in this regard. It is likewise implicit that MS should ideally implement measures rather than explicit.

In relation to **obsolete provisions**, Art. 7 (strategic noise mapping) refers to agglomerations in R1 with more than 250,000 inhabitants, whereas the definition of an agglomeration in Art. 3 refers to the definitive threshold of 100,000 inhabitants. References to the transitional period of END implementation could be deleted in any future codification and updating exercise.

EQ6 To what extent is the Directive sufficiently clear in setting out the obligations of Member States at the level of (i) the Competent Authority and (ii) other stakeholders involved in national implementation?

Whilst Art.4 makes clear that each MS should designate CAs responsible for END implementation, in particular in relation to the preparation and developments of SNMs and NAPs. However, the Directive is not prescriptive as to how they should organise **national administrative arrangements**. The research found evidence that most EU MS appreciate the flexibility (under subsidiarity) to determine how they should organise END implementation at national level.

However, some national CAs would prefer there to be greater clarity in the END as to how national implementation arrangements should operate, the role of different stakeholders within the END etc. since they have experienced practical difficulties in coordinating arrangements effectively, and in determining sub-national administrative arrangements for END implementation. The research found that this has led to delays in the provision of reporting data and information by local to national levels of administration and in particular to the national CA responsible for data collection and collation. This in turn led to delays in the submission of such reporting data to the EC. A further problem was the lack of national enforcement capabilities to require designated CAs to produce SNMs and NAPs, especially at local level.

There was a perceived lack of clarity in the legal text as to what reporting information and data, public authorities responsible for mapping and action planning at a sub-national level must provide to national CAs responsible for collecting the data. The absence of details as to which other organisations should help to support END implementation was not seen as problematic. For instance, local authorities not directly involved in noise mapping and action planning themselves were generally willing to provide input data where available.

Effectiveness

EQ7 - What progress has been made towards achieving the first objective of the END?

Significant progress has been made towards achieving the first objective of the END (defining a common approach). The research has shown that greater progress has been made towards the first than the second objective of the END (informing source legislation).

Progress has been made through the adoption of a **common EU-wide approach to noise mapping** (**(Art. 1(1a))** initially using national and interim methods) and action planning and through the subsequent development of the CNOSSOS-EU common noise assessment method to replace Annex II. However, whilst the publication of the revised Annex II in Commission Directive (EU) 2015/996 was a major milestone towards a common approach, it will only be implemented across EU-28 from Round 4 (2022), which means that some aspects of the goal of attaining a common approach can only be realised over the longer-term.

Less progress has been made in respect of the achievement of **a common approach to assessing health effects** (i.e. relating to Annex III of the Directive). Work by the EC commenced in 2014, but the timing of the development of the assessment method for determining source-specific dose-response relationships required is dependent in turn on the timing of the finalisation of WHO guidance on dose-response relationships. The EC expects to make considerable progress in the next two years in this regard.

Strong progress has been made in **making information publicly accessible (Art. 1(1b)).** Most SNMs and NAPs were found to have been published online R1 and R2, although the research found that R1 SNMs and NAPs were more readily available online than in R2 to date. This may reflect the considerable delays in some countries in R2 in finalising key reporting information, submitting it to the EC and publishing it online.

A common approach to **noise action planning** (**Article 1(1c))** has already been achieved, albeit mainly in terms of all MS going through a common process to produce a NAP, whilst adhering to the minimum requirements of a NAP outlined in Annex V and undertaking a public consultation. The research identified major differences between countries in terms of how they have approached action planning (from strategic to operational approaches) and as to whether they have identified expenditure measures, other types of measures, or a combination of the two.

Nevertheless, divergence in approaches but following the same common broad framework were seen as reflecting the spirit of subsidiarity which should guide the END's implementation. One aspect where less progress has been made is in respect of the financial information section relating to NAP implementation required under Annex V. In particular, a key finding was that there is often a lack of data on the costs (and especially the benefits) of noise mitigation measures.

In terms of the **speed of progress**, there is no formal defined timeline in the END for the achievement of a common approach. Whilst some national CAs were found to be disappointed that CNOSSOS-EU could not be implemented earlier, others requested the extra time in order to allow them to make the transition from using national and interim assessment methods.

EQ8 - What progress has been made towards achieving the END's second objective?

Good progress has been made towards the END's second objective (Art. 1(2) of "providing a basis for developing Community measures to reduce noise emitted by the major sources". However, this objective was found to be less concerned with developing *new* measures, and more concerned with informing the revision and updating of *existing* source legislation, since some transport sources covered by the END (i.e. major roads and major airports) were already subject to source legislation. An exception in this regard was the adoption of the TSIs in the railways sector, where some new developments have occurred in addition to the updating of previous rules and the extension of their scope (e.g. from new rolling stock only to existing rolling stock).

The legal mapping found that since 2014, when a number of pieces of existing source legislation were revised (in respect of airports and the automotive sector), the impact assessments and recitals to the revised source Directives[169] have made strong references to the END as providing a strategic reference point for source legislation. They also emphasised the future importance of END data on population exposure in informing the monitoring of the implementation of source legislation.

Until the revised Annex II (Commission Directive (EU) 2015/996) is fully implemented, however, END data is not yet comparable between rounds or countries, and the evidence shows that this will directly influence the timescale over which the second objective of the END, of providing a basis for determining source legislation, is likely to be achieved.

The achievement of harmonised and comparable population exposure data through noise mapping under the first objective was regarded as a precursor for END data to be utilised by EU policy makers to inform the revision of existing EU noise at source legislation. Although some END stakeholders involved in national END implementation believe that the data is already sufficiently robust to be used to inform the development of source legislation, the research showed that policy makers themselves have not yet used END data. They stated that they are unlikely to do so until the issues of data comparability and data completeness have been addressed.

EQ9 - What are the main impacts of the Directive?

The impacts of the END to date were assessed both qualitatively (under this EQ) and quantitatively (EQ13), the latter as part of the measure-level case studies and the cost-benefit assessment (CBA). Impacts are considered in relation to several sub-questions.

EQ9a - How far has the Directive achieved any significant changes (positive or negative)?

Key findings were that many stakeholders attested to the END having had positive, non-quantifiable effects over and above measure implementation. These include: (i) promoting a more strategic approach to environmental noise management, mitigation and reduction through action planning (ii) strengthening the visibility of environmental noise (iii) raising awareness about the adverse health effects of high levels of noise at receptor and among policy makers (e.g. transport planning, infrastructure development, urban development and planning) about the importance of incorporating environmental noise mitigation from the outset and (iv) promoting "joined-up" working between different stakeholder organisations at national, regional and local levels, who might not have previously cooperated together prior to the END.

The END was found to be primarily driven by the collection of data and information on a common basis that can subsequently be used for different policy-making purposes at EU level (with indirect benefits for policy makers and public officials at national, regional and local levels). For EU policy makers, a clear impact of the END is that noise maps are now available by source which provide population exposure data. This is useful for assessing the effects of existing source legislation and for considering its potential revision (subject to data comparability issues being addressed). The END has made noise data available that provides a means to monetise the impact of noise, for determining the overall environmental burden of disease (see the CBA findings in EQ13).

The data also has indirect benefits for national and sub-national policy makers (even if that is not the primary purposes of the END), since the maps and exposure data can help to prioritise environmental noise interventions domestically. Evidence was also found that some national authorities are utilising END data and approaches to action

[169] See for instance the recitals and impact assessments for Regulation 540/2014 (motor vehicles), Regulation (EU) No 598/2014 (airports) and Regulation 1304/2014 and Regulation (EU) 2015/429 (both TSIs on railways)

planning to benchmark their performance and own approaches to noise mitigation and abatement at receptor. Lastly, the END has also made information about the level of noise exposure by 5dB band (from road and rail in particular) available to EU citizens (who previously had little or no access to information of this type).

EQ9b - Has the Directive contributed to ensuring that by 2020 noise pollution has significantly decreased?

The END was found to have contributed to reducing noise pollution (and the associated objectives set out in the 7th Environmental Action Programme). There are well-documented uncertainties relating to attribution factored into the CBA (see EQ13 and Annex E, which explains the methodology for the CBA in detail). It was consequently difficult to establish the precise percentage contribution of the END. Moreover, at an EU level, there is an absence of data collection through reporting systems on measure implementation across the EU as a whole. This makes it difficult to obtain a comprehensive overview as to which measures identified in NAPs have gone ahead in full, partially or not at all and thus to determine the extent to which the estimated benefits can be attributed to the END.

Notwithstanding, the END was found to have made a positive contribution to decreasing noise not only through measure implementation but also by raising the visibility of environmental noise on the domestic policy agenda, such that central, regional and local governments have given greater attention to the problem through expenditure programmes in relevant government departments (e.g. infrastructure development, transport) in some countries. In some cases, noise mitigation actions have been established within transport and infrastructure planning programmes that might not have gone ahead were it not for the END.

The findings from the test case data suggest that END measures have made a valuable contribution to reducing population exposure, although for some types of measures, the net benefit can only be fully assessed in subsequent mapping rounds, since (a) the full benefits can take a significant period of time to materialise and (b) the test cases have assumed complete implementation of measures identified in the NAPs and for which cost and benefit data was available.

The analyses conducted in the 19 test cases revealed that there has been a positive impact on noise reduction measured in terms of the change in the size of the population exposed to noise by 5dB class due to measure implementation. The level of magnitude of the reduction by source is set out in the table below, which is taken from the detailed case study work (see EQ9b and also Annex F, which sets out the case studies in full).

Table 4.1 - Change in the size of the population exposed to noise due to case study measure implementation

Change in the size of the population:	Major roads (n=2)*	Major railways (n=2)	Major airports (n=5)	Agglomerations (n=6)
Annoyed	40,777	7,924	27,356	74,440
Highly annoyed	18,685	3,256	12,833	38,859
Sleep disturbed	22,037	2,228	19,593	38,479
Highly sleep disturbed	10,044	1,020	12,312	18,710

** n = number of case studies from which the estimates are derived.*

EQ9c - Can any unexpected or unintended consequences be identified?

The research did not uncover many unexpected or unintended consequences.

An example of an **unexpected effect** of the END is that it has stimulated stronger interest among MS in quiet areas in urban areas (agglomerations). There is evidence of increased research interest in the urban soundscape as a result, as shown in the assessment of the research topics of projects funded through FP6, FP7 and the LIFE programme (*see Appendix I - Assessment of Utility of EU Funded Research Projects on Environmental Noise).*

An example of a further positive unexpected effect was that in some MS, END data has been integrated into other datasets, for instance in the health field. END data has been used to feed into epidemiological studies to assess the health impacts of high levels of noise exposure in tandem with other health variables.

There were concerns that END data might be used for purposes that it was not originally designed for, with a risk of unforeseen consequences. For instance, it may not be clear to end users (especially individual citizens but also less well-informed NGOs) that there are assumptions and limitations in the data. For instance, the research has shown that it was not always appreciated that END data is often based on a computerised projection based on an average metric over 12 months rather than on *actual* noise levels. Whilst in some EU countries, this potential problem was actively managed by producing FAQs, no evidence was found that the misinterpretation of END data was a major problem.

EQ9d - To what extent can impacts be quantified?

It is too early to assess the full range of quantitative impacts of the END, particularly through the implementation of measures, because many measures identified in NAPs have not yet been implemented, but also because of the long-term time horizon over which benefits materialise (25 years was assumed in the CBA). However, through the CBA, a preliminary assessment of impacts was undertaken (see EQ9b which examines how far the END may lead to a reduction in noise by 2020 and EQ13, which sets out the CBA findings, and provides a monetised assessment of the health benefits).

EQ10 - How have the provisions of the Directive been accepted by the stakeholders?

The research examined the extent to which each of the following END provisions been accepted by stakeholders:

- Noise measurement through a system of common indicators and a common methodology (CNOSSOS-EU) being implemented in future through Commission Directive (EU) 2015/996);
- Noise mapping;
- The preparation of noise action plans;
- Information and consultation of the public; and
- Reporting to and by the EC / EEA and reporting under Art. 11.

The evaluation findings were that the three actions required under the END, as set out in Art. 1(1a, 1b and 1c) of the Directive relating to noise mapping, information and consultation with the public and action planning respectively are **widely accepted by stakeholders.**

Although some END stakeholders were initially reluctant to make the transition to producing SNMs using a common approach based on the revised Annex II, there was an acceptance that this would be necessary to strengthen the availability of data at an EU level of high levels of noise and to strengthen comparability in future.

The L_{den} and L_{night} indicators have been welcomed by stakeholders, since these provide a common basis for collecting noise exposure data on affected populations within scope by source across the EU. Even if some MS have decided to retain the use of additional national noise indicators, they can see the value of common noise metrics (e.g. allowing MS to benchmark with one another, better assessing the net impact of source legislation on noise at receptor).

The process of action planning – including the public consultation dimension – is widely accepted by END stakeholders. Indeed, the research found that the END plays a positive role because it provides a formal mechanism through which they can undertake community engagement. The reporting requirements to the Commission, as required under Art. 11, were accepted and generally regarded as administratively proportionate, although a small number of stakeholders questioned whether quantifying population exposure down to a precise number of inhabitants is in keeping with the concept of a *strategic* approach to noise mapping.

Efficiency

EQ11 - How far are the administrative costs of END implementation proportionate? To what extent does the level of administrative costs vary?

The administrative costs of END implementation at EU and national level are mainly incurred in carrying out the three activities of a) strategic noise mapping, b) making data and information *publicly accessible* and c) noise action planning. All three activities contribute towards achieving objective Article 1(1). In addition, other types of costs may also be incurred, such as human resources linked to overall coordination at national (and / or regional level), the costs of collecting data from different CAs at national level and the costs of reporting data and information to the EC.

The Costs of Strategic Noise Mapping

Although it was challenging to obtain a complete, consistent, and comparable dataset across all EU-28 MS, the cost data that was obtained identified considerable heterogeneity in costs. This reflects the fact that under subsidiarity, very different implementation approaches are being adopted. The level of costs varied significantly between EU MS and was dependent on country size and total population, as well as on the type of implementation approach adopted (i.e. whether more centralised or decentralised noise mapping, etc.). Based on 23 EU MS for which national CAs provided data, the total cost of END implementation (focussing on noise mapping and action planning) amounted to at least € 75.8m in R1 and in R2. When extrapolated to EU28 level, the calculated figures are €80.3m in R1 and €107.4m in R2. This increase can be considered moderate given the increased scope of noise mapping and action planning required in R2.

The average estimated costs of noise mapping spread across the total population were €0.18 / capita (with a median of €0.15). The costs per affected inhabitant are higher, estimated at approximately €0.50 up to €1.00, depending on the MS.

The costs of procuring noise mapping services were lower in R2 than in R1 in many (although not in all) EU MS, reflecting greater experience among CAs in managing the procurement of noise mapping and greater competition among contractors, and the impact of the economic and financial crisis, which has had ongoing negative budgetary implications for END implementation in at least several EU MS. The trend towards lower mapping costs in R2 was in spite of an overall increase in the volume of noise mapping, due to the transition to the definitive R2 END thresholds.

The costs of action planning

Action planning costs also appear to have been reduced between Rounds in some EU MS, but this was more difficult to assess due to the lack of data on the costs of noise mapping, since this has relied on MS being able to assess accurately how much civil servant time CAs had spent on action planning. Since many different public authorities were often involved in action planning, and it was not common to monitor the time spent on such activities (including the public consultation dimension), it was only possible to estimate human resources in a small number of MS.

Insofar as cost data was available, there was also **considerable variance in respect of the costs of noise action planning.** As far as the level of human resources dedicated to END implementation were concerned, there was considerable variance, with a wide range in the estimated number of FTEs involved in END implementation (covering all activities). For instance, the number of FTEs in R2 ranged from 0.1 in Malta and 0.35 in Cyprus to as high as 196 in Germany. The costs were influenced by a similar range of factors to noise mapping, such as population size and the implementation approach adopted. The average costs of action planning per capita (based on total population size rather than END coverage only) were only €0.06 per capita (with a median of €0.03).

The general downward trend in administrative costs was attributed to the fact that the legislation has become better embedded and the fact that in R2, there were no longer any one-off compliance costs, for instance, those associated with familiarisation with the END's requirements, IT equipment and software purchase, etc. Some stakeholders however pointed to additional one-off compliance costs in future, when recalibrating noise calculation models to implement Commission Directive (EU) 2015/996.

Although the **reduction in administrative compliance costs between rounds** can be interpreted positively, the research through the interview programme found that some CAs have simply cut the budget available for END implementation in R2. This doesn't necessarily mean however that they have become more efficient at implementing the END, but rather that they have allocated less human and financial resources, which was found to sometimes have had adverse consequences from the perspective of efficiency *(e.g. the timeliness of SNM and NAP completion and data and information submission)* and effectiveness *(e.g. the lack of a complete EU-wide dataset, which risks undermining the achievement of the second objective of the END, informing source legislation).* There were however positive aspects in a small number of EU MS where the financial crisis has led authorities to focus more strongly on identifying cost savings (e.g. through more competitive procurement procedures).

Since the END is implemented under the subsidiarity principle, with evidence of very different approaches being adopted by different EU MS, it is not possible to compare the cost-effectiveness of these different implementation approaches. This is partly because the approaches are so different, which means that the cost-benefit ratio between the **inputs** *(i.e. human and financial resources mainly focused on action planning and noise mapping)* and the **outcomes** is not straight-forward**.** The benefits can be assessed quantitatively through measure-level assessment of costs and benefits, which is an important proxy of the Directive's efficiency. However, it does not capture the totality of costs and benefits which necessarily must take into account qualitative benefits.

The proportionality of the costs

Perceptions of the costs of END implementation were found to vary considerably among END stakeholders. In some MS, smaller municipalities viewed noise mapping as a costly exercise, but this was primarily because they do not receive a specific budget line for noise mapping from national government, and the budget has to be identified from their general budget. The costs of noise mapping were in the views of some NGOs interviewed quite high and risked detracting from measure implementation.

However, other stakeholders pointed out that whilst there are costs in the shorter term, over the medium – longer term, the costs of noise mapping should be only a fraction of the substantive compliance costs associated with the implementation of measures identified in NAPs. Another important point in relation to perceptions of costs was that not all national stakeholders understood the longer-term strategic benefits of the END in relation to informing source legislation (as set out in Art. 1(2)).

Stakeholders broadly agreed that the benefits of the END outweighed the administrative costs. However, whilst the majority of stakeholders viewed the costs of noise mapping / affected inhabitant are proportionate to the costs, where mapping takes place that covers a smaller unit (for instance, in smaller municipalities), the costs of mapping / inhabitant may be higher relative to the size of the affected population, since there are minimum costs of procuring consultants to carry out the mapping irrespective of the affected population covered, and conversely economies of scale to be realised when choosing fewer, larger units for mapping).

When the costs of END implementation are examined in aggregate across EU28 as a whole, the costs of noise mapping and action planning were estimated to be approximately €80.3m (R1) and €107.4m (R2). These costs were found to be proportionate relative to the total and the affected population, given that these costs are spread across a five year cycle and given the scale of the health challenges posed by environmental noise (see the findings from the CBA.

Although the costs were still low per affected inhabitant and per capita (among the total population), the research identified a difference of several times depending how particular MS have decided to implement the END. For example, the range in terms of the cost per capita was from €0.05 in the UK to €0.56 in Slovakia.

The assessment of whether administrative costs are proportionate needs to consider the (potential) benefits to be realised as a result of END implementation. It should be emphasised that these benefits relate not only to measure implementation, quantified in the CBA, but also to the qualitative benefits of adopting an EU-wide approach to environmental noise management identified in EQ9a *(e.g. heightened visibility of noise at receptor across different policy areas, a more strategic approach at national level, greater cooperation across a spectrum of different policy areas that have relevance to environmental noise).* The benefits associated with measure implementation were addressed in EQ9b (the contribution of the END to reducing noise by 2020) and in the CBA in EQ13 (cost-effectiveness of the END).

At the request of the EC, the focus was on an assessment of the cost-efficiency of measures identified in NAPs that have been implemented in R1 (see EQ13 (cost-effectiveness of the END). However, such cost-benefit ratios at the measure level, whilst an important proxy, are different from the question of assessing the cost-effectiveness of the Directive overall. The latter necessarily requires taking into account the quantitative and qualitative costs and benefits of the END. The qualitative benefits identified through the research[170] were summarised in the impacts section (see Section 3.2.3.7 – impacts of the Directive).

In other words, the administrative costs associated with activities required through the END (e.g. noise mapping and action planning), are processes that have a number of qualitative benefits associated with them and these also need to be taken into consideration in order to form an evaluative judgment of cost-effectiveness at this stage in the Directive's implementation.

[170] Examples are a more "joined up" and coordinated approach across different policy areas at national, regional and local level to environmental noise mitigation, abatement and reduction, a more strategic approach to the management of environmental noise etc.

Assessing the END's full cost-effectiveness is not possible at this stage of implementation[171], since there remains some way to go in the implementation trajectory before comparable data is available to inform source legislation (Art. 1(2)). The longer-term benefits of the END have yet to be fully manifested. Nevertheless, it can be concluded that there is already a favourable cost-effectiveness relationship between the costs, which have been quantified in terms of financial and human resources, and the benefits[172] associated with noise mapping and action planning. These benefits have been assessed both quantitatively (see CBA) and qualitatively (see impacts section).

EQ12 - To what extent is the END reporting mechanism efficient?

This question looked only at the efficiency of the END Reporting Mechanism, mainly the use of the Reportnet, since this was the submission mechanism currently being used by the majority but not all other EU MS. Other important issues, such as the timeliness of data availability and its utility in informing source legislation, and whether there are gaps in the types of monitoring data and information being collected in the ENDRM are examined instead under 'effectiveness'.

The Reportnet system developed within the EEA's EIONET to collect data and information on END implementation from MS was found to be a useful reporting mechanism but one which is not yet fully efficient.

The research found that most national CAs were satisfied with the guidelines issued and reporting templates produced by the EEA as to how to use. However, less positively, the Reportnet system within the ENDRM was viewed as being insufficiently user-friendly. Several stakeholders stated that it had taken them a lot of time to upload all the required reporting data, and that particularly for action plan summaries, there were many data fields to be completed. Perceptions as to how resource-intensive the transmission of reporting information was were dependent on the level of resourcing available for END implementation at national level more generally, since the national CAs responsible for reporting in some MS have a very large number of SNMs and NAPs to upload and only limited human resources to work on END coordination and EC reporting.

More positively, the database on SNMs maintained and updated and published periodically online by the EEA and the EIONET website's Noise Viewer tool provide an efficient means of making reporting information and data publicly accessible. Among the less efficient aspects of the reporting system identified were that it is difficult to extract EU-level reporting information in respect of NAPs and there are too many data fields for the NAP summaries.

Notwithstanding the limitations noted earlier, the outcomes of the assessment suggest that the END is efficient overall when the benefits of measures implemented to reduce noise levels are considered. The NPV is positive under all scenarios (base case, best and worst case) and only negative for airports and roads under the worst case scenario. Under the base case scenario, both the NPV and cost-benefit ratios are positive, with an aggregate return on investment of approximately 29 EUR for every 1 EUR spent (excluding agglomerations).

[171] A time-based trajectory illustrating the point that the full and effective implementation of the END and the realisation of its objectives will take time (see EQ7 – progress towards objectives in Section 3.2.3 - Effectiveness and impacts).

[172] The quantitative benefits of the END linked to measure implementation were explored separately through the CBA and since these measures are non-obligatory, cannot be directly compared with administrative costs.

It was not possible to assess agglomerations in the same way as major roads, major railways and airports but detailed investigation of a range of typical measures applied in agglomerations suggests that the benefits of END implementation are likely to significantly outweigh the costs even though the cost-benefit ratios vary widely between measures.

EQ13 - To what extent does the Directive demonstrate cost-effectiveness based on an assessment of the costs and benefits to date?

Overall, the END appears to be cost-effective in that the benefits are likely to outweigh the costs over time. There are challenges in assessing the benefits at this early stage of measure implementation, given the long-term nature of many noise mitigation programmes and measures.

The administrative costs of END implementation have declined on a "like for like" basis in R2 compared with R1 (i.e. the total costs have remained steady but the volume of mapping and action planning have increased). The cost curve in implementing new legislation is centred on the initial stages of implementation (including one-off costs) whereas the benefits of bringing about a common, harmonised approach to noise mapping through a common assessment method will only materialise in full over the longer term. The costs of implementing noise abatement, mitigation and reduction measures identified in NAPs are likely to significantly exceed the administrative costs, in common with most EU legislation (where substantive costs frequently exceed administrative costs).

The benefits of measure implementation will only fully materialise after the end of the implementation lifecycle and are likely to extend for many years into the future. Notwithstanding, at this stage, there appears to be a favourable cost-benefit ratio for most types of noise mitigation measures, although there is variation as to the level of benefit, depending on whether a worst-case or best-case scenario is applied.

The level of benefit is dependent on taking attribution into account. Determining an appropriate attribution ratio is not straight forward due to the nature of the END, which is dependent on MS implementing measures at national, regional and local level through NAPs but using national funding sources. There is a perception that many measures have at least some form of national dimension.

The test case findings suggest that the benefits of END implementation exceed the costs of measures for all noise sources, and under a range of scenarios, the costs and benefits per person vary significantly and will depend on a number of factors including population density, background noise levels, traffic composition and the degree of maturity in addressing noise issues (which in turn will influence the selection of measures and background noise levels).

The total present value costs (including costs of implementation linked strictly to the END as well as costs of measures) across the EU-28 (excluding agglomerations) range from around €480 million to €30.8 billion over a 25-year period while the total present value of benefits (again excluding agglomerations) range from €8.5 billion to €157 billion. It should be noted that this due account should be taken of the data limitations and the assumptions applied.

The analysis of the relative costs and benefits of a number of typical measures suggests that the benefits of END implementation are likely to significantly outweigh the costs even though the cost-benefit ratios vary widely between measures.

EQ14 - What has been the overall EU added value of the Environmental Noise Directive?

EQ14a - What has been the overall EU added value of the Environmental Noise Directive?

The END has delivered European Added Value (EAV) by putting in place a common legal framework across the EU. Many MS did not have national environmental noise legislation prior to the adoption of the END**.** 15 MS were found to have no national environmental noise legislation in place prior to the END's adoption. Especially in the new MS (e.g. **EE, LV, LT, RO, SK and SLO),** the existence of an EU Directive on environmental noise has added value, since this required national legislation to be developed.

The END has also made a significant positive contribution to raising awareness among national, regional and local policy makers, politicians and the wider public about the importance of environmental noise as a policy issue and the extent of the problem.

EQ14b - To what degree were EU Member States already carrying out noise mapping prior to the END and how far were mitigation measures already in place?

Almost half of all EU MS had no environmental noise legislation in place prior to the adoption of the END. However, through the research, those MS that did have such legislation were identified (these include, for instance, **DE, DK, FI, FR, IE, IT, LU, NL, PL, PT and the UK)**.

Some of these MS were already carrying out noise mapping prior to the END. However, the data and maps were not always made available to citizens. However, noise maps were not produced on a common basis across the EU, so it would therefore have been very difficult for source policy makers to systematically use the data and maps to inform source legislation.

In terms of the existence of mitigation measures prior to the END, many of those MS that had national legislation already were also found to have long-established noise mitigation schemes in place (**e.g. AT, DE, DK, NL and the UK).** Some of these were established a long time ago and their period of implementation may extend over 20-25 years, reflecting the long-term challenge of tackling noise at receptor. National regulations were the key drivers of measures, and some measures were already well-established by the time the END was adopted.

The mitigation measures already in place have been continued under the END. In general, these have been continued on the same scale, although some examples were found as to how the heightened visibility of environmental noise within the END had increased the scale of funding. In countries that did not have any such legislation before the END, there were generally no mitigation measures because the issue was not on the domestic policy agenda as being a serious problem. In these countries, for the CBA, we have therefore assumed a much higher level of attribution.

Among stakeholders in countries that already had national legislation, however, there remains a perception that the END is only partially responsible for measures identified in NAPs that have been implemented. An important finding from the evaluation is that it is often not the END alone but rather the END in combination with existing national legislation that has triggered positive developments in noise reduction.

EQ15 - Do the issues addressed by the Directive continue to require action at EU level?

The research has clearly shown that the different components of a common approach will take time to achieve. The research found evidence that the objectives of the Directive will only fully achieved after 2020.

This was the case for both the END's objectives, but was particularly the case for informing source legislation, which is dependent on harmonised data produced on a consistent and comparable basis. Achieving the Directive's objectives will therefore require an ongoing commitment by the EC in its coordination and monitoring role, and by the MS, who are responsible for implementing CNOSSOS-EU across EU-28 from R4. There is strong support for continued action at EU level since the process of defining and then subsequently implementing a common approach requires a long-term approach to achieve this objective.

EQ16 - Are there are any ways in which the European added value of the END could be further enhanced?

A number of suggestions were made by END stakeholders as to how the END might be enhanced, such as: ensuring improved data completeness by ensuring that MS submit strategic noise maps and population exposure data and noise action plans on a more timely basis to the EC, which would help to maximise the value added of EU reporting (such as the EEA's Noise in Europe report) and also be useful for source policy makers, who were reluctant to use the data so far and attributed this partly to lack of data completeness. In addition, added value was expected to be enhanced once the CNOSSOS-EU common noise assessment method has been fully implemented so as to strengthen data comparability between rounds. Being confident in the longitudinal comparability of the data is crucial if policy makers responsible for source legislation are to assess the scale of the problem and to assess the (net) benefit of limit values set in existing source legislation.

Although some stakeholders were found to be in favour of introducing limit values at receiver in the END, there was however no clear consensus as to whether in future EU noise limit values at receiver would help to enhance the Directive' added value. There was however greater support for setting broad, non-mandatory targets for noise reduction either at an EU level or specific to individual MS depending on their relative baseline situation in respect of environmental noise levels.

EQ17 - What would happen if the END were to be repealed?

If the END were to be repealed, the research findings point to a number of negative consequences, such as the fact that there would no longer be a common approach to noise assessment methods and to undertaking mapping.

Most MS would largely revert to using their own national methods of noise mapping and action planning, even if they may continue to report using L_{den} and L_{night}. This would make it difficult for EU policy makers responsible for source legislation to assess the net effect of existing source legislation (including source-specific limit values). In addition, there is a clear risk that environmental noise would become less of a priority among national policy makers compared with other environmental concerns, such as air quality, tackling climate change.

Although some noise mitigation measures would still go ahead anyway because measures identified in NAPs were driven by national or other EU regulations (e.g. the Air Quality Directive) or there were other drivers, such as introducing speed limits to reduce pollution and to comply with EU air quality limits and national regulations (e.g. on aircraft noise and mitigation). However, at least some measures would no longer be supported were the END to be repealed. This would potentially lead in future to a higher number of exposed persons to environmental noise, with significant adverse implications for the health and well-being of those affected by noise as a result.

Since measures often take time to fully implement, and the benefits resulting from measures already implemented under the END (and those that have begun implementation) typically take up to 25 years to fully materialise, it does not seem advisable to repeal the Directive, when the main benefits of measures have yet to be realised.

EQ18 - Is the scope of the Directive (as laid down in Art. 2) appropriate or does it need to be modified?

The scope of the END, as defined in Art. 2 was found to be broadly appropriate, although it remains unclear why schools and hospitals are within the scope of the Directive, since they are not addressed elsewhere in the legal text.

The scope of the Directive in terms of the sources of environmental noise that it covers (i.e. transport noise and industrial noise) could perhaps also be defined as part of this Article (they are presently incorporated as part of the objectives of the END). Most stakeholders agreed that the sources that the END covers are appropriate, although a minority of stakeholders argued that it would be more coherent if the END only focused on transport noise rather than industrial noise. The consensus however was that it remains appropriate to also include industrial noise within agglomerations.

EQ19 - Are there gaps where further EU noise legislation is required in order to achieve the objectives of the Directive?

The research did not identify any major areas not already covered where new EU legislation on noise at source could be required in order to achieve the END's objectives. As noted earlier, the main role of END data collection is to better inform *existing* source legislation through noise mapping results to produce comparable population exposure data.

EQ20 - How could the efficiency of the END Reporting Mechanism be improved?

The research identified a number of ways in which the efficiency of the END could be improved. This was a future-oriented question and a number of possible means of improving efficiency were identified, relating to how to improve reporting processes through the possible elimination of some steps to streamline the process. It was suggested that the RM would be more efficient if all MS used the same reporting system. The specific suggestions made are outlined in Section 4.3 (future perspectives).

4.2 Overall Conclusions

The overall conclusions are now set out, grouped according to each of the different evaluation criteria of *relevance, coherence, effectiveness, efficiency* and *EU added value*. These have been structured drawing on the key evaluation findings by EQ outlined in Section 4.1.

4.2.1 Overall conclusions

The overall conclusions are now presented by evaluation criterion:

4.2.1.1 Relevance

The two objectives set out in Article 1 of the END were found to remain strongly relevant. In relation to the first objective [Art. 1(1)], there is a continuing need for a "common approach" to the assessment and management of environmental noise, since the collection of adequately harmonised population exposure data at EU level remains a pre-requisite for informing existing EU noise at source legislation. The second objective of the END [Art. 1(2)], relates to providing a basis for developing EU source legislation and also remains highly relevant, given that tackling the problem of high levels of environmental noise will only be possible through combined action on noise at source and through action on noise mitigation and abatement at receptor. Most importantly, the focus in the description of Art. 1(1) on defining a common approach intended to avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to exposure to environmental noise, overlooks the importance of explicitly mentioning the need to implement this common approach in a consistent manner across EU-28.

Given the adverse health effects attributed to high levels of exposure to noise at the receptor, the relevance of the END could be further strengthened by making clearer what the longer-term objective of the Directive is relating to public health. Although this is implicit through references in the recitals to ensuring a high level of protection of the environment and public health, it remains highly relevant to European citizens and society as a whole but is as yet an objective that is unclear unstated in the core text of the Directive.

The study conclusions are now summarised.

<u>Conclusion 1</u>: The first objective [Art. 1 (1)] of the END, that of defining a common approach to the assessment and management of environmental noise remains relevant. However, given that significant progress has been made in defining a common approach, it could be made clearer that the focus in future should be on implementing a common approach in a consistent manner within and between MS.

<u>Conclusion 2</u>: The second objective of the Directive [Art. 1(2)] remains highly relevant, in particular to informing EU policy-making in respect of the development of new, and the revision of existing EU source legislation.

<u>Conclusion 3</u>: It is unclear what the longer-term objective of the END is, since this is implicit, rather than explicit in the legal text. This could be made more explicit if the Directive is reviewed and updated in future, for instance by making it clearer that the aim is to protect citizens from the negative effects of excessive noise from transport and industry.

4.2.1.2 Coherence

The Directive was viewed as being generally 'internally coherent'. There were however a number of definitions (e.g. agglomeration, quiet areas in open country, quiet areas in an agglomeration), that either need to be better defined, or alternatively clarified in supporting interpretative guidance. A further finding is that minor changes are needed to the END's legal text so as to ensure greater consistency in the different articles and sub-articles (e.g. draw up vs. adopt a Noise Action Plan). This could potentially reduce the scope for differences in interpretation between MS.

With regard to 'external coherence', the END was seen as being strongly coherent with EU noise-at-source legislation and other relevant EU legislation (environmental legislation and legislation on industrial machinery). Most stakeholders did not perceive there to be any overlap or duplication between the END and other EU legislation.

With regard to impacts, a number of benefits from the Directive's implementation to date were identified, such as promoting a more strategic approach to noise management, mitigation and reduction, heightening awareness among policy makers in relevant areas (e.g. transport planning, infrastructure development, urban development and planning) about the importance of environmental noise and its mitigation, among others. In addition, a number of quantifiable benefits from measure implementation were identified through the CBA (see efficiency).

<u>Conclusion 4</u>: The Directive is generally 'internally coherent', although a detailed review of the legal text by the EC is needed to review the issues identified in this report to ensure that minor inconsistencies are addressed.

<u>Conclusion 5</u>: The Directive demonstrates strong 'external coherence' with other relevant EU legislation. There do not appear to be any contradictions or inconsistencies between the END and other relevant EU legislation.

<u>Conclusion 6</u>: The process of updating existing source legislation to take the END into account (e.g. in the recitals, END population exposure data) is necessarily an ongoing one, since source legislation is typically updated only once every 10-15 years. Nevertheless, in the previous five years, several key pieces of source legislation have already been revised.

<u>Conclusion 7</u>: Since other regulatory developments have taken place at EU level since the END was adopted (e.g. adoption of the INSPIRE Directive, the Lisbon Treaty), at some point in future when the END is updated, there will be a need for a legal codification exercise to ensure that the Directive reflects broader relevant developments.

<u>Conclusion 8</u>: National noise control legislation was found to be coherent with the END, although there were many practical challenges in the early stages of the Directive's transposition to update and to ensure consistency with national legislation in those 13 MS that already had such legislation.

4.2.1.3 Effectiveness

Significant progress has been made in respect of the development of common noise assessment methods through the development of the CNOSSOS-EU methodology (by 2012) and the subsequent adoption of Commission Directive (EU) 2015/996 (the revised Annex II). Nevertheless, there remains further progress, in particular in moving beyond the *development* of the revised Annex II to its *actual implementation* (from R4 onwards).

In addition, good progress has been made in bringing about a common approach through action planning across the EU (in spite of wide divergences in implementation approaches under subsidiarity) and in making information publicly accessible. The END has also begun to make progress towards the future development of a methodology to support Annex III (measuring the health effects of environmental noise based on dose response relationships).

However, since the new WHO guidance on dose response relationships has not yet been published, significant progress is unlikely to be made until approximately 2018.

Some progress was also found to have been made towards achieving the END's second objective (Art. 1(2)), '*providing a basis for the development of Community measures to reduce noise emitted by major sources'*. In particular, revised source legislation (and in the case of major railways, also new Technical Standards for Interoperability (TSIs) adopted in the past three years have made reference to the END as a strategic reference point and referred to its explicit role in addressing the adverse health effects of environmental noise in the recitals of updated source legislation and in impact assessments.

However, to date, END noise population exposure data by source has not yet been used by source policy makers, although they have made explicit references (e.g. in impact assessments and in the recitals) to the potential utility of such data in future. The reason why policy makers have not yet appeared to make full use of this data was due to (1) the lack of EU28-wide data completeness and (2) the lack of comparability in the data between rounds and countries. .

The late submission (and/ or non-submission) of reporting information and data by some Member States in both R1 and R2 has undermined the ability of the END to provide comprehensive baseline data to inform source legislation, and also makes monitoring and reporting by the EC and external evaluation of progress more difficult. Moreover, END population exposure data was found to be not yet fully comparable across EU28 or between Rounds, since data produced so far was based on noise mapping results using different national and interim computation methods, noise software, input parameters etc. This issue will however be addressed over time as the transition to the implementation of Commission Directive (EU) 2015/996 gets underway across EU28 (in R3 on a voluntary basis and R4 on a mandatory basis), but until then this remains an area of weakness in the Directive's implementation.

The five year timeframe for END implementation in respect of the activities linked to the achievement of the first objective (Art. 1(1)) appears to be effective. IN a hypothetical situation under which a ten year cycle were instead to be adopted rather than the current five years for END implementation, whilst this could potentially reduce administrative costs, it could equally lead to a loss of expertise and technical capacity at both an individual and organisational level. Data collected on the number of full-time equivalents (FTEs) involved in each END implementation round has shown that only a small number of people work on END implementation. This means that their experience and expertise is highly concentrated. However, the one year timeframe between the finalisation of SNMs and the submission of NAPs was found to be too short for stakeholders in many EU MS to meet NAP reporting requirements.

The END was recognised as effective in fully respecting subsidiarity in its implementation in that MS are responsible for setting out their own implementation arrangements. Whilst most MS strongly welcomed this flexibility, some would prefer a more detailed set of implementation arrangements for the national level in the Directive. However, this would clearly be inappropriate for a Directive drawn up and implemented under the subsidiarity principle.

With regard to impacts, a number of non-quantifiable benefits from the Directive's implementation were identified, such as promoting a more strategic approach to noise management, mitigation and reduction, heightening awareness among policy makers in relevant areas (e.g. transport planning, infrastructure development, urban development and planning) about the importance of environmental noise and its mitigation, among others. In addition, a number of quantifiable benefits were identified through the CBA from measure implementation (see efficiency).

Conclusion 9: Overall, the END was found to be an effective means of tackling the problem of environmental noise at receptor.

Key conclusion 10: Considerable progress has been made towards achieving the first objective [Art. 1(1)] of the END, through significant progress on implementation of the three steps within the common approach. However, greater progress has been made in *defining* a common approach to noise assessment methods, whilst progress towards a more consistent approach to implementation will require further time, at least to ensure a harmonised approach to strategic noise mapping with comparable data. In addition, it will take further time to revise Annex III and to develop a common approach to assessing the health effects of environmental noise.

Conclusion 11: Some progress has been made in respect of the second objective [Art. 1(2)] of the END, less in terms of the development of new Community measures, but more through the revision of existing source legislation.

Conclusion 12: Less positively, whilst the Directive has been effective in encouraging source policy makers to take into consideration the adverse health effects of noise, population exposure data is not yet being used systematically.

Conclusion 13: The END has had a positive impact in strengthening attention to environmental noise and the importance of increasing efforts to mitigate and reduce noise due to its adverse health effects at MS level. In at least some countries, this has led to extra public funding being directed towards noise mitigation.

Conclusion 14: The five year timeframe for END implementation appears to be the optimal approach and is effective in ensuring that expertise is not lost and that institutional memory within responsible CAs with regard to managing strategic noise mapping and noise action planning is preserved.

Conclusion 15: The END has been implemented in a way that fully recognises subsidiarity.

Conclusion 16: Enforcement was an aspect of the END's implementation that was found to have been less effective (e.g. lack of effective sanctions or penalties on Member States for the late submission of reporting information and data to the EC, lack of enforcement powers at national level for national authorities to compel local authorities to provide timely reporting data).

4.2.1.4 Efficiency (administrative costs and reporting)

The administrative costs of END implementation (which are associated with carrying out three types of activities linked to the achievement of the Art. 1(1) objective i.e. strategic noise mapping, making information accessible and noise action planning) were found to be proportionate and not overly burdensome. The costs were also found to be proportionate to the scale of the challenge of tackling the problem through an EU-wide "common approach" to the assessment of environmental noise.

For instance, the costs per inhabitant (exposed to high levels of noise) of noise mapping, action planning, organisation and holding of public consultations etc. were approximately €1.50 - €2.00, according to acoustics consultancies, and lower, according to the estimates made by national authorities (although the latter may risk under-estimating the total costs for reasons explained in EQ11 – see Section 3.2.4). The costs per capita among the total population were found to be negligible (e.g. an average of €0.06 and median of €0.03 per inhabitant).

The costs of noise mapping per inhabitant taking the total population as a basis (which seems appropriate given that these costs are borne by public administration overall), is much lower still, amounting to €0.18 in R2 as an average across a sample of 13 MS. This represents good value for money in the view of the evaluators, given the scale of the societal challenge of tackling environmental noise and the importance of strengthening the availability of comparable data on population exposure at EU level in order to inform "Community measures at source". These costs were also viewed as reasonable by most END stakeholders. Less information was available on the costs of action planning since this mainly involves human resource inputs by civil servants). However, the average cost per capita (based on the total population) across a sample of 13 MS amounted to a mere €0.06 in R2, considerably lower than the cost of noise mapping.

Overall, there was evidence of a general reduction in costs between R1 and R2 in relation to other types of (non-staffing) costs. This was attributed to the fact that there were upfront, largely one-off costs of R1 END implementation.

There were found to be wide variations as to the level of human and financial resources that MS have allocated to END implementation overall, reflecting different implementation approaches, and different levels of centralisation and decentralisation. Out of a sample of 13 MS, the cost of noise mapping in R2 ranged from €0.05 to €0.56 per capita, and € 0.01 to €0.29 per capita for R2 noise action planning. A general trend towards reduced staffing levels among national CAs and more generally in R2 compared to R1 can be observed. Likewise, there was found to have been a decline in the costs of noise mapping in many EU MS between Rounds.

Whilst it is clearly positive that the overall administrative costs have generally decreased in R2, there were concerns among some END stakeholders that national CAs need to be allocated sufficient resources by MS governments if they are to implement the Directive in an efficient and timely manner. Insufficient resources, while formally resulting in a reduction in expenditure and hence END-related costs, can undermine aspects of the Directive's effectiveness. For instance, EU policy makers dealing with source legislation have explicitly stated that if the data isn't complete across EU-28, they are not yet able to use END data to underpin impact assessments. This risks undermining the achievement of the second objective of the END (informing source legislation). The lack of resources to ensure the timely commissioning and delivery of SNMs (an efficiency issue) may therefore adversely impact on effectiveness.

Stakeholders interviewed were generally positive about the END Reporting Mechanism. However, the online data entry system for the submission of reporting data and information, and the online summary pro forma for NAPs could be simplified. Relational aspects of the database of SNMs and NAPs could also be strengthened. The CDR was designed as a relational database[173] in 2007, so that there would be linkages between the SNMs and the NAPs. Whilst this is evidently positive in terms of enabling the data and information contained therein to be analysed in a number of different ways, some stakeholders expressed the view that In addition, the research found that there is a need to consider how END data might best be integrated with other datasets in future, including the INSPIRE requirements to make spatial datasets available to the public and also ensuring that SNMs and population exposure available through the Noiseviewer are made available through the EU's open access data portal[174].

Conclusion 18: The administrative costs of END implementation vary considerably between MS, reflecting the subsidiarity principle. The overall costs – especially of noise mapping - were found to have generally declined between rounds, and were cost-effective and proportionate to the scale of the challenges posed by high levels of environmental noise to health.

Conclusion 19: The qualitative benefits (e.g. a strategic approach to noise, heightened visibility of the problem) as well as the quantitative benefits (linked to NAP measure implementation – see CBA findings below) outweigh the costs.

Conclusion 20: The END Reporting Mechanism was found to be efficient in enabling the prompt electronic submission of reporting data by MS once these were available. However, the database itself could be strengthened by strengthening the relational dimension in the databases of SNMs and NAPs.

[173] A relational database is one structured to recognise relations between stored items of information.
[174] https://open-data.europa.eu/

4.2.1.5 Efficiency – cost-benefit assessment

Given the difficulty in quantifying the benefits associated with the explicit requirements of the Directive, the cost-benefit analysis included consideration of the costs and benefits of measures within selected NAPs where at least some R1 measures had gone ahead. This is an important proxy for the assessment the Directive's efficiency and is linked to the ultimate implicit objective of the END which is to reduce exposure to harmful levels of environmental noise.

On the basis of the findings from the cost-benefit analysis focused exclusively on the costs and benefits of measures within selected NAPs where at least some R1 measures had gone ahead. This is an important proxy for the assessment the Directive's efficiency and is linked to the ultimate implicit objective of the END which is to reduce exposure to harmful levels of environmental noise.

Noting the underlying assumptions as well as the limitations of the analysis, it can be concluded that the implementation of the END has been efficient overall. The 19 test cases revealed a high degree of variability in the costs and benefits associated with the implementation of measures to reduce noise. The variability in costs and benefits across test cases may be attributed to a number of factors including the number and type of measures implemented, the size of the noise-affected and beneficiary populations and the influence of local conditions (e.g. topography) on the effectiveness of individual measures. As may be expected, the most cost-effective measures are those that require little capital expenditure and benefit a large number of people (e.g. the imposition of speed limits).

In terms of the situation across EU-28, the base case scenario results in a favourable cost-benefit ratio (of 1:29) overall (including the administrative costs incurred by the European Commission, JRC and EEA) and for each of major roads, major railways and major airports. The overall net present values range between minus €22,334 million (in a worst case scenario) and €156,977 million (in a best case scenario). The differences are largely explained by the underlying assumptions relating to the degree to which costs and benefits can be attributed to the END. Agglomerations were treated separately as it was not possible to obtain sufficiently comparable data across the test cases to support a reliable extrapolation. However, on the basis of an assessment of the typical measures applied in agglomerations, it can be concluded that the benefits of END implementation in agglomerations significantly outweigh the costs even though the cost-benefit ratios vary substantially between measures.

Moreover, the benefits are likely to be somewhat understated as the analysis only considered the effects of noise reductions on the highly annoyed and highly sleep disturbed populations and neither included the impacts on productivity, employer costs and healthcare costs nor the benefits arising from the generation of large and consistent datasets on noise (through SNMs). These have been invaluable in advancing research on the effects of noise on health and productivity and supporting actions in other areas (e.g. development of technical standards, emission levels and other Directives) that have a positive effect on noise levels.

Indirect impacts (e.g. on property values and greenhouse gas emissions) were also excluded from the analysis because of the difficulties in reliably quantifying and generalising these across the EU-28. Meta-analyses of various revealed preference studies suggest that a 1 dB increase in noise levels can reduce house prices by between 0.08 and 2.22% depending on the noise source.

The cost-effectiveness of the implementation of Art. 1(2) was not part of the CBA. It can in any case only be assessed preliminarily at this stage in END implementation. EU policy makers interviewed and those responding in writing stated that they have not used END population exposure data systematically, for instance in impact assessments to justify source legislation, or changes to source Limit Values.

This was partly because of partial data completeness across EU-28 and data comparability issues between rounds. However, they made clear – that they intend to make greater use of END population exposure data in future. Indeed, the commitment to use END data more extensively in future is also stated in the legal text of transport source legislation that has undergone revision in the last 3-4 years particularly (e.g. in the aviation, railways and automotive sectors). A detailed assessment of the relevant legislation concerned was provided in Section 3.2.3.6 (Progress in achieving the END's second objective).

Assuming that population exposure data collected through noise maps is used more extensively in future than it has been to date, the achievement of objective Art. 1(2) should be cost-effective, since the administrative cost data per affected inhabitant are low (estimated by acoustics consultancies at €1.50 - €2.00/ affected person, which includes noise mapping, action planning and public consultations and lower estimated costs by national CAs – see Section 3.2.4 efficiency / EQ11a).

Conclusion 21: A favourable cost-benefit ratio of 1:29 was identified under a base case (most likely scenario) which accounts for the administrative costs incurred by both supra-national authorities (the EC, supported by the EEA) and implementing authorities in MS. This estimate is, however, underpinned by a large number of assumptions which is reflected in the wide range (from 1:0 under a worst case scenario to 1:327 under a best case scenario) within the actual estimate is expected to lie.

A similarly large range was obtained for each of major roads, major railways and major airports. For major roads the cost-benefit ratios vary between 1:0 and 1: 3,341, for major railways they vary between 1:2 and 1:9,474 and for major airports between 1:1 and 1:11. The analysis revealed wide variations in the types and level of costs and benefits, even for the same type of measure, across different countries.

An analysis of the efficiency of typical measures in agglomerations suggests that the benefits of END implementation in agglomerations significantly outweigh the costs even though the cost-benefit ratios vary substantially between measures.

Conclusion 22: The benefits are likely to be somewhat understated as the analysis only considered the effects of noise reductions on the 'highly annoyed' and 'highly sleep disturbed' populations.

4.2.1.6 European Added Value (EAV)

The END has generated significant EAV by providing a common EU-wide regulatory framework for gathering information and data on environmental noise at receptor underpinned by a "common approach" to noise assessment. There is a clear EAV of the END for EU policy makers responsible for source legislation who need complete and comparable data at EU level to inform the development of new, and the revision of existing noise at source legislation, and to monitor the impact of environmental noise at receptor on health.

The research demonstrated that the END has added value through an EU-level approach in a number of ways, such as through *'volume effects'* (creating a budget for the first time in some EU countries or increasing the budget earmarked to environmental noise mitigation and abatement in national and regional funding programmes), *'scope effects'* (encouraging policy makers across the full spectrum of relevant policy areas such as urban development, infrastructure and transport planning to take greater consideration of environmental noise) and *'role effects'* (through benchmarking, the END has encouraged MS to consider how other MS States are tackling the problem of high levels of environmental noise, with some positive demonstration effects discerned).

In the absence of the END, there would be no harmonised data available for source policy makers to assess noise at receptor and in turn to review limit values in source legislation. In addition, there would be a lack of EU-wide data available on population exposure through which the harmful effects of environmental noise could be quantified. Clearly, the lack of such data would have materially impacted the availability of an evidence base to inform EU noise policy. Moreover, without the END, very few countries would have adopted a more strategic approach to managing environmental noise through an action planning approach.

If the END were to be repealed, then many of the benefits identified to date would be lost. More importantly, the *future* benefits of END implementation from measure implementation and from the collection of gradually more harmonised population exposure data would not materialise. This reflects the fact that the quantifiable benefits of END implementation take significant time (up to 25 years) to fully materialise. Moreover, the effective management of noise is a long-term process and the added value for instance of an action planning approach is only likely to be fully manifested over the longer term.

From a national policy maker perspective, the END has added value by providing opportunities for benchmarking noise mapping and population exposure results at European level, and by increasing the visibility of environmental noise as a serious health issue and strengthening the case for policy makers who compete for scarce public resources domestically to implement measures to reduce noise pollution and/or exposure.

Key conclusion 23: The END has already demonstrated significant European Added Value. Once Commission Directive (EU) 2015/996 is implemented, there is scope for it to add even further value in future, as noise maps and population exposure data becomes more harmonised.

Key conclusion 24: The END has added value to actions some MS were already taking through a combination of 'volume effects' (increased resources for environmental noise), 'scope effects' (greater attention to the problem across a wider range of policy areas) and 'role effects' (promoting benchmarking and the exchange of good practices in noise mitigation).

Key conclusion 25: In the absence of the END, there would be no common approach to noise mapping and action planning, a lack of harmonised data on the level of noise population exposure and longitudinal changes every five years. Source policy makers would also lack data on which to determine limit values in future (once outstanding comparability issues are addressed).

Key conclusion 26: If the END were to be repealed, although some MS would continue to produce noise mapping data and to implement noise mitigation measures, this would not be the case across EU-28. Moreover, the longer-term benefits of the END (e.g. reduced population exposure resulting from measure implementation) would be significantly reduced.

4.3 Future perspectives

Prospective issues relating to how the Directive's relevance, effectiveness and added value might be further strengthened in future are presented in Section 4.3 below.

A number of 'future perspectives' were identified through the research, drawn from a combination of sources, including desk research, an interview programme, oral feedback from the validation workshop and written feedback received on the Working Paper published on the evaluation.

Whilst some suggestions as to how to improve the effectiveness, value added and impact of the END in future were made by stakeholders, others have been made by the evaluation team, drawing on the extensive primary and secondary research carried out.

For each "future perspective" identified through the research, an explanation is then provided as to the rationale and a reminder of the evidence base for these suggestions. Further reference should be made to the relevant sections of the report to gain a full appreciation of the evidence base presented to justify each point. The rationale and evidence base underlying the prospective issues identified that could be addressed in future is now outlined in further detail:

1 - The first objective of the END relating to a "common approach" should be redefined so that this refers not only to 'defining' but also to 'implementing' a common approach.

In relation to the first objective of the END, the legal text of the Directive presently refers in Art. 3 to the need to '**define** a common approach intended to avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to exposure to environmental noise". However, whilst the definition of a common approach was evidently a major priority during the first ten years of implementation of the END through the development of CNOSSOS-EU and will continue to be a priority for a further two years in respect of Annex III (assessing the health effects by establishing dose response relationships by source), looking ahead, it is clear that the priority should be not only to define but to actually implement a common approach.

There is presently a lack of compulsion relating to implementation in some areas. For example, the END only requires the development of NAPs, but does not legally oblige the implementation of measures, which are voluntary.

2 - Due consideration should be given as to whether the END should go beyond a "common approach" and set out a more explicit objective as to what the Directive is ultimately trying to achieve (e.g. "protecting human health by reducing population exposure to high levels of environmental noise").

As pointed out in the evaluation of *relevance, coherence* and *effectiveness*, the END lacks an explicit longer-term objective to address public health or the other needs of European citizens and society at large. The END is currently centred on defining a 'common approach' but this is only an intermediate aim.

Although many MS have implemented at least some measures identified in NAPs, the implementation of measures is non-mandatory, and remains at the discretion of MS. In contrast, the Air Quality Directive (2008/50/EC) has established mandatory limits which must be achieved within a specific timeframe.

There are however key differences between air quality and noise, in that the effects of environmental noise exposure are at least partly perception-based (e.g. annoyance).

Nevertheless, if negative health effects are demonstrated through collecting population exposure data and quantifying the harmful effects of noise through revised dose response relationships, , then there is an argument for strengthening the END's objectives.

If a more explicit longer-term objective were set, then a specific target could be introduced relating to the level of noise reduction relative to the baseline situation. There are however different views as to whether such a target should be mandatory or non-mandatory. Setting voluntary targets to reduce the number of exposed persons to environmental noise to achieve a particular percentage reduction by a particular point in time may be a possible compromise.

3 – The implementation of the END could be made more effective in future by recognising the links between tackling environmental noise and other inter-related policy issues.

Noise does not exist in isolation. Many of the sources of noise are considered an essential part of modern society and there are especially close links with issues such as air quality, road safety, transport infrastructure planning (especially the design of new roads), urban and development planning (especially the location and construction of new dwellings). A number of stakeholders mentioned that the END could become more effective there were more of a "joined-up" approach that linked other areas that are relevant to environmental noise. At the level of national implementation, the END might be more effective in future if a holistic approach is adopted by CAs drawing up MAPs and in the identification of appropriate measures that explicitly recognise the links between tackling environmental noise and other relevant areas, such as air quality[175].

4 – The European Added Value of the END could be further enhanced by using population exposure data more extensively to inform the development and revision of noise at source legislation.

The Directive's added value could be further enhanced and serve as a more direct source of inspiration for the revision and development of noise at source Directives if the quality, comparability, utility and completeness of data were to be improved. Whilst comparability issues can only be addressed through CNOSSOS-EU's implementation, the quality of input data and ensuring the full provision of reporting data and information is the responsibility of EU MS, and should be addressed urgently (given that if some countries have access to high-quality input data but others do not, there will be considerable variance in outputs).

5 – The legal text of the END should be subject to a thorough review in future to take into account the various issues identified in this report that would help to improve the clarity of the legal text and to eradicate ambiguities.

A number of issues were raised by stakeholders in relation to the need to ensure that inconsistencies in the Directive are addressed and to bring about greater clarity in the END. This would help to limit the scope for ambiguity in interpreting and implementing the END. This would help to ensure that the legal text is clear, easily comprehensible by CAs and other END stakeholders.

6 - In order to ensure that the definitions and other aspects of the END are better understood by stakeholders, a short accompanying interpretative guidance document could be provided by the EC.

7 – A review of the legal text will need be undertaken at some point in future to ensure that the END is updated to reflect wider EU regulatory developments since its adoption.

It is common to update EU legislation every 10-15 years, depending on the specific directive or regulation. In the case of the END, the Directive needs to be updated with minor wording changes to reflect EU regulatory developments that have taken place since the END came into force in 2002, such as the adoption of the Lisbon Treaty. The changes required ought to be relatively minor (for instance referring to the EU rather than to the Community). There is also a need to ensure that the END makes explicit reference in the recitals to the importance of an open access data policy in the context of ensuring information accessibility to the public and also the importance of open data in

[175] A project was recently undertaken by the EEA and a number of researchers at national level to look into the extent of linkages and possible synergies between Noise Action Plans prepared under the END and the Action Plans prepared under the Air Quality Directive.

the context of the INSPIRE Directive. However, it is for individual MS to determine how they should utilise END data and integrate this with other spatial datasets.

8 – Ensure that the linkages between the END and specific pieces of EU legislation can control the noise emitted by major sources is made more explicit in the Directive. Some END stakeholders appear to be unclear that there are linkages between the END and EU source legislation. Given the mutually reinforcing interrelationship between noise at source legislation and tackling noise at receptor through the END, when the Directive is next updated, it could be helpful to make reference to the most relevant pieces of source legislation either in the recitals or the annexes of the Directive so that the links are more explicitly clear.

9 - The EC should engage further with stakeholders as to whether binding EU, receptor-based noise limit values should be introduced in the END in future.

There was a wide divergence of views as to whether the END should consider introducing source-specific common LVs at EU level in future. There was no support however for having a single common LV across all sources. A less contentious suggestion was that non-binding targets could be set either at an EU or MS level, linked to the prevailing baseline situation in different EU MS, which varies considerably depending on geographic factors, population size, economic development, the state of development of different transport sectors, whether the country concerned is a transport hub, etc.

An alternative approach, which appeared to enjoy some support, was that voluntary targets could be adopted as to the percentage target for the level of noise reduction.

10 - The cumulative nature of noise at receptor from different sources should be measured so as to improve its relevance to citizens and to avoid double counting/over-estimating the benefits of noise reduction measures.

In assessing the health effects of environmental noise, future methodological work could take into account the cumulative nature of noise at receptor from different sources so as to improve its relevance to EU citizens, who are likely to be more interested in their total noise exposure. The END adopts a more technical approach to inform source legislation which seeks to measure noise from each source independently and in isolation. Aggregating data across sources would also help to avoid double counting/over-estimating the benefits of noise reduction measures. However, this would need to be discussed with the MS since it would represent a significant change from current practice.

11 – The efficiency of reporting and monitoring on the implementation of NAPs could be strengthened by ensuring that information is reported in each successive round on which measures have gone ahead in full, in part and those that have not gone ahead at all. Annex V (1) of the END already requires "any noise-reduction measures already in force and any projects in preparation" to be reported. In addition, when the NAP is revised each time it should report on which previous actions have been undertaken or are in preparation. Although some NAPs contain an update as to which measures have been implemented, there is as yet no systematic monitoring and reporting at EU level as to which measures have - and have not been implemented - within each five year cycle.

NAPs could identify the main constraints (e.g. budgetary, other) wherever particular measures could not be implemented, and identify which measures will be continued / discontinued in the next five-yearly action planning cycle and why. Otherwise, the current problem will continue whereby some EU MS include only budgeted measures in their NAPs, whilst others mention a wide range of measures many of which do not appear to have any realistic chance of actually being implemented.

This would help to ensure that better information is available at EU level as to what has been achieved in each successive five year implementation cycle and would provide a stronger evidence base as to the Directive's achievements and the extent of attribution. Both of these are crucial for estimating the END's contribution to reducing high levels of environmental noise.

12 - The information and data provided in NAPs on costs and benefits in the "financial information" section needs to be strengthened, possibly by making further guidance available on estimating measure-level costs and benefits.

In many NAPs, there is either no data or information on either the estimated costs and benefits of proposed measures, or only an estimate of the costs. In other NAPs, data is provided but in aggregate (i.e. covering groups of measures but with no disaggregation of individual measures). Feedback received suggests that many national CAs find it very difficult to estimate the projected benefits of measure implementation in reducing noise.

A clear value added of this study is that through the development of test cases, benchmarks have been established for the costs and the benefits (measured in terms of the magnitude of dB reduction) by type of measure. Reference should be made here to Appendix D (case study methodology and examples of cost-benefit ratios by type of measure), and Appendix F (full set of case studies) which sets out cost-benefit ratios for individual measures developed through this evaluation.

Guidance on how to assess the benefits of measures could be developed by the EC, drawing on the findings and benchmarks presented in this study to assist the MS in estimating costs and benefits. It is also important that in future, MS produce better ex-ante estimates in their NAPs of the costs and benefits, but equally, that greater emphasis is put by national CAs on checking the actual costs and benefits post-implementation of measures (ex-post) so that the two can be better compared.

The 19 test cases relied on ex-ante cost projections provided in NAPs, complemented by data provided by the authorities from the selected cases (where available), expert judgement on benchmarks wherever data was missing or needed an estimate. However, since measures are implemented in different contexts, the cost- benefit ratios are likely to vary significantly by source and by MS.

Improving the availability and reliability of estimated and actual cost-benefit data on measure implementation would be especially useful for the extrapolation of measure-level data to the EU-28 level facilitate future evaluation and cost-benefit assessment work to assess the impact of measure implementation and the contribution of the END to reducing noise at receptor. Currently, the impacts of the Directive require speculative assumptions to be developed for the purposes of extrapolation due to only limited measure-level cost-benefit data being available. If the EC / EEA wishes to have more accurate cost-benefit ratios in future, there will need to be more systematic collection of reporting data on measure implementation under the END reporting systems.

If no data is collected, then cost-benefit estimates at the EU level would have to be undertaken in future using a similar approach to the present study (i.e. be reliant on micro level data collection based on a representative sample of case studies).

13 - In assessing the health effects of environmental noise, future methodological work to assess the benefits needs to take due account of the cumulative nature of noise from different sources so as to avoid double counting/over-estimating the benefits.

Households are affected by noise from multiple sources but END reporting is source-specific, reflecting its important role in informing source legislation for individual transport modes. This is an issue that the EC should consider how to address from a methodological and reporting perspective in future since it will affect the estimates of the costs and benefits and the health benefits of measures implemented through the END. Since population exposure data is presently collected on a source-specific basis, there is presently some risk of double-counting, although this should be kept in perspective since the research also found that the mostly highly affected exposed population are usually affected most by one source. For instance, people living in a main street in a city are not normally affected by rail or airport noise to the same level of intensity.

14 - Consideration could be given by the EC and the EU MS to strengthening the enforcement of timely reporting on the END's implementation.

a. At EU level, financial penalties could be introduced if Member States do not submit reporting information on SNMs and NAPs by the reporting deadline, or within a specified limit thereafter.

There have been significant delays encountered in the submission of R1 and R2 SNMs and NAPs to the EC in some EU countries. Since this risks undermining the Directive's full and effective implementation (especially the achievement of the second objective of the END (Art. 1(2)) of informing source legislation) due to the absence of timely reporting data and information.

Without timely reporting, the second objective of the END will be much more difficult to achieve (since EU policy makers stated that they were unlikely to use the data without a comprehensive dataset and greater comparability).

The lack of a suitable enforcement mechanism at EU level to oblige MS to submit reporting data and information to meet their obligations under the END in respect of Art. 10 (Collection and publication of data by MS and the EC) was noted in the END. Fulfilling the EC's reporting requirements under Art. 11 has also been made more difficult due to the significant delays that have occurred in both R1 and R2 in the submission of reporting information and data. Consideration could therefore be given by the EC to strengthening the Directive's enforcement.

Although official infringement proceedings could potentially be launched in instances when the reporting information is provided very late (or not provided at all), this was seen by some stakeholders as being too much of a blunt instrument considering the lack of human and financial resources available for implementing the END (and for environmental noise more generally) that remain a problem in some EU countries.

The EU should consider setting proportionate fines in a future revised Directive if MS continue in subsequent rounds to deliver the required reporting deliverables on time since this undermines the effective implementation of the END. In order for population exposure data to be useful to EU policy makers responsible for source legislation, it needs to be available on a timelier basis. The research identified examples of delays in reporting submission of several years. Imposing small fines for such delays in future rounds could providing these were proportionate prompt MS to take earlier action to ensure that SNMs and NAPs are finalised and submitted on time.

This measure should however only be taken in conjunction with other steps to make it easier for national CAs and their local and regional counterparts to meet reporting submission deadlines, such as extending the deadline between the submission of SNMs and NAPs from 12 to 18 months (given that many MS stated that the current 12 months' timeframe caused them difficulties in fitting in an effective public consultation process, analysing the feedback, etc.).

In parallel, further dialogue would be required with MS authorities that have experienced reporting bottlenecks to develop an understanding why delays are occurring. For instance, some EU countries have alluded to budgetary and human resource constraints and others to delays in input data being available for noise mapping.

Others have stated that the END Reporting Mechanism is not user-friendly and it has taken them a long time to submit reporting data and information given limited resources. It will be important to develop an understanding of the specific challenges before launching any enforcement proceedings against particular MS.

b. At national level, the enforcement of national LVs could be further strengthened by EU MS in those MS that have adopted them, including the issue as to what sanctions should be imposed upon exceedence.

It should be noted that the above suggestion to the MS is advisory only, given that the END is implemented under the subsidiarity principle and it is up to individual MS to determine whether to introduce LVs and what sanctions should apply. Nevertheless, the fact that very many END stakeholders pointed to weaknesses in the enforcement of LVs suggests that further action may be needed by MS in this area, otherwise mandatory LVs risk becoming ciphers.

In addition, Steps could also be taken by the MS to review national implementation arrangements including the corresponding national implementing regulations in order to address problems in respect of weak enforcement arrangements at national level to compel local and regional authorities to meet their END reporting obligations on a timelier basis. However, strengthening the implementation rules at national level is the role of national CAs, and formally outside the scope of the END, since under subsidiarity, national authorities are responsible for determining national administrative arrangements and for meeting their END reporting obligations to the EC.

15 - The EEA could assume greater responsibility for checking the quality of data and information presented in NAPs (on behalf of the EC).

Currently, the EEA has been delegated responsibility by the EC to check the quality of SNMs and population exposure data submitted. Although the EEA checks the quality of NAP summaries, subject to resources being made available, it could assume a greater role in checking the quality of data and information presented in the complete version of NAPs. The desk research identified a problem that NAPs are of variable quality.

16 - The efficiency of the END Reporting Mechanism could be strengthened by implementing the various suggestions made in EQ20.

Although the Reportnet, the main reporting tool used for the submission of END reporting information was regarded as being efficient overall, there were various suggestions as to how the tool could be made more user-friendly and how the transmission of reporting information might be simplified. The specific recommendations made are:

- Gaps in END data and information could be more easily identified if Reportnet were to be used as the single END Reporting Mechanism.
- The current requirement in the END for MS' Permanent Representations in Brussels to inform the EC when END reporting requirements have been met should be dropped. This appears to be inefficient and unnecessary, since the data and information ought to be already available in the CDR database (which aggregates data submitted online through the Reportnet). Indeed, an automated email could be set up to alert the EC (and EEA) whenever SNMs and NAPs have been submitted, supported by a courtesy email from the national CA.
- The quality of data collected could be enhanced by eliminating the scope for non-comparability of data in the CDR database between MS, especially in relation to agglomerations (since it is currently unclear for major roads and major railways whether reporting information for these two sources relates to within or inside agglomerations).

- MS should submit reporting data and information electronically via Reportnet, and avoid sending SNMs and NAPs in hard copy, unless this is just a courtesy copy.
- Consideration could be given to allowing MS to submit some reporting information relating to NAP summaries in Word since there are presently a lot of different data fields where information and data has to be re-entered using an online data entry system.
- If MS don't have to manually input the data themselves, this might also prevent them from making data entry mistakes. However, this would require the EC making further resources available for the data entry of reporting information submitted by CAs.
- It should be made clearer what information on the completeness of data in respect of major roads and major railways actually relates to. Presently, it has not been systematically clarified across all MS whether this should include road and railway segments inside or outside of major agglomerations, or both within the same dataset. This impairs data comparability.

With regard to steps that could be taken to address the problem of better managing the problems of delays:

- Reportnet could be customised to provide an **early warning system** for the EC to flag up a situation where MS have missed the formal cut-off dates for the submission of reporting data and information stipulated in the Directive.
- A **written explanation** for the delays from the national CA could be required within a specified timeframe in a future possible revised Directive by the EC.
- A **training session** should be organised for relevant MS authorities by the EC (supported by the EEA) so that national CAs have a better understanding as to how the reporting system works.
- **Extracting data on NAPs** at an aggregate level could be made more user-friendly.
- The number of data fields that MS have to input as part of the **reporting submission process** could be reduced and / or the EC could make some resources available to help to manually input information on NAPs submitted in Word templates to reduce the burden in submitting reporting information for EU MS.

17 - Noise-relevant research results of research projects funded through the EU RTD Framework Programmes and the LIFE programme should be disseminated more widely to increase the uptake of results and strengthen the effectiveness of particular aspects of END implementation (e.g. sharing good practices in respect of quiet areas within agglomerations).

The dissemination of EU research results relevant to END implementation should be further strengthened to support MS in implementing the END. There are a series of interesting projects whose findings could be of practical benefit to competent authorities. For example, there have been a number of projects relating to the development of good practices in the protection of quiet urban areas and preserving the urban soundscape. Since many EU MS have had difficulties in relation to quiet areas, and since only a few have yet designated any quiet areas, it would be useful to share good practices in this area. Reference should also be made to Appendix I which contains a non-exhaustive list of such projects.

The full list of projects identified in table form in the course of this evaluation in Annex I could be disseminated to members of the Noise Regulatory Committee, which could draw it to the attention of other CAs in their MS. The list – or a publication summarising the research results in a project compendium form - could be published on the noise policy website of DG Environment with signposting to the websites of the relevant projects.

Evaluation of Directive 2002/49/EC relating to the assessment and management of environmental noise

Final Report – Country Fiches

Second Implementation Review of the Environmental Noise Directive

The Centre for Strategy & Evaluation Services LLP
July – *2016*

EUROPEAN COMMISSION

Directorate-General for Environment
Directorate F
Unit ENV F.3
Knowledge, Risks and Urban Environment

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European Commission
B-1049 Brussels

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2016

CONTENTS

1. INTRODUCTION / HOW TO READ THIS REPORT

This report contains the 28 country reports summarising the implementation of the END across the 28 EU Member States. The country reports are structured as follows:

1. National implementing legislation for END:

This section presents national legislation transposing the END and contains a tabular overview of the change in END coverage (expressed in terms of the *number* of agglomerations and airports as well as the *km* in length of major railways and roads) between Round 1 ("R1") and Round 2 ("R2"). These changes reflect the transition from the introductory threshold in R1 to the definitive END threshold applicable from R2 onwards:

Type of entity	Round 1 (2007-2012)	Round 2 (2013-2018) and thresholds for subsequent rounds
Agglomerations	> 250,000 inhabitants	> 100,000 inhabitants
Major airports	Civil airport, designated by the Member State, which has > 50,000 movements per year (a movement being a take-off or a landing)	Civil airport, designated by the Member State, which has > 50,000 movements per year (a movement being a take-off or a landing)
Major roads	> 6 million vehicle passages a year	> 3 million vehicle passages a year
Major railways	> 60,000 train passages per year	> 30,000 train passages per year

2. Competent Authorities and designated administrative bodies:

This section provides an overview of the different Competent Authorities ("CAs") in the country concerned and their responsibilities for preparing and approving SNMs and NAPs, as well as reporting to the European Commission ("EC"). The section includes a table listing all designated CAs under the END. It should be noted that other public authorities and wider stakeholders not listed in these tables may well play a role in END implementation, e.g. by collecting data or providing input under public consultation.

3. Designation and delimitation of agglomerations, major roads, major railways and major airports:

This section describes problems that may have occurred relating to the designation and delimitation of agglomerations, major roads, major railways and major airports, which is an indispensable preparatory step before producing Strategic Noise Maps ("SNMs") for these areas and sources.

4. Noise limits and targets:

This section highlights any national legal noise limits or targets. Although there are no common EU-wide Limit Values in the Directive itself, most but not all MS have put in place mandatory noise limits at national level, whose exceedance generally leads to sanctions, or whose potential exceedance blocks the operation of installations (such as new roads, railways, or industry). Noise targets are values whose exceedance demands the consideration of action to reduce noise. This section also reports as to whether the exceedence of noise limits is being legally enforced, and on related implementation issues. Noise limits are examined since they play a role in the END's implementation, even though they aren't addressed in the Directive, for instance, in identifying priorities for noise action planning.

5. Quiet areas:

This section describes how quiet areas are defined in national transposing legislation, and mentions whether quiet areas have been designated in a particular Member State ("MS") to date, along with any associated implementation issues.

6. Strategic noise mapping:

This section presents the state of play in terms of the production of SNMs in each EU MS, as mandated by the END. First, a tabular overview of the number of SNMs produced in each Round is presented. The figures refer to the number of SNMs formally adopted. Where this information was available, the number of SNMs *originally envisaged* is figures provided in brackets as contextual information. An analysis of completeness by noise source at EU level is provided in section 2 of the Main Report. Where brackets are missing, this does not indicate that reporting submissions are complete, but simply that information on the number of SNMs originally envisaged was not available.

It should be noted that whereas the completeness data in the main body of the report is based on official data as reported to the EC by the EU MS against what was originally meant to be reported, the data contained in the country reports is self-reported data by each MS national competent authority ("CA"). In many cases, the data will be the same in both cases, whereas in some cases, there may be discrepancies. These may be explained by a range of factors:

- *Different calculation methods* (e.g. whilst in case of agglomerations, the EEA data calculates the number of Strategic Noise Maps (SNMs) based on the number of agglomerations, in some Member States the number of SNMs may be higher than the number of agglomerations within END scope due to several maps being produced *within* agglomerations for various sources).
- *Different cut-off dates*: Whilst the EEA data analysed in the implementation review in the main body of the report dates back to November 2015, the bottom-up data collection was carried out in June 2015. Where possible, later information was taken into account.
- *Different interpretations of the data*: whereas the EEA counts the number of SNMs and NAPs reported to the EC, the data presented in this country report refers to the number of SNMs and NAPs *formally adopted* in the country, with the number of SNMs and NAPs *expected* (based on the END coverage and what Competent Authorities communicated to the EEA/EC) presented in brackets to allow for comparison.
- *Different levels at which information is aggregated and presented*: Whereas the EEA data reports on noise sources within agglomerations *separately* for major roads, railways, and aircraft noise, the information presented in this country report covers completeness in terms of agglomerations *overall*.

The section goes on to discuss responsibility and methodologies used for data collection for SNMs, and the availability of data. The section also describes the extent to which SNMs are publically available, providing weblinks where applicable. Finally, the section highlights any implementation issues in R1, how these have been addressed in Round 2, and whether any new issues occurred in R2.

7. Noise action planning:

This section presents the state of play in terms of the production of Noise Action Plans ("NAPs") in the country, as mandated by the END.

Firstly, a tabular overview of the number of NAPs produced in each Round is presented. It should be noted that similar presentational issues and limitations apply as outlined above in case of SNMs with regard to the comparability of the information presented with the analysis carried out in the implementation review in the main body of the report. This means that where brackets are missing, this does not indicate that reporting submissions are complete, but simply that information on the number of NAPs originally envisaged was not available.

The section goes on to examine methodologies used for action planning purposes, as well as a description of measures included in the NAPs, and an assessment of whether these have been implemented in practice. The section also describes the steps undertaken to consult with the public on NAPs, and any implementation issues in Round 1, how these have been addressed in Round 2, and whether any new issues occurred in Round 2.

It should be noted that wherever a table cell contains the words 'no data' this means that it was not possible to obtain the relevant information either through own research or by the Competent Authorities. Wherever a table cell contains the value 'n/a' this means that this is not applicable. In the example below this means that no agglomerations were within END scope in Round 1 in the country in question.

	R1
Agglomerations	n/a

GLOSSARY OF ABBREVIATIONS, TERMS AND DEFINITIONS

A glossary and definition of acronyms, abbreviations and technical terms is provided below:

Abbreviations and acronyms	Full wording
Art.	Article in an EU legal text
CAs	Competent Authorities
CNOSSOS-EU	Common Noise Assessment Methods in Europe. This will be used for the purpose of strategic noise mapping.
DALYs	Disability-Adjusted Life Years
ETC/ACM	European Topic Centre on Air Pollution and Climate Change Mitigation
END	The Environmental Noise Directive - Directive 2002/49/EC.
ERFs	Exposure-response functions
HA	Highly Annoyed
ICAO	International Civil Aviation Organization
JRC	Joint Research Centre
LV(s)	Limit Value(s)
NAPs	Noise Action Plans
SNMs	Strategic Noise Maps
WHO	World Health Organisation

Technical terms/ definitions	Description
Action Planning Body	An organisation nominated in the capacity of a CA responsible for producing a Noise Action Plan.
Agglomeration	Agglomeration' shall mean part of a territory, delimited by the Member State, having a population in excess of 100000 persons and a population density such that the Member State considers it to be an urbanised area. However, it should be noted that in R1, an agglomeration was an area with a population in excess of 250,000 persons as part of a transitional period.
Major airports	A civil airport with >50000 movements per year (a movement being a take-off or a landing).
Major railway	'Major railway' shall mean a railway, designated by the Member State, which has more than 30 000 train passages per year. Note: Major railways in R1 were defined as > 60000 train passages per year and in R2, the threshold changed to > 30000 train passages per year.
Major roads	'Major road' shall mean a regional, national or international road, designated by the Member State, which has more than 3 million vehicle passages a year; Note - major roads in R1 were defined as a road with > 6 million vehicle passages a year. In R2, the threshold was changed to > 3 million vehicle passages a year.
NRA	National Road Authority
R1/ Round 1	The noise mapping which took place in 2007 and the subsequent adoption of Action Plans in 2008 onwards.
R2/ Round 2	The noise mapping which took place in 2012 and the subsequent adoption of Action Plans in 2013 onwards.
R3/ Round 3	The noise mapping that will take place in 2017 and the subsequent Action Plans that will be prepared in 2018. There will be a transition in some countries towards the use of CNOSSOS-EU (voluntary only).
R4 / Round 4	The noise mapping that will take place in 2022 and the subsequent action plans that will be prepared in 2023. The use of CNOSSOS-EU will be mandatory.

Technical terms/ definitions	Description
TFEU	Treaty for European Union, the Lisbon Treaty, adopted in December 2009.

A list of some of the acoustical and technical terms used in the report for the benefit of non-technical readers is provided below:

Technical term	Explanation/ description
A 'common approach'	The term 'a common approach' is used in the report as shorthand when referring to Article 1(1) of the END whose full aim is to "define a common approach intended to avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to exposure to environmental noise".
Annoyance	One of the health endpoints mentioned in the current WHO guidelines for quantifying the burden of disease from environmental noise. The WHO defines annoyance as an emotional state connected to feelings of discomfort, anger, depression and helplessness.
Cardiovascular diseases	One of the health endpoints mentioned in the current WHO guidelines, includes minor changes in cardiovascular activity and myocardial infarction.
Competent Authority	The organisation nominated as being responsible either for the development of Strategic Noise Map(s), Noise Action Plans or both.
Disability-Adjusted Life Years (DALYs)	One DALY represents one lost year of "healthy" life. The sum of these DALYs across the population, or the burden of disease, can be thought of as a measurement of the gap between current health status and an ideal health situation.
Dose-effect relationships	The END describes this as meaning "the relationship between the value of a noise indicator and a harmful effect". This also describes the change in effect on exposed population caused by differing levels of exposure (or doses) to noise (measured in dBs) after a certain exposure time.
EIONET	European Environment Information and Observation Network
Health endpoints	Examples of health endpoints mentioned in the current WHO guidelines are: annoyance, sleep disturbance and cardiovascular diseases.
Reportnet	The EEA's reporting mechanism for gathering data and information on END implementation through the EIONET network of Member State authorities. https://www.eionet.europa.eu/reportnet
Sleep disturbance	Sleep disturbance is a further health endpoint mentioned in the current WHO guidelines, includes EEG awakening, motility, changes in duration of various stages of sleep, sleep fragmentation, waking etc.
Noise metrics	*There are two key indicators that are used in implementing the END, L_{den} and L_{night}. Definitions of these terms are provided below:*
L_{den}	'L_{den}' (day-evening-night noise indicator) shall mean the noise indicator for overall annoyance, as further defined in Annex I of the END.

Technical term	Explanation/ description
L_{night}	L_{night}' (night-time noise indicator) shall mean the noise indicator for sleep disturbance, as further defined in Annex I of the Directive;
TSIs	Technical Standards for Interoperability – voluntary standards in the rail sector.

2. AUSTRIA

2.1 National implementing legislation for END

2.1.1 Legal implementation

The implementing legislation for the END at national level in Austria is the Federal Law on Protection from Environmental Noise (*Bundes-Umgebungslärmschutzgesetz, BGBl. I 60/2005*), which entered into force on 5th July 2005[1]. A Federal Ordinance on Protection from Environmental Noise (Bundes-Umgebungslärmschutzverordnung, BGBI. II Nr. 144/2006)[2] of 5th April 2006 provides clarification on technical details related to noise indices, Strategic noise mapping, Noise action planning, and the definition of agglomerations.

The division of competences for END implementation across the country's nine Federal States has resulted in additional legal acts that enact END measures in each of these states[3].

2.1.2 Scope of END implementation – Rounds 1 & 2

R1 of strategic noise mapping and noise action planning in Austria included a single agglomeration (Wien) and airport (Wien), and approximately 2,453 km of major roads and 604 km of major railways.

The introduction of definitive thresholds in R2 mean that an additional 4 agglomerations were included within the scope of the END, and meant an expansion in coverage of major railway lines by 1,410 km and of major roads by 2,858 km.

Table 1 END coverage – Austria

Round	Agglomerations	Major airports	Major rail	Major roads
1	1	1	604 km	2,453 km
2	5[4]	6[5]	2,014 km	5,311 km

[1] Bundesgesetz 60/2005; Official Journal: Bundesgesetzblatt für die Republik Österreich (BGBl.), Nr. 60/2005, Publication date: 04.07.2005, Entry into force: 05.07.2005; Reference: (MNE (2005)52738).

[2] Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über die Methoden und technischen Spezifikationen für die Erhebung des Umgebungslärms (Bundes-Umgebungslärmschutzverordnung – Bundes-LärmV), 144. Verordnung, Publication date: 5. April 2006, BGBl. II - Nr. 144.

[3] For a full list of the legislative acts please see:
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:72002L0049:EN:NOT#FIELD_AT

[4] Wien, Graz, Innsbruck, Linz, Salzburg

[5] Wien, Graz, Linz, Innsbruck, Salzburg, Klagenfurt

2.2 Competent Authorities and designated administrative bodies

An overview of the different administrative responsibilities for the END in Austria is shown in the table below.

Table 2 Administrative Responsibility for the END - Austria

Role/Activity	Agglomerations	Roads	Railways	Airports
Preparing SNMs	Federal state authorities	BMVIT (assisted by ASFINAG or federal state authority)	BMVIT (assisted by ÖBB or federal state authority)	BMVIT
Approving SNMs	Federal Ministry for Transport, Innovation and Technology (BMVIT)	BMVIT	BMVIT	BMVIT
Preparing NAPs	Federal state authorities	BMVIT (state roads) and Federal state authorities (federal state roads)	BMVIT (railways) Municipalities (trams)	BMVIT

ASFINAG: Autobahnen- und Schnellstraßen-Finanzierungs-Aktiengesellschaft / Highway Financing Listed Company
ÖBB: Österreichische Bundesbahnen / Austrian Railways

The Federal Ministry of Agriculture, Forestry, Environment and Water Management (*BMLFUW*) has overall responsibility for national implementation of the END, in accordance with Article 14 of the Federal Law on Protection from Environmental Noise. Responsibility for the development of SNMs and NAPs is split vertically across sectors and geographically (horizontally) as per Articles 6 and 7 of the law mentioned above. The Federal Ministry for Transport, Innovation and Technology (*BMVIT*) is responsible for Strategic noise mapping and Noise action planning for major roads, major railways and major airports (including those within agglomerations).

SNMs and NAPs for agglomerations are developed by the relevant regional authority and then submitted to the BMVIT. Both SNMs and NAPs also include noise from tramlines that fall within agglomerations. The Federal Ministry for Economics and Labour (*BMWA*) is responsible for some sections of SNMs and for the plans that capture installations sited within agglomerations regulated by the IPPC Directive[6] in cooperation with the *BMLFUW*. All SNMs and NAPs are then collected by the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management *(BMLFUW)* and made available to all the above ministries and the public.

In addition, Austria has set up a Working Group for Controlling Noise (*Österreichischer Arbeitsring für Lärmbekämpfung,* OÄL) to address issues related to noise from an interdisciplinary perspective. The group, which was established in 1958, is responsible for generating guidance and expert opinions on all aspects of environmental noise control from individual and multiple sources. ÖAL developed the directive ÖAL-Richtlinie Nr. 36 Blatt 2 providing guidance on the preparation of SNMs and planning of noise abatement measures[7].

[6] Council Directive 96/61/EC concerning integrated pollution prevention and control (IPPC)

[7] See: http://www.oeal.at/

2.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

2.3.1 Data collection

The Austrian authorities did not experience any problems in either Round in terms of obtaining data for the designation and delimitation of agglomerations, major roads, major railways and major airports.

2.3.2 Implementation Issues

The only issue raised in R1 was the difficulty of mapping noise in border areas. For example, noise levels in agglomerations may be affected by noise from sources in another, adjacent administrative region (the same applies to national borders where agglomerations are located near them). In these cases, data on the noise from sources across the administrative border has to be requested from other administrative authorities. At times, such data is not readily available at the time when noise maps are developed. This problem likely persists in Round 2. No remedial action has been identified, and no additional issues were raised in R2.

2.4 Noise limits and targets

2.4.1 Objectives and Scope

The main objective of noise limits is the protection of the general public against noise from traffic and industry. Due to the various regulations, competencies and interests, a comprehensive approach resulting in equal protection from the various noise sources is anticipated. Preventive measures against road traffic noise only apply in case of major road reconstructions and new roads. For railways, a modernisation scheme is available which contributes to meeting the set limit values.

Although there is no requirement in the END to set noise limit values, national legislation in Austria does so. The table below provides a summary of noise limit values in force applied under the Instructions on Noise from Federal Roads (Dienstanweisung Lärmschutz an Bundesstraßen, BMwA No. 890.040/2-VI/14a/99) and the Ordinance for the Control of Rail Noise Pollution (Schienenverkehrslärm-Immissionsschutzverordnung, SchIV, BGBI No. 415/1993). The Instructions on Noise from Federal Roads apply to existing and new highways and expressways built anywhere in the country. The Ordinance for the Control of Rail Noise Pollution applies to new construction as well as the substantial reconstruction of routes throughout the federal territory.

Table 3 Noise limit values - Austria

L_{night} 22:00-06:00hr	L_{day} 06:00-22:00hr	Relevant legislation
50	60	Instructions on Noise from Federal Roads, (BMwA number 890.040/2-VI/14a/99)
55	65	Ordinance on Rail Noise Pollution Control Regulation (SchIV)

Protection against air traffic noise is not regulated to date. The BMVIT has issued a draft regulation LuIV (Luftverkehr-Immissionsschutzverordnung) that currently is under review.

In addition, noise threshold values in relation to environmental are determined in the Federal Ordinance on Protection from Environmental Noise (Bundes-LärmV):

Table 4 Noise threshold values - Austria*

L_{night}	L_{den}	Noise Source
50	60	Road traffic noise
55	65	Air traffic noise
60	70	Rail traffic noise
50	55	Industry and trade noise

** Values can differ between federal states*

Planning values and noise emission limit values are defined in the ÖNORM S 5021 for various area categories. Planning values are derived from the dedication category of the area with a range of 45 - 65 dB day / 35 - 55 dB night. The planning values of the federal states may differ from the values in the ÖNORM S 5021[8].

2.5 Quiet areas

2.5.1 Overview

No quiet areas were established in R1. They are defined in the Federal Law on Environmental Noise. According to this Law, they are supposed to be part of the NAPs "if applicable".

In R2, the agglomeration Vienna defined 10 quiet areas within the municipal boundaries. These areas represent existing protected areas such as national parks, nature reserves and landscape conservation areas.

Article 9 of the Federal Ordinance on Protection from Environmental Noise requires the identification of quiet areas in NAPs, and the inclusion of measures to protect quiet areas in cases where noise limit values are being transgressed.

Quiet areas are defined in Article 3 of the Federal Law on Protection from Environmental Noise as: *"areas that on the basis of their designation exhibit a particular need for protection with regard to environmental noise, in connection with a suitable noise index".* There is no specific distinction between quiet areas in agglomerations and open country.

Quiet areas within agglomerations are identified on the basis of the noise index L_{den}.

There is no national level methodology for defining quiet areas.

In the federal state of Vienna, quiet areas are defined in the Vienna Environmental Noise regulation (*Wiener Umgebungslärmschutzverordnung*) to mean protected areas where the noise threshold value of L_{den} = 50 dB and L_{night} = 40 dB is not exceeded (excluding air traffic noise).

2.5.2 Implementation Issues

No issues were raised as a result of END implementation in either Round.

[8] A comprehensive overview is provided in: „Handbuch Umgebungslärm, Minderung und Ruhevorsorge ", IG Umwelt und Technik, BMVIT

2.6 Strategic noise mapping

2.6.1 Overview

An overview of SNMs produced in Rounds 1 and 2 is shown below. SNMs for Austria are published at *www.laerminfo.at* in three different maps: Roads (including agglomerations), Railways and Airports. A SNM for Vienna is available from: http://rigolett.home.xs4all.nl/ENGELS/maps/wien.htm

Table 5 – SNMs – Austria

	R1	R2
Agglomerations*	1	1 (5)
Major airports	1	1 (1)
Major railways	1	1 (2,014 km)
Major roads***	2	2 (5,311 km)

** No separate maps – agglomerations incorporated in the maps for major roads, and for trams and metro lines*

*** no map available online*

**** 1 map for federal roads, 1 map for state roads*

2.6.2 Data collection

Responsibility for data collection lies with the authority responsible for generating the relevant section of a SNM. In order to ensure clarity as to which authorities were responsible for generating (collecting) data, working areas for road traffic have been divided up between the relevant administrative authorities given administrative boundaries which are independent of competence over specific stretches of road.

The table below describes data availability and collection over the two Rounds.

Table 6 Strategic noise mapping – data availability and collection methods - Austria

R1	R2
New data collection exercises on a case-by-case basis, in particular for major federal roads (as geographical data is not always up to date).	Collection of data was undertaken using the same methodology
Correlation of population census with geo-referenced address details for data on buildings	

2.6.3 Strategic noise mapping methods

Detailed technical specifications for Strategic noise mapping are set out in Article 5 of the *Federal Ordinance for Noise Protection*. In addition, Guidance documents on Strategic noise mapping were developed at the national level by the OAL. These are available at:

www.laerminfo.at/dms/laerminfo/massnahmen/publikationen/oal_richtlinien/oeal_richtlinie_nr_36_blatt_2.pdf

Although only L_{den} and L_{night} indices are used for SNM development, they are also used for specific applications, for example in the implementation of legislation to control noise from railways, namely the Federal Ordinance for the Protection of Noise from Trams (*Schienenverkehrslärm-Immissionsschutzverordnung,* BGBl. Nr. 415/1993). These are defined in Article 3 of the Federal Ordinance for Noise Protection, following ISO 1996-2:1987, with a measurement time of one year, and include $L_{evening}$ (19:00-22:00hr), L_{day} (06:00-19:00hr) and L_{night} (22:00-06:00hr).

2.6.4 Public accessibility of SNMs

SNMs are accessible via a website presenting source-specific maps (major roads, railways, trams and one major airport, and IPPC installations) which display at multiple scales and include a zoom function. Precise addresses may also be entered. SNMs also incorporate noise for tramlines into maps for agglomerations.

Quiet areas, in agglomerations and open country, are not made explicit on maps.

Pages on SNMs form part of a larger website established by the *BMLFUW* (http://www.laerminfo.at) to provide comprehensive information on noise regulation, and specifically on the processes for Strategic noise mapping and NAP development. A number of publications are available on the website, aimed at making information available to the public in a concise and accessible format. SNMs do not currently compare the existing situation against a future prognosis.

2.6.5 Implementation Issues

A number of issues were raised as a result of R1, a summary of which is shown below, together with actions taken to address them, and new issues from R2.

Table 7 Strategic noise mapping issues - Austria

R1	R2
Data collection using geo-data	Approved concept of data collection from R1 was refined and carried out without major problems
Obtaining data on exposed populations and number of dwellings, schools and hospitals exposed to specific noise indicator values, in particular number of inhabitants per building, location of existing noise protection walls and protection measures.	Data collection methodology from R1 was refined to be best practice.
Bridges could only be represented as 2D objects (in maps).	Existing fragmented data was reprocessed to design a consistent database of the ÖBB railway network for Strategic noise mapping.
Process slowed down by the need for multiple meetings due to competence split (federal state (local) authorities: tramlines; BMVIT major roads, major railways and major airports)	This remains an issue.
Defining responsibilities and determining the depth of the work, in terms of required level	This is no longer an issue since the level of detail was kept the same in R2.

R1	R2
of detail	
Lack of central point for the collection, management and administration of relevant data	This remains an issue.
5-year revision period considered too short (7 – 10 years would be preferable)	This remains an issue.

2.7 Noise action planning

2.7.1 Overview

An overview of NAPs is shown in the following table.

Table 8 – NAPs – Austria[9]

	R1	R2
Agglomerations	1	5 (6)
Major airports	1	5 (6)
Major railways	9	5 (5)
Major roads	2	9 (9)

** For all envisaged NAPs public consultation was completed in 2013 (except for 2 NAPs for main roads which were completed in 01/2015 and 04/2015)*

2.7.2 Methodologies for noise action planning

National guidelines have been developed for noise action planning in Austria by the OAL and combined with those for Strategic noise mapping. These set out a systematic approach to the preparation of NAPs and their required content. In addition, the *BMLFUW* has developed guidance -" *Handbuch Umgebungslaerm, Laermminderung und Vorsorge"*, available via its website *www.laerminfo.at*.

2.7.3 Measures

Measures in the R1 and R2 NAPs include: technical measures at source, the reduction of excessive noise, traffic planning, land-use planning, economic measures, noise isolation and mention of the contribution of measures required under national noise regulations. Additional measures include the installation of low-noise street surfaces and noise protection measures in residential buildings. The criteria for the selection of measures include population exposure, the implementation costs / ease of implementation, the need for flexibility in measure implementation and a check to ensure compatibility with other legislation.

SNMs were used to assess the effectiveness of existing noise protection measures for the reduction of noise from railways under the Ordinance for the Protection from Noise from Railways. The objectives and measures of such pre-existing and ongoing programmes for noise control have been integrated into NAPs developed under the END.

[9] Action Plans: As reported to the EC. And www.laerminfo.at

2.7.4 Public consultations

The OAL provides guidance on the provision of information to the public and their participation in the development of measures to address noise[10]. It emphasises timely engagement with the public and encourages the use of a range of materials to publicise information, including: community leaflets, mailings, posters, internet, radio and television.

NAPs are made available on:
http://www.laerminfo.at/massnahmen/aktionsplaene.html

Recommended procedures include establishing a process manager, delivering appropriate information work to ensure that all residents have the opportunity to learn from this procedure; giving at least 6 weeks for the population to give an opinion; respecting the requirements of population groups with special needs, such as disabled, elderly and infirm persons, persons with an immigrant background, children, etc.; publicising results. The guidance also considers the value of a roundtable approach to public consultation, but notes that such an approach generally takes up to a year.

The above stakeholder consultation process is managed by:

- Highways, railways and airports: *BMVIT* (*BMLFUW*),
- Other roads and agglomerations: federal state governments.

In R1 SNMs and actions plans were issued almost at the same time making public participation as required by END difficult. In Vienna no public consultation was carried out; only the heads of the Viennese districts were invited to participate in the process.

In R2 a comprehensive public consultation process was strived for. Citizens and organisations were invited to comment on the various NAPs. Public information was provided through the internet page www.laerm.at.

2.7.5 Implementation Issues

A number of issues were raised as a result of R1, a summary of which is shown below, together with actions taken to address them, and new issues from R2.

Table 9 Noise action planning issues - Austria

R1	R2
(There is a) lack of (adequate) human and financial resources	No data
SNM detail is insufficient to allow CBA of individual measures	No data
Division of competences between multiple regional and sectoral authorities is a major barrier to planning measures to control noise emissions	This remains an issue.
5-year revision period too short (7 – 10 preferable)	This remains an issue.

[10] OAL Richtlinie No. 36, available at: www.laerminfo.at/dms/laerminfo/massnahmen/publikationen/oal_richtlinien/oeal_richtlinie_nr_36_blatt_1.pdf

3. BELGIUM

3.1 National implementing legislation for END

3.1.1 Legal implementation

The END was transposed into national legislation in Brussels and Walloon in 2004, and in Flanders in 2005.

Table 10 END transposition by region – Belgium

Region	Transposing Legislation
Brussels	Order of 1 April 2004 amending Order of 17 July 1997 regarding the fight against noise in urban areas
Flanders	Decree of 22 July 2005 on the evaluation and management of environmental noise
Wallonia	Order of 13 May 2004 regarding the evaluation and management of environmental noise

3.1.2 Scope of END implementation – Rounds 1 & 2

R1 of strategic noise mapping and noise action planning in Belgium included 3 agglomerations, 1 airport, and approximately 2,946 km of major roads and 416 km of railways. The introduction of definitive thresholds for R2 led to an *additional* agglomeration being covered. Information on major railway lines and major roads had not been reported to the EC by August 2014. Flanders reported information on major railway lines, major roads, major airports and major agglomerations on Eionet for R2 on 26th of May 2009 (Dataflow 5, http://cdr.eionet.europa.eu/be/eu/noise/df5/), and updated this information on the 16th of June 2014 for the major agglomerations and major roads. An update for major airports and railway lines was not deemed necessary as 2009 information was still valid. In case of Brussels, noise for all transport modes was covered within the scope of the Brussels region.

Table 11 END coverage – Belgium

Region	Round	Agglomerations	Major airports	Major rail	Major roads
Belgium	**1**	3	1	416 km	2,946 km
	2	6	1	1,336 km	5,024 km
Brussels	1	Brussels region (all transport modes)	n/a	n/a	n/a
	2	Brussels region	n/a	n/a	n/a
Flanders	1	2[11]	1	286 km	1,886 km

[11] Antwerp, Ghent

Region	Round	Agglomerations	Major airports	Major rail	Major roads
	2	3[12]	1	689 km	3,872 km
Wallonia	1	n/a	n/a	130 km	1,060 km
	2	2[13]	n/a	647 km	1,152 km

3.2 Competent Authorities and designated administrative bodies

The IBGE (Institut Bruxellois pour la Gestion de l'Environnement) [Brussels], The Flemish Environment, Nature and Energy Department – Air, Nuisances, Risk management, Environment and Health Division [Flanders] and The Service Public de Wallonie are Belgium's CAs.

Administrative responsibility for the implementation of NAPs has not been determined in Flemish legislation. Some administrative bodies also have advisory responsibility for the preparation and approval of NAPs. The details are described in the following document (for which no English version is available): http://emis.vito.be/sites/emis.vito.be/files/legislation/migrated/sb150108-5.pdf

The responsibilities of these and other bodies within regions are shown in the table below.

Table 12 Administrative Responsibility for the END - Belgium

Role/Activity	Agglomerations	Roads	Railways	Airports
Brussels				
Preparing SNMs	Institut Bruxellois pour la Gestion de l'Environnement (IBGE)			
Approving SNMs	Institut Bruxellois pour la Gestion de l'Environnement (IBGE)			
Preparing NAPs	Institut Bruxellois pour la Gestion de l'Environnement (IBGE)			
Approving NAPs	IBGE and Brussels Region Government			
EC/EEA reporting	Institut Bruxellois pour la Gestion de l'Environnement (IBGE)			
Flanders				
Preparing SNMs	City Authorities, Roads and Traffic Agency, Environment, Nature and Energy Department			
Approving SNMs	The Government of Flanders			
Preparing NAPs	Authorities, Roads and Traffic Agency, Environment, Nature and Energy Department			
Approving NAPs	The Government of Flanders			
EC/EEA reporting	Environment, Nature and Energy Department			
Wallonia				

[12] Antwerp, Ghent, Bruges

[13] Charleroi, Liège

Role/Activity	Agglomerations	Roads	Railways	Airports
Preparing SNMs	Service Public de Wallonie			
Approving SNMs				
Preparing NAPs				
Approving NAPs				
EC/EEA reporting	The Walloon Government			

3.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

3.3.1 Data collection

An overview of designation is shown in the following table.

Table 13 END designation by region – Belgium

Region	Description
Brussels	Data was obtained through collaboration and conventions (most already decided upon before Directive 2002/49/CE) with the different transport administrators. The Bruxelles-Capitale Region is an agglomeration. All data (buildings, transport, infrastructure characteristics) was mapped as much as possible. Information on the annual volume of traffic for major roads was given to the IBGE by the Administration of Equipment and Mobility (AED), information on the volume of traffic for major railways was provided by SNCB (national railway company) and information on public transportation was provided by STIB (Brussels public transport organisation)
Flanders	The Environment, Nature and Energy Department is responsible for the collection of data for END site designation. Information on the annual volume of traffic for major roads is delivered by the Roads and Traffic Agency and on major railways was provided by the national railway company. For the delimitation of major agglomerations, the Flemish authority used the borders of administrative municipalities.
Wallonia	During R1, it was reported that information was available for the 2005 designation process and that no major problem was encountered when increasing the scope of sites for reporting in 2008. Indeed, in the Walloon Region, there are no major airports and only two major agglomerations (Liège and Charleroi) according to the END definitions. The Walloon government designated areas for noise planning based on the recommendations of the Working Group Assessment of Exposure to Noise (WGAEN).

3.3.2 Implementation issues

A number of issues were raised as a result of R1, a summary of which is shown below, together with actions taken to address them, and any new issues raised during R2.

Table 14 Designation issues - Belgium

Region	R1	R2
Brussels	Data collection was problematic since transport administrators were used to reporting on traffic data, but had no experience of assessing noise levels or of other types of input data. Data from different transport administrations had different formats. Incomplete databases, including traffic intensities (since completed). Inconsistent data, and incorrect formats for maps.	There were no significant changes for railways and roads. New noise maps were only developed for Brussels Airport.
Flanders	Data differences between site designation deadline (2005) and reference year SNMs (2006) A lack of clarity in definitions (Article 3 of the END), especially agglomeration	Differences in data between site designation deadline (31th December 2008) and SNMs reference year (2011). The most recently available data was used for the SNMs of major roads (reference year 2011). The delineation of the agglomeration of Antwerp (as defined for the implementation of Directive 2002/49) changed for R2. In R1 SNMs, the district 'Berendrecht-Zandvliet-Lillo' of the city of Antwerp weren't included in the delineation of the agglomeration. During the public consultation for the first NAP, several commentators asked that 'Berendrecht-Zandvliet-Lillo' be included in the SNMs and the NAP. For this reason, the delineation of the agglomeration of Antwerp was extended for R2. The delineations of agglomerations are based on administrative units (municipalities).
Wallonia	A lack of clarity in definitions (Article 3), especially of "agglomeration" led to many discussions and subsequent delays.	No new issues were raised

3.4 Noise limits and targets

3.4.1 Scope

3.4.2 Brussels

Noise limit values applied in the Brussels Region are shown in the table below.

Table 15 Noise limit value – Brussels region – Belgium

Noise source	L_{night}	L_{day}	$L_{evening}$	Comments
Road traffic	60	65		Limit values defined in LAeq (8h) which correspond to intervention levels, i.e. noise levels from which the acoustic situation of residents is seen as intolerable and requires public authorities' intervention. Not legally-binding
Rail traffic	60; 65; 68	65; 70; 73		LAeq,T (22-7h) and (7-22h): specific measures at façades. Defined by the environmental convention signed between the Brussels Region and the SNCB (Belgian National Railway Society). For each period, 3 levels of intervention are defined
Aircraft around airports	55 (Zone 2) 50 (Zone 1) 45 (Zone 0)	65(Zone 2) 60 (Zone 1) 55 (Zone 0)		LAeq,T (23-7h) and (7-23h): specific to environmental noise, generated by planes. Limit values set by order of 27 May 1999 of the Government of the Brussels. Three zones are defined in the region. Enforcement and mitigation measures are described in order of 25 March 1999 regarding search, recognition and suppression of infringements in environmental matters. SEL is also used to characterise flights
Industrial activity sites	33-54	42-60	36-60	LAeq,T (22-7h), (7-19h) and (19-22h) take into account total level of noise, level of environmental noise and value of possible tonal emergence. Limit values defined by Order of 2 July 1998 regarding the fight against noise and vibrations generated by installations. Enforcement and mitigation measures are described in order of 25 March 1999 regarding search, recognition and suppression of infringements in environmental matters

3.4.3 Flanders

Legal noise limit values for road and rail traffic noise have not yet been set in the Flanders Region, although environmental impact assessment (EIA) procedures take non-binding guide values into account. Limit values for establishments considered to be a nuisance are set out in Flemish regulations: VLAREM II appendix 4.5.4 Guide values for the specific noise in the open air of establishments classified as nuisance-producing and appendix 4.5.6. Guide values for fluctuating, incidental, impulsive and intermittent noise in the open air caused by establishments classified as nuisance-producing.

The environmental conditions for classified establishments can be consulted at: https://navigator.emis.vito.be/mijn-navigator?woId=9484

3.4.4 Wallonia

The Walloon Region has no overview of noise limit values available in tabular form, except for industrial sites (see below).

Table 16 General noise limit values for classified installations (dB) – Wallonia

Zones in which noise emission limit values apply		Day 7-19hr	Transition 6-7hr/19-22hr	Night 22-6hr
I	All zones within 500m of an extraction zone, centre of industrial or economic activity, or at least 200m from a zone of mixed economic activities, within which the installation is situated	55	50	45
II	Rural zones, excepting Zone I	50	45	40
III	Agricultural, forested, green and natural zones, except Zone I	50	45	40
IV	Recreation zones, public services and community facilities	55	50	45

The Walloon Region adopted limit values for road and rail noise inside agglomerations above which action plans must be prepared, on 17 December 2015.

Noise source	L_{day}	L_{night}
Road traffic	70	60
Rail traffic	70	60

3.4.5 Purpose

The enforcement of noise limit values varies by region.

Table 17 Noise limit values enforcement – Belgium

Region	Description
Brussels	1999 Order on plane noise - airlines can be held responsible for exceedance of noise limit values (determined through monitoring sites) and be fined accordingly 1998 Order on neighbourhood noise - relies on complaints from neighbours - the inspectorate in charge of noise limit enforcement given a mediation power – revised and updated in 2002 1998 Order on IPPC noise - if installation exceeds noise limits, inspectorate must require works to be done on the site to reduce noise – revised and updated in 2002 Railways - BGE agreement with SNCB (Belgian National Railway) to conduct noise studies and establish noise abatement measures on new infrastructures. The same approach applied to STIB (Brussels Public Transport Society) for future public transport infrastructure. The purpose is to make noise an environmental issue that is systematically taken into account by transport administrations
Flanders	Legal noise limit values for road and rail traffic noise have not yet been determined Limit values for establishments considered to be a nuisance are set out in environmental licenses
Wallonia	No information is available on the method for establishing limit values for agglomeration, road, railways and aircraft noise

3.4.6 Non-binding target values

The Flemish Environment, Nature and Energy Department has completed a study to edit the NAPs for the major roads and railways in R2. Noise priority areas were identified on the basis of a threshold value by using the SNMs.

3.4.7 Comparison of limits and targets with WHO guidance

The WHO's health-based assessments were used in Brussels and Flanders regions.

Table 18 Noise limit values and the WHO – Belgium

Region	Description
Brussels	WHO health-based assessments were used, but were refined on the basis of actual experience. Limit values had to be tailored to Brussels' unique urban-only nature. Otherwise the whole region would have been a red zone, and it would have been more difficult to set priorities.
Flanders	WHO health-based assessment and studies provided by the WGHSEA (Working Group Health and Socio-Economic Aspects) were used in preparatory studies for the NAPs of R1 and R2 to determine threshold values to detect noise priority spots.
Wallonia	No information available

3.4.8 Implementation issues

No issues were raised in relation to noise limit values in either Round.

3.5 Quiet areas

3.5.1 Overview

No methodology was established at national or regional level for delimiting quiet areas.

Table 19 Criteria used for the delimitation of quiet areas – Belgium

Region	Description
Brussels	IBGE launched a study in June 2009 to obtain an acoustic and sociological picture of the possibilities for "quiet area" delimitation within the agglomeration and to support the revision of NAPs to include quiet areas defined on criteria other than purely acoustic ones. The study is available at: http://document.environnement.brussels/opac_css/doc_num.php?explnum_id=4752 http://www.environnement.brussels/etat-de-lenvironnement/rapport-2007-2010/bruit/focus-zones-de-confort-acoustique
Flanders	No quiet areas were designated on the basis of the END. The Flemish government has a "silence area" policy in open country, independent of END. The "silence areas" are determined on the basis of acoustic and non-acoustic criteria, based on a regional methodology.
Wallonia	No quiet areas have been designated on the basis of the END

The table below summarises the number and size of quiet areas established during R1 and R2.

Table 20 Quiet areas – Belgium

	R1	R2		
	All regions	Brussels	Flanders	Wallonia
Number	0	1 (Forêt de Soignes)	0 (designated on the basis of the END)	0
Size (km^2)	0	~16km² (10% of Brussels Region)	0 (designated on the basis of the END)	0

3.5.2 Delimitation

Flanders

No change.

Brussels Region

- L_{den} ≤ 55 dB (A)
- Legally accessible to all at no charge with no physical barrier (to entry)
- A ground vegetation rate greater than 50%
- A clear daily use/role, evidenced by the presence of street furniture
- Clear paths within an area of at least 100 metres or 1 hectare)
- Little noise from terrestrial transport modes, with L_{den} at least 50% of 55 dB (A)

3.5.3 Agglomerations

In the Flanders NAPs for agglomerations (Antwerp, Ghent and Bruges) - R2, which is under preparation - actions regarding quiet areas are included. There are no regional criteria for quiet areas. Rather, each agglomeration will instead develop its own method for the delimitation and preservation of quiet areas.

3.5.4 Open country

Flanders still uses its own classification system to determine rural quiet areas based upon acoustic (L_{A50}) and non-acoustic criteria.

3.5.5 Implementation issues

A number of issues were raised as a result of R1 implementation, a summary of which is shown below, together with actions taken to address them, and any new issues raised during R2.

Table 21 Quiet area issues - Belgium

R1	R2
Brussels	
As the Bruxelles-Capitale Region is entirely urban, END definitions and guidelines were not precise enough on quiet areas within agglomerations	No change
Flanders	
Linking Flanders-based rural silent areas with END requirements	Each agglomeration will develop its own method for the delimitation and preservation of quiet areas during R2.
Since noise mapping only covers the most significant transport infrastructure (such as major roads and railways or airports), there is a lack of mapping in rural areas to help identify quiet areas.	Same as previous. A lack of mapping to help identify quiet areas in rural areas. No new issues.
SNMs of agglomerations, containing quiet areas, were still being worked on in 2010.	SNMs of agglomerations have been finished and reported. R2 NAPs are still in the process of being prepared. These are expected to include quiet areas.

3.6 Strategic noise mapping

3.6.1 Overview

An overview of SNMs produced in Rounds 1 and 2 is shown below.

Table 22 SNMs - Belgium

	R1			R2		
	Brussels ***	Flanders	Wallonia	Brussels ***	Flanders	Wallonia
Agglomerations	8	14	n/a	4	20	12*
Major airports	n/a	2	n/a	n/a	2	n/a
Major railways	n/a	2	2	n/a	2	2**
Major roads	n/a	2	2	n/a	2	2**

** The maps for the 2 major agglomerations > 100 000 inhabitants (Liège and Charleroi) were adopted by the Walloon Government on 17 December 2015, but they have not yet been reported to the Commission. The number amounts to 12 because separate maps were produced for the values L_{den}, L_{night}, for industry, railways and roads.*

*Only END-required maps have been reported, but far more were developed in R1 – A large number of maps for 2006 were created, covering: Periods : days of week, days of week-end and all the week; Noise indicators : L_d, L_e, L_n, L_{den} + exceeding of limit values; per transport mode (roads, railways, aircrafts and tramways & underground) and all transports (multi-exposure, only L_{den} and L_n for days of all the week, thus 2 maps + 2 conflict maps according to the attribution of ground); 2015 different RER scenarii, same noise indicators and periods + differential maps 2006-2015; **Liege and Charleroi, each with road L_{den}; road L_{night}; railway L_{den} railway L_{night}; industry L_{den}; industry L_{night}*

*** the preparation of SNMs for the major railways and major roads is currently being finalised, they are not yet approved by the Walloon Government and not yet reported to the Commission.*

****Only END-required maps have been reported, but far more were developed in R1 – A large number of maps for 2006 were created, covering: Periods : days of week, days of week-end and all the week; Noise indicators : L_d, L_e, L_n, L_{den} + exceeding of limit values; per transport mode (roads, railways, aircrafts and tramways & underground) and all transports (multi-exposure, only L_{den} and L_n for days of all the week, thus 2 maps + 2 conflict maps according to the attribution of ground); 2015 different RER scenarios, same noise indicators and periods + differential maps 2006-2015. Major airports, railways and roads are included in the SNMs for the agglomeration of Brussels, hence no separate maps had to be produced.*

3.6.2 Flanders

For major roads and railways, a clear comparison of noise exposure between Rounds is not feasible as R2 took into account considerably more roads and railways than in R1. For other sources, changes in noise contours and exposure data are largely due to differences in input data used in the noise models. For example, in R2:

- For major roads and railways, input data (the format of census data, GIS layer of houses) used to calculate noise exposure were different (see below)
- For the major agglomerations of Antwerp and Ghent, the source of the traffic model of the major roads was different, and a more detailed layer for the soil absorption effect was used.
- The delineation of the agglomeration of Antwerp (as defined for the implementation of Directive 2002/49) was changed.

3.6.3 Data collection

The methods used in each region are outlined in the table below.

Table 23 Data collection by region – Belgium

Region	Round	Description
Brussels	1	• Time required to collect data for strategic noise mapping was underestimated as competences were split between different administrations • The collection of one year's noise data on railways, roads and agglomeration between the beginning of 2007 and processing it before the end of June was impossible • SNMs were delayed compared with the timetable in the Directive. These were not ready until Spring 2009 • Data on noise barriers proved very hard to obtain and required aerial photographs and modelling of average heights
	2	There were still issues with regard to carrying out noise mapping between different administrations.
Flanders	1	• Data on general (non-acoustic) information, such as geographic information or information about housing located in proximity to major transport infrastructure, was problematic. • Calculation of exposure data requires information about the number and the exact location of the neighbouring inhabitants of a specific infrastructure. In absence of such information, a worst-case approach was taken – leading to potentially considerable over-estimations
	2	• Data were available from different administrations, and no specific problems were reported. • For the calculation of noise exposure data of major roads and major railways, more detailed (non) acoustic information was available in R2. • For R1, the number of residents and the number of dwellings per statistical segment was assigned to residential buildings in proportion to their volume. And there was no GIS layer available for single houses, a layer that consists of large building blocks was used. For R2, a GIS layer where all houses are indicated separately and the number of inhabitants per address was used to calculate the noise exposure data.
Wallonia	1	• Data were available from different administrations, and no specific problems were reported
	2	• Data were obtained from different administrations or surveys, and the national railway company for rail traffic

Responsibilities within each region are outlined in the table below.

Table 24 Data collection responsibilities

Region	Agglomerations	Major airports	Major railways	Major roads
Brussels	IBGE collects all data from CAs - SNCB and Infrabel (rail), Brussels Mobility (roads), Belgocontrol and Brussels Airport (airports), CIRB (buildings), INS (population…)			
Flanders	City authorities		Non-acoustic data (geographic information, housing, building height, topography) - The Environment Nature and Energy Department – Air, Nuisances, Risk management, Environment and Health Division with data mainly provided by the Agency of Geographical Information in Flanders (AGIV)	
			Velocity data, annual traffic intensity data, railway network, location of noise walls,) - national railway company (NMBS and Infrabel).	Velocity data, annual traffic intensity data, road network, location of noise walls, - Road and Traffic Agency
Wallonia	Consultancies are responsible for the data collection			

Although data were delivered by several administrations in Flanders, no specific availability problems have been experienced. In Wallonia, all necessary topographical and traffic input data were available.

3.6.4 Strategic noise mapping methods

Overview

Belgium's location necessitated co-operation with neighbouring regions, with intra-regional alignment required to ensure that cross-border regions were covered in noise mapping.

Brussels

Table 25 Strategic noise mapping method - Brussels

Round	Method
1	Data obtained by cross-referencing different information types (buildings, uses, census of population by statistical sectors, etc.) and formats (Excel, ArcView, Access) Resultant variability was problematic IBGE had to advise public and professional users that map results were global and not realistic pictures of local noise levels L_{den} and L_{night} indicators were used as well as L_{day} and $L_{evening}$ to have a complete view of the day It has been reported that the use of L_{day} and $L_{evening}$ allows a more realistic approach than L_{den}. The weighted average used for L_{den} for the evening or the night indicates that it is much more an annoyance indicator than an indicator of the real level of noise. National Public Transport noise indicators, LA_{eq} 8h Day et L_{Aeq} 8h Night were also used as special indicators (before harmonization in L_{den} and L_{night}). The 2007 GPG was used, as well as the guidelines of the CERTU (French Centre of Studies for Networks, Transport, Town-planning and Construction) « Strategic noise mapping in urban areas». For Strategic noise mapping, IBGE subcontracted to a French research department, which used the CERTU's study.
2	IBGE has made the transition to using END recommended interim methods.

Flanders

Table 26 Strategic noise mapping - Flanders

Round	Method
1	No guidelines were given to agglomerations that had to draw up SNMs, but the authorities organised a preparatory study in which a sound model was specifically developed for the data available in agglomerations L_{den} and L_{night} indicators and other supplementary indicators were used. (Airports referred to the frequency of exceeding values using LA_{max} indicators, and not just L_{den} and L_{night}) There was a discrepancy between the required scale-size for site designation (road network: 1.900km, railway network: 300km) and the required precision of the maps to evaluate how many people were exposed For roads and railways, the authorities followed the GPG and the GIS (Geographic Information System) as much as possible Protocols indicating equivalences between calculation methods were only made available by the Commission late in the process

Round	Method
2	Road traffic noise was computed by the Dutch national computation method published in: "Reken- en Meetvoorschrift Wegverkeerslawaai 2006" (RMV/ SRM II) including all revisions up to the 2009 version. The software used for the computation is IMMI. Rail traffic noise was computed by the Dutch national computation method: 'Reken- en Meetvoorschrift Railverkeerslawaai 2006' RMW/ SRM II including all revisions up to version 2009. The software used for the computation is IMMI. Industrial noise was computed by the ISO 9613-2 – Acoustics: Attenuation of sound propagation outdoors, Part 2; General method of calculation. The software used for the computation is IMMI Air traffic noise was computed by the Integrated Noise Model (INM) version7.0b, published by FAA (U.S. Federal Aviation Administration), taking into account recommendation 2003/613/EC of the Commission. L_{den} and L_{night} indicators only were used for strategic noise mapping. When no data were available, the assumptions from the EC's Good Practice Guide for Strategic noise mapping and the Production of Associated Data on Noise Exposure of the was used. The "precautionary principle" was followed to determine the number of people and number of dwellings exposed. The highest noise level on the most exposed façade of the building was attributed to all persons in the building as their "most exposed facade" levels. All reported numbers are calculated using this "precautionary principle" approach. This indicates that the numbers reported are possible overestimated in case of apartment buildings. The noise models of the agglomerations of Antwerp and Ghent were only partially updated in R2. In the noise model of Ghent, only the traffic intensities of the major roads and railways were updated. In the noise model of Antwerp, the traffic intensities of the major roads and railways were updated, and also the census data per address, the noise emission of industry in the port of Antwerp and the noise emission of the regional airport of Deurne were updated.

Wallonia

Table 27 Strategic noise mapping - Wallonia

Round	Method
1 + 2	L_{den} and L_{night} indicators only were used GPG and "Presenting Strategic noise mapping to the Public" guides were both used All Strategic noise mapping was made in line with END-recommended methods: industrial noise: ISO 9613-2; road noise: NMPB 2008; rail noise: SRM II

3.6.5 Public accessibility

Table 28 Public accessibility of SNMs and presentation by region – Belgium

Region	Round	Source
Brussels	1	SNMs available at: http://www.ibgebim.be/Templates/etat/informer.aspx?id=3082&langtype=2060&detail=tab3
	2	Entry to portal - http://www.environnement.brussels/thematiques/bruit-0 SNMs available at: http://www.environnement.brussels/thematiques/bruit/la-situation-bruxelles/cartographie-et-exposition-de-la-population?view_pro=1&view_school=1 and for Brussels Airport (2011): http://document.environnement.brussels/opac_css/doc_num.php?explnum_id=4915
Flanders	1	SNMs were available on website
	2	Available at: http://www.lne.be/themas/hinder-en-risicos/geluidshinder/beleid/eu-richtlijn/goedgekeurde-geluidskaarten/goedgekeurde-geluidskaarten-ontwerp SNMs for the major roads, railway lines and airports are also available at: www.geopunt.be
Wallonia	1	SNMs available at: http://carto1.wallonie.be/CIGALE/viewer.htm?APPNAME=BRUIT.
	2	As of April 2016: For the Walloon Region the preparation of the maps for the R2 SNMs for major railways and major roads is currently being finalised. They have not yet been approved by the Walloon Government and have not yet been reported to the Commission. The SNMs for the major agglomerations were adopted by the Walloon Government on 17 December 2015, but they have not yet been reported to the Commission.

3.6.6 Implementation issues

A number of issues were raised in R2, a summary of which is shown below.

Table 29 Strategic noise mapping issues - Belgium

Flanders	Wallonia
The collection of data on railways and roads for the reference year 2011 at the beginning of 2012 and processing it before the end of June was not possible. A whole year was needed to prepare SNMs of major roads and railways. Not all data for the preparation of SNMs was available with the desired accuracy and level of detail. It was sometimes necessary to make assumptions. The Good Practice Guide was used as much as possible.	Rules and constraints on public expenses result in a significant administrative burden The first contract awarded to a consultancy for R2 road Strategic noise mapping was contested and cancelled. The procedure had to be started all over again. This partly explains the delay for Strategic noise mapping (R2) in Wallonia.

3.7 Noise action planning

3.7.1 Overview

An overview of NAPs is shown in the following Table. In 2010, NAPs had yet to be drawn up for the Walloon Region.

Table 30 NAPs – Belgium

	R1			R2		
	Brussels	Flanders	Wallonia	Brussels	Flanders*	Wallonia**
Agglomerations	1 for all sources	2	n/a	1 for all sources	3*	2
Major airports		1	n/a		1*	n/a
Major railways		1	n/a		1*	1?
Major roads		1	n/a		1*	1?

** The NAPs in Flanders for Round 2 are currently in preparation, they have not yet been reported to the EC*

*** The NAPs for the major agglomerations with more than 100,000 inhabitants (Liège and Charleroi), major railways and major roads are currently in preparation.*

3.7.2 Methodologies for noise action planning

Table 31 Noise action planning methodology by region – Belgium

Region	Round	Methodology
Brussels	1	Consultations of administrations (transport, public authorities, etc.) were conducted before the public consultation begun No regional methodology was established because a previous plan had already been drawn in 2000. Experience and results of this first plan (and not 2006 maps as they were not finished by that time) used to draw up the new one. Areas of exceedance and health-based assessment used to set NAP priorities Other criteria for setting priorities included complaints, public inquiry, polls, land settlement The Brussels urban land settlement is based on the PRAS (Plan Régional d'Affectation du Sol), which is a regulatory document. Noise action planning requires relying on this plan to set priorities. Indeed, noise-protected areas are going to be mainly residential areas (although green open spaces will be protected too) and IBGE uses the PRAS to determine which zones are residential ones, which are constructible, etc.
	2	No change
Flanders	1	The provisional NAP drawn up was revised in 2010 on the basis of a further analysis of noise mapping data. The authorities set up a provisional plan, to be refined later, to prioritise noise in making current policy and budgetary choices.
	2	All NAPs are now complete and are at various stages of approval.
Wallonia	1	After R1 strategic noise mapping, the DG responsible for roads (DGO1) developed a method to prioritize noisy sites along major roads. This method is for now waiting for approval from the Walloon government. The NAP will be based on this method and the hierarchical list established according to the method constitutes a guide to determine the annual budget allocation.
	2	R2 NAPs are to be prepared when corresponding SNMs have been approved, and will adopt the same method developed for R1 mapping.

3.7.3 Measures

Table 32 NAP measures by region – Belgium

Region	Round	Measures
Brussels	1	Traffic planning, land-use planning, technical measures at noise source, insulation, selection of quieter sources, reduction of sound transmission, regulation and incentives Collaboration enquiries, conventions, studies and awareness raising also used The measures were selected on (1) compatibility with existing legislation (as they are already several pieces of legislation on noise), then (2) flexibility, as the diversity of administrations (whether at local or ministerial level) necessitated a flexible approach based on compromises and dialogue Estimated NAP implementation costs for the administration: € 5.5 million over five years. Same amount expected for future Rounds of END implementation. Costs of stakeholders not estimated
	2	The interim version of the 2008-2013 plan is available at: http://document.environnement.brussels/opac_css/elecfile/RAP%20201207%20PlanBruitBilanCE%20FR Actions are set out in tables on pages 13 to 15. A new version will be prepared before moving to a new plan (probably in 2017).
Flanders	1	Exceedance limit values were taken into consideration to set up measures to reduce noise, but the specific manner as to how to do this still needed to be specified. Several possible measures were developed and simulated on noise models to assess their effects for Flanders. On the basis of that simulation, as well as through a cost-benefit analysis to compare population exposure and recommendations of the WGHSEA from health-based assessment with economic desirability, noise abatement measures were identified.
	2	For the major airport and agglomerations draft action plans are publicly available from http://www.lne.be/themas/hinder-en-risicos/geluidshinder/beleid/eu-richtlijn/actieplannen The plans contain a number of proposed actions, and have already been subject to a public consultation, but none has yet been approved by the Flanders government. The draft action plans for major roads and railways are not yet publicly available.
Wallonia	1	As a result of R1 noise mapping, an estimated 188 km of major roads are to be treated with noise barriers, with a total estimated budget of € R250 million. Concrete measures will be implemented as budgets become available.
	2	Continued implementation of the R1 NAP

3.7.4 Public consultations

Table 33 NAP public consultation by region – Belgium

Region	Round	Description
Brussels	1	The public consultation took place between 15 October - 15 December 2008
	2	As the 2008-2013 plan is still being implemented and there has been a delay in the R2 NAP being adopted, there has as yet not been a further public consultation.
Flanders	1	The provisional NAPs have been presented to the public before being approved by the government. They should be approved in July but the change of regional government could have compromised that.
	2	Public consultations on the draft NAPs for major agglomerations (Antwerp, Ghent and Bruges) ran from 8 June to 31 July 2015. The results have already been integrated into the NAPs, and the latter's submission to the Government of Flanders for final approval is expected soon. The public consultation on the Brussels Airport draft NAP ran from 16 November 2015 to 15 January 2016. The results of the public consultation are currently being processed. Submission to the Government of Flanders for notification of the draft action plans for the major railways and major roads has taken place on 25 March 2016. The public consultation for the draft action plans of major roads and railways will be organised from 15 April 2016 to 15 May 2016.
Wallonia	1	None have yet been undertaken
	2	None have yet been undertaken

3.7.5 Implementation issues

A number of issues were raised as a result of R1, a summary of which is shown below, together with actions taken to address them, and any new issues raised during R2.

Table 34 Noise action planning issues – Belgium

R1	R2
Brussels	
There is a need for consensus between the different authorities responsible for drawing up NAPs as to action planning priorities	Action planning has been delayed in R2. No detailed information available.
Flanders and Wallonia	
The short time-span between SNM NAPs completion deadlines, with input from the former required for the latter	More time to develop NAPs would be desirable. The period of one year between finalising SNMs and developing NAPs is too short Preparing and conducting NAPs every 5 years is very time consuming, and has also financial implications. A longer time-span between the consecutive rounds of Noise action planning is desirable.

4. BULGARIA

4.1 National implementing legislation for END

4.1.1 Legal implementation

The END was transposed by means of the Law on Protection from Environmental Noise[14] published in State Gazette no. 74/13.09.2005[15]. The Law on Protection from Environmental Noise covers all the requirements for preparation and contents of SNMs and NAPs.

Some Orders of the Ministry (OM) provide clarification on the technical details related to noise indicators, strategic noise mapping, noise action planning, and the evaluation of SNMs and NAPs. The different applicable national regulations that transpose the END are as follows[16]:

- Ordinance № 54 of 13.12.2010 on the activities of the national system for the monitoring of environmental noise and the requirements for internal monitoring and information from industrial sources of environmental noise.[17]
- Ordinance № 6 of 26.06.2006 for environmental noise indicators, taking into account the degree of discomfort at different parts of the day, setting limit values in respect of noise indicators, methods for assessing the performance levels of noise and the harmful effects of noise on human health[18].
- Ordinance on the essential requirements and conformity assessment of machinery and equipment for use outdoors, in terms of noise emissions in the air[19].
- Ordinance № 3 of 25.04.2006 on the requirements for the creation, maintenance and content of the registers of agglomerations, major roads, railways and airports in the country[20].

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[14] available in English, old version last modified in 2012 http://www.moew.government.bg/?show=top&cid=309&lang=en

[15] effective from 1.01.2006 and amended by the law published in State Gazette no. 30/11.04.2006, effective from 12.07.2006, amended and supplemented by the law published in State Gazette no. 41/2.06.2009, effective from 2.06.2009, amended by the law published in State Gazette no. 98/14.12.2010, effective from 1.01.2011, supplemented by the law published in State Gazette no. 32/24.04.2012, effective from 24.04.2012, amended by the law published in State Gazette no. 66/26.07.2013, effective from 26.07.2013 amended by the law published in State Gazette no. 98/11.28.2014, effective from 28.11.2014; available in Bulgarian new version last modified in 2014 http://www.moew.government.bg/files/file/Noise/Legislation/Zakoni/ZAKON_za_zashtita_ot_shuma_v_okolnata_sreda.pdf

[16] in Bulgarian on http://www.moew.government.bg/?show=top&cid=310&lang=bg

[17] issued by the Minister of Health and Minister of Environment and Water, published in SG no. 3/ 11. 01. 2011 with effect from 12.02.2011 in Bulgarian on http://www3.moew.government.bg/files/file/Noise/Legislation/Naredbi/Noise/NAREDBA_54_monitoring_shum.pdf

[18] issued by the Minister of Health and Minister of Environment and Water, published in SG no. 58/18.07.2006 in Bulgarian - www3.moew.government.bg/files/file/Noise/Legislation/Naredbi/Noise/NAREDBA_6_pokazateli_sum.pdf

[19] adopted by Decree No 22/29.01.2004, published in SG no. 11/10.02.2004, with effect from 11.02.2005, with all amendments and supplements in Bulgarian on http://www3.moew.government.bg/files/file/Noise/Legislation/Naredbi/Noise/NAREDBA_sashtestveni_iziskvaniya_shum.pdf

[20] issued by the Minister of Health, Minister of Regional Development and Public Works and the Minister of Transport, published in SG no 38/9.05.2006 in Bulgarian on

- The Ordinance on the development and content of SNMs and NAPs adopted by Decree no. 217/18.08.2006, published in SG 70/29.08.2006[21]

- Ordinance № 16 of 01.14.1999 on aircraft noise and emissions from aircraft engines[22]

4.1.2 Scope of END implementation – Rounds 1 & 2

R1 of strategic noise mapping and noise action planning in Bulgaria included 3 agglomerations and approximately 89 km of major roads. The introduction of definitive thresholds in R2 led to 6 *additional* agglomerations being covered, and the length of major road covered increased to 1,044 km. No airport or railways met the R1 or R2 size designation criteria.

Table 35 E ND coverage – Bulgaria

Round	Agglomerations	Major airports	Major rail	Major roads
1	3[23]	n/a	n/a	89 km
2	7[24]*	n/a	n/a	1,044 km

** According to the 2011 population census the towns of Sliven and Dobrich have below 100,000 people*[25]

4.2 Competent Authorities and designated administrative bodies

Environmental Noise responsibilities for strategic noise mapping and noise action planning as specified by the Law on Protection are presented in the table below.

Table 36 Responsibility for the END – Bulgaria

Role	Agglomerations	Roads	Railways	Airports
Preparing SNMs	Municipalities	Ministry of Regional Development and Public Works	Minister of Transport	Minister of Transport

http://www3.moew.government.bg/files/file/Noise/Legislation/Naredbi/Noise/NAREDBA_3_ot_25_04_2006.pdf

[21] adopted by Decree No 217/18.08.2006, published in SG 70/29.08.2006 with effect from 11.02.2005 in Bulgarian on http://www3.moew.government.bg/files/file/Noise/Legislation/Naredbi/Noise/NAREDBA_sashtestveni_iziskvaniya_shum.pdf

[22] issued by the Minister of Transport, published in SG 8/29.01.1999, effective form 1.03.1999, with all amendments and supplements in Bulgarian on http://www3.moew.government.bg/files/file/Noise/Legislation/Naredbi/Noise/NAREDBA_16_aviacionen_sum.pdf

[23] Plovdiv, Sofia, Varna

[24] Pleven, Ruse, Stara Zagora, Burgas, Varna, Plovdiv, Sofia

[25] available in English at National Statistical Institute at http://www.nsi.bg/census2011/pageen2.php?p2=179&sp2=209

Role	Agglomerations	Roads	Railways	Airports
Approving SNMs	Minister of Health and Minister of Environment and Water give an opinion regarding the SNMs Municipal councils approve noise maps	Ministry of Health*		
Collecting SNMs	Ministry of Health and the Ministry Environment and Water			
Preparing NAPs	Municipalities	Ministry of Regional Development and Public Works		
Approving NAPs	Municipal councils approve noise maps	Ministry of Health*		
Collecting NAPs	Ministry of Health and the Ministry Environment and Water			
EC/EEA reporting	Executive Environmental Agency [26]			
Environmental monitoring	Executive Environmental Agency [27]			

** Minister of Health and the Minister of Environment and Waters determined by equal number of members of the expert council for approving the SNMs.*

4.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

4.3.1 Data collection

Bulgaria reported on major roads, railways, airports and agglomerations for the whole of 2008 to the EIONET Central Data Repository for the EC in both R1 and R2[28]. The maps and the NAPs are available on the website of the Ministry of Environment and Water of Bulgaria[29].

The number of inhabitants for each city is available on the website of the National Institute for Statistics and the data to delimit major roads is available from the Central Institute of Road Technologies, National and European Norms and Standards. At the beginning of each year, the Ministry of Regional Development and Public Works defines them while updating the "**Agglomerations** register according to the Law of Protection from Noise in the Environment" (http://www.regag.eu/?l=2).

The information about the **major roads** in Bulgaria with more than 3,000,000 vehicle passages a year is collected after the Total profile traffic counting on the national road network, carried out by the Institute for roads and bridges - a specialized unit within the Road Infrastructure Agency. This happens every five years. The data will next be processed in 2016.

[26] http://epanet.pbe.eea.europa.eu/european_epas/countries/bg

[27] http://eea.government.bg/en/about/directorates.html

[28] http://cdr.eionet.europa.eu/bg/eu/noise/

[29] http://eea.government.bg/bg/dokladi/noise

In Bulgaria there are no **major railways**. According to data collected annually by the National Railway Infrastructure Company, the number of train passages per year train is less than the END threshold of 30,000 train passages annually.

With regard to **major airports**, the Directorate General "Civil Aviation Administration" of the Ministry of Transport, Information Technology and Communication, stated that there are no airports in Bulgaria that fall within the END (i.e. none have more than 50,000 movements annually).

4.3.2 Implementation issues

A number of issues were raised as a result of experiences gained over both Rounds of END implementation.

Table 37 Designation issues - Bulgaria

R1	R2
Lack of required input data	Lack of required input data. Data collection and ensuring data consistency were the main challenges.
Cost of SNM development	Cost of SNM development
Duration of necessary legal procedures	Duration of necessary legal procedures and duration of tendering.

4.4 Noise limits and targets

4.4.1 Objectives and Scope

The environmental noise indicators for Bulgaria are set out in Ordinance № 6 of 26.06.2006, which takes into account the relative degree of annoyance due to environmental noise exposure at different times during the day, the limit values for environmental noise indicators and the methods for assessing environmental noise values and the harmful effects of noise on human health.

According to the Law on Protection from Environmental Noise, "Limit" is the value of the indicator for noise beyond which CAs have to consider and implement measures to reduce noise.

The noise indicators defined in Ordinance № 6 of 26.06.2006 are for day L_{den}, for evening $L_{evening}$, and for night L_{night} and for 24 hours L_{24hr}.

Noise limit values are set for:

- The day (07.00-19.00), evening (19.00-23.00) and night (23.00-07.00)
- L_{night} and L_{24hr} are used for the evaluation of strategic noise mapping results.

Table 38 Noise limit values - territories and development zones in urban areas and outside used in strategic noise mapping – Bulgaria

Territories and development zones in urban areas and outside		Equivalent Level of Noise dB (A)		
		day	evening	night
1	Residential areas and territories	55	50	45
2	Central areas	60	55	50
3	Areas exposed to heavy traffic	60	55	50

Territories and development zones in urban areas and outside		Equivalent Level of Noise dB (A)		
4	Areas exposed to track railway and tram	65	60	55
5	Areas exposed to aircraft noise*	65	65	55
6	Production and storage areas and zones	70	70	70
7	Areas for public and individual recreation	45	40	35
8	Areas for hospitals and sanatoriums	45	35	35
9	Areas for research and training activities	45	40	35
10	Quiet areas outside agglomerations	40	35	35

**Limit for the maximum noise level flyover of aircraft over a certain territory is 85 dB (A).*

4.4.2 Non-binding target values

In Ordinance № 6 of 26.06.2006 (also referred to earlier), other noise limits used for measurement or noise assessment purposes but not used for strategic noise mapping and noise action planning are provided.

Table 39 Noise limit levels - residential premises and public buildings – Bulgaria

Purpose premises		An equivalent level noise, dB (A)		
		day	evening	night
1	Rooms in hospitals and sanatoria, operating rooms.	30	30	30
2	Living rooms, bedrooms in childcare and dormitories, recreation stations, hotel rooms	35	35	30
3	Consulting rooms in hospitals and sanatoriums, conference rooms, visual halls of theatres and cinemas.	40	40	35
4	Classrooms and auditoriums in educational establishments; Bars, restaurants for research activity, reading	40	40	40
5	Workplaces in the administrative buildings.	50	50	50
6	Cafeterias, canteens, lobbies theatres and cinema, clubs; hairdressing and beauty salons, restaurants.	55	55	*55*
7	Commercial halls of shops, halls passengers in stations.	60	60	60

4.4.3 Implementation issues

WHO guidance has not been taken into account.

Issues raised in R1 and R2, together with actions taken to address them are shown in the table below.

Table 40 Noise limits and targets issues: R2 - Bulgaria

Issue	Action
A limit for quiet areas in agglomerations does not exist. It is not clear by how much a noise value should be decreased.	Legislative modifications are being made to address this problem.

4.5 Quiet areas

4.5.1 Overview

No quiet areas have been designated to date. Within agglomerations, quiet areas have been proposed by consultants, but the responsible competent authorities have not as yet designated any quiet areas.

Definition

The Law on Protection from Environmental Noise provides the following definitions:

- "Quiet areas in urban areas" is part of the territory where values of noise performance are higher than the corresponding limit values.
- "Quiet areas outside urban areas" are defined as a territory where noise levels may not exceed certain limits due to transport, industry or from places of entertainment.

Delimitation

The law requires a list to be prepared of zones which be designated as quiet areas. This includes parks and gardens, areas around schools, hospitals etc. It is apparent that the examples are not delimited based on acoustic criteria.

Agglomerations

The Ordinance on the development and content of SNMs and NAPs adopted by Decree no. 217/18.08.2006 specifies that every NAP must include measures to preserve quiet areas.

Open country

Ordinance № 6 of 26.06.2006 only contains limit values for quiet areas in open country.

4.5.2 Implementation issues

A number of issues were raised as a result of experiences over both Rounds.

Table 41 Quiet area issues – Bulgaria (R1 and R2)

Issue	Action
Within agglomerations, quiet areas were proposed by consultants. However, in the relevant legislation, no clear method is provided which requires the competent authority to actually establish quiet areas. Competent authorities can also declare that the agglomeration does not have any quiet areas.	Legislative modifications are foreseen in future.
A limit value to determine quiet areas in agglomerations does not yet exist. It is also not clear in the case of exceedance by how much a noise value should be decreased.	Legislative modifications are foreseen in future.

4.6 Strategic noise mapping

4.6.1 Overview

An overview of SNMs produced in Rounds 1 and 2 is shown in the table below.

Table 42 SNMs - Bulgaria

	R1	R2
Agglomerations	3	7 (7[30])
Major airports	-	n/a
Major railways	-	n/a
Major roads	1	1 (1)

**1 SNM for all major roads (89km)*

***1 SNM for all major roads (1044km)*

4.6.2 Data collection

Decree № 217 from 18.08.2006 stipulates that the input and output data of the SNMs in digital and graphic form in accordance with the Bulgarian Geodetic System 2000 SNMs shall be developed in compliance with the Law on Cadastre and the Property Register.

Obtaining data for strategic noise mapping is the responsibility of the consultant from the institutions and local authorities (i.e. city halls).

4.6.3 Strategic noise mapping methods

According to the Ordinance № 54 of 13.12.2010 of the national monitoring system of environmental noise and requirements for internal monitoring and providing information from industrial sources of environmental noise; the Regional Inspectorates for Protection and Control of Public Health create a database in which data collected from all measurements and / or calculations carried out at noise monitoring stations in their territory must prepare a consolidated annual report on the level of noise pollution in urban areas as part of the development of an annual report on the state of health. The number, location and distribution of noise monitoring stations and the frequency of measurements and / or calculations shall be determined by a method approved by the Minister of Health.

Only L_{24hr} and L_{night} are used for strategic noise mapping. The table below identifies the strategic noise mapping methodologies used in Rounds 1 and 2.

[30] First, 9 were reported 9 but 2 of the agglomerations in 2011 were no more under the scope of the Directive and the information were updated to 7

Table 43 Strategic noise mapping methods used in R1 and R2 – Bulgaria

Noise source/type	Method
Road	French NMPB Routes-96
Railway	Dutch SRM II - 1996
Aircraft	international ECAC.CEAC Doc. 29
Industrial	ISO 9613-2

4.6.4 Public accessibility of SNMs

The SNMs and NAPs are available to the public on the website of the Bulgarian Executive Environment Agency[31].

4.6.5 Implementation issues

A number of issues were raised as a result of R1, a summary of which is shown below, together with actions taken to address them, and any new issues raised during R2.

Table 44 Strategic noise mapping issues - Bulgaria

R1	R2
• Absence of common noise level calculation methods • Lack of required input data • Cost of SNM development • Lack of domestic noise experience and expertise • Length of necessary legal procedures	• Lack of required input data. Data collection, data consistency was the main challenge. • Length of necessary legal procedures and tendering. • Absence of common methods for calculation of noise levels • Lack of domestic experience and expertise to address noise issues

[31] available in Bulgarian http://eea.government.bg/bg/dokladi/noise

4.7 Noise action planning

4.7.1 Overview

An overview of NAPs is shown in the table below.

Table 45 NAPs – Bulgaria

	R1	R2
Agglomerations	3	4 (7)
Major airports	n/a	n/a
Major railways	no data	no data
Major roads	1	1

Source: Eionet[32] website and Bulgarian Executive Environment Agency[33]

4.7.2 Methodologies for noise action planning

The Law on Protection from Environmental Noise regulates "the development of NAPs based on the results of enrolment with a view to preventing and reducing environmental noise, especially in cases where exceedance of values set for noise levels can cause harmful effects on human health, or to preserve noise values quality where it is good. NAPs are prepared for the management of environmental noise, including taking steps to reduce it, if necessary. Decree № 217 from 18.08.2006 sets out the methodology that should be used for noise action planning.

4.7.3 Measures

Priorities have been set at local level. NAPs must provide an analysis of the current situation, forecasts and measures to reduce and prevent noise associated with the exceedance of limit values. The measures of the NAP are an integral part of the municipal programme for environmental protection. "Measures" are defined as organisational, economic or technical solutions relating to the prevention and reduction of environmental noise, excluding a specific technology model trademark, patent, type, origin or production. The measures can relate to planning land use systems, the design and planning of traffic and noise reduction through measures for sound-proofing and the control of noise sources.

Table 46 Sofia Airport noise mitigation program, 2006

Activity	EUR
Noise monitoring system	250,000
Noise insulation of 106 primary schools;	50,000
Noise insulation of resident buildings within western part of hygiene protective area (HPA)	350,000
Noise insulation of resident buildings within the eastern part of the HPA	30,000
Noise protection fence on the engine run-up pad	2,500,000
Total	**3,180,000**

[32] http://cdr.eionet.europa.eu/bg/eu/noise

[33] http://eea.government.bg/bg/dokladi/noise

4.7.4 Public consultations

Drafts of NAPs are published on the websites of the CA 30 days before the public consultation is scheduled to take place. The CA notifies the public through the media or by other appropriate means and provides a link to the draft NAP and informs the public about the date, time and place where the public discussion will take place. The public may then present their views in writing no later than 7 days after the date of the public meeting. The opinions expressed during the public consultation or afterwards in writing are then taken into account by the CAs when developing the final version of the NAPs. The CA provides public access to approved SNMs and approved NAPs by making these available online.

The minutes from public consultations organised in accordance with the Law on protection against noise the environment are included in a dedicated chapter in the NAPs.

4.7.5 Implementation issues

A number of issues were raised during R1, a summary of which is shown below, together with any subsequent actions taken to address them, and new issues raised during R2.

Table 47 Noise action planning issues - Bulgaria

R1	R2
Plans for implementation of the NAPs were under development in 2010	There are no clear obligations to implement measures to protect residents from noise caused by rail transport and interurban bus transport, such as building noise insulation barriers along/ close to railway lines and bus stations
	The Mayor as the representative of the local authority and responsible for environmental noise levels should have the ability to require noise sources to adopt measures to reduce noise levels around the territory under their responsibility. However, this is not currently the case.
	The main challenges were in aligning the proposed measures in the draft NAP with the existing noise action plan and with local planning strategies

5. CROATIA

5.1 National implementing legislation for END

5.1.1 Legal implementation

The Noise Protection Act (OG 30/09, 55/13, 153/13) transposes the END at national level, supported by a number of ordinances, including Ordinance OG 75/09 on the method of preparation and content of SNMs and NAPs, and Ordinance OG 145/04 establishing noise limit values for the environment in which people live and work.

The most recent addendum to the Noise Protection Act (OG 153/13) defines delivering of the data about SNMs and NAPs (DF tables and corresponding data) to the competent authority, where the records should be kept, and then be reported further on to the European Commission/EEA.

5.1.2 Scope of END implementation – Rounds 1 & 2

Croatia only became a member of the EU in 2013, and was therefore not subject to Round 1 of noise mapping and action planning.

Round 2 (Croatia's *de facto* Round 1) covered 4 agglomerations, and approximately 44 km of major railway lines and 1,270 km of major roads.

Table 48 END coverage – Croatia

Round	Agglomerations	Major airports	Major rail	Major roads
1	n/a	n/a	n/a	n/a
2	4	n/a	44 km	1,270 km

5.2 Competent Authorities and designated administrative bodies

The national Competent Authority is the Ministry of Health. The Ministry is responsible for the collection and reporting of data related to SNMs and NAPs to the European Commission/EEA in collaboration with the Croatian Environment Agency (EIONET NFP). The organisations responsible for the production and approval of noise maps and action plans in Croatia are shown in the table below.

Table 49 Administrative Responsibility for the END - Croatia

Role	Agglomerations	Roads	Railways	Airports
Producing and approving strategic noise maps and action plans	City of Zagreb City of Split City of Rijeka City of Osijek	Croatian Motorways Croatian Roads Motorway Rijeka – Zagreb Motorway Zagreb – Macelj Motorway Bina Istra	Croatian Railways	Croatian Civil Aviation Agency
EC/EEA reporting	Ministry of Health			

5.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

5.3.1 Data collection

The Noise Protection Act (OG 30/09, 55/13, 153/13) transposes the END's definitions of agglomerations, major roads, major railways and major airports. Agglomeration borders are aligned with the administrative borders of cities with more than 100,000 inhabitants. The number of inhabitants for each agglomeration is publicly available from the Croatian bureau of statistics on the basis of the 2011 census of population, households and dwellings.

Data to delimit major roads, major railways and major airports are available from the Croatian Motorways, Croatian Roads, Motorway Rijeka – Zagreb, Motorway Zagreb – Macelj, Motorway Bina Istra, Croatian Railway and Croatian Civil Aviation Agency.

5.3.2 Implementation issues

Croatia's Round 2 reporting was delayed. A summary of issues raised as a result of END implementation in Round 2, together with actions taken to address them are shown in the table below.

Table 50 Designation issues - CROATIA

Issue	Action
Financial: A lack of funds SNMs and NAPs meant responsible authorities generally failed to deliver results on-time.	The competent authority has insisted on development of binding 3-year financial and project plans for delivering strategic noise maps and action plans.
Availability of the input spatial data: Digital terrain and digital surface models are available from the State geodetic administration. Building footprints are available through National cadastre on the national level, while the building heights exists mainly within agglomeration boundary.	The CA has required datasets used for previous Rounds to be updated for Round 3 (to ensure continuity and consistency).
Availability of the input traffic data	Road traffic data mainly exists within the database of the responsible authority, while the Croatian railways has necessary data about railway traffic.
Insufficient collaboration between stakeholders	The competent authority actively promotes collaboration between responsible administrative bodies when developing SNMs and NAPs in agglomerations where multiple major sources must be mapped.
Data reporting	Due to the recent change in the EC reporting mechanism and shift to ENDRM, the competent authority, in collaboration with EIONET NFP, has defined the (new) procedure in the latest addendum to the Noise Protection Act (OG 153/13).

5.4 Noise limits and targets

5.4.1 Scope

Ordinance OG 145/04 establishes maximum noise levels in working and living environments:

- day (07.00-19.00), evening (19.00-23.00) and night (23.00-07.00)
- L_{day}, and L_{night}

Table 51 Summary of limit values for noise – Croatia

Noise zone	Land use	L_{day} and $L_{evening}$ (dB(A))	L_{night} (dB(A))
1.	Hospitals and recovery	50	40
2.	Residential	55	40
3.	Mixed - mainly residential	55	45
4.	Mixed - mainly commercial and business, with housing	65	50
5.	Production with no housing	80 (within the zone) *In line with neighbouring area values at borders*	80 (within the zone) *In line with neighbouring area values at borders*

The Ordinance on the method of preparation and content of noise maps and action plans (OG 75/09) in the process of noise mapping requires maps to indicate where limit values have been exceeded as a basis for the preparation of NAPs. It also requires existing noise limits directly related to the land use documents for the relevant municipality or agglomeration to be used. These are used on conjunction with other parameters determined by the responsible bodies.

5.4.2 Purpose

The purpose of setting noise limit values is to avoid noise nuisance and protect human health and well-being.

5.4.3 Non-binding target values

There are currently no non-binding target values.

Implementation issues

The WHO's health-based assessments were not used in Croatia.

No issues were raised in relation to noise limits and targets.

5.5 Quiet areas

Quiet areas are defined in Article 2 of Noise Protection Act (OG 30/09, 55/13, 153/13), which distinguishes between:

- Quiet area in an agglomeration - a noise protection area, delimited by the competent authority, which is not exposed to a value of L_{den} or of another appropriate noise indicator greater than a certain value laid down in special regulations on relevant limit values of noise
- Quiet area in open country - a noise protection area, delimited by the competent authority, that is undisturbed by noise from traffic, industry or recreational activities.

There is no evidence of quiet areas in agglomerations and in open country in Croatia having been delimited so far. It can be expected that criteria for a "Quiet area in an agglomeration" will be developed during development of the NAP of the agglomerations.

5.6 Strategic noise mapping

5.6.1 Overview

An overview of SNMs produced in Round 2 is provided below.

SNMs have now been developed for all agglomerations with more than 100,000 inhabitants.

The tender for preparation of a SNM and NAP for the major railway has been awarded, and the exercise is currently being carried out – see * in the table below.

The third and final map covering major road outside agglomerations is currently being prepared - see ** in the table below.

Table 52 SNMs – Croatia

	R1	R2
Agglomerations	n/a	4
Major airports	n/a	n/a
Major railways	n/a	1* (44 km)
Major roads	n/a	3** (1,270 km)

5.6.2 Data collection

Data were not collected centrally for strategic noise mapping, and significant efforts were necessary to obtain them.

Some of the data (like building footprint from State Geodetic Administration) were very hard to collect at a national level, with major problems being synchronisation of their collection between different road authorities, and some not being collected at all, for example traffic speed and composition at night.

Table 53 Data collection - Croatia

Nature of data	Responsible body
Major agglomerations	City authorities (excluding roads not managed by them)
Major railways	Croatian railways
Major roads	Relevant responsible administrative bodies (including roads within agglomerations)
Digital terrain and surface models	State geodetic administration
Building footprints	State geodetic administration - national cadastre*

** A **cadastre** is a comprehensive register of the real estate or real property's metes-and-bounds of a country*

5.6.3 Strategic noise mapping methods

SNMs and NAPs for Rounds 2 and 3 in Croatia are to be produced by using "interim" methods provided in Annex II of the END and Recommendations 2003/613/EC.

Table 54 Noise mapping methods used in Round 2 and 3 - Croatia

Noise source/type	Method
Road	French NMPB
Railway	Dutch RMR
Aircraft	International ECAC
Industrial	ISO 9613-2

5.6.4 Public accessibility of SNMs

Depending on the responsible body, SNMs and NAPs are publically available on websites, either through web gis applications or documents in pdf format. Example web GIS applications are:

- Agglomerations:
  - City of Zagreb - https://geoportal.zagreb.hr/Karta (" Katalog slojeva" ➔ "Strateška karta buke")
  - City of Osijek - http://bit.ly/skbos
  - City of Rijeka - http://www.kartebuke.com.hr/pmapper32/map.phtml?config=rijeka
- Major Roads:
  - Croatian Motorways - http://bit.ly/hac_skb
  - Motorway Zagreb – Macelj - NAP - http://azm.hr/obavijesti.asp?oID=10&lang=

5.6.5 Implementation issues

A summary of issues raised as a result of END implementation in Round 2, together with actions taken to address them are shown in the table below.

Table 55 Strategic noise mapping issues during Round 2 – Croatia

Issue	Action
Collection of geospatial data on national level	Improve collaboration with the State Geodetic Administration
Building footprints exist within the national cadastre. However, statuses may not correspond to the real situation (the data have not been updated) with respect to the assessment years of END. There is no national database about building heights and use. There are no regular updates on developments (new buildings, change of building use etc.).	Ongoing issue
Collection of source related data (road traffic data, railway data)	Closer collaboration between the responsible bodies. A binding list of bodies responsible for the collection data for Round 3 is being prepared
Validation of the SNMs (noise levels)	Implementation of an accreditation scheme for noise mapping specialists and acoustics laboratories in accordance with the ISO 17025
Usage of interim noise assessment methods	The default rail noise emission data used for noise mapping has some inaccuracies, causing some noise maps to be corrected to ensure comparability with long-term and noise emission measurements. Development of a national emission catalogue for the railway is an option.

5.7 Noise action planning

5.7.1 Overview

An overview of NAPs is shown in the following table.

NAPs are currently being completed for one agglomeration and one major road - see * in the table below.

A NAP for the major railway is currently being prepared – see ** in table below. Outstanding plans are either in the tendering process or being planned.

Table 56 NAPs – Croatia

	R1	R2
Agglomerations	n/a	1*
Major airports	n/a	n/a
Major railways	n/a	1**
Major roads	n/a	1*

5.7.2 Methodologies for noise action planning

Croatia uses END provisions for action planning, as transposed by Ordinance OG 75/09 and annexes.

No guidelines have been developed at any administrative level.

5.7.3 Measures

Experience of END action planning is very limited as Croatia has only produced plans from Round 2. Development of (Round 2) NAPs will lead to the application of standard technical measures at noise source and traffic and land-use planning. For example, the operator of a particular major road has indicated that no NAPs were prepared previously, but that they are planning the construction of noise barriers on the basis of project documentation using acoustic calculations. In the case of existing highways, priorities have been established in response to complaints raised in correspondence.

5.7.4 Public consultations

Action Plan proposals are made available to the public via the websites of responsible administrative bodies. During public hearings, there has been a commitment to ensuring public access to strategic noise and exceedance maps as a starting point of action planning process.

5.7.5 Implementation issues

Issues raised in Round 2, together with actions taken to address them are shown in the table below.

Table 57 Action planning issues - Croatia

Issue	Action
Lack of financial and human resources within administrative bodies to implement the END Insufficient budget to implement noise action planning tasks (Lack of) Availability of finance to implement measures identified in action plans	No actions taken.

6. CYPRUS

6.1 National implementing legislation for END

6.1.1 Legal implementation

In Cyprus, the END was transposed through Law 224 (1) of 30 July 2004 on the assessment and management of environmental noise, and Act 31 (1) of 17 March 2006 amending, amending law 75 (1) of 29 June 2007.

6.1.2 Scope of END implementation – Rounds 1 & 2

The implementation of the END Directive is based on the application of Law 224 (1) of 30 July 2004 on the assessment and management of environmental noise, and Act 31 (1) of 17 March 2006 amending, amending law 75 (1) of 29 June 2007. Furthermore, subsequent Ministerial Decrees define the major agglomerations, airports and major roads[34][35] and approved the strategic maps developed for the major roads[36].

Law 224 (1) of 30 July 2004 provides for the establishment of noise limits, quiet areas within agglomerations and open country and sets out a timetable for the delimitation of major airports and major roads, the development of SNMs for the major roads and airports (30.06.2007), delimitation of major agglomerations (31.12.2008) and development of all relevant actions plans (18.07.2009). The notification of the list of major airports and roads to the Commission was due to take place by 30.06.2010[37].

R1 of strategic noise mapping and noise action planning in Cyprus covered 231 km of major roads, predominantly part of the road network inside or adjacent to the four largest towns (Nicosia, Larnaka, Limassol and Pafos). A NAP was developed for each of these agglomerations respectively in 2007.

The introduction of definitive thresholds in R2 triggered the development of SNMs for roads with over 3 million vehicles passing and the agglomerations (30.06.2012) and the development of the respective actions plans by 18.07.2013. This round has also assessed noise from industrial activities in both agglomerations.

Thus, as part of R2, SNMs have been developed for two agglomerations (Limassol and Nicosia), having a population in excess of 100,000 persons. Finally, as part of the development of SNMs for agglomerations, the major roads covered over 1,000 km in total.

This is summarised in the table below:

Table 58 END coverage – Croatia

Round	Agglomerations	Major airports	Major rail	Major roads
1	n/a	n/a	n/a	231 km

[34] http://www.moa.gov.cy/moa/environment/environment.nsf/All/F5BED63FCF495482C22578DC0028054B/$file/KDP333-2007.pdf

[35] http://www.moa.gov.cy/moa/environment/environment.nsf/All/F5BED63FCF495482C22578DC0028054B/$file/KDP45-2008.pdf

[36] http://www.moa.gov.cy/moa/environment/environment.nsf/All/F5BED63FCF495482C22578DC0028054B/$file/KDP186-2009.pdf

[37] http://www.moa.gov.cy/moa/environment/environment.nsf/All/684A1F8D92911C63C22578CE003BB0E1?OpenDocument

2	2	n/a*	n/a	> 1,000 km

Table 59 END coverage – Cyprus

Round	Agglomerations	Major airports	Major rail (km)	Major roads (km)
1	N/A	N/A*	N/A	231
2	2	N/A*	N/A	710 (within and outside agglomerations)

*Note *: two major airports (Larnaka and Pafos) were mapped in R1 and R2. However, according to the EEA spreadsheet, there was no formal requirement to map either of these airports since they do not have more than 50,000 movements per year, although in the case of Larnaca, they are close to the threshold.*

6.2 Competent Authorities and designated administrative bodies

The body responsible for implementation of the END in Cyprus is the Ministry of Agriculture, Rural Development and Environment.

6.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

6.3.1 Data collection

Data to help inform the designation and delimitation of sites was already available in 2005. No specific data collection problems were identified in R2.

6.3.2 Implementation issues

Table 60 Designation issues – Cyprus

R1	R2
Reporting road start and end nodes (x, y) as there is not yet an electronic GIS system to have the major roads as shape files	No issues.

6.4 Noise limits and targets

Even though Law 224 (1) of 30 July 2004 provides for the establishment of noise limits, to date, no such limits have been set. The Department of Environment will propose noise limits in consultation with the Legal Service in order to prepare the legal framework and will follow the regular procedure for approval.

6.4.1 Noise limit values

There are no noise limit values in force in Cyprus. As part of the SNMs developed for R1, possible limits of L_{den}=70dB(A) and L_{night}=60dB(A) for roads were considered but no action has yet been taken.

As part of the SNM and NAP developed for the airport of Larnaca[38], the following scenarios for possible limits were examined:

- For the 2008–2012 period: (criterion A) L_{den}≤70 dB (A) and L_{night}≤60 dB (A)
- After the 2012 period: L_{den}≤65 dB (A) and L_{night}≤55 dB (A).

However, these proposals have not yet been adopted (as of April 2016).

6.4.2 Non-binding trigger thresholds

There are no trigger thresholds in force in Cyprus.

6.4.3 Methods for establishing noise limit values

Law 224 (1) of 30 July 2004 as amended thereafter defines the methods for establishing noise limit values for L_{den} and Lnight indicators on the basis of ISO 1996-2 standard: 1987. The Law stipulates that measurements for the purpose of Strategic noise mapping should take place 4 (±0.2) m above ground. The proposed methodology for road traffic noise is the French method «NMPB−Routes−96 (SETRA−CERTU−LCPC−CSTB)». For air traffic noise, the proposed method is ECAC.CEAC Doc. 29 "Report on Standard Method of Computing Noise Contours around Civil Airports", 1997. Railway noise mapping is not applicable since Cyprus does not have any major railways where the END thresholds have been reached.

6.5 Quiet areas

6.5.1 Overview

Law 224 (1) of 30 July 2004 defines two types of quiet areas, in agglomerations and in open country. Quiet areas in agglomerations are areas that are not exposed to noise levels above a certain limit for the indicator L_{den} that should be set by law. However, no such limit has been set to this point.

In relation to quiet areas in open country, the law states that these should be areas that are not affected by noise from traffic, industrial or leisure activities.

Delimitation

At this stage, there are no quiet areas delimited in Cyprus. As part of R1 the authorities noted that since they did not have to prepare SNMs for agglomerations they were not able to identify quiet areas. The development of SNMs of R2led – as part of the NAPs - to proposals for the development of a quiet area in Nicosia, only.

Protection

As indicated above, no quiet areas have been delimited and no protection measures have been adopted.

Agglomerations

No quiet areas have been delimited in agglomerations.

[38] Vogiatzis, K., (2012), Airport environmental noise mapping and land use management as an environmental protection action policy tool. The case of the Larnaka International Airport (Cyprus), Science of the Total Environment 424 (2012) 162–173

Open country

No quiet areas have been delimited in open country.

6.5.2 Implementation issues

The Even though scope is provided in the relevant Law to delineate quiet areas, no such areas have yet been designated.

6.6 Strategic noise mapping

6.6.1 Overview

An overview of the position in respect of strategic noise mapping.

Table 61 SNMs – Cyprus

Round	Agglomerations	Major airports	Major railways	Major roads
1	0	0(*)	0	1
2	2	0 (*)	0	1

** Note: in respect of airports, it should be noted that although mapping has been undertaken in two airports on a voluntary basis, the airports are not yet formally within the END's scope due to aircraft movements being below the thresholds.*

6.6.2 Data collection

No specific guidelines have been laid down at national level. Data were gathered in paper and electronic formats in cooperation with relevant government departments and local authorities.

For R2, the data collection and mapping built on digital terrain models (DTM) with the use of a Geographical Information System (GIS) for the two agglomerations and the road network was developed by the consultants responsible for the study. Data from the Land and Surveys Department, in situ survey and satellite data were combined to determine building blocks, relevant land uses, sensitive uses (e.g. schools, churches, health centres) and estimates of the population affected. Relevant road traffic data from the Department of Public Works, the Department of Town Planning and Housing and the Local Authorities was also used. Statistical data on the 2011 census was collected from the Statistical Service.

Noise data was collected on the basis of 24h noise measurements for the various indicators, including L_{den}, L_{day}, $L_{evening}$, L_{night}, L10(18h) and L_{eq} (8-20hrs). Specifically, 85 24h noise measurements (50 in Nicosia and 35 in Limassol) were undertaken with the use of mobile noise measurement stations. These measurements were also compared against the results from the theoretical model.

Overall, R2 SNMs covered a much greater road network length and population than in R1, as shown in the following table.

Table 62 Coverage of SNMs by Limassol and Nicosia SNMs

Round	Lemessos			Nicosia		
	Road length (km)	Area covered (Km2)	Population covered	Road length (km)	Area covered (Km2)	Population covered
1 (2007)	70	16.5	129,800	117	42.6	170,034
2 (2013-14)	1,101	67.5	187,214	1,495	97.9	243,254

Source: Presentation of external consultants responsible for the two studies

In addition, in 2010, SNMs were developed for two international airports (Larnaka and Pafos) – even though they do not exceed the 50,000 movements/year limit threshold for the END. These airports were mapped voluntarily. In the case of Larnaka, the number of aircraft movements per year was very close to the END minimum threshold[39]. Since there are airport expansion plans, there was an interest in undertaking noise mapping among the public authorities and private operators that have recently taken over ownership. Hence, some work has been done in order to assess noise levels at these airports. Aircraft traffic data were used together with 24hs measurements at different locations around the airports with the use of mobile noise measurement stations. Furthermore, alternative future scenarios for air traffic were developed for the two airports (2018 for Larnaka and 2020 for Pafos). This reflects the transfer to private ownership and the possibility of future expansion.

6.6.3 Strategic noise mapping methods

The 2007 Good Practice Guide has been used as well as "State of the art report on Strategic Noise Mapping (EEA/ETC-LUSI, 2005)", Environmental Noise Data Reporting Mechanism Handbook (2007) and the "Report Network Delivery Guide".

The consultant that produced the noise maps used a combination of 24h noise measurements for the various indicators, including L_{den}, L_{day}, $L_{evening}$, L_{night}, L10(18h) and L_{eq}(8-20hrs).

6.6.4 Public accessibility

The presentation of SNMs to the public is envisaged, based on national guidelines.

The SNMs developed as part of R1 and R2 are currently accessible to the public via the website of the Department of Environment[40]. The SNMs for the two airports of Larnaca and Pafos – with the respective studies - are also available[41] and the most recently developed noise maps are expected to be made available once the relevant studies have been completed.

[39] See Table 1, Aircraft movements and passengers at Larnaka Int. airport (2004–2008), http://www.cesruc.org/uploads/soft/130308/1-13030Q55016.pdf

[40] www.moa.gov.cy/moa/environment/environment.nsf/0/1fefe293f3754b37c2257948003df5a7?OpenDocument&ExpandSection=1#_Section1

[41] www.moa.gov.cy/moa/environment/environment.nsf/0/49a83895fbef6b43c2257995003e282a?OpenDocument&ExpandSection=1#_Section1

6.6.5 Implementation issues

Table 63 Strategic noise mapping issues - Cyprus

R1	R2
A lack of sufficient information "in electronic format". Cyprus is working on this in cooperation with relevant government departments	There is significantly more information currently available as a result of the studies already completed or in the completion process. However, there is no infrastructure developed and no noise monitoring system in place. Any future SNMs will require new measurements.

6.7 Noise action planning

6.7.1 Overview

The table below presents an overview of the NAPs produced in Cyprus in Round 1 and 2.

Table 64 NAPs – Cyprus

Round	Agglomerations	Major airports	Major railways	Major roads
1	0 (2)	0	no data	no data
2	0 (2)	2	no data	no data

6.7.2 Methodologies for noise action planning

During R1 there were no national guidelines for drawing up and implementing NAPs. Maps from 2006 were used as the basis for developing the 2008 NAPs. By using these maps, the authorities were able to determine which areas suffered from the greatest noise problems. The exceedance of noise limit values was used as a basis for establishing NAP priorities.

Health-based assessments were not referred to in establishing noise limit values. In some cases, complaints from residents in particular areas were used as the basis for deciding whether NAPs would be developed for those areas. Priorities were set at the local level.

6.7.3 Measures

The proposed noise reduction measures in R1 NAPs for major roads included installation of noise barriers along the sensitive users (schools and universities), application of stricter regulations on reducing noise of vehicles, exploitation of traffic routes to improve traffic flow, reduction of speed in critical ways, intervention on infrastructure by purification of the technical characteristics, reorganisation of the studied urban fabric region and special sound-absorbing construction of buildings.

The proposed **noise reduction measures** in R2 NAPs included: traffic planning, noise barriers and introduction of other transport means like tram and electric buses. The main criteria for selecting measures were: population exposure, implementation costs, and compatibility with other legislation.

The NAPs for the two airports – prepared on a voluntary basis - also included the establishment of a special phone hotline through which citizens will be able to acquire information and submit complaints.

6.7.4 Public consultations

Law 224 (1) requires that the NAPs are subject to public consultation. Before the adoption of R2 NAPs, the Department of Environment carried out information days in Nicosia and Limassol and uploaded all the relevant information onto its website to allow for electronic comments by the public. The public was also consulted on proposals for R1 NAPs, again through information days.

The earlier NAPs of R1 and for the two airports were made also available to the public through the website of the Department of Environment.

6.7.5 Implementation issues

Table 65 Noise action planning issues - Cyprus

R1	R2
NAPs should be revised at the minimum every eight years rather than every five years as now Responsible authorities used 100-150 man hours for drawing up NAPs, with an estimated cost for their implementation of 16-19 million Euros. A lack of adequate budget to follow through on the NAP was a concern. Inter-departmental inconsistencies	The same noise barriers identified in R1 were proposed in R2. The implementation of other noise measures such as improving existing roads or the introduction of other transport modes (trams, electric buses) fall under the responsibility of other departments, thus there is a need of coordination by the Department of Environment. A lack of adequate budget to follow through on the NAP was again a concern.

7. CZECH REPUBLIC

7.1 National implementing legislation for END

7.1.1 Legal implementation

The END's requirements have been transposed by several distinct laws, the most important of which are:

- Law 258/200 (Coll.) on the protection of public health (as amended by Law 392/2000 Coll. and Law 222/2006 Coll.)
- Regulation 523/2006 on noise limits, Strategic noise mapping, Noise action planning.

Although in the views of some stakeholders, this approach has created considerable legal complexity and made it harder for public bodies to implement and administer the relevant provisions of the END, the Competent Authority noted that there is a distinction between separating the strategic approach under the (END) and operational statutory supervision in public health safety against environmental noise which is the subject of a separate Regulation (Regulation 272/2011).

In planning and implementing the Directive, the Czech authorities referred to the 2007 Good Practice Guide (GPG) for Strategic noise mapping and the Production of Associated Data on Noise Exposure, presentation of Strategic noise mapping to the public, Environmental Noise Data Reporting Mechanism Handbook (2007) as well as the Reporting Network Delivery Guide.

7.1.2 Scope of END implementation – Rounds 1 & 2

Table 66 END coverage – Czech Republic

Round	Agglomerations	Major airports	Major rail	Major roads
1	3[42]	1	300 km	1,370 km
2	7	1	1,202 km	3,521 km

7.2 Competent Authorities and designated administrative bodies

The main bodies responsible for implementing the legislation are the Ministry of Health (and affiliated agencies), the Ministry of Transport (and affiliated agencies), and regional authorities.

The production of SNMs has been assigned to several professional commercial organisations that were selected by means of a public tender.

[42] Brno, Ostrava, Prague

Table 67 Administrative Responsibility for the END in the Czech Republic

Role/Activity	Agglomerations	Roads	Railways	Airports
Preparing SNMs	Institute of Public Health Ostrava (ZUOVA)*			
Approving SNMs	Ministry of Health			
Preparing NAPs	Ministry of Transport** Regional authorities	Ministry of Transport** Regional authorities ***	Ministry of Transport	Ministry of Transport
EC/EEA reporting	Ministry of Health			

** With private contractors*

*** I. Class road*

**** II. and III. Class roads*

7.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

7.3.1 Data collection

Data from various sources was used in both rounds to develop SNMs. A digital terrain model as well as part of the data on buildings was extracted from the map layer ZABAGED (ČUZK- State Administration of Land Surveying and Cadastre) system. Most of the data on the location and height of buildings was obtained from local municipalities. In the case of main roads and railways, the height of buildings was calculated based on the number of stories. Population data, and data on the location of educational facilities was obtained from the Czech statistical office (ČSU). Data on roads was obtained from ZABAGED and the Directorate of roads and motorways (ŘSD), which was also the source of data on traffic intensity and its composition. Data on the location of railways and train traffic was obtained from the Railway administration (SŽDC). Airport parameters and flight data was provided by the Praha-Ruzyně Airport (LKPR). Data on healthcare facilities was provided by the Ministry of Health. Data accuracy was checked with the help of aerial photos (ortofoto maps provided as WMS by CUZK) and field inspections.

As of 2010, no complex digital maps of the rail network existed, but the methods used in the preparation of data for SNMs could be utilised to transform existing data into GIS format. The software programmes CadnaA and LimA were used to address data gaps regarding the terrain along the tracks. The use of GIS is thought to be extremely important in creating SNMs of the required quality.

7.3.2 Implementation Issues

The issues raised in the R1 legal implementation review and in R2 are shown in the table below.

Table 68 Designation issues – Czech Republic (R1 and R2)

R1	R2
Problem with address centroid accuracy	Problem in addressing centroid accuracy.
Problem with emission data acquisition from industry.	Problem with emissions data acquisition from industry.
Train emission data were not available.	Train emissions data were not available.
Need to strengthen the precision of digital data about the terrain, building location and road and railway position.	Bad precision of digital data about the terrain, building location and road and railway position. It was improved by checking against the "ortofoto" maps.
Need for data validation of road surface and its acoustical properties.	Need for data validation of road surface and its acoustical properties.
Location of noise barriers and their properties.	Location of noise barriers and their properties.

7.4 Noise limits and targets

7.4.1 Objectives and Scope

Limit values for noise indicators (trigger limits) are set for the purpose of preparing NAPs for noise protection. Based on the limit values, problematic areas are identified along with proposed measures for reducing the noise load from individual sources. The measures adopted must relate to compliance with environmental noise limits defined in Government *Regulation 272/2011 Coll.: On health protection against adverse effects of noise and vibration.*

Table 69 Noise limit values – Czech Republic

Noise source	Noise limit values	
	Day dB (A)	Night dB (A)
Road traffic	70	60
Rail traffic	70	65
Air traffic	60	50
Industry	50	40

Source: Article 2(3) of Regulation 523/2006 (Coll.)

For the purpose of monitoring noise in the outdoor environment and operational statutory supervision, noise parameters and limits are specified in *Government Regulation no. 272/2011 Coll.* According to this Regulation, an A-weighted equivalent sound pressure level for the reference time interval by day and night is the determining variable for noise in the outdoor environment.

Permissible values are set for different territorial categories. The default value for the external environment is set at 50 dB in accordance with the regulations. This is used as a determining factor for all noise sources equivalent sound pressure level (mean level) intended for the reference time interval day and night. These limits are obligatory and enforced through the threat of penalties.

If, in extreme cases, the use or operation of a sound source is not in compliance with the permissible values of the determining parameter, then the owner of that source is allowed to operate only with permission by the CA for health protection. Temporary permits for operating such a source can be issued by the CA if the owner or the operator demonstrates that the noise will be reduced to the extent possible.

With regard to long-term exposure of noise emitted by road traffic, limit values are set for the reference period day (from 6.00 to 22.00 hours) and night (from 22.00 to 06.00 hours the following day). Three types of protected external zones are recognised. Specific limits are set for class III roads and class III local roads; for motorways, class I & II roads and class I& II local roads; as well as for roads where traffic noise dominates noise from other transportation lines (railway and tramway transport, transport on class III roads).

Noise limits in protected outdoor areas under Czech legislation:

A. Environmental exposure limits for noise from road traffic on Class III roads and class III local roads:

1. Protected outdoor space of healthcare facility structures with wards, including spas (2 m in front of a facade)
    a. Day - $L_{Aeq,p,d}$ = 50 dB;
    b. Night - $L_{Aeq,p,n}$ = 40 dB;
2. Protected free outdoor area of healthcare facilities with wards, including spas
    a. Day - $L_{Aeq,p,d}$ = 50 dB;
    b. Night - $L_{Aeq,p,n}$ = 50 dB;
3. Protected free outdoor area of other structures
    a. Day - $L_{Aeq,p,d}$ = 55 dB;
    b. Night - $L_{Aeq,p,n}$ = 55 dB;
4. Protected outdoor space of other protected outdoor space (2 m in front of a facade)
    a. Day - $L_{Aeq,p,d}$ = 55 dB;
    b. Night - $L_{Aeq,p,n}$ = 45 dB;

B. Environmental exposure limits for noise from road traffic on highways, class I & II roads and class I & II local roads.

1. Protected outdoor space of healthcare facility structures with wards, including spas (2 m in front of a facade)
    a. Day - $L_{Aeq,p,d}$ = 55 dB;
    b. Night - $L_{Aeq,p,n}$ = 45 dB;
2. Protected free outdoor area of healthcare facilities with wards, including spas
    a. Day - $L_{Aeq,p,d}$ = 55 dB;
    b. Night - $L_{Aeq,p,n}$ = 55 dB;
3. Protected free outdoor area of other structures
    a. Day - $L_{Aeq,p,d}$ = 60 dB;
    b. Night - $L_{Aeq,p,n}$ = 60 dB;

4. Protected outdoor space of other protected outdoor space (2 m in front of a facade)
    a. Day - $L_{Aeq,p,d}$ = 60 dB;
    b. Night - $L_{Aeq,p,n}$ = 50 dB;

C. Environmental exposure limits for old noise load, traffic noise on highways, class I, II & III roads and local roads, with the exception of traffic on private roads.

The limits of the so-called old noise load on the all roads is equal to the equivalent noise level that was in place until 01.01.2001 ("old" roads). In the case that noise exposure exceeds the "regular" limits according clause A and B above and does not exceed the level of 70/60 dB in daytime/night time, this exposure i.e. limit can be temporarily tolerated, until such time as it increases by up to 2 dB. If noise increases beyond this limit, then the old noise load can no longer be applied and only the "regular" limits are valid.

1. NOTE: The limits shown above are also valid for railways with the exception of night limits, which are adjusted up by +5dB correction increments.

7.5 Quiet areas

7.5.1 Overview

Quiet areas in open country should be determined by the Ministry of Environment. Quiet areas in agglomerations should be defined by individual regional authorities. The requirements for quiet areas in open country have not yet been established by the Ministry of Environment.

No quiet areas were designated in the context of preparing NAPs to date.

There are no legally-specified noise limits for quiet areas.

7.5.2 Implementation Issues

A number of issues were raised as a result of R1, a summary of which is shown below, together with actions taken to address them, and any new issues raised during R2.

Table 70 Quiet area issues: Czech Republic

R1	R2
The criteria based on DEFRA 2006 "Research into quiet areas, recommendations for identification" were presented and disseminated to the NAP CA	Some criteria for open country have now been proposed, but have not yet been legally implemented: • luxury: L_{day} & L_{night} < 40 • comfortable: L_{day} < 50, L_{night} < 40 • good: L_{day} < 55, L_{night} < 45 • acceptable: L_{day} < 60, L_{night} < 50 • unfavourable: L_{day} > 60, L_{night} > 50
Lack of legally specified noise limits for quiet areas, the quietness in agglomerations is relative and should be processed individually	Legal instruments at national level are still lacking to create and protect quiet areas in nature

7.6 Strategic noise mapping

7.6.1 Overview

An overview of the number of SNMs that were originally envisaged, meant to be reported to the EC and which have actually been reported is now presented.

Table 71 SNMs – Czech Republic

	R1	R2
Agglomerations	22	62 (62)
Major airports	2	2 (2)
Major railways	2	2 (2) (1,202 km)
Major roads	2	26 (26) (3,521 km)

The Ministry of Health[43] has overall responsibility for strategic noise mapping but is assisted by a range of public and private sectors organisations.

Table 72 R1 SNM preparation – Czech Republic

Organisation	NM / Role
ZUOVA	Railway network
	Ostrava agglomeration
	Compilation of overall SNMs
ZUPU*	Roads in several regions (7)
Private organisations	Prague Airport, roads in several regions (6), Prague and Brno agglomerations

**ZUPU was joined with ZUOVA in 2010*

Table 73 People exposed to noise above L_{den} and L_{night} limits in 2006 – Czech Republic

Noise source	Limit value (L_{den})	People exposed to noise above L_{den} limit	Limit value (L_{night})	People exposed to noise above L_{den} limit
Road	70	226,700	60	278,800
Rail	70	14,800	65	600
Industry	50	652	40	1,406
Air	60		50	500

[43] Law 258 of 2000 (Coll.) on public health protection.

7.6.2 Data collection

The Ministry of Health was responsible for all data collection. The data collected were given to single SNM contractors.

The data required to carry out noise mapping was obtained from the following sources:

- Traffic intensity data from the Road and Motorway Directorate (RSD)
- Maps from the State Administration of Land Surveying and Cadastre (ČÚZK);
- Number of people in buildings from the Czech Statistical Office (ČSÚ).
- Land cover data from the Czech Environmental Information Agency (CENIA)
- Railway data form the Railway Infrastructure Administration (SŽDC)
- Airport data from the airport Praha Ruzyně (LKPR)
- Public transport data from individual municipalities
- Industrial noise data for IPPC sources from single Regional Authorities

Table 74 Strategic noise mapping – data availability and collection methods – Czech Republic

R1	R2
Spatial databases obtained from photogrammetry	Same approach adopted
Noise emission data from noise sources obtained by measurement, roads and railways data as mentioned above.	As above
Inhabitant data obtained from the census of the Czech Statistical Office.	As above

7.6.3 Strategic noise mapping methods

For calculation of SNM of roads the French method (NMPB-Routes-96 – SETRA-CERTU-LCPC-CSTB) was adopted in accordance with the Good Practice Guide for Strategic noise mapping (2006 version). Several existing data sources have been used when modelling the vicinity of the relevant roads.

For railway noise, the Dutch RMR2 rail noise method has been used. The RMR2 method was used for tram noise too. For industrial noise, ISO 9613-2 'Acoustics – Abatement of sound propagation outdoors, Part 2: General method of calculation' has been used.

The calculations were conducted in the CADNA A (Dataakustik) and LIMA (Stapelfeldt) programmes. Output included maps in the scale of 1:10 000 with noise exposure contours expressed as L_{den} and L_{night} using a colour coding scale.

The approach to produce the SNMs was the same in R1 and R2.

7.6.4 Prague

The SNM for the agglomeration of Prague was developed by Akustika Praha using data from local government and the Czech Statistical Office. A large number of data sources were used to compile data on road traffic, railway, and air traffic noise. For noise from industrial production, IPPC data have been used. For railway, road transport, and air traffic noise the Dutch rail noise, French road noise and ECAC.CEAC air traffic noise methods were used. The RMR2 method was used for tram noise.

For industrial noise, ISO 9613-2 'Acoustics – Abatement of sound propagation outdoors, Part 2: General method of calculation' was used.

The programmes used for calculation and GIS were LimA C and B and GIS Kristyna.

The outputs were presented in maps with a scale of 1:35,000 displaying L_{den} and L_{night} contours.

7.6.5 Brno

The SNM for the agglomeration of Brno was developed by Akustika Praha using data provided by local government and the Czech Statistical Office. A large number of data sources were used to compile data on road traffic, railway, trams and air traffic noise. Information on industrial production was provided by local government. The same calculation methodologies were used as those used for noise exposure calculations in Prague. The final output was a map with a scale of 1:25,000.

7.6.6 Ostrava

SNM for the agglomeration of Ostrava were developed by ZUOVA. While maps were provided by the State Administration of Land Surveying and Cadastre (CUZK), the study team opted for using maps provided by the local government in Ostrava. This was complemented with data from the Czech Statistical Office. A large number of data sources were used to compile data on road traffic, railway, trams and air traffic noise. Information on industrial production was provided by local government using their IPPC register. The same calculation methodologies were used as those used for noise exposure calculations in Prague and Brno. The software used was LimA, ArcView, GIS Kristyna. The output is presented as maps with a scale of 1:30,000 and 1: 10,000 displaying L_{den} and L_{night} contours.

7.6.7 Strategic noise mapping methods

The END specified the interim computing methods for both the R1 and R2 of strategic noise mapping that have been used. Details were already described above.

7.6.8 Public accessibility of SNMs

Czech legislation[44] obliges the Ministry of Health to make SNMs available to the public in paper format and on its website.[45] At this stage, SNMs in paper format are available for inspection at the Ministry's Prague office. SNMs are also available online at:

http://www.geoportal.cenia.cz and http://hlukovemapy.mzcr.cz.

For R2 new map presentation has been prepared. Now (in April 2016) it is available on the address

https://eregpublicsecure2.ksrzis.cz/Registr/shm/ but the address will change soon. The text part will be available on the mzcr.cz web page.

[44] Paragraph 4 of Regulation 523/2006 Coll. on Noise Mapping

[45] http://www.mzcr.cz/Verejne/Pages/23-zverejnovani-udaju-o-shm-dle-vyhlasky-c-5232006-sb.html

7.6.9 Implementation Issues

A number of issues were raised as a result of R1, a summary of which is shown below. A number of further implementation issues were raised during R2.

Table 75 Strategic noise mapping issues – Czech Republic

R1	R2
Lack of precision on number of inhabitants per building	Issue remained problematic
Compatibility of datasets, e.g. from the Czech Statistical Office (CSU)) and the State Administration of Land Surveying and Cadastre (CUZK)	Delays in R2 were expected as funding yet to be allocated, and the need to comply with public procurement rules to engage private companies to compensate for a lack of internal resources means their appointment will take up to 12 months. Delay in SNM implementation due to slow public tendering processes. The complete set of SNMs are expected to be ready only by 30.06.2016.
Traffic intensity datasets for the reference year required by END (2006) had to be recalculated as national traffic intensity is surveyed in 5-year intervals (2005, 2010, etc.). The same problem was expected in 2011 (for R2)	
There was a challenge in integrating a wide variety of input data. Some data had to be manually prepared and adjusted.	

7.7 Noise action planning

7.7.1 Overview

Table 76 NAPs – Czech Republic

	R1	R2*
Agglomerations	260 (3 agglomerations)	0 (7 agglomerations)
Major airports	16	0 (1)
Major railways	5	0
Major roads	175	0

* *NAPs for R2 will be finished until the end of 2016*

The vast majority of R1 NAPs were adopted by local government bodies and the Ministry of Transport (or agencies falling under the Ministry's supervision, such as the Road and Motorway Directorate). In some cases, their preparation was subcontracted to commercial organisations.

7.7.2 Methodologies for noise action planning

The legislation (Annex III of Regulation 523 of 2006 Coll.) provides a brief overview of the desired content of NAPs, but no detailed requirements.

Guidelines on noise action planning were developed by the Centre for Transport Research in Brno (CDV), but their use is not compulsory.

NAPs were driven by the outcome of strategic noise mapping which were used to identify “hot spots” where noise limits were exceeded.

Priorities in the NAPs were set at national as well as regional levels.

When adopting measures, noise abatement was one of several criteria used, with transport effectiveness and safety being considered as well.

No changes have been made in the methodology between Rounds 1 and 2.

The national CA identified lack of common European guidelines for the development of NAPs as a problem since it has proved very challenging to develop robust NAPs. Guidance would be especially welcome in respect of the development of methods for undertaking cost-benefit assessment and to assess the costs of the implementation of NAP measures.

7.7.3 Measures

An overview of the types of measures adopted in NAPs is provided below. It should be noted that little information is available at this stage in respect of R2 implementation, since due to delays in public tendering processes getting underway, the R2 SNMs have not yet been completed, and therefore noise action planning is taking place too late in the process for information to be included in this country report.

Table 77 Noise reduction measures in R1 and R2 NAPs – Czech Republic

	R1	R2
Traffic planning	Yes	No info
Land-use planning	Yes	No info
Technical measures at noise source	Yes	No info
Economic measures	No	No info
Insulation	Yes	No info
Selection of quieter sources	Yes	No info
Reduction of sound transmission	Yes	No info
Regulation	Yes	No info
Incentives	No	No info

Table 78 R1 and R2 NAP measures – key selection criteria - Czech Republic

	R1	R2
Population exposure	2	1
Ease of implementation	2	3
Costs of implementation	2	2
Compatibility with other legislation	5	5
Noise source in the case of exceedance	2	2

Legend: 1 – very important criteria 5 – criteria of minimal importance. Based on discussions with national Competent Authority and wider stakeholders.

Stakeholders interviewed suggested that R1 NAPs may, in some cases, have included measures that had been planned regardless of the END, and noise abatement was not the main reason behind their adoption. For example, some infrastructure construction projects had been adopted for road safety reasons but where these projects also contribute to noise abatement, they have also been listed in NAPs. Thus, some measures contained in NAPs may not have been adopted in response to noise limits being exceeded, but for other reasons.

Since noise action planning for the R2 NAPs have not yet been adopted at all, it is at this stage impossible to form an overall judgment of the extent and effectiveness of anti-noise measures implemented on the ground.

Table 79 NAP cost estimates (EUR million)

	Measures*	Cost estimates (EUR million)
R1 (up to 2012)	12	37,000
R2 (after 2012)	No data**	No data**

Source: ZUPU

** Previous and planned expenditure over a 5 – 10-year horizon*

***The R2 NAPs are still under preparation, therefore no detailed information is available yet on measures and their costs.*

It can be noted that since the R2 NAPs are late, there is no data or information yet available with regard to R2 NAPs.

7.7.4 Public consultations

Public consultation was carried out prior to finalising NAPs. Consultation methods included notices being placed on boards at public authority offices as well as Internet presentations. In addition, some information was published in the media.

All the comments received from the public related to both Prague Airport (around 300) and noise action planning for the Prague agglomeration. Other NAPs received zero comments.

A summary of some of the comments received and a brief account of the manner in which they were incorporated into NAPs is available from the website of the Ministry of Transport.[46] This allows the public to check whether their comments have been taken up in the NAPs. However, this site does not seem to include all the NAPs currently in place across the country. NAPs were published on official notice boards and on websites of the regions. If there were any comments, they were discussed.

7.7.5 Implementation Issues

A number of issues were raised as a result of R1 and R2, a summary of which is shown below, together with actions taken to address them, and any new issues raised during R2.

[4646] http://www.mdcr.cz/cs/Strategie/Akcni_plany/akcni_plany.htm

Table 80 Noise action planning issues – Czech Republic

R1	R2
The period between finalising SNMs and completing NAPs was insufficient (12 months).	
The lack of more precise specifications as to what NAPs should contain	The CA reiterated the need for the EC to develop further guidance on noise action planning.
The lack of an impact assessment of the costs and benefits of measures adopted	No info at this stage in R2 since NAPs are delayed in CZ
It was a challenge working with input data. It will be easier producing NAPs with noise level assigned to every building in NAP.	
• Lack of financial resources • Lack of interest by CA • Problems with obtaining correct input data (incomplete, incorrect, wrong format)	Major delays in submission of R2 NAPs. Delays in R2 can be explained by the knock-on delays from noise mapping, specifically due to: • Lack of financial resources • Lack of interest among CAs • Problems with obtaining correct input data (incomplete, incorrect, wrong format) Currently, authorities are discussing how to improve the data situation for subsequent Rounds.
	The request for statistical data on the costs of SNMs and NAPs development and implementation, human resources, etc. should be collated by the Commission at the beginning of each single round of SNM. This would be useful for the purposes of monitoring but also evaluation.

8. DENMARK

8.1 National implementing legislation for END

8.1.1 Legal implementation

The Noise Directive was implemented based on the Environmental Protection Act by issuing Executive Order no. 766 of 7 July 2004: Notice of mapping of environmental noise and noise action planning.[47]

In 2011, Executive Order no. 1309 of 21 December 2011 on mapping of environmental noise and preparation of noise action was issued. The new order defines the scope of the survey for the second phase of the Noise Directive.[48]

At least two additional pieces of legislation also set out requirements in respect of environmental noise:

- The **Environmental Protection Act** empowers the Environmental Ministry to set quality standards for allowable noise level - guiding as well as binding rules.[49]
- The **Act of Planning**, § 15a, prohibits the planning authorities from laying out noise affected areas for noise-sensitive applications unless the plan provides for the establishment of shielding measures etc., that can secure the future use against noise nuisance.[50]

Both acts provide a statutory basis for a number of guideline documents regulating noise pollution. Building provisions set in-door noise limit values for new houses at 33 dB.[51]

Prior to the Directive, Denmark had already adopted a Road Noise Strategy in 2003, which runs until 2020 and already triggered the development of municipal noise mitigation plans and the adoption of noise-reducing asphalt. The Road Noise Strategy was evaluated and revised in 2010. The evaluation showed that most government initiatives had been implemented or were being implemented. However, the number of affected homes was still high, as 785,000 homes were affected by road noise above the recommended limit value – almost one in every three homes.

One issue raised by the Commission with Denmark is the inconsistent relation between Strategic noise mapping reports and NAPs. Denmark proposes a solution based on a geographical assignment using GIS for linking the municipalities to the NAP.

8.1.2 Scope of END implementation – Rounds 1 & 2

R1 of strategic noise mapping and noise action planning in Denmark included 1 agglomeration, 3 airport(s), and 1,043 km of major roads and 444 km of railway.

The introduction of definitive thresholds in R2 led to 3 *additional* agglomerations, and a total of 894 km of major railway lines and 1,043 km (same as in R1) of major roads being covered.

[47] https://www.retsinformation.dk/Forms/R0710.aspx?id=12753

[48] https://www.retsinformation.dk/Forms/R0710.aspx?id=139549

[49] https://www.retsinformation.dk/Forms/r0710.aspx?id=132218

[50] https://www.retsinformation.dk/Forms/r0710.aspx?id=144425

[51] IV with competent authority

Table 81 END coverage – Denmark

Round	Agglomerations	Major airports	Major railways	Major roads
1	1	3	444 km	1043 km
2	4	3	894 km	1043 km

8.2 Competent Authorities and designated administrative bodies

The **Danish Environmental Protection Agency** (Miljøstyrelsen) under the Ministry on Environment has the **overall responsibility for both the SNMs and the NAPs**. There are in addition a number of other organisations that are involved in END implementation for different transport infrastructure types, as summarised in the following table:

Table 82 Administrative Responsibility for the END – Denmark

<table>
<tr><th>Role/Activity</th><th>Agglomerations</th><th>Roads</th><th>Railways</th><th>Airports</th></tr>
<tr><td>Preparing SNMs</td><td>Municipalities*</td><td rowspan="4">Cross-ministerial Road-Noise Group jointly with the Road Directorate
Major roads Ministry of Transport & Road Directorate</td><td rowspan="4">Ministry of Transport
The responsible traffic association</td><td rowspan="4">Environmental Protection Agency (Copenhagen airport)
Municipalities – wherever smaller regional airports were included within agglomerations</td></tr>
<tr><td>Approving SNMs</td><td rowspan="2">Municipalities</td></tr>
<tr><td>Preparing NAPs</td></tr>
<tr><td>Approving NAPs</td><td>Environmental Protection Agency</td></tr>
<tr><td>EC/EEA reporting</td><td colspan="4">Danish Environmental Protection Agency (Miljøstyrelsen) under the Ministry of Environment</td></tr>
</table>

In case of agglomerations, The Environmental Protection Agency reviews the noise action plans with regard to minimum requirements mentioned in annex V of the Directive and sends an acknowledgment of receipt. However, the Agency has no competence to instruct municipalities or any of the other authorities involved.

The Danish Environmental Protection Agency is moreover responsible for coordinating and publishing the SNMs.

Further guidance exists in the form of an extensive handbook[52] with directions on mapping noise and preparing NAPs. This as well as another booklet[53] are mainly intended for municipalities.

[52] http://www2.mst.dk/Udgiv/publikationer/2006/87-7052-146-8/pdf/87-7052-146-8.pdf

[53] http://mst.dk/media/mst/66261/styr_paa_stoejen.pdf

8.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

8.3.1 Data collection

According to the first implementation report, there was enough data and information available for the 2005 designation of sites and no specific problems were encountered when increasing the scope in 2008.

8.3.2 Implementation issues

Issues raised in R1, together with actions taken to address them, and new issues in R2 are shown in the table below.

Table 83 Designation issues – R1

R1	R2
Municipalities expressed concern that focus on a few bypass roads in strategic noise mapping missed the roads with major noise problems in densely populated city centres.	Extended road coverage for strategic noise mapping in R2.
An examination of the municipal roads in Denmark revealed that almost every municipality had one or a few short sections of road with traffic above the Environmental Noise Directive criteria, and that the most of the traffic were neither related to city centres nor to the network of regional roads.	Major roads were mapped as a coherent network of regional or national roads, administered by the Ministry of Transport. The EC and European Environmental Agency were notified of this decision 21 June 2012.
	Some road data used in the initial calculations at national level should have been excluded since roads designated as "major roads" were found to be outside the END threshold of passenger journeys. Some of the designated roads were found to have less traffic than had been expected and should not have been mapped.

8.4 Noise limits and targets

8.4.1 Objectives and Scope

The non-binding guidance limit values were last reviewed in 1994 in the Environmental Protection Agency's guideline 5/1994 on noise from airfields. The limit values are presented in the table below.

Table 84 Noise limit values in Denmark for airports[54]

Type of area	Airports	General airfields
Residential areas and noise-sensitive buildings for public purposes (schools, hospitals, nursing homes, and similar)	55 dB	45 dB[1]
Scattered buildings in open country	60 dB	50 dB
Professions (hotels, offices, and similar)	60 dB	60 dB
Recreational areas with overnight residence (summerhouses, allotment gardens, camping sites, and similar)	50 dB	45 dB
Other recreational areas without overnight residence	55 dB	50 dB

If the county council considers the general airfield as being of regional importance in a regional planning context, the guidance limit value is 50 dB. The maximum noise limit values expressed in terms of L_{max} apply between 10 p.m. and 7 a.m. for built-up and recreational areas, 70 dB for general airfields and 80 dB for airports and airbases. The limit values and L_{max} indicated in the table will continue to be applied in connection with the regulation of noise from airfields and airports and associated planning.

There are no general noise limits for **railway noise** in Denmark. Rather, noise limits exist for the construction of new lines or new construction of dwellings along existing lines. However, it is possible to expand rail capacity along existing without paying attention to noise limits.[55] The noise limits that apply in the former case are[56] (dwellings, areas for staying out of doors): 64 dB[57].

There are also requirements for both the maximum noise level and vibration level of the individual dwellings. The recommended limit for the maximum level is 85 dB, and limit vibrations is 75 dB KB-weighted acceleration level.

The noise limits for **road traffic** noise are[58]:

- Recreational areas in the open country (areas for holiday cottages, camping sites, green areas, etc.): 53 dB
- Recreational areas near or in cities (parks, allotment gardens, city camping, etc.): 58 dB
- Dwelling areas (dwellings, areas for staying out of doors): 58 dB
- Public purposes (hospitals, institutions, schools, universities, etc.): 58 dB
- Commercial purposes (hotels, offices, etc.): 63 dB

[54] http://eng.mst.dk/topics/noise/recommended-noise-limits/noise-zones/airport-and-airfield-noise-zone/

[55] Interview with Danish Rail Network

[56] http://eng.mst.dk/topics/noise/recommended-noise-limits/noise-zones/railway-noise-zone/

[57] According to the railway authority, this is the only limit value used when upgrading or building new railway lines

[58] http://eng.mst.dk/topics/noise/recommended-noise-limits/noise-zones/road-traffic-noise-zone/

Table 85 Limit values for noise from installations - examples[59]

Land-use type	Noise limit values	
	Day dB (A)	Night dB (A)
Industry	40-70 dB (depending on location)	35-70 dB (depending on location)
Wind turbines	3744 dB (depending on location and wind speed)	37-44 dB (depending on location and wind speed)

Methods for establishing noise limit values

Since 2007, L_{den} guidance limit values have been used for traffic noise from road and rail.[60] There are no limit values expressed in terms of L_{night}, but limit values for the maximum value expressed in $L_{max.}$ For the regulation of noise from companies the unit used is L_{Aeq} as the averaging period for noise generated by companies is 8 hours, 1 hour and half an hour respectively during daytime (7 a.m.-6 p.m.), evening (6 p.m.-10 p.m.) and night (10 p.m.-7 a.m.). Health based assessments were used when establishing the noise limit values.

In conjunction with the adoption of the *Order on strategic noise mapping and noise action plans*, Denmark has revised the guidelines on road and rail noise, and from now on noise is expressed in terms of L_{den}. This metric will be used for both strategic noise mapping and planning and in further regulation of these types of noise. With regard to business-generated noise, L_{den} will be applied in planning (optional) and Strategic noise mapping while the regulation of noise from businesses is expected to continue to be based on L_{Aeq} in each of the day, evening and night periods. For planning purposes, it is expected that guidance limit values will be worked out for business-generated noise to be expressed in terms of L_{den}.

Non-binding target values

Irrespective of the Directive, the Danish government in 1993 adopted the goal to reduce the number of residences exposed to severe noise nuisance to 50,000 by 2010. This target has not been achieved.[61] The Danish Road-Noise Group calculated that this target could only be achieved with an investment of DKK 7 billion which is not realistic for the foreseeable future.

The Environmental Protection Agency has set recommended limit values for noise from road traffic in connection with planning and projecting of new residential areas along busy roads. These are laid down under Section 14 of the Environmental Protection Act. New constructions and major rebuilding along roads that lead to a noise level of more than 58 dB L_{den} for individual buildings are to be insulated against the extraneous noise so that the noise level indoors in the dwelling rooms does not exceed 33 dB L_{den}. No limit values have been established in respect of the existing housing stock. No recommended limit values have been established either for the construction of new roads. The Road Directorate has also issued road regulations that recommend that the

[59] http://eng.mst.dk/topics/noise/recommended-noise-limits/noise-zones/

[60] http://mst.dk/virksomhed-myndighed/stoej/stoejgraenser/

[61] http://eng.mst.dk/media/mst/69033/Road%20traffic%20noise%20strategy%20UK%20version.pdf

road boards endeavour to achieve the lowest possible noise levels along new roads, i.e. 58 dB L_{den} in the case of all-year residences and 53 dB L_{den} for holiday homes.[62]

8.4.2 Implementation issues

In relation to noise limit values, one of the main problems highlighted by interviewees is that there is very little enforcement activity if maximum binding noise limit values are exceeded. This was the case in both Rounds.

8.5 Quiet areas

8.5.1 Overview

L_{den} is used to define quiet areas within agglomerations. Another non-acoustic criterion was that the areas had to be publicly accessible. Quiet areas are defined within the municipality NAPs. Before the END, Denmark also sought to preserve certain natural areas for their quietness.

8.5.2 Implementation issues

No issues were raised as a result of END implementation in R1. Issues raised in R2, together with actions taken to address them are shown in the table below.

Table 86 Quiet area issues

Issue	Action
Only limited standards set for quiet areas in END, according to Copenhagen municipality. Could be more ambitious.	To be decided

8.6 Strategic noise mapping

8.6.1 Overview

An overview of the number of SNMs produced in Rounds 1 and 2 is shown below, showing the effect that introducing the definitive thresholds had on the number of SNMs that were required under the Directive.

Table 87 SNMs - Denmark

	R1	R2
Agglomerations	1	17 (17)
Major airports	3	3 (3)
Major railways	2 (444 km)	4 (4) (894 km)
Major roads	2 (1043 km)	3 (3) (1043 km)

[62] http://eng.mst.dk/media/mst/69033/Road%20traffic%20noise%20strategy%20UK%20version.pdf

8.6.2 Data collection

The Danish Road Directorate is in charge of collecting road traffic data and estimating the noise exposure from state roads, while 17 municipalities are responsible for collecting data for the municipal roads, and the Danish rail collects rail data. The new and more close-meshed mapping used in the Road-Noise Strategy as a basis for the calculation of scenarios does not provide the opportunity to calculate the individual contribution from state, county and municipal roads to the total noise nuisance. This is first and foremost because some of the dwellings exposed to noise nuisance are exposed to road noise from several types of road. Noise does not respect state, county and municipal road demarcations. There is no corresponding mapping for county roads but the Environmental Protection Agency has carried out a rough estimate on the basis of previous mapping exercises and estimates the county contribution to be in the range between 5 and 10 per cent of the total noise exposure. It is therefore estimated that 85% of the dwellings affected by noise are exposed to road noise from municipal roads.[63]

Valid data such as traffic counts, topography etc. have been available for the assessment for most authorities

8.6.3 Strategic noise mapping methods

Different procedures to obtain data were employed by different public authorities. Many public authorities used central registers of buildings and inhabitants to link inhabitants to buildings, while the SNMs used average inhabitant densities to make this calculation. Prior to the END, Danish Strategic noise mapping only calculated noise exposure as LAeq, 24h i.e. as 24-hour equivalent values.[64] In connection with implementing the Directive, national guidelines were adopted and L_{den} and L_{night} were used for the preparation of the SNMs. The guidelines do not prescribe the GIS formats to be used. This implies that the different map formats needed to be translated into one standard to make them compatible which caused some delays. For the next round, only the shp file format will be specified. The guidelines are regarded as clear and very useful by the Copenhagen municipality.

The guidelines no. 4/2006 specify that Nord2000 has to be used as a noise calculation method for mapping of road and rail noise.[65] Initially developed from 1996-2001, the method includes source models for road and rail traffic in third octave bands from 25 Hz to 10 kHz. The propagation model can be applied for a variety of weather conditions, allowing a precise yearly average to be determined. Complicated terrain is handled by a concise procedure, so the interpretation of terrain shapes by skilled personnel that earlier was necessary is now abandoned, and the method can be applied to automated Strategic noise mapping without loss of accuracy. The team responsible for Nord2000 took part in the European Harmonoise project, where the Nord2000 model formed a basis for the development of the Harmonoise Engineering model. Several of the findings from this project have been subsequently introduced in an update of Nord2000 and the data from both projects are assumed to be comparable.

It has not been decided yet whether to use the same methodology in Rounds 3 and 4. Guidance will be updated accordingly.

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[63] http://eng.mst.dk/media/mst/69033/Road%20traffic%20noise%20strategy%20UK%20version.pdf

[64] http://eng.mst.dk/media/mst/69033/Road%20traffic%20noise%20strategy%20UK%20version.pdf

[65] http://eng.mst.dk/topics/noise/noise-mapping-and-action-plans/

8.6.4 Public accessibility of SNMs

With regard to public accessibility to SNMs and graphical presentations of SNMs, SNMs have been published online and are available in Danish from the following website: http://noise.mst.dk/. According to the Environmental Protection Agency, in R1, public demand was high and positive feedback has been received from individuals and, for example, from architects using the SNMs in planning for quiet neighbourhoods. Promotional material from the EPA was also sent to municipalities.

8.6.5 Implementation issues

A number of issues were raised as a result of R1, and a number of further issues were raised during R2, as summarised in the following table.

Table 88 Strategic noise mapping issues

R1	R2
The long period of time required for data computations and calculations Technical problems with various GIS-formats being used by different public authorities Technical challenges in publishing SNMs online in a readily accessible format. Nord2000 was a technical challenge in R1 for the Copenhagen municipality.	No actions taken.
	In R2, the technical challenges with regards to Nord2000 have been small.

In terms of steps taken to address these implementation challenges, the Environmental Protection Agency in 2011 published a revised statutory order no. 1309 on Mapping of Environmental Noise and Preparation for NAPs which makes ESRI Shape (SHP) or MapInfo Interchange Format (MIF) mandatory for GIS formats.[66]

[66] https://www.retsinformation.dk/Forms/R0710.aspx?id=139549, according to competent authority

8.7 Noise action planning

8.7.1 Overview

An overview of NAPs in Denmark is shown in the following table.

Table 89 NAPs – Denmark

	R1	R2
Agglomerations	17	14 (17)
Major airports	3	3 (3)
Major railways	2	4 (4)
Major roads	2	3 (3)

Source: Danish CA

In addition to NAPs, the Danish Planning Act is a very important resource for municipal and other planners.[67]

8.7.2 Methodologies for noise action planning

Guidelines have been adopted at the national level and the SNMs were used as a basis in developing the NAPs. The specifications for NAPs include a summary of the SNMs. The municipalities and other traffic authorities are free to choose any criteria in order to prioritise actions. The Ministry of Environment recommends for municipal planning, environmental and road sections, and potentially health sections, to cooperate in this regard. The plans thus devised should be used in conjunction with the traffic and environment plans to feed into the spatial plan for the respective municipalities. The municipal NAPs should be presented at a public hearing and be discussed in the municipal councils.[68] The exceedance of Danish noise limit values was used as a basis for establishing priorities for the NAPs. Priorities have been set at both the national and the local level. Denmark considers five years to be an appropriate time period for the revision of the NAPs. The Environmental Protection Agency indicated that evaluation of NAPs could be streamlined with the evaluation of pre-existing noise measures.

8.7.3 Measures

No specific measures were identified in the 2011 implementation report. However, the research found that examples of the types of measures identified in Denmark and implemented in Rounds 1: Five noise partnership demonstration projects financed by the Ministry of the Environment. For these projects in the municipalities of Allerød, Aarhus, Copenhagen and Frederiksberg (two projects), 4 million DKK were set aside. Along with resident financing, DKK 13 million were used to finance noise protection from 2005 to 2007, benefitting at least 500 residents in 250 homes.[69] With regards to noise stemming from construction activities, the Danish Building Act provides that new housing is not built with noise nuisances exceeding 55 dB. New residential areas cannot be laid out where noise from road traffic exceeds 55 dB.

[67] Interview with Danish Road Directorate

[68] http://eng.mst.dk/topics/noise/noise-mapping-and-action-plans/

[69] Report available in Danish: http://eng.mst.dk/media/mst/66256/stoej_magasin_feb08.pdf

State efforts to reduce **road noise** have focused on three areas:

- Noise reduction along existing roads
- Noise reduction in connection with new constructions/widening of roads
- Research, development and communication.

Prior to the END, from 1992-2001, the Danish Road Directorate spent DKK 212 billion on noise-abating measures along state roads.[70] New road construction projects already allocate significant amounts to noise reduction. For example, 10% out of the overall budget for the extension of a motorway around Copenhagen (DKK 190 million) had been allocated to such measures.

Below is a list of state initiatives part of the road traffic noise strategy 2010-2014:[71]

Table 90 – List of noise mitigating initiatives

No.	Initiative
1	Noise protection at existing state roads. New initiative. In the green transportation agreement from 2009, DKK 400 million have been earmarked for noise protection at existing state roads and tracks, towards 2014. [Danish Ministry of Transport]
2	Action in the EU for increased vehicle and tire requirements. Continued initiative. There is a large potential gain by switching to low noise tires [Danish Transport Authority]
3	Information concerning the choice of low noise tires. Continued initiative. Can be implemented when labelling of tires enters into force. [Danish Transport Authority]
4	High noise protection at new state road constructions. Continued initiative. Has been the practice for many years [Danish Road Directorate]
5	Noise reducing asphalt on state roads. Continued initiative. Low noise asphalt (thin-layer coating) are increasingly becoming standard on state roads since 2003 [Danish Road Directorate]
6	Low noise asphalt – research and dissemination. Continued initiative. The development of low noise asphalt and dissemination of knowledge will continue [Danish Road Directorate]
7	Noise considerations regarding public procurement of cars and driving services. New initiative. [Danish Environmental Protection Agency]
8	Reduced speed. Guide with good examples. Adjusted effort. In some cases, there are poor communication between municipality and police in the reduction of speed for the sake of noise. A guide to improve the framework for dialogue [Danish Environmental Protection Agency, Danish Ministry of Justice]
9	Noise barriers, research and dissemination of visual identity and power. Noise barriers have been used for years. Efforts must be maintained and further developed. [Danish Road Directorate]
10	Noise in public housing. New initiative. In collaboration with the National Building Fund, a campaign has been launched on how their funds can be used for noise abatement in public housing, as part of renovation projects. [Danish Environmental Protection Agency, the National Building Fund, Danish Ministry of Social Affairs]
11	Communication with municipalities on effective means, quiet areas. Continued initiative. The evaluation shows that municipalities have a good knowledge of effective means to reduce noise. This continued initiative maintains that. [Danish Road Directorate, Danish Environmental Protection Agency]

[70] http://eng.mst.dk/media/mst/69033/Road%20traffic%20noise%20strategy%20UK%20version.pdf

[71] http://eng.mst.dk/media/mst/69034/State%20initiatives%20in%20road%20traffic%20noise%20strategy%202010-14.pdf

No.	Initiative
12	NAPs, case studies and possible networking. New initiative. NAPs form the basis for a noise action. Good examples of NAPs will be disseminated and networking among municipalities will be promoted. [Danish Environmental Protection Agency]
13	SNM of Denmark. New initiative. The Danish SNM on mst.dk will be continuously updated and cover more noise affected residences as the Strategic noise mapping of the four largest cities are completed in 2012. [Danish Environmental Protection Agency]

With regard to **noise from railways**, Rail Net Denmark along with the Danish Environmental Protection Agency has initiated noise protection projects[72], including installing 47 km of acoustic screening and soundproofing 4,000 homes since 1986. Until the project came to an end in 2014, DKK 600 million had been spent. Out of that amount, roughly DKK 20 million were spent on tackling noise at source.[73] The project focused on dwellings that are exposed to a noise level of above 64 db. The Environmental Protection Agency mandates that in case of any new rail construction projects that would result in dwelling being exposed to noise levels above 64 dB, Rail Net Denmark needs to cover 100% of the costs of either soundproofing those houses or installing noise screens.[74] The project successfully came to an end once all dwellings above L_{den} 64 dB either were protected by a noise screen or received or were insulated.

8.7.4 Public consultations

In R1, all NAPs were published and in a number of cases, responses were solicited from the public as part of a public consultation process. The beginning of this process started with a public hearing. In guidance prepared by the Environment Protection Agency on strategic noise mapping and noise action planning, municipalities and implementing authorities were encouraged to involve the public in the process.

According to the Danish Road Directorate, public consultations are hard to carry out at national level in practice snice the Road Directorate potentially needs to consult with stakeholders located across major roads in the whole country. It was seen as easier for municipalities to engage with local stakeholders during consultations. The Danish Railway Authority only received a few comments on their NAP which were incorporated in the publication.

8.7.5 Implementation issues

A number of issues were raised as a result of R1, a summary of which is shown below, together with actions taken to address them, and any new issues raised during R2.

Table 91 Noise action planning issues

R1	R2
Delays in strategic noise mapping led to delays in Noise action planning. Problem: The Environmental Protection Agency lacks the legal means to force municipalities to devise NAPs.	No action foreseen.

[72] http://eng.mst.dk/media/mst/69031/COWI%20Feature%20noise%20control%20along%20main%20railways.pdf

[73] Interview with the Danish Rail Network

[74] Interview with the Danish Rail Net

R1	R2
Administrative changes due to a municipal reform which was carried out on 1st January 2007. This led to a substantial decrease in the number of municipalities, but meant additional work for those remaining.	
	The Environmental Protection Agency stated that they had written to different municipalities several times to stress the importance of finalising the NAPs. Three small ones did not submit on time which meant that the entire END implementation deadline was not met. The three action plans are expected to be approved by the municipal councils in spring 2016 Subsequently the Environmental Protection Agency will send the final summary for Round 2 to the EU Commission.

9. ESTONIA

9.1 National implementing legislation for END

9.1.1 Legal implementation

The END has been transposed by sections 130-136, 142 and 151 of the *Ambient Air Protection Act* (Välisõhu kaitse seadus (RT I 2004, 43, 298)) and by *Regulation No. 87* of the Minister of Social Affairs of 29 June 2005 "The minimum requirements of SNM and NAP designed to reduce noise" (Sotsiaalministri 29. juuni 2005. a määrus nr 87 "Välisõhu strateegilise mürakaardi ja välisõhus leviva müra vähendamise tegevuskava sisule esitatavad miinimumnõuded" (RTL, 14.07.2005, 78, 1092).[75]

9.1.2 Scope of END implementation – Rounds 1 & 2

R1 of Strategic noise mapping and Noise action planning in Estonia covered 1 agglomeration, no airports, and approximately 11 km of major roads and no railway. The reintroduction of definitive thresholds in R2 led to 1 *additional* agglomeration, and approximately 27 km of major railway lines and 158 km[76] of major roads being covered in total.

Table 92 END coverage - Estonia

Round	Agglomerations	Major airports	Major rail	Major roads
1	1	0	0 km	11 km
2	2	0	27 km	158 km

9.2 Competent Authorities and designated administrative bodies

Table 93 Administrative Responsibility for the END - Estonia

<table>
<tr><th>Role/Activity</th><th>Agglomerations</th><th>Roads</th><th>Railways</th><th>Airports</th></tr>
<tr><td>Preparing SNMs</td><td>Tallinn and Tartu City Government</td><td>Estonian Road Administration</td><td>Estonian railway</td><td rowspan="4">n/a</td></tr>
<tr><td>Approving SNMs</td><td colspan="3">The Health Board, but we will change the system and then the administrative bodies will approve themselves and the bodies, who will make the SNMs and will be the consultants for the NAPs, must be accredited as noise measurement bodies</td></tr>
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<tr><td>EC/EEA reporting</td><td colspan="4">Ministry of Environment</td></tr>
</table>

[75] Information on noise mapping legislation can be found at https://www.riigiteataja.ee/ert/act.jsp?id=13202035, and https://www.riigiteataja.ee/ert/act.jsp?id=917329.

[76] Initially 245 km envisaged. Only sections exceeding 3 million vehicles per year included.

These arrangements did not change between R1 and R2. While in theory the flight administration would be in charge of strategic noise mapping for **airports**, in practice no such mapping was carried out due to the minor importance of air traffic in Estonia.[77] At Tallinn airport, a permanent noise monitoring system is in place, however. Regarding **railways**, the responsible authority will only become active once they reach over 30 000 trains per year, and would then submit these numbers to the City Environmental Department. Currently, they are not active.

According to the CA, it is not sufficiently clearly defined by the Directive whether the CA should only play supervisory role or be actively engaged in SNMs and NAPs as well as abatement measures.

9.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

The Good Practice Guide was used in some instances.

Stakeholders in Estonia disagreed as to whether a threshold of 3 million movements should be used or not in Round 2. Under the Road NAP 2009-2013, only roads with more than 6 million vehicles were included.

9.4 Noise limits and targets

9.4.1 Objectives and Scope

Based on the Ambient Air Protection Act and the Public Health Act, the main act to provide binding noise limits in Estonia is Regulation No 42 of the Minister of Social Affairs from 4 March 2002 “Standard noise levels for residential and recreational areas, dwellings and buildings with joint use, and the methods of measuring noise”. Regulation No 42 applies to the following sources of noise, vehicle-, flight-, and air transport); industrial enterprises; commercial- and services’ enterprises, sports fields and entertainment venues; and construction works.

Table 94 Limit values for noise from traffic - Estonia

	Day dB (A)	Night dB (A)
Recreational	55	50
Residential	60	55
Mixed	65	55
Industrial	75	65

[77] According to the competent authority

Table 95 Limit values for noise from industry Estonia

	Day dB (A)	Night dB (A)
Recreational	55	40
Residential	60	45
Mixed	65	50
Industrial	60	45

More specific noise limits are also provided in:

- Government of the Republic Regulation No 108 from 12 April 2007 "Requirements of occupational health and –safety for the noise-influenced occupational environment, noise limit levels of occupational environment and conditions of measuring noise"
- Regulation No 122 of the Minister of Environment from 22 September 2004 "The limit values of emissions, pollutant emissions, smokiness and noise-levels in fumes of a motor vehicle"
- Regulation No 87 of the Minister of Economic Affairs and Communication from 4 August 2005 "Requirements for noise, measuring of noise and marking of noise caused by the devices used in outdoor environment".

The Health Protection Inspectorate exercises supervision over ambient air noise levels and has the right to:

- Demand information and documents from persons generating noise and use the results of measurements or technical devices for recording noise levels
- Issue an order to restrict or terminate the operation of a stationary source of pollution if the noise levels exceed the limit or critical ambient noise levels (failure to comply can result in a penalty with the upper limit of € 639)
- Conduct tests to verify noise levels.

The Health Protection Inspectorate also has the right to impose sanctions in case of violation of limit levels either on the grounds of violating the Ambient Air Protection Act or the Public Health Act. If the sanctions are applied under the Public Health Act the fine for legal persons is € 3,196. If the sanctions are applied under the Ambient Air Protection Act the fine is € 1,917.

In order to prevent the exceedance of the standard levels of ambient noise, local authorities have the right to restrict the movement of motor vehicles within their territory (Section 138 of the Ambient Air Protection Act).

9.4.2 Implementation issues

Some issues with regard to the scope of roads included – threshold of 6 million vehicles per year not directly applicable to Estonian categorisation.

9.5 Quiet areas

9.5.1 Overview

24 quiet areas were established during R1 as part of the NAP for Tallinn. In R2, an additional 20 areas were established for Tartu.

Delimitation

The criteria L_{night} and L_{den} were used for the delimitation of quiet areas. Another non-acoustic criterion was recreational area larger than 3 hectares. There is no common methodology for defining quiet areas in Estonia.

Agglomerations

The only quiet areas designated in Estonia lie within the agglomerations of Tallinn and Tartu and were devised in the NAPs of these cities.

Open country

During the preparation of the current NAP, the Estonian Road Administration did not identify any quiet areas along main roads or received any requests from local authorities to take any quiet areas into consideration.

9.5.2 Implementation issues

Quiet areas are not clearly defined in Estonian legislation. Nevertheless, no issues were raised as a result of END implementation.

9.6 Strategic noise mapping

9.6.1 Overview

Several guidance notes were used for Strategic noise mapping in Estonia: "2007 Good Practice Guide for Strategic noise mapping", "Reporting Strategic noise mapping information to the public", "State of the art report on Strategic noise mapping", and "Environmental Noise Data Reporting Mechanism Handbook".

An overview of SNMs produced in Rounds 1 and 2 is shown below.

Table 96 SNMs - Estonia

	R1	R2
Agglomerations	1	2 (2)
Major airports	n/a	n/a
Major railways	n/a	n/a
Major roads	1	1 (1) (158 km)

No separate SNMs were produced for railways or airports because they are linked to the agglomeration SNMs.[78] The airport of Tallinn has its own continuous noise monitoring system.[79]

9.6.2 Data collection

GIS overlays were used for gathering data. Both L_{night} and L_{den} were used for Strategic noise mapping, as well as L_{de}, L_{Aeq}, L_{pAeqT}, L_{pAmax}. Five years is considered to be an appropriate time interval between revisions of SNMs by the Estonian authorities.

The Health Protection Inspectorate as the CA and the Ministry of environment, and locally, the Tallinn City Government. From 2016 onwards, municipalities are obliged to produce local SNMs.[80] The environmental investigation foundation at the Ministry of Finance funded strategic noise mapping based on revenue from environmental taxes.[81]

The completed SNMs of the City of Tallinn, the SNM of road-cuts, which vehicle passages exceed six million a year, and the SNM of the Old City Harbour in Tallinn are made available online.[82]

9.6.3 Implementation issues

A number of issues were raised as a result of R1, a summary of which is shown below, together with actions taken to address them, and any new issues raised during R2.

Table 97 Strategic noise mapping issues - Estonia

R1	R2
Several problems with collecting data for strategic noise mapping. There were particular problems with the data regarding the numbers of inhabitants in dwellings, and sound power levels of industrial sources.	It is important to update the digital topographic maps, which are the base for noise modelling, with new buildings and specify existing information for building parameters. This will be addressed in round 3.
The authorities reported problems arising from the range of different noise computational methods and a lack of Strategic noise mapping software. There were problems in the assignment of noise exposure levels to population.	There is a lack of information about the building use which has to be collected and the number of residents in buildings. This will be addressed in round 3.
The CA stated that it was unclear what kind of ports should be included in the strategic noise mapping.	Necessary to separate data for vehicles and specify the data about traffic load in streets. Separate data for car and truck traffic and their variability in day and night time should be added. This will be addressed in round 3.
The Health Inspectorate rejected the SNM for Tallinn, although it was submitted to the Commission nevertheless.	Not an issue in Round 2.

[78] According to the competent authority

[79] According to the competent authority

[80] According to the competent authority

[81] According to the competent authority

[82] http://www.tervisekaitse.ee/?page=237 and http://www.tervisekaitse.ee/?mid=175 (for the roads)

9.7 Noise action planning

9.7.1 Overview

An overview of NAPs is shown in the following table.

Table 98 NAPs - Estonia

	R1	R2
Agglomerations	1	2 (2)
Major airports	n/a	n/a
Major railways	n/a	n/a
Major roads	1	1 (1)

Source: CA

No separate NAPs were produced for railways or airports because they are linked to the agglomeration NAPs.[83]

9.7.2 Methodologies for noise action planning

National guidelines for drawing up NAPs are available online in Estonian.[84] The 2006 maps were used as a basis for developing the two NAPs in 2008. Other criteria included public demand and acoustic insulation. Both of the NAPs were prepared in order to fulfil the requirements of article 8(1) of END.

According to the Road Administration's NAP 2014-2018, there are 177 dwellings where the night time noise limit values are exceeded and measures required (based on SNM 2012). For reasons of cost-effectiveness, the dwellings housing a larger number of residents are prioritised. With the noise reduction measures over the period of 2014-2018 approximately 527 people will be experiencing noise reduction.

The NAP on Roads includes an evaluation of how the construction of noise barriers will reduce noise. The implementation of Noise Action Plans will be evaluated by the number of dwellings that will no longer be in the area of where the noise limit value is exceeded. Evaluation of the implementation will be carried out on 2018, when the Action Plan will be revised.

9.7.3 Measures

The City of Tallinn NAP specifies measures including traffic planning, land-use planning, technical measures at the source, insulation, selection of quieter sources, reduction of sound transmission, and regulation. In most cases the measures are not accompanied by cost estimates or implementation deadlines. Sources of financing are not specified in the NAPs. While there is no binding obligation to integrate the measures of an NAP in land use plans, the NAP of Tallinn has also a special section of measures, referred as "Considering environmental noise in new land-use plans". This provides a list of measures that could be especially relevant to different land-use plans, e.g. on new land use plans not posing a danger to quiet areas. In 2013, Tallinn

[83] According to the competent authority

[84] http://www.riigiteataja.ee/ert/act.jsp?id=13164685 and http://www.riigiteataja.ee/ert/act.jsp?id=917329

also introduced free public transport to its citizens, a measure which could potentially reduce noise.

Because the implementation of the NAP overlapped with the economic recession, mainly previously used administrative measurements like the preparation and establishment of part plans were carried out. Technical measurements (like noise barriers) have not been implemented. The following table summarises noise management actions resulting from the City of Tallinn NAP and their cost, where available:

Table 99 Tallinn City NAP cost of measures

Action	Cost, EUR
Establish plan of green areas	0
Establish plan „Streets and light traffic roads"	0
Noise-related actions: 1) requirements to part plans; 2) check defensive measures when certificate of occupancy is accepted	0
Considering with silent areas and their protection in detail planning	0
Whit new part plans prefer public transport and bicycle transport	0
Keep existing greenery, add new greenery	0
Reconstruct park Kalamaja	500 000
Encourage use of public transport: month of environmentally friendly movement, car free day	30 000
Rails together brazing	134 000
Changing the school windows	-
Buying new trains	-
Set up public transport lanes	-
Set up bicycle paths	-
Vehicle movement restriction, traffic redirect, heavy goods vehicle traffic forbidding	-
Mark down speed limits	0
Solving noise complaints	0

The Road Administration's NAP recommends the construction of certain types of noise barriers as a key measure. The NAP 2009-2013 identified six places where noise barriers should be erected. However, only one out of six noise barriers was in fact built during the period of 2009-2013 due to a lack of national budget available. At the same time, more than 16 km of new noise barriers were built in the context of other road construction and renovation projects. Some noise reduction may have also been achieved by reducing speed limits.

9.7.4 Public consultations

Section 12 of Regulation No 87 specifies that:

- Approved SNMs and NAPs shall be made available to the public and disseminated on the internet, ensuring free access to environmental information;
- The compilers of the NAPs must: notify the public and provide them with the possibility to participate in the preparation and overview of all phases of the NAP; ensure that the opinion of public is taken into account; and ensure that the public is informed of the decisions made. The deadlines of the NAP process must enable the public to participate in all the phases of the NAP.

The NAP of Roads was on public display from 1-15 October 2008 in the offices of two local governments, in the office and on the website of Road Administration. On 15 October 2008, public consultations were supposed to be held in two locations. One of them was cancelled due to the lack of participants and the other one went ahead with only limited participation. No written comments were submitted with regard to the NAP of Roads.

The NAP of Tallinn was on public display from 3-16 February 2009, after having been announced in one nationally distributed newspaper and on the website of the City of Tallinn. From 16-18 February 2008, three public consultations were held. Participation was quite limited, two of the consultations were attended by four citizens and the other was attended by only one citizen. Several letters with proposals were also submitted during the public display of the NAP. The NAP of Tallinn includes the minutes of the public consultations as well as a table listing the proposals made and the answers provided. Out of approximately twenty proposals, only one led to an amendment of the NAP[85].

For the Road Administration's NAP 2014-2018, public consultation was organised through their website as well as letters sent out to all local authorities whose territory was covered by SNMs. According to the Road Administration, the low participation rate in consultations with the public represents a major problem.

9.7.5 Implementation issues

A number of issues were raised as a result of R1, a summary of which is shown below, together with actions taken to address them, and any new issues raised during R2.

Table 100 Noise action planning issues - Estonia

R1	R2
There was a delay in strategic noise mapping and developing NAPs of roughly one year (two companies were involved; amount of work was underestimated).[86]	No longer an issue.

In both rounds, there was very low participation in public consultation events so it was suggested to simply make documents publicly available in the future rather than organising hearings, which were poorly attended. However, this would not meet the spirit of the Directive, of involving the public in consultation processes so as to improve the quality of NAPs.

[85] Ibid

[86] According to competent authority

10. FINLAND

10.1 National implementing legislation for END

10.1.1 Legal implementation and relevant legislation

The transposition of the Environmental Noise Directive (2002/49/EC) is based on amendment of a law (459/2004) to the Environmental Protection Act (86/2000, 527/2014). The detailed legal provisions on the assessment and management of environmental noise (e.g. indicators, contents of strategic mapping and NAPs, timetables for different tasks) were transposed into Finnish law by Government Decree (801/2004) issued under the Environmental Protection Act (EPA).[87]

Besides, there are several pieces of separate legislation which affect END implementation in Finland.

The noise abatement NAPs produced for airports and industry under the END may overlap with the environmental permit system already established in Finland in accordance with the EPA. Under the Act, a notification must be submitted on any activity or event that causes noise or vibration if there is reason to suppose that the noise or vibration will be particularly disruptive.[88]

Public road planning, design, construction and maintenance are regulated by the Road Act (503/2005). The Act requires any development and maintenance of the public road network to promote the implementation of the national land use guidelines, and also to adhere to national goals set for the urban structure and the environment in land use planning. Attention also has to be paid to ensure that damage caused by the road network to the environment is minimised.

In 2006, the Finnish Government adopted a resolution on noise abatement.[89,90] This resolution, which applies exclusively to environmental noise, sets out the general objectives of and targets on noise abatement, and measures for reducing noise emissions and their harmful impacts. The resolution also emphasises closer cooperation between different authorities. The resolution is relevant for the implementation of the END as it sets the overall goal for noise reduction. The very aim of the resolution is a reduction in noise emissions and the prevention of the spread of noise, resulting in fewer people being exposed to noise than is the case now. It specifically sets out that by 2020 the number of people living in areas where average daytime noise emissions exceed 55 dB (L_{Aeq} 7-22) should be at least 20% lower than in 2003.[91]

10.1.2 Scope of END implementation – R1 & 2

R1 of strategic noise mapping and noise action planning included 1 agglomeration, 2 airports, 96 km of railways and approximately 750 km of major roads.

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[87] Milieu, TNO and RPA (2010) Final Report on Task 1 Review of the Implementation of Directive 2002/49/EC on Environmental Noise

[88] Ibid.

[89] Government resolution on noise abatement. Reports of the Ministry of the Environment 7en | 2007.

[90] Finnish Ministry of the Environment, Helsinki via Milieu, TNO and RPA (2010) Final Report on Task 1 Review of the Implementation of Directive 2002/49/EC on Environmental Noise

[91] Milieu, TNO and RPA (2010) Final Report on Task 1 Review of the Implementation of Directive 2002/49/EC on Environmental Noise

The introduction of definitive thresholds in R2 led to the inclusion of an additional 6 agglomerations, and approximately a total of 2,100 km of major roads. The total length of railways included in R2 is still to be confirmed.

Table 101 END coverage – Finland

Round	Agglomerations	Major airports	Major railways	Major roads
1	1[92]	2[93]	96 km	645 km
2	7[94]	3[95]	2,330 km	2,243 km

10.2 Competent Authorities and designated administrative bodies

The Centres for Economic Development, Transport and the Environment (ELY Centres) coordinate the implementation of the END, providing support and advice to the cities and agencies involved. The ELY Centres operate on behalf of the Ministry of the Environment, legally responsible for the collection of data related to SNMs and NAPs. The authorities responsible for preparing and approving the SNMs as well as the NAPs are the Cities of Helsinki, Espoo/ Kauniainen, Lahti, Oulu, Tampere, Turku, and Vantaa, the Finnish Transport Agency and Trafi (the Finnish Transport Safety Agency).

Table 102 Administrative Responsibility for the END - Finland

Role/Activity	Agglomerations	Roads	Railways	Airports
Data collection	The Centres for Economic Development, Transport and the Environment (ELY Centres)	The Centres for Economic Development, Transport and the Environment (ELY Centres)	The Centres for Economic Development, Transport and the Environment (ELY Centres)	The Centres for Economic Development, Transport and the Environment (ELY Centres)
Preparing SNMs	Municipalities	Finnish Transport Agency	Finnish Transport Agency	Finnish Transport Agency
Approving SNMs	Finnish Transport Agency	Finnish Transport Agency	Finnish Transport Agency	Trafi (Finnish Transport Safety Agency)
Preparing NAPs	Finnish Transport Agency	Finnish Transport Agency	Finnish Transport Agency	Trafi (Finnish Transport Safety Agency)
Approving NAPs	Finnish Transport Agency	Finnish Transport Agency	Finnish Transport Agency	Trafi (Finnish Transport Safety Agency)
EC/EEA reporting	Uusimaa ELY Centre (Ministry of the Environment)	Uusimaa ELY Centre (Ministry of the Environment)	Uusimaa ELY Centre (Ministry of the Environment)	Uusimaa ELY Centre (Ministry of the Environment)

[92] Helsinki

[93] Helsinki-Vantaa, Helsinki-Malmö

[94] Helsinki, Tampere, Oulu, Espoo- Kauniainen, Lahti, Turku, Vantaa

[95] Helsinki-Vantaa, Helsinki-Malmö, Turku Airport

10.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

10.3.1 Data collection

The Uusimaa ELY Centre has overall responsibility for collecting and reporting data to the EEA through the Reportnet system within EIONET. Individual municipalities are responsible for collecting data in respect of agglomerations, while the Finnish Transport Agency and the Finavia are responsible for road and railways, and for airports respectively. The data has been delivered and is readily available for both Rounds.

10.3.2 Implementation issues

A number of issues were raised with regard to designation, a summary of which is shown below.

R1	R2
According to the implementation report for R1, road traffic data collection was challenged by the lower limit for traffic flow, which sometimes resulted in strange results. Nevertheless, Finland decided to stick to the lower limit for traffic flow for reasons of comparability of results for different areas.	No specific implementation issues have been reported for R2.
For aircraft noise, problems were encountered with regard to i) small airports inside agglomerations, ii) major airports near the boundary of an agglomeration, iii) civil and military airports.	

10.4 Noise limits and targets

10.4.1 Objectives and Scope

Finland does not legally enforce noise limit values. Instead there is a Government Decision on General Guideline Values for Noise Levels (993/1992) which was enacted under the Noise Abatement Act (382/1987).

By 2020 the Government's Guideline Values for Noise Levels (GVNL) must be met in present residential areas, in the vicinity of educational and care institutions, and in play-grounds. Daytime noise levels must not exceed 55 dB (L_{Aeq} 7-22). At night-time the value is 50 dB (L_{Aeq} 22-7). If this is not possible in all existing residential areas, noise abatement measures will be taken to restrict maximum daytime and night-time noise levels to 60 dB and 55 dB respectively. It is envisaged that noise abatement actions will initially be targeted at residential areas where the average daily noise levels exceed 65 dB.[96]

The Government Decision on GVNL concerns daytime and night-time. It is applied in the planning of land use, traffic and transport, and construction work and in permit procedures for construction work. They are also applied in environmental permit procedures. The GVNL are divided into outdoor and indoor noise values.

[96] Milieu, TNO and RPA (2010) Final Report on Task 1 Review of the Implementation of Directive 2002/49/EC on Environmental Noise

The table below outline non-binding target values for noise in Finland.

Table 103 - END Guideline noise values in Finland under Decision (993/1992)

Noise source	Noise limit values		Categories to which recommended noise values are applied
	L_{den}	L_{night}	
Road-traffic	58	51	Residential areas, recreational areas in built areas and areas in their proximity, and areas serving nursing or educational institutions
	58	46	New residential areas and areas serving nursing institutions
	48	41	Holiday settlements, camping sites, nature conservation areas
Rail-traffic	63	52	Residential areas, recreational areas in built areas and areas in their proximity, and areas serving nursing or educational institutions
	63	47	New residential areas and areas serving nursing institutions
	53	42	Holiday settlements, camping sites, nature conservation areas
Aircraft around airports	55	50	Residential areas, recreational areas in built areas and areas in their proximity, and areas serving nursing or educational institutions
	45	40	Holiday settlements, camping sites, nature conservation areas
Industrial activity sites	58	51	Residential areas, recreational areas in built areas and areas in their proximity, and areas serving nursing or educational institutions
	58	46	New residential areas and areas serving nursing institutions
	48	41	Holiday settlements, camping sites, nature conservation areas

The following legislation includes provisions on noise emissions:

- Road Traffic Act (267/1981), the Vehicles Act (1090/2002)
- Decree of the Ministry of Transport and Communications on the Construction and Equipment of Motor Vehicles and Trailers (1248/2002)
- Decree of the Ministry of Transport and Communications on the Construction and Equipment of Tractors, Power-driven Work Machines and Off-road Vehicles, their Trailers and Equipment (1251/2002)
- Decree of the Ministry of Transport and Communications on the Construction and Equipment of Two- and Three-wheeled Motor Vehicles and Four Wheelers gives (1250/2002)
- Decree on Noise Emission Levels for Equipment for Outdoor Use (621/2001)
- Act on the Safety and Emission Requirements of Recreational Craft (621/2005)
- Decree on the Safety and Noise Emissions of Recreational Craft and Personal Watercraft and Noise and Exhaust Emissions for Recreational Craft and Personal Watercraft Engines (748/2005)

10.4.2 Implementation issues

None reported.

10.5 Quiet areas

10.5.1 Overview

Finland has no designated quiet areas under the END. However quiet areas are likely to be included for Round 3.

10.5.2 Implementation issues

No issues were highlighted in either Round.

10.6 Strategic noise mapping

10.6.1 Overview

The table below shows the SNMs produced in Finland for Rounds 1 and 2.

Table 104 SNMs – Finland

	R1	R2
Agglomerations	1	7 (7)
Major airports	2	3 (3)
Major railways	1	8 (8) (2,330 km)
Major roads	1	8 (8) (2,243 km)

Source: the ELY Centres

For R1, Helsinki was the only agglomeration producing SNMs. For R2, the following cities have produced SNMs: The City of Helsinki, City of Tampere, City of Oulu, City of Espoo/ Kauniainen, City of Lahti, City of Turku, and the City of Vantaa. The airports Helsinki-Vantaa, Helsinki-Malmö produced SNMs for Rounds 1 and 2, and Turku Airport has produced SNMs for R2.

10.6.2 Data collection

For R1 data collection the Finnish authorities used various methods, including GIS for linking inhabitants to buildings. Movement, performance, and radar data were used for aircraft noise. There were no major challenges reported although some minor issues occurred with regards to noise barriers and numbers of people. The authorities used multiple guidelines, including the '2007 Good Practice Guide for Strategic noise mapping'; 'Presenting Strategic noise mapping information to the public'; 'Environmental Noise Data Reporting Mechanism Handbook'; and the 'Report Network Delivery Guide'.[97] The same methods continued to be used for R2.

Finland – including its cities/municipalities – has a long tradition of collecting noise data. The Uusimaa ELY Centre is the national coordinating body in Finland. The Centre is responsible for a range of regional implementation and development tasks on behalf of the central government, and END implementation is one of these tasks. The Centre provides guidance and Q&A sessions for the cities and authorities that are in charge of the actual data collection on the ground.

For R1 a SNM was prepared for the agglomeration of Helsinki, which included data on the noise caused by Helsinki-Vantaa and Helsinki-Malmö airports as well as data on the noise of highways and railways within the city area. The Finnish Road and Rail Administrations (today merged into the Finnish Transport Agency) conducted their own SNMs simultaneously with the city of Helsinki.

[97] Milieu, TNO and RPA (2010) Final Report on Task 1 Review of the Implementation of Directive 2002/49/EC on Environmental Noise

For R2, an additional six agglomerations were covered (Tampere, Oulu, Espoo/Kauniainen, Lahti, Turku and Vantaa. Finavia also covered Turku Airport.

No issues were reported on **data availability** (Rounds 1 and 2). Data collection had previously been carried out, independently of the END, by the stakeholders involved.

There is national guidance for strategic noise mapping. For both Rounds 1 and 2, L_{night} and L_{den} were used. Also the indicators L_{Aeq}(1.5m,07-22h) and L_{Aeq}(1.5m,22-07h) have been used. Exposure to noise in Finland is assessed by calculating SNMs and the population of residential buildings within specific noise zones. For both Rounds, calculations were made using the Nordic calculation models for road and rail traffic noise as well as the calculation model for air traffic noise. Road traffic noise was calculated for major highways, and the main and collector streets within the city area. Rail traffic noise was calculated for main railway lines, the metro light rail lines and tram traffic.

10.6.3 Public accessibility of SNMs

Summary information on the SNMs for the seven cities and three airports are available online via the respective municipality/authority. For R2, there have been very few enquiries from the public (approx. 10-20) and very limited participation in consultations. There is a general lack of interest from the public. In particular, Finland is a sparsely populated country and noise pollution is confined to a select few areas.

10.6.4 Implementation issues

According to the R1 Implementation Report, a number of implementation issues were brought up during R1. These are summarised in the Table below, along with new issues raised in R2.

Table 105 - Strategic noise mapping issues - Finland

R1	R2
Stakeholders indicated that there is a sense of disproportionally between the technical and administrative action demanded and the actual benefits for noise assessment and management. Regarding noise calculation methods and technologies, the Finnish respondents indicated that any EU level methodology must be compatible with the resources, programming and calculation capacities available. It has been noted in Finland that most of the detailed calculation methods have been tested only for small areas, not appropriate for the Finnish case. Five years was considered a rather short time interval between revisions of SNMs.	Five years is considered a rather short time interval between revisions of SNMs. Seven to 10 years could be more efficient use of national resources as there tends to be no or only minor changes noted during the five-year intervals.

10.7 Noise action planning

10.7.1 Overview

The table below shows the SNMs and NAPs for Finland for Rounds 1 and 2 respectively.

Table 106 NAPs - Finland

	R1	R2
Agglomerations	1	7 (7)
Major airports	2	3 (3)
Major railways	1 (96 km)	8 (8) (375 km)
Major roads	1 (approx. 750 km)	8 (8) (approx. 2,100 km)

Source: ELY Centres

10.7.2 Methodologies for noise action planning

Guidelines were established at national level though the ELY Centres for drawing up and implementing NAPs. These were also used for R2. The Centres also provided general support and functioned as a forum for discussion and for advice. The 2006 maps were used as a basis for developing the NAPs in 2008: the NAPs are based on 'the most urgent areas' identified in the SNMs. Similarly, for R2, the 2012 SNMs were used for the subsequent NAPs. Other key criteria used for the two Rounds were health-based assessments and Finnish guideline values.

For aircraft noise there were a number of additional criteria, namely i) air traffic safety and capacity management, ii) land-use planning, and iii) population near but outside the area of the noise limit values.

10.7.3 Measures

For R1, NAPs were prepared for the City of Helsinki, Helsinki-Vantaa airport, and the busiest highways and railroads.

For R2, NAPs have been prepared for an additional six agglomerations, the busiest highways and railroads and additional airports.

Generally, a key challenge for implementation of measures covered in the NAPs – for all the NAPs prepared – is obtaining the necessary financial resources. As a result, the measures presented tend to focus more on the building of noise barriers, activities to encourage reduction in traffic such as by promoting public transport (rail) over private transport.

For the biggest agglomeration's – Helsinki's – NAP, the long-term goals for noise abatement have been presented up until the year 2020 and cover:

- Protecting people living in areas of high noise level (over 65dB);
- Targeting the actions for noise abatement in areas where multiple people have been exposed to ambient noise;
- Protecting citizens so that the noise level inside their homes does not exceed the guideline levels set by the Council of State;

- Lowering the noise level in other susceptible locations, in addition to habitation;
- Preserving relatively silent areas;
- Ensuring that noise level in recreation areas remains low enough;
- Encouraging taking noise abatement into account in community planning; and
- Establishing an extensive selection of means for noise abatement.

10.7.4 Public consultations

For R1, no information was provided on public consultations for the NAPs for the City of Helsinki. Regarding the NAP for Helsinki-Vantaa airport, a public consultation was undertaken simultaneously with the environmental permit application. Participants heard 21 statements from the authorities and 220 opinions from the citizens were given on the environmental permit application. All statements and opinions were observed in the NAP hearing process. A consultation on Helsinki-Malmö airport NAP was considered unnecessary because of the existing environmental permit (15.2.2008) and the fact that a noise control plan had already been implemented by then. The competent authority confirmed that public consultations have been undertaken as part of R2. According to the competent authority, there have been very few enquiries from the public (approx. 10-20) and very limited participation in the consultations. There is a general lack of interest from the public. In particular, Finland is a sparsely populated country and noise pollution is centralised to a select few areas.

10.7.5 Implementation issues

A number of implementation issues have been brought up. These are summarised in the table below.

Table 107 Noise action planning issues - Finland

R1	R2
Finnish respondents indicated that strategic noise mapping should be clearly defined as a strategic activity aimed at enabling further choice, greater precision and the selection of effective measures at subsequent and more detailed stages. They felt that the examples of actions provided in Annex V were unhelpful and should be included elsewhere (in Guidance).	
Finnish respondents noted that the period of one year between finalising SNMs and developing NAPs was too short and that communicating the methodology to the public was problematic. Seven years was proposed as an appropriate time interval between revisions of NAPs.	
	A key challenge for implementation is securing the financial resources for measures on *existing* infrastructure. With a lack of resources, NAPs tend to focus on (future) planning rather than existing infrastructure.

11. FRANCE

11.1 National implementing legislation for END

11.1.1 Legal implementation

Directive 2002/49/CE was transposed in France through a number of different pieces of legislation, namely:

- Decree n°2006-361 of 24 March 2006[98] and the Order of 4 April 2006[99] regarding the establishment of SNMs and NAPs (termed "prevention plans" in the French context have been).
- The decree of 3 April 2006 establishing the list of airports mentioned in Article I of R 147-5-1 of the Urban Planning Code.
- Circular 7 June 2007 on the implementation of the policy for combatting noise. These provisions are transcribed in Articles L 572-1 to 572-11 and R 572-11 to 572-1 of the Environmental Code.
- Circular 10 May 2011 on the organization and financing of the SNMs and NAPs respectively due in June 2012 and July 2013 –, DGPR-DGITM. http://www.cete-est.developpement-durable.gouv.fr/a-textes-reglementaires-r1460.html
- Methodological note for the production of SNMs of major terrestrial transportation infrastructures for round, May 2011. http://www.cete-est.equipement.gouv.fr/b-methodologie-r1461.html

The purpose of Decree n°2006-361 is to stop or limit noises emissions or vibrations that present a hazard for people's health or for the environment. It applies specifically to the prevention of sound nuisances (neighbour disturbance,), urban development and building houses near to transport infrastructure, as well as the protection from environmental noise pollution for those living in proximity to airports. The Decree provides for strengthening enforcement and mitigation measures against noise nuisance. The legal provisions for major airports were directly transposed into the Urban Planning Code (Article R.147-5-1).

Organisational arrangements for ensuring coordination between relevant actors in the development of SNMs were specified in the circular of 7 June 2007 of the Ministry of Ecology, Development and Sustainable Planning. This also provides guidelines for the methodology for preparing NAPs.

Prior to transposition, Law n°92-1444 of 31 December 1992 regarding the combatting of environmental noise already regulated noise levels in areas not addressed through sector-specific regulations.

11.1.2 Scope of END implementation – Rounds 1 & 2

R1 of strategic noise mapping and noise action planning in France included 24 agglomerations, 9 airport(s), 983 km of railway and 12624 km of major roads. The introduction of definitive thresholds in R2 led to 34 *additional* agglomerations, and an

[98] http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=LEGITEXT000006053526

[99] Arrêté du 4 avril 2006 relatif à l'établissement des cartes de bruit et des plans de prévention du bruit dans l'environnement http://www.developpement-durable.gouv.fr/IMG/pdf/Arrete_du_4_avril_2006_sur_l_elaboration_des_cartes_de_bruit_et_des_PPBE.pdf

increase of circa 671% (+6300 km) in major railway lines. Major roads increased of circa 98 % (+12348 km).

Table 108 END coverage – France

Round	Agglomerations	Major airports	Major rail	Major roads
1	24	9	983 km	12,624 km
2	58	9	7,283 km	24,972 km

Source: EIONET country fiche, France, June 2014.

11.2 Competent Authorities and designated administrative bodies

In France, there is a largely decentralised approach to carrying out strategic noise mapping and noise action planning. This consists of state representatives in the Departments *("Préfet de département")* responsible for the designation of sites, the preparation of SNMs and the drafting of actions plans for major roads and railways and elected municipal bodies for the designation of sites, the preparation of SNMs and the drafting of NAPs for agglomerations. The overall approach to implementation and the role of different competent bodies is now summarised:

Table 109 Administrative Responsibility for the END – France

Role/Activity	Agglomerations	Roads	Railways	Airports
Data collection				French Ministry for Ecology, Energy, Sustainable Development and Energy
Preparing SNMs	Departmental territorial directorates (DDT) – working on behalf of the prefecture (préfet de département) Local authorities (communes and établissements publics à caractère industriel et commercial (EPCI)**	Départements (regional)* Local authorities (communes and établissements publics à caractère industriel et commercial (EPCI)** Infrastructure managers (e.g. RATP for the rail network, state airport authorities, motorway authorities).	Departmental territorial directorates (DDT) – working on behalf of the prefecture (préfet de département) Infrastructure managers (e.g. RATP for the rail network, state airport authorities, motorway authorities).	Infrastructure managers (e.g. RATP for the rail network, state airport authorities, motorway authorities).

Role/Activity	Agglomerations	Roads	Railways	Airports
Preparing NAPs	Departmental territorial directorates (DDT) – working on behalf of the prefecture (préfet de département) Local authorities (communes and établissements publics à caractère industriel et commercial (EPCI)**	Départements (regional)* Infrastructure managers (e.g. RATP for the rail network, state airport authorities, motorway authorities).	Departmental territorial directorates (DDT) – working on behalf of the prefecture (préfet de département) Infrastructure managers (e.g. RATP for the rail network, state airport authorities, motorway authorities).	Infrastructure managers (e.g. RATP for the rail network, state airport authorities, motorway authorities).
EC/EEA reporting	French Ministry for Ecology, Energy, Sustainable Development and Energy			

** There are 96 departments in metropolitan France (note – working in coordination with responsible national authorities)*

*** 729 local authorities and EPCIare involved.*

11.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

11.3.1 Data collection

In major agglomerations, data was generally available but was not centralised whereas in smaller agglomerations, data was not always available and had to be collected. Modelling estimates were used whenever actual data was unavailable. Since 1995, French roads have been classified by five noise level categories, with areas on the edge of roads flagged as "affected areas" where sensitive buildings, such as schools, hospitals and dwellings, need extra acoustic protection. These noise "hotspots" are required to be carefully monitored by the authorities.

11.3.2 Implementation issues

A number of issues were raised as a result of R1, a summary of which is shown below, together with actions taken to address them, and any new issues raised during R2.

Table 110 Designation issues - France

R1	R2
Local authorities experienced difficulty in collecting data on roads, leading to estimates being provided by the State ministry based on previous data.	The same difficulties were encountered for R2, especially for roads with a low volume of traffic.
Data collection in major agglomerations has been slow. Data were available but not centralised, whereas in smaller agglomerations, data were not always available and had to be collected. Estimates were used when actual data was unavailable.	Same as for R1 with problems for small communities in agglomerations.
	Data collection for major rail infrastructures was accelerated by a centralised database from "SNCF réseaux" the public body in charge of

R1	R2
	rail infrastructure.

11.4 Noise limits and targets

11.4.1 Objectives and scope

In the following table, mandatory limit values for noise are specified. These were adopted through the order of 4 April 2006 regarding the establishment of SNMs and NAPs.

Table 111 Noise limit values – France, 2010

	Day dB (A)	Night dB (A)	Comments
Road traffic *	68	62	Motorways, national roads and High-Speed Railways (TGV)
Rail traffic *	73	65	All conventional national railways falling under scope of the END.
Aircraft around airports	55		All airports falling under scope of the END.
Industrial activity site	71	60	All industrial installations falling under scope of END

* *Based on L_{aeq} instead of L_{den}, limit values for Roads and TGV = 70dB (day) and 65dB (night); Conventional trains = 73dB (day) and 68dB (night)*

No specific enforcement system is foreseen if the above limit values are exceeded, but these limit values must be taken into account during the design and commissioning of new railways, roads or during industrial works.

11.4.2 Methods for establishing noise limit values

The Noise Observatory *(l'Observatoire du bruit)* based its limit values on the classification of roads and noise "hotspots". Current L_{den} limit values are based on previous L_{aeq} limit values. Furthermore, the Noise Observatory overlaid noise "hotspot" maps drawn up since 1995 and END SNMs to identify whether the earlier hotspots remained hotspots. This was then fed back to the French Ministry to help inform the debate on limit values

11.4.3 Implementation issues

No issues were raised as a result of END implementation in R1. In R2, no specific issues relating to limit values were raised.

11.5 Quiet areas

11.5.1 Overview

Quiet areas (*les zones calmes*) are defined in Article L.572-6 of the decree of 24 March 2006 amending the Environmental Code and the Town Planning Code did not impose a method to identify quiet zones. The definition of quiet areas in French law is defined in a way that is quite flexible as: "Outdoor spaces with low noise exposure, in which the authority that establishes the plan wishes to control the evolution of this exposure given the human activities practiced or planned". However, in the views of some stakeholders, this definition is not sufficiently clear.

Major delays were experienced in R1 in the identification and creation of quiet areas in France. This was attributed in earlier literature to different understandings as to what constitutes a quiet area and a lack of consensus as to how this should be defined[100]. In particular, stakeholders have debated whether this should only be based on noise exposure levels or whether it is necessary to take into account other criteria. However, quiet areas are implicitly identified in noise maps themselves. Whereas red indicates the noisiest zones, green in the maps indicates the quietest areas within a noise map.

Although a good practice document was developed in 2008 (described later in this section), in Round 2, delays in defining quiet areas have persisted. The national CA and other French stakeholders were not able to provide any data and information on quiet areas, although the EEA 2014 Noise in Europe report suggests that there is one quiet area in Lyon, no further information or weblink was provided.

Delimitation

The detailed criteria for the definition and delimitation of quiet areas are not specified in the French national regulations transposing the END. Rather, these are left to the discretion of the responsible CA in charge of developing the NAP *(Plan de Prévention du Bruit dans l'Environnement (PPBE)).*

Under Article L.572-6 of the Environmental Code does not impose a single method to identify and designate quiet areas. Rather, each municipality is able to determine appropriate methods and means under the responsibility of the prefect.

Acoustic criteria alone are insufficient to meet the definition of a "quiet area". CAs are therefore required to select criteria to help them to define quiet areas, such as specifying noise limit values or other non-acoustic measures.

In order to help CAs to better define quiet areas, a National Guide (*Guide national pour la définition et la création des zones calmes - synthèse du référentiel national)*[101] was developed in 2008. This provides a definition and suggested criteria for the creation of quiet areas. It also serves as a "national synthesis repository" for information about good practices in respect of quiet areas. The guidance document states that the process of identifying quiet areas in urban areas needs to take into account the lack of quiet in most urban areas and the importance of preserving acoustic quality in an urban environment wherever this is good. It is suggested that the selection of quiet areas should be based on “multiple criteria, notably acoustic character, the uses and functionality of the area with a focus on preserving quiet within the urban soundscape in places of leisure”.

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[100] See http://www.journaldelenvironnement.net/article/la-creation-des-zones-calmes-prend-du-retard,10226

[101] http://www.developpement-durable.gouv.fr/IMG/pdf/Referentiel_national_pour_la_definition_et_la_creation_des_zones_calmes_-_2008-2.pdf

According to the 2014 EEA's "Good practice guide on quiet areas", only selected competent authorities have developed criteria for the selection of quiet areas. In Lyons, for instance, the criteria are noise mapping results and "accessibility". However, it is not defined what these criteria actually mean. Implementation issues

Issues raised in R1 and R2, together with actions taken to address them are shown in the table below.

Table 112 Noise limits and targets issues – France

Issue - R1	Issue - R2
A National Guide was developed in 2008 on quiet areas. This provides a definition for the creation of quiet areas. The purpose of the development of guidance was also to help build up a "national repository of practices on quiet areas".	The French national competent authority stated that during R2, awareness-raising actions on quiet areas have taken place. The 2008 guidance document on quiet areas (and supporting toolboxes) have been disseminated. However, responsible CAs have still experienced difficulties in actually creating quiet areas.
Since no uniform national methodology was put in place in Round 1, differences in the definition of quiet areas between localities arose.	There has been a lack of budget for more concrete measures to be taken relating to the designation and subsequent protection of quiet areas.

11.6 Strategic noise mapping

11.6.1 Overview

An overview of SNMs produced in Rounds 1 and 2 is shown below.

Table 113 SNMs - France

	Agglomerations	Major airports	Major railways	Major roads
R1	No data	9	88	2,168
R2	Roads (57)	8	176 (7,283 km)	3,978 (24,972 km)

Note – source EEA country report, EEA database of submitted NAPs. No bottom-up data provided by the national competent authority, although requested.

All 96 French départements are involved in the implementation of the END. In addition, at the level of the commune, a further 729 competent authorities are involved in noise mapping (according to an EEA country fiche on France from June 2014). However, there was some discrepancy in the numbers since the interviewee estimated 1200). The French CA commented that the numbers in the table represent a number of sets. Each set includes 5 different maps: L_{den}, L_{night}, the threshold on L_{den}, the threshold on L_{night} and noise classification.

In both Rounds 1 and 2, there have been problems in terms of the percentage completion of noise maps, especially for agglomerations where a decentralised approach has been adopted. According to the French national competent authority, some communes have not prepared noise maps in R1 or R2. This was attributed to a lack of budget and in some cases, an unwillingness to pay for noise mapping out of the municipal budget in smaller communes, when there was no dedicated state budget made available (unlike for noise mapping of major roads and other transport infrastructure outside agglomerations, which is paid for by the state.

By mid-2015, the position in respect of data completeness for SNMs was as follows:

Table 114 SNM data completeness

Round 1	Round 2
73% of noise maps approved	20% of noise maps approved

Source: interview with national competent authority, June 2015.

The situation has subsequently improved. The French CA has now taken steps to ensure that for those agglomerations where individual municipalities have refused to produce noise maps and action plans to adopt a "substitution" approach whereby the CA will pay for the SNM or NAP to be produced (albeit late). Funding support has been extended to those communes within municipalities that have recently entered within the scope of the directive due to the transition to the definitive threshold of the END, but where budget was either not available or the municipalities concerned (*communes)* refused to dedicate budget to noise mapping from their general budgets.

The estimated cost for the French state of producing these documents in the nearly 500 *communes* where they are presently missing during 2016 and 2017 is estimated to be 2 million euros. Approximately half of the SNMs and NAPs will be available by the end of 2016 and in late 2017 for the other 50%.

11.6.2 Data collection methods

For R1, data were largely provided by the IGN (National Geographic Institute) and presented in GIS form. There were delays caused by the need to collect data from different CAs.

Estimates of the number of exposed persons were quite difficult to obtain as the national population census is undertaken by household and not mapped in detail. The adopted method led to an over-estimation of the number of exposed people in R1. Since there is no mandatory method laid down in the END, this method was used by several cities, but not by all of them. Noise data from shipping traffic along inland waters has been included in agglomeration maps.

11.6.3 Strategic noise mapping methods

Only the minimum requirements in the Directive, L_{den} and L_{night} indicators, have been used for strategic noise mapping.

Several documents have been produced on strategic noise mapping methodologies for roads and railways by the SETRA (Service for Technical Studies for Roads and Motorways) and the CETE (Centre of Technical Studies on Equipment), for airports by the Civil Aviation Department, and for agglomerations by the CERTU (Centre for Studies on Networks, Transports, Town-planning and Constructions).

According to the Decree of 4 April 2006 on the establishment of SNMs and noise prevention plans in the environment, the measurement methods used in strategic noise mapping must comply with a number of French national standards, as well as international standards (aircraft noise).

The decree states that the methods of calculation must be consistent with the following international standards:

1 For industrial noise: ISO 9613-2: "Acoustics - Attenuation of sound during propagation outdoors, Part 2: General method of calculation

2 For aircraft noise: document of the European Civil Aviation Conference ECAC Doc. 29 " Report on Standard Method of Computing Noise Contours around Civil Airports

„, 1997, using the segmentation technique referred to in section 7.5 of ECAC Doc. 29;

3 For noise emitted by road and rail traffic: standard NF S 31-133:2007 or NMPB 2008 as soon as it was implemented in software: "Acoustics - Noise land transport - Calculation of the attenuation of sound during propagation outdoors environment, including meteorological effects."

In addition, the decree makes reference to the need for mapping to comply with the following French national standards:

- NF S 31-110 "Description and measurement of environmental noise - General Basic quantities and assessment methods";
- NF S 31-010 "Description and measurement of environmental noise - Specific measurement methods for other noise sources ";
- NF S 31085 " Description and measurement noise due to traffic ";
- NF S 31-088 "Measurement of noise due to rail traffic for its characterization for rail noise".

Looking ahead, France will in common with other EU countries be making the transition to the use of CNOSSOS common assessment methods.

11.6.4 Public accessibility of SNMs

Some transport infrastructure maps have been published by public authorities on their websites and are accessible to the public. Examples are the Préfecture of Bas-Rhin[102].

Making SNMs publically available is easier for roads and railways because different governments departments are responsible and where the French State was responsible for the development of SNMs and NAPs, these have tended to be adopted and published on a more timely basis than is the case for agglomerations (where municipalities are responsible). The publication of SNMs can only take place once they have been approved by the electoral body of the local authority in charge. It can therefore take considerable time before SNMs are published. Some local authorities have produced and published their SNMs however, and they are available on their website: e.g. *Communauté de Rennes*[103]:

CARTELIE is an application developed by the Ministry of Ecology, Development and Sustainable Development (MESD) to facilitate the publication of maps on the Internet relating to local geographical information and national standards. R1 maps for major roads[104] and major railways[105] were published for France as a whole on the MESD website. In R2, there were delays in the publication and availability of SNMs, especially for agglomerations.

Noise maps for major roads are produced at a departmental level and have typically been published. An example of a noise map published at departmental level is

[102] http://www.bas-rhin.gouv.fr/Politiques-publiques/Environnement-prevention-inondation-et-prevention-risques-technologiques/Bruit-des-transports/Bruit-des-transports-terrestres-dans-l-environnement/Cartes-de-bruit-strategiques-echeance-2012

[103] http://metropole.rennes.fr/politiques-publiques/environnement-economie-recherche/l-environnement/le-plan-bruit/

[104] http://cartelie.application.developpement-durable.gouv.Fr/cartelie/voir.do?carte=Reporting2007route&service=CEREMA

[105] http://cartelie.application.developpement-durable.gouv.Fr/cartelie/voir.do?carte=Reporting2007fer&service=CEREMA

available from the following website: http://www.territoire-de-belfort.gouv.fr/Politiques-publiques/Environnement/Bruit/Les-cartes-strategiques-du-bruit-des-infrastructures-routieres-du-Territoire-de-Belfort. This relates to the A36 *autoroute* and the main road RN1019.

For agglomerations, in R1, individual regions and communes have published noise maps and made these available online. In R2, however, there have been major delays in making SNMs publicly available. As noted earlier, the French government has recently recognised that there are nearly 500 *communes* where neither a SNM nor a NAP has yet been finalised, adopted and published. These will only be produced during 2016 and 2017 which means that they will be published several years late. Moreover, a further significant problem is that under the French approach to implementation, in an agglomeration where there are multiple noise maps being produced, the SNM for the agglomeration as a whole cannot be considered complete until all SNMs have been submitted and approved. This has therefore meant that even if the majority of SNMs are available, their publication has been highly fragmented and frequently delayed.

The role of NGOs / the not for profit sector and public sector organisations in raising awareness about environmental noise related issues should also be noted in France. For example, the Centre for Information and Documentation on Noise (CIDB - http://www.bruit.fr/) is a resource centre and information dissemination dedicated to promoting the quality of our sound environment. Information is available via its website that provides access to noise maps and to action plans. Consult www.bruit.fr/boite-a-outils-des-acteurs-du-bruit/cartes-de-bruit-et-ppbe/

Since France has implemented the END in a strongly decentralised way, the picture in terms of noise maps and action plans is quite fragmented. Therefore, organisations that bring this information together in an accessible way, such as the CIDB mentioned above, are quite useful. For example, the CIDB website brings together some (though not all) of the noise maps for large agglomerations[106].

The noise observatory in Paris (http://www.bruitparif.fr/en), which focuses on noise in the Ile de Paris region, fulfils a similar role. It was mentioned during the interviews that gaining access to noise maps is highly fragmented in France. For instance, in Paris, there are very many separate noise maps rather than a single noise map covering the whole Paris agglomeration.

11.6.5 Implementation issues

A number of issues were raised as a result of R1 relating to noise mapping, a summary of which is shown below, together with actions taken to address them, and any new issues raised during R2.

Table 115 Strategic noise mapping issues - France

R1	R2
Multiple-exposure in agglomerations was not taken into account. However, multi-exposure maps are not required in the END	Still valid
Industrial installations in agglomerations were mapped from numerous small sources at the edge of sites, resulting in local authorities having to redo industrial SNMs in agglomerations	Still valid

[106] See for instance www.bruit.fr/boite-a-outils-des-acteurs-du-bruit/cartes-de-bruit-et-ppbe/exemples-de-cartes-publiees/cartes-strategiques-du-bruit-dans-les-grandes-agglomerations.html.

R1	R2
A concern as to whether the future use of an EU-wide common assessment methodology would be better than the existing national approach, which was considered to be superior.	Transition to CNOSSOS from R4.
	Although individual noise maps are accessible, access is highly fragmented since there are a large number of noise maps overall. It is difficult to obtain an overview. However, NGOs/ not-for-profits have helped to bring together links to noise maps from a wide range of sources though portals which provide an overview[107].

11.7 Noise action planning

11.7.1 Overview

An overview of the number of NAPs submitted in France in R1 and R2 is shown in the following table.

Table 116 NAPs – France

	R1	R2
Agglomerations	57	19
Major airports	9	9
Major railways	29	53
Major roads	253	129

Source: First implementation review fiche and the EEA. For roads, data was provided directly by the French national CA. Note – this only relates to data that has been accepted as complete by the French national authorities and published rather than the number of NAPs expected.

The figures in table above relating to agglomerations refer to the number of NAPs produced. In many instances, several NAPs have been produced for one agglomeration. Hence, the number of NAPs for R1 agglomerations is higher than the total number of agglomerations within END scope.

There have however been considerable delays in the development of NAPs in both Rounds 1 and 2, with many NAPs not formally approved by the responsible authorities. This is shown in the following table, which is an estimate provided by the national competent authority in respect of the position on data completeness for NAPs in mid-2015:

Round 1	Round 2
20% of noise action plans approved	10% of noise action plans approved

Source: interview with national competent authority, June 2015.

[107] www.bruit.fr/boite-a-outils-des-acteurs-du-bruit/cartes-de-bruit-et-ppbe/exemples-de-cartes-publiees/cartes-strategiques-du-bruit-dans-les-grandes-agglomerations.html.

In July 2016, additional data was provided by the Competent Authorities, according to which only 4 (Round 1) and an additional 3 (Round 2) agglomerations have published *all* their NAPs – a total of 7.

The interview with the national CA with overall responsibility for END implementation and reporting to the EC in France identified possible explanatory factors as to the lack of data completeness, such as the fact that within agglomerations, a very fragmented approach has been adopted to noise mapping and some communes have refused to produce a noise map, leading to considerable delays in noise mapping and action planning processes.

A lack of budget at local level was also cited by the CA as a reason for delays in NAP development for agglomerations. There was also concern among some CAs at the local level that if they published a NAP, and identified expenditure measures, they would not have the budget to follow through and actually implement measures. The CA confirmed that whilst significant national investment has been made in noise abatement and mitigation for major roads and through a national insulation scheme for airports, a problem is that municipalities do not have funding for noise mitigation.

An example of the type of problems encountered in respect of the timely submission of END reporting data in France was the case of **major roads**. In R1, in France, 253 NAPs were meant to be produced for major roads, including 96 that were due from the state. Of this total, 157 have so far been submitted (62%). Of the total 253, a total of 97 were due to be produced by the French state covering state roads. Of these, 87 have already been submitted (i.e. circa 90%). This demonstrates that there is a specific problem in relation to highways and smaller, departmental roads where other administrative bodies such as county councils are responsible for producing NAPs, which accounts for the remainder of the road NAPs due to be submitted. As with noise mapping, delays are partly attributable to budgetary availability at a non-State level.

In relation to **agglomerations**, part of the reason for the delays is that in urban areas of France, there are often a number of different NAPs produced by different CAs. Therefore, a given city is only considered to have completed their obligations in respect of the finalisation and adoption of NAPs when all the different urban areas that collectively make up a large town or city have adopted and published their NAP. So even in a situation within an agglomeration where 90% of municipalities have published their NAP, since all the NAPs have not yet been completed, this means that the city concerned has not met their overall reporting requirements to the French national CA. Many French cities are in this situation. For example, the agglomeration of Lille (1 million people) has conducted and approved its overall NAP but since the NAPs for some urban districts within the Lille conurbation have not published their NAP, the overall NAP has not yet been published. Consequently, Lille is not reflected in the statistics. According to the French national CA, several cities are in the same situation.

The French CA has also taken steps in 2016 to compel municipalities that have taken several years to produce a NAP to actually publish the NAP, since otherwise this cannot be considered as completed from an END reporting perspective. The CA is also launching "Round 3" (Review and if necessary the revision of R2 documents for 2017 and 2018).

11.7.2 Methodologies for noise action planning

At the request of the Ministry of Ecology and Sustainable Development, *Guidance for the development of NAPs*[108] was produced by ADEME *(l'Agence de l'Environnement et de la Maîtrise de l'Énergie) i*n 2008.

Before the adoption of the END, French noise policy was already centred on the development of Prevention Plans for Noise in the Environment (PPBE), which was a mechanism through which the state services could put in place anti-noise measures and draw up draft NAPs. However, a key difference was that actions and measures did not have to be based on SNMs. A bill of 23 July 2008 from the Directorate General on Risk Prevention and the Directorate General on Infrastructures, Transports and Sea sets out the methodology for Noise action planning and states explicitly that the 2006 SNMs used by the Directorate for Infrastructure Development in the Departments (which is in charge of Noise action planning on behalf of the *Préfet*) should form the basis for Noise action planning.

11.7.3 Measures

Among the main selection criteria for selecting measures were prioritising measures in areas affected by high population exposure and the level of implementation costs.

Among the noise abatement measures identified in R1 NAPs in France were traffic planning, land-use planning, technical measures at noise source, insulation, the reduction of sound transmissions and incentive measures (to encourage investment in insulation). In R2, broadly similar types of measures were being supported in the sample of PBBE consulted by the study team. There was however in the case of major roads a greater emphasis on quiet road surfaces where a nationally funded scheme has been supported. In terms of expenditure, *EUR50m on noise mitigation for roads is made available annually from the state budget and a further EUR50m from the collectivités i.e. EUR100m per year.* It was also noted by the national CA that some measures pre-exist the adoption of the END. For instance, a soundproofing aid assistance system is provided in the noise French law since 30 December 1992. There were problems in ensuring sustainable funding for insulation in the early years so it has in practice been implemented since the late 1990s only and using the state budget. It was noted however that "the directive has greatly increased the volume of aid for noise insulation".

Another key development was that in 2003, the French government created the TNSA, which is tax that has been paid since 1 January 2005 by airlines under the "polluter pays" principle. This has raised significant funding to reinvest in noise insulation and other measures to mitigate noise. Another criterion for taking action at the national level is the noise exceedance level.

11.7.4 Public consultations

The 2006 decree transposing the END states that public consultations should take place on the same basis as normal public consultations for impact assessments (as defined in Law "Bouchardot" of 12 July 1983).

There were delays during R1 in public consultations getting underway, although the role of public consultation was foreseen in the 2006 decree and is built into the approval process for NAPs. Depending on the type of NAP, consultation is organised by the state services (in the case of major roads and infrastructure outside agglomerations) and by local authorities (agglomerations).

[108] http://www.developpement-durable.gouv.fr/IMG/pdf/Guide_pour_l_elaboration_des_PPBE_-_ADEME_-_2008-2.pdf

In R2, public consultation often took place later than expected, in 2014 and extending into 2015, with many R2 NAPs consequently not finalised until 2015, compared with the 2013 deadline.

The general approach to consultation relating to Noise action planning in France is as follows:

- Following the preparation of a draft NAP, a statutory public consultation takes place over a 2-month period.
- Responses can be submitted either electronically or in writing.

An example of public consultation in France is now provided:

Public consultation in the Isère region in France

In order to inform the finalisation of the draft NAP for the Isère region for the 2013-2018 period, a public consultation was organised. This focused on national major roads infrastructure (roads, motorways) passing through the Isère region and in respect of major railways.

The public consultation[109] ran for a 2-month period from 15th September to 15th November 2014. Residents were able to reply either electronically or by mail but only one commune and three residents responded to the 8-week consultation. Following this consultation, the regional authority carried out a synthesis assessment of the consultation responses. Managers of transport infrastructure mentioned in the NAPs provided a response to the public consultation feedback received. The final document was by approved by the prefect on May 25, 2015 and accompanied by a supporting note setting out the consultation results.

Example of a public consultation from the Alpes-Maritimes area - http://www.alpes-maritimes.gouv.fr/Actualites/Breves/Consultation-publique-sur-le-plan-de-prevention-du-bruit-de-l-autoroute

Although many public consultations in France have already been finalised, not all R2 public consultations have yet been completed. For instance, in the area of major roads, the public consultation period for the *Plan de Prévention du Bruit dans l'Environnement du réseau autoroutier concédé dans les Alpes-Maritimes* ran from May 11th to July 11th 2015.

11.7.5 Implementation issues

A number of issues were raised during R1, a summary of which is shown below, together with any subsequent actions taken to address them, and new issues raised during R2.

Table 117 Noise action planning issues - France

R1	R2
Guidance was sought on the contextual format of the plans (whether the PPBE should be presented under a text format or an electronic format for instance).	The length of time between the submission of SNMs and the development of NAPs was problematic in many regions. Public consultation was still ongoing in mid-2015 in some *départements* and *régions* whereas the NAPs should have been published before the end of 2013.

[109] http://www.isere.gouv.fr/Politiques-publiques/Environnement/Bruit/Directive-europeenne-du-bruit-dans-l-environnement/Plans-de-prevention-du-bruit-dans-l-environnement-en-Isere

Coordination of various responsible bodies	
Multi-exposure measurement	The challenge of assessing the cumulative effects of noise across different sources has not been addressed. Although not required in the END, some CAs would like to be able to do this to engage with citizens more.
PPBE are currently not synchronised with the revision of road classification, which also takes place every 5 years. Once these are synchronised, CAs will then be able to ensure complementarity in revising documents relating to road noise levels.	Now synchronised.

12. GERMANY

12.1 National implementing legislation for END

12.1.1 Legal implementation

The END is implemented at federal level through the Law for the Implementation of the EU Guidelines on the Evaluation and Abatement of Environmental Noise (*Gesetz zur Umsetzung der EG-Richtlinie über die Bewertung und Bekämpfung von Umgebungslärm*). The law came into force on 30th June 2005[110] and has been incorporated into para. 47a-47f of the Federal Emissions Protection Law (*Bundesimmissionsschutzgesetz (BImSchG)*). The Federal Ordinance on Strategic Noise Mapping, which came into force on 16th March 2006 (*34. BImSchV, Verordnung für die Lärmkartierung*)[111], sets out technical requirements and establishes European L_{den} (day-evening-night noise indicators for overall annoyance) and L_{night} (night-time noise indicator for sleep disturbance) as the basis for Strategic noise mapping.

This Ordinance is complemented by non-binding Technical Guidelines for Strategic Noise Mapping (*Hinweise für die Lärmkartierung*)[112] and Noise Action Planning (*Hinweise für die Lärmaktionsplanung*)[113] produced by the Federation of Federal States' working group on emissions protection, as well as guidelines drafted by individual Federal States (Länder).

12.1.2 Scope of END implementation – Rounds 1 & 2

R1 of strategic noise mapping and noise action planning in Germany included 40 agglomerations, 8 airport(s), and approximately 17,000 km of major roads and 7,400 km of major railways.

The introduction of definitive thresholds in R2 led to 48 *additional* agglomerations and 14 *additional* airports being covered as well as an increase in coverage of major railway lines to 16,795 km and major roads to 48,587 km.

Table 118 END coverage – Germany

Round	Agglomerations[114]	Major airportsError! Bookmark not defined.	Major rail[115]	Major roads[116]
1	40	8*	7,400 km	17,000 km
2	88	22*	16,795 km[117]	48,587 km[118]

** numbers include NAPs produced for districts bordering airports, EEA data for 11 airports in R2*

[110] In: Federal Law Gazette vol. 2005, chapter I, pp. 1794 ff.

[111] In: Federal Law Gazette vol. 2006, chapter I, pp. 516 ff.

[112] http://www.umweltbundesamt.de/sites/default/files/medien/pdfs/LAI-Hinweise_Kartierung.pdf

[113] http://www.lai-immissionsschutz.de/servlet/is/20170/LAI-Hinweise.pdf?command=downloadContent&filename=LAI-Hinweise.pdf

[114] As reported to the EC.

[115] In: http://www.eba.bund.de/DE/Service/FAQs/Laerm/faq_laerm_node.html

[116] http://www.lai-immissionsschutz.de/servlet/is/20170/LAI-Hinweise.pdf?command=downloadContent&filename=LAI-Hinweise.pdf

[117] EIONET data analysis

[118] EIONET data analysis

12.2 Competent Authorities and designated administrative bodies

Strategic noise mapping as well as noise action planning for agglomerations and roads prevalently is a responsibility of the municipal authorities. Some federal states however carry out the mapping of main roads and airports in order to support the municipalities. Others such as the federal state of Hesse carry out strategic noise mapping as well as noise action planning state-wide for these noise sources without municipality involvement. Strategic noise mapping of railways falls within the competence of the Federal railway authority (*Eisenbahn-Bundesamt*) and is carried out on a national level.

Federal State authorities are each responsible for collating maps and reporting to the Federal Ministry of the Environment, Conservation and Reactor Safety (*Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit)*, which in turn is responsible for providing completed SNMs as part of the reporting process to the European Commission.

Table 119 Administrative Responsibility for the END in Germany

<table>
<tr><th>Role/Activity</th><th>Agglomerations</th><th>Roads</th><th>Railways</th><th>Airports</th></tr>
<tr><td>Preparing & approving SNMs</td><td>Municipalities and Federal States</td><td>Municipalities and Federal States</td><td>Federal Railway Authority and Federal States</td><td rowspan="3">Federal States</td></tr>
<tr><td>Preparing NAPs</td><td>Municipalities, regional authorities and/or Federal States</td><td>Municipalities, regional authorities and/or Federal States</td><td>Municipalities, regional authorities and/or Federal States</td></tr>
<tr><td>Approving NAPs</td><td>Authority responsible for preparing the NAP</td><td>Authority responsible for preparing the NAP</td><td>Authority responsible for preparing the NAP</td></tr>
<tr><td>EC/EEA reporting</td><td colspan="4">Federal Ministry of the Environment, Conservation and Reactor Safety
Federal States</td></tr>
</table>

The large number of responsible administrative authorities involved in strategic noise mapping and noise action planning, reflects the federal state structure and the decentralised arrangements extending to the municipality level. As an example, the number of responsible authorities in the Federal State of Bavaria for noise action planning are summarised in the following table.

Table 120 Responsible administrative authorities for the END in Bavaria (Noise action planning)

	R1	R2
Municipalities incl. agglomerations	77	294
Federal State of Bavaria	9	9

According to a German Acoustics Association[119], this decentralised approach quite often meant that administrative entities lacked competence, i. e. rural communities adjacent to a major road or railway line lacking the possibilities to implement source-related measures. However, a recent revision of the corresponding law now obliges the German Railway Agency EBA to design the NAP for major railway lines.

An implementation issue highlighted by a German Acoustics Association is that the designation of CAs on a decentralised level lead to some responsible authorities lacking the competence to impose measures in their vicinity – this has since been revised, however.

11.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

12.2.1 Data collection

Data to delimitate major roads, railways, airports and agglomerations according to the definitions of END was available for both Rounds and were provided from the Federal states.

Under the directive of BImSchG (Bundes-Immissionsschutzgesetz), agglomerations are defined as areas with more than 100,000 residents and a population density of more than 1,000 residents per square kilometre. The Federal states mainly used the municipal borders to define agglomerations. Some agglomerations were also defined by functional or urban relation.

Major roads under the directive of BImSchG are national and state roads with a traffic volume of 3 million motor vehicles per year.

12.2.2 Implementation issues

A number of issues were raised as a result of R1, a summary of which is shown below, together with actions taken to address them, and any new issues raised during R2.

Table 121 Designation issues - Germany

R1	R2
Lack of clarity on the use of administrative and political boundaries or population thresholds and density. Lack of political willingness at regional level and among local authorities at municipality level to classify which areas crossed national borders as agglomerations.	To achieve community understanding the authorities are encouraged to communicate the compulsory mapping coverage to the public. For agglomerations it is recommended to extend the mapping to the requirements of the NAP. This implicates the mapping of the main road network as a minimum.
Much frequented municipal roads were excluded from the NAP in the first round, which led to an incomprehensive mapping outside of agglomerations. This was difficult to explain to the communities that also experienced noise problems and averted a regional observation of road network structures.	Within R2 of noise action planning, municipalities often recalculated the SNMs and added noise relevant local roads falling into END scope (more than 3 million cars/year). This led to more comprehensive mapping outside of agglomerations.
Indistinct information in the END regarding noise sources other than the main sources. This led to incomplete collection of data	Indistinct information in the END regarding noise sources other than the main sources

[119] Noise Control Association of the German Acoustical Society

R1	R2
and lack of understanding in the community.	remains an issue.

12.3 Noise limits and targets

12.3.1 Objectives and Scope

12.3.2 Purpose

The primary aim of noise related regulations as constituted in para. 1 BImSchG is to provide precautions against harmful effects on the environment and humans. This includes health risks as well as considerable disadvantages and nuisances. To ensure compliance, adherence with limit values is verified in advance. Therefore, exceedance of noise limits is prevented by the provisions in the planning stage of a development. In case of airports, only passive noise reduction measures are applied.

There are three broad sets of noise limit values in Germany. These cover:

- Installations
- Road and railway traffic
- Aircraft and airports

12.3.3 Installations

Noise emitting from installations is regulated by the *Federal Emission Control Act* (BImSchG) and the associated Technical Instruction on Noise Abatement (*Technische Anleitung zum Schutz gegen Lärm (TA Lärm*[120]), as per § 48 BImSchG). The TA Lärm sets noise limit values, but is normally not legally binding as an administrative provision. However, the Federal Administrative Court has established in its rulings that technical administrative provisions that further detail the related legislation are generally legally binding not only for administrative bodies but also for the national courts[121]. Values are generally applicable indicators, but deviations are permissible in individual cases.

Table 122 Limit values for noise from installations - Germany

Land-use type	Noise limit values	
	Day dB (A)	Night dB (A)
Industrial	70	70
Commercial	65	50
“Core areas”, villages and mixed areas	60	45
General residential areas and small residential estate	55	40
Pure residential	50	35

[120] In: Official Ministry Gazette No. 26 of 28 August 1998 pp. 503 ff.

[121] Whyl-judgement, in: Official Collection of the Federal Administrative Court’s decisions, BVerwGE 72, 300, 320.

Spa districts, next to hospitals and nursing institutions	45	35

12.3.4 Road and railway traffic

The noise limits stipulated in the *Traffic Noise Protection Ordinance (Verkehrslärmschutzverordnung, 16 BImSchV)*[122][123] must be observed during construction of, or essential changes to, public roads and railways for local and long-distance transport.

Table 123 Limit values for noise from road and rail traffic - Germany

Land-use type	Noise limit values	
	Day dB (A)	Night dB (A)
Next to hospitals, schools, rehabilitation centres and retirement homes	57	47
Pure and general residential areas and small residential estate areas	59	49
In "core areas", villages and mixed areas	64	54
Commercial	69	59

12.3.5 Airplanes and airports

The Act on Aircraft Noise (*Fluglärmgesetz/FluLärmG*)[124] sets out day and night protection zones (areas surrounding an airport, where certain noise levels are exceeded). In such zones, noise remediation must be provided and, if not sufficient, certain forms of land use are prohibited, such as the building of hospitals, retirement homes, rest homes and similar facilities. In some cases, the owner of an effected property must be compensated.

Table 124 Limit values for noise from airports - Germany

	Civil		Military	
	New build or extended dB(A)	Existing dB(A)	New build or extended dB(A)	Existing dB(A)
Day-Protection zone				
1: L_{Aeq} day =	60	65	63	68
2: L_{Aeq} day =	55	60	58	63
Night-protection zone				
L_{Aeq} Night =	50	55	50	55
L_{Amax} =	6 times 53	6 times 57	6 times 53	6 times 57

[122] In: Federal Law Gazette vol. 1990, chapter 1, pp. 1036 ff.

[123] 16BImSchV, Verordnung zur Änderung der 16. Verordnung des Bundesimmissionsschutzgesetzes _April_2014

[124] In: Federal Law Gazette vol. 2007, chapter 1, pp. 2551 ff.

12.3.6 Non-binding target values

Neither the BImSchG nor the 34. BImSchV establish legally binding trigger thresholds for NAPs, although para. 4 of the latter states that SNMs[125] must graphically depict noise values, the exceedance of which can trigger a requirement for noise action planning and mitigation measures.

The German Federal Environmental Agency (*Umweltbundesamt/UBA*) recommends non-binding trigger thresholds for NAPs.[126]

Table 125 Umweltbundesamt non-binding trigger thresholds for NAPs - Germany

Objectives	Time frame	L_{den} dB (A)	L_{night} dB (A)
Avoidance of health hazard	Short-term	65	55
Reduction of substantial noise disturbance	Medium-term	55	45
Avoidance of substantial noise disturbance	Long-term	50	40

The Federal States of Brandenburg, Saxony and Schleswig-Holstein provide municipalities within their jurisdiction with threshold and orientation values similar to the UBA's short- and medium-term recommendation. Other Federal States operate with higher trigger thresholds that do not completely eliminate the possibility of substantial noise disturbance and health hazards.

12.3.7 Implementation issues

Germany has a very detailed sectoral legal regime for noise. This includes:

- Bundes-Immissionsschutzgesetz, including requirements for protection against harmful effects on the environment, e.g. noise from industry and trade installations, municipal roads and railways
- Verkehrslärmschutzverordnung (16. BImSchV) specifying emission limit values for construction and extension of municipal roads and railways
- Verkehrswege-Schallschutzmaßnahmenverordnung (24. BImSchV) including requirements to the nature and extent of noise protection measures
- Noise abatement programme for existing state roads since 1978
- Noise abatement programme for existing state railways since 1998
- Act on Aircraft Noise
- Regulation on data collection and calculation procedures for determination of noise protection areas (1. FlugLSV)
- Schallschutzverordnung (Directive for noise protection)
- Technische Anleitung zum Schutz gegen Lärm - TA Lärm including emissions limit values for industry and trade installations

[125] The BMU reported to the European Commission noise limit values for noise maps (Art. 5 subsection 4 END). However, these values were not incorporated in the LAI' s non-binding technical guidelines for noise mapping.

[126] German Federal Environmental Agency: http://www.umweltbundesamt.de/themen/verkehr-laerm/umgebungslaermrichtlinie/laermaktionsplanung

In 2010, noise abatement programmes at a federal level were increased to € 50 million for existing federal highways and to € 100 million for federal railways. Additionally, in the framework of the "economic stimulus package two" (Konjunkturpaket II) the Bund (federal level) made another € 3.5 billion available which could, inter alia, be invested in noise management measures.

12.4 Quiet areas

12.4.1 Overview

Quiet areas are solely defined for agglomerations within the framework of noise action planning, with various approaches being used on definition and delimitation. In a R1 survey, 30 % of the municipalities confirmed they had identified quiet areas. No data is yet available in the framework of NAP production for R2. The table below shows selected major agglomerations where quiet areas are identified or have already been established.

Table 126 Quiet areas in selected major cities

Agglomeration	Number of quiet areas	Determination between
Berlin	11 37	- quiet areas (according to END) and - inner city recreational areas (smaller areas, quieter than surroundings)
Bremen	> 20 > 30 > 90	- quiet regional zone - quiet agglomeration zone - city oasis
Hamburg	52	Quiet areas in the future to be determined between especially quiet regional zone / quiet agglomeration zone / inner city space / quiet axis / city oasis
Munich	 11 17 17	Recommendations on the establishment of quiet areas as follows: - quiet areas - inner city recreational areas - landscaped recreation areas

Definition

There is no legal definition of quiet areas, but Para. 47a of the BImSchG stating environmental noise provision also applies to quiet areas in agglomerations and rural areas as defined by the END.

Non-binding Technical Guidelines for Noise action planning "*Hinweise für die Lärmaktionsplanung*" indicate that the determinant factor as to whether an area can be defined as a quiet area is that the area is not exposed to noise from traffic, industrial, commercial or leisure activities. The area's location alone is insufficient to be deemed a quiet area. The extent to which there are economic activities taking place in the area needs to be taken into account. The competent municipality also needs to determine that the area is covered by a NAP. Whether an area contains buildings is irrelevant.

Among the criteria for being defined as a *quiet area in the countryside* are large-scale areas that are not exposed to anthropogenic noise, except for noise due to forestry and agricultural use. Mapped areas judged not to be noisy are also potential quiet areas, as well as areas with sound levels below L_{den} = 40 dB (A). Quiet areas in the countryside are not usually defined since relevant areas are not covered by the END mapping targets.

Quiet areas in agglomerations are characterised as quiet landscape areas, and generally represent naturally preserved spaces or those used by forestry and agriculture. Various approaches are adopted in order to define quiet areas in agglomerations as presented in the following section.

Delimitation

The Technical Guidelines for Strategic Noise Mapping leave the determination of quiet areas under NAP development to the discretion of the CAs. Usually, threshold values in between L_{den} 50 and 55 dB(A) are applied. Many cities also use a differential value e.g. 6 dB(A) to distinguish the border and inner centre of a quiet area. In some cases, a minimum area size is determined and more often quiet areas are further categorised based on noise levels, location, size and accessibility.

12.4.2 Implementation Issues

No issues were raised as a result of END implementation in R1 as the focus was on NAP production rather than quiet areas. Issues raised in R2, together with actions taken to address them are shown in the table below.

Table 127 Quiet area implementation issues: R2

Issue	Action
Definition of quiet areas as well as the legal consequences are unclear. Depth of Strategic noise mapping is insufficient to identify quiet areas on the basis of the noise level values.	Some federal states have identified quiet areas by the means of reverse strategic noise mapping thus identifying areas with low noise levels to assist municipalities in establishing quiet areas. Consideration on planning requirements to allow for adequate protection.

12.5 Strategic noise mapping

12.5.1 Overview

An overview of SNMs produced in Rounds 1 and 2 as reported to the EC is shown below.

Table 128 SNMs - Germany (as reported to the EC[127])

	R1	R2
Agglomerations	35	72 (88)
Major airports	8	13 (22)
Major railways	4	1* (16,795 km)
Major roads	9	14 (48,587 km)

** Maps of 16 federal states combined in one map from Federal Railway Authority.*

[127] http://cdr.eionet.europa.eu/de/eu/noise/df8/coluk47sq (as of 2012) and http://cdr.eionet.europa.eu/de/eu/noise/df8/colvi7k8q (updated 2014)

12.5.2 Data collection

Para. 3 of the BImSchV empowers CAs to order data required for strategic noise mapping free of charge from authorities and natural and legal persons who run certain noise emitting facilities, for example railways, transport companies, civil airports, and harbours.

During R1, many Federal State bodies used GIS technology to collect, compile and conflate data. E.g. Bremen and Bayern also engaged external consultants to carry out data collection. Mecklenburg-West Pomerania stores data in a different format allowing easy access to it by the municipalities.

During R2, in some states, e.g. in Baden-Württemberg, external consultants were assigned to improve the database. In North Rhine-Westphalia, a state wide database was held available consolidating several data sources: Geobasis. NRW supplied data on buildings and topography and Straßen. NRW provided details on road traffic and noise protection structures.

Overall, the method of data collection of R1 was maintained in R2.

12.5.3 Strategic noise mapping methods

The legal regime for Strategic noise mapping is based on:

- Para 4 of 34. BImSchV, which states that SNMs must:
    - Comply with the minimum requirements set out in Annex 4 of the END
    - Be developed separately for every type of noise on the basis of L_{den} and L_{night}
- Para. 4 of the 34. BImSchV regulates the noise levels to be graphically depicted with noise contours in the SNMs and the corresponding colours, according to DIN 18005[128].

Major noise sources, area categories, cities, villages, rural areas and urban areas and land use must be graphically depicted.

A SNM must also:

- Provide information on existing or planned naps, and include a table showing the areas exposed to noise.
- Depict the exceedance of a trigger threshold for potential or actual Noise action planning.

Provisional calculation methods can be found in para. 5 of the 34. BImSchV in connection with published calculation methods of the competent ministries. Complementing the 34. BImSchV, the Federal States working group for emission protection (LAI) has developed non-binding technical guidelines "*Hinweise zur Lärmkartierung*"[129].

[128] DIN 18005 part 2, September 1991, published by the Beuth Verlag GmbH, 10772 Berlin and archived in the German Patent and Trade Mark Office in Munich.

[129] http://www.mufv.rlp.de/fileadmin/img/inhalte/laerm/neu_LAI-Hinweise-Laermaktionsplanung.pdf

As the END does not provide harmonised calculation methods for noise indicators, national procedures are used, based on the Provisional Calculation Methods defined in 2006[130]:

12.5.4 Public accessibility of SNMs

The German Federal Railway Authority, the Federal States and the agglomerations have published digital SNMs. The R1 maps were provided in the previous legal implementation review. Information sources relating to Round 2 implementation are usually provided through interactive noise maps on the official internet sites of the federal state agencies[131] as well as the internet site of the Federal Railway Authorities for noise maps relating to railway noise[132].

12.5.5 Implementation issues

A number of issues were raised as a result of R1, a summary of which is shown below, together with actions taken to address them, and any new issues raised during R2.

The main effort – about 90 % - in meeting the strategic noise mapping requirements consisted of the acquisition, processing and preparation of a vast amount of input data. This led some federal states to support small municipalities by conducting Strategic noise mapping through a central department. In R2 larger cities that had already experience from the previous round where able to resolve issues easier.

Table 129 Strategic noise mapping issues - Germany

R1	R2
Generating sufficient data to provide valid estimates of individuals exposed to noise Generating data for graphical depictions of houses, schools and hospitals exposed to noise and exceedance of trigger thresholds Differing quality of input data Varying data sources let to mismatching noise levels along adjoining mapping areas Lack of human and technical resources	Road traffic census 2010 to be conducted in a timely manner to generate reliable data for R2 in 2011 Recommendation to the municipalities to start collating data early in the process of R2. Achieve assurance for easy access to geographical data through federal guidelines and support from the CAs. Access to population data to be available through a central department to ensure data protection.

[130] Provisional Calculation Methods for Environmental Noise from Roads (VBUS)
Provisional Calculation Methods for Environmental Noise from Railways (VBUsch)
Provisional Calculation Methods for Environmental Noise at Airports (VBUF)
Provisional Calculation Methods for Environmental Noise from Industry and Commerce (VBUI)

[131] E.g. Brandenburg: http://udo.lubw.baden-wuerttemberg.de/public/pages/map/default/index.xhtml

[132] http://laermkartierung1.eisenbahn-bundesamt.de/mb3/app.php/application/eba

12.6 Noise action planning

12.6.1 Overview

An overview of NAPs reported to the EC is shown in the table below.

Table 130 NAPs – Germany (as reported to the EC[133])

	R1	R2
Agglomerations	40	88
Major airports	3	22
Major railways*	196	324
Major roads	678	1,801

12.6.2 Methodologies for noise action planning

The "Hinweise zur Lärmkartierung" (National Guidelines for Noise Action Planning), developed by the Bund-Lander working group on emissions protection, are non-binding recommendations. Brandenburg, Hamburg, Hesse, North-Rhine Westphalia, Saarland and Schleswig-Holstein have developed supplementary guidelines.

CAs at the regional level introduced noise trigger thresholds to the SNMs. If these are exceeded, noise action planning *could* take place in order to reduce noise to below the threshold limits. The recommended trigger thresholds are specified further above.

All the CAs that have implemented a NAP did so on the basis of existing SNMs. The trigger thresholds of the SNMs were used by many authorities as trigger mechanisms. For example, Brandenburg, Rhineland-Palatinate, Saxony and Saxony-Anhalt all developed their own trigger mechanisms.

The FluLärmG makes the noise limit values for the surrounding of airports contained in NAPs legally binding (Para. 14). According to this provision, noise action planning on aircraft noise must take into account noise limit values for protection zones as defined in para. 2 of the FluLärmG. The Law for the Improvement of the Protection from Aircraft Noise in Surrounding Areas (Gesetz zur Verbesserung des Schutzes vor Fluglärm in der Umgebung von Flugplätzen)[134] that came into force on 7th June 2007 contains related transitional provisions.

12.6.3 Measures

Noise protection measures included in the R2 NAPs by municipalities and the Federal States range from traffic planning, land-use planning, the selection of quiet sources, the reduction of noise transmission, technical measures at the noise source, economic measures, isolation, to the regulation and using stimulating measures. NAPs have also facilitated the imposition of speed limits on main roads, for example in Berlin.

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[133] Noise Maps: http://cdr.eionet.europa.eu/de/eu/noise/df8/coluk47sq (as of 2012) and http://cdr.eionet.europa.eu/de/eu/noise/df8/colvi7k8q (as of update 2014)
Action Plans: http://cdr.eionet.europa.eu/de/eu/noise/df7/ (round 1) and http://cdr.eionet.europa.eu/de/eu/noise/df10/colvlp2wg/ (round 2)

[134] In: Bundesgesetzblatt vol. 2007 chapter 1, pp. 986 ff.

Substantive measures to mitigate noise have included the installation of sound-insulating windows, sound-insulating walls, speed limits and low noise surfacing on roads.

The key criteria for prioritising noise reducing measures are:

- The number of individuals exposed to noise
- Compatibility with related national laws on noise
- Implementation costs.

With regard to funding the implementation of the measures included in NAPs, the budget for the federal noise abatement programmes for existing federal highways was increased to € 50 million per year. The budget for existing railways of the federal railways was in 2014 raised to € 130 million per year. In the framework of the second stimulus package (Konjunkturpaket II), the Federal state provided € 3.5 billion in 2009 and 2010 from investments in infrastructure. This money could be invested in noise protection measures on municipal roads. For state roads the annual funding for preventative noise as well as noise remediation measures ranges from € 120 to 220 million per year.

In various regions, government grants and subsidies are tied to the existence of a NAP. In the Free State of Saxony more than € 15 million have been invested for measures for noise abatement at municipal roads where the harmful values of 65 dB (A) during the day or 55 dB (A) at night are exceeded. In addition to the replacement of noisy pavements by quieter road surfaces, the construction of noise barriers and the replacement of the existing pavement by open-void (low-noise) asphalt has been funded in pilot projects in Chemnitz and Dresden.

Financial support for municipalities is also available through state and federal funds such as:

- Federal redevelopment funds
- City traffic funds for municipal roads and promotion of public transport
- low interest funding for investments in improved transport infrastructure and noise protection measures.

The state North Rhine-Westphalia provides an online search tool for municipalities to identify applicable funding: *http://www.laermschutz.nrw.de/Foerderprogramme*.

12.6.4 Public consultations

Depending on the size of the municipality, public involvement was handled differently. Online publication is viewed as preferable given limited financial and human resources, especially in the municipalities. A comprehensive way of participating was to invite the residents and other interested parties to take part in action groups to make suggestions to the proposed NAP. Public involvement was initiated through:

- Online-participation
- Public gatherings or presentations
- Printed and online information material
- Publication in official journals
- Public city council and committee meetings
- Action days
- Idea competitions

In summary, the indefinite regulation on how to perform public consultation allowed the municipalities to adapt to their individual possibilities and situation.

12.6.5 Implementation issues

A number of issues were raised during R1, a summary of which is shown below, together with any subsequent actions taken to address them, and new issues raised during R2.

Table 131 Noise action planning issues - Germany

R1	R2
The (too short) one-year interval between strategic noise mapping and noise action planning.	Considering the possibility to consign noise action planning to the Federal Railway Authority.
Delays in the provision of railway data.	Implementation of actions from the NAP is not regulated satisfactorily in the existing legislation. • No current obligation for noise remediation exists for existing roads and railways, therefore noise remediation is dependent on available budgetary resources. • Existing regulations direct toward emission thresholds and leave no scope for additional management measures. • The preconditions for noise protection through structural measures along state roads are due to high noise limits usually not met.
Lack of binding guidelines and noise limit values triggering NAPs.	Larger cities that had already experience from the previous round where able to resolve issues easier
Municipalities' lack of human resources and experience in carrying out noise action planning.	Responsible authorities still have only limited possibilities to develop measures for state roads, main railway lines and airports and define in an NAP.
Different authorities being responsible for Noise action planning and the implementation	Due to the lack of financing NAPs contain mainly traffic-related measures like tempo

R1	R2
of noise reduction method.	30, ban on heavy through traffic and improvement of traffic flow (e.g. NAP Berlin).
Lack of financing for implementation of NAPs. Lack of financial instruments to support noise reduction measures after phase-out of Germany's Stimulus Package II.	Lack of coordination between noise and air NAPs thus impeding the combination of both plans.
A lack of uniform calculation methods for traffic noise.	Measurements concerning airports could not be implemented in the actions plans due to missing options to restrict the approved operation of the airport.
Time allowed to prepare NAP after finalising them mapping too short.	
Protecting quiet areas.	

13. GREECE

13.1 National implementing legislation for END

The END was correctly transposed into Greek law by Ministerial Decision 13586/724 (Official Gazette 384/B/28.3.2006[135]) on Measures, Conditions and Methods for the Assessment and Management of Environmental Noise. This Decision was published in the Official Gazette after the deadline indicated in Article 14 of the END. Since then there have been two additional Ministerial Decisions. Ministerial Decision 211773/2012 (on the setting of indicators and maximum permitted levels of environmental noise from the operation of transportation projects, technical specifications for the acoustic studies for the calculation and installation of noise barriers, specifications for environmental noise monitoring programmes and other provisions[136]) replaced an earlier Ministerial Decision[137] addressing the same aspects and the earlier (1992) Ministerial Decision[138] applicable to that point.

Additional Greek legislation on environmental noise is shown in the table below.

Table 132 Key Legislation for the Abatement of Environmental Noise - Greece

Reference	Scope/Description
1178/81 - Off. Gaz. 291/A/5-10-81	Presidential Decree stipulating the measurement and control of noise emanating from airplanes
1650/86 - Off. Gaz. 150/A/16-10-86	Law for environmental protection - Article 14, Noise Prevention
3046/304 - Off. Gaz. 58/D/3-2-89	Urban Planning Decision - Building Code - Article 12 noise insulation noise prevention, auditory comfort Parameters - auditory comfort categories - noise insulation and prevention criteria
330/90 - Off. Gaz. 131/A/27-09-90	Presidential Decree on the transposition of EEC Directive 89/629/EEC on the limitation of noise emission from civil subsonic jet airplanes
17252/92 - Off. Gaz. 395/B/19-6-92	Decision of Ministry for the Environment, Physical Planning and Public Works on definition of indicators and maximum permissible noise limits emanating from road traffic and transport works
28340/2440/92 - Off. Gaz. 532/B/18-8-92	Joint Ministerial Decision on prevention of noise pollution from motorcycles, in compliance with Directives 78/1015/EEC, 87/56/EEC and 89/235/EEC. Acceptable noise levels, EU-type approvals, measurement patterns, etc.
19567/1725 - Off. Gaz. 442/B/ 18-06-93	Ministerial Decision on noise from motorcycles (noise levels and exhausts)
25006/2234 - Off. Gaz.	Joint Ministerial Decision about the acceptable noise level of vehicles - compliance with provisions of 92/97/EEC - Article 2: from

135 Υ.Α. 13586/724/2006 (ΦΕΚ 384/Β`/28.3.2006) Καθορισμός μέτρων, όρων και μεθόδων για την αξιολόγηση και τη διαχείριση του θορύβου στο περιβάλλον, σε συμμόρφωση με τις διατάξεις της οδηγίας 2002/49/ΕΚ «σχετικά με την αξιολόγηση και τη διαχείριση του περιβαλλοντικού θορύβου» του Συμβουλίου της 25-6-2002.

136 Υ.Α. οικ. 211773/2012 - Καθορισμός δεικτών αξιολόγησης και ανώτατων επιτρεπόμενων ορίων δεικτών περιβαλλοντικού θορύβου που προέρχεται από τη λειτουργία συγκοινωνιακών έργων, τεχνικές προδιαγραφές ειδικών ακουστικών μελετών υπολογισμού και εφαρμογής (ΕΑΜΥΕ) αντιθορυβικών πετασμάτων, προδιαγραφές προγραμμάτων παρακολούθησης περιβαλλοντικού θορύβου και άλλες διατάξεις

137 Υ.Α. οικ. 210474/2012 (ΦΕΚ 204/Β`/9.2.2012) Καθορισμός δεικτών αξιολόγησης και ανώτατων επιτρεπόμενων ορίων δεικτών περιβαλλοντικού θορύβου που προέρχεται από τη λειτουργία συγκοινωνιακών έργων (σύμφωνα με την οδηγία 2002/49/ΕΚ)

138 Υ.Α. οικοθεν 17252/1992 (ΦΕΚ 395/Β`/19.6.1992) Καθορισμός δεικτών και ανωτάτων επιτρεπομένων ορίων θορύβου που προέρχεται από την κυκλοφορία σε οδικά και συγκοινωνιακά έργα

Reference	Scope/Description
523/B/13-7-93	1.10.96 prohibition of traffic) - Reformation of the Decision G20/81567/898/1988 Off. Gaz. 403B
3/96 - Off. Gaz. 15/B/12-1-96	Police Ordinance about the observance of public tranquillity
29087/2295 - Off. Gaz. 79/B/7-2-97	Modification of the Joint Ministerial Decision 25006/2234 - Off. Gaz. 523/B/97 about acceptable noise levels on cars - compliance with provisions of 70/157/EEC about rapprochement of the legislation of Member States
34245/2779 - Off. Gaz. 1050/B/ 27-11-97	Ministerial Decision on adaptation of Greek law to Directive 96/20/EC adapting to technical progress Council Directive 70/157/EEC relating to the permissible sound level and the exhaust system of motor vehicles
2696/99 - Off. Gaz. 57/A	Law on the introduction of Greek Highway Code (Article 15 on pollutants, noise, etc.)
7034/1298 - Off. Gaz. 368/B/24-3-2000	Joint Ministerial Decision about the minimum distances of recreational activities
211773/2012 – Official Gaz. 367/B`/27.4.2012	Ministerial Decision setting indicators and maximum permitted levels of environmental noise from the operation of transportation projects, technical specifications for the acoustic studies for the calculation and installation of noise barriers, specifications for environmental noise monitoring programs and other provisions

Source: *www.minenv.gr/1/12/122/12202/e1220212.htm and www.elinyae.gr/el/keywords.jsp?keyword=1946*

13.1.1 Legal implementation

The Ministry of Reconstruction of Production, Environment and Energy, Directorate for Climate Change and Atmospheric Quality is responsible for environmental noise.

According to Article 4 of the 2006 Ministerial Decision, for the purposes of the implementation of the Decision, a five-strong Technical Inter-Ministerial Working Group (TIWG) was set up, and tasked with:

- Developing recommendations and delegating responsibility for strategic noise mapping and noise action planning to the Directorate of Atmospheric Pollution and Noise
- Submitting opinions on any issue arising in the process of implementing the 2006 Ministerial Decision
- Providing the necessary technical support on issue of collaboration with other EU Member States and third parties[139].

However, the TIWG convened only once. In practice, the implementation of the Directive has been the responsibility of the Unit responsible for Noise, Vibrations and Radiation within the Ministry (1 full-time employee), supported by external consultants (private and academic, including the Laboratory of Transportation Environmental Acoustics (L.T.E.A.) of the University of Thessaly) that have been responsible for the various strategic noise mapping and actions plan studies.

[139]Greek Ministry of Environment, Physical Planning & Public Works (2006): Press Release 27 February 2006, http://www.minenv.gr/download/2006-02-27.odigia.2002.49.gia.perivalontiko.thorivo.doc (accessed on 17 June 2009).

13.1.2 Scope of END implementation – Rounds 1 & 2

R1 of strategic noise mapping and noise action planning in Greece included 2 agglomerations, 1 airport, and approximately 75 km of major roads. The introduction of definitive thresholds in R2 led to the inclusion of 13 *additional* urban agglomerations within the scope of the END[140]. There was again 1 major airport during R2, around 50km of urban and interurban railway in Athens and Thessaloniki and 135 km of major roads. It should be noted that as part of the agglomerations of Heraklion (Crete) and Corfu, there were also targeted studies made for the respective international airports which represent the main source of environmental noise.

Table 133 END coverage – Greece

Round	Agglomerations	Major airports	Major rail	Major roads
1	2	1	6 km	75 km
2	13[141]	1	50 km[142]	135 km[143]

13.2 Competent Authorities and designated administrative bodies

The Noise, Vibration & Radiation Department at the Ministry of Environment & Energy is the Competent Authority.

13.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

13.3.1 Data collection

There was sufficient data for the designation and delimitation of sites for reporting in 2005 (although communication of these to the Commission was late).

In R2, out of a total of 1,034 municipalities, Greece has only two agglomerations with populations greater than 250,000, and six with populations greater than 100,000. However, some additional agglomerations that were below the limits were also included and consequently the total of agglomerations covered is 13.

13.3.2 Implementation issues

Table 134 Designation issues

R1	R2
A lack of digital maps Low prioritisation of environmental noise Lack of expertise among the relevant authorities with regard to strategic noise mapping, noise mitigation and management. Uploading of data onto the CIRCA web	Digital maps have been fully developed as part of R2 making use of maps from the cadastre. Environmental noise issues are considered a priority although this was not the case in relation to the two most important infrastructures (Athens Airport and Attiki Highway).

140 The respective studies for some of these agglomerations have yet to be finalized or approved.

141 Attiki region (broken down to 6 agglomerations), Thessaloniki (2 agglomerations), Neapoli, Giannena, Kavala, Patras, Volos, Larisa, Heraklion, Chania, Ioannina, Corfu, Agrinio, Serres

142 Covered by Athens and Thessaloniki agglomerations

143 Attiki highway (75km), Egnatia odos (40 km)

R1	R2
space	Expertise in strategic noise mapping, mitigation and management remains rather limited. There is essentially one laboratory with relevant capacity and expertise and only a few civil servants with relevant experience. There have been delays in the uploading of relevant data onto CIRCA web space even though the Greek authorities have already submitted the relevant files to the EIONET.

13.4 Noise limits and targets

13.4.1 Objectives and Scope

There are mandatory noise limit values in Greece which are set out in the Ministerial Decision 211773/2012.

13.4.2 Noise limit values

General noise limits in Greek law are linked to land use and established under Presidential Decree 1180/81 (Off. Gaz 293/A/6-10-1981).

Table 135 Noise limits – Greece

Area type	Noise limit - dB(A)
Industrial as determined by legislation	70
Predominantly industrial	65
Industrial and urban co-existence	55
Urban	50
Installations adjacent to inhabited dwellings, irrespective of area characterisation	45 (measured inside the dwelling with open door and windows)

Source: http://www.minenv.gr/4/ypexode4/pd%201180/81.htm

Traffic noise indicators under the Ministerial Decision 211773/2012, are:

- L_{den} (24 h)
- L_{night} (8 h)

As noise limits for these indicators, the following are set at 2 metres from the building façade:

- For L_{den} (24 h): 70 dB (A),
- L_{night} (8 h): 60 dB (A)

These limits are applicable for all inhabited areas where there are established planning limits and regulations. In the case of sensitive areas (including hospitals, schools, culture centres, etc.) the limits for a specific transport infrastructure may be further reduced by up to 5 dB (A), in accordance with the Ministerial Decision.

The specific limits apply to all types of traffic noise. There are no specific limits for aircraft noise. While not defined in any relevant piece of legislation, standard criteria for tramway noise and vibration are generally used in practice:

- 40dB(A) maximum permissible ground borne noise level from train operation inside dwellings (in the frequency area of 10 to 200Hz); and
- 35dB(A) maximum permissible ground borne noise level from train operation inside sensitive buildings (e.g. theatres) (in the frequency area of 10 to 200Hz)[144].

13.4.3 Methods for establishing noise limit values

According to Ministerial Decision 13586/724/2006 transposing the END, the methods for establishing noise limits values for road and rail traffic are:

- For road traffic, the French traffic noise prediction methodology «NMPB−Routes−96 (SETRA− CERTU−LCPC−CSTB) », (Guide de Bruit); and
- For rail traffic, the Netherlands noise prediction methodology as published in Reken−en Meetvoorschrift Railverkeerslawaai '96, Ministerie Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, 20 November 1996», or alternatively the «Guide du bruit des transports terrestres, fascicule prevision des niveaux sonores, CETUR 1980».

There is no methodology specified in relation to air traffic but the methodology described in ECAC.CEAC Doc. 29 "Report on Standard Method of Computing Noise Contours around Civil Airports", 1997 is the one that has been followed in all relevant studies.

Health-based assessments are not used for setting out noise limits values.

13.4.4 Noise monitoring systems

According to the Ministerial Decision 211773/2012, for all major transport infrastructure projects a noise monitoring programme needs to be developed establishing fixed and mobile locations for the measurement of environmental noise close to residential and other sensitive areas together with a programme of hourly measurements.

Indicators used for permanent noise monitoring systems are L_{den} and L_{night}.

Environmental noise measurements systems are in operation in the case of two major highways, Attiki odos and Egnatia odos.

In the case of Attiki odos, eight automatic noise measuring stations are in operation for continuous monitoring of the level of noise. In 2011 the noise measurement infrastructure was updated on the basis of a study of the LEAT laboratory aiming to monitor noise in real time. 150-200 24-hour measurements annually with mobile noise measurement units were also made which led to the establishment of additional noise barriers, increasing them to over $100m^2$[145].

In the case of Egnatia, noise measurements are systematically undertaken in accordance with the Directive and the transposing Greek law. Measurements started in 2007. The latest measurements were taken in 2013 in residential areas located in a

[144] Vogiatzis K (2009): Πολιτικές Μείωσης & Προστασίας από τον Περιβαλλοντικό Θόρυβο - Θεσμικά & Τεχνικά Εργαλεία, http://ecocity.gr/uploaded/files/Kostas_Vogiatzis.pdf (accessed on 18 June 2009).

[145] http://www.aodos.gr/summary.asp?catid=19617&subid=2&pubid=11246982

zone of 200 metres from the nearest road. This included 66 villages, and a total of 153 data points along the whole of the Egnatia highway. The monitoring over 24 hours involved a measuring height of 4.0 metres; as well as 15-minute, 30-minute and hourly decibel measurements with a measuring height of 2.5 to 3 metres[146].

According to the results of the measurements, for the largest percentage of settlements on either side of the Egnatia, the noise level is below the statutory limits L_{den} (70 dB(A)) and L_{night} (60 dB(A)). There were 15 locations were the limits were exceeded (6 in the case of L_{den} and 9 for L_{night}) all around the Thessaloniki agglomeration. However, in these locations there are no residential areas affected (only industrial uses) and, as a result, the total share of the population affected along the whole highway is 0%.

This is a significant improvement from the 2010[147] measurements which found that a small part of the population in certain locations (such as in the village of Vrasna) was subject to noise above the then applicable limits[148] [149], upon which noise-barriers were installed.

Finally, measurements made in the proximity of the fence of Egnatia showed noise levels exceeding the limits and reaching up to the 72.0 dB(A) for the L_{night} indicator and 80.8 dB (A) for the L_{den} indicator. The company has argued that the spatial expansion of residential areas towards the motorway needs to be curbed[150].

13.5 Quiet areas

13.5.1 Overview

L_{den} is the criterion to be used for delimitation of quiet areas both within and outside agglomerations.

Delimitation

So far, no quiet areas have been established although all SNMs completed so far have made proposals for quiet areas. During R1 there had been proposals for quiet areas in Athens as part of the Rethink Project[151] and there have been further proposals as part of R2. However, very limited progress has been made with regard to the adoption of the relevant measures since most of the studies have only recently been adopted.

Protection

In the case of sensitive areas, the Ministerial Decree provides that the noise limits may be up to 5 dB (A) lower than the generally applicable L_{den} and L_{night} limits.

The NAPs make proposals for specific measures to be taken (such as no traffic zones). However, these have so far not been taken up in practice.

Agglomerations

[146] Egnatia (2004): ENV01: Έκθεση Πληθυσμού σε Θόρυβο, http://observatory.egnatia.gr/factsheets/fs_2014/ENV01_factsheet_2014.pdf

[147] http://observatory.egnatia.gr/factsheets/fs_2011/ENV01_factsheet_2011.pdf

[148] L10 (18h): 70db (A), Leq (8-20 h): 67 dB(A)

[149] In relation to the L_{den} and L_{night} indicators, the share of the population exposed was 0.9%

[150] Ibid

[151] http://www.rethinkathens.org/eng/project

A series of quiet areas have been identified in the SNMs and the relevant measures are pending.

Open country

No quiet areas in open country have been identified.

13.5.2 Implementation issues

Actions plan proposals for quiet areas have yet to be implemented since most of the studies were only recently formally completed and some are still pending.

13.6 Strategic noise mapping

13.6.1 Overview

Table 136 SNMs Greece

	R1	R2
Agglomerations	0 (2)	17*
Major airports	1	1
Major railways	6 km	(50 km)
Major roads	1	2 (135 km)

** covering 13 agglomerations*

13.6.2 Data collection

Prior to the END, the Ministry of the Environment prepared SNMs for all cities in Greece with a population of more than 50,000[152]. For Athens, information from the early 2000s suggests a SNM had been prepared every 10 years: in 1977, 1987 and 1997. A 2007 map was not prepared. SNMs produced prior to the introduction of the END were based on data and information provided by the Greek National Statistical Census Bureau (on, for example, building block maps, the number of residents per building block, etc.) and parameters such as L_{max}, L1, L10, L50, L90, L95 and L_{eq}. L_{den} and L_{night} measurements as required under the END were not undertaken and therefore the SNMs prepared as part of R1 (2006) were developed using different measurement tools.

It should also be noted that Attiki odos and the Athens international airport have established their own noise monitoring systems and submit annual reports to the ministries.

For R2, SNMs based on L_{den} and L_{night} measurements have already been completed for five agglomerations[153], with 14 more at different stages of implementation. There are also SNMs for the two main highways (Attiki and Egnatia odos) and the Athens International airport.

The main guidance documents that were used in the implementation of the Environmental Noise Directive in Greece are the EEA's "2007 Good Practice Guide for

[152] Thirty-three noise maps for Athens, Holargos, Papagos, Kallithea, Ilion, Peristeri, Nea Smyrni, Nea Philadelphia, Aegaleo, Halandri, Ilioupolis, Korydallos, Thessaloniki, Patras, Piraeus, Volos, Kavala, Rhodes, Ioannina, Larissa, Heraklion, Trikala, Serres, Lamia, Chania, Chalkis, Kalamata, Katerini, Veria, Alexandroupolis, Agrinio, Kerkyra (Corfu), Ptolemais.

[153] Attiki region (split in 5 agglomerations), Thessaloniki, Kalamaria, Giannena, Kavala, Volos, Larsia, Heraklion, Hania, Corfu, Agrinio, Serres

Strategic noise mapping and the Production of Associated Data on Noise Exposure" and the document on "Presenting Strategic noise mapping Information to the Public".

The SNMs were developed on the basis of a multidisciplinary methodology taking into account simultaneously real time acoustic measurements, software prediction results and feedback from an interview programme with inhabitants on the theme of acoustic comfort and sonic identities. SNMs were produced using acoustic prediction software and using detailed 3D models. In parallel, a full 24 h noise measurements monitoring program was executed. Finally, interviews with residents covered aspects of the overall acoustic environment, assessment of the sound environment, identification of main sound sources, identification of representative sounds for the specific district. The interviews were used to develop sound identity maps.

Guidelines on carrying out strategic noise mapping have been set at national level. The main noise indicators used were L_{den} and L_{night}, and no supplementary indicators have been used from the national level.

For the agglomeration and the major highways, the mapping methods followed were the national French method "NMPB-Routes-96 (SETRA-CERTU-LCPCCSTB)", as it is presented in the "Article du 5 mai 1995 relatif au bruit des infrastructures routières, Journal O-ciel du 10 mai 1995, Article 6" and in the French standard "XPS 31-133".

When relevant, aircraft noise was taken into consideration using the methodology "ECAC.CEAC Doc. 29 / Report on Standard Method of Computing Noise Contours around Civil Airports, 1997". The same method was also used in the case of the Athens "Eleftherios Venizelos" airport[154] for the 2006 and 2011 SNMs.

The analysis of air traffic was based on the airports' annual air traffic and flight track data for the most recent years. The receptor height was determined at 4 metres. Results were presented in maps and tables/diagrams showing the indicators L_{den} and L_{night} as defined in Annex I of JMD 13586/724 in scales of 5 dB. A complete evaluation of results was made as far as the calculation of area/land uses and numbers of individuals who live in residences inside municipal blocks exposed in various levels of noise are concerned, as it is determined in Annex VI of the Directive, while a special study was made for all the recorded sensitive receptors.

The population data used in strategic noise mapping was based on official results of the 2001 census (data from the 2011 census was not available at the time of the study) per block of residences at settlement level of all municipalities and communities of the study area[155].

The **responsibility for overall data collection** lies with the national authorities (Ministry of Environment – Directorate for Climate Change and Quality of Environment). The Ministry issued a number of calls for the development of the various SNMs.

13.6.3 Strategic noise mapping methods

Data for the SNMs have been developed on the basis of extensive 24h noise measurement programme making use of specially designed masts and covering various sources of environmental noise. These were also compared with acoustic models and in all cases a high level of correlation was found.

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[154] TT&E Consultants, 2007, "Athens International Airport "Eleftherios Venizelos," Draft Study on Aircraft Noise, Strategic Noise Map 2006, June 2007 (available from the CIRCA website).

[155] Ibid.

For the development of R2 SNMs, geographical information system based on the national cadastre and the geographic data base of the Hellenic Statistical Authority in combination with population census data to measure the affected population.

In general, the quality of the data from the R2 studies is considered as particularly high.

13.6.4 Public accessibility of SNMs

The findings from environmental strategic noise mapping but also social surveys related to noise levels and impacts have been included in the relevant studies and presented to the Ministry of Environment and to all affected local authorities for open discussion with public participation. The maps for some of these studies have been made available in electronic format and on the Ministry's website[156]. There is also a production of actual colour SNMs in paper (size about 27x39 cm) in scale 1:5000 or 1:10000. The maps are also available free of charge to administrations and the general public.

The website of the Ministry of Environment provides access to the initial SNMs for Egnatia and Attiki odos. The SNMs developed as part of R2 are expected to be made available through the website in the coming period.

In case of the Athens airport, information concerning noise and measurement results is given to the local community through the annual publication of A.I.A.'s Environmental Services Department entitled "Care for the Environment"[157].

13.6.5 Implementation issues

One key implementation issue during R1 was the absence of digitised maps for agglomerations. For R2 studies the digital maps from the national cadastre and the Hellenic Statistical Authority were used. The main issue has been the delays for the completion of the relevant studies due to budget cuts and bureaucratic procedures.

13.7 Noise action planning

13.7.1 Overview

The table below provides an overview of the NAPs produced in Greece in Round 1 and 2.

Table 137 NAPs – Greece

	R1	R2
Agglomerations	0 (2)	17 (13 agglomerations)
Major airports	1	1
Major railways	no data	no data
Major roads	1	2

[156] http://www.ypeka.gr/Default.aspx?tabid=452&language=el-GR

[157] http://www.aia.gr/company-and-business/the-company/Corporate-Publications/enviroment

13.7.2 Methodologies for noise action planning

In the past, NAPs have been developed on the basis of earlier impact assessments carried out in respect of major transport infrastructure upgrade developments (airports/ major rail/major roads), although no such previous studies were available for agglomerations). Moreover, in instances where local authorities had sought to develop new environmental noise management initiatives, the Ministry of Environment has generally been keen to support them.

As part of R2, NAPs were developed in tandem with the SNMs for all agglomerations, the Athens international airport and the two main highways.

During R1, a key problem was that there were no national guidelines and a further issue was the lack of digitisation of the necessary information. Such issues have already been addressed, as indicated further above.

13.7.3 Measures

During R1, there were some delays in noise action planning, but a number of different types of measures were identified as possibly relevant. These include:

- Technical measures at noise source;
- Noise insulation;
- Changes towards the use of sources producing less noise
- Regulation.

The Directive requires evidence that the responsible authorities have developed appropriate selection criteria in order to prioritise noise reduction and mitigation measures in order of importance.

In R1, these included the level of population exposure (i.e. environmental noise affecting more people), the costs and ease of implementation.

In case of Attiki odos, the proposed NAP included the installation of additional noise barriers[158] in certain locations. A noise monitoring system was already in place since 2002. The study also proposed the partial coverage of the highway in two specific locations, expected to bring significant reduction to the level of noise. However, to date, this proposal has not been implemented, possibly due to reductions to the level of traffic as a result of the financial crisis. In case of Egnatia odos no specific measures were considered necessary on the basis of the SNMs[159].

In total there were 67,000 m^2 of anti-noise barriers in place[160] along Attiki Odos and around 70,000m^2 more distributed across locations where highways are in proximity

158 Τεχνική έκθεση: Σχέδια δράσης Αττικής Οδού - δείκτες L_{den} & L_{night}» σύμφωνα με την Ευρωπαϊκή Οδηγία 2002/49/ΕΚ &την ΚΥΑ 13586/724/ΦΕΚ Β' 384/28.3.2006, http://www.ypeka.gr/LinkClick.aspx?fileticket=3Un5fGAEep4%3d&tabid=452

159 ΧΑΡΤΟΓΡΑΦΗΣΗ ΤΟΥ ΘΟΡΥΒΟΥ ΣΤΑ ΤΜΗΜΑΤΑ ΤΗΣ ΕΓΝΑΤΙΑΣ ΟΔΟΥ ΑΠΟ Α/Κ ΒΕΡΟΙΑΣ ΕΩΣ Α/Κ Κ1 ΚΑΙ ΑΠΟ Α/Κ ΓΗΡΟΚΟΜΕΙΟΥ ΕΩΣ Α/Κ ΣΤΡΥΜΟΝΑ - ΤΕΛΙΚΗ ΤΕΧΝΙΚΗ ΕΚΘΕΣΗ http://www.ypeka.gr/LinkClick.aspx?fileticket=0kV%2bNtI9flQ%3d&tabid=452&language=el-GR

160 Vogiatzis K (2007): Monitoring of Environmental Noise & Noise Abatement Measures, The GR experience: Attiki Odos & Athens Tram, 23 November 2007, Nicosia – Cyprus, http://www.cyprus.gov.cy/moa/agriculture.nsf/All/CDE98DCFC8F1BCC9C225739E0069A387/$file/Monitoring%20of%20Environmental%20Noise-%20811%20KB.pdf?OpenElement (accessed on 17 June 2009).

to residential or sensitive areas. It is estimated[161] that in 2015 the anti-noise barriers along Attiki Odos had increased to over $100m^2$ with additional barriers built along certain parts of Egnatia Odos and other major motorways. In total, there are probably more than $200m^2$ anti-noise barriers established.

[161] Interview with Konstantinos Vogiatzis, Laboratory of Environmental Transportation Acoustics (L.T.E.A.) of the Dept. of Civil Eng. of the University of Thessaly

The box below represents a case study of measures detailed in the NAP for Athens airport.

In relation to Athens airport, the noise abatement procedures were established before the commencement of the operation of the airport in cooperation with the Hellenic Civil Aviation Authority (HCAA) and included:

- Avoidance of the use of the east runway 03R for departures, for an eight-hour period during the night (23.00-07.00). Exceptions are allowed in case of operational restrictions (e.g. Maintenance works or other kind of works), in case of increased traffic and extremely bad weather conditions;
- Implementation of measures for noise reduction during aircraft landing (use of gear, flaps and power) according to the relevant safety procedures;
- For departing aircraft, speed, use of power and flaps according to the procedures of the ICAO for noise reduction; and
- Take-offs from the east 03R runway as well as landings to the east 21R runway are avoided and for the time period from 15:00 until 18:00, by issuing a temporary NOTAM which is being renewed until today after the expiration of its implementation period.[162]

The Athens airport is operating a permanent Noise Monitoring System (NOMOS). NOMOS is used for monitoring noise levels in the broader area of the airport as well as the automatic correlation of noise levels with specific aircraft movements. This system is composed from a network of ten (10) permanent Noise Monitoring Terminals (NMTs), one mobile station and a central unit with software for the collection, procession and storage of data. It also includes connection with the Hellenic Civil Aviation Authority's radar in order to obtain flight path data, the Airport Operation Data Base (AODB) in order to receive flight plan data, as well as connection with the Air Quality Monitoring Network for the provision of weather data. The automatic correlation of noise levels with specific aircraft movements is performed based on the minimum distance of the aircraft flight path from each NMT. The measurement data is used to assess the impact of aircraft movements on the noise levels in the vicinity of the airport, monitoring the compliance with the Noise Abatement Procedures, the investigation of complaints from the public and general planning purposes. NOMOS uses a large number of indices for the description of the acoustic environment[163].

A 2009 publication by the airport company[164] provided average noise levels for L_{den} and L_{night} for all nine monitoring stations operated by the company with highest average levels shown for the Koropi locality with L_{den} around 67-68 dB and L_{night} around 60-61 dB.

[162] TT&E Consultants (2007): Athens International Airport "Eleftherios Venizelos", Draft Study on Aircraft Noise, Strategic Noise Map 2006, June 2007

[163] Ibid

[164] AIA (2009): Noise, available from the Athens International Airport Internet site http://www.aia.gr/UserFiles/File/Environment/2009_updates/164700_noise.pdf (accessed on 31 July 2009).

With regard to noise mitigation planning for buildings, City Planning Decision 3046/304 (Official Gazette 59/D/3 February 1989) lays down the parameters of the "acoustic comfort" along with a description of the necessary measures for sound insulation in buildings according to specific uses (i.e. schools, hospitals, residential buildings etc.). All new buildings in Greece should comply with the relevant specifications (i.e. noise insulation of a house from outdoor traffic noise is expressed as L_{eq} hr which should not be more than 35 dB(A) etc.).

Regarding R2 studies, information is only partially available. In the case of Athens International airport[165], the 2011 SNM found an overall reduction of the noise levels in comparison to 2006 for all affected areas. There is no part of the population exposed to noise levels above 65 dB (A) for L_{den} and 55 dB (A) for L_{night}. The existing NAP was considered effective and no additional measures were implemented. The most recent Care for the Environment publication (2014) reports that there is no municipality around the airport where L_{den} exceeds 60db (A) and Light 50 dB (A)[166]. The fact that, according to the most recent report submitted by the Airport authority, only one noise-related complaint was in March 2015, provides further evidence of the reduced impact of the airport on the surrounding area.

In contrast, in the case of Heraklion airport[167] the proposed NAP includes as a key action the relocation of the airport in a low density urban agglomeration 25km from Heraklion (Kastelli). The airport relocation – which is already in the tender process and has been decided on the basis that the current airport has exceeded its capacity –is expected to lead to significant reduction of the noise levels below the relevant limits for the Allikarnassos area that is currently affected by the air traffic noise.

The plan included:

- Construction of noise barriers
- Traffic flow management measures
- Widening of sidewalks and allowing parking only on one side of the road
- To introduce pedestrian axes, particularly around education buildings and public services (town hall, social security building, churches, etc.)
- Promote the building of small buildings opened on the back façade in the aims to create islands of tranquillity.

The NAP also includes a proposal for management of activities on the area ensuring land use mixture and the creation of sound aesthetic dimensions in order to promote soundscape listening.

13.7.4 Public consultations

Public consultation plans were already obligatory pre-END in Greece in relation to the planning stage of major infrastructure development.

[165] Konstantinos Vogiatzis (2014), Assessment of environmental noise due to aircraft operation at the Athens International Airport according to the 2002/49/EC Directive and the new Greek national legislation, Applied Acoustics 84 (2014) 37–46

[166] http://www.aia.gr/ebooks/ENC/carefortheenvironment/issue16/index.html#p=10

[167] Konstantinos Vogiatzis and Nicolas Remy (2014), Strategic Noise Mapping of Heraklion: The Aircraft Noise Impact as a factor of the Int. Airport relocation, Noise Mapp. 2014; 1:15–31

As part of efforts to engage in public consultation "Eleftherios Venizelos" airport in Athens has set up a special telephone communication line "*Sas akoume*" (We Listen), where citizens can call for information and report noise-related complaints and issues. The telephone line operates on a 24hr basis.

Reports based on the results of the implementation of the NAP are submitted to the relevant authorities (e.g. Ministry of the Environment, Hellenic Civil Aviation Authority) on a monthly and a six-monthly basis. Furthermore, information about noise as well as measurement results is given to the local community through the publication "Care for the environment" which is published by the airport company. This publication is published annually and includes data about various environmental parameters and activities of the Environmental Services Department of the airport[168].

However, there have been complaints with regard to public participation in the development of the NAP for the Athens airport. In March 2009, the East Attica Prefecture within which the airport is located sent comments to the Ministry of Environment, Physical Planning & Public Works indicating that they were only advised of the NAP being developed from an announcement on the Ministry Internet site[169]. The Prefecture argued that there had been no consultation of stakeholders (local residents and local authorities) in the process of developing the SNM and NAP.

Such consultations took place as part of R2. There were two meetings organised for each of the studies, one for the presentation of the strategic maps and the send for the presentation of the NAPs. There were also informal discussions with the technical services of the municipal authorities. According to the Ministry representative, the authorities have been fully involved in all stages of the process.

13.7.5 Implementation issues

Due to the delays in the formal completion of some of the studies the implementation of R2 NAPs has also been delayed.

[168] TT&E Consultants (2007): Athens International Airport "Eleftherios Venizelos", Draft Study on Aircraft Noise, Strategic Noise Map 2006, June 2007 (available from the CIRCA website).

[169] See announcement of the Prefecture available here: http://www.atticaeast.gr/index.php?option=com_content&task=view&id=1840&Itemid=340 (in Greek).

14. HUNGARY

14.1 National implementing legislation for END

14.1.1 Legal implementation

The END has been transposed into national legislation in Hungary[170] through two main decrees. These are:

- Governmental Decree 280/2004 (X.20) on the Assessment and Management of Environmental Noise[171] ;
- Decree 25/2004 of the Ministry of the Environment and Water on Detailed Requirements of Strategic noise mapping and Noise action planning[172] .

Government Decree No. 280/2004 (X.20) sets out noise limits, and includes the delimitation methods for quiet areas and arrangements for producing NAPs.

Decree No. 25/2004 (XII. 20) relates to the required form and content of SNMs used for the evaluation and management of environmental noise, and the calculation and testing methods used for the preparation of SNMs.

There are a number of other documents relating to Hungarian legislation that deal with environmental effects of noise. These are as follows:

- Government Decree 284/2007 (X.29.) on certain rules relating to protection from environmental noise and vibration;
- Joint Decree of the Ministry of the Environment and Water and of the Ministry of Health 27/2008. (XII. 3.) on the Establishment of Noise and Vibration Limits.

14.1.2 Scope of END implementation – Rounds 1 & 2

In Hungary in R1,[173] the scope of strategic noise mapping and noise action planning included one agglomeration, one airport and approximately 539 km of major roads and 32 km of railway. The introduction of definitive thresholds in R2 led to an extension of the scope to include nine agglomerations, and approximately 958 km of major railway lines and 3370 km of major roads.[174] All the obligatory R2 strategic noise mapping data is available online[175].

[170] In order to avoid duplicating requirements Hungary has modified the national legislation in 2007.

[171] relates to noise limits, and includes the delimitation methods for quiet areas and action plans. Available in Hungarian at http://net.jogtar.hu/jr/gen/hjegy_doc.cgi?docid=A0400280.KOR

[172] relates to the required form and content of strategic noise maps used for the evaluation and management of environmental noise, and the calculation and testing methods used for the preparation of strategic noise maps. The decree is an amendment to the Environmental Protection Act, LIII/1995, available in Hungarian http://net.jogtar.hu/jr/gen/hjegy_doc.cgi?docid=A0400025.KVV

[173] Information available at: http://www.kvvm.hu/cimg/documents/05_23_miniszteri_kozlemeny.pdf

[174] Information available at: http://www.kormany.hu/hu/foldmuvelesugyi-miniszterium/kornyezetugyert-agrarfejlesztesert-es-hungarikumokert-felelos-allamtitkarsag/hirek/strategiai-zajterkepek

[175] Information available at: http://www.kormany.hu/hu/foldmuvelesugyi-miniszterium/kornyezetugyert-agrarfejlesztesert-es-hungarikumokert-felelos-allamtitkarsag/hirek/strategiai-zajterkepek

Table 138 END coverage – Hungary

Round	Agglomerations	Major airports	Major rail	Major roads
1	1[176]	1[177]	25 km	539 km
2[178]	9[179]	1[180]	914** km	2,903*** km

** The Budapest agglomeration consists of the capital and its outskirts (22 separate municipalities in total). In the 1st round of strategic noise mapping, Budapest and 21 lesser municipalities formed an association and made one common SNM which covered the whole of the Budapest agglomeration. In R2, all 22 municipalities in the Budapest Agglomeration had to prepare an individual SNM but in order to avoid further delay in data reporting caused by the incompleteness of data, the Hungarian authorities gave them separate Unique Agglomeration ID-s.*

*** 28 SNMs for all major roads (914,1km): M0, M1 motorway and a main road, M2 motorway, M3 motorway, M5 motorway, M6, M7 highway, M30 motorway and main road, M43 motorway, Baranja County, Kiskun County, Bekes County, Zemplén County, Budapest and Pest county, Csongrad County, Fejér, Gyor-Moson-Sopron county, Hajdu-Bihar County, Heves county, Jasz-Nagykun-Szolnok County, Komárom-Esztergom county, Nograd county, Somogy County, Bereg County, Tolna County, Vas, Veszprem County, Zala county*

**** 9 SNMs for all major roads (2902.871km): No. 1 line Budapest - Hegyeshalom, No. 30 line Budapest - Székesfehérvár, No. 40 line Budapest - Pusztaszabolcs, No. 70 line Budapest - Vac, No. 80 line Budapest - Mezőzombor, No 100 line Budapest - Nyíregyháza, No. 120 line Budapest - Szolnok, No. 140 line Szeged director - Szeged, No. 150 line Budapest, Ferencvaros - Budapest Soroksári.*

14.2 Competent Authorities and designated administrative bodies

According to Governmental Decree 280/2004 (X.20) on the Assessment and Management of Environmental Noise, the Ministry of Environment and Water was responsible for Round 1 mapping. However, responsibility for noise mapping in Round 2 was reallocated to the Ministry of Agriculture. The Ministry of Agriculture is also responsible for the collection and reporting of data related to SNMs and NAPs to the European Commission/ EEA and actively implicated in legislation-making. According to this law, other responsible bodies include:

Table 139 Administrative Responsibility for the END - Hungary

Role	Agglomerations	Roads	Railways	Airports
Preparing SNMs	Municipalities	Road administrations	Railway administrations	Airport administration
Collecting and approving SNMs	Environmental Authority	Ministry of Transport, Ministry of Agriculture	Ministry of Transport, Ministry of Agriculture	Ministry of Transport, Ministry of Agriculture
Preparing NAPs	Municipalities	Road railway administrations	Railway administrations	Company which administrate the main airport or the city airport

[176] Budapest

[177] Budapest Ferihegy International Airport

[178] Information available at: http://www.kozlonyok.hu/kozlonyok/Kozlonyok/31/PDF/2008/13.pdf

[179] Budapest, Debrecen, Gyor, Kecskemét, Miskolc. Nyíregyháza, Pécs. Szeged, Nyíregyháza

[180] Budapest Ferihegy International Airport

Role	Agglomerations	Roads	Railways	Airports
Information of the public	Municipalities	Road administrations	Railway administrations	Airport administration
Participation of the public	Municipalities			
Approving NAPs	NAP proposals are transmitted to competent public health authority, transport authority, municipalities in the county. These organizations comment on the proposal			
	Municipalities	Ministry of Transport	Ministry of Transport	Ministry of Transport
Collecting NAPs	The Ministry of Agriculture			
EC/EEA reporting	The Ministry of Agriculture is responsible for sending data to the European Commission			

14.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

14.3.1 Data collection

On the 6th March 2009[181], Hungary reported to EIONET Central Data Repository for the EC for the whole of 2008: one "major" airport (Budapest Ferihegy International Airport[182]), nine agglomerations over 100,000 inhabitants and one over 250,000 (Budapest), 78 "major" railways and 647 "major" road sections. The number of major roads sections was modified by the decree 8003/2008 (HÉ 46) of Ministry of Transport, Telecommunication and Energy (KHEM) [5].

The Law on Noise Management in Hungary transposes the END's definitions of agglomerations, major roads, major railways and major airports. Agglomeration borders are aligned with the administrative borders of cities with more than 100,000 inhabitants. The number of inhabitants for each city is publicly available from the Hungarian Central Statistical Office[183].

Data to delimit major roads, major railways and major airports are available from the Ministry of Transport, Telecommunication and Energy (KHEM) in decree 8003/2008. (HÉ 46.)[5]

14.3.2 Implementation issues

There has been a change in the number of agglomerations compared to the 1st round of strategic noise mapping. The Budapest agglomeration consists of the capital and its outskirts which means 22 separate municipalities altogether. In R1, Budapest and 21 lesser municipalities formed an association and made one common SNM which covered the whole territory of Budapest agglomeration. In the 2nd round, each of the 22 municipalities are each responsible for the completion of their own SNMs.

Table 140 – Designation issues - Hungary

Issue	Action
No specific problems were reported with relation to the designation and delimitation of sites.	

[181] Information available at: http://cdr.eionet.europa.eu/hu/eu/noise/df5/envsa6poq/

[182] The airport was renamed in 2011 to Budapest Liszt Ferenc International Airport

[183] available in English on http://www.ksh.hu/population_and_vital_events

14.4 Noise limits and targets

14.4.1 Objectives and Scope

Hungary has established a series of noise limit values, as presented in the table below.

Table 141 Noise limit values in Hungary

	Industrial facilities	Traffic-related noise sources
Noise target values in Hungary		
L_{den} (day, evening, night)	46 dB	63 dB
L_{night} (from 22.00 – 06.00)	40 dB	55 dB
Noise trigger values in Hungary*		
L_{den} (day, evening, night)	56 dB	73 dB
L_{night} (from 22.00 – 06.00)	50 dB	65 dB

**In addition to the target values, there are noise values above which action on noise-abatement should be carried out.*

The Governmental Decree 280/2004 (X.20) specifies that when noise limit values are exceeded there are applied measures for noise reduction for a period of 10 years. When noise trigger values are exceeded measures for noise reduction are applied for a period of 5 years.

According to Government Decree No. 280/2004, the L_{den} and L_{night} values in force for road, rail, airport and industrial noise, as presented in Table 5 below. In terms of acoustic criteria, the maximum noise emissions by source are specified as follows: for an industrial facility, L_{den} = <41 dB, L_{night} = < 35 dB; and for traffic-related noise source, L_{den} = < 58 dB, L_{night} = < 50 dB.

Table 142 Source specific noise limit values in Hungary

Noise Source	Noise Limit Values	
	L_{den}	L_{night}
Road-traffic noise	63	55
Rail-traffic noise	63	55
Aircraft noise around airports	63	55
Noise on industrial activity sites	46	40

14.4.2 Methods for establishing noise limit values

The values of L_{den} and L_{night} are determined by calculation, and Hungary has official national methods which can be used for road traffic noise, railway noise, noise propagation and industrial noise. It judged that there is no need for the application of foreign standards as Hungarian requirements take into account the specific features of Hungarian vehicles. Hungarian calculation methods conform to the Directive in every respect. Details of these calculations are given in the Annexes of Lärmknotor, 2003[184].

14.4.3 Associated enforcement and mitigation measures

Hungarian national law requires that the Hungarian Railways (MAV) must implement noise protection measures when constructing new or upgrading existing lines. MAV is also revising its noise protection measures (noise barriers, noise-insulated windows) when reconstructing or upgrading railway lines, and also revising its noise protection technology such as wagon warm-up systems, passenger information systems (loudspeakers), shunting operations and loading/unloading activities at freight terminals near residential areas[185].

The Decree No. 12/1983 [186](V. 12.) laid down rules that proved effective in forcing the operators of industries, mines, and agricultural sites to reduce the noise emission. According to this regulation in the case of contravention of the regulations in connection with emission limit values the operators were punished with a fine and was obliged to reduce the noise emission under the limit value.

14.4.4 Implementation issues

No issues were raised as a result of END implementation in R1. Issues raised in R2, together with actions taken to address them are shown in Table 143 below.

Table 143 Noise limits and targets - issues in R2 - Hungary

Issue	Action
Problems were encountered when printing SNMs at a 1:15,000 scale, since one set of printed SNMs consists of 133 A0 sized SNMs. Printing was significant in terms of cost and time.	No actions identified
It was regarded as labour-intensive to produce SNMs for industrial areas, since noise emissions from industrial sites are covered by different EU Directives (in particular the IPPC and the IED) and by different national legal regulations. Old industrial areas have generally closed down and the new ones have been built to conform to the environmental regulations – IPPC-obliged sites have a negligible	No actions identified

[184]Lärmknotor (2003): Guidelines to Strategic Noise Mapping and Action Planning, according to Directive 2002/49/EC. Available at: www.kvvm.hu/cimg/documents/Guide.doc.

[185] International Union of Railways and Community of European Railway (2007): Status Report 2007: Noise reduction in European Railway Infrastructure. Available at: www.cer.be/force-download.php?file=/media/publications/EN_Noise_Reduction.pdf.

[186] The decree was replaced in 2007 by Governmental Decree No. 284/2007 which sets out certain rules of environmental noise and vibration protection, but the basic theory has not changed.

Issue	Action
environmental noise impact compared to other noise sources[187].	
In some cases, when strategic noise mapping is carried out by different entities for the same areas (for example, railways inside an agglomeration, some SNMs may be produced by municipalities and a SNM in respect of major railway may be produced by a transport authority). This can mean that GIS data used for strategic noise mapping is not the same.	No actions identified

14.5 Quiet areas

In Hungary, quiet areas have been established through law 27/2008. (XII. 3.) Appendix 1 of the Ministry of the Environment (KvVM)[188].

14.5.1 Overview

No quiet areas have yet been established in Hungary during either Rounds 1 or 2.

Delimitation

A quiet area in Hungary is defined in Government Decree 280/2004 as: *"an area designated by the council of the community municipality (hereinafter referred to as: municipality) pursuant to a separate piece of legislation[189], which is subject to an increased degree of noise protection, as well as a quiet zone designated around facilities requiring an increased degree of noise protection."*

Agglomerations

Regarding the criteria used for the delimitation of quiet areas, Government Decree 280/2004 defines a quiet area as: *"an area designated by the council of the community municipality (hereinafter referred to as: municipality) pursuant to a separate piece of legislation[190], which is subject to an increased degree of noise protection, as well as a quiet zone designated around facilities requiring an increased degree of noise protection."*

Open country

The definition of quiet areas only applies to agglomerations.

[187] Berndt and Muntag (2008): Budapest Noise Mapping Project II – Results. Presented at Acoustics 08 – Paris, in association with EuroNoise.

[188] Information available at: http://net.jogtar.hu/jr/gen/hjegy_doc.cgi?docid=A0800027.KVV

[189] Act No. XX. of 1991 "On Tasks and Powers of Local Municipalities and their Bodies, the Republic's Commissioners as well as Individual, Centrally Subordinated Bodies".

[190] Idem.

14.5.2 Implementation issues

Issues arising as a result of END implementation in R1 as identified in the 2011 implementation report as well as any further issues raised through the interview programme in respect of the early phase of R2 implementation are provided in the table below.

Table 144 Quiet area issues - Hungary

R1	R2
The Hungarian authorities perceived there to be a lack of clarity in the requirements relating to the delimitation and protection of quiet areas in open country.	Continued perception of a lack of clarity in the requirements relating to the delimitation and protection of quiet areas in open country.
Article 2 indicates that the Directive shall apply to environmental noise to which humans in quiet areas in open country, are affected, whilst Article 3 point (m) defines quiet areas in open country as "an area, delimited by the CA, that is undisturbed by noise from traffic, industry or recreational activities".	In Government Decree 280/2004, quiet areas are defined only for agglomerations.
In addition, Article 8, para. 1 and Annex V foresees the protection of quiet areas as the part of NAPs. However, there is a lack of guidance regarding the delimitation of quiet areas in open country, and their protection.	Still an issue. The producer of SNMs identified some areas within all nine agglomerations in order to be proposed as quiet areas. For the moment the municipality did not act in order to subscribe these quiet areas.

14.6 Strategic noise mapping

14.6.1 Overview

An overview of SNMs produced in Rounds 1 and 2 is shown in the tables below.

Table 145 SNMs Hungary

	R1	R2
Agglomerations	1	8 (9)
Major airports	1	1 (1)
Major railways	1	1 (1) (914 km)
Major roads	1	2 (2) (2,903 km)

The R2 implementation position in respect of strategic noise mapping ("noise mapping") is now outlined. For R2, the number of **agglomerations** has increased from one agglomeration in 2007 to nine agglomerations in 2012, as a result of the transition to the definitive END threshold of 100.000 inhabitants. Noise mapping in agglomerations was prepared by nine different municipalities in R2 compared with only one in R1. Noise mapping of major railways was carried out by a single organisation, the Institute for Transport Sciences Office, Environmental and Energy Division[191].

This information was then shared with the relevant city municipalities. For example, there are major railway sections both inside and outside of the Budapest agglomeration.

The mapping of **major roads** was carried out by a single organisation, the Institute for Transport Sciences Office, Environmental and Energy Division. Noise mapping of **major airports** was more complex because it was undertaken by different CAs.

14.6.2 Data collection

Government Decree 280/2004 states that for the communities within its agglomeration area, the methods applied to collect the traffic data and to determine the number of people concerned, as well as the computation programmes used for calculation shall be identical.

The data included in SNMs are to be based on the previous calendar year, and if data is not available they may be based on the most recently available data, which may not be more than four years old. Nearly all districts in Hungary have digital maps, with some districts having detailed 3D building data maps, and population data are available from the Central Statistical Office. Some of this data has to be purchased. Data also has to be submitted by the operators of traffic and industrial facilities.

Obtaining data for strategic noise mapping is the responsibility of consultants for agglomerations. Usually, the data for roads (Road administrations) and railways (Railway administrations) is provided by the public authority which is responsible for producing the initial noise mapping results. The responsible public authorities then pass on the data to the consultant who aggregates the data. The same approach is used for roads and railways whereby public authorities provide consultants with the data since they are responsible for data collection.

Further information about SNMs and NAPs is available on the website of the Hungarian Government.[192]

14.6.3 Strategic noise mapping methods

Detailed technical rules regarding the preparation of SNMs are specified in Decree 25/2004 (XII. 20) which states that:

- The calculation of the noise of public roads is made on the basis of the Road Technical Rules Út 2-1.302:2000 „Calculation of the noise of public road transport" as amended in 2003 according to the proposals of KTI Rt.
- The calculation of railway noise is made on the basis of the amended version of the standard MSZ 07-2904:1990 „Calculation of railway transport noise", developed in 2003 by KTI Rt. The calculation of noise propagation is made in accordance with the standard MSZ 15036
- The calculation of the noise of air transport is made on the basis of the method developed and published by KTI Rt, meeting the requirements contained in the

[191] http://www.kti.hu/

[192] Information available on the website of the Hungarian Government: http://www.kormany.hu/hu/foldmuvelesugyi-miniszterium/kornyezetugyert-agrarfejlesztesert-es-hungarikumokert-felelos-allamtitkarsag/hirek/strategiai-zajterkepek

common decree 18/1997. (X. 11.) of two ministries (KvVM and KTM) which makes reference to that method.

- The calculation of the noise is made on the basis of the following standards MSZ 15036, MSZ EN ISO 3744, MSZ EN ISO 3746: 1999 and MSZ ISO 8297: 1994.

14.6.4 Public accessibility of SNMs

The public has the possibility to access strategic noise mapping results on the internet, since noise maps and population exposure data has been made publically available on the website of the Hungarian Government (http://www.kormany.hu) and of Budapest municipality (http://terkep.budapest.hu).

14.6.5 Implementation issues

No issues were raised as a result of END implementation in R1. Issues raised in R2, together with actions taken to address them are shown in the table below.

Table 146 Strategic noise mapping issues in R2 - Hungary

Issue	Action
The National Cadastral Program was not in accordance with the timetable for undertaking strategic noise mapping. In order to get the necessary geospatial input data in time, the Ministry of Environment and Water negotiated with the organisation in charge of National Cadastral Program and the Program was rearranged. Inconsistent data quality is used in the development of noise maps. There are for instance different GIS used to produce SNMEs for the Budapest agglomeration and for major railways within the agglomeration. Taking into account the two examples it can be observed that the number of affected inhabitants is different. Input data should not be too detailed. Although the Central Statistics Office has detailed data on the number of inhabitants, it proved too time-consuming and labour-intensive to integrate these meta-data with the affected buildings. Less detailed data as described in the Good Practice Guide was instead utilised. The assessment height of 4,0± 0,2 m above the ground was not considered relevant for the preparation of SNMs. The problems have arisen on areas having houses of one storey, because in this case the real receiver points are much lower than 4 m.	No actions identified.

14.7 Noise action planning

14.7.1 Overview

An overview of NAPs is shown in the following table.

Table 147 NAPs – Hungary

	R1	R2
Agglomerations	1	8 (9)
Major airports	1	1 (1)
Major railways	1	0 (1)
Major roads	1	0 (2)

** The NAPs for Debrecen, Győr, Major railways and Major roads are not completed.*

Table 148 NAPs coverage – Hungary

	Major railways		Major roads	
	SNMs	NAPs	SNMs	NAPs
R1	25 km	n/a	539.4 km	n/a
R2	914.1 km	n/a*	2902.8 km	n/a*

**The NAPs for Debrecen, Győr, Major railways and Major roads are not completed.*

The estimation of the expected benefits is an essential element of NAPs. The consultants use an indicator which shows the number of people whose noise situation has been improved due to a given noise reduction measure implemented through the NAPs. Due to the fact that revised SNMs are not yet available, the implementation organisation has no information on the accuracy of the R1 estimations. Hungary national legislation emphasises the reduction in the number of people affected by high noise levels. According to this approach, the limited resources of the implementation bodies are used to improve the situation by prioritising areas that are worst affected by high levels of noise.

For the NAPs for roads and railways, whenever noise limit values are significantly exceeded, the operator of the transport facility is obliged to prepare a NAP to address the problem. However, if the given road or railway line has already drawn up a NAP derived from the END, then this serves the purpose of providing a basis to identify suitable noise reduction measures, and it is then unnecessary to draw up an additional action plan based on exceedance.

14.7.2 Methodologies for noise action planning

The information on NAPs provided in Government Decree 280/2004 is: "*NAPs can be prepared by the natural person or the business organization … or other artificial person holding a permit for expert activity in the field of environmental noise and vibration protection … The NAP shall contain the specifications for the noise reduction or other, technical, organizational, urban planning solutions and other measures aiming at noise protection (e. g initiation of administrative proceedings) which can be applied to prevent the increase of noise in quiet areas designated by the municipality or in areas to be protected from noise (or where such protection is intended) where the noise characteristics satisfy or do not exceed the …strategic threshold values*."

Government Decree 208/2004 states that in order to create a good foundation of the NAP, a noise committee can be established which would be responsible for consultation, counselling and the "harmonisation of interests".

Neighbouring Member States are supposed to cooperate on the NAPs for border regions (Lärmknotor, 2003). By late 2005, noise protection measures had been installed in the process of upgrading the three rail corridors of Hungary, namely Budapest – Hegyeshalom - Vienna, Budapest – Szolnok – Romania and Budapest – Boda – Slovenia.

Guidelines have been produced in Hungary on noise action planning at national level, available at: http://www.kvvm.hu/cimg/documents/_12___tmutat__zaj.doc.

14.7.3 Measures

According to Government Decree 280/2004, the NAPs for R1 and R2 must include the information as provided in Annex V of the END. Examples of the types of measures included in the NAPs are: traffic planning; land-use planning; technical measures at noise source; insulation; and measures to reduce sound transmissions. Priorities were set at national and local levels. The selection criteria include compatibility with existing legislation and the costs of implementation, the ease of implementation and the level of benefit in terms of the potential to reduce high levels of population exposure to environmental noise. Measures that benefit a higher number of people are prioritised.

14.7.4 Public consultations

Government Decree 208/2004 regarding public consultation requires the municipality that prepared a given NAP to inform the relevant public in a locally appropriate manner. Access is provided to the approved SNMs that serve as the basis for the NAPs concerning the area in question (location, date and time), and the contents of the NAP proposal and relevant objectives. The measures adopted in Hungary in R1 and R2 include: putting NAPs online, holding public meetings and launching a press campaign. The process appears to be more focused on communicating information to the public in NAPs that have already been drawn up rather than on informing the development of the NAP during its preparation. There was a questionnaire published on the Internet, but there was no substantial public involvement, as the participation was minimal. So, even the directly affected population was not aware of the role and mission of the directive and the new potentials provided by it.[193]

[193] Issue arise by Mr. Mihály BERNDT from OPAKFI

14.7.5 Implementation issues

Issues raised in R1 and R2, together with actions taken to address them are shown in the table below.

Table 149 Noise action planning issues - Hungary

<table>
<tr><th>R1</th><th>R2</th></tr>
<tr><td colspan="2">Limited time from approval of SNMs to the development of NAPs and difficulties in conducting public consultations within this timeframe.</td></tr>
<tr><td colspan="2">In addition to public consultation, other administrative steps under national legislation also have to be taken to approve NAPs.</td></tr>
<tr><td colspan="2">The shared responsibility made it very hard to draw up an NAP that all stakeholders were ready to implement.</td></tr>
<tr><td>Local government also lacked the skills to draw up an NAP.</td><td>The NAPs are realised by consultants with the final approval of local government</td></tr>
<tr><td>SNMs do not provide enough information to identify the real problem areas, because they do not use an indicator that combines the noise levels with the affected number of inhabitants.</td><td>Such an indicator was not developed. In accordance with the Annex 5 of Government Decree 208/2004, the NAP has to have an evaluation of the estimated number of people exposed to noise levels, the problems and situations that require improvement exploration. This is the way the number of inhabitants affected is provided in the NAP.</td></tr>
<tr><td></td><td>The R2 NAPs for major roads and railways are still under development.</td></tr>
<tr><td></td><td>There was no active public participation in the development process of NAPs.

The Hungarian regulation transposing the END relating to consultation aspects focuses only on the provision of information to the public. Participation by the public in the consultation process is only optional.</td></tr>
<tr><td></td><td>The sharing of responsibilities between different public authorities has made it hard to draw up a NAP that all stakeholders were ready to implement. Local government often lacked the skills to draw up an effective NAP.</td></tr>
<tr><td></td><td>SNMs do not provide enough information to reveal the real conflicts, because they do not use an indicator that combines the noise levels with the affected number of inhabitants. It is recommended that such an indicator be developed. Guidelines have however been produced at national level, these are available at:

http://www.kvvm.hu/cimg/documents/_12___tmutat__zaj.doc</td></tr>
</table>

15. IRELAND

15.1 National implementing legislation for END

15.1.1 Legal implementation

In Ireland, the Environmental Noise Directive has been implemented through the Environmental Noise Regulations 2006 (SI 140/2006)[194]. With regard to national legislation on environmental noise, the main relevant pieces of legislation in Ireland are the Environmental Protection Agency Act (Noise) Regulations 1994, and Sections 106, 107 and 108 of the Environmental Protection Agency Act 1992.

The EPA Act has now been superseded by the EU (Industrial Emissions) Regulations 2013, S.I. 138 of 2013. These Regulations primarily amend the EPA Act 1992 as amended and the Waste Management Act 1996 as amended, to transpose Chapters II and VI of Directive 2010/75/EC on industrial emissions (IPPC).

Noise issues can also be addressed under Section 77 of the 1993 Roads Act, as amended, which provides that the minister may, after consultation with the EPA, issue regulations requiring road authorities or the Authority to carry out works or take such other measures as are necessary to mitigate the effects of road traffic noise in respect of such types of public roads constructed or renovated as specified in the regulations.

15.1.2 Scope of END implementation – Rounds 1 & 2

R1 Strategic noise mapping and Noise action planning in Ireland covered one agglomeration (Dublin), one airport (Dublin) and 564km of major roads outside the agglomeration. In addition, 8km of Major Rail (above 60,000 train passages per annum) in R1 (Connolly to Howth Junction) was also mapped. This section is within the Dublin Agglomeration Area. The first phase of Strategic noise mapping was mainly implemented by five Strategic noise mapping bodies (NMBs) while 26 Noise action planning authorities (APAs) were involved in the development of associated NAPs[195].

In R2, one additional agglomeration (Cork) fell within the Directive’s scope. There was also a major increase in the amount of Strategic noise mapping required for major roads with 8,330 km of major roads outside agglomerations mapped in the second round. In both R1 and 2, whilst Strategic noise mapping was carried out for Dublin airport, the maps were incorporated to support the development of the Dublin agglomeration NAP. An overview of END coverage by Round is provided below:

Table 150 END coverage – Ireland

Round	Agglomerations	Major airports	Major rail	Major roads
1	1	1	8 km	564 km
2	2	1	189 km	8,294 km

[194] http://www.irishstatutebook.ie/2006/en/si/0140.html

[195] Implementation of the EU Environmental Noise Directive: Lessons from the first phase of strategic noise mapping and action planning in Ireland, E. A. Kinga, E. Murphy, H.J. Rice

15.2 Competent Authorities and designated administrative bodies

The Environmental Protection Agency (EPA - http://www.epa.ie/) is responsible for reporting to the European Commission so as to meet the relevant Strategic noise mapping and Noise action planning timelines. According to the Environmental Noise Regulations 2006, the EPA functions are to: exercise general supervision over the functions and actions of noise-mapping bodies and Noise action planning authorities; and to provide guidance or advice to such bodies and authorities. The Department of the Environment, Community and Local Government has the lead authority in relation to policy issues.

It is important to note that in Ireland, under the legislation transposing the END, a distinction is made between strategic noise mapping bodies and noise action planning authorities (whereas in most other countries, these functions are carried out by competent authorities, without a clear distinction between these roles, which is instead determined in national implementation arrangements rather than in the legislation.

Strategic noise mapping bodies produce SNMs on behalf of the relevant noise action planning authorities. Whilst some mapping bodies are also engaged in action planning too, this is not always the case. Taking a practical example, the National Roads Authority (NRA) in Ireland is responsible for carry out extensive noise mapping, but is not involved in action planning since it is not a designated national action planning body under Irish national law.

The responsibilities for END implementation of other institutions are shown in the table below.

Table 151 Responsibility for SNMs and Noise action planning in Ireland

<table>
<tr><th>Role/Activity</th><th>Agglomerations</th><th>Roads (outside agglomerations)</th><th>Railways</th><th>Airports</th></tr>
<tr><td>Data collection</td><td rowspan="3">Local authorities</td><td rowspan="3">National Roads Authority (NRA)*
For non-national roads the relevant (local) road authority or authorities, as appropriate[196]</td><td>Local authorities</td><td rowspan="3">Dublin Airport* Authority and Fingal County Council</td></tr>
<tr><td>Preparing SNMs</td><td rowspan="2">Irish Rail[197]
Railway Procurement Agency (RPA)[198]
Local authorities**</td></tr>
<tr><td>Approving SNMs</td></tr>
<tr><td>Preparing NAPs</td><td rowspan="2"></td><td rowspan="2">Local authorities</td><td rowspan="2">Local authorities</td><td rowspan="2">Dublin local authorities</td></tr>
<tr><td>Approving NAPs</td></tr>
<tr><td>EC/EEA reporting</td><td colspan="4"></td></tr>
</table>

** Strategic noise mapping only ** data collection only*

[196] For major roads: where such roads are classified as national roads in accordance with Section 10 of the Roads Act 1993 (No. 14 of 1993), the National Roads Authority, on behalf of the action planning authority or authorities concerned,

[197] Major heavy railways above 30,000 train passages and all heavy railway within Agglomeration Areas

[198] Major light-railways (LUAS lines) above 30,000 train passages, railways within Dublin agglomeration

For agglomerations, although all local authorities are nominally involved, in practice, the lead coordination role in mapping has been played by particular local authorities. In Dublin, for instance, there are four local authorities that provided input data for Strategic noise mapping for the Dublin agglomeration but the mapping work was coordinated and led by a single local authority, Dublin City Council (DCC). For major roads outside the agglomerations, Kildare Co. council acted as the lead authority for R2, but worked closely with the National Roads Authority (NRA).

A number of designated Strategic noise mapping bodies, such as the NRA, Irish rail, Railway Procurement Agency (RPA), and the Dublin Airport Authority are all involved in Strategic noise mapping but they do not have a specific role in Noise action planning. An interesting feature of the approach in Ireland (in contrast to the UK) is that some national mapping bodies are undertaking the work in-house (e.g. NRA, RPA and DCC for the Dublin agglomeration.

15.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

15.3.1 Data collection

For R1, data was available for the identification of major airports, agglomerations and railways, but only for some roads. In a number of cases, specific surveys were required to generate this data.

In R2, the NRA collected aerial LiDAR data for approximately 3,019km of the Irish national road network. The survey corridor was 1,200m in width. The survey was completed in early 2011 and outputs included 1 metre contours for the entire survey area, building height information for buildings within the survey corridor as well as a digital terrain model.

15.3.2 Implementation issues

For R2, there were no new technical issues raised during the review process. The EPA set up and co-ordinated a Steering group to deal with policy and administrative issues, as well as a Technical Working Group to address any specific technical issues or questions which arose during the Strategic noise mapping process, and to share experience and best practice. The working groups met on a bi-monthly basis over a two-year period, and the EPA also arranged a number of workshops for the NMBs in relation to Strategic noise mapping and Noise action planning.

Table 152 Designation issues - Ireland

R1	R2
Consistency of data generated by different surveys.	No specific issues identified.

15.4 Noise limits and targets

There are currently no ambient noise limits specified in Ireland. The EPA may set noise limits in respect of certain activities that are subject to IPPC licensing; relevant guidance is set out in the EPA publication *"Guidance Note for Noise in Relation to Scheduled Activities"*, which was updated in 2012[199]. The IPPC Licensing Guidance Note for Noise in Relation to Scheduled Activities suggests typical noise limits of 55 dB($_{Ar,T}$) for day, 50 dB($_{Ar,T}$) for evening and 45 dB($_{LAeq,T}$) for night-time, though lower limits may be applied at "sensitive locations" with low background noise levels, or if it identified as a Quiet area for any proposed developments.

Section 107 of the EPA Act 1992 provides LAs with powers to require measures to be taken to prevent or limit noise. These powers are generally exercised in preventing and limiting noise from commercial and industrial premises within their functional areas. A Notice can be served by a LA on any person in charge of any premises, processes or works, other than an activity controlled by the EPA.

In relation to road traffic noise, the most common noise indicator is the L_{A10}, which under the UK CRTN method is measured over 18 hours. Prior to the implementation of the END, the design goals for new national road developments was 60dB (L_{den}). Although the 2004 guidelines issued by the NRA[200] specified a noise limit value target in the design of new national roads in Ireland of L_{den} 60 dB, this is not a mandatory requirement.

There was strong consistency between the R1 and R2 NAPs for the Dublin agglomerations in terms of the target limit values. In the Dublin agglomeration NAP 2013-2018, preferred sound levels have been set at < 50 dB(A) L_{night}, < 55 dB(A) L_{day}, while maximum desired was classified at > 55 dB(A) L_{night}, and > 70 dB(A) L_{day} respectively.

15.5 Quiet areas

15.5.1 Overview

An overview of the situation in respect of quiet areas in Rounds 1 and 2 is provided in the following table:

Table 153 Quiet areas – Ireland

	R1	R2
Number	0	8 (Dublin)
Size (km^2)	N/A	N/A

For R2, there were 8 designated Quiet areas within Dublin City[201]: There are no quiet areas in open country. There are currently no designated quiet areas in Cork. In the 2013-2018 NAP for Cork, it is mentioned that "In the life of this NAP it is proposed to identify quiet areas in consultation with the public".

[199] https://www.epa.ie/pubs/advice/noise/NG4%20Guidance%20Note%20(April%202012).pdf

[200] See National Roads Authority publication "Guidelines for the Treatment of Noise and Vibration in National Road Schemes" http://www.nra.ie/environment/environmental-planning-guidelines/Guidelines-or-the-Treatment-of-Noise-and-Vibration.PDF

[201] www.dublincity.ie/sites/default/files/content//WaterWasteEnvironment/NoiseMapsandActionPlans/Documents/ProposalQuietAreas.pdf

The Environmental Noise Directive (END) and the Irish Regulations transposing the Directive do not give precise guidance as to how to define a quiet area within an agglomeration. The Irish regulations state: - "quiet area in an agglomeration" means an area, delimited by a Noise action planning authority following consultation with the Agency and approval by the Minister, where particular requirements on exposure to environmental noise shall apply; (S.I. No. 140 of 2006 -Environmental Noise Regulations 2006).

While the EPA Guidance note for NAPs does provide some guidance on how quiet areas should be defined, it also notes that there is no universally accepted definition for quiet zones. It indicates that a range of criteria can be used, and it cross-references areas of SNMs below 55dB L_{day} with a dataset of public open spaces. During the implementation of NAPs, the EPA had proposed that possible additional quiet areas could be identified, and had suggested that the existing noise levels could then be preserved or reduced if possible.

There are examples of ways in which criteria to define quiet areas have been developed in Ireland. For example, in the Dublin agglomeration NAP for 2013-2018, the following limit values have been defined as one of the criteria to be used in defining a quiet area.

- < 45 dB(A) L_{night}
- < 55 dB(A) L_{day}
- < 55 dB(A) L_{den}

In the NAP adopted by Dublin City Council in 2008, an absolute value was set of below 55db L_{day} and below 45 decibels for L_{night} as criteria for defining a quiet area. A second criterion related to the concept of relatively quiet areas was also proposed. Such locations are defined by their proximity to areas with high noise levels, and which are valued by the public as a perceived area of tranquillity, such as a local park or green area. Both quantitative and qualitative assessments are used to identify these types of locations. In 2003, the EPA commissioned a research project to meet the requirements of the END in relation to quiet areas. The study sought to establish baseline data for Ireland[202] for the identification of quiet areas. The focus was on quiet areas located in rural areas, rather than in urban areas. The overall definition of rural quiet areas in Ireland is *"an area in open country, substantially unaffected by anthropogenic noise."* The following minimum distance criteria were defined for identifying rural quiet areas:

[202] Waugh, D. *et al*. (2003): Environmental Quality Objectives, Noise in Quiet Areas, Synthesis Report. Prepared for the Environmental Protection Agency, by SWS Environmental Services, SWS Group, available at: http://www.epa.ie/pubs/reports/research/land/noiseinquietareassynthesisreport-epa.html#.VWWj8M9VhBc

Table 154 Rural Quiet Area criteria

Minimum distance from any ...	Other Factors
Urban areas with a population >1,000 people (3km) Local industry (3 km) National Primary Route (5km) Motorway or dual carriageway (as recommended in EU studies) (7.5km) Major industry centre (10km) Urban areas with a population of >5,000 people (10km) Urban areas with a population >10,000 people (15 km)	Low population density Low agricultural productivity (away from intensive farming) Good network of minor roads/tracks to facilitate accessibility and noise monitoring Topography, elevation and land use, including flight paths, wind direction and rural activities Inclusion of a selection of sensitive ecological habitats and land uses at varying elevations Proximity to and inclusion of areas designated for conservation and places of high amenity value with regard to their natural soundscape and transport pressures, in particular traffic flow on national primary and regional routes along the densely populated east coast compared with the low- density population on the western side of the country

However, the conclusions and recommendations in relation to this research project were not followed up on.

The identification of quiet areas was one of the responsibilities of Noise action planning authorities when preparing their NAPs (NAPs). However, it was not referred to in the Dublin Agglomeration NAP, as this dealt with quiet areas in an urban environment. It had been intended that the main findings & recommendations of the report would be made available to the relevant planning authorities, but this did not happen for various reasons (ex. EPA staff re-assigned to other areas).

The methodology used in the Waugh *et al* (2003) report[203] was part of a national 18-month monitoring programme to develop criteria for identifying quiet areas and to establish comprehensive environmental quality standards for quiet areas. Special consideration was given to Natural Heritage Areas, Special Protection Areas, RAMSAR sites and places of high amenity value with regard to their natural soundscape. Measurement locations were chosen to provide sound-level data that would be indicative of what may be experienced by persons frequenting the area. Digital sound recordings were made at some sites to have data representing actual sounds, and physical acoustical measurements were undertaken with GIS modelling to select the sites.

[203] Op cit 74

15.6 Strategic noise mapping

15.6.1 Overview

An overview of the number of SNMs produced in Rounds 1 and 2 is shown below.

Table 155 SNMs - Ireland

	R1	R2
Agglomerations	1*	2*
Major airports	1	1
Major railways		1 (189 km)
Major roads	1	1 (8,294 km)

For R1, since this was the first time that SNMs had been developed at a national level in Ireland, the development of the maps was driven by communication between the various Strategic noise mapping authorities and supported by guidance received from the EPA through various meetings, workshops and presentations[204].

The NRA[205] is a designated Strategic noise mapping body, developed SNMs for all major roads outside agglomerations. In addition, it offered to undertake the Strategic noise mapping of non-national roads identified as major roads on behalf of local authorities. All local authorities within the Dublin and Cork agglomerations dealt with non-major roads for their own areas of jurisdiction. Dublin City Council, together with Fingal County Council, were both primarily responsible for the development of the SNM for the agglomeration of Dublin. These two authorities were also supported by South Dublin County Council and Dún Laoghaire/Rathdown County Council. The SNM for Dublin Airport was developed by the Dublin Airport Authority.

In R2, as shown in the table above, the scope of mapping coverage was significantly extended for major roads. Whereas only 564kms were mapped in R1, this was extended to 8294 in R2. For major railways[206], there was an increase from 58kms to 189.

A national Strategic noise mapping website developed by the NRA provides details on the SNMs produced in 2012 is available here: [http://nra-gis.maps.arcgis.com/apps/Compare/Configure/index.html?appid=0a26a9dd79fd44a68dd90f5445449701.](http://nra-gis.maps.arcgis.com/apps/Compare/Configure/index.html?appid=0a26a9dd79fd44a68dd90f5445449701)

[204] Implementation of the EU Environmental Noise Directive: Lessons from the first phase of strategic noise mapping and action planning in Ireland, E. A. King, E. Murphy, H.J. Rice, Department. Trinity College and Dublin University College, Ireland

[205] The NRA and RPA have now merged to form Transport Infrastructure Ireland (TII).

[206] http://www.irishrail.ie/about-us/strategic-noise-maps

15.6.2 Data collection

The main guidance documents and data sources utilised relating to Strategic noise mapping are summarised in the following table:

Table 156 Strategic noise mapping – data availability and collection methods - Ireland

R1	R2
Specific surveys were necessary to generate the data required for Strategic noise mapping. The Environmental Noise Data Reporting Mechanism Handbook (2007) and the Report Network Delivery Guide were used. EPA Guidance Note for Strategic noise mapping for the Environmental Noise Regulations 2006 (2009)	The EPA updated its 2009 *Guidance Note for Strategic noise mapping* in August 2011 to reflect developments in R2. EPA Guidance Note for Noise action planning 2009 2013-2017 NAPs have also been published – see for example Dublin agglomeration[207].

The institutional responsibilities for carrying out Strategic noise mapping were outlined in the section on CAs and bodies above. A distinction can be made in this regard between designated "mapping bodies", such as the National Roads Authority, which undertook Strategic noise mapping for national roads outside agglomerations (but was not responsible for Noise action planning) and public authorities, such as Dublin City Council which were not only involved in mapping but also nominated as "Noise action planning authorities".

15.6.3 Strategic noise mapping methods

In R1, the UK's CRTN method was used for road traffic noise (Department of Transport and the Welsh Office, UK, HMSO, 1988), and the UK's CRN method for railway noise (Department of Transport and the Welsh Office, UK, HMSO, 1995). CRTN was used for the development of SNMs from road traffic noise for both major roads and agglomerations in Ireland in R1. These methods were included because they have been used previously as part of Environmental Impact Assessments (EIAs) in Ireland, in relation to new road and rail developments. For Dublin airport the ECAC method was used (Doc 29 2nd Edition) as well as INM[208] 6.2a for airport Strategic noise mapping.

In R2, the following changes were made:

RMR Interim was the method to be used for R2 railway noise. CRN was used for the calculation of Rail maps in R1. For consistency with R1, EC adapted Interim Method, Reken en Metvoorschrift Railverkeerslawwaai (RMR Interim) method was used for assessment of railway noise levels.

- The adapted UK CRTN was confirmed as the method to be used for R2 road traffic noise.
- Data input requirements for road source were amended to the UK CRTN method. Road traffic modelling and flow attributes also used the UK CRTN method.

[207] www.dublincity.ie/sites/default/files/content/WaterWasteEnvironment/NoiseMapsandActionPlans/Documents/DublinNoiseActionPlan2013-2018Final.pdf

[208] Although INM 7 is considered by many users as the better technical solution.

In R2, the EPA provided revised Strategic noise mapping guidance and support to Local Authorities on mapping. For instance, in respect of major roads, the revised guidance note covered issues such as producing datasets, as well as traffic flow data. In addition, a number of workshops (3) were organised to cover both Strategic noise mapping and Noise action planning. The NAP for Dublin agglomeration includes the airport.

For major roads, there was a centralised approach to Strategic noise mapping. All SNMs were developed based on modelling calculations and predictions. Specialist Software was used e.g. Predictor, ArcGIS.

Within the Dublin Agglomeration, population exposure statistics were based on incident sound calculation points at the façade of the buildings with the highest sound value.

15.6.4 Implementation issues

A number of issues were raised as a result of R1, a summary of which is shown below, together with actions taken to address them, and any new issues raised during R2.

Table 157 Strategic noise mapping issues - Ireland

R1	R2
Lack of training and previous experience in preparation of SNMs among local authorities.	A revised guidance note was issued by the EPA on Strategic noise mapping in 2011.
Gaps in input data and dependence on carrying out surveys.	Experiences gained and knowledge has been transferred e.g. from Dublin City Council to Cork County Council. Dublin City Council acquired technical expertise in mapping during R1, and has supported local authorities in the Cork agglomeration that weren't included in R1 as an agglomeration.
Lack of guidance/information on cost-effective survey methods.	The importance of frequent coordination between different types of Strategic noise mapping bodies with responsibilities at different levels of governance was stressed (e.g. road maps for agglomerations were dependent on NRA at national level).
Lack of guidance on data requirements and choice of methods for noise models. Lack of standardised method for calculating population exposure levels in Europe.	There remains a lack of standardised method for calculating population exposure levels in Europe.
Reported façade data were not used – interpolated contour data were used as an alternative. Estimates of population exposure risk being erroneous.	
Lack of availability of robust data sets.	

In undertaking Strategic noise mapping, extensive coordination was needed between organisations involved in mapping and Noise action planning at different levels of governance specially to produce SNMs and NAPs for agglomerations. For instance, local authorities had to liaise with each other and with the NRA.

An evaluation survey of Strategic noise mapping bodies that was carried out by the EPA at the end of R2 did identify a number of issues (modelling data, qualified personnel, reduced budgets) that the Strategic noise mapping bodies felt would need to be considered at the start of the Round 3 process.

15.7 Noise action planning

15.7.1 Overview

Table 158 NAPs Ireland

	R1	R2
Agglomerations	1 (1)	2 (2)
Major airports	1 (1)	1 (1)
Major railways	0	0
Major roads	22	26

The following data was provided by the Irish national competent authority.

R1 NAPs 2008-2013 (all infrastructure, including within an agglomeration)

- 23 NAPs were produced.
- 27 Local authorities were involved in the process of producing these NAPs

R2 NAPs 2013-18

- 28 NAPs were produced.
- 34 Local authorities were involved in the process of producing these NAPs.

Major Rail 2013:

SNM**:** One SNM was produced for all major rail in Ireland (189 km).

- The **Dublin agglomeration** NAP included the major rail section (150km)
- The Kildare NAP included actions for this section of major rail.

Major Airports 2013:

- A SNM derived from computation was prepared for Dublin airport, and the validated data was then incorporated into the SNM for Dublin agglomeration.
- The NAP for **Dublin agglomeration** includes the airport (as part of requirements within agglomerations to map aircraft noise, but there is no separate dedicated airport action plan).

15.7.2 Methodologies for noise action planning

The EPA issued a guidance note for the development of NAPs in R1. The final version of this document was published in July 2009. The action guidance note also refers to other guidelines such as the WHO guidelines, the UK DfT levels for airports, Irish criteria relating to industrial noise (IPPC guidance), as well as English planning guidance for railways and guidance on undertaking cost-benefit analysis. The guidelines put a strong emphasis on setting priorities locally.

15.7.3 Measures

Among the summary measures identified following a review of the NAPs submitted were:

- Noise mitigation measures for roads, such as traffic planning and the installation of noise barriers
- Promoting greater consideration of environmental noise related issues in land-use planning
- Measures to promote greater use of public transport and to encourage people to walk and/ or cycle more, etc.

Among the selection criteria for the identification of measures to tackle noise on a prioritised basis in NAPs is whether a cost-benefit assessment has been carried out of the proposed measures and whether sufficient reference has been made to guidelines on noise limits.

Some information was available on noise mitigation measures for roads. For example, during R1, the M50 Upgrade Scheme required the installation of noise barriers and low noise road surfacing measures. This Scheme led to the construction of 16km of new noise barriers, and 7km of existing barriers had their height raised. Most of the proposed barriers are 2-4m in height, but some are up to 6m. A noise and vibration assessment was undertaken for the construction and operation of the proposed scheme. The assessment was undertaken with regard to the guidance set out in the National Roads Authority (NRA) Draft Guidelines for the Treatment of Noise and Vibration in National Road Schemes 2004.[209]

15.7.4 Public consultations

Public consultations in Ireland require that Noise action planning authorities must ensure that:

- The public are consulted on proposals for NAPs;
- The public are given early and effective opportunities to participate in the preparation and review of NAPs
- The results of public participation are taken into account in finalising NAPs or reviews of NAPs; and that
- The public are informed of the decisions taken in relation to NAPs; and that reasonable time-frames are adopted to allow sufficient time for each stage of public participation.

With regard to how the public consultation process is managed, taking the NAP 2013-2018 for the Dublin agglomeration as an example, feedback was sought over a 5-week period from statutory bodies and the general public. In order to publicise the consultation, advertisements were placed in two national Irish newspapers requesting feedback on the draft NAP. Copies of the draft NAP were placed in each of the four Council Offices comprising the Dublin agglomeration and an e-version was placed on each of the Council websites. Thirteen responses were received, four from statutory bodies, four from residents' associations and community groups and a further five from individuals. The final version of the NAP provides a summary of the responses received to the public consultation in Section 8 with detailed responses set out in Annex G.

[209] https://www.engineersireland.ie/EngineersIreland/media/SiteMedia/groups/societies/roads-tranport/The-Upgrade-of-the-M50-in-the-context-of-an-integrated-approach-to-transportation-in-Dublin.pdf?ext=.pdf

Other initiatives have also been undertaken to improve information and data availability for the public. For instance, in the NAP 2013-2018 for the Dublin agglomeration, data was made available in 2014 from the ambient sound monitoring networks gathered through the implementation of the previous NAP 2008-2013.

15.7.5 Implementation issues

Issues related to implementation during Rounds 1 and R2 are highlighted below:

Table 159 Noise action planning issues - Ireland

R1	R2
Availability of sufficient funding to implement plans	There was good cooperation between the various Strategic noise mapping bodies in relation to Strategic noise mapping. However, there was less interactions when it came to the NAPs. Part of the problem relates to Noise action planning processes being localised whereas the budget needed to implement measures and legal jurisdiction e.g. over the railways and road network is at the national level. Therefore, there may be a mismatch between measures mentioned in NAPs and the ability to implement these (funding, practical constraints, other strategic planning processes being out of synch)

16. ITALY

16.1 National implementing legislation for END

16.1.1 Legal implementation

Legislative Decree No. 194/2005 of 19 August 2005 transposes the specific requirements of the END[210]. It defines the powers and procedures for Strategic noise mapping, the development and adoption of NAPs to reduce noise, and the provision of information to the public.

In addition, noise pollution issues are regulated under Law No. 447 of 26 October 1995, Framework Law on Noise Pollution[211], which contains noise limit values. For road infrastructures, the Environment Ministry Decree of 29 November 2000[212] and Presidential Decree No. 142 of 30 March 2004[213] set noise limit value, as well as establishing the technical parameters for building the noise mitigation works. Equally, the Presidential Decree 18 November 1998 n. 459 regulates noise pollution emissions produces by railways network traffic. [214].

The Italian law regulating noise pollution (447/1995) also introduced a series of implementation decree, including the D.P.C.M 14 November 1997 "Definition of noise value limits of noise sources" which establish the criteria for the acoustic classification in the territory and the respective noise limits.

In order to comply with the directive and accounting, at the same time of the national legislative framework, in 2012, the national CA developed guidelines to support in the implementation of the second round of implementation of the directive.

Although the END is implemented through a national legal framework, Italy has a federalised administrative structure, with each region being responsible for designating the responsible CAs for agglomerations and major road infrastructure at local level (i.e. provinces, municipalities). According to the Italian procedure, regions are also responsible for verifying the accuracy of SNMs and NAPs, and for communicating with the national CA. As mentioned above, the latter has the overall responsibility of formally verifying all NAPs and submit them to the Commission via the EIONET reporting system.

The Italian Ministry of the Environment has overall responsibility for END implementation. In this report, since it would not be possible to comprehensively cover all Italian regions in a single country report, more detailed information is provided for the Tuscany region, which was chosen because this was the focus of the Milieu country report in 2010 so a continued focus on the region will help to ensure consistency when making comparisons between Rounds. While the significant reference to the Tuscany region data and experience has repercussions for the applicability of information for the whole country, the expertise and know-how demonstrated by the responsible officials in the Tuscany regional authority means that their feedback adds value to the assessment of implementation in Italy. Wherever data is available on a national level, an overview of the national state of play is provided.

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[210] http://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.legislativo:2005;194

[211] http://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:legge:1995-10-26;447!vig=

[212] www.gazzettaufficiale.it/eli/id/2000/12/06/00A15030/sg

[213] http://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.del.presidente.della.repubblica:2004-03-30;142!vig=

[214] www.gazzettaufficiale.it/eli/id/1999/01/04/098G0508/sg

16.1.2 Scope of END implementation – Rounds 1 & 2

R1 of Strategic noise mapping and Noise action planning in Italy included 11 agglomeration with more 250.000 inhabitants per each agglomerations, 9 major airport(s) with more than 50,000 movements per year, and approximately 10,762 km of major roads with more than 6 million of vehicles per year, and 646 km of railway with more than 60 thousand trains per year.

The introduction of thresholds in R2 led to the coverage of agglomerations with more than 100,000 inhabitants, major railway lines with more than 30,000 trains per year, and major roads with more than 3 million of vehicles per year. [215]

The following table summarises the documentation concerning SNMs as requested in R1 and R2. The second column provides the data concerning the update of the data requested in R1, but were submitted in R2.

Table 160 END coverage – Italy[216]

Round	Agglomerations	Major airports	Major rail	Major roads
1	11	9	646 km	10,762 km
2	29	10	3,457 km	13,559 km

In terms of the national context and key developments since the Directive was adopted, there have been a number of developments to tackle noise in major roads. In 2011, the Italian Ministry of the Environment approved the Containment and Abatement Plan for Noise from Motorways through decree no. GAB - DEC - 0000034 of 11.03.2011 which was published in the OJ of 04.05.2011 with the specifications and requirements specified in the Scheme of Understanding approved in the Conference of the State and Regions in its meeting session of 18.11.2010.

Further key national legal developments in support of the technical implementation of the Directive were expected; however, the Italian government have not yet released them[217]. These were supposed to:

- Decree of the national government by 2008: to define criteria and algorithms to convert noise limit values as for art.2 of national legislative decree 447/1995, for acoustic indicators L_{den} e L_{night};
- Decree of the Ministry of the Environment by April 2006: to define criteria for developing SNMs and respective NAPs;
- Decree of the Ministry of the Environment by April 2006: to define criteria for determine environmental noise indicators and associated harmful effects;
- Decree of the Ministry of the Environment by October 2006, aiming at coordinating the implementation of the Directive in relation to the national Framework Law on environmental noise control and management (Dls. 447/95);

[215] ISPRA. State of art relating to Action Plans and Noise Reduction and Abatement Plans in Italy.

[216] EIONET Report, Country Report Italy.

[217] Callegari & Poli (2008) IL RECEPIMENTO ITALIANO DELLA DIRETTIVA 2002/49/CE: RIFLESSIONI E PROPOSTE PER IL COORDINAMENTO CON LA NORMATIVA VIGENTE AI SENSI DELLA L 447/95. AIA report for the 35th National Conference.

- Decree of the president of the Republic by October 2006: to agree on the amendments necessary to ease and improve the technical implementation of the Directive in relation to the national Framework Law.

Because of the delays in the national legal implementation during the period between R1 and R2, in April 2013, Italy was involved in infringement proceedings by the Commission for lack of compliance with the Directive 2002/49/CE requirements regarding R1.

In order to improve the Directive's implementation procedures by national CAs, the Ministry of Environment has developed guidance line to assist national bodies in the development of SNMs, NAPs and data requirements as well as providing default format to present and edit the documentation.

So far, the Italian regulation (194/2005) that regulates the implementation of the Directive has not changed nor updated. However, the Ministry of Environment maintains active by organising working groups and workshops with the aim of engaging designated CAs to agree a common way of gathering and elaborating data in respect of the guidance handbook provided by the commission. The art n. 19 of the law 30 October 2014, n. 161 "Regulations for the implementation of the European Law 2013-bis" delegates the Government to harmonise within 18 months the national regulation regarding noise pollution through the Directives 2002/49/CE, 2000/14/CE and 2006/123/CE, and with the Regulation (CE) n.765/2008.

16.2 Competent Authorities and designated administrative bodies

The Italian Ministry of the Environment is the national CA in Italy. Its role is to communicate and report to the Commission on the state of play of the directive implementation at national level. To comply with this procedure, the Ministry of Environment receives technical support by ISPRA, which is the National Institute for Environmental Protection and Research. The Institute supports the Italian Ministry of the Environment with the technical analysis of data and by attending technical meeting and working groups at national and European levels.

As mentioned in the section setting out the overview of the context at national level, there is a regionalised approach to END implementation, with regional authorities playing an important role.

Taking the Tuscany region as an example, the region is responsible for designating the CAs in charge of developing SNMs and related NAPs for the identified agglomerations and road infrastructures as specified by the Directive. In doing so, the region takes into account specific areas of competence concerning roads networks, reflecting whether they are managed at the province or municipal level. Table 5 below gives an overview of different authority level and areas of responsibility.

Table 161 Administrative Responsibility for the END - Italy

Role/Activity	Agglomerations	Roads	Railways	Airports
Preparing SNMs	Municipalities	Regional Authority[218] Provinces Municipalities	Italian Railway Network	Airport operator
Approving SNMs				
Preparing NAPs				
Approving NAPs				
EC/EEA reporting	Ministry of Environment			

[218] Some national Roads are managed by licensed authorities such as Autstrade Srl or ANAS

Specifically, the region requires the provinces to provide data and develop SNMs and NAPs for roads networks with an annual average traffic of over 3 million vehicles. The same applies to the municipalities, which are responsible of agglomeration with over 100,000 habitants.

The region is then responsible for verifying the factual accuracy of data and for the submission of the requested documentation to the national CA. In addition, the region also plays a coordinating role between the various government levels and the public. However, to be specific, it is the responsibility of the municipalities to arrange for public consultation before approving the NAP[219].

Responsible administrative bodies for the collection of data include the authorities of the Tuscany region, the Unit for Protection against electromagnetic, acoustic, and environmental radioactivity and ARPAT, which is the regional public body responsible for environmental protection in Tuscany. They also support provinces and municipalities with technical issues and data gathering.

Responsible administrative bodies for making and approving SNMs and NAPs include the Region of Tuscany (Unit for the Coordination of Transport and Logistics), Settore Viabilità di Interesse Regionale, the provinces of Firenze, Livorno, Pistoia, Pisa, Siena and Lucca and the City of Florence, Prato and Livorno.

In Italy, ensuring effective coordination of responsibilities between different administrative bodies is considered a problem. For example, municipalities due to lack of financial resources, capacity and knowledge failed to submit data and develop requested documentation in due course.

In R2, some municipalities made significant progress thanks to the additional guidance provided by the national CA. The latter worked to secure further engagement from local authorities and region to avoid the lack of commitment that happened during R1. In Italy, major implementation difficulties are related to the lack of coherence and coordination between the directive and the national framework law (447/95). During R1, a lack of clarity led to a duplication of efforts between national and local authorities.

16.3 Designation and delimitation

16.3.1 Data collection

The Italian Ministry of Environment has the overall responsibility for reporting data to the EEA through the Reportnet system within EIONET. In order to do so, ISPRA and the regional authorities provide technical, administrative and coordination support.

As mentioned before, regional authorities assign provinces and municipalities the responsibility for collecting data in respect of major roads at regional level and agglomerations. One of the interviewees indicated that the data collection required lots of communication between various departments.

Practical responsibilities for roads, railway and airport are allocated to different CAs, which have to report to the region on the progress made.

For example, responsibility for roads is shared between the provinces at regional level and local authorities. The provinces are responsible for Strategic noise mapping and Noise action planning for major roads that are not national highways or local/municipal roads. Local authorities at municipal level, which are considered

[219] http://www.regione.toscana.it/-/inquinamento-acustico

agglomerations, are responsible for the provision of data and information on local / municipal roads.

16.3.2 Implementation issues

A number of issues were raised because of experiences over both Rounds.

Table 162 Designation issues

R1	R2
Several Italian authorities indicated that the interpretation of the Directive concerning the term "agglomeration" raised significant issues for the designation of responsibilities. The Tuscany region intervened through its own law in order to resolve compatibility issues, which allowed identifying the agglomerations and related CA. This meant allocating tasks to the bodies in charge of the implementation of the European directive as specified in the Italian decree (lr. 89/98[220], edited with the latest lr. 39/2011)	Due to the geographical extension of agglomerations, managing the respective amount of data proved to be challenging. Difficulties were particularly experienced by CAs in charge of gathering data, which were different from those responsible of developing NAPs. This caused delays.
Competent and public authorities indicated that the transmission of data across all different authorities' levels posed serious difficulties due to the difference of data format adopted and data availability.	Same although some improvements occurred between R1 and R2. National guidance supported CAs in adopting same methods and format to analyse data.
CAs indicated the issue of coherence between the directive and the national legislation with regard to "quiet zones" and the action required to address such issues.	Same although some improvements occurred between R1 and 2. National guidance supported CAs in clarifying identification criteria for quiet zone in Italy, although it is still problematic. Via Regulation n. 2/R/[221], the Tuscany region has approved technical guidelines to identify quiet areas (these in the Italian legislation are called "silence zones") in a manner not properly suitable to the directive meaning) and linked them to the noise classification as foreseen by the national law.
The list of major railways in Italy changed between 2005 and 2008. This caused some difficulties for the 2008 reporting exercise. The Italian state railways mentioned however that some transport managers had trouble delivering study results that they had carried out to CAs in agglomerations.	The RFI respondent reported that several difficulties were encountered with the strategic map format to be used, which kept been updated until after the submission deadline. The problem of the different formats used by different authorities has been an issue for the CA of the agglomeration.

220 http://raccoltanormativa.consiglio.regione.toscana.it/articolo?urndoc=urn:nir:regione.toscana:legge:1998-12-01;89

221 http://raccoltanormativa.consiglio.regione.toscana.it/articolo?urndoc=urn:nir:regione.toscana:regolamento.giunta:2014-01-08;2/R

16.4 Noise limits and targets

16.4.1 Objective and Scope

The Decree of the President of the Cabinet, 14 November 1997, "Determination of limits for noise sources," sets noise limit values for five categories of land use. Limit values include maximum emissions, as well as absolute noise release limit values (emissions) for all noise sources. Specific regulations are provided for road, rail, sea and aircraft noise.

The limit values are provided in the table below:

Table 163 Noise limit values

Categories of land use	Leq in dB			
	Noise emission limit values		Absolute limit values for release of noise (emissions)	
	daytime (06.00-22.00)	night (22.00-06.00)	daytime (06.00-22.00)	night (22.00-06.00)
I specially protected areas	45	35	50	40
II areas predominantly Residential	50	40	55	45
III areas of mixed type	55	45	60	50
IV areas of intense human activity	60	50	65	55
V areas predominantly Industrial	65	55	70	60
VI purely industrial areas	65	65	70	70
Quality areas	Limits defined by regional law			
Silence zones (*)	Limits defined by regional law			

** At present foreseen only in the legislation of the Tuscany region*

It is important to specify that according to the Italian legislation 447/1995, different type of noise value limits is considered:

1. Emission Values: the maximum value of noise that can be emitted from a noise source and measured nearby the source itself;
2. Limits of emission values: the maximum values of noise that can be emitted by one or more noise sources in living environment or outdoor, which is measured nearby the receptors. These values are categorised as follows:
    a. Absolute limits values;
    b. Differential limits values;
3. Attention values: noise values which indicates the presence of a potential risk of harming human health or the environment.
4. Quality values: noise values to be addressed in the short, medium and long period through technologies and methods available, in order to meet the objective of the current law.

Table 164 Noise limit values for land use categories in the domestic and outside environment in Italy[222]

Categories of land use	Leq in dB			
	Noise emission limit values		Absolute limit values for release of noise (emissions)	
	daytime (06.00-22.00)	night (22.00-06.00)	daytime (06.00-22.00)	night (22.00-06.00)
I specially protected areas	45	35	50	40
II areas predominantly Residential	50	40	55	45
III areas of mixed type	55	45	60	50
IV areas of intense human activity	60	50	65	55
V areas predominantly Industrial	65	55	70	60
VI purely industrial areas	65	65	70	70

Under Law No. 447 of 26 October 1995, Framework Law on Noise Pollution, the following general guidelines are given for managing noise releases from transport infrastructure:

- The maximum noise exposure and the areas to which they are applied (relevant noise bands) are set by specific implementation decrees and regulations
- Levels of noise pollution must be brought down to within the limits of the law defined by the decrees and regulations by preparing and rolling out the multi-year improvement plans;
- To carry out noise reduction and abatement works, since 1995 the owners and licensees of transport infrastructures have been obliged by law to allocate no less than 7% of their funds to infrastructure maintenance and improvements. This value is 2.5% in the case of roads that are state-owned (ANAS).

Presidential Decree No. 142 of 30 March 2004, "Provisions for the control and prevention of noise pollution caused by vehicular traffic" defines the limit values from road traffic. Limit values distinguish between the type of road, distance from the infrastructure (affected bands within which no account need be taken of the common noise zones), building type (residential, schools and hospitals) and period of exposure (day and night). For every building, the most critical point of the most exposed wall is considered; as an alternative to the limits of exposure assessed from outside, also the permissible limits inside the homes are considered. The limit values for road traffic are provided in the table below.

[222] Come esempio di classificazione acustica del territorio può essere consultato il sito della Regione Toscana all'indirizzo: http://www502.regione.toscana.it/geoscopio/inquinamentifisici.html

Similar dispositions regulating the railway traffic are defined by the **Presidential Decree No. 459 of 18/11/1998, "Regulation allowing the definition of regulation rules of the art. 11 of the law 26 October 1995, n. 447**, concerning noise pollution produced by railways traffic.

Airport noise must be evaluated following the Minister Decree of October 31, 1997. Three airport limit zones are defined around each airport area: A zone (no activities limitations); B zone (agricultural, livestock breeding, industrial, trading, tertiary and assimilated are allowed only if suitable noise reduction procedures are adopted); C zone (only activities due to the airport infrastructure are allowed). LVA values have not to exceed the following limits.

- A zone: 65dB(A);
- B zone: 75 dB(A);
- C zone: 75 dB(A);
- Outside A, B and C zone: 60 dB (A)[223].

Table 165 Noise limit values for road traffic in Italy (existing roads).

Road Types	Sub-types	Noise band breath (m)	Schools, hospitals, rest/nursing homes		Other receptors	
			Day dB	Night dB	Day dB	Night dB
A – motorway		100 – A	50	40	70	60
		150 – B			65	55
B – main out-of-town roads		100 – A	50	40	70	60
		150 – B			65	55
C – secondary out-of-town roads	Ca – dual carriageway	100 – A	50	40	70	60
		150 – B			65	55
	Cb – all secondary out-of-town roads	100 – A	50	40	70	60
		50 – B			65	55
D – urban fast roads/dual carriageways	Da – inter-district dual carriageway	100	50	40	70	60
	Db – all urban fast roads/dual carriageways	100	50	40	65	55
E – district urban		30	Defined by the municipality in accordance with the limit values under Presidential Decree No. 447 (see table 4.29)			
F – local		30				

Source: Autostrade per Italia - http://www.autostrade.it/en/risanamento-acustico/normativa-italiana.html

[223] Cotana, F. and Nicolini, A, 2004, "Noise mapping: The evolution of Italian and European Legislation," http://www.crbnet.it/File/Pubblicazioni/pdf/1148.pdf

16.4.2 Associated enforcement and mitigation measures

With regard to mitigating noise from transport infrastructure and enforcing limit values, ***Environment Ministry Decree of November 29, 2000, entitled "Criteria for drafting plans for the control and abatement of noise by companies and bodies that operate public transport services or related infrastructure"***[224] obliges operators to prepare and implement noise abatement plans. Plans must specify costs, priorities and work methods (barriers, road surfaces, any actions undertaken on individual receptors etc.) with related completion timescales. Operators identify priorities, taking into account the number of persons exposed and the difference between the current noise levels and the permissible limits. The Decree sets criteria for noise reduction activities, identifies the requirements of the models used to calculate the barriers' characteristics; and establishes criteria for assessing multiple sources to ensure that noise values remain below permissible values in cases when other sources of noise are present. Following approval of the plans by the Environment Ministry, improvement works must be completed within 15 years.

At the regional level, taking Tuscany as example, further regulation was implemented to secure an effective implementation of the national decree (11.09.2000) in accordance with the requirements set by END.

In Tuscany, the regional law n.39, August 2011, amends regional responsibilities concerning environmental noise, and recognise specific management functions to the regional authority and to other local authorities (i.e. provinces and municipalities) in the area of mobility and traffic. From 2011, Tuscany region is responsible to:

- Develop plans for the control and abatement of noise, as required by the decree 29/11/2000 for the roads owned by the region;
- Develop SNMs and NAPs for roads as specified by the legislative decree 194/2005 for the above roads.

In line with these regulations, Tuscany region delivered the following measures:

- Regeneration and improvement of road pavement thorough the instalment of soundproof asphalt. This road (SGC FIPILI) is 100 km long and it crosses the towns of Firenze, Pisa and Livorno.
- Regeneration of road pavement through the implementation of an experimental asphalt, which was tested through the project Leopoldo[225]. This is the regional road SR 435.

The Italian Rail Authorities (RFI) have implemented measures to contain and reduce rail noise, including the construction of noise barriers and infrastructure monitoring (such as assessing the steel girders of bridges)[226]. According to one of the interviewee, RFI, in compliance with the national legislation, installed approximately 400/500 km of acoustic barriers.

Italian legislation on noise from airports obliges the following procedures for monitoring and enforcement:

- Definition of anti-noise procedure for each airport which must be respected by airplanes during taking off and landing phases and during land operations;

[224] http://www.autostrade.it/en/risanamento-acustico/pdf/D-M-29-novembre-2000.pdf

[225] http://www301.regione.toscana.it/bancadati/atti/DettaglioAttiG.xml?codprat=2013DG00000000163

[226] RFI, 2009, http://www.rfi.it/cms/v/index.jsp?vgnextoid=13fd2ce4c155b110VgnVCM1000003f16f90aRCRD

- Continuous monitoring system of airport noise in order to guarantee the noise limits,
- Classification of the national airports on the basis of noise emissions;
- Economic sanctions in the case of exceedance;
- Obligation to adopt noise reduction measures in case of exceedance;
- Restrictions of night-time air traffic.

The lines of action outlined above are provided for under the following decrees:

- Decree 31/10/97 on Measurement methodology of airport noise;
- Decree n.496, 11th December 1997, on regulations for the reduction of acoustic pollution caused by civil aircrafts;
- Decree 20/5/99 which defines criteria for the design of monitoring systems for controlling acoustic pollution levels close to the airports and criteria for the airport classification related to the acoustic pollution level;
- Decree 3/12/99 regarding anti-noise measures and respect areas in the airports; and
- Decree n.476, 9th November 1999, on the ban of air traffic at night.

16.4.3 Implementation issues

According to the interview respondents, issues raised in Rounds 1 remained issues in R2. This is because the Directive is not easy to reconcile with the national regulation on noise. The latter set different noise indicators and foresees sets of actions that differ from those requested by the NAPs drawn up under the END. Even the timing of the actions is different. This means that the implementation of noise mitigation measures, as requested by the national legislation, and the NAPs requested by the Directive are not coordinated and create duplication.

Moreover, while the introduction of common noise indicator for different periods of the days (L_{den}, L_{night}) might have been beneficial for those countries without pre-existing noise mitigation measures in place, but for countries, such as Italy, the introduction of such indicators created difficulties of translation and integration, especially when previously defined indicators led to mitigation actions already in progress.

16.5 Quiet areas

Criteria used for the delimitation of quiet areas

Italian national legislation already provides for a certain number of acoustic and non-acoustic criteria for the delimitation of quiet areas (the Italian legislation refers to “areas in class I”, “quality areas” and “silence zones”. Only the latter corresponds to the END definition. These include, among other elements, the protection of areas around schools, hospitals, nursing homes and retirement homes. Natural parks and general protected areas are other types of quiet areas, as defined by the national legislation.

Methodologies employed

A common methodology was implemented at the national level based on the non-acoustic criteria noted above. However, with regard to END implementation, one interviewee indicated that CAs encountered difficulties in defining them since the European directive set criteria not coherent with the national regulation. The region Tuscany, through the regulation n. 2/R/2014, which implements the lr. 89/98, as amended in 2011, defined the appropriate criteria for individualising quiet areas within its territory, integrating it with the national requirements[227]. With regard to R2, the agglomeration of Florence, supported by the region, implemented actions aimed at the protection of pilot quiet areas as defined by the LIFE+10/ENVIT407, QUADMAP.

16.5.1 Overview

At national level, quiet areas are defined by applying the "Class I" definition as foreseen by the municipal classification under the law 447/1995. This data is currently not available as reported by the national CA.

In the case of the Tuscany Region areas of "Class I" are 617 for a total of approximately 1591 km^2 and, within these, only one "quality area" has been identified which has an area of 2.61 Km^2.

The table below summarises the number and size of quiet areas established during Rounds 1 and 2 always in Tuscany Region.

Table 166 Quiet areas –Tuscany Region

	R1 *	R2 **
Number	551	552
Size (km^2)	4.29	4.84

** Florence. In Florence, for R1, the identification of quiet areas was done without implementing any particular criteria. The areas corresponded to schools, gardens and urban parks – which explains the high number.*

*** Florence, Livorno and Prato. In R2, the number of quiet areas for Florence remained the same as in R1. One quiet area was added for Prato, which fell into the scope of the END in R2 as an agglomeration. The definition of this quiet area followed the regional guidelines as established by the Regulation n. 2/R/2014. Livorno did not designate any quiet area but postponed it to the revision of their urban strategic plans.*

16.5.2 Implementation issues

Issues were raised as a result of END implementation in R1. Issues raised in R2, together with actions taken to address them are shown in the table below.

Table 167 Quiet area issues

Issue	Action
Lack of clarity and incoherence of criteria of definition of quiet zones between national and European directive. [228]	Between R1 and R2, the national/regional CA released guidance, which tried to address such inconsistency.

[227] See Chapter 7 of Good practice guide on quiet areas, EEA, Technical report No 4/2014 at: http://www.eea.europa.eu/publications/good-practice-guide-on-quiet-areas

[228] More specifically, according the Italian normative, the concept of quiet area, is applied in regard of areas that have a natural asset (i.e. parks and protected areas) or to those of which use is related to low noise level such as schools, hospitals and nursing and retirement houses. This concept is in conflict with what is foreseen by the END directive, which considers quiet area also urban zones (i.e. squares and urban parks).

16.6 Strategic noise mapping

16.6.1 Overview

An overview of SNMs produced at national level in Rounds 1 and 2 is shown below.

Table 168 SNMs – Italy (national level)

	R1	R2
Agglomerations	9	15 (29)
Major airports	9	9 (10)
Major railways	4	3 (3,457 km)
Major roads	28	29 (13,559 km)

Source: Italian Ministry of the Environment

Table 169 SNMs – Regional level (Tuscany region)

	Agglomerations	Major airports	Major railways	Major roads
R1	1	0	0	3
R2	3	0	0	55

16.6.2 Data collection

For the Tuscany region, data collection responsibility is defined by the lr. 89/98 as amended by the lr. 39/2011 and by the regulation that implement it n. 2/R/2014.

For the Tuscany region, methods are defined by the lr. 89/98 as amended by the lr. 39/2011 and by the regulation that implement it n. 2/R/2014.

16.6.3 Strategic noise mapping methods

Methodologies for Strategic noise mapping

RFI reported in the questionnaire that the detailed traffic data were derived from their database RIACE. The noise emission data were derived directly from RFI's database of noise measures. Geographic data were derived from RFI GIS and finally the number of people living in buildings has been pulled together from the latest ISTAT census.

The authority from Tuscany reports that data were obtained through GIS overlays. According to the Tuscany Region, national guidelines have been laid down for Strategic noise mapping. Indicators L_{den} and L_{night} have both been used in the preparation of the maps.

In particular, strategic mapping of regional roads network is based on the technical regional map. Traffic data for each route defined as main network, are extrapolated by other data measured by the regional department of viability. ARPAT defined the acoustic model for each route and calculated estimate of noise pollution level on the bases of the implementation guideline of END.

RFI reports that day and night L_{eq} have also been used to allow for the comparison with the limit values laid down in the national legislation. Both authorities believe revisions of the maps every five years to be appropriate. Similarly, to RFI, Tuscany region obtained the results by applying national and European indicators, and this criterion defined the conflict maps, and consequently the areas covered by the NAPs.

16.6.4 Public accessibility of SNMs

SNMs in Italy have been made available to the public via websites. Due to the decentralised, federalised structure, the approach has been regionalised with SNMs available via the GIS tool of Tuscany region[229].On the Tuscany region website SNMs for agglomerations and regional and provincial roads, are accessible together with the maps on the main national infrastructure (roads and railways) that cross the Tuscany regional territory.

For major roads, a webpage has been set to maps on the website of Autostrade per Italia.[230]

A number of issues were raised as a result of END implementation in R1 and 2, as summarised in the following table:

Table 170 Strategic noise mapping issues

R1	R2
Problems with estimating the number of dwellings exposed to noise. One of the reasons was that land planning maps were too old and there is no census of the number of inhabitants per building. Furthermore, difficulties were reported regarding the estimations of the number of exposed facades of buildings. These difficulties were partially overcome through calculations using the volume of buildings. Significant costs in the production of SNMs in R1.	For what concerns noise strategic maps of agglomerations in Tuscany, difficulties emerged because of the overlap in responsibilities. According the current Italian legislation, each managing authority of major infrastructure has to provide to the agglomeration CA the SNM showing the related noise rate adding up to total noise pollution level in the agglomeration. Such contribution has to be added up to the infrastructure that are of competence of the agglomeration. Therefore, it is clear that there is a lack of direction and instructions on how to calculate and provide data, in order to aggregate data properly. As result, maps so far produced can only be approximated. The issue stemmed in R2 since R1 did not require a total strategic map but a map concerning individual noise source, (i.e. roads, railways, airport, and industry). In R2, securing the funding necessary to implement the directive is considered one of the major obstacle to comply with the directive. In R2 the costs to implement the directive significantly increased, taking into account the fact that from R1 to R2, the number of bodies involved in went from 2 (Region and the Florence municipality) to 10 (Municipalities of Florence, Livorno and Prato, Region and Provinces of Firenze, Livorno, Lucca, Pisa, Pistoia and Siena).

[229] Noise Maps GIS tool. http://www502.regione.toscana.it/geoscopio/inquinamentifisici.html

[230] The webpage is: http://www.autostrade.it/it/la-nostra-rete/risanamento-acustico/normativa-europea/mappatura-del-rumore . Further information about acoustic http://www.autostrade.it/it/la-nostra-rete/risanamento-acustico

16.7 Noise action planning

16.7.1 Overview

An overview of NAPs at the national level is shown in the following table.

Table 171 NAPs –Italy (national level)

	R1	R2
Agglomerations	7	11
Major airports	9	18
Major railways	4	5
Major roads	28	43

Source: ISPRA Report[231]

16.7.2 Methodologies for noise action planning

For the Tuscany region, methods are defined by the lr. 89/98 as amended by the lr. 39/2011 and by the regulation that implement it n. 2/R/2014.

16.7.3 Measures

For the Tuscany region, methods are defined by the lr. 89/98 as amended by the lr. 39/2011 and by the regulation that implement it n. 2/R/2014. The measures identified with the NAPs coincide with those defined with the municipal plans for acoustic regeneration as established by art. 7 of the law 447/1995 and by the plans of containment and abatement of noise by transport infrastructure (DM 29/11/2000).

16.7.4 Public consultations

In the Tuscany region, Competent Authorities conducted two series of public consultation.

The first consultation, as foreseen by art.8 of the legislative decree 194/2005, was implemented in two phases. Phase 1 started on 1st July 2013, when the regional authority held a meeting with all stakeholders of regional infrastructures addressed in NAPs. During this meeting results of the SNM were presented together with the theoretical and methodological framework used to develop the NAP. Moreover, on 24th July 2013, the regional authority published on the official Tuscany Region Bulletin, informing all citizens and bodies interested in the development of the NAP of the consultation actions and on the different ways to submit comments. The NAP was made available on the regional authority website as well as for the purpose of consultation in each of the 'public relation' contact points at regional level.

Neither of these consultation actions did receive any comments.

Phase 2 started on 28 June 2013 with the implementation of an Environmental and Strategic Evaluation procedure as foreseen by the national and regional legislation. In this context, some interested municipalities submitted relevant documentation, which contributed to the overall development of the NAP.

[231] Silvaggio (2011) Stato di Attuazione Direttiva END – ISPRA Report.

16.7.5 Implementation issues

Issues were raised as a result of END implementation in R1 and R2. These, together with actions taken to address them, are shown in the table below.

Table 172 Noise action planning issues

Issue	Action
Most interviewees agree that some designated CAs had trouble on how to access data and how to use them in the elaboration of the NAP. These are due to lack of technical knowledge and of resources.	Minor improvements could be seen in R2 thanks to the support given by the national CA through guidance on how to implement the directive.
The Ministry of Environment indicated that issues with NAPs occurred especially with agglomerations. Especially due to the territorial extension happening in R2. This increased the difficulty of managing and aggregating the amount of data, which often were double or not coherent.	Adjustments to the guidelines, which were approved in order to harmonise the approaches and make data provided by all subjects compatible.
Need for coordination of the tasks in preparation for the deadlines and the realisation of the regeneration interventions foreseen by the national legislation and by the European directive for agglomeration and infrastructures.	Update of the national legislation framework.

17. LATVIA

17.1 National implementing legislation for END

17.1.1 Legal implementation

In Latvia, the END was transposed through the Law on Pollution and Regulations No 16 "Procedures for Noise Assessment and Management adopted 7 January 2014 (which replaced the Regulation of Cabinet of Ministers No 597, "Procedures for Environmental Noise Assessment and Management" adopted on 13th July 2004). There have subsequently been a number of amending regulations. These Regulations set noise indicators, methods of assessment, noise limit values, requirements for the strategic noise maps and actions plans and requirements for public information.

These Regulations cover not only environmental noise but also community noise (noise from domestic activities, noise nuisance from neighbours etc.) and indoor noise from domestic appliances

Further relevant legislation includes the Law on Pollution 20 June 2002, which has been amended several times in the previous decade. The relevant noise-related legal provisions were adopted on 7 May 2009 and came into force on 1 August 2009. Section 18.1 of the Law relates to the Assessment and Reduction of Noise [10 December 2009]. The law states that strategic noise mapping and noise action planning for noise reduction in agglomerations shall be ensured by the relevant local government. If in the territory of the agglomeration, there are several local municipalities, these must co-operate in carrying out strategic noise mapping and in the development of NAPs. The Ministry of Transport is responsible for the development and implementation of SNMs and NAPs for the reduction of noise in relation to roads and railways, as well as airports for which the traffic intensity is more than 50,000 aircraft movements per year.

17.1.2 Scope of END implementation – Rounds 1 & 2

The scope of END implementation at national level is now examined. In R1 in Latvia, SNMs only had to be developed for the Riga agglomeration and for 5 motorways with a traffic intensity of more than 6 million vehicles per year (35 km). The mapping of roads located within the Riga agglomeration was required. There were no major railways and major airports in Latvia falling within the Directive's scope (R1).

During R2, the introduction of thresholds led to an extension in mapping activities, with approximately 192 km of major roads being mapped overall. There were some major railways and one major airport Riga in R2. With regard to agglomerations, in R2, given that a very high proportion of the population lives in Riga, there was only one agglomeration in Latvia – Riga City.

Table 173 – END coverage – Latvia

Round	Agglomerations	Major airports	Major rail	Major roads
1	1	0	0 km	35 km
2	1	0	80 km	192 km

The above table relates to the numbers of NAPs (and in the case of major rail and roads to the volume of mapping in kms) that were due to be reported. However, it was noted during the interview programme that the Latvian authorities decided not to repeat noise mapping in respect of major roads in some instances because having reviewed the pre-existing noise map from 5 years earlier, they determined that based on traffic data, it was not necessary to undertake remapping.

Within the framework of the revision of noise mapping, the number of people significantly affected by potentially harmful effects of noise was updated.

17.2 Competent Authorities and designated administrative bodies

The Ministry of Environmental Protection and Regional Development is the overall responsible competent authority ("CA") for END implementation in Latvia. The Latvian Environmental, Geological and Meteorological Centre is responsible for the collection and storage of SNMs and NAPs in both R1 and R2 and for informing the public as to who is the responsible CA for different aspects of END implementation. A summary of the division of responsibilities for the development and approval of SNMs and NAPs is provided in the following table:

Table 174 Administrative Responsibility for the END – Latvia

Role/Activity	Agglomerations	Roads	Railways	Airports
Data collection	The Ministry of Transport	The Ministry of Transport	The Ministry of Transport	The Ministry of Transport
Preparing SNMs	Riga City Council and a series of local authorities[232] Riga City Council[233]	State Joint Stock Company Latvian State Roads	State Joint Stock Company "Latvijas dzelzceļš"	State Joint Stock Company Riga International Airport of the Republic of Latvia
EC/EEA reporting	Ministry of Environmental Protection and Regional Development (national CA) State Limited Liability Company "Latvian Environment, Geology and Meteorology Centre"			

** Data collection only*

As noted in the section on the legal context, local authorities have an important role in strategic noise mapping and noise action planning. In addition, the Law on Pollution (as amended in 2009) states that the development and implementation of noise mapping, and the production of SNMs and NAPs for the reduction of noise in relation to roads and railways, as well as airports in which the traffic intensity is more than 50000 aircraft per year are under the responsibility of the Ministry of Transport.

17.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

17.3.1 Data collection

Data has been gathered in vector file format, attached to a national coordinate system. Manual data input was also applied. Directive 2002/49/EC interim methods were used for the calculation of noise. Noise measurement methods recommended in the END were applied for Riga agglomeration (for data validation).

[232] Round 1 - Riga City Council, Baloži City Council, Babīte Community Council, Garkalne Community Council, Mārupe Community Council, Olaine Community Council, Stopiņi Community Council, Salaspils City and Rural Territory Council, Jūrmala City Council.

[233] R2 – Riga Agglomeration covers only Riga City

17.3.2 Implementation issues

The main issues raised relating to END implementation in R1 and 2 relating to designation and delimitation are shown in the table below:

Table 175 Designation issues - Latvia

Issues – R1	Issues – R2
The Latvian authorities indicated some difficulties in interpreting the term 'agglomeration' in the END. Directive 2008/50/EC on ambient air quality and cleaner air for Europe uses a different definition of agglomeration. It would be helpful to align the definitions.	The division of responsibilities for strategic noise mapping for major railways within agglomerations between the municipal authority (Riga city council) and the national railway authority (State Joint Stock Company "Latvijas dzelzceļš"). The interpretation in the new legislation of 'quiet area in an agglomeration' has been replaced by 'quiet area in a populated place'. Another key term in the END 'annoyance' has been replaced by 'discomfort'.

17.4 Noise limits and targets

17.4.1 Objectives and scope

The noise limit values that applied in R1 were set out in Regulation No. 597 "Procedures for Environmental Noise Assessment and Management" from 2004. However, this law was repealed in 2014 and Latvia adopted a revised set of LVs, as set out in the following table:

In R2, the new Regulations of the Cabinet of Ministers No 16 "Procedures for Environmental Noise Assessment and Management" was adopted on 7 January 2014. These have been in force since 24 January 2014, and the following noise limit values now apply:

Table 176 Limit values for noise – Latvia

	L_{den}	L_{day}	$L_{evening}$	L_{night}	Explanations about their implementation
Building territory of individual (private houses, low-storey or farmsteads) residential houses, institutions for children, medical treatment, health and social care institutions	-	55	50	45	1) Regulations of Cabinet of Ministers No 16, "Procedures for Environmental Noise Assessment and Management" on 7 January 2014.
Building territory of multi-storey residential houses	-	60	55	50	2) Limit values for road-traffic noise; rail-traffic noise; aircraft noise around airports; noise on industrial activity sites.
Public building territory (territory of public and administration objects, including the territory of cultural institutions, educational and scientific institutions, State and local government administration institutions and hotels) (also residential building)	-	60	55	55	3) The limit values cover all the country with respect to certain residential and public areas regardless of particular source of noise.
Mixed building territory,	-	65	60	55	4) In protective zones

	L_{den}	L_{day}	$L_{evening}$	L_{night}	Explanations about their implementation
including the territory of trade and service buildings (also residential building)					along motor roads (including along motor roads where the traffic intensity is less than 3 million vehicles per year), in protective zones along railways and in territories that are located closer than 30 m from stationary noise sources the limit values for environmental noise shall be considered to be target values.
Quiet areas in populated areas (including in agglomerations)		50	45	40	

A key difference in the new legislation is that there are now noise limit values for quiet areas in populated areas (including in agglomerations).

Methods for establishing noise limit values

Experience and information about noise limits established in other EU countries and historical limits in Latvia was used to inform the establishment of noise limit values in Latvia (see the Regulation of the Cabinet of Ministers No. 597 "Procedures for Environmental Noise Assessment and Management" on 13 July 2004).

For the time being in Latvia, there are no stated limits of the L_{den} indicator for practical use due to difficulties in the assessment (including measurements) of such a noise characteristic. Strategic noise mapping is carried out for noise indicators (L_{night}, L_{day}, $L_{evening}$) and also the exceedance of the limit values for these noise indicators. These LVs have subsequently been revised and amended in 2014 (Regulations of Cabinet of Ministers No 16 "Procedures for Environmental Noise Assessment and Management" on 7 January 2014). According to the Regulations, the limit value for noise is the permissible value of a noise indicator upon the exceeding of which a relevant authority considers the possibility of taking measures or takes measures that reduce the limit value for noise.

The exceeding of noise limits has been used as the basis for establishing priorities in the NAPs.

17.4.2 Implementation issues

No issues were raised as a result of END implementation in R1 and R2 in relation to LVs.

17.5 Quiet areas

17.5.1 Overview

The table below summarises the number and size of quiet areas established during Rounds 1 and 2.

Table 177 Quiet areas – Latvia

	R1	R2[234]
Number	36	Not yet
Size (km^2)	11 928	Not yet

In Latvia, local government is responsible for the determination of quiet areas in an agglomeration where the value of the noise indicator for any noise source is lower than the limit value for noise for the delimitation of quiet areas.

Since 2014 taking account Regulations of Cabinet of Ministers No 16, "Procedures for Environmental Noise Assessment and Management" on 7 January 2014:

- A quiet area in a populated area (agglomeration too) – a territory in a populated area, where the limit value for noise is lower than the limit values for noise indicators – L_{night} 40 db(A), $L_{evening}$ 45 db(A) and L_{day} 50 db(A)

- A quiet area in a rural district – a territory in a rural district that is free of noise caused by traffic, industrial activity or recreational activities, and where the limit value for noise is lower than the limit values for noise specified in Annex 2 to Regulations of Cabinet of Ministers No 16, "Procedures for Environmental Noise Assessment and Management" on 7 January 2014.

One stakeholder argued that the legislative changes that were made mean that the definition of a quiet area in an agglomeration is not incorporated correctly into the new legislation due to the focus on quiet areas in a populated area but the Competent Authority stated that this concept also incorporates quiet areas within agglomerations.

Methodologies employed

Specific guidelines were not developed for the determination of quiet areas. However, criteria for the determination of quiet areas are included in the 2014 Regulation and the Latvian CAs make use of the EU guidelines "Definition, Identification and Preservation of Urban & Rural Quiet Areas", Final report, SYMONDS, 2003 (European Union Service Contract ENV, C 1/SER/2002/0104R) and the UK guidelines "Research into Quite areas, Recommendations for identification", DEFRA, 2006.

In R1, taking into account these criteria, quiet areas were determined for the Riga agglomeration, mainly public, recreational areas, areas of greenery and forest territories in which the Lday value is under 55 dB(A) and in areas above 9 hectares.

[234] Noise action plan for Riga agglomeration have not prepared yet (Round 2).

17.5.2 Implementation issues

During Rounds 1 and 2, the main implementation issues that have emerged during END implementation are shown in the table below.

Table 178 Quiet area issues – Latvia

R1	R2
Not clear how the definition of a quiet area would be determined in Latvia.	In the 2014 consolidated Regulations, the definition of quiet areas in Latvia legislation has changed from 'quiet area in an agglomeration' to 'quiet area in a populated place'. Some stakeholders stated that this was too narrow a definition. Not clear how to implement quiet areas in a rural district, taking into account there are not many major noise sources outside the Riga agglomeration. Taking into account the definition of a quiet area, there are only small areas within the Riga agglomeration in which noise indicator values are under the specified noise limits and would meet the definition of a quiet area.

In Latvia, with the exception of some parts of the Riga agglomeration, there are not many major noise sources which have harmful effects on humans. This reflects the relatively small population. There are also large rural areas and areas covered by forest in which there are no noise sources and noise levels are low.

For the preservation of areas where the quality of sound is good, local authorities identify residential areas and/ or recreational areas in the local government spatial plans and also specify the requirements which help to protect residents from high levels of noise.

17.6 Strategic Noise Mapping

17.6.1 Overview

An overview of the number of SNMs produced in Rounds 1 and 2 is shown below.

Table 179 SNMs – Latvia

	R1	R2
Agglomerations	1	1
Major airports	n/a	1
Major railways	n/a	3 (80 km)
Major roads	5	15[235] (192 km)

[235] Strategic noise maps which were produced in 2007 were reviewed in 2012 but the maps have not been revised. There was an update for the population numbers only.

It should be noted that there weren`t any major airports and major railways in R1 in Latvia. Rather, in R1 and R2, Riga was the only agglomeration. It is not possible to define the number of SNMs specifically produced in relation to the END because in Latvia, for every major noise source, several SNMs were produced because strategic noise mapping is driven not only by the requirements of the END, but also by national legislation:

1. Exceedances of the limit values for noise (L_{night}, $L_{evening}$ and L_{day}). This means that 3 maps are needed for each noise source;

2. The number of people living outside agglomerations in dwellings into the following zones:

    a. For L_{den}: 55–59, 60–64, 65–69, 70–74, > 75 db(A);

    b. For L_{night}: 50–54, 55–59, 60–64, 65–69, > 70 dB(A);

3. The number of people, in conformity with Point 2, who live in dwellings with special sound insulation and dwellings with a quiet façade (if the relevant data are available);

4. The total area (km^2) that is exposed to noise at values of the noise indicator L_{den} greater than 55, 65 and 75 dB(A), respectively. The number of dwellings and the number of people living in each of the areas referred to shall also be indicated, including agglomerations.

<u>For Riga agglomeration several maps were produced:</u>

1. Noise sources (road traffic, railway traffic, airports and industrial activity zones) – separately maps and common map for each noise indicators (L_{night}, $L_{evening}$ and L_{day});

2. Exceedances of the limit values for noise;

3. The number of people living in dwellings into the following zones:

    a. For the noise indicator L_{den}: 55–59, 60–64, 65–69, 70–74, > 75 db(A);

    b. For the noise indicator L_{night}: 50–54, 55–59, 60–64, 65–69, > 70 db(A);

4. Information on how the people living in the zones referred to in Point 3 are affected by noise caused by road traffic, railway traffic and air traffic, as well as by noise sources from industrial activity;

5. The number of people, in conformity with Point 3, who live in dwellings with special sound insulation and dwellings with a quiet façade and the effect of noise caused by major roads, railway lines and airports therein (if the relevant data are available).

17.6.2 Data collection

Data are collected by different local and state institutions which are responsible for data collection. The State Limited Liability Company "Latvian Environment, Geology and Meteorology Centre" has been responsible for the collection of SNMs and NAPs in both Rounds 1 and 2.

There are several institutions which are **responsible for data collection**:

- Topographical maps and digital terrain models - Latvian Geospatial Information Agency;
- Address register, houses, topographical information – State Land Service, local authorities;
- Data about inhabitants - Office of Citizenship and Migration Affairs (register), local authorities and Central Statistical Bureau;
- Information about traffic (including traffic intensity);
  - Road traffic - State Joint Stock Company Latvian State Roads and local authorities (local roads and streets);
  - Railway traffic – State Joint Stock Company "Latvijas dzelzceļš", trams – local authorities;
  - Air traffic – State Joint Stock Company Riga International Airport of the Republic of Latvia and Civil Aviation Agency
- Industrial objects – information from pollution permits.

In R1, there was a lack of input data to prepare the SNMs. Where information was available, this was often of insufficient quality. In R2, the situation was easier because there was greater experience in strategic noise mapping and noise action planning.

17.6.3 Strategic noise mapping methods

There is no guidance in Latvia at either national, regional or local level for strategic noise mapping. Both L_{night} and L_{den} were used for strategic noise mapping. In addition, the indicators L_{day} and $L_{evening}$ were used.

The following guidance was used: '2007 Good Practice Guide for Strategic Noise Mapping and the Production of Associated Data on Noise Exposure', 'Presenting Strategic noise mapping Information to the Public', 'IMAGINE – State of the Art', 'Environmental Noise Data Reporting Mechanism Handbook (2007)', and 'Report Network Delivery Guide'.

Interim computation methods for L_{den}, L_{night}, L_{day}, $L_{evening}$ were used:

- For INDUSTRIAL NOISE: ISO 9613-2: "Acoustics - Abatement of sound propagation outdoors, Part 2: General method of calculation".
- For AIRCRAFT NOISE: ECAC.CEAC Doc. 29 "Report on Standard Method of Computing Noise Contours around Civil Airports", 1997.
- For ROAD TRAFFIC NOISE: The French national computation method "NMPB-Routes-96 (SETRA-CERTU-LCPC-CSTB)", referred to in "Arrêté du 5 mai 1995 relatif au bruit des infrastructures routières, Journal Officiel du 10 mai 1995, Article 6" and in the French standard "XPS 31-133".
- For RAILWAY NOISE: The Netherlands national computation method published in "Reken- en Meetvoorschrift Railverkeerslawaai '96, Ministerie Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, 20 November 1996".

An EU funded LIFE project has been undertaken in Latvia. "Innovative Solutions for Railway Noise Management (ISRNM) has been undertaken to explore the possibility of using the Dutch RMR method in mapping rail noise[236].

17.6.4 Public accessibility

The SNMs are available for the public at those local governments that are included in the Riga agglomeration and at the Ministry of Transport. The maps can be downloaded from the Riga City Council and Ministry of Transport websites - see www.riga.lv and www.sam.gov.lv. The map for Riga airport is also available online[237].

17.6.5 Implementation issues

A number of issues were raised as a result of END implementation in R1. Issues raised in R2, together with actions taken to address them are shown in the table below.

Table 180 Strategic noise mapping issues - Latvia

Issues – R1	Issues – R2
There were problems in obtaining data for SNMs. Data was gathered in vector file format and manually. There were problems in obtaining appropriate data on inhabitants, traffic intensities, and industrial objects. Harmonised EU level methods for SNMs would be preferable. There should be more time allowed for SNMs (SNMs) to be produced. There is no experience with the noise calculation methods mentioned in the END and the software is not available in Latvia. The lack of experience in the field of developing SNMs was a problem. Finding budget to fund the development of SNMs was a problem.	Harmonised EU level methods for the development of SNMs would be preferable. Identifying budget to fund the development of SNMs was a problem for Riga agglomeration. The Latvian road authorities did not repeat the mapping of roads from R1 because SNMs were reviewed and a decision was taken that SNMs did not need to be revised since there were no major changes between rounds based on a review of traffic intensity data.

17.7 Noise action planning

17.7.1 Overview

An overview of NAPs that were produced in Latvia and submitted to the Commission is shown in the following table.

Table 181 NAPs – Latvia

	R1	R2
Agglomerations	1	1[238]

236 http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=422

237 http://www.riga-airport.com/uploads/files/Par%20lidostu/Vide/Troksna_strategiska_karte_maza.pdf

238 Noise action plan for Riga agglomeration have not prepared yet (Round 2).

Major airports	0	1
Major railways	0	1
Major roads	5	9

17.7.2 Methodologies for noise action planning

In R1, the SNMs in 2006 were used as a basis for developing NAPs in 2008. The exceedance of noise limit values was used to establish priorities for NAPs. In addition, the 'noise score index' by W. Probst (Accon) was applied to establish priorities for NAPs. Furthermore, municipality development plans were taken into account.

In R2, there were updates to the SNMs in 2012 (which was not the case for all roads), these were then used as the basis for determining Noise action planning priorities.

17.7.3 Measures

Examples of noise abatement measures included in NAPs in Latvia include traffic planning, land-use planning, technical measures at noise source, economic measures, insulation, regulation, and incentives.

17.7.4 Public consultations

In Latvia, public consultations on NAPs are required to take place under the Regulations of the Cabinet of Ministers of Republic of Latvia Nr. 597 (13.07.2004) and Regulations of Cabinet of Ministers No 16 "Procedures for Environmental Noise Assessment and Management," which was enacted on 7 January 2014. The new Regulations replace the "Procedures for Environmental Noise Assessment and Management".

In both R1 and 2, public hearings took place. Inhabitants were interested in proposed noise reduction measures already in the NAPs and wanted these implemented as quickly as possible. However, there is a lack of budget to implement most measures identified in NAPs.

17.7.5 Implementation issues

The main issues raised as a result of END implementation in Rounds 1 and 2 are shown in the table below.

Table 182 Noise action planning issues - Latvia

R1	R2
More time needed to develop NAPs. A common method to identify areas that are noise hotspots and need to be prioritised would be desirable. A lack of sufficient availability and quality of input information e.g. on the number of inhabitants, the lack of information in vector file format. Incomplete information on planned measures identified in NAPs. Limited budget to actually implement noise abatement measures.	More time needed to develop NAPs. A common method at EU level to identify areas that are noise hotspots and need to be prioritised would be desirable. Limited budget to actually implement noise abatement measures.

18. LITHUANIA

18.1 National implementing legislation for END

18.1.1 Legal implementation

The Law on Noise Management of 26th October 2004 (No. IX-2499) (Official Gazette, 2004, No. 164-5971)[239] is the main act transposing the END into national legislation, and sets out the framework for additional implementing acts to ensure its full transposition and implementation.

Governmental decision of No. 581 of 14th July 2006 on the adoption of a National Strategic noise mapping Programme (Official Gazette, 2006, No. 68-2508)[240] sets out the main requirements, responsibilities and funding for carrying out Strategic noise mapping. The NAP for 2006–2007 of the National Strategic noise mapping Programme (adopted through Governmental decision Nr. 581 of 2006) was prepared to ensure the implementation of the R1 Strategic noise mapping obligations. A follow-up NAP for the 2008–2012 period for the National Strategic noise mapping Programme (adopted by Governmental Decision No. 716 of 2008) (Official Gazette, 2008, No. 84-3356)[241] was prepared to implement the R2 strategic noise mapping obligations.

Governmental decision Nr. 564 of 2007 on the adoption of the National Noise Prevention Action Programme for Year 2007–2013 (Official Gazette, 2007, No. 67-2614)[242] set out a framework for implementing noise-reduction measures for governmental institutions and proposed some measures and preliminary budget for Noise action planning to local municipalities in Round 1. The Round 2 NAP – the National Noise Prevention Action Programme for Year 2007–2013 – for the 2009–2013 period (adopted by the Governmental decision Nr. 157 of 2009) (Official Gazette, 2009, No. 28-1087)[243] was prepared to ensure implementation of the R2 Noise action planning. .

The requirements in Annex I and II of the END on noise indicators and strategic noise mapping methods were transposed through Order No. V-604 of 2011 of the Minister of Health on the adoption of the Hygiene Regulation HN 33:2011: "Noise Limit Values in Residential and Public Buildings and in Their Environment" (Official Gazette, 2011, No. 75-3634)[244].

EU reporting obligations are defined in the 2005 Order No. V-787/D1-507/3-467 by the Minister of Health, Minister of Environment and Minister of Transport and Communications on the adoption of Rules of the Reporting to the European Commission on the Implementation of the Requirements of European Union Noise Management Legal Acts (Official Gazette, 2005, No. 128-4621)[245].

The forms to be used by Strategic noise mapping and Noise action planning authorities to submit Strategic noise mapping and Noise action planning reports to the national CA responsible for reporting to the EC were adopted through Order No. V-616 of 2007 of the Minister of Health (Official Gazette, 2007, No. 83-3406)[246].

239 http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=454086
240 http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=278272
241 http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=325017
242 http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=299788
243 http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=338869
244 http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=402074
245 http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=264739
246 http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=302384

The Noise Prevention Council[247] is an inter-institutional body that is responsible for ensuring coordination on environmental noise in Lithuania. This consists of representatives from different government Ministries, sectors, NGOs and research institutions. EU funded project PRONET (Pollution Reduction Options NETwork) found Noise Prevention Council as a good example of administrative / political Instruments[248]. The Council has been operating for a number of years and was regarded as functioning quite effectively, although it has met more infrequently in the previous couple of years.

18.1.2 Scope of END implementation – Rounds 1 & 2

R1 of Strategic noise mapping and Noise action planning in Lithuania included 2 agglomerations and approximately 166 km of major roads. There was no major airport nor major railways. The introducient of definitive thresholds in R2 led to an additional 3 agglomerations, 76 km of major railway lines and 819 km of major roads falling within the scope of the END, as summarised in the following table.

Table 183 END coverage – Lithuania

Round	Agglomerations	Major airports	Major rail	Major roads
1	2[249]	n/a	n/a	166 km[250]
2	5[251]	n/a	76 km	819 km

Source: Country fiches. European Commission, Rp DF4 8 2012 ANNEX countries ETCSIA Review 130828 with WM. data flow 4_8, due in December 2012

18.2 Competent Authorities and designated administrative bodies

The CA for R1 collection and reporting was the former State Environmental Health Centre, but since 2012, has been the responsibility of the Ministry of Health of the Republic of Lithuania. The Ministry is responsible for the collection and reporting of data related to SNMs and NAPs to the European Commission/ EEA. The organisations responsible for the production and approval of SNMs and NAPs in Lithuania are shown in the table below.

Table 184 Administrative Responsibility for the END - Lithuania

Role/Activity	Agglomerations (including major roads sections within agglomerations)	Roads	Railways	Airports
Preparing SNMs Approving SNMs	Municipality Administration and Council[252]	Lithuanian Road Administration (Ministry of Transport and	State Railway Inspectorate (Ministry of Transport and	Civil Aviation Administration

[247] http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=477834

[248] http://www.sam.lt/get_file_short.php?TPT_pronet

[249] Vilnius, Kaunas

[250] 123 km out of which are outside agglomerations (http://cdr.eionet.europa.eu/lt/eu/noise/cols_fbjw/envs_fcjw/)

[251] Vilnius, Kaunas, Klaipeda, Šiauliai and Panevežys

[252] Vilnius, Kaunas, Klaipeda, Siauliai, Panevėžys

Role/Activity	Agglomerations (including major roads sections within agglomerations)	Roads	Railways	Airports
Preparing NAPs		Communications)	Communications)	
Approving NAPs		Municipality Administration and Council[253]		
EC/EEA reporting	Ministry of Health			

18.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

18.3.1 Data collection

The Law on Noise Management of the Republic of Lithuania transposes the END's definitions of agglomerations, major roads, major railways and major airports. Agglomeration borders are aligned with the administrative borders of cities with more than 100,000 inhabitants. The number of inhabitants for each city is publicly available from Statistics Lithuania[254].

Data to delimit major roads, major railways and major airports are available from the Lithuanian Road Administration, State Railway Inspectorate and Civil Aviation Administration (governmental institutions under the Ministry of Transport and Communications of the Republic of Lithuania) respectively.

18.3.2 Implementation issues

There were some problems defining institutional responsibilities for major road and major railway sections and major airports within agglomerations. This was because administrative responsibilities vary depending on the specific section of road or rail within an agglomeration concerned. This has however now been resolved through dialogue between the different administrative responsibilities concerned. During R1 and R2 Strategic noise mapping and Noise action planning responsibility issues were solved through informal agreement. However, the division of responsibility between different organisations has yet to be legally formalised.

18.4 Noise limits and targets

18.4.1 Objectives and scope

The purpose of setting noise limit values is to avoid noise nuisance and to protect human health and well-being.

According to the definition of noise limit value, provided in the article 2 of the Law on Noise Management, noise limit value – value of L_{day}, $L_{evening}$, L_{night}, above which noise source holder must take actions to eliminate or reduce noise.

Article 14 (duties and rights of noise source holders) of the Law on Noise Management states, that noise source holders must comply with the noise limit values and ensure that the emitted noise does not exceed the noise limit values set to certain areas.

[253] Vilnius, Kaunas, Klaipeda, Siauliai, Panevėžys

[254] http://www.stat.gov.lt

Noise limit values were adopted by Order No. V-604 of 2011 of the Minister of Health on the adoption of Hygiene Regulation HN 33:2011 "Noise Limit Values in Residential and Public Buildings and in Their Environment"[255]

Noise limit values are set for:

- Day (06.00-18.00), evening (18.00-22.00) and night (22.00-06.00)
- L_{day}, $L_{evening}$, L_{night} and L_{den} used for evaluation of Strategic noise mapping results.

Noise limit values have been determined largely based on experience obtained through implementation and on the basis of complaints made by the public.

Table 185 Residential and public buildings - Noise limit values dB(A) - Lithuania

	L_{den},	L_{day}	$L_{evening}$	L_{night}
Transportation noise	65	65	60	55
Industrial noise	55	55	50	45

Source: Hygiene Regulation HN 33:2011 "Noise Limit Values in Residential and Public Buildings and in Their Environment"[256]

18.5 Quiet areas

18.5.1 Overview

The END definitions of "quiet area in an agglomeration" and of a "quiet area in open country" were transposed into national legislation by the Law on Noise Management, which also defines the additional concept of a "quiet public area". Designated quiet areas are delimited on the basis of decisions made by relevant municipal authorities. For example, quiet areas within the agglomeration of Vilnius city municipality are delimited by city Council Decision No. 1-341 of 2011, in Kaunas city municipality (Council Decision No. T-546 of 2007), and in Klaipėda city municipality (city Council Decision No. T1-159 of 2013).

Table 186 Scope of delimited quiet areas – Lithuania, 2015

Quiet area type	Coverage
Quiet agglomeration areas	3 out of 4 agglomerations
Quiet rural areas	39 of 60 municipalities
Quiet public areas	55 out of 60 municipalities

Source: Ministry of Health, 2015 Report by Noise Prevention Council on the Noise Management in Lithuania in 2012–2013[257]

L_{den} is the main criterion used for the delimitation of quiet areas in agglomerations.

Other criteria include a categorisation of the immediate vicinity of noise sources and the expectation of quietness.

[255] http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=402074
[256] http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=402074
[257] http://sam.lt

There is no common detailed methodology set out in legislation for delimiting quiet areas. However, non-binding guidelines were prepared in 2008 by the State Environmental Health Centre (which as noted earlier was formerly the national CA).

Updated guidelines for delimiting quiet areas were incorporated into the non-binding Exemplary Model for the Organization and Implementation of Environmental Noise Prevention in 2012.

18.5.2 Implementation issues

No issues were raised as a result of END implementation in R1 in the 2011 implementation report. However, a number of issues were raised in both Rounds.

Table 187 Quiet area issues - Lithuania

R1	R2
There was no common methodology for defining quiet areas in Lithuania.	The EEA is seeking to collect spatial data on the location of quiet areas, but since there is no formal requirement to do so in the END and there are no formal reporting obligations, this is on a voluntary basis.
However, criteria were developed to help to define quiet areas. These included the categorisation of the immediate vicinity of noise sources and the expectation of quietness.	It is difficult to oblige small municipalities (who are not familiar with the END) to digitise the locations of delimited quiet areas.

18.6 Strategic noise mapping

18.6.1 Overview

An overview of SNMs produced in Rounds 1 and 2 is shown below.

Table 188 SNMs - Lithuania

	R1	R2
Agglomerations	2	4[258] (5)
Major airports	n/a	n/a
Major railways	n/a	1 (1) (76 km)
Major roads	1	1 (1) (819 km)

[258] Kaunas city agglomeration (2nd by size Lithuanian agglomeration) failed to adopt strategic noise maps or information is not publicly available

Strategic noise mapping in agglomerations was prepared by 5 different municipalities in R2 compared with only 2 in R1. Strategic noise mapping (and Noise action planning) of major railways was carried out by a single organisation, the State Railway Inspectorate. This information was then shared with the relevant city municipalities. For example, there are major railway sections inside Vilnius agglomeration and outside of the Vilnius agglomeration. Noise affected population data from Strategic noise mapping of major railways were included in the spreadsheet for Strategic noise mapping of major railways and into the spreadsheet of Strategic noise mapping of Vilnius agglomeration as required by EC/EEA reporting mechanism.

Strategic noise mapping (and noise action planning) of major roads was more complex because it was undertaken by different CAs. At the national level, the Lithuanian Road Administration prepared SNMs and NAPs for major road sections outside agglomerations. Vilnius, Kaunas, Klaipėda, Šiauliai and Panevėžys agglomerations prepared SNMs of major road sections within their agglomeration. Noise-reduction measures of the major road sections within agglomerations were incorporated in the NAPs of respective agglomerations.R1 strategic noise mapping reporting data is available online[259][260]

All the obligatory R2 Strategic noise mapping reporting data is available online[261] [262]. Additional voluntary R2 noise contour maps of agglomerations in spatial (GIS) format are available online[263].

18.6.2 Strategic noise mapping methods

Lithuania has no legal and compulsory detailed national guidance on Strategic noise mapping. Instead, the EC's Good Practice Guide for Strategic noise mapping and the Production of Associated Data on Noise Exposure[264] was translated into Lithuanian and published in 2007.

In 2011/2012, the National Public Health Surveillance Laboratory under the Ministry of Health[265] produced non-binding guidance (*The Exemplary Model for the Organization and Implementation of Environmental Strategic noise mapping*) to provide methodological assistance to help in the harmonisation and preparation of SNMs in Lithuania.

Strategic noise mapping methodologies are set out in Hygiene Regulation HN 33:2011 *"Noise Limit Values in Residential and Public Buildings and in Their Environment" (Official Gazette, 2011, No. 75-3638)*[266]. Governmental resolution No. 581 of 2006 approved the State's Strategic noise mapping Programme and the NAP for Year 2006-2007 of State's Strategic noise mapping Programme (Official Gazette, 2006, No. 68-2508)[267]. This sets out main Strategic noise mapping requirements, the measures envisaged, the means of implementation and the key responsible actors, the main deadlines, and the preliminary budget needed to implement the measures. NAP for Year 2008–2012 of the National Strategic noise mapping Programme (adopted by Governmental Decision No. 716 of 2008) (Official Gazette, 2008, No. 84-3356)[268] was

[259] http://cdr.eionet.europa.eu/lt/eu/noise/colsc0ctg/envsc0c6a/

[260] http://cdr.eionet.europa.eu/lt/eu/noise/colss7hgw/envss7kfa/

[261] http://cdr.eionet.europa.eu/lt/eu/noise/df8/envuldvha/

[262] http://cdr.eionet.europa.eu/lt/eu/noise/df8/envutyzgw/

[263] http://cdr.eionet.europa.eu/lt/eu/noise/df8/envugnhcq/

[264] http://ec.europa.eu/environment/noise/pdf/wg_aen.pdf

[265] http://nvspl.lt

[266] http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=402074

[267] http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=278272

[268] http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=325017

prepared to ensure implementation of the R2 Strategic noise mapping obligations. SNMs were developed using the "interim" methods provided in Annex II of the END.

Table 189 Strategic noise mapping methods used in R2 - Lithuania

Noise source/type	Method
Road	French NMPB
Railway	Dutch RMR
Aircraft	international ECAC
Industrial	ISO 9613-2

It has not yet been decided by governmental and municipal authorities whether Lithuania will adopt the methodology on a voluntary basis for Round 3 or make the transition to CNOSSOS only once this becomes mandatory in Round 4.

18.6.3 Public accessibility of SNMs

Strategic noise mapping data (statistical information) has been made publically available on the website of the Ministry of Health (www.sam.lt). In addition, SNMs have been made publicly available. For instance:

- Major Roads: www.lakd.lt/lt.php/triuksmo_valdymas/strateginiai_triuksmo_zemelapiai/13700
- Major Railways: http://www.vgi.lt/lt/triuksmo-valdymas
- Agglomerations:
- Kaunas - http://maps.vplanas.lt/aplinka/; Kaunas agglomeration: http://infr.kaunas.lt/noise#null; Klaipėda agglomeration:
- Klaipeda - http://maps.klaipeda.lt/flexviewer/
- Šiauliai agglomeration: http://www.matl.lt/index.php?ID=3;
- Panevėžys agglomeration: http://www.panevezys.lt/lt/veikla/veiklos-sritys/ekologijos-skyrius/aplinkos-apsauga-266/triuksmo-zemelapis.html

Spatial data files of noise contour maps of major roads in shape file format (LT_a_Mroad_L_{den}. * and LT_a_Mroad_L_{night}. *) are available on the website of EEA[269] and comprise noise contour maps of the all major road sections (inside and outside agglomerations). On the same website of EEA, spatial data files of noise contour maps of major railways (LT_a_Mrail_L_{den}. * and LT_a_Mrail_L_{night}. *) are available.

Voluntary R2 noise contour maps in spatial shape file format of agglomerations are publicly available on the EEA website[270].

18.6.4 Implementation issues

A number of issues were raised as a result of R1, a summary of which is shown below, and any new issues raised during R2.

[269] http://cdr.eionet.europa.eu/lt/eu/noise/df8/envutyzgw/

[270] http://cdr.eionet.europa.eu/lt/eu/noise/df8/envugnhcq/

Table 190 Strategic noise mapping issues - Lithuania

R1	R2
Collection of geospatial data outside agglomerations and residential data	Collection of geospatial data outside agglomerations and residential data
The assessment of noise levels from industrial sites	Guide produced by National Public Health Surveillance Laboratory in 2011/2012 – no longer an issue
Lack of common noise assessment methods	Lack of common noise assessment methods. The introduction of CNOSSOS in Round 4 is expected to make a significant difference towards a common approach. The default rail and road noise emission data used for Strategic noise mapping lead to some inaccuracies in the calculation results, so in some cases SNMs had to be corrected to be more comparable with long-term noise measurements.
Some SNMs were completed after the deadline	SNMs of Kaunas agglomeration were revised after the deadline
Lack of available consultants specialised in undertaking strategic noise mapping	At national level, there is strengthened capacity among consultancies to produce SNMs compared with R1. However, there remains a lack of local Strategic noise mapping and Noise action planning specialists in some municipalities.

Looking ahead to R3 Strategic noise mapping, the current lack of budgetary allocation at national level for Strategic noise mapping in 2017 is a concern.

18.7 Noise action planning

18.7.1 Overview

An overview of SNMs and NAPs is shown in the following table:

Table 191 NAPs - Lithuania

	R1	R2
Agglomerations	2	5 (5)
Major airports	n/a	n/a
Major railways	n/a	0[271] (1)
Major roads	1	1 (1)

Source: Member State reporting to the European Commission and EEA, interview with Ministry of Health (CA)

The above table is based on self-reported data on the number of NAPs that were due and have actually already been submitted.

[271] The Ministry of Transport and Communications was warned by the official letter of the Ministry of Health in Dec. 2014. No actions were taken by the Ministry of Transport and Communications.

R1 NAP summaries Vilnius, Kaunas agglomerations and of major roads are available online[272].

R2 NAP summaries for the municipalities of Vilnius, Klaipėda and Šiauliai are available in xml file format online[273] and NAPs summaries for major roads, major railways and for the municipalities of Kaunas and Panevėžys are available in xml file format online[274].

The full text of the R2 NAP for major roads (covers major road sections outside agglomerations) is available on the EEA website[275].The full text of the R2 NAP for major railways (covers all major railway sections) is available on the EEA website[276].

NAPs were prepared for sections of major roads inside and outside of agglomerations in R1 and R2. For major railways, no major railway sections had more than 60,000 movements per year (R1 and R2) but SNMs and NAP was prepared for R2 (76 km of major railways with more than 30 movements a year) of major railway sections inside and outside of agglomerations.

NAPs for agglomerations were developed by the relevant municipal authorities[277], but the development of such NAPs required close cooperation with other organisations at national level also involved in Strategic noise mapping and Noise action planning. For instance, in relation to major railways, Noise action planning for major sections of rail falling within agglomerations, as well as those located outside, are carried out by the State Railway Inspectorate. They are also responsible for planning and implementing noise reduction and mitigation measures.

In the case of major roads, whilst the Lithuanian Road Administration has prepared NAPs for major road sections outside agglomerations, the agglomeration NAPs for Vilnius, Kaunas, Klaipėda, Šiauliai and Panevėžys prepared by the city municipalities include noise reduction measures for sections of major roads within their agglomerations.

18.7.2 Methodologies for noise action planning

There is no legal framework setting out a detailed common methodology for Noise action planning in Lithuania. Instead, in order to provide methodological assistance and to harmonise the preparation of NAPs, the National Public Health Surveillance Laboratory under the Ministry of Health organised the preparation of a common Noise action planning methodology: Exemplary Model for the Organization and Implementation of Environmental Noise Prevention. An example model is published on the website of the Ministry of Health at http://nvspl.lt.

CAs have faced various problems in drawing up NAPs. The strategic maps were used as a basis for developing the NAPs. The exceeding of national noise limits was used as the main basis for establishing priorities in the NAPs.

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[272] http://cdr.eionet.europa.eu/lt/eu/noise/df7/envst919w/

[273] http://cdr.eionet.europa.eu/lt/eu/noise/df10/envvg24ua/Noise_Action_Plans_summaries_DF_7_10__1.xml/manage_document

[274] http://cdr.eionet.europa.eu/lt/eu/noise/df10/envutkztq/questionnaire_noise-df7_10.xml/manage_document

[275] Noise action plan (LT_a_AP_MRroad00001.pdf) of major roads on http://cdr.eionet.europa.eu/lt/eu/noise/df10/envutkztq/.

[276] Noise action plan (LT_a_AP_MRail00001.pdf) of major railways on http://cdr.eionet.europa.eu/lt/eu/noise/df10/envutkztq/.

[277] Klaipėda city municipality, Šiauliai city municipality, Panevėžys city municipality, Vilnius city municipality, Kaunas city municipality.

18.7.3 Measures

Among the different types of measures implemented in R1 and R2 are:

- Traffic planning – e.g. constructing a bypass
- Land-use planning
- Technical measures at the source
- Noise insulation
- The reduction of sound transmissions.

18.7.4 Public consultations

NAPs were published on the websites of the CAs responsible for the development of particular NAPs for agglomerations, major roads and major railways. However, in many cases consultation was not generally given a high priority by the national authorities and local (city) municipalities responsible for Noise action planning.

An exception was Kaunas City Municipality whose administration organised a dedicated public meeting in November 2013 to launch the consultation process on the development of the Kaunas agglomeration NAP for the 2014 – 2018 period. The purpose of the meeting was to explain the NAP in detail and to outline the proposed noise prevention measures and the zones designated as quiet areas. Following the meeting, written responses to the proposals were solicited and these were published by Kaunas City Municipality on its notice board and on the municipal website (www.kaunas.lt).

During the period from 18th September– 11th November 2013, the draft NAP proposals were exhibited on a municipal bulletin board in the Health section of the municipal administration. The public were also invited to submit requests and proposals for noise protection measures before the NAP was finalised. The public were given access to an online and hard copy version of the NAP proposals, the annexes as well as to the meeting minutes from the public meeting.

18.7.5 Implementation issues

A number of issues were raised during R1, a summary of which is shown below, together with any subsequent actions taken to address them, and new issues raised during R2.

Table 192 Noise action planning issues - Lithuania

R1	R2
A lack of consistency in NAP content and detail due to different interpretations of requirements	
A lack of financial and human resources	A lack of financial and human resources within public administration to implement the END was again noted. There was initially insufficient budget to implement Noise action planning tasks in R2 (and a knock-on delay in complying with deadlines).
Lack of local Noise action planning specialists	The lack of local Noise action planning specialists was again an issue, especially in smaller municipalities implementing the END for the first time.

R1	R2
	Availability of finances to implement measures identified through Noise action planning
	(The ability to) compel noise source holders to implement reduction measures

19. LUXEMBOURG

19.1 National implementing legislation for END

19.1.1 Legal implementation

The END was transposed through the Grand Ducal Regulation of 2nd August 2006[278]. Noise limit values for establishments and building sites are fixed by the Grand Ducal Regulation of 13th February 1979 on the level of noise in the immediate surroundings of establishments and construction sites, as amended by Grand Ducal Regulation of 7th November 2007[279]. Additional noise limit values are set under Grand Ducal Regulation of 16th November 1978 on the sound levels for music within establishments and in their neighbourhood.

19.1.2 Scope of END implementation – Rounds 1 & 2

The coverage of Strategic noise mapping and Noise action planning in Luxembourg was the same in Rounds 1 and 2 for airports (1), major roads (128km) and railways (20km). The introduction of thresholds in R2 meant that one agglomeration now falls within scope. These do not however fall within END scope.

Table 193 END coverage – Luxembourg

Round	Agglomerations	Major airports	Major rail	Major roads
1	n/a	1	20 km	128 km
2	1	1	181 km	718 km

19.2 Competent Authorities and designated administrative bodies

On the basis of Article 5 of the Grand Ducal Regulation of 2nd August 2006, the *Environment Administration* is the administrative body responsible for implementing the technical provisions of the Regulation. In consultation with Ministries, administrations and other interested parties, establishing, revising and publicising SNMs and NAPs for agglomerations, major roads and railways, major airports and quiet areas, and for collecting SNMs and NAPs. According to Article 8, *"Strategic noise mapping*" and Article 9, *"NAPs"*, SNMs and NAPs are approved by the Ministry for the Environment[280]. However, following organisational changes, responsibility has now been transferred to the Ministry of Sustainable Development and Infrastructure. An overview of the different responsibilities in END implementation is provided below:

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[278] Règlement grand-ducal portant application de la directive 2002/49/CE du Parlement européen et du Conseil du 25 juin 2002 relative à l'évaluation et à la gestion du bruit dans l'environnement. http://eli.legilux.public.lu/eli/etat/leg/rgd/2006/08/02/n4

[279] http://www.legilux.public.lu/leg/a/archives/2007/0204/a204.pdf#page=2

[280] http://www.environnement.public.lu/air_bruit/dossiers/BR-bruit/bruit_plans_action/index.html?highlight=bruit

Table 194 Administrative Responsibility for the END – Luxembourg

<table>
<tr><th>Role/Activity</th><th>Agglomerations</th><th>Roads</th><th>Railways</th><th>Airports</th></tr>
<tr><td>The provision of information and data</td><td>Ministry of the Interior and the Regions

Local authorities</td><td>National road administration[281] (major roads and roads outside agglomerations)

Local authorities (within agglomerations)</td><td>National railways[282]</td><td>Luxembourg Airport</td></tr>
<tr><td>Preparing SNMs</td><td rowspan="4">Ministry of Sustainable Development and Infrastructure (development of SNMs and NAPs)</td><td rowspan="4">Ministry of Sustainable Development and Infrastructure (development of SNMs and NAPs)</td><td rowspan="4">Ministry of Sustainable Development and Infrastructure (development of SNMs and NAPs)</td><td rowspan="4">Ministry of Sustainable Development and Infrastructure (development of SNMs and NAPs)</td></tr>
<tr><td>Approving SNMs</td></tr>
<tr><td>Preparing NAPs</td></tr>
<tr><td>Approving NAPs</td></tr>
<tr><td>EC/EEA reporting</td><td colspan="4">Environment Administration[283] within the Ministry for the Environment</td></tr>
</table>

Whilst national coordination is under the overall responsibility of the Ministry of Sustainable Development and Infrastructure, the implementation of noise reduction measures identified in NAPs at local level remains with the competent authorities for these measures.

19.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

19.3.1 Data collection

Data required for delimitation of major road/train axis, airports and agglomerations were made available by relevant bodies upon request by the CAs.

19.3.2 Implementation issues

The sole issue raised was the difficulty in acquiring sufficient skills and competences to undertake the work required for the greater geographic scope required in R2.

19.4 Noise limits and targets

19.4.1 Scope

In Luxembourg, there are legally binding noise limit values and also non-binding noise trigger values. The Grand Ducal Regulation of 1979, as amended in 2007, sets out noise limit values in six zones for establishments and construction sites. With regard to road and rail noise, German national legislation is applied. These applied both in R1 and R2.

[281] Administration des ponts et chaussées - http://www.pch.public.lu

[282] Société Nationale des Chemins de Fer Luxembourgeois (CFL)

[283] http://www.environnement.public.lu/

Table 195 Noise limit values – R1 - Luxembourg

Zone	Noise Level (dB(A))		Nature of zone
	Day	Night	
I	45	35	Hospitals, recreational areas
II	50	35	Rural area, quiet residential area, low traffic
III	55	40	Urban area, mainly residential, low traffic
IV	60	45	Urban district with some factories or businesses, average level of traffic
V	65	50	Town centre (businesses, shops, offices, entertainment), heavy traffic
VI	70	60	Mainly heavy industry
Major Road and Rail routes			
	57	47	Hospitals, schools, sanatorium and nursing homes
	59	49	Pure and general and small residential estate areas (residential dwelling with a garden or agricultural smallholding)
	64	54	In business zones (mainly for commerce, gastronomy, and industry and administration), village areas, and mixed areas (residential and business/commerce)

Limit values for major road and rail routes are aligned with the German Ordinance on the Protection from Traffic Noise, sixteenth act on the implementation of the Federal Pollution Protection Law (Verkehrslärmschutzverordnung, Sechzehnte Verordnung zur Durchführung des Bundes-Immissionschutzgesetzes) of 12th June 1990. Limit values to trigger the development of R1 NAPs (http://www.environnement.public.lu/air_bruit/dossiers/BR-bruit/bruit_valeurs_limites/let-comite-pil.pdf) were established in the Ministry of the Environment's Decision of 17th July 2008. This approach was continued in R2.

19.4.2 Non-binding target values

In addition, to the legally binding noise limit values set out above, there are also non-binding noise trigger values, as summarised in the following table:

Table 196 R1 and R2 NAP Trigger Values - Luxembourg

Requirement	Noise Level - dB(A)	
	L_{den}	L_{night}
Develop NAP	70	60
Implement measures to reduce noise in NAPs	65	≥ 55

19.4.3 Implementation issues

Limit values adopted in 2008 to trigger NAP development and associated measure were based on the German approach to noise management and WHO recommendations[284].

The issues identified in respect of END implementation in R1 and 2 in relation to limit values and non-binding target values are summarised in the table below.

Table 197 Implementation issues in respect of limit values and non-binding target values – Luxembourg

R1	R2
The L_{den} and L_{night} noise indicators do not match with the noise indicators used under previous legislation. With the implementation of the END, the Luxembourg authorities were obliged to change indicators and methodology.	The situation had improved by R2 as the L_{den} and L_{night} noise indicators became more widely accepted by stakeholders.
Although there were legally binding noise limit values in place, there was still a major challenge as to what should happen when noise limits are exceeded.	The scope of the problem of exceedance of noise limit values continues to be an issue.

19.5 Quiet areas

19.5.1 Overview

As there were no END-defined agglomerations in R1, no “quiet zones” were designated in agglomerations. Since R1, progress has nevertheless been made, for instance, criteria were developed for the identification of potential quiet areas. The Ministry of Sustainable Development and Infrastructure has commissioned a study on potential quiet areas but this has not yet been finalised.

Delimitation

It is important that wider national policies are taken into account in the designation and delimitation of quiet areas, notably the Sectoral Landscape Plan (Plan Sectoriel Paysage (PSP))[285]. Noise will be only one of many criteria used in the PSP in the context of zones that should be protected for their “environmental quality”. Specifically, the PSP deals with areas of landscape worthy of protection, in which the building of new infrastructure should be avoided if it would lead to additional fragmentation.

Agglomerations

As there were no END-defined agglomerations in R1, no “quiet zones” were designated in agglomerations. Quiet zones are usually zones, in agglomerations, that should be protected for their “environmental quality”. Noise is only one of the many criteria to be taken into account in the protection of those zones.

[284] http://www.environnement.public.lu/air_bruit/dossiers/BR-bruit/bruit_valeurs_limites/bruit.pdf

[285] http://www.environnement.public.lu/conserv_nature/dossiers/PSP/avantprojet_oct2008.pdf

Open country

Quiet areas in open country are usually defined as areas located in the countryside that need to be protected to preserve their "environmental quality" within the overall framework of the Sectoral Landscape Plan (PSP) mentioned above. Noise is only one of the many criteria to be taken into account in the protection of those zones.

19.5.2 Implementation issues

No issues were highlighted in either Round since there are as yet no quiet areas.

19.6 Strategic noise mapping

19.6.1 Overview

In R1, the Environment Administration developed SNMs for Luxembourg's major transport infrastructure, including motorways A1, A3, A4, A6 and A13, the Luxembourg-Esch/Alzette railway line, and Luxembourg airport. In R 2, SNMs were again developed for road and railways and for Luxembourg airport. An overview of SNMs produced in R1 and R2 is shown below.

Table 198 SNMs - Luxembourg

	R1	R2
Agglomerations	0	1
Major airports	1	1
Major railways	1	1 (181 km)
Major roads	1	1 (718 km)

19.6.2 Data collection

Data required for the development of SNMs were provided by the relevant designated CAs at different levels of governance.

19.6.3 Strategic noise mapping methods

No common methodology was formally established at national level either in R1 or R2. In principle, the interim method was used in most areas but for airports, some customisation was necessary so it can be considered as a national method. However, this has been complemented by the AZB German recommendations. There was a minor change in the process between Rounds in airports. The Ministry of Sustainable Development and Infrastructure and local authorities in Luxembourg instead followed good practice guidance provided by the EEA. In accordance with the Directive, L_{den} and L_{night} were used to establish SNMs and no further indicators were used.

19.6.4 Public accessibility of SNMs

Rounds 1 SNMs were made available on the Ministry of the Environment's website. In R2, the maps have again been made accessible. http://www.environnement.public.lu/air_bruit/dossiers/BR-bruit/bruit_plans_action/index.html?highlight=bruit

Ongoing noise emissions monitoring of Luxembourg airport is accessible to the public at: http://www.aeroport.public.lu/fr/environnement/index.html

19.6.5 Implementation issues

Issues raised in Rounds 1 and 2, together with actions taken to address them, where these could be identified, are shown in the table below.

Table 199 Strategic noise mapping issues - Luxembourg

Round 1	Round 2
Development of the initial methodology for noise mapping was challenging in small countries.	Comparability of NAPs between countries – in Luxembourg, a greater level of detail has been presented in noise exposure data. The situation appears worse than it actually is in the EEA's Noise in Europe report. Comparability between Rounds was broadly OK. Increased subcontractor costs between Round 1 and 2 to reflect increase in mapping. However, reduced internal costs among public authorities due to greater familiarity with the mapping requirements.

19.7 Noise action planning

19.7.1 Overview

In Luxembourg, Noise action planning under the END is seen as an important component of the National Strategy for the prevention and combatting of environmental noise. An overview of SNMs and NAPs is shown in the following table.

Table 200 NAPs – Luxembourg

	R1	R2
Agglomerations	0	1
Major airports	1	1
Major railways	1	1
Major roads	1	1

Source: CA

19.7.2 Methodologies for noise action planning

In R1, a national inter-ministerial Steering Committee was created under the Grand Ducal Regulation to develop NAPs. The 2006 SNMs were used to establish NAP priorities which were set at a national level and to identify priority areas where noise limit values adopted by the Ministry of Environment in 2008 were exceeded. The decision to develop an NAP was determined by:

- The extent to which limit values had been exceeded;
- A combination of other factors, including:
  - The number of people affected
  - The presence of critical infrastructure.

A similar approach was adopted in R2. The 2012 SNMs have been used as the basis for the development of the R2 NAPs. However, as of May 2015, these do not appear to be publicly available. The implementation of NAPs has been prioritised using these criteria and adjusted according to the budget available. Other criteria considered when setting priorities, included technical constraints, the scale of the works, investment costs and opportunities for direct action as part of on-going or planned projects.

19.7.3 Measures

In Luxembourg, NAPs have prioritised noise prevention measures at source since there was perceived to be more cost-efficient in tackling noise at source. It was however recognised that in order to be effective, these should be supplemented by further measures to tackle noise hotspots identified in NAPs e.g. erecting noise barriers and soundproofing housing facades exposed to noise. Examples of the types of measures implemented in R1 are provided in the following box:

Railway NAP: Key actions

- Systematic consideration of noise in determining the operating conditions of new railway infrastructure
- Remediation of priority areas for noise management, as defined by strategic mapping along the railway line Luxembourg-Esch
- Prevention and Remediation of noise problems related to the operation of the viaduct Pulvermühle and of Esch-sur-Alzette.

Road NAP: Key actions

- Remediation of priority areas for noise management, as defined by strategic mapping along the national motorway network
- Prevention and remediation of noise problems related to the operation of the A3 and A6 between Bettembourg and Strassen.

Airport NAP: Key actions

- Establishment of a management organisation on soundproofing of housing around Luxembourg airport and creating a grant scheme for soundproofing dwellings located in noise management areas.
- Redefining zoning based on noise exposure provided by the Luxembourg airport land use plan.

In 2013, a new financial aid scheme was introduced for the improvement of sound insulation of residential buildings against airborne noise around Luxembourg Airport. A Grand Ducal regulation was adopted to provide grants which came into force on 1 May 2013. Subsidies are provided for windows-related and attic insulation measures.

The R2 NAPs have not yet been published.

Priority was given in both Rounds 1 and 2 to using the process of developing SNM as the basis for identifying priority areas where noise reduction measures should be targeted in NAPs. The steering committee responsible for preparing NAPs are given flexibility in the assessment criteria to select appropriate noise abatement measures to allow different factors to be taken into consideration (e.g. the costs of measures, opportunity costs, level of exposed population by dB threshold, etc.). Permanent noise monitoring was also set up next to Luxembourg airport to provide monthly reports on noise levels.

19.7.4 Public consultations

With regard to public consultation, in R1, the draft NAP for the management of noise Luxembourg airport was presented on March 16th, 2009 in Sandweiler[286], while NAP projects for the management of rail and road noise were presented on 1st April 2009 in Schifflange[287]. Noise awareness campaigns were run during R1 by competent ministries. The results of the insulation verifications were also communicated to the public.

In R2, public consultation input received through the consultations were regarded as having been useful by the National Competent Authority interviewed. The draft NAPs were made available on the Environment Administration's website. Following comments received, revisions were then made by the Steering Committee before the NAP was provisionally finalised. However, there have been delays in the final political approval of R2 NAPs and their subsequent publication.

19.7.5 Implementation issues

No issues were raised as a result of END implementation in R1. Issues raised in R2, together with actions taken to address them are shown in the table below.

Table 201 Noise action planning issues - Luxembourg

R1	R2
Development of an initial methodology for NAPs was challenging in smaller EU countries. There was a lack of human resources to develop a methodology for action planning and challenges in ensuring effective coordination between the development of SNMs and NAPs.	Noise action planning in Luxembourg has been beneficial because it has meant that the responsible public authorities have given early consideration to reviewing major transport infrastructure projects being implemented in the next five years.
	There has been a focus on identifying in advance whether there are hotspots or priority zones to ensure that they are taken into account from the design phase. The costs are much lower if noise mitigation measures are dealt with from the outset.

[286] For the presentation material see: http://www.environnement.public.lu/air_bruit/dossiers/BR-bruit/bruit_enquete_publique/sceance_publique_aeroport_13032009.pdf

[287] For the presentation material see: http://www.environnement.public.lu/air_bruit/dossiers/BR-bruit/bruit_enquete_publique/sceance_publique_routesrail_01042009.pdf

20. MALTA

20.1 National implementing legislation for END

20.1.1 Legal implementation

Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise was transposed by Subsidiary Legislation 549.37 *"Assessment and Management of Environmental Noise Regulations"*, on the basis of the Environment Protection Act (Chapter 549). This places it within the country's wider noise and nuisance legislative framework.

Table 202 Noise Management – Malta

Agency	Responsibility
Environment and Resources Authority (ERA) falling within the portfolio of the Ministry for Sustainable Development, Environment and Climate Change (MSDEC), which is responsible for Environmental Policy.	Responsibility for reporting obligations under the END Environmental assessments - **Environmental Impact Assessment (EIA)** – falling within the remit of ERA and **Strategic Environmental Assessment (SEA)** falling within the remit of MSDEC Environmental policy enforcement
Police	Enforcing Code of Police Laws in order to regulate nuisance or noise.
Department of Health	Considers noise within National Environmental Health Action Plan
Malta Competition and Consumer Affairs Authority (MCCAA)	Product safety, including noise limit values for certain equipment, and craft
Planning Authority (PA)	Planning Mapping and land surveying – National Mapping Agency is primary supplier of data for Strategic NM
Other *(Transport Malta, Occupational Health and Safety Authority, Malta Tourism Authority, Local Councils)*	Emissions from roads; airport regulation; workplace noise regulation; hostelry licensing; …

20.1.2 Scope of END implementation – Rounds 1 & 2

R1 of Strategic noise mapping and Noise action planning in Malta covered no agglomerations, airports or railway, but 173 km of roads[288]. The reduction in thresholds by 50% for R2 *increased* coverage to one agglomeration and 292km of major roads.

Table 203 END coverage – Malta

Round	Agglomerations	Major airports	Major rail (km)	Major roads

[288]Data Flow 7 Supplementary report, Noise Action Plan (Summary), MEPA, January 2013

				(km)
1	n/a	n/a	n/a	173
2	1	n/a	n/a	292

20.3 Competent Authorities and designated administrative bodies

The Environment and Resources Authority (ERA) is the designated CA with responsibility for:

- Developing SNMs
- Publishing information on environmental noise
- Drawing up NAPs.

One of the major challenges which Malta faced was to establish the key stakeholders responsible for the implementation of the END including the provision of data. As part of the reporting for R2, a "noise steering committee" was established. This committee was composed of all key stakeholders, which are considered to be the major sources.

20.4 Designation and delimitation of agglomerations, major roads, major railways and major airports

20.4.1 Data collection

For R1, a range of spatial datasets were collected to meet the END's requirements.

Table 204 Agglomeration design databases

Database	Source	Scope
CORINE land Cover (CLC)	Information Resources Unit, PA (IR)	CORINE "urban fabric" layer Some adjacent CORINE "industrial, commercial and transport units" [to overcome urban layer inconsistencies
Limit of Development	PA Planning	Extent of urban fabric from a planning perspective
Open spaces	PA Mapping Unit	When partially/wholly within agglomeration footprint
Population distribution	National Statistics Office (NSO), PA IR	Census Output Area (COA) Geographic footprint of each COA Coastline Satellite Imagery LA boundaries
Reference data Traffic counts	ERA Environment & Resources Authority Transport Malta	Air Quality agglomeration definition Road traffic counts statistics
CORINE land Cover (CLC)	Information Resources Unit, PA (IR)	CORINE "urban fabric" layer Some adjacent CORINE "industrial, commercial and transport units" [to overcome urban layer inconsistencies

For R2, the same datasets were used as for R1.

20.4.2 Implementation issues

Were any issues identified and addressed?

For R1, a need for coordination with respect to data collection and ownership was identified. Therefore, to improve stakeholder engagement and collaboration a cross-departmental working group on Strategic noise mapping was established.

For R2, the data acquisition exercise was time consuming due to unavailability of data. Therefore data had to be based on a number of assumptions in line with guidance documents provided by the European Commission to reach the acoustic calculation requirements.

Table 205 Designation issues - Malta

R1	R2
There was a need for coordination on data collection and stakeholder engagement. A working group on Strategic noise mapping was established.	Data acquisition was laborious and time consuming Data sets for noise calculations had to be optimised.

20.5 Noise limits and targets

Malta has no limit values in force or under preparation[289].

However, R1 proposed onset levels, for assessment of noise mitigation measures due to road traffic noise exposure were (a) L_{den} = 65 dB and (b) L_{night} = 55dB.

20.6 Quiet areas

20.6.1 Overview

The regulations empower ERA through the development of NAPs to:

- Setup noise managements zones;
- Designate quiet areas either inside agglomerations or in open countryside; and
- Establish noise reduction programs where necessary.

The NAP for Malta acknowledges the importance of preserving Quiet Areas. However, no such quiet areas have been defined by the competent authority yet.

Delimitation

For R1, the identification and preservation of quiet areas in the vicinity of a major road is considered to be below the proposed on set level at (a)Lden: 55dB and (b) Lnight: 45dB.

Areas having noise levels below thresholds have been identified such that the NAP notes the need for preserving quiet areas.

Agglomerations

Information is currently not available.

[289] *Data Flow 7 Supplementary report Noise Action Plan(Summary), 2013, Section 2.4*

Open country

The preservation of relatively quiet areas in open countryside was also to be considered in the NAP.

20.6.2 Implementation issues

No implementation issues have been identified since no quiet areas have yet been defined.

20.7 Strategic noise mapping

20.7.1 Overview

For Round 2 reporting, major roads (and a single agglomeration, the "Malta Noise Agglomeration" were identified by MEPA. The identification of such sources was supported by Acustica Ltd. and Transport Malta (TM) from auto-count surveys and TEN-TM feasibility study reports held by the relevant authorities. Where data gaps were identified, estimates were made based on the recommendations from WG-AENGPGv2. The total length of R2 major roads is 292km compared with 173 km mapped as R1 major roads.

The agglomeration identified has a population of 243, 746 and an area of 65.8km^2. Hence this was not an END agglomeration under the first round (2007) but was reported in 2007 (R1). However it is an agglomeration that was identified and used for R2 and subsequent rounds.

The Strategic noise mapping included are as exposed to noise from the major roads above a level of L_{den} 55dB (A) or L_{night} 50dB(A).An overview of SNMs produced in Rounds 1 and 2 is shown below.

Table 206 SNMs – Malta

	R1	R2
Agglomerations	1	1
Major airports	n/a	n/a
Major railways	n/a	n/a
Major roads	173 km	292 km

It can also be noted that R1 noise maps were only required in Malta for major roads. The SNM was however developed late and published in 2011. The submission of noise maps for R2 (which included a noise map for agglomeration and all major roads) was published and reported to the European Commission in December 2012 (in line with the deadline of END).

An update of noise maps for Malta is expected to be available by the end of December 2017 only. In R2, this will be required for both one agglomeration and for major roads.

20.7.2 Data collection

Data collection methods

SNMs have been generated by estimating noise levels from Major Roads (defined as roads with more than 6 million vehicle passages annually, for R1 and 3 million vehicle passages for R2) then derived by computational methods.

Data collection responsibility

The input data required to develop the SNMs is wide-ranging in its coverage and quantity, and is managed by a number of stakeholders, apart from the competent authority which is ERA. Transport Malta records traffic data, the PA as the national mapping agency records landscape and building information and the National Statistics Office records information on population.

Data availability

For R1, a document prepared by consultants[290] provides an overview of the data sources. In particular, Chapter 4.8 deals with the collection of data and building the new noise model. On pages 49-51, information is provided about the source data, pathway data and population data utilised, as summarised in the following table:

Table 207 Data sources for Round 1 Noise Mapping

Data sources:	Description of data source and detail
Major roads	3 sources of traffic flow data were made available to the consultants: • The MT 2005 dataset that was reported to the EC in 2005 • Autocount dataset – traffic count with short-term auto traffic count data of up to 1 week in duration (1989 – 2007) • TEN-T dataset. Feasibility and environmental impacts of T-TEN transport infrastructure projects for Malta.
Pathway data	The 3D environment to support the assessment of road noise from 2000 roads consisted of the following datasets: • Digital terrain dataset • Ground cover (CORINE 2006) • Buildings dataset (MEPA basemap) • Barriers dataset (MEPA basemap) • Bridges dataset (defining the position and height of bridges)
Population data	Malta Census of population data and Housing data 2005 were used. Note – for R2, it is likely that Census of Population and Housing data 2011[291] will be used.

Source: Consultancy and field surveys to implement the EU Noise Directive 2002/49/EC in Malta (Acustica consultancy, see pages 49-51.

It should be noted that since there were no major airports, major railways or agglomerations within the scope of the END in Malta in R1 (only for major roads), it was not required to determine the noise model areas for these infrastructure.

[290] Consultancy and field surveys to implement the EU Noise Directive 2002/49/EC in Malta (Acustica consultancy, UK), https://www.mepa.org.mt/file.aspx?f=6847

[291] https://nso.gov.mt/en/publicatons/Publications_by_Unit/Documents/01_Methodology_and_Research/Census2011_PreliminaryReport.pdf

Table 208 - Data sources for Round 2 Noise Mapping

Data sources:	*Description of data source and detail*
Major roads	3 sources of traffic flow data were made available to the consultants: • The MT 2005 dataset that was reported to the EC in 2005 • Autocount dataset – traffic count with short-term auto traffic count data of up to 1 week in duration (1989 – 2007) • TEN-T dataset. Feasibility and environmental impacts of T-TEN transport infrastructure projects for Malta.
Pathway data	The 3D environment to support the assessment of road noise from 2000 roads consisted of the following datasets: - Digital terrain dataset - Ground cover (CORINE 2006) - Buildings dataset (MEPA basemap) - Barriers dataset (MEPA basemap) - Bridges dataset (defining the position and height of bridges)
Population data	Census of Population and Housing data 2011.
Population distribution	Census Output Area (COA) Geographic footprint of each COA Coastline Satellite Imagery
CORINE land Cover (CLC)	CORINE "urban fabric" layer Some adjacent CORINE "industrial, commercial and transport units" to overcome urban layer inconsistencies
Limit of Development	Extent of urban fabric from a planning perspective (to determine the building block of the infrastructure)
Open spaces	When partially/wholly agglomeration footprint

20.7.3 Strategic noise mapping methods

R1 SNMs were generated by estimating noise levels from Major Roads – (defined as roads with more than 6 million vehicle passages annually) then derived by computational methods.

R2 SNMs were generated by estimating noise levels from: a) Major Roads (defined as roads with more than 3 million vehicle passages annually) b) Agglomeration (defined by an area within a territory delimited by the Member State having a population of more than 100,000 persons and a population density such that the Member State considers it to be an urbanised area); and then were derived by computational methods.

Since Malta does not have any national methods, therefore as indicated in the END, the national regulations specify that the EC recommended Interim Methods are to be used for strategic noise mapping. Therefore, Malta used these Interim Methods.

20.7.4 Public accessibility of SNMs

The R1 and R2 noise maps for Malta (for major roads and the agglomeration, including a separate map for industrial noise) have been made available online (http://era.org.mt/en/Pages/Noise-Maps0316-9547.aspx).

20.7.5 Implementation issues

Table 209 Strategic noise mapping issues - Malta

R1	R2
To improve stakeholder engagement and improve collaboration by establishing a cross-departmental working group on environmental Strategic noise mapping, a Working Group was set up.	Encourage the development of a national policy statement on noise.
Encourage the development of a national policy statement on noise. -	Utilise improved input data delivered via GIS enabling of Government agencies and the Lidar survey results.
Utilise improved input data delivered via GIS enabling of Government agencies and the Lidar survey results.	To develop a unified spatial data infrastructure for sharing relevant datasets between stakeholders.
To develop a unified spatial data infrastructure for sharing relevant datasets between stakeholders.	
There were delays in R1 and the SNMs were only published in 2011.	

20.8 Noise action planning

20.8.1 Overview

- The NAP was prepared in accordance with the END's requirements, and an overview of SNMs and NAPs that were due in R1 and R2 is shown in the following table. It can be observed that in R1, there were no NAPs required for agglomerations, major railways or major airports falling within the transitional END thresholds. A NAP was however required in respect of major roads. In R2, a NAP for one agglomeration in Malta was required and for major roads, but these have not been submitted to the EC yet. The latest available estimates for the delivery of these documents is: Noise action plan for major roads by end of October 2016
- Noise action plan for agglomerations due by the end of January 2017

Table 210 NAPs– Malta

	R1	R2
Agglomerations	1	1
Major airports	n/a	n/a
Major railways	n/a	n/a
Major roads	1	1

Source: Malta Environment and Planning Authority (http://www.mepa.org.mt/topic-noise)

In Malta, Greater Valetta is the only agglomeration with a population above 250,000.

20.8.2 Methodologies for noise action planning

The R1 NAP set out a proposed approach for a study (to identify) any necessary noise reduction measures. The plan also outlined a method by which noise mitigation measures were to be assessed for feasibility.

The R1 NAP's approach was to manage and reduce environmental noise emissions and its impact at source through operating procedures and restrictions. The NAP was drafted on the basis of recommendations made to the Competent Authority by a team of noise experts engaged through a consultancy contract[292] to assist in the implementation of the END, to prepare the required SNMs and to draft the technical specifications for the supply of noise monitoring equipment.

20.8.3 Measures

Round 1 and 2 NAP noise (mitigation) measures are shown in the table below.

Table 211 – Noise action planning measures - Malta

R1	R2
Improve stakeholder engagement and improve collaboration by establishing a cross-departmental working group on Strategic noise mapping	Currently not available. There have been delays in the development of R2 action plans, however Malta indicated the timeframes when such plans and maps will be delivered.
Encourage the development of a national policy statement on noise, adoption of noise as a public health issue, and development of guidance on the assessment of neighbourhood noise entertainment noise and noise nuisance.	
Utilise improved input data delivered via GIS enabling of Government agencies, the proposed Inspire portal and especially the wider environmental monitoring programme, specifically LiDAR survey results	
Develop capacity within MEPA to deliver the requirements of the Noise action planning process set out within the strategy,	
Procure noise measurement equipment and mapping software	
Introduce additional trained personnel who are required to undertake the specialised work set out	
Provide staff training to enable effective use of the technical measurement equipment and Strategic noise mapping software procured.	
Develop planning guidance - an assessment of noise on proposed residential developments, Guidance on control of envisaged noise impact from proposed developments on existing residential areas	
Work closely with the Planning section to ensure all applications with a noise aspect, whether producer or recipient, are assessed by specialist staff within the noise team.	

20.8.4 Public consultations

The R1 Draft NAP was published for public consultation on the MEPA website with the general public invited to submit comments. This process started on June 1, 2011. The process was formally open for 4 weeks. Further information on this public consultation can be found on: http://www.mepa.org.mt/newslet15-article2 and http://www.mepa.org.mt/news-details?id=703.

292 Assignment "Consultancy and field surveys to implement the EU Noise Directive 2002/49/EC in Malta", Acustica Consultancy, UK, http://contracts.gov.mt/en/Tenders/Pages/Archived/2009/CT2332.aspx

To solicit input, a number of presentations were also made with key stakeholders, such as the 13 June, 2011 presentation organised for the general public by the Malta Environment and Planning Authority in collaboration with the Malta-EU Steering and Action Committee (MEUSAC). A MEUSAC core group meeting took place on 27 May 2011 and an Information Session on 13 September 2011. A number of media events were also organised.

Since there have been delays in the R2 NAPs being published, no consultation has yet taken place in respect of R2 NAPs.

20.8.5 Implementation issues

The main issues identified with regard to noise action planning relate to the delays in noise action planning experience in both Rounds 1 and 2. There appears to be a lack of in-house capacity, however ERA has recently embarked on an extensive recruitment drive with resources also earmarked for the implementation of the END. However, the results from the consultancy report provided a significant input to the development of the Round 1 NAP. However, as yet, no R2 NAP is available.

21. NETHERLANDS

21.1 National implementing legislation for END

21.1.1 Legal implementation

The Netherlands transposed the END into national legislation through amendments to the Noise Abatement Act of 1979 (Wet Geluidhinder)[293] in June 2004[294]. Noise-related issues covered by the Noise Abatement Act include: equipment and soundproof facilities; industrial noise, insofar as it relates to industrial sites; road traffic; railway noise; and developing SNMs and NAPs under the END. In January 2007, among further amendments to the Noise Abatement Act were the introduction of L_{den} as the key metric for road traffic and railway noise.

A further amendment to the Noise Abatement Act made in 2007[295] was that there was a process of decentralising responsibility for Strategic noise mapping and Noise action planning in agglomerations to Dutch municipalities and provinces. In total, about sixty municipalities are involved in Strategic noise mapping and Noise action planning.

In July 2012, further legislative changes were introduced. The implementation of the END for national (major) roads and railways moved to the Environmental Protection Act, whilst environmental noise for roads in agglomerations and for industrial noise remains within the Noise Abatement Act. The revisions to the 2012 Environmental Protection Act also introduced changes to noise limits for national (major) roads and railways, which are now set out in Chapter 11 of the Act. Under the revised Act, by 2018, every municipality in the Netherlands will have to produce a SNM and NAP not only agglomerations.

There are also links between the Noise Abatement Act and other Dutch national legislation. For instance, a new planning law on homes located in rural areas was adopted in 2012[296]. Article II of the Noise Abatement Act has been adjusted in relation to the implementation of measures to reduce noise emissions in order to strengthen the planning regime. The definitions for home, building and other sensitive noise areas have been adjusted accordingly. Changes were made to the Calculation and Measurement Regulations on noise in 2012. Only some changes were relevant to the implementation of the Noise Abatement Act.

21.1.2 Scope of END implementation – Rounds 1 & 2

R1 of strategic noise mapping and noise action planning in The Netherlands included 6 agglomerations, 1 airport, 854 km of railway and 3,503 km of major roads. The introduction of definitive thresholds in R2 led to 15 *additional* agglomerations. Airport, rail and road coverage stayed the same, with the latter reflecting a R1 decision to cover 100%.

[293] http://www.vrom.nl/pagina.html?id=7652

[294] 30 June 2004, staatsblad 338, memorie van toelichting 29021-3

[295] Information sheet on the 2007 amendment to the Noise Abatement Act, available in Dutch at: http://www.vrom.nl/pagina.html?id=2706&sp=2&dn=6403

[296] Plattelandswoningen Stb. 2012, nr. 493, Stb. 2012, nr. 571

Table 212 END coverage – The Netherlands

	Agglomerations	Major airports	Major rail	Major roads
R1	6[297]	1	854 km	424 km
R2	21[298]	1	854 km	3,503 km

21.2 Competent Authorities and designated administrative bodies

The Ministry of Infrastructure and Environment is the national CA in the Netherlands. The Ministry is responsible for the collection of data related to SNMs and NAPs for agglomerations. In October 2010, the Ministry of Housing, Spatial Planning and the Environment (VROM) and the Ministry of Transport, Public Works and Water Management merged into the Ministry of Infrastructure and Environment[299].

Municipalities are responsible for the development and approval of SNMs and NAPs. The Ministry of Transport, Public Works and Water Management is responsible for making and approving SNMs concerning major roads, railways and airports.

Table 213 Administrative Responsibility for the END - The Netherlands

Role/Activity	Agglomerations	Roads	Railways	Airports
Preparing SNMs Approving SNMs Preparing NAPs Approving NAPs	Municipalities (i.e. local authorities)	Ministry of Infrastructure and Environment (Rijkswaterstaat for highways) Provinces* (i.e. regional authorities) Municipalities (i.e. local authorities)	Ministry of Infrastructure and Environment	Ministry of Infrastructure and Environment
EC/EEA reporting	Ministry of Infrastructure and Environment**			

**A Dutch province represents the administrative layer in the Netherlands between the national government and the local municipalities, and has responsibility for matters of subnational or regional importance.*

***As noted earlier, the Ministry of Housing, Spatial Planning and the Environment (VROM) and the Ministry of Transport, Public Works and Water Management were merged into a single Ministry in October 2010.*

Responsibility for roads is shared between the provinces at regional level and local authorities. The provinces are responsible for Strategic noise mapping and Noise action planning for main roads that are not national highways or local/municipal roads. Local authorities at municipal level are responsible for the provision of data and information on local / municipal roads.

[297] Amsterdam, Eindhoven, Heerlen, Rotterdam, The Hague, Utrecht

[298] Amsterdam, Eindhoven, Heerlen, Rotterdam, The Hague, Utrecht, Alkmaar, Almere, Amersfoort, Apeldoorn, Arnhem, Breda, Den Bosch, Enschede, Gouda, Groningen, Hilversum, Maastricht, Nijmegen, Tilburg and Zwolle

[299] In Dutch, this is the Ministerie van Infrastructuur en Milieu, abbr. IenM).

During R1, ensuring effective coordination of responsibilities between different administrative bodies in the Netherlands was considered to be a problem. Following changes to the END implementation system with considerable decentralisation since 2010, in R2, coordination appears to remain difficult, given the large number of municipalities involved (91), and the attendant challenges in obtaining data and information.

21.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

21.3.1 Data collection

The Ministry of Infrastructure and Environment has overall responsibility for reporting data to the EEA through the Reportnet system within EIONET. Individual municipalities have been responsible for collecting data in respect of agglomerations since 2007. One of the questionnaire respondents in R1 indicated that the data collection required lots of communication between various departments.

21.3.2 Implementation issues

In relation to the designation and delimitation of transport corridors and agglomerations, only minor implementation challenges were identified in R1. In R2, together with actions taken to address them are shown in the table below.

Table 214 Designation issues - The Netherlands

R1	R2
There were problems with areas or stretches of road and railway that run across municipal boundaries and fall within the scope of more than one CA.	The municipalities are now better aware of delineations in administrative responsibilities, but the large number of municipalities involved can still cause coordination difficulties.

21.4 Noise limits and targets

21.4.1 Objectives and Scope

In the Netherlands, legally binding noise limits are set out in the Noise Abatement Act 1979, as amended in 2007 for noise from industrial estates. Limit values for road traffic and major railways are now set out in the 2012 Environmental Protection Act which introduced changes to noise limits for national (major) roads and railways, which are set out in Chapter 11. These were formerly included in the Noise Abatement Act. When establishing noise limit values, a distinction can be made between the preferential value, which indicates a level consistent with good acoustic living conditions, and the maximum value, which should not be exceeded. Under the Noise Abatement Act as amended in 2012, once municipalities are informed about any proposed physical changes, such as an expansion of a road or a proposed new building development, then the relevant municipality must make projections based on modelling to determine whether the noise level in future will be within the range of the preferred noise limit.

If necessary, municipalities can decide to apply a higher noise limit than the preferred limit provided that the maximum limit is not exceeded and noise levels inside the dwelling, as defined in the Noise Abatement Act, are met.

There are also limit values in relation to aviation, as summarised below:

- The Aviation Act [300], with a recent Amendment[301] for noise from aircraft taking off from and landing at Schiphol airport
- Extension of the 'old' (1958) Aviation Act [302] for noise from aircraft taking off from and landing at other airfields.

The applicable limit values are different for different noise sources. One reason for this is that dose-effect ratios differ for each noise source. Another reason is that cost-benefit analyses have arrived at different conclusions with regard to the level at which noise limit values should be set to strike a balance between public health and economic development.

Preferential and maximum limit values applicable to roads and railways under the Noise Abatement Act are expressed in terms of L_{den} and for industry in terms of L_{ETM} in dB(A), and are provided in the following table:

Table 215 Noise limit values for road, rail and industry - The Netherlands

Legislation and noise source	L_{den} (road, rail) / L_{ETM} (industry)	
	Preferential limit value (dB)	Maximum limit value (dB)
Environmental Protection Act, 2012, Road traffic noise (limits apply to existing roads and new dwellings)	48 (urban roads) 50 (non-urban roads)	63 (urban roads) 65 (non-urban roads)
Environmental Protection Act, 2012. Railway noise (limits apply to existing road and new dwelling)	55 *	68
Noise Abatement Act (as amended 2007) Industrial noise	50 dB(A) (In general, exemptions cannot exceed 55 dB(A))	In certain cases, and subject to strict conditions, exemptions of 60 or 65 dB(A) may be possible

** The reason for the higher limit value is the different dose-effect relation between road and rail traffic.*

Changes were made in 2012 to the limit values for non-urban roads through the Environmental Protection Act. The noise regulations moved from the Noise Abatement Act to the EPA in 2007 (roads and railways). The preferential limit value has been set at 50 dB with a maximum limit value of 65 dB. There are also noise limits for inside buildings. In most cases/situations this limit inside the dwelling is 33 dB.

[300] Aviation Act (18 June 1992), http://wetten.overheid.nl/BWBR0005555/geldigheidsdatum_28-12-2009

[301] Ammendment Schiphol (29 June 2006), http://www.nmanet.nl/Images/VK%20-%2019%20juli%202006%20wet%20luchtvaart_tcm16-89562.pdf.

[302] Extension of the Aviation Act for other airfields (27 December 1990), http://www.st-ab.nl/wettennr02/0194-024_Besluit_geluidsbelasting_kleine_luchtvaart.htm

Derogating the preferential value (which is never higher than the maximum value) was previously a responsibility of the provincial administration which granted exemptions. However, since 1st January 2007, this task lies at local/municipal level and no approval is needed from the provinces to grant such an exemption. Such exemptions are only possible if measures required to achieve compliance with the preferential value are considered unreasonable or disproportionate. Wherever the preferential value is exceeded, requirements will automatically be imposed with regard to the sound insulation of the façade.

In addition to noise requirements imposed on designated industrial estates, there are also noise requirements laid out in environmental permits delivered under the Environmental Management Act (Wet Milieubeheer)[303] which all companies must adhere to. There are no national level rules stipulating common noise requirements; rather the licensing authority (usually the municipality) is responsible for noise requirements. It has become common practice that companies may not generate more than L_{ETM} = 50 dB(A) as measured at the nearest dwellings. If the background noise is less, lower values may also be set in the environmental permit. Higher values are also possible; L_{ETM} = 55 dB(A) is the upper limit. Additional penalties may be imposed for tonal, impulsive and music noise.

However, as part of a long year national programme of ‘cutting red tape’ and minimising administrative burdens, many activities by SMEs are ‘regulated’ via general binding rules and SMEs no longer have to apply for an environmental permit. Only the larger, noise relevant-industries (including those regulated by the IPPC) have to apply for a permit which sets specific noise limits.

For aircraft noise around Schiphol airport, 35 "enforcement points" have been designated under the Aviation Act. At these points (located in residential areas in an approximate 30 km radius around the airport), location-specific limit values have been formulated ranging from 52.04 to 59.79 dB L_{den}. There are restrictions on planning new dwellings within a prescribed "limitation area". For other airports, the limit value is B = 35 Ke (B is defined below); no urban development is permitted above this value. 35 Ke corresponds to serious annoyance at 25% of the population exposed to it. For smaller fields, the limit value is 47 BKL.

For railways, according to a report by the UIC[304], The Netherlands has introduced noise-differentiated track access charges.

[303] 1 March 1993, http://www.vrom.nl/pagina.html?id=24176

[304] Railway Noise in Europe, the UIC - www.uic.org/download.php/publication/516E.pdf

21.4.2 Methods for establishing noise limit values

The noise indicator L_{ETM} is used for industrial noise, and is defined as the maximum of the following three values:

- L_{Aeq} over all day periods of a year (7 am to 7 pm)
- L_{Aeq} of all evening periods of a year + 5 dB (7 pm to 11 pm)
- L_{Aeq} of all night periods of a year + 10 dB (11 pm to 7 am)

The value is determined on the basis of the noise-generating rights of a company as laid down in their respective environmental permit. These usually relate to what is termed the Representative Company Situation (in Dutch abbreviated RBS), which is a worst-case situation (in which the 12 most extreme days in terms of noise generation are not taken into account as they are considered non-representative incidents). The RBS is in most cases not equal to the annual average.

The impact of weather conditions on noise levels is determined as a long-term average. For this purpose, no distinction is made between possible differences between day, evening and night. Unless otherwise indicated, noise levels are determined at the façades of dwellings and other noise-sensitive buildings. Only incident sound is taken into account. Sound reflection against the façade for which noise levels are determined is disregarded.

For aircraft noise around Schiphol airport, the noise limit values are expressed in terms of L_{den}. The limit values are recorded per residential area in the surroundings of Schiphol airport. Limit values also apply in respect of L_{night}. For other major airports in the Netherlands, "noise in Kosten units" is taken as the indicator, which is defined as follows:

$$B = 20\log\left(\sum_{i=1}^{n} g_i 10^{Li/15}\right) - 157$$

whereas L_i is the maximum level on the ground during the passage of aircraft *i*, *n* is the total number of aircraft per 24 hours, and g_i is a penal factor varying from 1 in the day time to 10 during night time. The following (rough) rule of thumb can be used: L_{den} = 0,5 x B + 40. The level B is used for larger aircraft. For smaller aircraft an additional quantity BKL is used.

21.4.3 Associated enforcement and mitigation measures

Zoning became an important principle under the Noise Abatement Act in order to regulate noise annoyance. Noise zones became compulsory for noise sources such as industry, road traffic, and railways. The zoning system creates a strong association between noise abatement and spatial planning. Thus, noise policy focuses on protecting noise sensitive buildings such as dwellings, schools and hospitals, plus designated quiet areas.

The Noise Abatement Act allows scope to prioritise possible noise abatement measures in the following hierarchical order:

- Abatement at noise source (silent machines; noise absorbing asphalt);
- Measures between source and receiver(s) (barriers);
- Measures in buildings (sound insulation) that are noise sensitive.

The Traffic Noise Remediation Office (Bureau Sanering Verkeerslawaai (BSV)) works with the national CA to implement measures to reduce noise from roads and rail. In the case of road traffic noise, most costs are for noise barriers and insulation of dwellings, and the government pays for these measures. Most noise barriers have been built alongside motorways. This is rarely possible in towns and cities, where soundproofing insulation is used instead.

21.4.4 Implementation issues

In relation to noise limit values, one of the main problems identified is that there is very little enforcement activity if maximum binding noise limit values are exceeded. This applied in both Rounds 1 and 2.

21.5 Quiet areas

21.5.1 Overview

In the Netherlands, the total surface of Quiet Areas is 650 hectares. This includes a few large wetlands. Quiet areas ("stiltegebieden") are natural areas where no 'disturbing sounds' are allowed) to disturb the prevailing natural sounds. Areas include those designated as protected nature reserves or national natural areas, and areas designated under the Ramsar Convention of 1971 (habitats for water birds).

The Dutch Noise Act distinguishes between two kinds of quiet areas: those designated by law as nature reserves (including Natural Parks) and those identified as designated quiet areas by municipalities. Larger natural areas protected as quiet areas through the Environmental Protection Act (EPA) are designated by the provinces. Environmentally protected areas are also regulated in Dutch environmental permits under the 2012 Environmental Management Act. The total size of these areas is 650 thousand hectares in 2012 (source: Inter Provincial Overleg (IPO) www.atlasleefomgeving.nl). However, these are not the same as – but are often confused with - quiet areas (see implementation issues). General information about the numbers and area of designated quiet areas under the END is not available in the Netherlands at the national level.

General information about numbers and area of quiet areas according to the END are not available.

According to the Dutch Health Council, "agreeable sounds must be distinguished from unwanted noise, when assessing the quietness of areas. For desirable sounds, *i.e.*, natural sounds and other sounds that are appropriate to an area, there is no limit in level or duration of these sounds. When high levels of wanted sounds do exist, such as in a sports or musical event, it need not be quiet, though the acoustic quality can still be high[305]. "For non-continuous noises, such as a car passing through an otherwise quiet area, the percentage of time during which that noise is audible seems to have more influence on the experience of quietness than the actual noise level".

A national methodology has been developed for defining and selecting 'stiltegebieden', but this methodology is not applicable to quiet areas situated in agglomerations.

There are some examples of good practices, e.g. the municipalities of Amsterdam and Rotterdam have been involved in a project funded through Life+ to protect acoustic quality where it is good.

305 http://www.mdpi.com/1660-4601/9/4/1030/pdf

21.5.2 Implementation issues

A number of issues were raised as a result of R1, a summary of which is shown below, together with new issues raised during R2.

Table 216 Quiet area – implementation issues

R1	R2
Overall, quiet areas have had a positive impact. There was already a system for the designation of quiet areas in The Netherlands. No surveillance takes place to check whether prohibited activities has taken place in designated Quiet Areas; Even when inspections did take place, no enforcement activities were carried out by the police or park keepers; In granting environmental permits to enterprises near or within Quiet Areas, the specific conditions and any development limitations in Quiet Areas were not adequately taken into account. Spatial planning often didn't take the conditions and limitations set in the legislation into account either. Lack of promotion of Quiet Areas (e.g. absence of road signs where to find these areas); Walking and biking routes along or through the Quiet Areas (Quiet Areas biking or hiking trails) are not installed too.	Within the provinces, the focus has switched in R2 to tackling the problem of noise hotspots because they are already very familiar with the protection of quiet areas. However, almost nothing was said about quiet urban areas in many NAPs in R1 / R2. However, there are examples of emerging good practices (e.g. in Amsterdam and Rotterdam) There are some examples of the protection of quiet areas at municipal level in urban areas but there remain challenges compared with the designation of quiet areas in rural areas which is not a problem at all.

21.6 Strategic noise mapping

21.6.1 Overview

An overview of SNMs produced in Rounds 1 and 2 is shown below.

Table 217 SNMs – The Netherlands

	R1	R2
Agglomerations	6	21
Major airports	1	1
Major railways	424 km	3,503 km
Major roads	854 km	854 km

There was an increase from 6 to 15 in the number of SNMs produced between R2 and R1. In R1, the following agglomerations produced SNMs: Amsterdam, Den Haag, Eindhoven, Heerlen, Rotterdam and Utrecht. In R2, this was extended to include in addition the following: Alkmaar, Almere, Amersfoort, Apeldoorn, Arnhem, Breda, Den Bosch, Enschede, Gouda, Groningen, Hilversum, Maastricht, Nijmegen, Tilburg and Zwolle.

SNMs for all the above transport types are available from: http://www.infomil.nl/onderwerpen/hinder-gezondheid/geluid/actieplannen-0/.

21.6.2 Data collection

In R1, SNMs were prepared using the national interim methods. The interim methods used were ISO-9613 for industrial noise, XPS for road traffic noise, RMR for railway traffic noise and ECAC 29 for air traffic noise. In R2, SNMs for road and rail traffic noise were produced using the Dutch SKM2 calculation method[306], which can be considered as an efficient implementation of the Dutch standard methods for calculating road and rail traffic noise.

Input data for noise calculations was obtained from GIS data, and through visual inspection. Data on the numbers of dwellings were also difficult to obtain. Data files with ZIP codes were employed. Traffic data is generally based on counts with default assumptions for the composition and distribution over time; generating a source of uncertainty. The EEA's *'2007 Good Practice Guide for Strategic noise mapping'* was used, as well as the WG-AEN position paper *'Presenting Strategic noise mapping information to the public'.*

Responsibility for data collection lies at different administrative levels. The national CA has overall responsibility for coordinating the development of SNMs, Rijkswaterstaat and the provinces and cooperate in the development of SNMs for major roads, the Dutch railways company, Prorail for major railways, etc. The Schiphol airport operator is responsible for airports. The Dutch national road authority is the CA for highways, the provinces for major roads outside agglomerations, and municipalities for roads inside agglomerations.

During R1, there were coordination challenges between different administrative levels in collecting input data to facilitate Strategic noise mapping was a major problem. Specific types of input data for noise calculations were difficult to obtain, such as data on barriers, road pavement and buildings. However, these problems appear to have been overcome.

In R2, some coordination challenges remained but stakeholders acknowledged there was greater familiarity with the process of Strategic noise mapping.

In accordance with the Directive, in both L_{night} and L_{den} were used for Strategic noise mapping. Also the indicator L_{Aeq}(0-24h) was used. No further national indicators were used.

21.6.3 Public accessibility of SNMs

SNMs are available on various websites, maintained by the municipalities. For example, the SNM of Amsterdam can be viewed on a website of the city of Amsterdam.[307]

In R1, in the Milieu report, it was commented that the "methods used for public consultation were rather conventional, with the public being made aware of consultation meetings through advertisement in local newspapers. Participation by the public in these events was reported by the Dutch authorities as being generally disappointing".

[306] http://www.stillerverkeer.nl/

[307] http://www.dmb.amsterdam.nl/wat_doet_dmb/advies_en_beleid/geluidadvies

During R2, there appear to have been similar issues, with a difficulty in attracting participation in public consultation. Although Utrecht actively involves citizens in consultation panels on other topics (both online and through the organisation of working groups e.g. to develop a new energy strategy), there has not specifically been anything on environmental noise. Rotterdam has tried to involve citizens but did not succeed in attracting more than 10 people during the 2nd round of Noise action planning.

21.6.4 Implementation issues

The main implementation challenges raised in R1 and R2 are summarised below.

Table 218 Strategic noise mapping issues – The Netherlands

R1	R2
Ensuring effective coordination between different administrative bodies, especially for agglomerations, where there are 60+ local municipalities involved and several municipalities within different cities. Data collection and obtaining input data. The lack of national or EU guidance as to how to aggregate the contributions of various noise sources (multiple exposure).	Lack of comparability of SNMs in R2 since a new tool for calculating and modelling noise was used and this meant that there was an increase in population exposure between Rounds with more sleep disturbed and highly annoyed people. Cities had invested a lot of money on noise abatement measures, such as quiet pavement surfaces. But the results did not show a positive evolution. Better tools are needed to evaluate the impact of investment. Lack of comparability between Rounds is also because between 1st and 2nd round, a lot of time and money was invested to improve input data. For example during the first round Rotterdam applied the suggested multiplier of 2.3 inhabitants per dwelling. During the second round more data from the statistical bureau was available and learnt that the average number is 2.5 instead of 2.3 This resulted in higher numbers of (highly) annoyed and (highly) sleep disturbed people. Limited changes to modelling and input data result in completely different outcome data.

21.7 Noise action planning

21.7.1 Overview

An overview of NAPs is shown in the following table.

Table 219 NAPs – The Netherlands

	R1	R2
Agglomerations	6	21
Municipalities	43	87
Major airports	1	1
Major railways	1	1

	R1	R2
Major roads	1	1[308]
Rijkswaterstaat	1	
Provinces	12	1
		10

The CA was not able to provide data and the EC database on NAPs was only provided for agglomerations and major airports, but not for major railways and major roads.

Agglomerations are somewhat difficult to quantify in the Netherlands because CAs not only drew up NAPs for 21 agglomerations but also for 96 municipalities within these agglomerations. Across the 96, 43 NAPs have been submitted for Round 1.

21.7.2 Methodologies for noise action planning

The national authorities have prepared a 'manual' for drawing up and implementing NAPs. National guidelines have also been established (the "Handreiking omgevingslawaai"). The most recent 2011 guidelines are available from the web link in footnote[309].

The 2012 maps were used as a basis for developing the NAPs in 2013-2014, with the NAPs being based on the identification of 'hot spots' in SNMs. However, hotspots generally identify locations with a high noise exposure, but often a relatively small number of people are exposed to high levels. Addressing hot spots was not seen as being that helpful in terms of reducing overall exposure to potentially harmful noise levels.

21.7.3 Measures

In R2, examples of the types of measures mentioned in NAPs include: traffic planning to tackle road congestion, measures to promote more sustainable transport, noise insulation measures in dwellings located near noise hotspots, among others. There has also been a strong focus on low noise road surfaces. Specifically, the provinces have made extensive use of this abatement measure. In addition, several municipalities have changed road pavements into quieter types.

21.7.4 Public consultations

In accordance with the requirements under the END, there is a requirement in Dutch legislation that citizens have to be kept informed about Strategic noise mapping, the content of actions plans and proposed measures. The legal base is the General Government Justice Act (*Algemene Wet Bestuursrecht,* Section 3.4).

Draft NAPs are made available online. In terms of the timeframe for carrying out public consultation, the draft NAP must be made available for at least six weeks. All citizens and civil society organisations are able to provide their opinions during this period. Public consultations have been carried out in the Netherlands in different ways, for instance, by holding public meetings, establishing committees formed of different organisations, such as residents' or community-based organisations and local environmental and conservation organisations. In a few municipalities, there is a legal arrangement in place to facilitate / structure a process of interactive policy making.

[308] Covering 12 provinces. NAPs for 2 provinces still not submitted yet.

[309] http://www.enschede.nl/loketten/lokettensubsectie/handreiking_omgevingslawaai_2011.pdf/

At municipality level, local councils play an important role in the development of NAPs and in promoting public participation. Municipalities are meant to take responses from the public into consideration in their decision-making processes during the participation procedure.

However, the research found that there has often only been minimal participation in public consultations. In larger Dutch cities, it has been especially difficult to attract participation. An example of how difficult it can be being provided on Rotterdam. Despite a lot of promotion through the involvement of local media and the publication of publicity materials about NAPs on websites, it has been difficult to attract interest from the public. For instance, a consultation evening was organised where only 1-2 people came. The quality of consultation input is important. Local action groups in rural areas are more interested in participating.

The Dutch Society of Noise Nuisance (Nederlandse Stichting Geluidhinder, NSG) is an example of a relevant organisation in The Netherlands able to provide technical input to public consultations on noise -related issues. However, in practice, it has not been that closely involved, but rather influences the development of national noise policies and legislation.

21.7.5 Implementation issues

A summary overview of the main issues raised in relation to Noise action planning in The Netherlands as a result of END implementation in Rounds 1 and 2 is presented in the table below:

Table 220 Noise action planning issues - The Netherlands

R1	R2
Lack of synchronisation between timetable for Noise action planning and periodic governance schedules at national level, such as city council governance plans and budgetary planning. The lack of noise abatement options at local level. The period between finalising SNMs and the development of NAPs of 12 months was regarded as too short. Identifying financing for the implementation of measures mentioned in NAPs was a problem. Difficulties in ensuring coordination between the different organisations responsible for implementing measures mentioned in NAPs.	The period between finalising SNMs and the development of NAPs of 12 months was still regarded as too short. Synchronisation between the development of NAPs and related activities, such as air quality NAPs, would be helpful. Difficulties remained in ensuring coordination between different organisations responsible especially at the local municipality level.

22. POLAND

22.1 National implementing legislation for END

22.1.1 Legal implementation

This sub-section sets out:

- General legislation transposing the Directive;
- Additional implementing acts and specific national implementation provisions.

The main legislative act regulating issues relating to environmental noise in Poland is the Environment Protection Law Act of April 27 2001 (as amended)[310,] especially Articles: 117, 118 and 179. According to Article 112a, protection from noise exposure is defined as "providing the most accurate conditions for the acoustic climate by maintaining the level of noise which does not exceed admissible values".

In addition, there are a series of further decrees and ordinances that set out more detailed implementation arrangements. Noise limit values are set out in the Ministry of the Environment's Ordinance of 14 June 2007[311] (as amended – change in noise limits in 2012)[312]. The limit values are described in details below in chapter 1.4.1 and 1.4.2. A further relevant regulation is the Ministry of the Environment Ordinance of 16 June 2011 (as amended)[313] which sets out the requirements in respect of environmental noise measurement, and Ministry of the Environment Ordinance of 19 November 2008 (as amended)[314] which specifies the standard formats for documenting and presenting the results of noise measurements.

A decree was adopted by the Polish Ministry of the Environment on October 1, 2007[315] with regard to the data range that should be included and presented in SNMs (further details are provided in the strategic noise mapping section).

22.1.2 Scope of END implementation – Rounds 1 & 2

R1 of strategic noise mapping and noise action planning in Poland included 12 agglomerations, one major airport (Warsaw), and approximately 1005 km of major roads and 66 km's of railway. There are two major roads with over 6 million cars per year.

The introduction of definitive thresholds in R2 led to 23 *additional* agglomerations (i.e. a total of 35 in R2) being included, and approximately 1 215 km of major railway lines and 9 710 km of major roads being covered.

310 http://isap.sejm.gov.pl/DetailsServlet?id=WDU20010620627
311 http://isap.sejm.gov.pl/DetailsServlet?id=WDU20140000112
312 http://isap.sejm.gov.pl/DetailsServlet?id=WDU20120001109
313 http://isap.sejm.gov.pl/DetailsServlet?id=WDU20111400824
314 http://isap.sejm.gov.pl/DetailsServlet?id=WDU20111400824
315 http://isap.sejm.gov.pl/DetailsServlet?id=WDU20071871340

Table 221 END coverage – Poland

Round	Agglomerations	Major airports	Major rail	Major roads
1	12	1	66 km	1,005 km
2	35	1	1,215 km	9,710 km

Source: Report on the state of the environment acoustic based on the results of SNMs, GIOŚ Warsaw, Poland 2013

SNMs and NAPs were prepared for sections of major roads inside and outside of agglomerations in Rounds 1 and 2. For major railways, no major sections had more than 60,000 movements per year (R1) but an NAP was prepared for R2. NAPs summaries e.g. for the municipalities of Gdynia, Poznań, Wrocław and NAPs summaries for major roads outside the municipalities in Świętokrzyskie province are available in xml file format online[316, 317].

22.2 Competent Authorities and designated administrative bodies

In Poland, the Ministry of Economy has overall responsibility for the implementation of the Environmental Noise Directive. Noise control in Poland is the concern of the Committee on Acoustics of the Polish Academy of Sciences and the Polish Acoustical Society, which organises International Noise Control Conferences. Road, rail and airport authorities and municipalities are responsible for Strategic noise mapping and NAP development.

Table 222 Administrative Responsibility for the END - Poland

<table>
<tr><th>Role/Activity</th><th>Agglomerations</th><th>Roads</th><th>Railways</th><th>Airports</th></tr>
<tr><td>Preparing SNMs</td><td rowspan="4">Municipality Administration and Council of cities</td><td rowspan="4">General Directorate of National Roads and Motorways in Poland (GDDKiA), Boards of Provincial Roads in Poland and Privet Companies e.g. Gdańsk Transport Company S.A., Stalexport Motorway S.A.</td><td rowspan="4">Polish Railways (PKP PLK)</td><td rowspan="4">State Enterprise “Airports” Warsaw</td></tr>
<tr><td>Approving SNMs</td></tr>
<tr><td>Preparing NAPs</td></tr>
<tr><td>Approving NAPs</td></tr>
<tr><td>EC/EEA reporting</td><td colspan="4">Ministry of Environmental Protection</td></tr>
</table>

With regard to municipalities, the responsibilities are allocated the following way:

a) 9 cities (urban)> 250 000 inhabitants: Bialystok, Bydgoszcz, Gdańsk, Lublin, Łódź, Kraków, Poznań, Warsaw, Wrocław.

26 cities > 100 000 inhabitants (than 250 000 inhabitants): Bielsko-Biala, Bytom, Chorzów, Częstochowa, Dąbrowa Górnicza, Elbląg, Gdynia, Gliwice, Gorzów Wielkopolski, Kalisz, Kielce, Koszalin, Legnica, Olsztyn, Opole, Płock, Radom, Ruda Śląska, Rybnik, Rzeszów, Sosnowiec, Toruń, Tychy, Włocławek, Zabrze, Zielona Góra.

[316] http://cdr.eionet.europa.eu/pl/eu/noise/df7/envsxrtcq/

[317] http://cdr.eionet.europa.eu/pl/eu/noise/df10/

22.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

22.3.1 Data collection

The Law on Noise Management of Poland transposes the END's definitions of agglomerations, major roads, major railways and major airports. Agglomeration borders are aligned with the administrative borders of cities with more than 100,000 inhabitants. The number of inhabitants for each city is publicly available from statistics in Poland.

Data to delimit major roads, major railways and major airports are available from the Poland Road Administration (GDDKiA, ZDW), Polish Railways (PKP PLK) and Civil Aviation Administration (governmental institutions under the Ministry of Infrastructure in Poland) respectively.

22.3.2 Implementation issues

Issues raised as a result of END implementation in R1 in Poland are illustrated below. Issues raised in R2, together with actions taken to address them are shown in the table below.

Table 223 Designation issues

R1	R2
Lack of a common methodology for performing the SNMs (SNMs) and NAPs (NAPs); Guidelines prepared by the Chief Inspector for Environmental Protection in Poland (2006)[318] appeared as some SNMPs have already done; Lack of experience in preparing SNMs and NAPs for most performers; Difficulties with the appointment of sections of major roads and railways for whom to be performed SNMs.	The Regulation of the Minister of the Environment of 1 Oct. 2007 does not clearly define the data range that should be included and presented in SNMs319, which caused a lot of problems in the interpretation of the regulations; Wide range of mapping e.g. over 9 710 km of national roads, 1215 major rail and 35 agglomerations in Poland (R2), Change in the noise limit values between the stage of performing SNMs and proceeding to execute NAPs; Guidelines prepared by the Chief Inspector for Environmental Protection in Poland June 2006 and 2011; Many trainings and conferences were the results of R1 SNM were presented organized in the period between end of R1 and beginning of R2 SNMs;

[318] *Acoustic Maps design guidelines*. Development of preparation by the Institute of Environmental Protection ordered by the Chief Inspector of Environmental Protection, June 2006.

[319] http://isap.sejm.gov.pl/DetailsServlet?id=WDU20071871340

22.4 Noise limits and targets

22.4.1 Objectives and Scope

During R1, noise limit values in Poland were set out in the Ministry of the Environment's Ordinance of 14 June 2007 (as amended).

Table 224 Long term noise limit values in force in Poland (R1 of Strategic noise mapping)

Type of area	Roads or rail way		Other facilities and activities being the noise sources	
	L_{DWN}	L_N	L_{DWN}	L_N
Health centres, hospitals located outside city centres	50	45	45	40
One-family houses, hospitals located in cities	55	50	50	40
Multi-family houses, one-family houses serving as artisans' workshops, recreation areas outside cities, farm buildings	60	50	55	45
City centres in cities with more than 100,000 inhabitants, with buildings close together and a high density of administrative and commercial buildings	65	55	55	45

In R2, in October 2012, a new not so restrictive noise limits were set out in the Ministry of the Environment's Ordinance of 8 October 2012 (amending the regulation on permissible noise levels in the environment)

Table 225 Long term noise limit values in force in Poland (R2 of Strategic noise mapping)

Type of area	Roads or rail way		Other facilities and activities being the noise sources	
	L_{DWN}	L_N	L_{DWN}	L_N
Health centres, hospitals located outside city centres	50	45	45	40
One-family houses, hospitals located in cities	64	59	50	40
Multi-family houses, one-family houses serving as artisans' workshops, recreation areas outside cities, farm buildings	68	59	55	45
City centres in cities with more than 100,000 inhabitants, with buildings close together and a high density of administrative and commercial buildings	70	65	55	45

22.4.2 Methods for establishing noise limit values

EU interim methods have been used to determine noise levels, and noise levels are determined by calculation (Popp, nd). Information on acceptable noise levels is to be found in the Ordinance of the Ministry of Environment, issued in 14 June 2007 (R1) and issued in October 2012 (R2). As a result, during R1, less-acceptable levels of noise were obtained than during R2.

In Poland, for major noise sources e.g. roads, railways and airports, the choice of 'Action Level' was left at the discretion of the Noise action planning body i.e. the local authorities. The "M indicator" is used, which takes into account the value of exceedance of noise limit values and the number of people exposed to noise living in a particular area. NAPs take into consideration areas where the "M" indicator is above 0 and specific actions to protect them have been identified. The formula for the "M" indicator co-efficient is: M = 0.1 m (100.1ΔL - 1) where: M "M" indicator value:

- ΔL Noise excess value in dB,
- m Number of people exposed to noise over the limits.
- In order to determine the M indicator in some NAPs L_{den} was used whilst in others L_{night} was used (Ministry of the Environment's Ordinance of 14 October 2002).

Binding legislation only defines the formula for the "M" indicator, but does not stipulate the level or how areas should be prioritised. However, most NAPs have adopted a pragmatic approach in which greatest priority has been dedicated to areas where the "M" indicator is >50. The areas with "M" indicator value over 50 are most exposed to noise, which have top priority in being provided with equivalent noise mitigation measures.

Table 226 Limit values for force in Poland (R2 of Strategic noise mapping)

Type of area (Land-use type)	Roads or rail way		Other facilities and activities being the noise sources	
	L_{day}	L_{night}	L_{day}	L_{night}
Health centres, hospitals located outside city centres	50	45	45	40
One-family houses, hospitals located in cities	61	56	50	40
Multi-family houses, one-family houses serving as artisans' workshops, recreation areas outside cities, farm buildings	65	56	55	45
City centres in cities with more than 100,000 inhabitants, with buildings close together and a high density of administrative and commercial buildings	68	60	55	45

22.4.3 Associated enforcement and mitigation measures

The main obligations for Polish railways are to ensure that noise is kept at or below noise limit values, and to reduce noise to the limit (or below) if the limit is exceeded. The noise abatement programme on the Polish railway network includes:

- Track grinding as part of day-to-day maintenance, with the annual programme veering aR1000km with an annual budget of EUR3.9m;
- Noise barriers and anti-vibration equipment;
- Monitoring noise emissions or drawing potential SNMs; and
- There are currently 6 railway line modernisation projects with noise abatement programmes.

Railway line modernisation has included the costs of 50 km of noise barriers (EUR47.3m), 10,000 noise-insulation windows, and the total project costs are estimated at EUR90m to 2013. Noise measurements are mandatory in the event of modernisation of railway lines and noise from railway operations must be periodically measured. SNMs should be completed every 5 years for railways but this is not a legal requirement[320].

The noise limits values are enforced by local authority e.g.:

a) Regional Directorate for environmental protection - on the stage of administrative procedure for obtaining environmental permits (Information Cards of Investments, EIA Reports),

b) Department of Environmental Protection Marshal's Office - e.g. on the stage of procedure for establishing Areas of Limited Usage,

c) Provincial Environment Protection Inspectorate - on the stage of acoustical environmental monitoring.

22.4.4 Non-binding target values

There are no non-binding targets.

22.4.5 Implementation issues

Issues were only raised in R1:

- Difficult to adapt Polish law to European standards
- Difficult to adapt national noise calculation methods to be compatible with those required through the END.
- Setting appropriate noise limit values was also challenging, given the absence of such limit values in the Directive and the fact that there was no previous experience in Poland in setting national limit values.

[320] International Union of Railways (UIC) and Community of European Railway (CER) (2007): Status Report 2007:
Available at: www.cer.be/force-download.php?file=/media/publications/EN_Noise_Reduction.pdf.

22.5 Quiet areas

22.5.1 Overview

No quiet areas were designated in Poland during either R1 or R2.

With regard to the criteria used for the delimitation of, there is a common methodology at national level for the definition of quiet areas. Quiet areas outside of agglomerations are areas free from roads, rail, industry and recreational noise. Current land use and future land use both on the site and in the vicinity are used as criteria for delimitation.

Based on the Polish Environmental Law (Art. 118b) 1. County councils may by resolution, designate quiet areas in agglomerations or quiet areas outside urban areas relating to the specific noise protection needs of these areas and give requirements to ensure that noise levels are maintained at least at the existing level. 2. The draft resolution, referred to in paragraph. 1, subject to the agreement of the local mayor, the mayor has up to 30 days to raise an objection to a responsible authority within this period. If no such objection is received, then this is considered to mean that the draft resolution has been approved.

The definition of quiet areas described above was obligatory during noise mapping in R1 and R2.

L_{den} was used as the main indicator both within and outside agglomerations in both Rounds 1 and 2.

22.6 Strategic noise mapping

22.6.1 Overview

An overview of SNMs produced in R1 and R2 is shown below.

Table 227 SNMs (SNMs) - Poland

	R1	R2
Agglomerations	12	35
Major airports	1	1
Major railways* **	3 (66 km)	30 (1 215 km)
Major roads * **	97 road sections (1005 km)	2,000 road sections (9 710 km)

** - SNMs for 3 main railway lines were prepared. These have a total length of 66 km and 97 different sections of national roads in Poland with total length 1005 km,*

*** SNMs for around 30 main railway lines with total length of 1 215 km and 2 000 different sections of national roads (7 850 km) and voivodship roads (1 860km) in Poland. The total length of road mapped is 9 710 km.*

The Environmental Protection Law, which transposed the END into national Polish legislation, requires local authorities in Polish cities to include the results from strategic noise mapping in spatial planning processes and procedures and in the development of conclusions and recommendations. . SNMs should then provide the basis for the development of Local Land Use Plans and administrative decision-making. In accordance with the act, local plans must include consideration of planning issues. This includes the need to protect the population from noise exposure and to preserve noise quality where it is good. Links between the development of SNMs and local land use plans in Poland have been highlighted in various documents[321].

22.6.2 Data collection

According to a decree adopted by the Polish Ministry of Environment on October 1, 2007, a SNM should consist of both a descriptive part and a graphical presentation of the map. The first part should include the characteristics of an area, the acoustic features included in planning documentation of a commune, the identification and specification of noise sources as well as the identification of quiet areas that are "at risk" of being affected by environmental noise. The visual part is represented by numerous maps depicting the acoustic climate of a researched area which may include: noise emission maps, conflict SNMs as well as indicators relating to the number of inhabitants subject to excessive noise exposure. Additionally, the map includes quiet areas where excessive sound levels have been identified with the L_{den} indicator.

Responsibility for data collection lies with the designated responsible authorities, which are: Inspector for Environmental Protection overall, General Directorate of Roads and Motorways in Poland, private companies: Autostrada Wielkopolska S.A, Gdańsk Transport Company, Stalexport Autostrada Małopolska S.A. and Regional Roads and Mayors with county rights for major roads, Polish Railways for major rail and Presidents of Cities for agglomerations.

In order to help local authorities in carrying out Strategic noise mapping, some support has been provided through projects to provide support and guidance to local authorities. One such project was the project "a network-based system for supporting the administrators of strategic acoustic maps of urban areas", financed by the Polish National Centre for Research and Development (NCBiR).

22.6.3 Strategic noise mapping methods

The SNMs were produced using the following data:

- Annual average parameters and conditions on road, tram and railway traffic, divided by day, evening and night;
- Location of roads, trams and railway lines;
- Geographical and economic data including building heights;
- Demographic data;
- Meteorological data; and
- Emission and propagation data.

[321] IMPLEMENTATION OF THE EU NOISE DIRECTIVE IN PROCESS OF URBAN PLANNING IN POLAND, J. Kwiecień a, K. Szopińska.

Based on this data, at least one agglomeration map was produced with acoustic fields layout along the major roads and junctions, and including natural and artificial screens and green belts. This allowed for determination of noisy areas and led to recommendations about reducing the noise in these locations. Measures adopted to obtain acoustics data for Strategic noise mapping in Poland are listed below.

Table 228 Strategic noise mapping measures - Poland

	Description
Metrics	L_{Aeq} (L_{day}, L_{night}) Reference periods are day (6-22) and night (22-6) L_{Aeq} is often calculated from L_{AE} measurements when the traffic is low and in relation to rail noise
Frequencies	A-weighted
Type of measurements	Measurements at the source Measurements at the receiver Combinations of measurements and calculation are included Reference is made to national prediction methods
Microphone positions above ground	Generally based on the Ministry of the Environment's Ordinance of 16 June 2011: measurement points should be located in areas protected from the noise in such a way that they performed measurements allowed us to determine the place of greatest impact of noise on people in their place of residence of the possible sources from which measurements relate to the following rules: a) on the open road measuring points locates at a height of not less than 1.5 m above ground, b) at the built locates measuring points, depending on the possibilities: • At the facades of buildings to be protected against noise in the discharge of the functions for which the site is implementing protected against noise, at a distance of 0.5 m to 2 m from the facade of the buildings in the light of the window exposed to the noise floor; the permissible noise measurements, as far as possible, the window open, closed or cancelled in such a way as to be able to carry out their boom microphones and cables connecting the measuring of measuring instruments located in the room; • At a height of 4 m ± 0.2 m above ground, where there is no possibility of making measurements of noise in the light of the windows on the floor or in the areas surrounding these buildings;
Microphone positions relative to vertical surfaces	• -
Indoor measurements	• -
Measurement distance	Source measurements: If the road is placed in urban area, microphone should be placed 1m from the road (street) edge. In case of other roads, the distance should be 10m and 20m (according e.g. internal regulations General Directorate National Road and Motorways in Poland). Receiver measurements: At the receiver (height of 4 m ± 0.2 m.)

Source: Ordinance Ministry of the Environment's 16 June 2011 and internal regulations General Directorate National Road and Motorways in Poland

GIS data were used as overlays for conflict maps, and statistical methods were used to link inhabitants and dwellings. Aerial photographs, on-site surveys, conduction of measurements and calculations were also used to gather data for SNMs.

22.6.4 Public accessibility of SNMs

Noise maps for National Roads in Poland are presented on the web site of the General Directorate of National Roads and Motorways: https://www.gddkia.gov.pl/pl/1811/Mapy-akustyczne-dla-drog-krajowych-o-ruchu-powyzej-3-000-000-pojazdow-rocznie or on the Government web site: http://geoserwis.gdos.gov.pl/mapy/.

Noise Maps are delivered to the local authority e.g. Sanitary Inspectorate and District Offices in Poland. In this places (local authority) local society is able to see the prepared documentation (Noise Maps) and check the results of noise calculation. When the local society has some questions, remarks to the Noise Maps report it to the local authority. In this case local authority based on Polish Environmental Law is able to start the new environmental procedure e.g. Environmental Review. The result of this administrative procedure is confirmation or negation the results of noise analysis presented on the Noise Maps based on the noise measurements and new noise calculation.

In Poland, SNMs are available through the following links:

I. Examples of noise maps for 12 Cities in Poland (R2):

1. Mapa akustyczna Warszawy (http://www.akustyczny.pl/linki/50-mapyakustyczne/16-mapaakuwarszawa)
2. Mapa akustyczna Białystok (http://www.gisbialystok.pl/gis-bialystok/app/menupage.jsp)
3. Mapa akustyczna Wrocławia (http://gis.um.wroc.pl/imap/?gpmap=gp2)
4. Mapa akustyczna Gdańska (http://www.gdansk.pl/srodowisko,1244,9475.html)
5. Mapa akustyczna Gdyni (http://server.miasto.gdynia.pl/GeoSerwer/e-mapa.htm)
6. Mapa akustyczna Poznania (http://www.poznan.pl/mim/public/wos/pages.html?co=list&id=11105&ch=11745&instance=1017&lang=pl)
7. Mapa akustyczna Krakowa (http://mapa-akustyczna.um.krakow.pl:280/mapa_k/mapa.php)
8. Mapa akustyczna Łodzi (http://www.akustyczny.pl/linki/50-mapyakustyczne/21-mapaakulodz)
9. Mapa akustyczna Katowic (http://bip.um.katowice.pl/index.php?s=16&id=1227080023)
10. Mapa akustyczna Lublina (http://www.akustyczny.pl/linki/50-mapyakustyczne/25-mapaakulublin)
11. Mapa akustyczna Szczecina (http://bip.um.szczecin.pl/UMSzczecinBIP/chapter_50377.asp)
12. Mapa akustyczna Bydgoszczy (http://www.akustyczny.pl/linki/50-mapyakustyczne/29-mapaakubydgoszcz)

II. SNMs for main roads and motorways in Poland (R2): Portal map akustycznych GDDKiA (http://www.akustyczny.pl/linki/50-mapyakustyczne/28-mapygddkia and http://mapy.geoportal.gov.pl/pomoc/ or http://mapy.geoportal.gov.pl/imap,)

III. For main railways in Poland (R2): http://mapa.plk-sa.pl/ Implementation issues

During the testing of Strategic noise mapping technologies with administrators responsible for the development of SNMs in agglomerations, it became clear that local municipality staff directly involved in Strategic noise mapping lack the competences required either for the process of creating SNMs or for exploiting the findings, such as identifying appropriate measures at local level to reduce and / or mitigate noise exposure through Noise action planning based on the results of SNMs[322]

22.7 Noise action planning

22.7.1 Overview

An overview of the number of NAPs in Poland is shown in the following table.

Table 229 NAPs – Poland

	R1	R2
Agglomerations	10	40
Major airports	0	0
Major railways	3 (66 km)	30 (1,215 km))
Major roads	97 (1,005 km)	2,000 (9,710 km)

** - NM for 3 main railway lines with total length of 66 km and 97 different sections of national roads in Poland with total length 1005 km,*

*** - NM for around 30 main railway lines with total length of 1 215 km and 2 000 different sections of national roads (7 850 km) and voivodship roads (1 860km) in Poland with total length 9 710 km*

**** - AP prepared by regional offices of 16 provinces in Poland*

22.7.2 Methodologies for noise action planning

"Index M" has been used, which is a coefficient that links the number of people exposed to noise with noise levels. This was used for creating the NAPs, along with exceedance maps for change in L_{den} and L_{night}. The noise threat indicator was also used; this is a function of noise above permitted level and number of inhabitants endangered.

22.7.3 Measures

A wide diversity of different types of noise reduction and mitigation measures were included in NAPs. During R1, these include among others, traffic control, land-use planning, technical measures at source, economic measures, noise insulation, reduction in noise exposure and regulations. Many NAPs in Poland differentiate between short-term actions, long-term actions and awareness-raising and education measures to raise awareness about the issue of environmental noise.

[322] Collaborative Web-Based System for Knowledge Transfer to Distributed Groups of Users Within Strategic Noise Mapping Domain, Marcin Dąbrowski, Silesian University of Technology, Gliwice, Poland (International Journal of Distributed Systems and Technologies, 4(4), 39-49, October-December 2013)

There have been differences in the approach to the preparation of NAPs in each region, resulting in a high diversity of noise action plans across each of the 16 provinces, for instance in the case of major roads. A report by CEDR from March 2013 highlighted some of the problems encountered[323]. "*Action plans were outsourced by provincial marshals and almost all NAPs were prepared by different companies. Due to many different approaches and methodologies adopted, it is difficult to carry out a comprehensive analysis of the results, aims and recommendations of the plans, at national level".* The estimated costs of implementation were also found to vary. For instance, the costs of noise barriers are expressed differently in each action plan. *"In some NAPs this was the price per square metre, in others a linear metre and in others still the total length of the noise barrier. Moreover, in most cases it is not stated if the cost of barriers includes only the price for erecting them, or if the price includes also the project and the cost of noise analysis". .*In R2, similar types of measures have been identified, with a continued emphasis on integrating noise mitigation measures into local land-use planning (agglomerations) and in the installation of noise barriers (major roads).

22.7.4 Public consultations

Public consultation as part of the development of NAPs in Poland has taken a number of forms. This has included:

- Information about the draft NAP in the media as part of information and awareness-raising campaigns;
- Organising public meetings with citizens;
- Internet-based consultations;
- Organising educational projects regarding noise;
- Making sure information is clear and easy to understand;
- Organising an open appointment and public discussions about problems with urban noise; and
- Cooperation between competent authorities and NGOs.

In terms of feedback on consultations, it was noted by END stakeholders in Poland that internet-based consultations were not found to be an effective approach in obtaining useful feedback. However, feedback received at public meetings had been more useful.

[323] Source: NRAs' practice and experiences with preparation of noise action plans, CEDR, March 2013.

An example of the way in which public consultation has been carried out in Poland is now provided.

In Wielkopolska Voivodeship in Poland in the small city Powodowo based on the results presented in Strategic Noise Maps in R2, local citizens suggested that in one of the allotment areas (these areas are also protected from environmental noise in Poland), noise levels were predicted to exceed the national limit value due to traffic from national road number 32. Once attention had been drawn to this issue through a public consultation meeting under the END, the District Offices in Wolsztyn decided to perform an Environmental Review of this area. General Directorate of National Roads and Motorways in Poland carried out this work to check the results from noise measurement and new noise calculations presented in Noise Maps. The average values in exceedance of the limit were confirmed through this independent assessment to check the accuracy of the mapping results. Consequently, mitigation and noise reduction measures were built in to the NAP specifically to tackle this problem.

22.7.5 Implementation issues

Among the main issues raised in END implementation in R2 were that the noise action planning period of 12 months from the submission of SNM was viewed as being too short (in both Rounds 1 and 2). In addition, there were problems in financing NAPs and a lack of budget to implement measures (also R1 and R2). The heterogeneity of action planning approaches was also found to be a problem in R2, especially for major roads.

Particularly in R1, there was a lack of experience in noise action planning among public authorities. In R2, the position had improved, but some public authorities were involved in END implementation for the first time (due to the change to the definitive END thresholds).There were also coordination challenges, for instance in terms of the difficulties and problems in analysing all the strategic action plans for the national competent authority. In particular, the difficulty was that many NAPs were quite different in approach and methodology and in estimating costs. This meant that it was very difficult to assess the situation across Poland overall. This issue applied in both Round 1 and 2.

23. PORTUGAL

23.1 National implementing legislation for END

23.1.1 Legal implementation

In Portugal, the Environmental Noise Directive has been transposed at national level through the Decree-Law 146/2006, of 31st July 2006[324], relating to the preparation of SNMs, including data collection, the provision of information to the public, and the use of indicators and assessment methodology, and the preparation of NAPs.

Pre-existing noise legislation under Decree-Law 292/2000 of 14 November 2000 was then revoked and harmonised with Decree-Law 146/2006 under Decree-Law No. 9/2007[325] of January 17, as amended by Decree-Law 278/2007[326] of 1st August 2007, which provides for the General Noise Regulation (RGR) and establishes the legal basis for the prevention and control of noise pollution. It is worth noting that, before that, Portugal had a Noise Law since 1987 (approved by Decree Law 251/87) which included environmental noise together with acoustic building requirements.

Although this legislation applies to the whole country, in the case of the Azores, the Regional Legislative Decree 23/2010/A[327] separately transposed the END into the regional law.

23.1.2 Scope of END implementation – Rounds 1 & 2

R1 strategic noise mapping and noise action planning in Portugal was initially thought to cover two agglomerations: Lisbon and Porto. However, the population Porto dropped to just below 250,000 inhabitants and was therefore excluded from R1. The criteria adopted in Portugal to define a large agglomeration for the purpose of application of the END were: a) number of inhabitants, b) a population density of no less than 2,500 inhabitants/km2 and c) location within one jurisdiction.

With regard to transportation infrastructures, R1 covered one airport (Lisbon), 1,743 km of major roads outside the agglomerations and 115 km of major rail.

In R2, the scope of the Directive was extended to *five additional* agglomerations (Amadora, Matosinhos, Odivelas, Oeiras and Porto). There was also a major increase in the amount of strategic noise mapping required for major roads with additional 1,714 km of major roads and 392 km of additional major rail outside agglomerations to be mapped. An additional airport (Porto) has been added in R2.

[324] http://dre.pt/pdf1sdip/2006/07/14600/54335441.PDF

[325] http://www.dre.pt/pdf1sdip/2007/01/01200/03890398.PDF

[326] http://www.dre.pt/pdf1sdip/2007/08/14700/0491204913.PDF

[327] http://azores.gov.pt/NR/rdonlyres/258B9095-20B3-4728-A8EC-48F0FBC4E64A/423089/DecretoLegislativoRegionalN232010A1.doc

An overview of END coverage by Round is provided below:

Table 230 END coverage – Portugal

Round	Agglomerations	Major airports	Major rail	Major roads
1	1[328]	1[329]	115 km	1,743 km
2	6[330]	2[331]	507 km	3,457 km

23.2 Competent Authorities and designated administrative bodies

The Portuguese Environmental Agency[332] (APA) is responsible for reporting to the European Commission and ensuring that relevant strategic noise mapping and noise action planning timelines are met.

The authorities responsible for the SNMs and NAP development are:

- The municipalities of Lisbon, Porto, Amadora, Matosinhos, Odivelas and Oeiras for SNMs and NAPs for their agglomerations;
- EP-Portuguese Road Authority[333], for major roads;
- National Rail Authority (REFER E.P.) for major railways;
- ANA-Portuguese Airport Authority for major airports;
- Portuguese Environment Agency, responsible for approving SNMs and NAPs for major roads, railways and airports.

Table 231 Responsibility for SNMs and Noise action planning in Portugal

Role/Activity	Agglomerations	Roads	Railways	Airports
Preparing SNMs	Municipalities (i.e. local authorities)	EP-Portuguese Road Authority[334]	REFER - National Rail Authority	ANA-Portuguese Airport Authority,
Approving SNMs				
Preparing NAPs				

[328] Lisbon
[329] Lisbon Airport
[330] Lisbon
Porto
Amadora
Matosinhos
Odivelas
Oeiras
[331] Lisbon and Oporto Airports
[332] http://www.apambiente.pt
[333] Although EP is officially responsible for application of END for roads, in Portugal there are many roads that are consigned to private operators or to public-private partnerships and, in those cases, these entities are directly responsible to produce and deliver to EP the noise maps and action plans of the corresponding roads. EP is only directly responsible for the implementation of END in the case of national roads that are run directly by EP.
[334] EP and REFER went through a merging process during 2015, so there will be a unique national authority for both roads and rail which is called IP – Infrastructures of Portugal.

Role/Activity	Agglomerations	Roads	Railways	Airports
Approving NAPs				
EC/EEA reporting	APA - Portuguese Environment Agency			

23.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

23.3.1 Data collection

The CAs had difficulties providing data in time to meet the deadline for the designation of sites. For both Rounds, data was more readily available for the identification of major airports, agglomerations and railways, but only for some roads due to the need to compile traffic information for all relevant roads. In a number of cases, specific surveys were required to generate this data.

Cartographic data was generally available in a suitable form for the agglomerations, but for roads and rail specific cartography had to be produced by the responsible entity for the SNMs.

All processes have suffered significant delays, which is generally explained by the financial and economic crisis that has affected the country since 2009 and that forced the CAs to restrict their financial resources.

23.3.2 Implementation issues

A single issue was raised for both Rounds, a summary of which is shown below.

Table 232 Designation issues -

R1	R2
A lack of sufficient human and economic resources	A lack of sufficient human and economic resources

23.4 Noise limits and targets

Noise limit values in force in Portugal are set by Decree-Law No. 9/2007 of January 17, as amended by Decree-Law 278/2007 of 1st August 2007. These limits are shown in the table below.

Limit Values	L_{den}	L_{night}
Mixed zones**	65	55
Sensitive zones*	55	45
Sensitive zones in the vicinity of existing major roads, railways or airports	65	55
Sensitive zones in the vicinity of planned major airports	65	55
Sensitive zones in the vicinity of planned major roads or railways	60	50
Interim values (in force until zone classification is completed by the municipalities)	63	53

Table 233 Noise limit values in force in Portugal

**zones appropriated for housing, schools, hospitals, leisure activities and other community facilities mainly used for rest*

***zones where, along with the above mentioned land uses, there are other uses such as commercial and services facilities*

Noise limit values were already established at the national level before the Directive was adopted and L_{Aeq} (ISO 9613 indicator) for day and night periods were used as noise indicators. With the transposition of the Directive, the evening period and the indicator L_{den} was added, replacing the L_{day} indicator. For that purpose, Portugal established the same obligations as with L_{Aeq} indicators despite changing the measures. The WHO recommendations and health-based assessment were taken into account but were not strictly copied.

According to the APA, the limits will be enforced in the future. The Decree-Law No. 9/2007 classifies as "serious environmental offense" the responsibility for exceeding these noise limits. Sanctions can go up to € 34,000, in case of negligence, and up to € 48,000 in case of wilful action, according to what is established in the Law Framework of Environmental Offenses (Law 50/2006, amended by Law 89/2009). After being notified, the person or legal entity, has 15 days to reply. Deadlines for reducing the noise are set on a case by case basis and can be agreed flexibly depending on the complexity of the situation.

23.5 Quiet areas

23.5.1 Overview

A common methodology was established at national level, with definitions of quiet areas established under Decree-Law 146/2006:

- A quiet area in an agglomeration is an area defined by the city council, proposals and plans under municipal planning exposed to a value of L_{den} less than 55 dB (A) and L_n equal to or less than 45 dB (A) from all noise sources – to be revised every 10 years
- A quiet area in open country is an area defined by the city council, proposals and plans under municipal planning that is not disturbed by noise emissions from traffic, industry, trade, services or recreational activities.

L_{den} and L_{night} were used for the delimitation of quiet areas within and outside agglomerations. A supplementary indicator for the definition of quiet areas outside agglomerations was that they should be residential areas without any industry or major commercial areas, such as large shopping centres.

In practice quiet areas coincide with the classification of Sensitive zones defined in Decree-Law 9/2007 and its delimitation is a responsibility of the municipalities, that must define them in their municipal land use plans, but only when new plans or revision of existing plans occur. Due to this legal framework, and since most of the municipalities have been taking a long time to revise existing land use plans and very few new plans have been launched in the last years, the delimitation of quiet areas has been a very slow process in Portugal, which almost had no impact on the development of SNMs and on the NAPs.

23.6 Strategic noise mapping

23.6.1 Overview

An overview of the number of SNMs produced in Rounds 1 and 2 is shown below.

Table 234 SNMs - Portugal

	R1	R2
Agglomerations	1	2 (6)
Major airports	1	2 (2)
Major railways	6	6 (13) (507 km)
Major roads	58	69 (130) (3,457 km)

**Note – in some countries, SNMs may be available in draft and have been submitted to the EC and the EEA but still not formally adopted by the responsible political decision maker. As such, some R2 NAPs may still not be adopted or published in-country.*

Note: in brackets are the numbers of SNM of R2. Example: number or major roads with 3 to 6 million vehicle passages/year.

Sources: APA and DataFlow2 from REPORTNET

It is worth noting that SNMs have been produced for municipalities and transportation infrastructures since at least 2000, due to the requirement of Decree-Law 29/2000 of 14 November 2000 which obliged every municipality to produce a SNM of the entire area of the municipality. Over 80% of the 308 Portuguese municipalities have produced their SNM according to the 2000 regulation and most of them have already adapted these SNMs to the Decree-Law 9/2007 requirements, according to the END indicators L_{den} and L_n. The requirements for these SNMs, however, are less complex than those defined in the END, as they consist basically on the coloured maps which are to be included in municipal GIS systems for planning purposes, not including normally data on the number of exposed population.

23.6.2 Data collection

In R1, the methods laid down in the END were followed, except for railways data where, in some cases, it was found to be more appropriate to use the Schall03 method rather than the SRMII method.

The limited availability of national data on population by dwelling, with information only available on city apartment blocks, made estimations necessary. In some cases, there was no data on building heights either, requiring experts to actually measure the houses. Finally, measurements to estimate noise emissions from industrial sites had to be done in the field as well as there was no previous data. The EEA 2007 Good Practice Guide was used.

23.6.3 Strategic noise mapping methods

Portugal has developed national guidelines for strategic noise mapping at the national level, available here: http://www.apambiente.pt/index.php?ref=16&subref=86&sub2ref=532

The calculation methods are those defined in the END, although for railways alternative methods can and have be used, such as Schall03, as long as evidence is made of its equivalence to the reference method SRMII.

APA guidelines recommend that the SNMs should be validated by means of continuous noise monitoring for at least 48 h, at some points strategically chosen.

23.6.4 Public accessibility of SNMs

SNMs are available to the public through the Environmental Protection Agency's website, as shown in the table below.

Table 235 Strategic noise mapping locations - Portugal

	SNM location
Agglomerations	http://www.apambiente.pt/_zdata/DAR/Ruido/SituacaoNacional/MapasAglomeracoes/Mapas%20estratgicos%20de%20rudo%20e%20populao%20exposta%20em%20aglomeraes_jan2015.pdf
Roads	http://www.apambiente.pt/_zdata/DAR/Ruido/SituacaoNacional/Mapas%20GITs%20Rodoviario/MER%20GITs%20Rodo%20versao%20Jan2015.pdf
Railways	http://www.apambiente.pt/_zdata/DAR/Ruido/SituacaoNacional/Mapas_GITs_Ferroviario/Mapas_GITs_Ferroviario_JANEIRO2013FINAL.pdf
Airports	http://www.apambiente.pt/_zdata/DAR/Ruido/SituacaoNacional/Mapas_GITs_Aereo/Portal_GITa_rev2.pdf

23.6.5 Implementation issues

A number of issues were raised as a result of R1, a summary of which is shown below, together with actions taken to address them, and any new issues raised during R2.

Table 236 Strategic noise mapping issues - Portugal

R1	R2
Inadequate and overly complicated EC guidance for estimating exposed population	This issue has been partially solved with availability of the new population Census dated 2011
Simple EU-wide methodology is necessary	Not an issue anymore
The need to validate noise levels in the field for one year. Assessments were made over a week or a day and the results were then modelled as long-term assessments	This is still an issue which delays and rises the cost of SNM production, especially if a large number of points is required to validate the SNM.
Making realistic simulations 4 metres above ground	Not an issue anymore
-	The economic and financial crises of the country imposed severe budget reductions which delayed the development of the SNMs.

23.7 Noise action planning

23.7.1 Overview

Table 237 number of NAPs (NAP)

	R1	R2
Agglomerations	0	1 (6)
Major airports	0	2 (2)
Major railways	0	0 (13)
Major roads	1	4 (130)

**Note – in some countries, NAPs may be available in draft and have been submitted to the EC and the EEA but still not formally adopted by the responsible political decision maker. As such, some R2 NAPs may still not be adopted or published in-country.*

Note: in brackets are the numbers of NAP of R2. Example: number of major railways with 30 000 to 60 000 train passages/year.

23.7.2 Methodologies for noise action planning

National guidance is provided on the development of noise reduction plans by municipalities, see:

http://www.apambiente.pt/_zdata/DAR/Ruido/NotasTecnicas_EstudosReferencia/PMRR.pdf

The 2006 SNMs were used to developing NAPs in 2008.

Noise reduction plans have been mandatory for municipalities since 2000 and land use planning has been including SNMs ever since.

23.7.3 Measures

The exceedance of noise limit values was generally used as a priority-setting criterion for the NAP.

NAP noise abatement actions are normally proposed so that all over-exposed dwellings in SNMs are protected by noise reduction measures. In practice there are situations where it is not feasible to reduce noise at all sensitive buildings to stay below the limits and, therefore some cost-benefit analysis has been used in those cases to establish priorities and find reasonable solutions.

Typical proposed measures for road traffic noise have been the construction of noise barriers, change of road surface to more silent pavements, reduction of speed limits and façade insulation reinforcement.

23.7.4 Public consultations

Requirements for public participation are set under Decree-Law 146/2006. The authority responsible for the development and review of plans of action is responsible for carrying out public consultation and deciding on procedures.

Depending on the plan's nature and complexity, the authority may decide upon the length of the consultation period, with the minimum set at 30 days. Consultation opens with a public notice, to include the consultation schedule, sources for relevant documentation and how to participate. The draft plan must be made public together with a summary. Following closure of the consultation period, the responsible authority must review the plan and prepare the final version, taking into account the results of public participation.

23.7.5 Implementation issues

A number of issues were raised as a result of R1, a summary of which is shown below, together with actions taken to address them. Due to the delays in R2 SNMs and NAPs, no new issues have been yet found.

Table 238 Noise action planning issues - Portugal

R1	R2
Problems setting up mitigation measures where noise comes from different sources (for instance from industrial sites and transports, etc.) and responsibility falls with different authorities	Still remains an issue
The period between SNM and NAP drafting	Still remains an issue
Noise abatement measures were not high priority given the economic crisis, limiting access to funds	Still remains an issue
Lack of coordination between different entities when implementing NAPs: For example, authorities in charge of roads crossing agglomerations fail to cooperate with municipalities which, according to Portuguese Noise Law, and independently from the END, must produce their own noise maps and municipal plans for noise reduction. The lack of cooperation can be explained by delays in the production of noise reduction plans by municipalities as well as lack of willingness amongst all authorities concerned to engage with each other.	Still remains an issue
Lack of clarity on the expected outcome of a NAP: Some stakeholders are of the opinion that a NAP for a motorway, for example, should detail all possible noise reduction measures, such as noise barriers and silent asphalts, to fully comply with noise limits stated in the Noise Law, irrespective of the cost. Concessionaries, on the other hand, propose taking cost into consideration, causing delays in the agreement on the actual content of NAPs.	Still remains an issue
The fact that most municipalities have not yet set their delimitation of mixed and sensitive zones, makes it unclear what noise limits should be applied, also contributing to a delay in the production of NAPs.	Still remains an issue
	The major issue delaying the implementation of the NAPs consists of significant cuts in public and private budgets, especially since the financial crisis in 2011, in the framework of the financial bailout of Portugal.

24. ROMANIA

24.1 National implementing legislation for END

24.1.1 Legal implementation

The END was transposed into Romanian legislation[335] by Government Decision (GD) no. 321/2005 (Official Journal No. 358/27.04.2005)[336]. In addition, some Orders of the Ministry (OM) provide clarification on further technical details related to noise indicators, strategic noise mapping, noise action planning, and the evaluation of SNMs and NAPs, as follows[337]:

- OM MMSC/MS no. 1311/861 of 2013 (Official Journal no. 471/30.07.2013)[338] regarding the analysis of the NAPs;
- OM MMGA/MTCT/MS/MAI no. 678/1344/915/1397 of 2006 (Official Journal no. 730/25.08.2006) [339] regarding the interim methods of calculation of the noise indicators;
- OM MMDD no. 1830/2007 (Official Journal no. 864/18.12.2007)[340] regarding the guidelines for developing, analysing and evaluating the SNM;
- OM MMDP/MSP no. 152/558/1119/532/2008 (Official Journal no. 531/15.07.2008)[341] regarding the noise limit values; and
- OM MT no. 266/2013 (Official Journal no. 198/08.04.2013) [342] regarding responsible units for the Strategic noise mapping.

[335] Available in Romanian on http://www.mmediu.ro/beta/domenii/protectia-atmosferei/zgomot-ambiant/legislatie-zgomot-ambiant-legislatie-nationala/

[336] Amended by the GD no. 674/2007 (Official Journal No. 485/19.07.2007) and by GD no. 1260/2012 (Official Journal no. 15/19.01.2013)

[337] Available in Romanian from http://www.mmediu.ro/beta/wp-content/uploads/2013/08/2013-08-13_Zgomot.pdf

[338] Order of the Ministry of Environment, Waters and Woods and Climate Change and of the Ministry of Health regarding the establishing of the committees for verification of the criteria used in developing and analysis of the action plans, as well for approving the composition, organizational rules and operation thereof

[339] Order of the Ministry of Environment, Waters and Woods and Waters Management, Ministry of Transport, Building and Tourism, Ministry of Public Health, Ministry of Administrative and Internal Affairs for the approval of the Guide regarding the interim methods of calculation of the noise indicators for the noise generated by the activities from industrial activities, road traffic, rail traffic and air noise from airports

[340] Order of the Ministry for approval of the Guide for developing, analysing and evaluating the strategic noise map

[341] Order of the Ministry of Environment, Waters and Woods and Sustainable Development, Ministry of Transport, Ministry of Public Health, Ministry of Internal Affairs and Administrative Reform for the approval of the Guide regarding the adoption of limit values and of the method to apply them when developing action plans for indicators L_{den} and L_{night}, when the noise produced by road traffic on the main roads and inside city agglomerations, rail traffic on the main railways and inside city agglomerations, air traffic at large airports and / or urban airports and for noise generated inside the areas where industrial activity in conducted listed in Annex. 1 to Government Emergency Ordinance no. 152/2005 concerning integrated control and prevention of pollution, approved with amendments by Law no. 84/2006

[342] Order of the Ministry of Transport regarding modification of Art. 1 of the OM no. 1258/2005 for establishing of the responsible units for the noise mapping for railroad, roads, harbours inside city agglomerations and airports, under their administration, for developing the strategic noise maps and for related action plans, in its domain of activity

24.1.2 Scope of END implementation – Rounds 1 & 2

R1[343] of strategic noise mapping and noise action planning in Romania included 9 agglomerations, 5 airports, 3 harbours, approximately 268 km of major roads and 70 km of major railways (2 sections: Bucuresti Nord - Chitila and Saligny Palas and 3 railway stations: Arad, Ploiesti Sud and Simeria Calatori). The introduction of definitive thresholds in R2 led to 10 *additional* agglomerations, 3 Harbours, 3258 km of roads and approximately 51 km of major railway lines (included 1 section Bucuresti Nord - Chitila)[344]. The Ministry of the Environment, Waters and Forests based on the data provided by the Romanian National Railway Company "CFR" has informed the agglomeration authority where the traffic is more than 30000 vehicles per year to make separate SNMs in accordance with Art. 4 alin (2) of GD 321/2005 as amended by GD no. 1260/2012.

Table 239 END coverage – Romania

Round	Agglomerations	Major airports	Major rail (km)	Major roads (km)	Industry source (Harbour)
1*	9	1	68	268	2
2**	19	1	119	3270	3

*Source: *GD 321/2005 amend it by GD no. 674/2007 **GD 321/2005 as amended by GD no. 1260/2012*

24.2 Competent Authorities and designated administrative bodies

Institutional responsibilities for END implementation are clearly defined in GD 321/2005, which was amended by GD 1260/2012. However, in reviewing the division of different administrative responsibilities across different institutions, the Competent Authority stated that it is also necessary to take into consideration all the requirements of GD 321/2005.

The Ministry of the Environment is responsible for reporting data related to SNMs and NAPs to the European Commission/ EEA and are active in the development of legislation on noise. The collection of END data is under the responsibility of the EPA and NEPA. An overview of the division of the different administrative responsibilities in Romania is now provided.

[343] available in Romanian http://www.romanian-ports.ro/legimediu/HG674_2007.pdf

[344] available in Romanian http://www.legex.ro/Hotararea-1260-2012-124698.aspx

Table 240 Administrative Responsibility for the END in Romania

Role	Agglomerations	Roads	Railways	Airports	Industry source (Harbour)
Preparing SNMs	Municipalities	National Company of Motorways and National Roads for motorways international and national roads, County or City Councils for county roads	Romanian National Railway Company and Municipalities for railways inside agglomerations	Company which administrate the main airport or the city airport	Company which administrates the Harbours
Collecting SNMs	Commission of Local Environmental Protection Agencies	Commission of National Environmental Protection Agency* for motorways international and national roads, or Commission of Local Environmental Protection Agencies County Councils for County Roads	Commission of National Environmental Protection Agency* for major railway Bucuresti-Brazi and Commission of Local Environmental Protection Agencies for railways which are inside agglomerations	Commission of National Environmental Protection Agency* for main airport and Commission of Local Environmental Protection Agencies for city airports	Commission of Local Environmental Protection Agencies
Approving SNMs	City Councils	Ministry of Transport for motorways, international and national roads and County Councils for County Roads	Ministry of Transport for major railway Bucuresti-Brazi and City Hall railways inside agglomerations	Ministry of Transport for the one major airport within scope For aircraft noise within agglomeration-s, Henri Coanda and for Aurel Vlaicu City Airport and City Councils or County Councils for city airports.	City Councils for other industry source and Ministry of Transport for Harbours
Preparing NAPs	Municipalities	National Company of Motorways and National Roads for motorways international and national roads, County or City Councils for county roads	Romanian National Railway Company for major railway Bucuresti-Brazi and City Hall for railways inside agglomerations	Company which administrate the main airport or the city airport	Company which administrates the Harbours

Role	Agglomerations	Roads	Railways	Airports	Industry source (Harbour)
Initial approval of the NAPs	City Councils	Ministry of Transport or County or County Councils	Ministry of Transport or County Councils	Ministry of Transport or County Councils	Ministry of Transport for Harbours and City Councils for other Industry source
Collecting NAPs	Commission of Local Environmental Protection Agencies***	Commission of National Environmental Protection Agency** for motorways international and national roads, or Commission of Local Environmental Protection Agencies ***	Commission of National Environmental Protection Agency**	Commission of National Environmental Protection Agency** for main airport and Commission of Local Environmental Protection Agencies*** for city airports	Commission of Local Environmental Protection Agencies***
Collecting NAPs	National Environmental Protection Agency				
European Commission/ EEA reporting	Ministry of Environment, Waters and Woods				

**The Commission is made up of members of: Local Environmental Protection Agencies and Ministry of Environment, Waters and Woods*

***The Commission is made up of members of members of: National Environmental Protection Agencies, Ministry of Environment, Waters and Woods and Health Ministry*

**** The Commission is formed by members of: the Environmental Protection Agencies and Health Local Agency*

24.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

24.3.1 Data collection

Government Decision (GD) no. 321/2005 (Official Journal No. 358/27.04.2005)[345] transposes the END's definitions of agglomerations, major roads, major railways and major airports. The borders of agglomerations are not defined but are usually the administrative borders of cities with more than 100,000 inhabitants. The number of inhabitants for each city is publicly available from the website of the National Institute for Statistics[346]. The agglomerations are identified in Annex 8 of the GD no. 321/2005 with further amendments and additions.

Data to delimit major roads, major railways and major airports are available from the National Company of Motorways and National Roads, National Railway Company "CFR" and Romanian Air Traffic Services Administration (governmental institutions under the Ministry of Transport of Romania) respectively.

24.3.2 Implementation issues

A number of issues were raised as a result of R1, a summary of which is shown below, together with actions taken to address them, and any new issues raised during R2.

Table 241 Designation issues - Romania

R1	R2
Inconsistent data quality used by City Halls	Inconsistent data quality used by City Halls remains a problem and some cities did not provide the data necessary to facilitate strategic noise mapping, especially in respect of GIS data. Also, because in some cases strategic noise mapping began with a delay of between 3 and 4 years, this made the collection of data relevant to designation more difficult. One consequence of this is that the NAPs developed to mitigate noise cannot applied in time, or need to be updated in the next round of action planning.
Airport - definition: Directive 2002/49/EC of "major airport"/ Directive 2002/30/CE "city airport"	This issue has been resolved in GD 321/2005 by designating one major airport and then determining which other airports fall under the requirements to map the effects of aircraft noise within agglomerations. In particular, 4 city airports were designated for R1 and 9 city airports in R2. Also, after the revision of GD 321/2005 in 2016, the results of noise mapping for some city airports (those located near agglomerations and not inside agglomerations) will also be taken into consideration. Currently, these do not contribute to population exposure to noise inside the agglomeration and for this reason do not formally have to be mapped. In future, those located near agglomerations will also be mapped in order to help update the mapping of aircraft noise within agglomerations.
Lack of budget	The lack of specific budget remains a problem for local authorities. As a result, in some cases, this has resulted in a 3 or 4-year delay in developing SNMs and NAPs. The process for budget allocation for strategic noise mapping and noise action planning is too lengthy.
	The process of legal approval takes too much time. The most recent amendment to GD 321/2005 was made in 2013 when the GD 1260/2012 has been published in the Official Journal no. 15/19.01.2013 to define major roads, major railway and major

[345] Amended by the GD no. 674/2007 (Official Journal No. 485/19.07.2007) and by GD no. 1260/2012 (Official Journal no. 15/19.01.2013)

[346] http://www.recensamantromania.ro/rezultate-2/

R1	R2
	airports. One of the source for this delay was the need to wait for the results of the 2011 Population Census to become available (but not the final results, only the interim results was available to use when GD 321/2005 was amended). Based on this the number of towns which have to carry out Strategic noise mapping has been reduced from 24 to 19. Also the final results for 2011 Census data was available in July 2013, and when MEWF amended the data again this year the GD 321/2005, the final results of the 2011 Census will be taken into consideration.

24.4 Noise limits and targets

24.4.1 Objectives and scope

Noise limit values have been set at national level in Romania as follows:

- Day (07.00-19.00), evening (19.00-23.00) and night (23.00-07.00)
- L_{night} and L_{den} are used for the evaluation of Strategic noise mapping results. Table 242 – Noise limit values – Romania

However, according to OM MMDP/MSP no. 152/558/1119/532/2008, these limit values are in fact threshold values. In NAPs, threshold values are used. In this document, a national standard STAS 10009 is mentioned and reference is also made to a Health Ministry Order 119/2014 regarding 55 dB limit values for sanitary protect areas. These limit values are compared with the values of the noise to be measured.

Table 242 Limit values (threshold values) in Romania

L_{den}-dB(A)			L_{night}-dB(A)		
Noise sources	Target values for limit values for 2012	Limit values allowed According to OM MMDP/MSP no. 152/558/1119/532/2008, these limit values are in fact threshold values)	Noise sources	Target values for limit values for 2012	Limit values allowed According to OM MMDP/MSP no. 152/558/1119/532/2008, these limit values are in fact threshold values)
	NOT used as a limit in R2	used as limit in R1 and R2		NOT used as limit in R2	used as a limit in R1 and R2
Roads	65	70	Roads	50	60
Railroad	65	70	Railroad	50	60
Airports	65	70	Airports	65	60
Industrial sites	60	65	Industrial sites	50	55
Harbours (activities for transport on road or railroad inside the Harbour)	65	70	Harbour s (activities for transport on road or railroad inside the Harbour)	50	60
Harbours (industrial activities inside the Harbour)	60	**65**	Harbour s (industrial activities inside the Harbour)	50	**55**

Note – the above values are used as threshold values for the purpose of identifying measures in NAPs.

24.4.2 Enforcement and mitigation measures

In accordance with Annex 5 of the GD 321/2005 with amendments and additions, one of the minimal requirements for a SNM is to represent in a graphical way the areas where the noise level exceeds the limit value. According to Art.1 (c) of the GD 321/2005 and with Art.7 (2) of the OM MMDP/MSP no. 152/558/1119/532/2008 when limit values are exceeded in a certain area, then NAP activities must be taken to reduce noise levels.

24.4.3 Methods for establishing noise limit values

In accordance with OM MMDP/MSP no. 152/558/1119/532/2008 the limit values for L_{den} and L_{night} are computed at the most exposed façade of the buildings.

24.4.4 Implementation issues

In Annex 4 of the recently amended GD 321/2005 additional information is included, such as some guidelines for the harmful evaluation of noise, reflecting the fact that it is mandatory to evaluate noise effects using the dose-effect relationship introduced in Annex 3 of Directive 2002 /49/CE. This must take into account the relationship between noise disturbance and L_{den} (generated by traffic or industrial activities) and sleep disturbance and L_{night} (generated by traffic or industrial activities). If it is necessary, some specific relationships can be analysed regarding: building with special noise isolation, buildings with quiet façades, vulnerable groups, industrial noise with important tonal components, impulsive industrial noise or other cases, climatic regimes or different cultural environments. However, the dose-effect relationship has not been introduced yet. Annex 3 of END has not been modified yet in order to establish the dose-effect relationship.)

Although no issues were raised as a result of END implementation in R1 in the Milieu report, a small number of issues were identified through the field research. Issues raised in R1 and 2, together with actions taken to address them are shown in Table 5 below.

Table 243 Noise limits and targets - Romania

Issue	Action
• There are differences between noise limit values used in mapping and measurements. Some interviewees found the use of a combination of limit values and threshold values confusing but the Romanian CA clarified that these are used for different purposes. The noise limits used for noise mapping are threshold values rather than limit values. For NAPs, threshold values are used to help identify measures to reduce noise. • Noise limit values used in mapping were established through Ministerial Order ("MO") MMDP/MSP no. 152/558/1119/532/2008. The previous limit values were set out in Ministerial Order no. 536/1997, which formerly applied in R1[347]. The new applicable limit values were changed in 2014 to 55 dB in the new Health Ministry Order 119/2014, but this is applicable only for sanitary protected areas. • Noise limit values for <u>new</u> roads, railways, airports, industrial areas	No need to take any action[348].

[347] Within protected territories, according to the 1997 MO, continuous equivalent acoustic level (Leq) measured at 3m from the outside wall of the dwelling and at 1.5m height from the ground, cannot exceed 50 dB(A) during day time, and 40 dB(A) during night time.

[348] The competent authority commented that "the noise limit used in noise mapping are in fact threshold values and in measuring is used limit values and we cannot make a comparison between them".

Issue	Action
and buildings (but not for existing infrastructure). According to the national standard STAS 10009-88 "Acoustics in constructions – Admissible limits of noise level", the admissible limits of external noise levels are based on the technical categorisation of streets (traffic intensity) for roads, and based on an assessment of noise emissions in urban areas from railways, airports and industrial sites. It should be noted that this does not apply to existing infrastructure, where threshold values apply. Rather, these limit values are for new roads, railways, airports, industrial areas and buildings. Not for the existing situation. The issues above were applicable in both R1 and R2.	

24.5 Quiet areas

24.5.1 Overview

The END definitions of "quiet area in an agglomeration" and of a "quiet area in open country" were transposed into national legislation by the GD 321/2005 with amendments and additions in Art.2. In Art. 4 (16) it is specified that local authorities together with Local Environmental Agencies can establish quiet areas inside agglomerations in a city setting after strategic noise mapping has been carried out. The table below summarises the number and size of quiet areas established during R1 and R2.

Table 244 Quiet areas – Romania

	R1	R2
Number	Usually the quiet area are the parks and is not given any data regarding their size. Quiet areas can be defined using the threshold values 55 dB for L_{den} and the minimum size 4.5 ha (but not parks)	Strategic noise mapping and noise action planning is not finished yet for all agglomeration and major roads and major railways. But in R2, parks are again designated as quiet areas. Quiet areas can be defined using the threshold values 55 dB for L_{den} and the minimum size 4.5 ha (but not parks)
Size (km^2)		

Delimitation

The GD 321/2005 with amendments and additions leaves the determination of quiet areas under NAP development to the discretion of individual CAs.

Agglomerations

Within agglomerations, L_{den} was used by all national and local authorities for the establishment of quiet areas. Non-acoustic criteria were also used, for areas which are not parks, such as the "minimum 'area of silence' filter", which specifies that only a 4.5 hectares' territory that falls below a <55 dB noise band may be identified as a quiet area (or area of silence) in accordance with OM MMDP/MSP no. 152/558/1119/532/2008.

Open country

Quiet areas in open country are defined as areas not exposed to noise generated by traffic, industry or other activities. It is not clear yet whether these criteria are sufficient to identify quiet areas in open country in practice.

24.5.2 Implementation issues

Difficulties in designating and delimiting quiet areas were not reported.

24.6 Strategic noise mapping

24.6.1 Overview

An overview of SNMs produced in R1 and R2 is shown below.

Table 245 SNMs – Romania

	R1	R2
Agglomerations	9	19
Major airports	1	1
Major railways*	5 (68 km)	18 (119 km)**
Major roads ***	30 (2412 km)	270 (3,270 Km)

** In respect of major railways, there has been an increase in the volume of mapping in Km.*

*** 1 major railway (51.457 Km) + 17 major railways inside agglomerations (67.826 Km)*

**** For 30 road sections noise mapping was produced of 241.717 Km in R1. In R2, across 270 road sections, noise mapping was carried out for a length of 3270.133 Km.*

24.6.2 Data collection

The data collection approach is based on the tools provided in OM MMGA/MTCT/MS/MAI no. 678/1344/915/1397 of 2006 (Official Journal no. 730/25.08.2006). Strategic noise mapping methodologies are set out in GD 321/2005 with amendments and additions and detailed in OM MMDD no. 1830/2007 - Order of the Ministry, for approval of the Guide for developing, analysing and evaluating the SNM.

Table 246 Strategic noise mapping methods used in R1 and 2 - Romania

Noise source/type	Method
Road	French NMPB Routes-96
Railway	Dutch SRM II - 1996
Aircraft	international ECAC.CEAC Doc. 29
Industrial	ISO 9613-2

Obtaining data for strategic noise mapping is the responsibility of local authorities (i.e. city halls) for agglomerations, CNADNR (Romanian National Company of Motorways and National Roads), the National Railway Company for main railway Bucharest-Brazi, and the company which administrate the airports and harbours for airports and harbours.

The Romanian authorities have data for the geographical position of houses, but not in GIS format (usually on paper maps). The interviewees reported that in R1, a lot of time was required to create the GIS database and to develop the noise mapping model by consultants. Population census data for each agglomeration was provided by the National Institute of Statistics, but no data was available on buildings' population, which has to be collected by consultants.

Regarding road traffic, some municipalities were able to use data from previous road studies, whereas others did not have any such data and had to initiate data collection in accordance with OM MMGA/MTCT/MS/MAI no. 678/1344/915/1397 of 2006.For IPPC industries, data was provided by local environment agencies and data collection is carried out by consultants in accordance with OM MMGA/MTCT/MS/MAI no. 678/1344/915/1397 of 2006. In R1, collating data from different authorities was a time-consuming process for the Ministry. Many national and local authorities reported problems with accessing certain data types, especially estimating the number of dwellings. However, in R2, the competent authority reported strengthened data availability.

24.6.3 Public accessibility of SNMs

Noise maps, where completed, have been made publicly available for download in Romania. These appear to be accessible to the public and can easily be downloaded. There is clear information available about the contours covered and population exposure data[349].

R1 strategic noise mapping data is available online. NAP summaries for the municipalities R1 have also been made available online. For major airport, R1 and R2 SNMs[350] and the NAPs for R2 are already available online[351]. It should be noted that the SNMs, NAPs and web references provided in footnotes are to documents that are available in **Romanian only**.

Strategic noise mapping data and the NAPs for **agglomerations** above 100,000 inhabitants in R2 are available as follows: Bucuresti (only SNMs) [352], Iasi[353],Cluj-Napoca[354] and Timisoara[355], Craiova [356](SNMs) and [357](NAPs), Galati[358], Brasov [359], Ploiesti Agglomeration (Ploiesti, Blejoi, Brazi and Barcanesti) [360], Pitesti[361] (SNMs) and [362](NAPs), Oradea [363](SNMs in format jpg), [364] (SNMs online) and [365] (NAPs), Targu Mures[366], Sibiu [367](SNMs) and [368](NAPs), Arad [369], Baia Mare [370].

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349 See http://www.bucharestairports.ro/files/pages_files/Harti_Strategice_de_Zgomot_Aeroportuar_AIHCB_2008.pdf

350 http://www.bucharestairports.ro/cnab/ro/despre-noi/protectia-mediului/harti-strategice-de-zgomot-aeroportuar

351 http://www.bucharestairports.ro/cnab/ro/despre-noi/protectia-mediului/plan-de-actiune-pentru-reducerea-zgomotului-aeroportuar-ambiental

352 http://hartiacusticebucuresti.ro/

353 http://www.primaria-iasi.ro/content.aspx?item=1856

354 http://www.primariaclujnapoca.ro/informatii-publice/harta-de-zgomot.html

355 http://www.opiniatimisoarei.ro/wp-content/uploads/2014/06/Planuri_de_actine_2013-harta-zgomot.pdf and the NAP http://www.primariatm.ro/uploads/files/harta_zgomot_2013/raport%20Timisoara.pdf

356 http://www.primariacraiova.ro/ro/harta-de-zgomot-a-municipiului

357 http://www.primariacraiova.ro/ro/2014-2/planuri-de-actiune-privind-diminuarea-zgomotului-ambiant-1.html

358 http://www.primaria.galati.ro/portal/pagini.php?page_id=52

359 http://www.brasovcity.ro/documente/public/Zgomot/PA%20Brasov%20dezbatere.pdf

360 http://rasp.ro/index.php/biroul-protectia-mediului/516-harti-de-zgomot

361 http://www.primariapitesti.ro/portal/arges/pitesti/portal.nsf/AllByUNID/00026DA2?OpenDocument

362 http://www.primariapitesti.ro/portal/arges/pitesti/stiri.nsf/cffb33e653f116e8c22572a4004bb1c2/d0b7fa7664221365c2257a8300265f8b?OpenDocument

363 http://www.oradea.ro/subpagina/harta-de-zgomot-a-municipiului-oradea

364 http://harta.oradea.ro/hartaoradea/#sthash.Q5nGZ2hQ.dpuf

The following cities are still developing SNMs and NAPs: Botosani, Constanta and Bacau[371] (Braila and Buzau made SNMs and NAPs) In terms of the timing, for Botosani, Constanta and Bacau, Romania will report SNMs before September 2016. All agglomeration have produced NAPs with the exception of Bucharest, Botosani, Constanta and Bacau. However, not all of the NAPs have yet been submitted to the EC, the work is "in progress".

Strategic noise maps and population exposure data and the NAPs for **airports** in R1 are available in the SNMs and NAPs of the agglomerations and in R2 the following airports are assessed separately: International Airport Bucuresti Băneasa - Aurel Vlaicu[372], International Airport Iasi [373], International Airport Cluj-Napoca[374], International Airport Craiova, the Strategic noise mapping and the NAPs are available in the Craiova town SNMs and the NAPs, International Airport Sibiu[375], International Airport Transilvania Târgu Mureş[376] (SNMs), the NAPs are not available, International Airport Baia Mare, International Airport „George Enescu" Bacău[377]. SNMs and NAPs were prepared for sections of major roads and for major railways inside and outside of agglomerations.

Major road SNMs and NAPs for R1[378] and for R2[379] are available online.

Also the **major railways** which are inside agglomerations are available for the agglomerations which finished the SNMs and all have been submitted to the EC by the Ministry of Environment.

For R2, the SNMs and NAPs for sections of major roads have been finished by the National Company of Motorways and National Roads for national roads and motorways, and the reports have been sent to the EC (for SNMs) and for NAPs the work is in progress. Was need to correlate to the data from different strategic noise mapping sources in order to finalise these reports.

There have also been delays in the development and submission of SNMs and NAPs for R2, since the sections for major roads are still being developed by the National Company of Motorways and National Roads for national roads and motorways. The most recently available reports (SNMs) for all major roads were sent to the EU in February and March 2016. SNMs and NAPs for major railways are available online for

[365] http://www.oradea.ro/subpagina/plan-de-actiune-pentru-reducerea-zgomotului

[366] http://www.tirgumures.ro/index.php?option=com_content&view=article&id=3233&Itemid=207&lang=ro

[367] http://www.sibiu.ro/ro2/pdf/2014/harta_zgomot_sibiu.pdf

[368] http://www.sibiuairport.ro/uploads/public-information/Proiect%20Plan%20de%20Actiune%20Aeroport%20Sibiu.pdf

[369] http://www.primariaarad.ro/info.php?page=hartizgomot.html&newlang=ron&theme=th1-ron

[370] http://www.baiamare.ro/ro/Administratie/Administratia-Publica-Locala/Structura-administratiei/Serviciul-Dezvoltare-Urbana/Compartiment-Dezvoltare-Durabila/

[371] http://www.primariabuzau.ro/index.php?loc=municipiul_bz&id=366&show=1

[372] http://www.bucharestairports.ro/baneasa/ro/informatii-aeroport/restrictii-de-zgomot/harti-strategice-de-zgomot-2011

[373] http://www.aeroport.ro/index.php/ro/plecari/articol/harta-zgomot.html

[374] http://airportcluj.ro/calitate-si-mediu/harti-strategice-de-zgomot-aeroportuar-1

[375] http://www.sibiuairport.ro/dezbatere-publica.html

[376] http://www.targumuresairport.ro/informatii_tehnice.php

[377] http://www.bacauairport.ro/mediu/

[378] http://www.cestrin.ro:8080/harti_zgomot/Default.html according http://noise.eionet.europa.eu/RO.pdf

[379] http://213.177.10.50:5555/zgomotrutier/harti2007.htm

R1 [380] and for R2[381].

The strategic noise mapping data and the NAPs for Harbours in R2 are available as follows: Harbour Constanta Strategic noise mapping and NAPs are still under development, Harbour Galati[382], Harbour Braila for both SNMs [383] and NAPs [384].

The overall picture in Romania is that some completed NAPs have been submitted to the EC, but not all. All reports regarding SNMs was sent with the exception of Constanta (including for harbour), Bacau and Botosani agglomerations. Data regarding SNMs for the Constanta harbour (which is finalised) cannot be sent to EC until the SNMs for industrial source in Constanta agglomeration is also completed, because the harbour noise is also part of the industrial noise from Constanta agglomeration. In other words, there are knock-on delays from particular SNMs not being finalised on time.

24.6.4 Implementation issues

A number of issues were raised as a result of R1, a summary of which is shown below, together with actions taken to address them, and any new issues raised during R2.

Table 247 Strategic noise mapping issues - Romania

R1	R2
Lack of experience	Collection of geospatial data and residential data
Lack of (timely) funding for noise mapping	The default rail and road noise emission data used for Strategic noise mapping has some inaccuracies in the calculation of results, so in some cases SNMs had to be corrected to be more comparable with the results of long-term noise measurements.
	Some SNMs were completed after the deadline or are still in development
	At national level, there is strengthened capacity among consultancies to produce SNMs compared with R1. Also, there remains a lack of local Strategic noise mapping and Noise action planning specialists in some municipalities.
	Not all NAPs which have been completed have yet been reported to the EC. In March 2016 all data regarding SNMs (which have been completed, with the exception of Constanta port) were sent to the EC. Data in respect of the remaining 3 agglomerations (Constanta, Bacau and Botosani) will be sent to the EC before September 2016. The NAPs reports to the EC are in progress (for example the NAPs for Baia Mare and for 3 major roads was loaded to Reportnet but the EC has not been informed yet, and for other NAPs the work is in progress). The reporting process was seen as being quite burdensome but due to the lack of human resources assigned in Romania for this task (only one person works on this task).

24.7 Noise action planning

[380] http://www.cfr.ro/CFR_new/Rom/Acorduri/maps_zgomot2008.htm according http://noise.eionet.europa.eu/RO.pdf

[381] http://www.cfr.ro/index.php/ct-menu-item-117/ct-menu-item-123/29-articles/1794-article-98

[382] http://www.romanian-ports.ro/html/harti_zgomot.html

[383] available in Romanian http://www.romanian-ports.ro/harti_zgomot2013/0_Raport_Braila.pdf

[384] available in Romanian http://romanian-ports.ro/harti_zgomot2013/Planuri%20de%20actiune_Port%20Braila_V2_rev1.pdf

24.7.1 Overview

An overview of the NAPs that were meant to be reported is shown in the following table. It has not however been possible to obtain complete data on the number actually submitted. However, data provided by the EC's DG ENV to the consultants in November 2015 suggests that there are some gaps in NAP submission. For instance, in R1, NAPs have been submitted for all 9 agglomerations but only 5 were submitted using the Reportnet mechanism[385]. (Bucharest, Constanta, Craiova, Galati and Iasi). In R2, NAPs have only been submitted for two agglomerations Oradea and Pitesti, for one major railway and for the major airport, and without inform yet the EC in March 2016 was loaded to Reportnet the NAPs for Baia Mare agglomeration and for 3 major roads, and the work is still in progress.

Table 248 The number of NAPs in Romania that are meant to be submitted

	R1	R2
Agglomerations	9	19
Major airports	1	1
Major railways	5	1
Major roads	30	270

** For the other 17 major railway sections inside agglomerations (67.826 Km), the NAP's will be common with the agglomerations NAPs*

Source: CA website and EEA Reportnet data.

The interview with the CA (Ministry of Environment, Water and Forests) identified that 3 agglomerations have not yet finished developing SNMs, which has had knock-on consequences in terms of delays in the development of NAPs. However, the EC database on NAP submissions suggests that a much greater number of NAPs have not yet been submitted and are subject to delays, but the interview with the CA identified also for one agglomeration (Baia Mare) and 3 major roads have finished the uploading process to Reportnet regarding NAPs. Work is also in progress to upload NAPs for all major roads and major railway and for 13 agglomerations.

24.7.2 Methodologies for noise action planning

No formal common methodology was established at the national level but local environmental protection agencies were provided with an Internal Guide, in accordance with the OM MMDD no. 1830/2007 on reporting data in NAPs to the National Environmental Protection Agency.

[385] In R1, some NAPs were sent without using Reportnet. The Reportnet was used as a mechanism to send reports only after the EC sent an official letter to all MS with the recommendation to use the Reportnet system to send reports to the EC.

24.7.3 Measures

Noise action plans in Romania, especially when limit values were exceeded, were produced using different type of noise reduction measures. These measures were drawn up using noise mapping tools (in particular, through the use of difference maps, and future mapping of the noise situation). The types of measures identified in NAPs in R1 and R2 included: traffic planning, land-use planning, technical measures at noise source, economic measures, insulation, the selection of quieter sources and the reduction of sound transmissions. The two main criteria for selecting measures were: population exposure and the ease of implementation. The costs of implementation is not a commonly used criterion because the municipalities do not normally provide any data regarding which actual measures they want to implement.

24.7.4 Public consultations

As required under the Directive, public consultations were undertaken when drawing up NAPs. Typically, draft NAPs were published on the websites of the administrative bodies responsible for the development of particular NAPs for agglomerations, major roads and major railways thirty days before the public consultation meeting actually took place.

After receiving any proposed modifications and suggestions from the public regarding the draft NAP, the competent authority responsible, typically the local or national public administration responded to these comments and then published the final version. A summary of the results from the public consultation is included as a chapter in the NAP.

The NAP for the city of Bucharest is available on the city's website but has not yet been formally adopted by City Hall. A forum was developed on the website to respond promptly to any questions from the public. It is foreseen that the summaries of the NAPs for other agglomerations will be made publicly available.

24.7.5 Implementation issues

A number of issues were raised during R1, a summary of which is shown below, together with new issues raised during R2.

Table 249 – Noise action planning issues – Romania

R1	R2
A lack of experience in noise abatement with few external consultants and experts	A lack of financial and human resources within public administration to implement the END was again noted. A lack of experience in noise abatement with few external consultants and experts.
Delays in the financial approval of funds slowed the overall process	There was insufficient budget to implement Noise action planning tasks in R2 (and a knock-on delay in complying with deadlines).
Delays in the submission of NAPs in R1, but all were subsequently sent.	The lack of local noise action planning specialists was again an issue, especially in smaller municipalities which are new in implementing the END.
	The availability of funding to implement measures identified through noise action planning
	The ability to compel noise source holders to implement reduction measures

	Delays in the submission of some NAPs in R2, as described in detail earlier.

25. SLOVAKIA

25.1 National implementing legislation for END

25.1.1 Legal implementation

The national legislation that transposes the END in Slovakia is comprised of a number of different legal acts, namely:

- National Act 2/2005 Coll. (with amendment in National Act 170/2009 Coll.) on the Assessment and Control of Environment Noise, which sets out the END's basic principles, integrated approach, basic definitions of SNMs and NAPs, and stipulates duties, obligations and fines for natural and legal persons, state bodies and local municipalities
- Government Regulation (GR) No. 44/2005 and GR No.43/2005 (with amendment No. 258/2008 Coll.) on SNMs and NAPs. This describes noise indicators in more details, sets limit for actions values for different sources of noise and elaborates detailed data requirements.
- Ministry of Health Regulation No. 195/2005 of 20th April 2005, which sets out the obligations for other bodies on providing data for noise for mapping.
- Expert Guideline of Public Health Authority of the Slovak Republic No. OŽPaZ/5459/2005 (with amendment No. OHŽP/6112/2006) and No. OHŽP/5828/2007 for put together SNMs and actions plans. [386].

Several END provisions had *not* been transposed during R1, those relating to the night time noise indicator, noise assessment method, strategic noise mapping, NAPs, and informing the public. However, these legal gaps had been addressed by the time of R2 implementation.

Additional Slovakian noise legislation includes:

- Ministry of Health Decree No. 549/2007 Coll., which establishes limit values for noise, infrasound and vibration requirements, and the objectification of noise, infrasound and vibration in the environment
- National Act (NA) 355/2007 Coll., on the protection, support and development of public health (with amendments in NA 204/2014 Coll.; NA 74/2013 Coll.; NA 172/2011 Col.; NA 132/2010 Coll.)

In addition, the Ministry of Health has issued four recommendations setting out guidelines on strategic noise mapping.

25.1.2 Scope of END implementation – Rounds 1 & 2

R1 of strategic noise mapping and noise action planning in Slovakia included one agglomeration, no airports or railways and 522 km of major roads.

The transition to the definitive thresholds of the END in R2 led to one *additional* agglomeration, 1 356 km of major roads as well as 512 km of major railways being covered compared with R1.

[386] Links to relevant legislation may be found at: http://www.hlukovamapa.sk/

Table 250 – END coverage – Slovakia

Round	Agglomerations	Major airports	Major rail	Major roads
1	1[387]	n/a	n/a	522 km
2	2[388]	n/a	512 km	1,878 km

25.2 Competent Authorities and designated administrative bodies

The national CA responsible for END implementation is the Public Health Authority (http://www.uvzsr.sk/en/) of the Slovak Republic, which is an agency under the Ministry of Health. In addition, a number of other bodies have been designated as the responsible authorities for major roads and agglomerations, as summarised below:

Table 251 – END implementation - Slovakia[389]

Role	Agglomerations	Roads	Railways	Airports
Preparing and approving SNMs	Local authorities*	Slovak Road Administration (major roads) National Slovak Motorway Company (major roads)	Railways of the Slovak Republic	
Preparing and approving NAPs	Local authorities*	Slovak Road Administration (major roads) National Slovak Motorway Company (major roads)	Railways of the Slovak Republic	
EC/EEA reporting	Public Health Authority (CA)			
Environmental monitoring				

** Bratislava city Capital and Košice city*

25.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

25.3.1 Data collection

For the purpose of SNM calculation, a 3D model of terrain was implemented by obtaining spatial data from databases. Spatial databases were created based on photogrammetry data. Aerial photos were taken in resolution of 25cm per pixel. Input databases were provided by EUROSENSE Ltd. and Geodis Slovakia. For the data on number of inhabitants in each building, data from the central register of Ministry of Interior were used.

[387] Bratislava

[388] Bratislava, Kosice

[389] As required formally by law (see chapter 1.2). Implementation in practice is carried out by private companies, designated by public tender.

25.3.2 Implementation Issues

The methodology for carrying out the calculations was not available before R1. The interim methods in the END were used as well as methods used in other countries which were validated in separate project. Through the project, a substantial number of measurements and comparative calculations were carried out. A number of significant issues were raised during R1, a summary of which is shown below, together with any new issues raised during R2. The issues identified below have significantly slowed down implementation overall, particularly in R1.

Table 252 – Designation issues - Slovakia

R1	R2
GIS data for railroads and road segments were missing	Resolved
Calculation methodology was not available and validated.	Resolved
Substantial amount of measurements was necessary to acquire emission data from different noise sources (roads, railways and industry.)	Resolved
There were communication problems with some of the responsible authorities (municipalities, operators of industries)	Resolved. Only additional issue in R2 was a lack of funds to carry out the tasks.

25.4 Noise limits and targets

25.4.1 Objectives and Scope

The END does not specify mandatory noise limit values. Legislation that implemented the Directive (see first chapter) defined thresholds for limit values. If these values were exceeded, then this was used as the basis for identifying noise abatement measures for preparing NAPs. The table below shows the LV thresholds for different noise sources according to different type of land use. The exceedance of limits set out in the table is not sanctioned.

Table 253 Action values for different noise sources applied in Slovakia

Noise source	Action values for noise indicators [dB]			
	Exterior*		Exterior with special protection from noise**	
	L_{den}	L_{night}	L_{den}	L_{night}
Road-traffic and tram	65	55	55	40
Rail-traffic	60	50	55	45
Airports	65	55	55	40
Industry	55	40	50	35

**without industrial and transport areas;*

***quiet areas in agglomeration, SPA, curative resort*

Source: Government Decree No. 258/2008 Coll.

The limits for outdoor noise are defined in separate legislation[390]. Exceeding limits stated in the separate legislation leads to sanctions that are imposed according to National Act 355/2007 Coll. Purpose Action values are used in creation of NAPs and for displaying of the conflict plans according to END. The purpose of setting national limit values (LVs) is to help prioritise measures and to help develop NAPs.

The LVs laid down in national legislation are mandatory for all operators of noise sources. Limits are set for the different noise sources and for different types of land usage. Accordingly, sources are divided into four groups (road traffic noise and waterways; noise from rail transport; aircraft noise; noise from other sources). Four types of areas are distinguished by type of land use. The limits are shown in the table below.

Table 254 Noise limits in Slovakia for noise descriptors in exterior

Area category	Description of protected region or outdoor space	Reference time interval	PERMISSIBLE VALUES a) (dB)				
			TRAFFIC NOISE				Noise from other sources
			Road and water traffic b) c)	Railways c)	Airborne traffic		
			$L_{Aeq,p}$	$L_{Aeq,p}$	$L_{Aeq,p}$	$L_{ASmax,p}$	$L_{Aeq,p}$
I	Territory with special protection against noise, e.g. Spas,[10)] spa and medical compounds	day evening night	45 45 40	45 45 40	50 50 40	- - 60	45 45 40
II	Space in front of the windows of residential rooms of apartment buildings and houses, the area in front of windows of protected rooms in school buildings, health care facilities and other protected objects, d) or recreational areas	day evening night	50 50 45	50 50 45	55 55 45	- - 65	50 50 45
III	Region as in category II and in the vicinity of a) motorways, I. Class and II. Class roads, local roads with public transportation, railway lines and airports, 11) town centres	day evening night	60 60 50	60 60 55	60 60 50	- - 75	50 50 45
IV	Region without residential land use and without protected outdoor spaces, production zones, industrial parks, factory complexes.	day evening night	70 70 70	70 70 70	70 70 70	- - 95	70 70 70

Notes:

a) *Permissible values are valid only for dry carriageway surfaces and terrain that is not covered by snow.*

b) *Road traffic is traffic on all road types including tram traffic.11)*

c) *Public transportation stops, bus, rail and water traffic and taxi parking designated only for embarking and disembarking are assessed as part of road and water traffic.*

[390] Ministry of Health Decree No. 549/2007 Coll.

d) Permissible values in front of facades of non-residential structures are applied during the time of their use, e.g. Schools during education period, etc.

As stated in the first section, limits are to be met by every operator of the above-mentioned noise sources. Compliance with the limits during the operation of existing noise sources is usually checked through on-site measurements. In special cases, this is also done by means of calculations. For monitoring the compliance with the limits, measured or calculated value of a noise descriptor is increased by value of uncertainty and the result must be less than the limit value. When designing new noise sources, calculation is used. When introducing the sound source into operation, a control measurement must be carried out. Compliance with the limits is checked at random times or after complaints from residents.

Noise LVs could thus far not be fully enforced due to the high amount of "old noise loads ", a lack of enforcement capacity and the difficulty in enforcing LVs given the perceived conflict among some stakeholders with economic development priorities. Noise limits are, however, applied when new transport or building projects are approved, to prevent problem situations and when inhabitants raise complaints. .

25.5 Quiet areas

25.5.1 Overview

According to the NR SR Act 2/2005 Coll., for the purposes of processing SHM and AP (SNMs and NAPs) under END, quiet areas are designated for which noise indicators have predetermined action values. The obligation to declare a quiet area in open country (outside agglomerations) is set by the law. The law states that on the territory of an agglomeration, quiet areas are declared by municipalities. In practice, no quiet areas in accordance with the requirements of the Act 2/2005 Coll. have been declared during Rounds 1 or 2.

Quiet areas in open country were delimited on the basis of national legislation on nature protection, whereby "quiet areas in open country" cover selected protected areas, including 9 National Parks, 14 Protected Landscape Areas, 384 Nature Protected Areas and 38 Special Protected Areas under the Birds Directive[391].

A national methodology was established for quiet areas in open country.

No quiet areas were however established in agglomerations.

25.5.2 Implementation Issues

No issues were raised as a result of END implementation in R1 or R2.

[391] Justice and Environment, 2009, "Shadow Report on the Implementation of the END"

25.6 Strategic noise mapping

25.6.1 Overview

An overview of SNMs produced in Rounds 1 and 2 in Slovakia is shown below. SNMs for Slovakia are published at www.hlukovampa.sk and in separate reports for individual adjudicating entities (SSC, NDS, City of Bratislava, ŽSR, RC Bratislava, etc.)

Table 255 Number of SNMs – Slovakia

	R1	R2
Agglomerations	0 (1)	0 (2)*
Major airports	0	0
Major railways*	0	1(1) (512 km)
Major roads ***	2(2)	6(6) (1,878 km)

**Only one finalised SNM for an agglomeration has been finalised to date (Bratislava)*

The purpose of the SNMs is to describe the noise levels in the vicinity of significant sources of noise (traffic, industry) and determine noise exceedance values that would require actions on a prioritised basis.

25.6.2 Data collection

Responsibility for data collection lies with the authority in charge of generating the relevant section of a SNM in order to ensure clarity as to which authorities were responsible for generating (collecting) data, working areas for road traffic have been divided up between the relevant administrative authorities given administrative boundaries which are independent of competence over specific stretches of road.

A consultancy company was contracted to prepare spatial vector databases for SNMs. Professional companies were also contracted to process and prepare SNMs and NAPs in R1. The same approach was adopted in R2. It was noted that the END methodology for the determination of the necessary statistical data (inhabitants, schools, buildings, hospitals, etc.) is not completely uniform, leading to problems in interpreting the data.

Table 256 Strategic noise mapping – data availability and collection methods - Slovakia

R1	R2
Spatial databases obtained from photogrammetry	Still valid
Noise emission data from noise sources obtained by measurements	Still valid
Inhabitant data obtained from Central register of Ministry of Interior	Still valid

25.6.3 Strategic noise mapping methods

Data requirements for strategic noise mapping are included in the Regulation of the Ministry of Health No. 195/2005. The methodology for strategic noise mapping is set out in the Expert Guidelines of the Public Health Authority of the Slovak Republic[392]. The methodology for noise action planning is set out in Expert Guideline No. OHŽP/5828/2007. The calculation methods used for each noise source are:

- Road noise by NMPB 96 (interim method by END with application for SK)
- Railway noise by Shall03 (German methodology with application for SK)
- Aviation noise by ECAC Doc. 29 (interim method by END with application for SK)
- Industrial noise by ISO 9613 (interim method by END with application for SK)

Only the two core END indicators, L_{night} and L_{den} are used. Other guidance used includes the '2007 Good Practice Guide for Strategic noise mapping' and the Production of Associated Data on Noise Exposure', and 'Environmental Noise Data Reporting Mechanism Handbook (2007)'.

25.6.4 Public accessibility of SNMs

SNMs and NAPs for Bratislava agglomeration (both Rounds), some major roads and railways are published at: www.hlukovamapa.sk. SNMs and NAPs finalised in 2015 will be uploaded and made publicly available at a later date in 2016.

25.6.5 Implementation Issues

A number of issues were raised as a result of R1, a summary of which is shown below, together with actions taken to address them, and any new issues raised during R2.

Table 257 - Strategic noise mapping issues - Slovakia

R1	R2 (New issues and R1 issue remediation actions)
Obtaining data for dwellings, schools, hospitals, inhabitants, and industry noise sources	Financing SNMs in agglomerations
Non-existent data for noise emission	
Creation of SNMs is not harmonised with road traffic monitoring cycles	
Time period for SNMs preparation is too short	
Lack of data comparability mainly due to modification of the way of calculation of number of people exposed (assignment to facades).	The same issue remained a challenge in R2
Deadlines defined in the Directive are different from national usual deadlines for regular traffic density monitoring, which is used for the designation (and, consequently, mapping) of major roads. Currently, designation has to be done before latest results from density monitoring are available.	The same issue remained a challenge in R2

[392] No. OŽPaZ/5459/2005 (with amendment No. OHŽP/6112/2006).

25.7 Noise action planning

25.7.1 Overview

An overview of NAPs is shown in the following table.

Table 258 Number of NAPs – Slovakia[393]

	R1	R2
Agglomerations	0(1)**	0(2)
Major airports	n/a	n/a
Major railways	n/a	n/a
Major roads	n/a	187(622)***

** In R1, there was only one agglomeration for Bratislava, whilst in R2, an additional agglomeration fell within the scope of the END, Košice*

*** A NAP was prepared for the Bratislava agglomeration, but not published due to funding problems caused by the lack of resources allocated to the municipality by the government.*

**** not all NAPs have been finalised for major roads in R2*

Sources: www.hlukovamaps.sk; Public Health Authority of SK; ZSR; NDS, a.s.; SSC; Regionálne cesty Bratislava; Správa ciest KSK; RC Žilina; Správa ciest BSK; Banskobystrická regionálna správa ciest

25.7.2 Methodologies for noise action planning

A guidance document "Expert Guideline No. OZPaZ/5828/2007" was produced by the Public Health Authority of the Slovak Republic. The aim was to define the principles of NAP preparation and the rules and procedures for information to the public, in accordance with Act. No. 2/2005 Coll.[394] and END.

The 2006 SNMs were used as the basis for the development of the 2008 NAPs. The exceeding of action values was used to establish priorities for NAPs. In addition, the 'noise score index' by W. Probst was applied to establish priorities.

25.7.3 Measures

Examples of noise abatement measures included in NAPs in R1 were traffic planning, technical measures at noise source, land-use planning, insulation, and the reduction of sound transmission, noise barriers, etc. In addition, there were examples of incentive-based measures. In R2, similar measures were adopted.

25.7.4 Public consultations

During R1, a report by the NGO called "Justice and the Environment" indicated there was no public participation due to delays finalising the three NAPs and financial constraints[395]. These allegations are not accurate. The public was informed in R1 regarding major roads, but there was very low interest.

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[393] Action Plans: As reported to the EC.

[394] Details of the guidance are provided in: http://www.health.gov.sk/redsys/rsi.nsf/0/3e6b545e2697a78cc1256f970033e1b0/$FILE/vestnik0707.pdf.

[395] Op cit 115

The NAP for the Bratislava agglomeration was not published due to funding problems, hence it was not possible to organise a public consultation. There was consequently no public participation. In R2, public participation has so far not been possible, because most of the NAPs are still under development and are not available in draft form.

25.7.5 Implementation Issues

A number of issues were raised during R1, a summary of which is shown below, together with any subsequent actions taken to address them, and new issues raised during R2.

Table 259 Noise action planning issues - Slovakia

R1	R2 (New issues and R1 issue remediation actions)
Time period for NAP preparation is too short	The same issue remained in R2. There have been delays in action planning again in R2
Lack of (adequate) human and financial resources.	The same issue remained in R2
Actions plan methodology and requirements were not sufficiently defined in the END	

26. SLOVENIA

26.1 National implementing legislation for END

26.1.1 Legal implementation

The END has been transposed into national legislation in Slovenia through the following pieces of legislation:

- Government Regulation (GR) No. 105/2005, with an amendment in 34/2008, 109/2009 and 62/2010 Coll (Ur.l. RS 105/2005 in 34/2008, 109/2009 in 62/2010 on the Assessment of Noise indicators in Environment, which sets out the END's basic principles, integrated approach, basic definitions of SNMs and NAPs, and stipulates duties, obligations and fines for natural and legal persons, state bodies and local municipalities.
- Government Regulation (GR) No. 121/2004 Coll (Ur.l. RS 121/2004) on the Evaluation Environmental Noise.
- National Act No. 105/2008 Coll Rules of the related assessment and operational monitoring of noise sources and conditions for its implementation.

26.1.2 Scope of END implementation – Rounds 1 & 2

R1 of strategic noise mapping and noise action planning in Slovenia included one agglomeration, no airports, some major railways and major roads. The introduction of the definitive END threshold in R2 led to one *additional* agglomeration, and an increase in the volume of mapping to 260 km of major rails and 1,128 km of major are covered in total.

Table 260 END coverage – Slovenia

Round	Agglomerations	Major airports	Major rail	Major roads
1	2[396]	n/a	67 km	462 km
2	2[397]	n/a	260 km	1,128 km

26.2 Competent Authorities and designated administrative bodies

The national CA responsible for END implementation is the Slovenian Environment Agency (http://www.arso.gov.si) which is an agency under the Ministry of the environment and spatial planning of Slovenia. In addition, a number of other bodies have been designated as the responsible authorities for major roads and agglomerations, as summarised below:

Table 261 END implementation - Slovenia

<table>
<tr><th>Role/Activity</th><th>Agglomerations</th><th>Roads</th><th>Railways</th><th>Airports</th></tr>
<tr><td>Preparing SNMs</td><td rowspan="3">Ljubljana city Capital
Maribor city</td><td rowspan="3" colspan="2">Ministry of infrastructure;
Slovenian infrastructure Agency</td><td rowspan="3"></td></tr>
<tr><td>Approving SNMs</td></tr>
<tr><td>Preparing NAPs</td></tr>
</table>

[396] Ljubljana, Maribor (out obligations (number of inhabitants < 250.000) Maribor agglomeration)

[397] Ljubljana, Maribor

Role/Activity	Agglomerations	Roads	Railways	Airports
Approving NAPs				
EC/EEA reporting	Ministry of the Environment and Spatial Planning of Slovenia Slovenian Environment Agency			

26.3 Noise limits and targets

26.3.1 Objectives and Scope

The END does not specify mandatory noise limit values (LVs). Legislation to implement the Directive (see introduction to the Slovenian country fiche) defined the limits of action values. If these values were exceeded, then this provided the basis for the identification of noise abatement measures on a prioritised basis through NAPs. The following Table shows action values thresholds for different noise sources according to different types of land use. Exceeding the limits set in the table is not sanctioned.

Table 262 Limit values for different protections area applied in Slovenia

Protection Area from Noise	Limit values for noise indicators [dB] – Road, Rail, Airport			
	$L_{A,day}$	$L_{A,evening}$	$L_{A,night}$	L_{DEN}
IV.	70	65	60	70
III.	65	60	55	65
II.	60	55	50	60
I.	55	50	45	55
Protection Area from Noise	**Limit values for noise indicators [dB] - industry**			
	$L_{A,day}$	$L_{A,evening}$	$L_{A,night}$	L_{DEN}
IV.	73	68	63	73
III.	58	53	48	58
II.	52	47	42	52
I.	47	42	37	47

26.4 Quiet areas

26.4.1 Overview

The decree on limit values for environmental noise indicators (Ur. l. RS, št. 105/2005; 34/08) includes the definition of quiet areas. Furthermore Article 4 defines that quiet area can be defined on whichever second area of noise protection or on its part.

However, no quiet areas have as yet been designated during either Rounds 1 or 2 in Slovenia.

26.4.2 Implementation Issues

No implementation issues were raised as a result of END implementation in either R1 or R2, since there were no designated quiet areas.

26.5 Strategic noise mapping

26.5.1 Overview

An overview of the SNMs produced in Round 1 in Slovenia is shown below. Some SNMs for Slovenia have been published (see www.arso.gov.si). The SNMs for agglomerations have not yet been submitted in respect of R2.

Table 263 Number of SNMs - Slovenia

	Agglomerations	Major airports	Major railways	Major roads
R1	1*	0	1 (67 km)	2 (462 km)
R2	2**	0	2 (260 km)	2 (1,128 km)

*There were less than *250.000 inhabitants in Maribor agglomeration, which only came within scope in R2.*

*** SNMs have only been finalised for R1, and have not yet been submitted for R2.*

The objective of SNMs is to describe the noise levels in the vicinity of significant sources of noise (traffic, industry) and determine noise exceedance values that would require actions on a prioritised basis.

26.5.2 Data collection

Responsibility for data collection is spread across different public authorities responsible for generating different parts of SNMs (e.g. road, railways etc.). In respect of major roads, responsibility for road traffic data has been divided between the relevant administrative authorities given that there are administrative boundaries which relate to specific stretches of road and different competences among different local authorities.

The main data sources were: (i) spatial databases obtained from photogrammetry (ii) noise emission data from noise sources obtained by measurements and (iii) inhabitant population data obtained from central register of the Ministry of Interior. The same data sources were used in Round 2.

A consultancy company was contracted to prepare spatial vector databases for SNMs. Professional companies were also contracted to process and prepare SNMs and NAPs in R1. The same approach was adopted in R2. It was noted that the END methodology for the determination of the necessary statistical data (inhabitants, schools, buildings, hospitals, etc.) is not completely uniform, leading to problems in interpreting the data.

26.5.3 Strategic noise mapping methods

The calculation methods used for each noise source are:

- Road noise by NMPB 96 (interim method by END)
- Railway noise by RM II 96 (interim method by END)
- Aviation noise by ECAC Doc. 29 (interim method by END)
- Industrial noise by ISO 9613 (interim method by END)

Other guidance used included the: '2007 Good Practice Guide for Strategic noise mapping and the Production of Associated Data on Noise Exposure', and 'Environmental Noise Data Reporting Mechanism Handbook (2007)'.

26.5.4 Public accessibility of SNMs

The R1 SNMs for the Ljubljana agglomeration are published at: www.arso.gov.si Separate noise maps were produced for road and rail traffic and also for industrial sources. Due to delays in preparing the R2 SNMs in both Ljubljana and Maribor, these are not yet published or accessible to the public.

26.6 Noise action planning

26.6.1 Overview

The table below provides an overview of the NAPs produced in Slovenia in Round 1 and 2.

Table 264 NAPs – Slovenia

	R1	R2
Agglomerations	0 (1)	0 (2)
Major airports	n/a	n/a
Major railways	n/a	n/a
Major roads	n/a	n/a

The data presented above refers to the numbers of NAPs that were submitted (and in brackets, the numbers of NAPs that were meant to be submitted). In R1, according to data from the ENDRM provided by the EC in November 2015, the R1 NAP for the Ljubljana agglomeration has not been submitted. In R2, no NAPs have been submitted for either the Ljubljana or Maribor agglomerations.

27. SPAIN

27.1 National implementing legislation for END

27.1.1 Legal implementation

In Spain, the Environmental Noise Directive has been transposed at national level through Law 37/2003 [398] (known as the "Noise Law"). This represented the first law on environmental noise to be passed at a national level in Spain, although many regional and municipal ordinances previously existed covering this subject.

The Noise Law is further specified through the following two Royal Decrees:

- Royal Decree (RD) 1513/2005[399]: covering evaluation methods and transposition of END Annexes, including noise indicators, supplementary indicators, and calculation methods;
- RD 1367/2007[400]: covering noise zoning, objectives and noise limits.

Another relevant national legislation (RD 1371/2007[401]) concerns noise in buildings, with the aim to reduce noise exposure in new developments.

Responsible authorities had developed different noise limits in regional legislation prior to RD 1367/2007, but are now moving towards common national limits.

27.1.2 Scope of END implementation – Rounds 1 & 2

R1 of strategic noise mapping and noise action planning in Spain included 19 agglomerations, 10 airport(s), and approximately 8,600 km of major roads and 830 km of railway. The introduction of definitive thresholds in R2 led to 41 *additional* agglomerations being covered, with major railway lines almost doubling to 1,480 km and major roads more than doubling to 19,500 km within END scope.

An overview of END coverage by Round is provided below:

Table 265 END coverage – Spain

Round	Agglomerations	Major airports	Major rail	Major roads
1*	19	10	832 km	8,574 km
2**	60***	12***	1,484 km	19,552 km

**Sources: http://cdr.eionet.europa.eu/es/eu/noise/df1/envtozyza ; http://forum.eionet.europa.eu/etc-sia-consortium/library/noise_database/end_df4_df8_results_2012_150630*

***Sources : http://cdr.eionet.europa.eu/es/eu/noise/df8/envvxgqng ; http://forum.eionet.europa.eu/etc-sia-consortium/library/noise_database/end_df4_df8_results_2012_150630*

[398] http://www.magrama.gob.es/es/calidad-y-evaluacion-ambiental/temas/atmosfera-y-calidad-del-aire/leydelruido_tcm7-1707.pdf

[399] http://www.magrama.gob.es/es/calidad-y-evaluacion-ambiental/temas/atmosfera-y-calidad-del-aire/rd1513_2005evaluacionygestiondelruido_tcm7-1710.pdf

[400] http://www.magrama.gob.es/es/calidad-y-evaluacion-ambiental/temas/atmosfera-y-calidad-del-aire/rd1367_2007zonificacionobjetivosdecalidadyemisionesacusticas_tcm7-1708.pdf

[401] http://www.magrama.gob.es/es/calidad-y-evaluacion-ambiental/temas/atmosfera-y-calidad-del-aire/rd1371_2007cte_dbhr_tcm7-1709.pdf

****Initially 64 agglomerations but some turned out to be below 100.000 inhabitants; also initially 13 airports but it turned out that Lanzarote airport did not reach 50.000 operations, so it was dropped.*

Note: Total km of covered railways and roads as reported to EEA by June 2015 – does not coincide with total km initially communicated to the EC.

SNMs were produced not only in terms of the indicators L_{den} and L_n, but also included L_d and L_e.

Strategic Map Units (SMUs) were defined, for each of which the exposed population was calculated in two stages:

- Basic SNMs, covering the entire SMU length or area, at a scale of 1:25.000;
- Detailed SNMs, covering in more detail urban areas and other noise sensitive areas exposed to noise, at a scale of 1:5,000 or 1:10,000;

27.2 Competent Authorities and designated administrative bodies

27.2.1 Implementation arrangements

The Ministry of Agriculture, Food and Environment (MAGRAMA) is responsible for reporting to the European Commission.

The CAs responsible at national level for implementing the END include MAGRAMA and the Ministry of Development through the following Directorates:

- Directorate General of Roads;
- Directorate General of Railways;
- Directorate General of Civil Aviation.

There are also 15 designated CAs at regional level, typically the Environment Department of each autonomous community government, which are responsible for implementing the END on the infrastructures under their jurisdiction (for example: regional roads) and, in some cases, for some municipalities within the region, together with the municipalities.

Each of the 60 municipalities defined as a large agglomeration is responsible for the implementation of the END in their agglomeration, in some cases jointly with the regional government. Bodies responsible for the designation and delimitation of sites, setting noise limit values and developing NAPs are shown in the table below.

Table 266 Administrative Responsibility for the END in Spain

Role	Agglomerations	Roads	Railways	Airports
Preparing SNMs Approving SNMs	Municipalities Autonomous Communities	Ministry of Development * Autonomous Communities	Ministry of Development * Autonomous Communities	Ministry of Development *
Preparing NAPs Approving NAPs	Municipalities Autonomous Communities	Ministry of Development * Autonomous Communities	Ministry of Development * Autonomous Communities	Ministry of Development *
EC/EEA reporting				

* *DGs within the Ministry of Development for Roads, Trains and Civil Aviation*

27.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

27.3.1 Data collection

For national roads, the Centre for the Study and Experimentation of Public Works (CEDEX) a public entity related to both the Ministry of Development and to the MAGRAMA) has prepared in due course some pilot-projects and guidelines which were of great help to establish a methodology and framework for the consultants and CAs to base their work and requirements. This was very important for Spain in order to be able to accomplish the production of SNMs covering thousands of km of roads, which was far beyond the existing strategic noise mapping capacity in Spain in the beginning of the process.

The CAs in charge of providing data had some difficulties to provide the data on the scope of application of the END, especially in the case of roads, for which many versions of number of km have come up along the process of R1.[402]

For both Rounds, data was more readily available for the identification of major airports, agglomerations and railways, but only for some roads due to the need to compile traffic information for all relevant roads.

Cartographic data was generally available in a suitable form although for roads and rail specific cartography had to be produced by the responsible entity for the SNMs.

For the delimitation of agglomerations, administrative criteria were predominantly used.

27.3.2 Implementation issues

A number of issues were raised as a result of R1, a summary of which is shown below, together with actions taken to address them, and any new issues raised during R2.

Table 267 Designation issues - Spain

R1	R2
Lack of coordination between different responsible authorities, resources and personnel	Improved significantly by means of the organisation of specific events and technical courses on the application of the Directive, the leading role of Cedex with the creation of SICAweb – a Noise Information System and also a result of a normal “learning curve”.
Some difficulties related to getting precise and updated data on traffic and population of the agglomerations to confirm inclusion for R1, especially where areas were just above/below the scope thresholds (e.g.: road traffic close to 6 million/year)	These difficulties increased slightly in R2 due to the increased number of cases which caused some inconsistency on number of agglomerations, airports, roads and railways to be mapped. Moreover, the economic crisis in Spain means that traffic has decreased in many locations, leading to further issues around locations dropping out of scope.
Lack of a national vision for developing an NAP that integrates all noise sources	Improved with the establishment of criteria for identification of critical areas and methodologies to prepare NAPs.

[402] http://sicaweb.cedex.es/docs/comunicaciones/2009-10-01/INFORME_cartaA14-7982_ago09_v3.pdf

Another implementation issue relates to the dispersion and variety of regional and local laws and regulations related to noise, from the definition of the reference periods of the day, to the types of zone classifications.

27.4 Noise limits and targets

National limits are set in RD 1367/2007. Some regional governments had previously set different standards and the transposition of the Directive came as an opportunity to bring some harmonization through the various regions. The Ministry has stated that regional governments are to move towards the RD 1367/2007 limits. RD 1367/2007 sets out different national limits values according to land use and other parameters (different surroundings and different noise sensitiveness of the populations; existing and new situations, etc.). The more relevant are shown in the following two tables, from Annex II of the RD.

Table 268 National noise limit values – agglomerations - Spain

Acoustic zone type	dB		
	L_d	L_e	L_n
Predominantly dedicated to sanitary, education or cultural use that will required special protection against noise	60	60	50
Predominantly residential use	65	65	55
Zones for other tertiary use other than that given below	70	70	65
Predominantly dedicated to recreation and spectacles	73	73	63
Predominantly dedicated to industrial use	75	75	65
Zones attached to transport infrastructures and other public infrastructure	Not set	Not set	Not set

Source: RD 1367/2007

Table 269 National noise limit values - internal space of buildings aimed at residential use, health, culture and education - Spain

Building use	Type	dB		
		L_d	L_e	L_n
Residential/Living space	Other areas	45	45	35
	Bedrooms	40	40	30
Hospitals	Waiting rooms and other areas	45	45	35
	Bedrooms	40	40	30
Education or cultural	Classrooms	40	40	40
	Reading rooms	35	35	35

Source: RD 1367/2007

Annex II also contains objectives for vibration for different types of buildings.

Annex III sets out the limits for the particular noise levels transmitted to sensitive receivers from roads, railways and airports in terms of L_d, L_e, and L_n and, for the specific cases of railways and airports, also in terms of L_{Amax} as defined in ISO 1996-1: 2003. It also sets out limits for ports and noisy activities in general, both for outdoor and indoor levels, in terms of the parameters $L_{k,d}$, $L_{k,e}$ and $L_{k,n}$ which are defined in Annex I and which basically are evaluation levels obtained from the L_{Aeq} by adding penalties when the noise exhibits tonal, impulsive or low frequency characteristics.

27.5 Quiet areas

27.5.1 Overview

There are provisions for the designation of quiet areas in Law 37/2003 and RD1513/2005.

The noise limits for quiet areas are set in RD 1367/2007:

Quiet areas in an agglomeration and in open country should keep their sound levels below the levels indicated in the table above subtracted by 5 dB(A), meaning for typically, for an area predominantly dedicated to sanitary, education or cultural use that will required special protection against noise, that noise levels should not exceed 55 dB(A) for L_d and L_e and 45 dB(A) for L_n.

Delimitation of quiet areas is a responsibility of the municipalities, which can either define them in their municipal land use plans or during the preparation of SNMs and NAPs. No special attention has been paid to this subject. In 2010, the use of L_{day} and areas of leisure and parks for public were given as potential criteria for the identification of quiet zones.

27.6 Strategic noise mapping

27.6.1 Overview

An overview of the number of SNMs produced so far in Rounds 1 and 2 is shown below, followed by the total number originally envisaged.

Table 270 SNMs – Spain

	R1	R2
Agglomerations	19 (19)	29 (60)
Major airports	10 (10)	12 (12)
Major railways	25 (36) (832 km)	25 (63) (1,484 km)
Major roads	393 (540) (8,574 km)	328 (830) (19,552 km)

Sources: http://sicaweb.cedex.es/ http://cdr.eionet.europa.eu/

Note: N.º of SNMs of roads and railways are expressed in terms of strategic map units, as was defined in Spain, but may vary according to the source. The MAGRAMA is preparing an updated information on these numbers which will be sent to the EC by end of January 2015.

27.6.2 Data collection

In R1 there were some problems with available data, such as building height, number of inhabitants per building, traffic counts in some agglomerations and, in some cases, the lack of enough detail of cartography around the roads, but in general these were overcome and no other major difficulties arose.

Due to the fact that there was only limited national data on population by dwelling, with information only available on city apartment blocks, estimations were made. In some cases, there were also no data on building heights, requiring experts to go out in the field and measure the houses. Finally, measurements to estimate noise emissions from industrial sites had to be done in the field as well as there were no previous data. The 2007 Good Practice Guide was used.

Most of these problems were already solved during R2, where information sources improved very significantly, especially altimetry, buildings and the availability of ortho-images.

There is national guidance on strategic noise mapping, provided through the SICAweb platform. Other reference documents used include: 2007 Good Practice Guide for Strategic noise mapping and the Production of Associated Data on Noise Exposure Roads. Other sources consulted include IMAGINE and the Environmental Noise Data Reporting Mechanism Handbook (2007).

27.6.3 Strategic noise mapping methods

Methods used for the elaboration of the SNMs coincide with those established as provisional recommended methods, in Annex II of the END. The exception was the Cataluña railway network, where the calculation method NMPB-96 SETRA-CERTU-LCP-CSTB was used. This method is considered equivalent to the provisional recommended method, in Annex II of the END.

27.6.4 Public accessibility of SNMs

According to RD 1513/2005 CEDEX created an information portal (Sistema Básico de Información sobre la Contaminación Acústica - SICA) via which the public have access to the SNMs online and other information, such as Ministry communications with the European Commission, NAPs, legislation, responsible authorities, etc.

SNMs are therefore available to the public at the portal SICAweb (Noise Information System) which is interactive and enables the public to access all relevant information by navigating on the map of Spain and select the airport, agglomeration, road or railway to discharge the corresponding SNMs and summary report.

SICA is the responsibility of the Ministry of the Environment and is managed by the General Directorate of Environmental Quality and Assessment. The information can be accessed at http://sicaweb.cedex.es/

Table 271 Strategic noise mapping locations - Spain

	SNM location
1st Round – SNMs	http://sicaweb.cedex.es/mapas-consulta-fase1.php
2nd Round – SNMs	http://sicaweb.cedex.es/mapas-consulta-fase2.php
Population exposed	http://sicaweb.cedex.es/poblacion-exp.php

27.6.5 Implementation issues

A number of issues were raised during R1, a summary of which is shown below, together with actions taken to address them, and any new issues raised during R2.

Table 272 Strategic noise mapping issues - Spain

R1	R2
Estimating the number of dwelling, schools and hospitals exposed to specific values of noise indicators and estimating the number of people exposed	Improved, both due to better quality of available data and to the learning curve of the consultants.
Obtaining data on land uses	Improved
Gathering data on exceedance of limit values, and the height of buildings	Partially solved with new guidance to identify critical areas for which an NAP is required. Information on height of buildings has improved in general with better more recent cartographic data available.
Weather conditions might also have affected noise assessments	-

27.7 Noise action planning

27.7.1 Overview

Table 273 NAPs – Spain

	R1	R2
Agglomerations	17	9
Major airports	0	0
Major railways	7	0
Major roads	13	3

27.7.2 Methodologies for noise action planning

The minimum requirements for an NAP are laid down in RD 1513/2005, which replicate those of Annex V of the END.

The main criteria for establishing priorities have been population exposure and exceedance of noise limits. Health assessments have not been used.

There were few guidelines at national level on noise action planning for R1. For R2, more guidelines and literature was available, including a guide on strategic noise mapping published by the Ministry of Development in 2010[403]. This guide refers to three types of noise abatement measures:

- Installation of noise barriers - the viability of such a measure must be studied and if found not viable a complex solution must be envisaged; length and height of barriers need to be specified;
- Action on road surfaces – approximate extension and type of pavement must be specified;
- Complex action – must be justified and a more complex solution defined.

For the definition of areas established for barrier installations, the following criteria have been considered:

- **Exposure levels**. Areas in which the L_{night} exposure values are below 55 dB(A) have been excluded.
- **Affected population**. Generally, the exposed areas with a minimum of 300 affected persons have been included in the proposals. However, a considerable number of areas with a smaller population have been included, due to the singularity of the area, the presence of schools or hospitals or the characteristics of the city centre.
- **Technical viability**. The real possibility of barrier construction is evaluated, having rejected the proposal when there is not enough space or when the receptor is much higher than the road. In the areas determined for the establishment of priority actions, the A and B categories have been defined based on the severity of the impact and the effectiveness of the action.

For actions, only residential buildings, educational buildings and hospitals have been considered.

27.7.3 Measures

Noise abatement measures included in NAPs in Spain in R2 included planning, technical measures at noise source, land-use planning, insulation, regulation, economic measures, reduction of sound transmission, and incentives.

For agglomerations, those measures that have been used the least include economic measures and reduction of sound transmission. For roads, the reduction of sound transmissions was the mitigation measure most commonly used.

Mitigation highlighted as particularly effective includes specific plans when noise pollution exceeds legal levels, since plans do not require statutory consultation, as well as building -related legislation on noise limits for new construction (RD 1371/2007 and 1909/81).

[403] http://webaux.cedex.es/egra/DOCUMENTACION/MER-criterios_elaboracion.pdf

27.7.4 Public consultations

While information on SNMs and NAPs has been made public, public consultation for the NAPs, as specified in article 22 of the Noise Law, due to delays in drawing up the NAPs, not many public consultations have been carried out yet. There have been public consultations for the SNMs though, and the results of these have been taken into account on the preparation of NAPs. However, rarely the public responds to these consultations, and it has been observed that people are in general more concerned and ready to take some actions in the case of noise from leisure activities, especially those at night in residential areas, such as outdoor parties, discotheques and bars, etc.

An exception are airports, where public consultation was in general effective and received relevant feedback from the public. For example, in the case of the airport of Madrid-Barajas, feedback was received in R1 that lead to AENA (public agency from the Ministry of Development responsible for the management of airports and for the implementation of the END) introduce important changes in the initial version of the SNM and NAP.

Suggested measures included:

- Carrying out surveys, and using the information from the SNMs
- Organising workshops and public campaigns
- Setting up committees at town city level
- Making the information available on the web

27.7.5 Implementation issues

A number of issues were raised as a result of R1, a summary of which is shown below, together with actions taken to address them, and any new issues raised during R2.

Table 274 Noise action planning issues - Spain

R1	R2
Lack of experience in evaluating and managing noise pollution	For R2 there was already more experience and some guidelines available.
Budget and costs implications of noise action planning	Budget limitations due to the financial crisis have delayed the launch of SNMs and NAPs for R2, as well as the implementation of measures from R1 NAPs.
Methodological problems with population data and cartographic information, although the problems were expected to diminish over time	Partially solved with better cartographical data
Noise calculations should be about strategic evaluation and not specific noise studies in specific areas	No an issue any more.
There should be common methods for the evaluation of NAPs	Still valid.
-	The timing set by the Directive for the production of NAPs causes difficulties.

28. SWEDEN

28.1 National implementing legislation for END

28.1.1 Legal implementation

The END is transposed in Sweden through the 2004 Regulation on Environmental noise (*Förordning 2004:675 om omgivningsbuller*[404]). Noise is regulated in an "environmental quality standard" (*miljökvalitetsnorm*) which, together with other environmental quality standards, forms part of the fifth chapter in the Environmental Code. The Environmental Code (*Miljöbalken 1998:808*) incorporates a number of EU directives, including the END, and applies to all noise activities.[405]

The Swedish regulation covers both the levels of noise permitted from different sources as well as the levels of noise to which different places can be exposed. In addition, planning regulations can be applied to aid the control of noise pollution at local level.

Environmental noise pollution is regulated in dwellings including patios and residential areas, and to a certain extent in open-air recreation areas (activities undertaken outdoors can obtain a specific permission that allows for them to exceed the set noise limits). Artillery ranges, industrial and other environmentally hazardous activities or facilities, including wind turbines and motor sport courses, are specifically regulated as well. Boat services and snowmobile traffic is largely unregulated (although there are some restrictions applying to certain areas).

Noise levels are specifically regulated for cars (and other motor driven vehicles), road, railway, and aviation. Relevant legislation and the responsible authorities for each regulation are outlined in the table below.

Table 275 Regulation and the relevant authorities - Sweden

Regulation	Relevant authority
The Environmental Code (*Miljöbalken 1998:808*)	*Swedish EPA* Public Health Agency of Sweden[406] Swedish Transport Administration Swedish Transport Agency National Board of Housing, Building and Planning
Regulation of Traffic Noise in Residential Buildings (*Förordning om trafikbuller vid bostadsbyggnader SFS 2015:216*)	National Board of Housing, Building and Planning
Planning and Building Act (*Plan- och bygglagen, 2010:900*)	National Board of Housing, Building and Planning
Regulation on the rules and procedures for the introduction of noise-related operating restrictions at airports (*Förordning 2004:501 om regler och förfaranden för att av bullerskäl införa driftsrestriktioner vid*	Swedish Transport Administration Swedish Transport Agency

[404] http://www.riksdagen.se/sv/Dokument-Lagar/Lagar/Svenskforfattningssamling/Forordning-2004675-om-omgiv_sfs-2004-675/

[405] http://www.naturvardsverket.se/Stod-i-miljoarbetet/Rattsinformation/Direktiv/EU-register---forfattningar-inom-miljobalkens-omrade/

[406] The Public Health Agency of Sweden has taken over the role of the National Board of Health and Welfare

Regulation	Relevant authority
flygplatser) N.B. This regulation will be amended or withdrawn in the near future following updates to EU rules and the introduction of noise-related operating restrictions at EU airports[407]	
Aviation Act (*Luftfartslagen 2010:500*) Civil Aviation Ordinance (*Luftfartsförordningen 2010:770*)	Swedish Transport Agency
The Road Act (*Väglagen, 1971:948*)	Swedish Transport Administration
The Railway Construction Act (*Lagen om byggande av järnväg, 1995:1649*)	Swedish Transport Administration

28.1.2 Scope of END implementation – Rounds 1 & 2

R1 of strategic noise mapping and noise action planning in Sweden included 3 agglomerations, 2 airport(s), and 1,318 km of major roads and 217 km of railway.

The introduction of definitive thresholds in R2 led to the inclusion of an *additional* 10 agglomerations, an additional airport and approximately an *additional* 1,179 km of major railway lines and 2,674 km of major roads.

Table 276 END coverage – Sweden

Round	Agglomerations	Major airports	Major rail	Major roads
1	3	2	217 km	1,318 km
2	13	3	1,318 km	3,992 km

28.2 Competent Authorities

In Sweden, environmental noise policy, including END implementation, is led by the Environmental Protection Agency, the Swedish EPA (*Naturvårdsverket*), which has been formally designated as the CA by the Swedish Government.

In R1, the Swedish EPA used their network for the national coordination of environmental noise in order to guide on the END. At that time, the national coordination of environmental noise consisted of 13 other national agencies and representatives from the three biggest communities in Sweden (Stockholm, Göteborg and Malmö).

Nowadays (R2), the national coordination of environmental noise has been reorganised and consists of a steering group (which comprises the National Board of Housing, Building and Planning (*Boverket*), the Public Health Agency of Sweden (*Folkhälsomyndigheten*), the Swedish Transport Administration (*Trafikverket*), the Swedish Transport Agency (*Transportstyrelsen*)[408], the Swedish EPA (Chair), and a

[407] http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/trans/141821.pdf

[408] The Sweden Transport Agency has taken on a supportive role to the Swedish Transport Administration as the Administration took over responsibility with short notice and with few resources in place. As shown in Table 3, the Agency and Administration share the workload with regards to mapping and the development of action plans.

noise network. The steering group decides on activities to be carried out through a number of working groups.

The noise network includes the agencies that are part of the Steering Group as well as the Swedish Work Environment Authority (Arbetsmiljöverket), the Swedish Energy Agency (Energimyndigheten), the Swedish Armed Forces (Försvarsmakten) and the associated Generalläkaren, the Swedish Agency for Marine and Water Management (Havs- och vattenmyndigheten), the Swedish Consumer Agency (Konsumentverket) the Swedish Maritime Administration (Sjöfartsverket), the Swedish County Administrative Boards (Länsstyrelserna) and the Swedish Association of Local Authorities and Regions (Sveriges kommuner och landsting).

In R1, the EPA chaired meetings (seven times per year), which covered discussions about the implementation of the Directive and national coordination of environmental noise. These meetings largely replaced written guidelines. The exception was the Swedish Road Administration that produced guidelines for mapping noise from roads. This involves coordination regarding major roads through agglomerations, the exchange of traffic data between the transport authorities and the municipalities, and establishing common technical and legal interpretations of the END.

In order to guide and inform about the END in R2, the Swedish EPA formed an END-network together with the Swedish Association of Local Authorities and Regions (Sveriges kommuner och landsting). The END-network consists of the Swedish Transport Administration (Trafikverket) and all the municipalities covered by the requirements of the END. Other interested municipalities are also welcome to participate in the network.

The Swedish EPA reports developments to the Commission on behalf of all municipalities and other agencies involved.

The Swedish EPA is tasked by the government, through the letter of instruction, to coordinate the implementation of the END. However, no financial resources have specifically been allocated to the task.

Table 277 Administrative Responsibility for the END - Sweden

Role	Agglomerations, Roads	Railways	Airports
Producing and approving SNMs and NAPs	The City of Stockholm's Environment and Health Administration The Environmental Administration of Göteborg The City of Malmö's Environment Department The Swedish Road Administration	Swedish Rail Administration	R2: Swedish Transport Administration (NAPs) and Swedish Transport Agency (mapping) R1: Luftfartsstyrelsen (mapping and NAP)
Coordination/European Commission/EEA reporting	Environmental Protection Agency		

28.3 Designation and delimitation of agglomerations, major roads, major railways and major airports

28.3.1 Data collection

The Swedish EPA has overall responsibility for reporting data to the EEA through the Reportnet system within EIONET. Individual municipalities have been responsible for collecting data on agglomerations for both Rounds 1 and 2. Communication between the CAs, except the communication directly with the Swedish EPA, is done mainly through the END-network (see below).

During both Rounds, the authorities involved used different strategic noise mapping methods:

- The Swedish Rail Administration used a range of data tools: GIS based mapping material, cadastral and land registration authority and certain municipalities and the Swedish Railway Administration's own information on rails and railway screens. For railways that are frequented by more than 60,000 trains/year, the Swedish Rail Administration also used L_{eq} 24 hours and L_{max} as supplementary noise indicators.
- In special cases, L_{eq} 24 hours and L_{max} were used at 2 metres height (rather than 4m as stipulated in the END) as supplementary noise indicators since these are the guiding values in Sweden.
- The number of dwellings affected by noise pollution was assessed using Statistics Sweden's (SCB) GIS-based information on population in house property[409], and which was matched with population statistics from SCB. The method is based on the assumption that everyone in a house is unprotected against noise from the façade which is most exposed to noise and this was commented on during the first implementation report. According to the Swedish Rail Administration this method leads to a systematic fault and over-reporting as many apartments, assessed as being exposed to noise pollution, also might have a quiet side.

28.3.2 Implementation issues

Overall, the Swedish authorities did not experience any implementation problems when delimiting and designating sites.

28.4 Noise limits and targets

28.4.1 Objectives and Scope

Sweden does not set limit values for noise, but applies indicative noise values that are set out in Government Bill 1996/97:53 Infrastructure Objectives for Future Transport. In addition, the Government Bill 2000/01:130 includes an environmental quality objective for a "Well developed environment". This quality objective includes a partial target for noise (see the tables below).

The Environmental Code, Miljöbalken (1998:808), applies to all noise activities. The purpose of the Code is to avoid the harmful of effects of noise on human health. Chapter 2 of the Environmental Code contains a number of general rules of consideration that express, for instance, the precautionary principle, and the ‘polluter pays’ principle, and suitable activities and measures.

[409] Divided in frames of 100 x 100 m

The rules have a preventive effect since they make binding demands on anyone running a business or an operation or taking action to learn about the environmental effects of such activities and express the principle that the risks of environmental impact should be borne by the polluter and not by the environment. Concerning airports and noise from aircrafts, the Swedish Environmental Code (Miljöbalken/) is tougher than the directive and there is a specific environmental court (Miljödomstolen), which sets out the conditions that airport owners must adhere to.

Supervisory and licensing authorities have the power to base their decisions on these general rules of consideration concerning injunctions, bans, permit conditions etc. As a result, the content of these rules becomes much more specific through regulations or decisions in each individual case. In devising noise limit values, Sweden took the WHO methodology into account in R1 and 2.

Table 278 Non-binding target values for noise from residential developments - Sweden

Assessment site	Indicative values for new residential developments or new or significantly altered traffic infrastructure* dB(A)		
	Road-traffic noise*	Rail traffic noise**	Air traffic noise
Equivalent level indoors	30	30	30
Maximum level indoors at night (22:00-06:00)	45	45	45
Equivalent level outdoors (at the façade)	55	60	55
Maximum level in outside spaces of dwellings	70	70	70
New dwellings (SFS 2015:215)[410] Equivalent level outdoors - at the façade – step one	55	55	55
New dwellings (SFS 2015:215)[411] Equivalent level outdoors -at patio/porch	50	50	-
*When applying the indicative values in connection with traffic infrastructure measures, consideration should be given to what is technically possible and economically justifiable. Where the outdoor noise level cannot be reduced to the above levels, the aim should be to ensure that the indoor level is not exceeded.			

[410] Förordning om trafikbuller vid bostadsbyggnader, SFS 2015:216 http://www.notisum.se/Pub/Doc.aspx?url=/rnp/sls/lag/20150216.htm

[411] Förordning om trafikbuller vid bostadsbyggnader, SFS 2015:216 http://www.notisum.se/Pub/Doc.aspx?url=/rnp/sls/lag/20150216.htm

Table 279 Non-binding target values for noise from industrial sites

Land-use type	Noise limit values[412]			
	Day dB (A)	Evening 18:00-22:00 and Sundays and bank holidays 06:00-18:00	Night dB (A)	Occasional noise during the night 22:00-06:00
Residential and leisure use close to residential areas, schools/colleges and healthcare facilities	50	45	40	55
Area for holiday developments and outdoor activities using the natural environment	40	35	35	50

If these indicative noise limit values are not met, authorities can take action (e.g. through injunctions, bans, permit conditions).

28.4.2 Implementation issues

None reported for Rounds 1 or 2.

28.5 Quiet areas

28.5.1 Overview

There were no formal national guidelines for the delimitation of quiet areas either in R1 or R2. However, in 2002, a Swedish Working Group consisting of competent bodies working on noise drew up a proposal for metrics, indicators and auditing methods for "Acoustic Quality in Natural and Cultural Environments"[413], which provides relevant recommendations. The study remains a Swedish EPA report for reference but has not been transcribed into formal guidance.

For the upcoming Round 3, Sweden will use the EEA's report Good practice guide on quiet areas.

There are areas in western and southern Sweden that have been suggested as – and concluded to be suitable – quiet areas. These areas are:

- Lövhagen
- Ören
- Hundudden
- Lövsta
- Fjättern

[412] According to the Round 1 reporting, when applying the indicative values, consideration should be given to what is technically possible and economically justifiable. Where the outdoor noise level cannot be reduced to the above levels, the aim should be to ensure that the indoor level is not exceeded.

[413] See summary document Good acoustic environment... (2007); http://www.naturvardsverket.se/Nerladdningssida/?fileType=pdf&downloadUrl=/Documents/publikationer/620-5708-1.pdf

Although there are no national noise limit values, these areas have been protected from exploitation. These areas are deemed to be "very quiet areas" in accordance with recommendations in the WHO Guidance (albeit not legally binding) and this has also been provided by the Swedish EPA, which published a report in 2007 outlining a classification system for different areas in Sweden.

Table 280 Quiet areas – Sweden

	R1	R2
Number	0	No quiet areas have been announced however the NAPs for the 13 agglomerations indicate that places to be designated as quiet areas are under development and will be announced shortly.
Size (km^2)	N/A	N/A

28.5.2 Implementation issues

No issues were raised as a result of END implementation in Rounds 1 or 2.

28.6 Strategic noise mapping

28.6.1 Overview

Compared to R1, R2 has produced an *additional* 10 SNMs for agglomerations and one *additional* SNM for airports.

No national guidelines have been laid down for Strategic noise mapping, except for roads. Guidelines for mapping noise from roads were developed by the Swedish Road Administration.

Table 281 SNMs - Sweden

	R1	R2
Agglomerations	3	13 (13)
Major airports	2	3 (3)
Major railways	3	13 (13) (1,318 km)
Major roads	3	13 (13) (3,992 km)

Source: European Commission, Rp DF4 8 2012 ANNEX countries ETCSIA Review130828 with WM. data flow 4_8, due in December 2012

28.6.2 Data collection

In R1, the authorities, depending on their access to data, used different methods for mapping noise. All authorities used L_{den} and L_{night} as noise indicators in the preparation of SNMs. Stockholm also used L_{eq} 24 hours as an indicator. L_{eq} 24 hours and L_{max} were also used as supplementary noise indicators by the Swedish Rail Administration for railways that are frequented by more than 60,000 trains/year. In special cases, L_{eq} 24 hours and L_{max} were used at 2 metres height as supplementary noise indicators since these are the guiding values in Sweden. The City of Stockholm, environment and health administration used L_{day} and $L_{evening}$ at 2 and 4 metres above ground separately.

The same data collection methods were used for R2.

Data collection is coordinated (e.g. providing a forum for discussion) by the Swedish EPA, but actual responsibility lies with the municipalities or transport specific agencies. The 13 municipalities are responsible for their respective agglomeration. Luftfartstyrelsen was the CA for airports during R1. For R2, the Swedish Transport Agency is the CA for airports (Luftfartstyrelsen no longer exists), highways, the provinces for major roads outside agglomerations. The municipalities are responsible for roads inside agglomerations. The Swedish Rail Administration is responsible for railways.

Interview feedbacks suggest that there was an element of duplication involved in areas where the authorities had to collaborate and share data (e.g. data for roads within municipalities could have been more easily obtained by the Transport Agency than by the municipalities).

28.6.3 Public accessibility of SNMs

The result of the strategic noise mapping was published on the websites of the responsible authorities through a portal at the EPA's website.

28.6.4 Implementation issues

Table 282 Strategic noise mapping issues - Sweden

R1	R2
With regards to the development of the SNMs for 2006, one major challenge was data access. E.g. the Swedish Rail Administration had problems accessing population data distributed between buildings and within buildings. The Swedish Rail Administration indicated that the information from the Swedish mapping, cadastral and land registration authority regarding the location of the rails was not always correct. The level of detail in the Swedish Railway Administration's maps varied a lot between different areas. The strategic noise mapping of the Swedish Rail Administration was also delayed because the calculation times of the computers used was several weeks. The City of Malmö, Environment Department, the City of Stockholm, environment and health administration and the Environmental Administration Göteborg had difficulties in estimating the number of individuals exposed to noise.[414] The cities had trouble accessing data regarding estimated numbers of dwellings, schools and hospitals exposed to specific values of noise indicators and estimated numbers of people in an area exposed to noise. The Environmental Administration Göteborg also had issues in accessing data regarding existing noise and exceedance of	The municipalities (in particular the 10 cities not involved in R1) have had trouble accessing data regarding estimated numbers of dwellings, schools and hospitals exposed to specific values of noise indicators and estimated numbers of people in an area exposed to noise.

[414] During Round 1, the City of Stockholm, environment and health administration and the Environmental Administration Göteborg called for guidelines and support from the national administration regarding for data quality.

R1	R2
the noise limit values for the 2006 SNMs.	

28.7 Noise action planning

28.7.1 Overview

For R1, six NAPs were produced (for three agglomerations and three airports).

According to an EPA report (2015) [415], for R2, 11 Swedish municipalities produced NAPs. In total, 14 NAPs have been adopted. The Swedish Transport Administration and two municipalities have been delayed with their NAPs and the SNM of one municipality was so deficient that an NAP has not been produced.

The table below provides an overview of the NAPs produced in Sweden in Round 1 and 2.

Table 283 NAPs – Sweden

	R1	R2
Agglomerations	3	14 (11 agglomerations)
Major airports	3 (3)	3 (3)
Major railways	no data	no data
Major roads	no data	no data

The NAPs developed cover a total population of 3 million people in the 12 municipalities. Of these 3 million inhabitants, more than 20% are exposed to equivalent noise levels exceeding 55 dB(A) at their dwellings. The proportion in these municipalities who are exposed to equivalent noise levels exceeding 65 dB(A) at their dwellings vary from just under 1% to around 5%. The cause of the increased exposure is mainly road traffic, followed by railway traffic. Only in the municipality of Stockholm is air traffic a greater problem with approximately 1.5 % of the population of the municipality exposed to noise levels exceeding 55 dB(A) FBN. No municipality identified high equivalent noise levels (>55 dB(A)) from large industries, ports etc. [416]

With regards to airports, Sweden had already spent a considerable amount of funding on noise abatement before END implementation. Noise measures to reduce pollution around the publicly owned airports in Sweden amounted to SEK 82,8m (EUR 8,87m) in 2007. Measures have particularly focused on Bromma Airport (part of Stockholm).

Specifically pertaining to airport mapping and NAPs, the Environmental Code (Miljöbalken) requires the owners of airports in Sweden to go through an initial process of negotiation which aims to agree on the level of environmental protection from the outset. This process includes agreeing on the levels of environmental noise permitted. However, once an agreement is reached the airport owner is also protected against requirements for additional actions. As a result, the NAPs produced as part of the implementation of the END are more effective in e.g. regulating the planning and

[415] Naturvårdsverket Åtgärdsprogram för att följa miljökvalitetsnormen för buller: Sammanställning av framtagna åtgärdsprogram år 2013 enligt förordning (2004:675) om omgivningsbuller

[416] Naturvårdsverket Åtgärdsprogram för att följa miljökvalitetsnormen för buller: Sammanställning av framtagna åtgärdsprogram år 2013 enligt förordning (2004:675) om omgivningsbuller

building on new infrastructure than regulating existing measures, which have already been negotiated as part of the Environmental Code rules. Despite this duplicative work, the mapping exercise (and subsequent NAPs) are seen as a useful tool in developing consistent data on the number of people exposed to noise across the EU.

Table 284 NAPs

	R1	R2
Agglomerations	3	12**
Major airports	2	3
Major railways	3	12**
Major roads	3	12**

**Note – in some countries, NAPs may be available in draft and have been submitted to the EC and the EEA but still not formally adopted by the responsible political decision maker. As such, some R2 NAPs may still not be adopted or published in-country.*

***Uppsala city is yet to report*

28.7.2 Methodology for §noise action planning

NAPs need to be developed in accordance with the Environmental Code (miljöbalken) and the Ordinance (2004:675) on Environmental Noise (förordning om omgivningsbuller).

In R1, no national guidelines for drawing up NAPs were developed. The City of Malmö and the Environmental Administration Göteborg used the 2006 maps as a basis for developing their 2008 NAPs but the other authorities did not. All authorities but the Swedish Transport Agency, Civil Aviation Department used exceedance of noise limit values as a basis for establishing priorities for the NAPs. Health based assessments were used in establishing the noise limit values, based on the recommendations of the WHO.

Other criteria used in Round 1 when establishing the priorities for the NAPs were the Swedish Environmental Quality Objectives and transport policy goals and that the actions must be cost effective.

For R2, the Swedish EPA continued to lead the work on developing priorities in the NAPs. The 2012 SNMs were used to develop all NAPs.

28.7.3 Measures

For R1, measures included in NAPs covered traffic planning, land-use planning, technical measures at source, economic measures, selection of quieter sources, regulation, reduction of sound transmission, insulations and incentives.

Population exposure and cost of implementation were rated as important criteria in selecting measures in NAPs, followed by compatible with other legislation. In addition, the flexibility of measures was considered very important by the Swedish Road Administration. In general, easy implementation was considered very important by competent bodies for agglomerations.

The EPA's summary of the NAPs[417] for R2 conclude that:

- The municipalities have been working to implement measures to reduce noise before the adoption of the END. Overall, the rate of implementing measures is generally planned to increase in the coming five years.
- The level of funding which is dedicated to noise reduction varies significantly and depends on the source of the noise.
- The majority of the noise limiting measures (approximately 75%), planned for the next five years are of an informative or investigative nature. Around one-fifth of measures are practical or physical measures (*e.g.* façade measures or speed reduction) and about 5% are inspection and/or enforcement actions taken primarily against property owners.
- All NAPs focus on measures to be implemented by municipal committees, administrations, and companies.
- In half of the municipalities, physical measures are planned for about SEK 20 (EUR 2.15) per inhabitant per year in the coming five years. In these municipalities the physical noise limiting measures will lead to a distinctly improved sound environment for every one in 100 inhabitants in the coming five years.
- Half of the municipalities plan to provide subsidies for noise reduction measures directed at those exposed to equivalent levels of 61-65 dB(A) at their dwelling.
- The SNMs and NAPs have contributed to the issue of noise having gained increased actualization and that further measures are being implemented in the larger municipalities to reduce noise exposure.

28.7.4 Public consultations

The Swedish authorities (the Swedish Environmental Protection Agency, the Swedish Rail Administration and the City of Stockholm) experienced difficulties to engage with the public during R1. The Swedish Rail Administration stressed the need for awareness raising and the understanding of noise impacts to increase the engagement from both the decision makers and the public.

No such issues have been reported for R2, although there seems to be an agreement that there is little interest from the general public with regards to noise pollution and impacts.

28.7.5 Implementation issues

R1	R2
The major problem encountered seems to have been the implementation time.	Still an issue for 2 municipalities and 2 airports whose NAPs are incomplete/yet to be reported. Another possible issue concerns the financing of measures. These are outlined by the municipalities and authorities in charge of the NAPs, but need to be approved yearly by the municipality's primary council through the annual budget and are as such not guaranteed for the five years which the NAP covers.
The authorities thought that the time between the SNMs and the NAPs to be	The competent authority did not consider this to be an issue for R2.

[417] Naturvårdsverket Åtgärdsprogram för att följa miljökvalitetsnormen för buller: Sammanställning av framtagna åtgärdsprogram år 2013 enligt förordning (2004:675) om omgivningsbuller

R1	R2
finished (one year) was too short. Most of them therefore did not base their NAPs on their SNMs.	
There were issues around the exposure measurement, which in Sweden is 2m over the ground, whereas in the Directive it is 4m. The directive allows other preliminary calculation methods, but the reporting must be in the 4m scale because it is included in the definition of L_{den}. This led to a duplication of work for those who carry out the noise assessments.	Despite the duplication of work, Sweden has chosen to continue to carry out both calculation methods in R2 as the additional efforts were considered to be worthwhile.

29. UNITED KINGDOM

29.1 National implementing legislation for END

29.1.1 Legal implementation

The UK's decentralised administrative structure has meant the END has been implemented separately in England, Scotland, Wales, Northern Ireland and Gibraltar. This country report therefore covers all of these jurisdictions.

The legislation required to implement END (listed in the table below) supplements a pre-existing and comprehensive suite of domestic legislation and policy that has developed over a period of over forty years and which helps to manage noise, over and above the END and related regulations. Other bodies such as local authorities, transport authorities, the Environment Agency and its counterparts in the devolved administrations also have certain responsibilities for specific noise issues that are conferred by statute.

Table 285 END legal implementation

Countries	Legislation
England	• Environmental Noise (England) Regulations 2006 • Environmental Noise (Identification of Noise Sources) (England) Regulations 2007 • Amendments to the Environmental Noise (England) Regulations 2006 and the Environmental Noise (Identification of Noise Sources) (England) Regulations 2007
Scotland	• Environmental Noise (Scotland) Regulations 2006
Wales	• Environmental Noise (Wales) Regulations 2006 • Environmental Noise (Wales) (Amendment) Regulations 2009
Northern Ireland	• Environmental Noise Regulations (Northern Ireland) 2006
Gibraltar[418]	• The Environmental (Assessment and Management of Noise) Regulations 2006 (Gibraltar Law of 23rd November 2006)

[418] https://www.gibraltar.gov.gi/new/environmental-noise

29.1.2 Scope of END implementation – Rounds 1 & 2

R1 of Strategic noise mapping and Noise action planning in UK included 28 agglomerations, 19 major airports, approximately 17,500 km of major road and approx. 2,000km of major railway. The various threshold definition changes in R2, and other societal changes, resulted in 45 *additional* agglomerations, 5 *fewer* major airports, and an *additional* approx. 20,000 km of major roads and an *additional* approx. 4,000 km of major railways. A breakdown of these figures by country is shown in the table below.

Table 286 END coverage – UK

Country	Round	Agglomerations	Major airports*	Major rail	Major roads
UK	**1**	**28**	**19**	**2,160 km**	**17,252 km**
	2	**73**	**14**	**6,339 km**	**37,200 km**
England	**1**	23	15	2,000 km	13,900** km
	2	65	10	5,200* km	25,400** km
NI[419]	**1**	1	1	0 km	1,582 km[420]
	2	1	1	89 km	4,460 km[421]
Scotland[422]	**1**	2	3	120 km	1,020 km
	2	4	3	900 km	5,800 km
Wales	**1**	2	0	40 km	750 km
	2	3	0	150 km	1,540 km
Gibraltar[423]	**1**	0	0	0 km	No data[424]
	2	0	0	0 km	No data[425]

** Other airports, in addition to major airports, may also be relevant in agglomerations; ** To nearest 100*

29.2 Designation and delimitation of agglomerations, major roads, major railways and major airports

During both R1 and R2, data were available to allow for the designation of major roads, major railways, major airports and agglomerations according to the definitions in the END.

A lack of precision in the END's definition of "agglomeration" has led to slightly different approaches to the designation of agglomerations within the UK. The boundaries of agglomerations in the UK are generally based on land defined as "urban" according to government geographical data used to determine the physical extent of towns and cities. This means that the boundaries do not coincide with the administrative boundaries of the (far larger number of) local authorities responsible for the management of most types of noise in these cities. In addition, the agglomeration boundaries sometimes exclude green spaces on the edges of built up

[419] http://www.doeni.gov.uk/doeni_-_final_roads_noise_action_plan.pdf; http://www.doeni.gov.uk/final_roads_noise_action_plan_round_2.pdf; http://www.doeni.gov.uk/ni_end_r2_rail_rr043i2.pdf

[420] outside the agglomeration

[421] outside agglomeration

[422] http://www.scottishnoisemapping.org/downloads/NAPS/Transportation_NAP_Revised_Dec_2010.pdf

[423] https://www.gibraltar.gov.gi/new/environmental-noise

[424] https://www.gibraltar.gov.gi/new/sites/default/files/Major_Road_Noise_Map_2008.pdf

[425] https://www.gibraltar.gov.gi/new/sites/default/files/Round_2_Level_Map.pdf

areas. Agglomeration boundaries in agglomerations in Wales were originally defined in the same way as the rest of the UK but were extended in R2 to encompass more green spaces so that such spaces could be identified as "quiet areas in agglomerations". This was because legal opinion was that a formally identified quiet area had to be within the agglomeration boundary.

29.2.1 Data collection

The approach to strategic noise mapping was strategic and designed to provide an overall indication of noise exposure rather than a precisely accurate value at a particular location. The implications of this approach had to be considered in the design of the R1 and R2 Noise action planning process.

29.2.2 Implementation issues

A number of issues were raised as a result of R1, a summary of which is shown below, together with actions taken to address them, and any new issues raised during R2. The issues identified are broadly common across the UK unless otherwise specified. Where a particular issue is specific to a particular part of the UK (e.g. England, Scotland, Wales, etc.), this is highlighted in brackets.

Table 287 Designation issues - UK

R1	R2
Some definitions in the Directive lacked clarity (such as equivalence and agglomerations)	The END definitions and UK interpretations have not changed in R2, with the exception of Wales extending the agglomerations to include more quiet areas.
	A similar policy, the Noise Policy Statement for Northern Ireland was adopted in Northern Ireland in 2014. Wales extended the scope of its R2 NAP to cover locations and noise issues outside the scope of the END.
The method for delimiting agglomerations was unclear	The END definitions and UK interpretations have not changed in R2, with the exception of Wales extending the agglomerations to include more quiet areas.
Need for interpretation of the definition of a major road or railway where adjacent sections fell above and below the threshold.	The END definitions and UK interpretations have not changed in R2. However, some of the source input data definitions have changed as different/updated datasets became available.

The example of "major roads" is provided to illustrate the complexity behind implementing END definitions. In England, Scotland and Wales, the highway authorities for "trunk roads" and "motorways" are Highways England, Transport Scotland and the Welsh Government respectively. For all other roads and public rights of way in England, the highway authority is usually the County Council or Unitary Authority for a particular area. District Councils in England may carry out some of the functions of a highway authority and these functions may be delegated to them by their County Council. In Northern Ireland the Department of Regional Development owns all roads. In Wales and Scotland there is only a single tier of local government. The END definitions of "> 6,000,000 vehicle passages per year" in R1 and "> 3,000,000 vehicle passages per year" in R2 therefore do not necessarily coincide directly with the UK administrative approach to roads management which requires consideration when allocating responsibilities for noise actions planning between the various responsible highway authorities.

The Directive requires Member States to prioritise steps to reduce and mitigate noise. In England, for example, as part of the NAP process in R1, Defra identified "Important Areas" where the top 1% of the worst-affected people were located (according to the results of strategic noise mapping). Within that, a subset of First Priority Locations (FPLs) was identified with the intention that these locations should be prioritised for investigation. A similar process was followed in R2 although FPLs were not separately identified. Wales took a similar approach to England when identifying "priority areas" in R1, but in R2 set a fixed decibel threshold for defining priority areas on roads and railways in terms of L_{den}, corresponding to the top 1% in R1 for non-motorway roads.

In developing this approach, the CAs needed to be mindful of the need for transport authorities and local authorities to respond to locally set budgets and priorities. The NAPs in England therefore provided a noise management framework with regard to road and railway noise, which allowed the relevant authorities to decide about what, if any, detailed action might be taken. Benefit has been seen from the END in that the NAPs have focussed attention on the areas subject to the highest levels of noise and, in some cases, have relieved pressure on Government to act domestically to introduce additional noise controls.

In Scotland, Noise Management Areas have been identified in order to prioritise noise management. Noise Management Areas are a function of noise, population density and annoyance.

29.3 Competent Authorities and designated administrative bodies

29.3.1 Implementation arrangements

Defra is responsible for engaging with the Commission regarding END on behalf of the UK. It is also the main administrative body for the END in England and produces SNMs (except for aircraft) on behalf of the Secretary of State. Responsibility for noise has been devolved and details of the CAs for the different areas of the UK are given in the tables below.

Whilst national government and the devolved administrations play an important role in setting an overall policy and financial framework, many other stakeholders are involved in implementation. For example, in the case of agglomerations, many of the detailed implementation and local expenditure priorities are delegated to the various relevant local transport authorities. In the case of those roads managed by the newly established Highways England (in England), it has delegated authority to resolve competing priorities within an annual budget and may be able to ring fence funding for noise management.

Table 288 Administrative Responsibility for the END - England

Role/Activity	Agglomerations	Roads	Railways	Airports
Preparing SNMs	Central Government (Defra), except airports where relevant	Central Government (Defra)	Central Government (Defra)	Airport Operators[426]
Approving SNMs		Secretary of State	Secretary of State	Secretary of State
Preparing NAPs	Central Government (Defra) except airports where	Central Government (Defra)	Central Government (Defra)	Airport Operators

[426] Central Government will map airports designated under section 80 for the purposes of section 78 of the Civil Aviation Act 1982

Role/Activity	Agglomerations	Roads	Railways	Airports
	relevant			
Approving NAPs	Secretary of State	Secretary of State	Secretary of State	Secretary of State
EC/EEA reporting	Central Government (Defra)			

Table 289 Administrative Responsibility for the END - Scotland

Role/Activity	Agglomerations	Roads	Railways	Airports
Preparing SNMs	Scottish Ministers			Airport Operators
Approving SNMs	Scottish Ministers			
Preparing NAPs	Scottish Government			Airport Operators
Approving NAPs	Scottish Ministers			
EC/EEA reporting	Scottish Government			

Table 290 Administrative Responsibility for the END – Wales

Role/Activity	Agglomerations	Roads	Railways	Airports
Preparing SNMs	Welsh Government	Welsh Government		Airport Operators[427]
Approving SNMs	Welsh Ministers			
Preparing NAPs	Welsh Government			Airport Operators
Approving NAPs	Welsh Ministers			
EC/EEA reporting	Welsh Government			

** There are no airports in Wales that trigger any of the END thresholds*

Table 291 Administrative Responsibility for the END – Northern Ireland

Role/Activity	Agglomerations	Roads	Railways	Airports
Preparing SNMs	CAs for roads, railways and airports	Department of Regional Development	Rail Operator	Airport Operators*
Approving SNMs	Department of the Environment			
Preparing NAPs	CAs for roads, railways and airports	Department of Regional Development	Rail Operator	Airport Operators*
Approving NAPs	Minister of the Environment			

[427] Central Government will map airports designated under section 80 for the purposes of section 78 of the Civil Aviation Act 1982

Role/Activity	Agglomerations	Roads	Railways	Airports
EC/EEA reporting	Department of the Environment			

For the absence of doubt, it should be noted that whilst NAPs have been prepared and approved/adopted centrally in the UK they will have been subject to an extensive public consultation exercise between these two stages. In addition, in Scotland and Wales and Northern Ireland, multi-agency partnership working was used to develop the NAPs whereas in England the scale of the exercise precluded such an approach.

Table 292 Administrative Responsibility for the END – Gibraltar

Role/Activity	Agglomerations	Roads	Railways	Airports
Preparing SNMs	N/A	Ministry of Environment/Environmental Agency		N/A
Approving SNMs	N/A	Government of Gibraltar		N/A
Preparing NAPs	N/A	Ministry of Environment/Environmental Agency Rail Operator		N/A
Approving NAPs	Government of Gibraltar			
EC/EEA reporting	Government of Gibraltar			

29.4 Noise limits and targets

29.4.1 Objectives and scope

No formal limit values were in force, or under preparation, during Rounds 1 and 2 in the UK. However, the UK does have noise level thresholds in regulations for determining eligibility for façade sound insulation under certain circumstances for road and rail (and guidance for offers of rehousing, and façade sound insulation in the specific case of aircraft noise). These have been taken into account during development of NAPs, and include:

- Noise Insulation Regulations 1975, as amended 1988
- Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996 (as amended)
- The Future of Air Transport, DfT White Paper of 2003
- The Aviation Policy Framework 2013

Some larger industrial installations have permits which include noise limit values under the IPPC regime. In addition, different parts of the UK also have administration-specific guideline values and noise exposure bands for new development in force and under preparation.

The system of Integrated Pollution Prevention and Control set out in the IPPC Directive (2008/1/EC, now re-cast as IED) applies an integrated environmental approach to the regulation of certain industrial activities. This means that emissions to air, water, land, plus a range of other environmental effects (including vibration and noise), must be considered together. It also means that regulators must set permit conditions so as to achieve a high level of protection for the environment as a whole. These conditions are based on the use of the Best Available Techniques (BAT), which balances the costs to the operator against the benefits to the environment. IPPC aims to prevent emissions and waste production and where that is not practicable, reduce them to acceptable levels. IPPC also takes the integrated approach beyond the initial task of permitting through to the restoration of sites when industrial activities cease. Hence, there is potential duplication with managing the noise from Industry sources within the END.

A fundamental reform of the land use planning system in England, has been taking place since 2012. This is one of the most important policy tools for managing the acoustic environment. The principles are that local planning authorities should have more flexibility to make decisions based on local requirements, rather than based on prescriptive, potentially limiting central government guidance. Noise level guidelines were contained in previous planning guidance (known as PPG24) but this has now been cancelled. Concise principles for the control of noise were laid out in the National Planning Policy Framework[428] in 2012. These principles are in line with Government policy in the Noise Policy Statement for England[429]. New Planning Practice Guidance on the control and management of noise under the planning system was first published in 2014 and has been further revised since[430]. Planners and developers are alerted to the existence of the END, NAPs and, in particular, Important Areas and advised that, where relevant, these "should be taken into account".

In Wales, by contrast, planning guidance in note TAN11 has been retained and remains in force. The TAN11 guidance includes some noise level guidelines. In England, Local Planning Authorities have powers to adopt noise level guidelines in local development control documents although they are advised not to apply such guidelines in an inflexible manner.

In Scotland revised planning advice has been published specifically to take account of the Directive and the resulting NAPs, noise management and quiet areas.

29.4.2 Non-binding guideline values

There are also non-binding guideline values, and other criteria, in guidance documents and in British Standards documents such as BS8233 (noise control for buildings), BS4142 (industrial and commercial noise) and BS5228 (construction noise). These documents may contain guideline noise levels but they would normally be applied in practice, in a wider social, environmental and economic context in line with Government policy on sustainable development.

29.4.3 Implementation issues

Any non-binding guidelines that may be applied in the UK will usually have taken into account WHO's latest advice on the health effects of noise, as well as the extensive existing suite of UK noise legislation and guidance. It is recognised that WHO guidance provides thresholds at which adverse effects might start to be detected. It is considered that simply to aim to achieve such WHO values would not take account of the wider social, environmental and economic context. The Noise Policy Statement for England recognises that it is not possible to have a single objective noise-based measure that is applicable to all sources of noise in all situations.

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[428] https://www.gov.uk/government/publications/national-planning-policy-framework--2

[429] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69533/pb13750-noise-policy.pdf

[430] http://planningguidance.planningportal.gov.uk/blog/guidance/noise/noise-guidance/

29.5 Quiet areas

29.5.1 Overview

During both R1 and R2, the UK has focused on the identification of quiet areas in agglomerations, as they were considered to provide the greatest direct benefit to society, and are the only types of quiet area required to be protected from increases in noise under Article 8 of the END.

There has been no attempt to identify quiet areas in open country, mainly because there are already several other existing policy mechanisms to designate areas of the countryside both for conservation purposes (e.g. Habitats Directives) and to protect land from incongruous development. In England, the National Planning Policy Framework also provides for local authorities and communities to designate local green spaces, including ones that are valued for their tranquillity, to protect them from development.

In Scotland, the decision was taken in R1 that candidate quiet areas in agglomerations should be defined as areas which are a minimum of 9 hectares and in which at least 75% of the area is subject to noise levels not exceeding 55dB L_{day} from all sources combined. This resulted in a total of 24 Candidate Quiet Areas (CQAs) being identified in R1 NAPs (12 in Edinburgh and 12 in Glasgow). During R2 a Local Authority was able with good and justifiable reasons to request that any area be classified as quiet. NAPs for the second round of mapping were prepared for four agglomerations. These were released for consultation towards the end of 2013 and together list a total of 77 CQAs (6 in Aberdeen, 5 in Dundee, 38 in Edinburgh and 28 in Glasgow). During the implementation of the NAP, it is intended that a review process should be applied to each CQA to determine whether or not it should become a designated QA. This process involves detailed scrutiny that includes site visits and follows an official procedure described in technical guidance[431].

During R1 in Wales a different approach was taken that involved central and local government officials working together in small working groups in each of the two agglomerations. A pragmatic approach was taken that involved using the SNMs to indicate places that may be quiet, supplemented by consideration of other subjective factors relating to a broader concept of tranquillity before making consensus recommendations for candidate quiet areas on which the public were consulted. A total of 29 quiet areas were designated in the 2 agglomerations in Wales[432] in R1. An additional agglomeration (Newport) qualified in R2, and a further 34 quiet areas designated, bringing the total to 63 across 3 agglomerations and 5 local authorities. They receive special protection from increases in noise under national planning policy. On the back of these designations, the Welsh Government has made grants available to local authorities across the whole of Wales each year since 2012 for projects to improve the provision of tranquil urban green spaces regardless of whether they are in an agglomeration, particularly in deprived communities, and is working to further promote tranquillity through the Green Flag Award scheme.

In Northern Ireland, during R1, the Department of the Environment Planning and Environmental Policy Group (2008) suggested that consideration be given to a range of possible means of defining quiet areas within agglomerations. The list of potential quiet areas would then be taken into consideration, given the knowledge of the nature and usage of the locations identified, before being taken to public consultation. A

[431] http://www.scottishnoisemapping.org/downloads/guidance/Technical_Guidance_for_Quiet_Areas.pdf

[432] http://gov.wales/topics/environmentcountryside/epq/noiseandnuisance/environmentalnoise/noisemonitoringmapping/1stroundquietareas/?lang=en

coarse assessment of CQAs, within the Belfast Agglomeration was undertaken during R1. Broad locations where the total noise level from all mapped sources was below 55dB L_{den} according to the SNMs were indicated in the R1 Roads NAP. Following the development of noise assessment criteria by the NIENDSG, it is intended that these preliminary CQAs will be further refined and prioritised by DOENI during R2.

An approach has evolved in England across Rounds 1 and 2 that encourages Local Authorities to nominate candidate areas using a semi-formal process that has been integrated with national and local land use planning policies. The R1 agglomerations NAPs outlined a high-level approach for the identification and management of quiet areas and described their anticipated attributes. Since R1, Defra has worked to support the implementation of this policy by commissioning a number of small studies in liaison with various local authorities, including and trials of different locally-led approaches to identifying quiet areas. Defra also commissioned research exploring how the benefits of quiet areas might be monetised. Defra has responded to the findings of these studies in the R2 Agglomeration NAP by providing a structured process and criteria to facilitate the identification and preservation of quiet areas. To avoid duplication with existing national planning policy, END quiet areas in agglomerations must first be designated local green spaces that are particularly valued for their tranquillity. A number of Local Authorities are believed to be making progress in identifying local green spaces and subsequent quiet areas within their districts but as yet Defra has not formally identified any quiet areas in England.

The table below summarises the number and size of identified or designated quiet areas established during Rounds 1 and 2 in the UK. It should be noted that the same R1 quiet areas may have also been identified in R2 NAPs.

Table 293 Quiet areas - UK

	R1		R2	
	Number	Size (km^2)	Number	Size (km^2)
England	0	n/a	0	n/a
Scotland	12*	n/a	77*	n/a
Wales	29	2	63	13
Northern Ireland	0**	n/a	0**	n/a
Gibraltar	n/a****	n/a	n/a****	n/a
Total UK	>41***	n/a	>140***	n/a

** CCQA; ** Areas < 55 dB(A) L_{den} indicated on consolidated R1 map; *** Including CCQA ****There are no agglomerations in Gibraltar*

Delimitation

During R1, a number of different approaches to the identification of quiet areas were used in each country, and these continued to develop and evolve during R2.

Table 294 Quiet area delimitation – UK

Country	Definition
England	A process has been created so that quiet areas in agglomerations can be nominated by local authorities and confirmed by central government in line with land use planning policy
NI	R1 quiet areas derived from SNMs and equate to broad areas below the L_{den} 55dB noise band from all sources combined, further guidance awaited.
Scotland	R1 candidate quiet areas were open spaces to which the public have access which are over 9ha in size, of which 75% falls below 55 dB Lday from all sources combined. Additional candidate quiet areas have been proposed in R2
Wales	A number of quiet areas have been identified by central and local government working groups using SNMs and subjective tranquillity assessments.

Agglomerations

The number of quiet areas (including candidate quiet areas) in the UK has increased from over 41 during R1 to over 140 during R2. The R2 process is continuing. .

Open country

There are no quiet areas in open country in the UK that have been identified or designated under the END (and indeed there is no requirement to do so). However, there are large areas in open country that are already designated both for conservation purposes and to protect them from incongruous development under existing policy mechanisms.

29.5.2 Implementation issues

A number of issues were raised as a result of R1, a summary of which is shown below, together with actions taken to address them - and any new issues raised during R2.

Table 295 – QA designation issues - UK

R1	R2
Definition of quiet areas lacked clarity	Scotland, Wales & NI have designated quiet areas using different approaches. England has developed a procedure to encourage local identification.
Insufficient evidence of benefits of delimiting quiet areas in rural areas from maps and the mapping requirement is not sufficient to allow such identification.	As identification of quiet areas in rural areas is not a requirement of the END, this is not considered an issue.
Conflicts exist between the control of new development and the protection of quiet areas.	These conflicts remain, need for liaison between development control and END procedures.

29.6 Strategic noise mapping

29.6.1 Overview

SNMs were produced in 2006 (R1) and 2012 (R2), and an overview of their number and type is shown below. The total in aggregate is first presented, followed by the number of SNMs disaggregated by country.

Table 296 SNMs - UK

	R1	R2
Agglomerations	**Total - 28** • England: 23 • Wales: 2 • NI:1 • Scotland: 2 • Gibraltar: 0	**Total – 70 (73)** • England: 65 (65) • Wales: 3 (3) • NI 1 (1) • Scotland: 4 (4) • Gibraltar: n/a
Major airports	**Total - 20** • England: 15 • Wales: 0 • NI: 1 • Scotland: 4 • Gibraltar: 0	**Total – 14 (16)** • England: 10 (12) • Wales: n/a • NI: 1 (1) • Scotland: 3 (3)*** • Gibraltar: n/a
Major railways	**Total** - 4 • England: 1 • Wales: 1 • NI: 1 • Scotland: 1#* • Gibraltar: 0	**Total** – **4 (4) (6,339 km)** • England: 1 (1) • Wales: 1 (1) • NI: 1 (1) • Scotland: 1 (1)* • Gibraltar: n/a
Major roads	**Total** - 5 • England: 1 • Wales: 1 • NI: 1 • Scotland 1 #* • Gibraltar: 1	**Total – 4 (5) (37,200 km)** • England: 1 (1) • Wales: 1 (1) • NI: 1 (1) • Scotland 1 (1)* • Gibraltar: 1**

*** For **England**- There is no legal requirement to submit maps to the Commission for agglomerations, just to submit the results from the population exposure assessment which was carried out for all 65 agglomerations. Furthermore, the CA stated that due to the large number of agglomerations for England submitting the maps would have had a significant administrative burden.*

**** For **Scotland**- one airport fell below the END threshold for R2.*

*# For **England**- 5 airports that had been major airports for R1 and the start of R2 fell out of the END threshold for R2 by the time the mapping was done.*

For **Scotland**- only has one online SNM covering all the transportation sources covered by END at http://www.scottishnoisemapping.org/.*

*#** For **Gibraltar**- we don't hold this information.*

The UK authorities completed R2 of strategic noise mapping as required by the END. A particular challenge in England was the far larger number of agglomerations and major roads captured by the definitive thresholds introduced in R2. This resulted in an increase in the extent of mapping calculations required, despite a reduction in the allocated budget.

29.6.2 Data collection

Most topographic data was already available from government agencies and local authorities. Information on noise sources was obtained from asset owners; industrial site information was obtained from national registers and data specific to propagation were captured by survey either directly in the field or remotely using aerial imagery. Data required for the calculations of noise levels were collated in liaison with various organisations including the Department for Transport, Highways Agency, Network Rail and the Environment Agency.

The Defra website indicates that the England SNMs were made using computer modelling techniques, based on information such as traffic flow data, road/rail type, and vehicle type data, with no actual noise measurements made. It further explains that the modelling took account of features that affect the propagation of noise, such as buildings and topology (e.g. earth bunds), and whether the ground is acoustically absorbent (e.g. grass covered) or reflective (e.g. concrete or water). Calculations produced noise level results on a 10m grid at a receptor height of 4m above ground, as required by the END and the Regulations. Strategic noise mapping in Wales, Scotland, Northern Ireland and Gibraltar followed a similar approach.

The R1 process completed in 2007 was the first strategic noise mapping covering all of the larger urban areas. This meant there were few contractors experienced in producing large scale SNMs. Therefore, for the first round of strategic noise mapping in England, Defra divided the agglomerations, major roads, railways, industry and support functions into multiple separate contracts that were awarded to a number of different contractors with varying amounts of expertise.

Defra reviewed options in preparation for the increased coverage of R2 Strategic noise mapping. Relevant capabilities and expertise were still not widespread in the marketplace. Defra made the decision that the Strategic noise mapping work for R2 would be provided using just two contracts, one for data sourcing and management, input data preparation task and exposure assessment, and one for the noise level calculation task.

The contractual arrangement was designed to minimise Defra's project management activities, as well as the overall cost of the process. All noise calculation for England was carried out within a six-month period, significantly quicker than in R1. Using a single data preparation and noise calculation contractor also meant that consistency was obtained across the country. In Scotland all data collection and cleaning was carried out by a single consultancy organisation.

Collecting data so it is real-world relevant can be costly and time-consuming (in particular for the ground model). Some of this data can be reused between rounds, which accounts in part for the efficiency savings made between R1 and R2. However, it is important to note that this data cannot be reused indefinitely as it will gradually become out of date.

29.6.3 Strategic noise mapping methods

The UK does not have a statutory Strategic noise mapping methodology, but national methods exist for the prediction of some of the noise sources and these have been used for Strategic noise mapping (see table below). For road and rail sources these methods were originally designed for other purposes, such as to help determine eligibility for façade sound insulation at high noise levels. There has been no official attempt to validate UK SNMs with measurements due to the strategic nature of the mapping exercise. However, available research indicated that the results obtained were broadly equivalent to the END interim methods.

Strategic noise mapping results were combined with information on population and their location to determine population exposure. The Defra website states that: "Population exposure figures are calculated by firstly statistically assigning census output area data to buildings in the mapped area (rather than precisely determining the number of people living in each building). A count is then made of number of people falling in each noise band calculated. All population exposure figures are rounded to the nearest 100 people, in accordance with the requirements of the END." In Scotland an average of 2.3 people per dwelling was used.

Table 297 Noise prediction methods used in R1 and 2 - UK

Noise source	Method
Road	UK Calculation of Road Traffic Noise + corrections
Railway	UK Calculation of Railway Noise
Aircraft	UK Aircraft Noise Model (CAA – ANCON) The SNMs for some airports were developed using the Report on Standard Method of Computing Noise Contours around Civil Airports (referred to as ECAC Doc. 29 v 3) as implemented in INM v 7
Industrial	Toolkit 10 of the "Good Practice Guide for Strategic noise mapping and the Production of Associated Data on Noise Exposure Version 2[433]

The formal publication (and subsequent transposition) of the Directive that amends Annex II of the END will lead to use of the EU's CNOSSOS common methodology from Round 4. However, none of the five UK countries intend to adopt the CNOSSOS methodology on a voluntary basis for Round 3, other than possibly undertaking some limited trials.

29.6.4 Public accessibility

It is UK government policy that environmental information is made available to the public.

In England, SNMs for major road and major rail sources identified in the first round of Strategic noise mapping are available on the archived Defra website at: http://archive.defra.gov.uk/environment/quality/noise/environment/mapping/index.htm. Interactive maps for first round agglomerations with links to Strategic noise mapping and exposure results are available from http://services.defra.gov.uk/wps/portal/noise, and can be searched by postcode to find SNMs for specific areas for road, rail and industrial sources. In the transition from a Defra website to a government-wide website, some links have been lost and this is being rectified as part of the transition process and will also include the R2 maps. Current SNMs for airports are available from their NAPs which are published on the airports' websites.

The Welsh interactive SNMs may be viewed and searched by postcode at:

http://data.wales.gov.uk/apps/noise

The Scottish interactive SNMs may be viewed and searched by postcode at

http://www.scottishnoisemapping.org/

433 Position Paper Final Draft (European Commission Working Group Assessment of Exposure to Noise, 13 January 2006) (WG-AEN)

Northern Ireland has online maps along with population exposure tables, available at:

http://www.noiseni.co.uk/index/maps-and-charts.htm

Gibraltar roads SNM can be viewed at:

http://www.environmental-agency.gi/documents/NoiseMap.pdf

29.6.5 Implementation issues

Defra produced a Progress Report[434] in January 2014 on END implementation in England with a focus on implementation of R1 NAPs (NAPs). The issues raised in the report are summarised in the table below.

A paper published in November 2014 at a major international conference, Internoise 2014, mentions some of the organisational and technical implementation issues that arose during R2 Strategic noise mapping in England[435], and concludes that: "A different contractual approach has led to a more cost-effective way of producing the calculated noise values. In addition, the English results may now be more comparable with some other EU country's results, because of the interpretation used on which roads to model within agglomerations. However, direct comparison between R1 and R2 results for England is discouraged because of the different assessment methodologies used. The use of CNOSSOS, if implemented, for Round 3 calculations across the EU will enhance comparability of results between different countries, but will also make comparison back to R1 and 2 results difficult."

Table 298 Strategic noise mapping issues - UK

R1	R2
Lack of a harmonised mapping method	Financial constraints have resulted in a need for a different more cost-effective approach to Strategic noise mapping in R2.
Lack of clarity on reporting requirements prior to the publication of ENDRM in 2007	Different approach taken to modelling roads in agglomerations means that R1 and R2 results are not directly comparable in England
Lack of guidance	Improved railway vehicle movements data that became available and was used in R2 means that R1 and R2 railway results are not directly comparable in either England or Wales
Lack of formal technical specifications	
Problems accessing all data Lack of high-quality data when mapping to a detailed level technical specifications were developed at a mapping project level	
A general lack of data designed specifically for Strategic noise mapping	

[434] Environmental Noise Directive, Implementation of Round 1 Noise Action Plans: Progress Report, January 2014, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/276239/noise-action-plan-progress-report-201401.pdf

[435] http://www.acoustics.asn.au/conference_proceedings/INTERNOISE2014/papers/p561.pdf

29.7 Noise action planning

29.7.1 Overview

An overview of the number of NAPs produced during R1 and R2 is shown in the table below. The total in aggregate is first presented, followed by the number of NAPs disaggregated by country.

Table 299 NAPs

	R1	R2
Agglomerations	**Total -** 28 • England:23 • Wales: 2 • NI: ** • Scotland:2 • Gibraltar: 0	**Total – 8 (72)** • England:1 (65) • Wales: 3 (3) • NI: ** • Scotland:4 (4) • Gibraltar: n/a
Major airports	**Total -** 19 • England:15 • Wales: 0 • NI: 1 • Scotland: 3 • Gibraltar: 0	**Total – 14 (16)** • England:10 (12) • Wales: n/a • NI: 1 (1) • Scotland: 3 (3)* • Gibraltar: n/a
Major railways	**Total -**4 • England: 1 • Wales: 1 • NI: 1 • Scotland: 1## • Gibraltar: 0	**Total – 4 (4)** • England: 1 (1) • Wales: 1 ##* (1) • NI: 1 (1) • Scotland: 1 (1) • Gibraltar: n/a
Major roads	**Total -** 5 • England: 1 • Wales: 1 • NI: 1 • Scotland: 1## • Gibraltar: 1	**Total -** 5 • England: 1 (1) • Wales: 1* (1) • NI: 1 (1) • Scotland: 1## (1) • Gibraltar: 1**

Source: Defra and the devolved UK administrations

*Notes: * R1 Agglomerations: NI-Belfast; Scotland - Edinburgh, Glasgow; Wales - Cardiff / Penarth, and Swansea / Neath Port Talbot; England –Birkenhead, Blackpool, Bournemouth, Brighton, Bristol, Coventry, Hull, Leicester, Liverpool, London, Manchester, Nottingham, Portsmouth, Preston, Reading, Sheffield, Southampton, Southend, Teesside, The Potteries, Tyneside, West Midlands, West Yorkshire; **One combined Transportation NAP for major roads and railways in Scotland; ***R2 Agglomerations: NI-Belfast, Scotland – Aberdeen, Dundee, Edinburgh, Glasgow; Wales - Cardiff and Penarth, Newport, and Swansea and Neath Port Talbot; England - One R2 Agglomeration NAP covers all 65 agglomerations – see https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/276228/noise-action-plan-agglomerations-201401.pdf; #R1 Major Airports: England: Birmingham, Blackpool, Bournemouth, Bristol, East Midlands, Gatwick, Heathrow, Leeds/Bradford, Liverpool, London City, Luton, Manchester, Newcastle, Southampton and Stansted; NI: Belfast International; Scotland: Aberdeen, Edinburgh, Glasgow; #R2 Major Airports: England: Birmingham, Bristol, East Midlands, Gatwick, Heathrow, London City, Luton, Manchester, Newcastle and Stansted; NI: Belfast International; Scotland: Edinburgh, Glasgow*

In practice, NAPs were prepared by Major Airports plus those other airports where their noise emissions contributed to the reported exposure statistics within agglomerations.

29.7.2 Methodologies for noise action planning

During R1, guidelines for drawing up and implementing NAPs were consulted upon and confirmed at a national level (for England, Scotland, Wales and Northern Ireland). The 2006 SNMs were used as a basis for the 2008 NAPs, and to identify areas for prioritisation during Noise action planning. The NAPs were developed following a consultation process involving local authorities, other government departments and other interested bodies and members of the general public. Central and devolved government (or government agencies) took the lead for most of the drafting of R1 NAPs the only exception being airports which were required to draw up, consult upon and implement their own NAPs.

A broadly similar approach was taken to the preparation of the R2 NAPs. A number of efficiency savings were made in the style of the finished documents and the contents drew heavily on the approach taken during R1.

29.7.3 Measures- a case study focusing on England

Across England, Wales, Scotland, NI and Gibraltar, a wide variety of different types of measures that have been identified in NAPs for R1 and R2. However, due to space limitations in this country report, and the fact that the UK is unusual in that there are five different sets of national regulations, the examples of measures focus on selected measures as a case study for England.

At the end of R1, for England, the Defra website had noted that "It is envisaged that NAPs will identify relevant measures (both existing and new) to manage environmental noise from the sources mapped. Such measures could range from over-arching national strategies which take noise into account, to local targeted measures designed primarily to address a specific noise issue. The plans will also include some form of cost-benefit assessment of measures, to ensure their sustainability, and estimates of the reduction of the number of people affected by excessive noise as a result of the proposed measures."

In January 2014, Defra reported[436] on progress in the implementation of R1 NAPs in England as follows:

- **General approach**: In the first instance it was necessary to clarify the main aims of Government policy on noise. This resulted in the publication of the Noise Policy Statement for England (NPSE)[437]. The NAPs were designed to focus on those worst affected and enable local decision makers to address the first aim of the NPSE. In order to facilitate this Defra identified "Important Areas" where the top 1% of the worst affected people were located (according to the results of the Strategic noise mapping). Within that, a subset of First Priority Locations was identified with the intention that these locations should be prioritised for investigation. Defra needed to be mindful of the need for transport authorities and local authorities to respond to locally set budgets and priorities. The NAPs therefore provided a noise management framework with regard to road and railway noise, which allowed the relevant authorities to decide about what, if any, detailed action might be necessary.

[436] Environmental Noise Directive, Implementation of Round 1 Noise Action Plans: Progress Report, January 2014, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/276239/noise-action-plan-progress-report-201401.pdf

[437] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69533/pb13750-noise-policy.pdf

- **Range of outcomes**: For each Important Area, the relevant transport authority was asked to consider the existing noise management and decide what further measures, if any, might be taken to assist the management of noise. A range of possible outcomes were anticipated. These were:

  A: It is possible to be able to implement an action and there are financial resources immediately available to do so.

  B: It is possible to be able to implement an action but there are no immediately available financial resources to do so.

  C: It is not possible to implement any action because there is no scope for doing so or there is some overriding technical issue that prevents implementation.

  D: It is not possible to implement any action because there would be large adverse non-acoustics effects that could not be accommodated by the proposed measure.

  E: Nothing further needs to be done as the noise level at each dwelling in the Important Area is below 65 dB(A), $L_{A10,18h}$, (roads) or 65 dB(A), $L_{Aeq,18h}$, (railways) ignoring the effect of reflection from the facade of the relevant dwelling.

  A/B: Both Outcomes A and B apply

Investigation: A three-stage investigation process was defined:

Stage 1. Identification of an outcome by the relevant transport authority;

Stage 2. Liaison between the transport authority and the relevant local authority about the proposed outcome;

Stage 3. Final decision by the transport authority, taking account of any feedback from the local authority.

Defra also developed an online (restricted access) NAP Support Tool to facilitate information exchange between Defra, the various transport authorities and local authorities.

Progress made was summarised for each noise source:

Roads: For the first round of NAPs, a total of 8,105 Important Areas for roads were identified, comprising 3,487 First Priority Locations and 4,618 other Important Areas. There are just over 150 different highway authorities in England and all except two authorities had at least one Important Area associated with the roads they manage. The Highways Agency had just over 2,400 Important Areas and Transport for London had just under 300. A further eleven highway authorities had over 100 Important Areas each. By 22nd January 2014 291 Important Areas had reached as far as Stage 2 and 2,622 had completed the process and reached Stage 3. This means that investigations have commenced or been completed for just over 35% of the identified Important Areas for roads at that time.

Railways: For the first round of NAPs, a total of 614 Important Areas were identified that comprised 159 First Priority Locations and 455 other Important Areas. The various bodies involved in the management and operation of the railways liaised to implement the NAP. As of 22nd January 2014 12 Important Areas had reached Stage 2 and 559 had reached Stage 3. This means that investigations have commenced or been completed on nearly 93% of the identified Important Areas at that time.

Aviation: Prior to the transposition of the END, most large airports in England were already routinely undertaking their own Strategic noise mapping, and had also implemented a range of local noise management measures specifically tailored to the size and impact of their operations. It was therefore decided that the relevant Airport Operator should be responsible for producing SNMs and for Noise action planning (in consultation with relevant stakeholders). SNMs were produced by all major airports and also those other airports where their noise emissions contributed to the reported exposure statistics within agglomerations. A total of 17 R1 aviation SNMs and NAPs (15 major airports plus 2 others) were reviewed and adopted by the Government. Each airport has a copy of their NAP on their website. As part of the process for reviewing and adopting the airport NAPs, the Government compiled and published a schedule of the noise management actions identified by the various airports.

Industry: Noise from industrial sources is currently managed through three parallel and complimentary regimes:

- development control through land use planning;
- control through European and national industrial pollution control regulations; and
- control through the use of national Statutory Nuisance legislation.

It is considered that above existing noise management regime provides suitable mechanisms for the proactive and reactive management of noise issues from the industrial sources mapped in END agglomerations.

Implementation of NAP (using roads as an example): On December 1st 2014, the government launched its first 'Road Investment Strategy' (RIS)[438]. This sets out an ambitious, long-term programme for motorways and major roads (not necessarily END major roads) with the stable funding needed to plan ahead effectively. The RIS has been summarised in a seven-page leaflet[439]. The RIS includes, amongst other features, a long-term vision for the strategic road network (SRN), outlining how the government plans to create smooth, smart and sustainable roads and a multi-year investment plan that will be used to improve the network and create better roads for users. Over the next 5 years it is stated that this first RIS will see £15.2 billion invested in over 100 major road schemes to enhance, renew and improve the network, help to prevent over 2,500 deaths or serious injuries on the network, build over 1,300 additional lane miles, improve 200 sections of the network for cyclists and "will seek to mitigate 1,150 Noise important Areas reducing the impact of noise for around 250,000 people as well as resurfacing 80% of the SRN using low noise road surfacing".

29.7.4 Public consultations

A public consultation was organised in England by Defra on behalf of UK government on all UK R1 and R2 NAPs in England. Furthermore, transport authorities and operators in most cases held additional public consultations at the local level on specific mitigation measures emerging during the implementation stage. In England, the government response to the full public consultation on the R2 NAPs was published in January 2014:

https://www.gov.uk/government/consultations/draft-noise-action-plans

[438] https://www.gov.uk/government/collections/road-investment-strategy

[439] https://www.gov.uk/government/publications/road-investment-strategy-summary-leaflet

The final R2 NAPs for agglomerations, major roads and major railways in England are available at:

https://www.gov.uk/government/publications/noise-action-plans-large-urban-areas-roads-and-railways

The public consultation was open for 14 weeks. Defra received a total of 23 responses from local authorities, transport authorities, private individuals, and other interested parties to its public consultation on agglomerations, major roads and major railways in England.[440]

Airport NAPs in England are published on the relevant airport website.

Gatwick Airport, for example, summarised the responses to its public consultation which was open for 16 weeks in a document along with its own position as an airport operator in relation to the feedback received.[441]

Details of R2 consultation undertaken in Northern Ireland are no longer available on the government website as the consultation is now more than two years old. The final R2 NAPs for Northern Ireland can be found here:

http://www.doeni.gov.uk/index/protect_the_environment/local_environmental_issues/noise/environmental_noise_directive-2.htm

Details of R2 public consultations undertaken in Scotland can be found here:

http://www.ep-scotland.org.uk/news/draft-noise-action-plan-consultation/

The final R2 NAPs for Scotland are available at:

http://www.scottishnoisemapping.org/public/action-planning.aspx

Details of R2 public consultation undertaken in Wales can be found here:

http://gov.wales/consultations/environmentandcountryside/noise-action-plan-for-wales/?lang=en

The final R2 NAP for Wales (which incorporates the individual END NAPs for major roads, major railways and agglomerations plus additional Wales-wide noise actions) is available at:

http://gov.wales/topics/environmentcountryside/epq/noiseandnuisance/environmental noise/noisemonitoringmapping/noise-action-plan/?lang=en

The draft R2 NAP for major roads in Gibraltar was made available on the Environmental Agency website for the information of the general public: http://www.environmental-agency.gi

The final R2 NAP for major roads in Gibraltar is available at:

http://www.environmental-agency.gi/NoiseActionPlan.pdf

[440] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/276228/noise-action-plan-agglomerations-201401.pdf

[441] Annex 9. https://www.gatwickairport.com/globalassets/publicationfiles/business_and_community/all_public_publications/2010/gatwick_airport_end_noise_action_plan_june_2010.pdf

29.7.5 Implementation issues

A single, albeit important, issue was raised during R1 with respect to implementation, which is repeated below, together with any subsequent actions taken to address it, and new issues raised during R2.

Table 300 Noise action planning issues

R1	R2
Time available between the completion of the mapping and for preparing, consulting upon and adopting NAPs was too short.	The wording of, and the approach to, R2 NAPs is based upon lessons learned during R1. The budget available for preparing NAPs was reduced. In England 23 agglomeration NAPs were produced for R1 whereas 1 NAP was produced to cover all 65 R2 agglomerations to avoid duplication. In Wales a single national NAP was produced to avoid the duplication and incomplete coverage resulting from separate NAPs for major sources and agglomerations. The implementation of R1 and R2 NAPs is a significant task and requires a longer term approach than is acknowledged in the requirements of END. The implementation of R1 and R2 NAPs needs to take account of wider economic, social and other environmental considerations. Funding has recently (Dec 2014) been made available to Highways England that should assist with the implementation of NAPs for major roads in England (see 1.7.3).

European Commission

Evaluation of Directive 2002/49/EC relating to the assessment and management of environmental noise

Appendices

Second Implementation Review and Evaluation of the Environmental Noise Directive

The Centre for Strategy & Evaluation Services LLP
April – *2016*

Centre for Strategy & Evaluation Services

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AECOM

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Evaluation of Directive 2002/49/EC relating to the assessment and management of environmental noise

Appendices

Second Implementation Review and Evaluation of the Environmental Noise Directive

Directorate-General for Environment
Knowledge, Risks and Urban Environment

2016

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APPENDIX A – LIST OF COMPLETED INTERVIEWS

No.	MS	Name	Organisation	Position	Organisation type
1	EU	Michael Dodds	DG GROW - Outdoor noise equipment mobile machinery	Policy officer	European Commission - Community legislation on noise at source
2	EU	Piotr RAPACZ	DG MOVE, railway noise	Policy officer	European Commission – Community legislation on noise at source
3	EU	Stylianos Kephalopoulos	DG JRC	Policy officer	European Commission, JRC
4	EU	Tobias BAHR	European Automobile Manufacturer's Association (ACEA)	Environmental Policy Director	Industry association
5	EU	Erwin KIRSCHNER	European Automobile Manufacturer's Association (ACEA)	Technical Affairs Director	Industry association
6	EU	Hans-Martin Gerhard	Porsche AG	Policy officer	Industry
7	EU	Chrystelle Damar	ACI EUROPE (Airports Council International)	Head of Environmental Strategy & Intermodality	EU – industry association
8	EU	Ethem Pekin	Community of European Railways	Policy officer	EU – industry association
9	CY	Joanna CONSTANTINIDOU	Ministry of Agriculture, Natural Resources and Environment	Policy officer	Public authority
10	DK	Lisette Mortensen (LIMO)'	Danish Railways (LIMO)		Public authority (rail)
11	DK	Jakob Fryd	Danish Road Directorate		Public authority
12	DK	Jens Jensen	COWI	Acoustics consultant	Consultancy
13	EL	Kyriakos Psychas	Ministry of Environment	Policy officer	Public authority
14	EL	Prof. Kostas Vogiatzis	University of Thessaly Laboratory of Transportation	Director	Academic Expert responsible for strategic noise maps and actions plans in Greece and

No.	MS	Name	Organisation	Position	Organisation type
			Environmental Acoustics		Cyprus Representative of Greece in EU working groups
15	IE	Willie Pearce	Irish Rail/ Iarnród Éireann	Manager, Energy & Environment	Public authority (rail)
16	IE	Mark Conroy	Irish Rail/ Iarnród Éireann	Manager, Energy & Environment	Public authority (rail)
17	IE	Dr. Vincent O'Malley	Irish Roads Authority	Environmental Manager, Environment Unit.	Public authority (roads)
18	IE	Tony Dolan	Environmental Protection Agency	Head of Competent Authority, noise division	Competent authority (national)
19	IE	Brian McManus	Dublin City Council.	Head of Traffic Noise & Air Quality Unit, Environment & Transportation Dept,	Public authority (agglomeration)
20	INT	Nick Craven	International Union of Railways		Industry association
21	LT	Valdas Uscila	Ministry of the Environment, Republic of Lithuania	Policy official, environmental noise	Competent authority (national)
22	LV	Oskars Beikulis	SIA Estonian, Latvian & Lithuanian Environment Skolas	Environmental consultant (SNM)	Consultancy
23	NL	Annemarie van Beek	RIVM		Competent authority
24	PT	Maria Leite	AP Ambiente		Competent authority
25	UK	Colette Clarke	Department for Environment, Food and Rural Affairs (DEFRA)	Head of Noise & Statutory Nuisance Policy Team	Competent authority
26	UK	Hilary NOTLEY	Department for Environment, Food and Rural Affairs (DEFRA)	Senior Technical Advisor, Noise and Nuisance	Competent authority

No.	MS	Name	Organisation	Position	Organisation type
				Team	
27	UK	Anna Hunt	Department for Environment, Food and Rural Affairs (DEFRA)	Policy Advisor, Resource, Sustainable Development, Noise and Nuisance	Competent authority
28	UK	Linda Story	Scottish government	Policy Advisor, Environmental Quality Division	Competent authority
29	UK	Martin McVay	Welsh government	Policy Advisor (Environmental Noise and Chemicals)	Competent authority
30	UK	Amy Holmes	Northern Ireland	Policy Advisor	Competent authority
31	UK	Rick Jones	Rail Safety and Standards Board (RSSB)	Acoustic Expert	Public authority (rail)
32	UK	Tim Johnson	Aviation Environment Federation	Director	Civil society organisation
33	UK	John Stewart	HACAN	Director	Civil society organisation
34	UK	Simon Shilton	ACUSTICA	Senior Consultant	Consultancy
35	UK	Brendon Sewill	Gatwick Area Conservation Campaign (GACC)	Chairman	Civil society organisation
36	UK	John Bryant	Gatwick Area Conservation Campaign (GACC)	Director	Civil society organisation
37	BE	Jean-Pierre LANNOY	DPA - Walloon Region, Belgium (Service Public de Wallonie, Département de l'Environnement et de l'Eau)		Competent Authority
38	BE	Mme Marie Poupé	Institut Bruxellois pour la Gestion de l'Environnement - Dpt Bruit – Service Plan Bruit - Bruxelles Environnement, Bruxelles-Capitale		Competent Authority
39	BE	Mrs Sandra Geerts	Flemish government, Department Environment, Nature		Competent Authority

No.	MS	Name	Organisation	Position	Organisation type
			and Energy		
40	MT	Christopher Camilleri	Environment Protection Directorate (MEPA)		Competent Authority
41	SE	Johanna Bengtsson Ryberg Moa Ek Per Andersson (Written input from Marta Misterewicz and Tor Borinder) interview undertaken 20 May	Swedish Environmental Protection Agency	Coordinator	Public authority
42	UK	Anna Hunt	Resource, Sustainable Development, Noise and Nuisance	Policy Advisor	Consultancy
43	PL	Piotr Ochnio	General Directorate of National Roads and Motorway in Poland (GDDKiA)	Head of Department Environmental Assessment and Monitoring Department of the Environment	Public authority (roads)
44	PL	Beata Telega-Królikowska	General Directorate of National Roads and Motorways in Poland (GDDKiA)	Vice Head of Department Environmental Assessment and Monitoring Department of the Environment	Public authority (roads)
45	PL	Łukasz Dudzikowski	Polish Railways (PKP PLK)	Project Director Environmental noise measurements	Public authority (rail)
46	PL	Piotr Kokowski	Adam Mickiewicz University in Poznań, Institute of Acoustic, Poland	Academic Expert responsible for noise monitoring, measurements, strategic noise maps and actions plans	Competent Authority
47	PL	Tomasz Kaczmarek	AkustiX Sp. Z o.o.	Director	Consultancy
48	EE	Reet PRUUL	Ministry of Environment	In charge of	Competent

No.	MS	Name	Organisation	Position	Organisation type
				road mapping	authority
49	BG	Maria KOSTOVA	Industrial Pollution Prevention at Ministry of Environment and Water		Competent authority
50	IE	Willie Pierce	Manager, Energy and E nvironment, national rail authority		Public authority and mapping body
51	SE	Kerstin Hannrup Magnus Lindqvist Agreed 20 May	Boverket	National coordinator	Competent authority
52	SE	Marie Hankanen Agreed 22 May	Transportstyrelsen	National coordinator	Competent authority
53	SE	Lars Dahlbom Karin Blidberg 13 May	Trafikverket	National coordinator	Competent authority (roads)
54	NL	Miriam Weber	Ministry of Infrastructure and Environment	Policy expert	Competent authority
55	IT	Emilio Lucadamo	Rete Ferroviaria Italiana S.p.A.	Technical manager	Competent authority (rail)
56	IT	Lorenzo Lombardi	Ministry for the Environment, Land and Sea - Sezione Inquinamento Acustico ed Elettromagnetico	Policy officer	Competent authority (national)
57	IT	Dr. Giorgio Galassi	Regione Toscana	Environmental noise specialist	Competent authority (regional)
58	UK	Stephen Turner	Consultant	Previous Head of Defra Technical Noise Team, member of EU END working groups	Independent expert

No.	MS	Name	Organisation	Position	Organisation type
59	UK	Nigel Jones	Consultant	Undertaken most of noise mapping in England and Wales, member of EU END working groups	Independent expert
60	UK	Howard Price	CIEH, NGO	Professional body responsible for LA noise experts	NGO
61	UK	Ben Fenech	Public Health England, government agency	Responsible for noise & health policies in UK	Competent Authority
62	UK	Graeme Willis	CPRE, NGO	Specialist in quiet areas and tranquillity	NGO
63	ES	Núria Blanes Guàrdia	Barcelona University of Technology European Topic Centre on Air Pollution and Climate Mitigation (ETC/ACM)	Assists the EEA with the EIONET reporting system)	Other
64	EU	Mrs. Fazilet Cinaralp	ETRMA - European Tyre & Rubber Manufacturers Association	Secretary General	EU industry association
65	EU	Jean-Pierre Taverne	ETRMA - European Tyre & Rubber Manufacturers Association	Coordinator Environment & ELT Technical Support	EU industry association
66	NL	Henk Wolfert	Euronoise conference organiser and Eurocities	European Policy Officer	Other
67	DK	Frank Pedersen	Environmental Protection Agency		National Competent Authority
68	FI	Larri Liikonen	Centre for Economic Development, Transport and the Environment	Coordinator	Competent Authority
69	BG	Antonia Danailova	Plovdiv city municipality administration	Chief expert "Ecology and waste management" Department	Public authority
70	BG	Maria Galabova	MINISTRY OF ENVIRONMENT AND WATER	Director of Preventive Activities Directorate	National Competent Authority

No.	MS	Name	Organisation	Position	Organisation type
71	BG	Boris Mihaylov	Consultant at SPECTRI Ltd.	Consultant	Independent expert
72	HU	Attila JAKAB	CENTRE FOR TRANSPORT IT (KTI)	Head of Centre	Competent authority (rail)
73	HU	Mihaly Berndt	OPAKFI	Environmental noise specialist	NGO
74	HU	Milán Kara	Ministry of Agriculture Department of Environmental Preservation Hungary	Lead Counsellor	National Competent Authority
75	DE	Dr. Michael Gerke	Bayerisches Landesamt für Umwelt (Federal Environment Agency Bavaria)	Director of Construction	Federal Competent Authority
76	DE	Jens Krüsmann	Ministerium für Ländliche Entwicklung, Umwelt und Landwirtschaft Brandenburg (Federal Environment Agency Brandenburg)	Consultant Noise, Light, Vibration	Federal Competent Authority
77	DE	Matthias Hintzsche	Umweltbundesamt (Federal Environment Agency)	Resort "Noise Reduction for plants and products, effects of noise"	National Competent Authority
78	DK	Karen Forsting	Municipality of Copenhagen		Public authority
79	HR	Valerija Golub	Ministry of Health		Competent authority
80	HR	Sandra Hamin	City of Zagreb		Public authority
81	LU	David GLOD	Ministry of Sustainable Development and Infrastructure, Administration de l'Environnement	Noise department	National Competent Authority
82	LU	Luc Buttel	Administration de l'Environnement	Noise department	National Competent Authority
83	FR	Pascal Valentin.	Ministry of Ecology, Sustainable Development and Energy Direction	Head of noise department	National Competent Authority

No.	MS	Name	Organisation	Position	Organisation type
			Générale de la Prévention des Risques (DGPR) Service de la prévention des risques et de la qualité de l'environnement, (SPNQE)		
84	FR	Lory WAKS	Ministry of Ecology, Sustainable Development and Energy.	Noise department	National Competent Authority
85	IE	Chris Dilworth	AWN Consulting	Head of Acoustics team	Consultancy
86	FR	Piotr Gaudibert	Bruitparc	Noise observatory of the Ile-de-France region, European projects manager	Noise monitoring body
87	FR	Guillaume DUTILLEUX	CEREMA (Centre for expertise and engineering on risks, urban and country planning, environment and mobility).	Head of the Acoustics Group PCI Acoustics and Vibrations	
88	LV	Dace Šatrovska	Ministry of Environmental Protection and Regional Development	Deputy Head of Environmental Protection Department, Head of Environmental Quality and Waste Management Division	
89	LV	Jānis Dundurs	Riga Stradina University	Academic in public health	
90	EE	Villu Lükk	Estonian Road Administration	Public authority	
91	HU	Mihaly Berndt	OPAKFI	Consultancy	
92	HU	Attila Jakab	KTI	Public authority	
93	HU	Milan Kara		Competent authority	
94	BG	Maria Galabova	KOSTOVA	Wider stakeholder	
95	BG	Antonia Danailova		Public authority	

No.	MS	Name	Organisation	Position	Organisation type
96	BG	Boris Mihaylov	BM1	Consultancy	
97	SE	Christin Zackrisson	Malmö Stad	Environmental Inspector	Public authority
98	FI	Jenni Kuja-Aro	City of Helsinki Environment Centre	Environmental Inspector	Public authority Notes: detailed response in writing
99	FI	Anu Haahla	City of Helsinki Environment Centre	Environmental Inspector	Public authority Notes: detailed response in writing
100	UK	Ian Holmes	Highways England	Principal Noise Advisor	Public authority (roads)
101	UK	David Foote and Tim Walmsley	Manchester Airport	Environment Advisor	
102	PT	Margarida Guedes	Portuguese Environmental Agency (APA)		National Competent authority
103	PT	Maria Joao Leite	Portuguese Environmental Agency (APA)		National Competent authority
104	SE	Jarmo Riihinen	Orebro County, Sweden	Traffic engineer	Public authority
105	ES	Miguel Garcia	lyCSA	Consultant	Consultancy
106	ES	Jose Manuel Sanz			National Competent authority

APPENDIX B - BIBLIOGRAPHY

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3	Reporting information communicated by the Member States to the Commission under Articles 4(2), 5(4), 7, 8 and 10 of the Directive, including the two last set of noise maps/data submitted by Member States under the Directive. See the EIONET and CIRCA links in table above.
4	First implementation report (COM(2011) 321 final of 1 June 2011) and the report prepared under Service contract No 070307/2008/510980/SER/C3: Preparation of Commission review on the implementation of the Directive 2002/49/EC, both available at http://ec.europa.eu/environment/noise/milieu.htm
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9	Good practice guide on quiet areas, EEA Technical report No. 4/2014
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11	National guidance documents on SNM and action planning such as Guidance for Possible Measures to Manage Noise from Road and Rail (Scottish Government), Noise Mapping and Action Planning in Northern Ireland[1], Danish guidelines (http://mst.dk/service/publikationer/publikationsarkiv/2006/aug/stoejkortlaegning-og-stoejhandlingsplaner/) etc. Guidance Note by the EPA Ireland for Strategic Noise Mapping for the Environmental Noise Regulations 2006.
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[1] http://www.noiseni.co.uk/airports_noise_mapping_and_action_planning_technical_guidance_2013.pdf

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Common noise assessment methods and the development of CNOSSOS-EU	
13	European Commission. 2012. JRC Reference Reports. Common Noise Assessment Methods in Europe (CNOSSOS-EU) - http://ec.europa.eu/environment/noise/cnossos.htm
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20	Position Paper on Dose-Effect Relationships for Night Time Noise, European Commission Working Group on Health and Socio-Economic Aspects, 11 November 2004
21	Methodological guidance for estimating the burden of disease from environmental noise, Edited by: Tomas Hellmuth, Thomas Classen, Rokho Kim and Stylianos Kephalopoulos. WHO Regional Office, World Health Organization / JRC 2012[2]
22	Report "Burden of disease from environmental noise" (WHO, JRC 2011). http://www.euro.who.int/__data/assets/pdf_file/0008/136466/e94888.pdf

[2] http://www.euro.who.int/__data/assets/pdf_file/0008/179117/Methodological-guidance-for-estimating-the-burden-of-disease-from-environmental-noise-ver-2.pdf

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APPENDIX C – LIST OF RELEVANT LEGISLATION

This Appendix provides a list of all relevant EU legislation on noise. The list is especially relevant to the following evaluation questions:

- How far is the Directive coherent and consistent with other EU legislation on noise? (coherence)
- What progress has been made towards the second objective of the END - "to provide a basis for developing Community measures" to reduce noise at source (Article 1(2))?

Article 1(2) of the Directive sets out the second objective of the END which is to "provide a basis for developing Community measures[3] to reduce noise emitted by the major sources, in particular road and rail vehicles and infrastructure, aircraft, outdoor and industrial equipment and mobile machinery". The Directive states that "to this end, the Commission shall submit to the European Parliament and the Council, no later than 18 July 2006, appropriate legislative proposals. Those proposals should take into account the results of the report referred to in Article 10(1)".

In order to meet this requirement in the Directive, the EC produced a report in 2004 "concerning existing Community measures relating to sources of environmental noise, pursuant to Article 10.1 of Directive 2002/49/EC relating to the assessment and management of environmental noise"[4]. This document points out links between the END and development of existing EU measures relating to sources of environmental noise as part of an **integrated approach to noise management**. The document states that "there is scope for better cooperation throughout the Community to improve the availability and comparability of data on information relating to exposure to environmental noise. There is also scope for the Community to help Member States share noise abatement experiences".

The report also describes EU measures relating to sources of environmental noise and highlights the relevant legal basis for EU intervention. The legal articles of the Treaty have changed since the END came into force due to the adoption of the Lisbon Treaty (TFEU), which came into effect in December 2009. The legal competences remain but simply, the relevant Articles have changed numbers. A table updating the articles of the legal base to reflect the Lisbon Treaty is provided below:

Table 1: The legal basis for EU intervention – Community measures to tackle noise at source.

Provision of the Lisbon Treaty (TFEU)	Scope
Article 90 - 100 (Common transport policy)	• Aircraft noise
Article 114 (Internal market – Approximation of the laws of Member States):	• Road vehicles • Tyres • Outdoor equipment and tractors • Recreational craft
Article 170 (Trans-European networks)	• Railway interoperability

[3] It should be pointed out that whereas in 2002, the correct terminology was Community legislation and Community measures, post the Lisbon Treaty (TFEU), we refer to EU legislation and EU measures.
[4] COM(2004) 160 final

Provision of the Lisbon Treaty (TFEU)	Scope
Article 192 (Environment)	• Environmental assessment[5] • Assessment and management of environmental noise • Integrated Pollution Prevention and Control

Source: CSES / ACCON update of legal basis for Community noise at source measures

The report then details the different transport modes where the EC has competence for Community measures on noise at source legislation. This includes legislation to tackle noise from motor vehicles (4 wheels, 2 and 3 wheels), rolling noise between tyres and road surfaces, railway noise at source through Directives on railway interoperability, and technical standards for interoperability (e.g. TSI on high-speed rolling stock), and aircraft noise.

In the following table, an overview of relevant EU noise at source legislation is provided. This gives an update on the 2004 report produced by the European Commission and is reasonably comprehensive as at November 2015.

Table 2: EU legislation tackling noise at source

Legislation	Description	References to END and other relevant references
Road traffic noise (Directorate General GROW – formerly Enterprise)		
Automotive Regulation 540/2014 on the sound level of motor vehicles and of replacement silencing systems, and amending Directive 2007/46/EC and repealing Directive 70/157/EEC	The Regulation aims to improve environmental protection public safety, and quality of life by reducing major sources of noise caused by motor vehicles. To this end, it sets out the administrative and technical requirements for the EU approval of all new vehicles of certain categories with regard to their sound level and for the EU approval of replacement silencing systems and related components. The regulation sets noise-limit values for the different vehicle categories and a timeframe for implementation.	Recital 1 refers to providing for a high level of environmental protection and to a better quality of life and health. Recital 3 states that traffic noise harms health in numerous ways. "The effects of traffic noise should be further researched in the same manner as provided for in Directive 2002/49/EC". Recital 13 points out that noise is a multifaceted issue with multiple sources and factors that influence the sound perceived by people and the impact of that sound upon them. Vehicle sound levels are partially dependent on the environment in which the vehicles are used, in particular the quality of the road infrastructure, and therefore a more integrated approach is required. Directive 2002/49/EC requires strategic noise maps to be drawn up periodically as regards, inter alia, major roads.

[5] Two types of procedure are provided for in Community legislation, Strategic Environmental Assessment (Directive 2001/42/EC) and Environmental Impact Assessment (Directive 85/337/EEC).

Legislation	Description	References to END and other relevant references
		The information presented in maps could form the basis of future research work regarding environmental noise in general, and road surface noise in particular, as well as best practice guides on technological road quality development and a classification of road surface types, if appropriate. Also references the objective in the 6th EAP of substantially reducing the number of people regularly affected by long-term average levels of noise, particularly from traffic.
Motor Cycles Directive 97/24/EC – Motor Cycles	The Directive provides that Member States can grant tax incentives to vehicles which meet specified requirements concerning atmospheric pollution and noise pollution set out in the Directive.	
Mopeds Directive 2002/51/EC on the reduction of the level of pollutant emissions from two- and three-wheel motor vehicles and amending Directive 97/24/EC	This Directive aims at reducing the level of pollutant emissions from two or three-wheel motor vehicles by tightening the limit values for such emissions allowed in the type approval procedures for these vehicles.	
Automotive The European Tyre Labelling Regulation (EC/1222/2009)	The Regulation introduced labelling requirements for tyres. The external rolling noise of tyres is one of three types of information that must be displayed.	
Aircraft noise (Directorate MOVE)		
Communication on air transport and environment (1999)	The Communication sets out an EU strategy to put in place a coherent and environmentally friendly policy in the field of air transport. Inter alia, this includes improvement of technical environmental standards on noise and gaseous emissions as well as various actions proposed to assist airports in limiting noise.	
Regulation 1592/2002 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, repealing Directive 80/51/EEC	Establishes a safety agency to ensure the uniform implementation within Europe of harmonised safety standards and regulations.	

Legislation	Description	References to END and other relevant references
Directive 89/629/EEC – Subsonic Jet Aeroplanes	This Directive sets limits for noise emission from civil subsonic jet aeroplanes.	
Directive 92/14/EEC – Limitation of the Operations of Aeroplanes	This Directive sets noise certification standards for civil subsonic jet aeroplanes.	
Directive 1999/28/EC amending the Annex to Council Directive 92/14/EEC on the limitation of the operation of aeroplanes covered by Part II, Chapter 2, Volume 1 of Annex 16 to the Convention on International Civil Aviation, second edition		
Directive 2002/30/EC – Operating restrictions at Community airports	This Directive aims to promote the sustainable development of air transport through the reduction of noise pollution from aircraft at airports. The use of aircraft with a better environmental performance can contribute to a more effective use of the available airport capacity and facilitate the development of airport infrastructure in line with market requirements. The directive lays down common rules for prohibiting the noisiest aircraft from European airports and repeals Regulation (EC) No 925/1999, the 'Hushkit' Regulation, which was intended to prohibit the registration in Europe of aircraft fitted with noise-reducing devices.	
Directive 2006/93/EC on the regulation of chapter 3 civil subsonic aeroplanes	A consolidated Directive of obligations contained in 3 earlier Directives. Prohibits Chapter 2 aircraft (the oldest and noisiest aircraft) from operating in Europe.	
Regulation 598/2014 on operating restrictions at community airports	The new Regulation aims to ensure the consistent application in the EU of the ICAO (International Civil Aviation Organization) set of principles and guidance known as the "Balanced Approach" for the introduction of noise-related operating restrictions at airports. It will establish uniform procedures for the assessment and management of noise around airports.	

Legislation	Description	References to END and other relevant references
Railway noise (DG MOVE)		
Directive 2008/57/EC on Railway Interoperability, repealing Directive 96/48/EC	The Directive sets out the conditions to be met to achieve interoperability within the Union rail system. These conditions concern the design, construction, placing in service, upgrading, renewal, operation and maintenance of the parts of this system as well as the professional qualifications and health and safety conditions of the staff who contribute to its operation and maintenance.	
Commission Decision 2002/735/EC – Technical specification for interoperability (TSI) relating to high-speed rolling stock	The Decision defines technical standards for the interoperability of the High-Speed Trans-European Rail network. It imposes statutory levels of exterior and interior noise.	
Directive 2001/16/EC on Interoperability of the conventional Trans-European rail system	Provides that the operation of the trans-European conventional rail system must respect existing regulations on noise pollution.	
Commission Decision 2004/446/EC	Specifies the basic parameters of the 'Noise', 'Freight Wagons' and 'Telematic applications for freight' Technical Specifications for Interoperability referred to in Directive 2001/16/EC.	
Directive 2004/50/EC on Railway Safety	This Directive harmonises safety principles, including procedures for granting safety approval to railway operators and infrastructure owners.	
Directive 2012/34/EC establishing a single European railway area	Consolidates EU railway legislation and provides the basis for Regulation 2015/429 and the measures setting out the modalities to be followed for the application of the charging for the cost of noise effects.	
Regulation 1304/2014 on the technical specification for interoperability relating to the subsystem rolling stock noise amending Decision 2008/232/EC and repealing Decision 2011/229/EU2	Sets technical specifications for interoperability of rolling stock of the trans-European conventional rail system, including requirements relating to noise emission limits.	
Regulation (EU) 2015/429 setting out the modalities to be followed for the application of the charging for the cost of noise effects	Sets out the modalities to be followed for the charging of cost of noise effects caused by freight rolling stock whereas charges are commensurate with noise levels.	

Legislation	Description	References to END and other relevant references
Other		
Directive 2000/14/EC of the European Parliament and the Council of 8 May 2000 on the approximation of the laws of the Member States relating to the noise emission in the environment by equipment for use outdoors	The Directive replaces a wide range of individual pieces of legislation associated with acoustic noise emission in the various member states of the EU. It attempts to make it easier for manufacturers to sell their products across the whole community by ensuring that the noise performance requirements for the machines within its scope are the same in all member states. The Directive also introduces a downward pressure on noise emissions by placing limits on certain types of equipment in two stages, the limits for stage 2, which came into force in 2006, being quieter than those for stage 1.	
Directive 2005/88/EC amending Directive 2000/14/EC	This Directive amended Directive 2000/14/EC by making the Stage 2 limits indicative for some types of equipment where the new limits were not going to be technically feasible in time for the deadline.	
Directive 2003/44/EC – Recreational Craft Directive, amending Directive 94/25/EC	This Directive sets out minimum technical, safety and environmental standards for the trade of boats, personal watercraft, marine engines and components and ensures their suitability for sale and operation in Europe. The Directive also introduced new noise limits for marine and propulsion engines.	

APPENDIX D – METHODOLOGY FOR COST-BENEFIT ASSESSMENT

1.1 Introduction

The purpose of the CBA is to provide a structured framework for identifying, quantifying, and comparing the monetary and non-monetary **costs and benefits of the implementation of the END** to date. The CBA was developed on the basis of data collected through 19 test cases covering agglomerations, major roads, major railways and major airports. This information has then been used to assess the efficiency of the END at EU level.

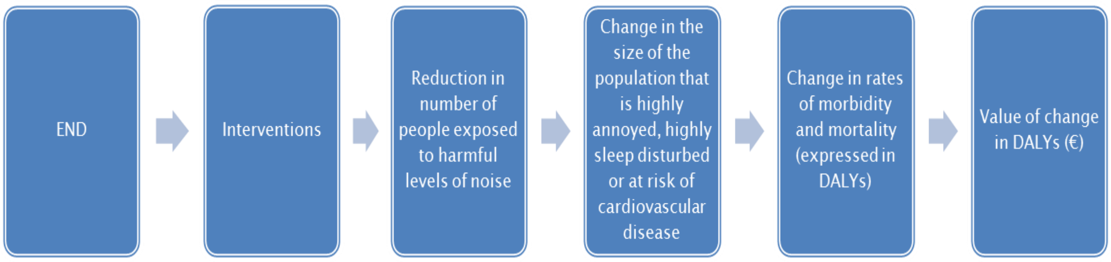
1.2 Overall approach

The approach to the CBA was informed by a review of the relevant literature and good practice guidance relating to the quantification and valuation of environmental noise. Key sources of information include:

- WHO (2011) Burden of Disease from Environmental Noise;
- EEA (2010) Good Practice Guide on Noise Exposure and Potential Health Effects;
- Defra (2014) Environmental Noise: Valuing impacts on sleep disturbance, annoyance, hypertension, productivity and quiet;
- HEATCO FP6 Project - Developing Harmonised European Approaches for Transport Costing and project assessment;
- Houthuijs et al (2014) Health implication of road, railway and aircraft noise in the European Union. Provisional results based on the 2nd round of noise mapping, RIVM Report 2014-0130;
- CE Delft, INFRAS and Fraunhofer ISI (2011) External Costs of Transport in Europe;
- JRC (2013) Final Report ENNAH – European Network on Noise and Health.

In order to help define the scope of the CBA and the associated data requirements, an impact pathway or logic chain was developed (see Figure 1). This provides a structured and transparent way of linking the sequence of events between implementation of the END and the outcomes or impacts that can be valued in monetary terms, and the assumptions that may be implicit within that.

Figure 1: The impact pathway



Thus, it is assumed that the introduction of the END has supported a number of activities or interventions including strategic noise mapping, noise action planning (both compliance activities) and, following these, the implementation of a range of measures to reduce harmful levels of noise. While the implementation of measures is not specifically mandated by the END, there is an implicit assumption or reasonable expectation that the measures identified in the Noise Action Plans (NAPs) will be implemented. Indeed, the implementation of many of these measures is already underway and some have already been completed.

The implementation of these measures in turn contributes to a reduction in the number of people exposed to harmful levels of noise. The benefits are considered in terms of a reduction in the burden of disease caused by environmental noise which can be quantified using the concept of disability-adjusted life years (DALYs) and valued using the concept of a value of a life year (VOLY).

The efficiency of measures has then been assessed using typical decision criteria – in this case, net present value (NPV) and cost-benefit ratios. Ultimately, the CBA seeks to identify and quantify the net benefits (i.e. the difference between costs and benefits) both with and without the END in place.

More simply, the general form of the equation for the calculation of impacts is:

Impact = Noise level x population at risk x Response function

The specific steps undertaken to quantify the costs and benefits and the overall net present value (NPV) of typical measures implemented as a result of the END are described in detail in Section 3.

1.3 Limitations

The extent to which it is possible to produce an assessment at an EU-level of the aggregate costs and benefits of the full implementation of measures identified in NAPs is limited by a number of factors. These are summarised in the table below together with a description of the implications for the analysis and the interpretation of findings.

Table 3: Factors that limit an EU-level assessment of the aggregate costs and benefits of the full implementation of measures identified in NAPs

Limitation / Issue	Description	Implications for analysis and interpretation of findings
Data gaps	In many instances, it was not possible to obtain reliable data on the costs of END implementation (both administrative costs and costs of measures). In most cases, only partial information was available on the costs of measures (i.e. it was only possible to obtain comparable information on costs and benefits for a selection of measures in each test case). This makes it difficult to compare costs and benefits across test cases or calculate an average cost or benefit per person or per area or per length (e.g. of road or railway). For the purposes of extrapolation, average (or median) costs are calculated using the test case data, supplemented with information from other published sources (e.g. NAPs) where available, or from interviews with relevant stakeholders. Where no such data was made available, estimates were made on the basis of cost factors (e.g. €2 / person for END implementation over 25 years) that have been established on the basis of secondary data sources and professional experience.	Estimates of net present value and cost-benefit ratio are indicative only

Limitation / Issue	Description	Implications for analysis and interpretation of findings
Differences in the types of measures implemented	The range and type of noise reduction measures implemented (or planned) varies significantly between agglomerations and the major infrastructure types. The choice of measures depends on, *inter alia*, the size of the infrastructure, the number of affected people and general maturity in addressing noise issues. The costs and benefits for each test case are in turn influenced by *inter alia* the choice of measures implemented (which may in turn reflect their affordability), the timing of interventions, the size of the infrastructure (e.g. in terms of number of vehicle movements) and population density in agglomerations or around major infrastructure	The test case studies are not necessarily representative of other situations and the relatively small sample of test cases makes it difficult to confidently extrapolate across the EU. For the purposes of the CBA, the costs and benefits are assessed drawing on information about implemented measures identified in the NAPs and applying assumptions around the typical measures adopted by agglomerations and major infrastructure schemes of similar scope and scale. Sensitivity analyses have also been undertaken to determine the range within which the actual costs and benefits (and hence NPV) are likely to lie.
Differences in the effect of measures implemented and gaps in information	While in some cases it was possible to obtain the costs of individual measures, it was not possible to determine the level of noise reduction that can be attributed to each measure or to different combinations of measures. The effects of implemented measures vary depending on factors such as the boundary conditions, e.g. the number of affected persons by noise from each of road, rail and air (within and outside of agglomerations) and source-specific factors (e.g. background noise, composition of traffic or geometrical considerations).	For the purposes of extrapolation, and in the absence of more refined data on the local context, the simplifying assumption is made that similar packages of measures are implemented to reduce noise associated with major infrastructure of similar sizes and types and that these measures are similar in terms of the overall noise reductions they achieve. It is not possible, however, to determine the effectiveness of measures with regards to the actual number of people benefiting as this requires detailed information on population densities within agglomerations and within the vicinity of major infrastructure schemes. The EU-wide CBA therefore makes use of median population densities (i.e. the median size of the population exposed to noise across groups of airports, agglomerations, roads or railways) based on information in the European Environment Agency Noise Observation and Information Service for Europe (NOISE) and the associated EIONET Forum Noise Database and other relevant sources.

Limitation / Issue	Description	Implications for analysis and interpretation of findings
Differences in the timing of implementation of measures and in which measures in the NAPs have been implemented to date	There are differences in the times at which the measures were introduced or their implementation was completed. Some measures were implemented before the NAPs were published (and should not therefore directly be attributed to the END) while other measures identified in the NAPs have not yet been implemented. Moreover, from the interviews, it became clear that some Member States report on all possible measures that could potentially be implemented (some of which have already been implemented, some of which may be underway and some of which may or may not be implemented in future) while other Member States only report measures for which there already is a dedicated budget. For the purposes of the test cases, it is assumed that the measures identified in the NAPs are implemented at some point during the 25 year assessment period, and thus the benefits (in terms of changes in the size of the population exposed to harmful levels of noise) correspond to a situation in which these measures are implemented, even though in some cases (e.g. major rail, Slovakia) the measures may be under discussion but have not yet been implemented and may not yet have a specific budget allocation. Where possible, the distribution of costs and benefits over the 25-year assessment period has been considered in the CBA, particularly for those measures that have already been implemented or that are underway.	Both the costs and benefits may be overstated in cases where these measures are not finally implemented.
Lack of information on the population exposed to noise levels below 55 dB L_{den} and 50 dB L_{night}.	The END requires Member States to report on the size of the population exposed to noise levels above 55 dB L_{den} and 50 dB L_{night}. However, epidemiological studies have shown that adverse health impacts begin to occur below these levels. For hypertension, coronary heart disease and stroke it is suggested that the threshold for the onset of these health effects starts at 50 dB L_{den}; for annoyance the threshold is less than 40 dB L_{den} and for sleep disturbance less than 40 dB L_{night}. Given that there is no readily available information across all Member States for all agglomerations and major infrastructure on the size of the population affected by noise below these thresholds, the health impact assessment has only been carried out for levels equal	The reported numbers and percentages are only relevant for the populations living at levels equal to or above 55 dB L_{den} and 50 dB L_{night} which underestimates the total impact of environmental noise in Europe.

Limitation / Issue	Description	Implications for analysis and interpretation of findings
	to or above 55 dB L_{den} and 50 dB L_{night} unless additional information on noise exposure below these levels was available in the NAPs investigated for the test cases.	
Incompatibility of approaches to the benefit estimation	The benefits of END implementation have been estimated by considering the reduction in the burden of disease from environmental noise. While dose-response relationships can provide estimates of the total number of people who are annoyed or sleep disturbed, the effects of annoyance and sleep disturbance in terms of morbidity and mortality can only be quantified for the highly annoyed and highly sleep disturbed populations (see step 4 in Section 1.4.1). An alternative approach would be to use estimates of willingness to pay (WTP) for a reduction in noise levels as reflected in differences in property value. While such an approach may capture the benefits of noise across the whole of the sleep disturbed and annoyed population, it is not possible to determine the effects of noise separately on the sleep disturbed and annoyed populations or on the incidence of cardiovascular diseases. The approach is therefore not compatible with the health-savings approach as to do so, would result in double-counting of the effects on the highly annoyed and highly sleep disturbed populations (which is larger than the effects on the moderately and highly annoyed and sleep disturbed populations).	The effects of the END on the annoyed and sleep disturbed populations are not quantified in the CBA and therefore the benefits are likely to be under-stated.
Attribution	Related to the above, it is also difficult to ascertain which benefits (reductions in noise levels) may be attributed directly to the END and which would have occurred anyway. As noted above, some of the measures that have been included in the analysis began to be implemented before the first round of NAPs were published and there may also be other reasons (unrelated to the END) why noise levels have diminished in certain areas (e.g. changes in the road network, or infrastructure upgrades). Indeed, as discussed in Section 3.2.5.1 of the main report, the findings of the online survey[6] showed that 61% of respondents agreed and a further 12% strongly agreed that	In the absence of any quantitative evidence relating to the effects of other (non-END) interventions, various assumptions have been made around the extent to which the costs and benefits of measures can be attributed to the END. In particular, the analysis assumes that the degree of attribution is lower in those Member States in which noise legislation was in existence prior to the introduction of the END (assumes only 50% attribution in the base case) and that the benefits are highest in situations where no previous noise legislation existed but where a

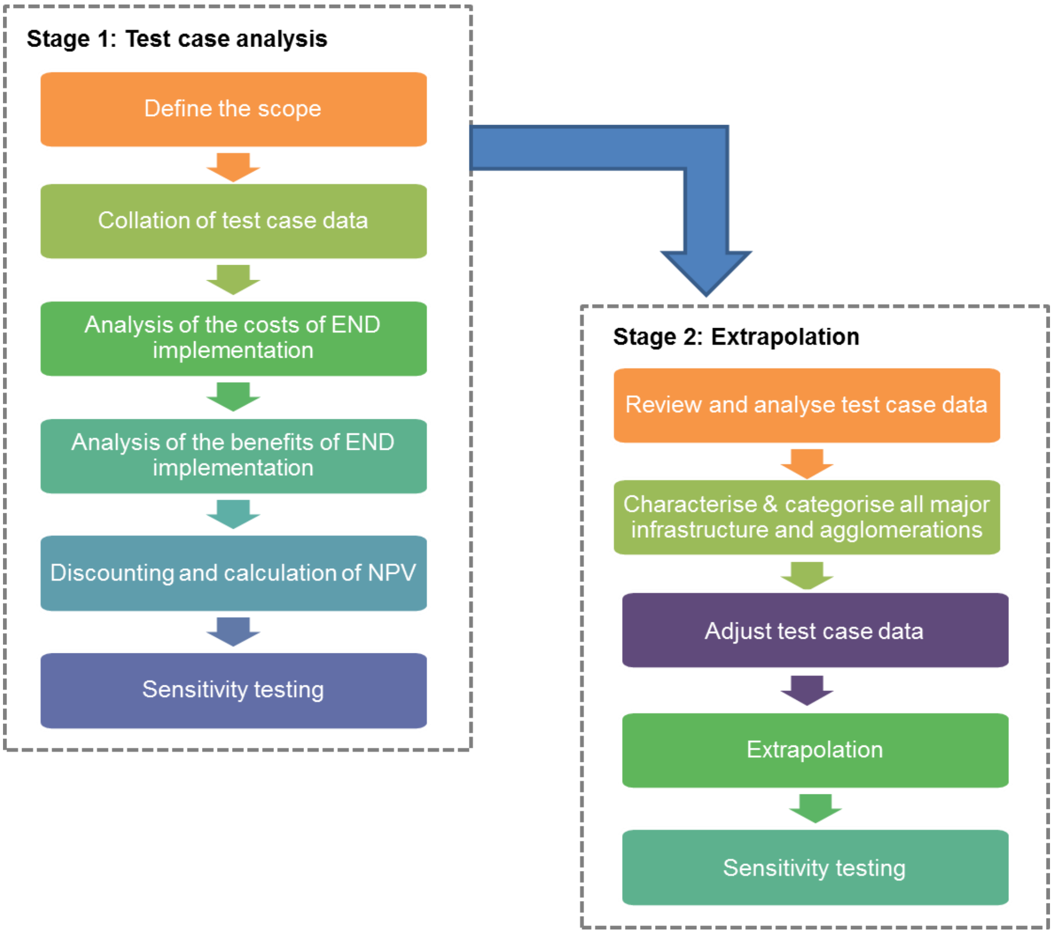
[6] The online survey was carried out with different categories of stakeholders. 73 valid questionnaire responses were received from public authorities, 7 from consultancies involved in strategic noise mapping, and 10 from NGOs/community groups

Limitation / Issue	Description	Implications for analysis and interpretation of findings
	progress in noise reduction was the result of national legislation. However, a similarly high percentage acknowledged that the END had at least partially contributed to noise reduction and positive developments in noise reduction would not have happened without the END.	NAP has been produced. The specific levels of attribution that have been applied in the analyses are set out in the sections relating to each of airports, roads, railways and agglomerations that follow. Sensitivity analyses have also been conducted to test how the outcomes may differ under a range of different assumptions regarding the extent (from 25-100%) to which the measures can be attributed to END.

1.4 Methodology

The cost-benefit analysis was conducted in two stages. These are set out in Figure 2 and described in more detail in the paragraphs that follow.

Figure 2: Overview of the methodology



1.4.1 Stage 1 – Test cases

1) The scope of the CBA

The scope of the CBA was determined based on a review of the guidance documents listed in Section 1.2, a wider review of the literature, discussions with relevant stakeholders and the availability of necessary data. It is necessarily limited to costs and benefits:

- that can be reasonably or reliably quantified, e.g. where there are established relationships between changes in noise levels and health or other outcomes;
- for which the necessary data exists to support the assessment; and
- that can be included without resulting in double counting.

In this light, the CBA includes:

- Direct **administrative compliance costs** relating to the implementation of the END, such as the preparation of strategic noise maps and the development of noise action plans (including making provision for public information and consultation);
- The **substantive compliance costs** associated with implementing the measures identified in the Noise Action Plans; and
- The benefits to those experiencing a reduction in noise levels expressed in relation to **improvements in three health endpoints** (described in more detail in a later section). It is important to note, however, that the **CBA is only able to consider the value of changes in the highly annoyed and highly sleep disturbed populations** as there are no published disability weights applicable to the low and moderately annoyed and sleep disturbed populations. While the use of willingness to pay (WTP) estimates was considered for valuing annoyance and sleep disturbance alongside the DALY estimates for highly annoyed and highly sleep disturbed), there are few studies that distinguish between the WTP amongst populations that are annoyed and highly annoyed, or sleep disturbed and highly sleep disturbed and therefore combining them with the DALY measures would in effect be double counting. As we are concerned with noise as a health endpoint, then it is only high levels of annoyance that have this effect.

It is important to note that there are a number of potentially important effects that the CBA does not consider. There are various reasons for this including difficulties in establishing reliable estimates of the impacts[7] and the potential for double counting. Some of these effects include:

- The influence of the END on **land use planning and residential development.** This is because it is not possible to place a monetary value on the contribution of the END to land use planning in such a way that it could be incorporated into the CBA. There is nevertheless evidence to suggest that noise concerns, driven by the END, are relevant to the siting and design of new developments. For example, Planning Practice Guidance and Planning Advice Notes issued by the Governments of England and Scotland respectively promote the appropriate location of new potentially noisy development, and a pragmatic approach to the location of new development within the vicinity of existing noise generating uses, to ensure that quality of life is not unreasonably affected and that new development continues to support sustainable economic growth.
- Changes in **property values.** It is nevertheless acknowledged that this means that a significant portion of the benefits of END implementation (i.e. those accruing to the moderately annoyed and sleep disturbed populations) are not captured (see Box 1).
- The effects of the END on direct, indirect or induced **employment.** Again, it is not straightforward to quantify the contribution of END to employment in monetary terms. It is nevertheless likely that there will have been some employment gains in terms of the specific requirements of the END in relation to preparation of strategic noise maps and action plans, as well as in the design and implementation of noise-reduction measures.

[7] In this case, the effort applied was proportionate to the estimated magnitude of the impact, outcomes at stake and resources available. Impacts were excluded from the analysis in cases where the level of effort required to generate quantified estimates was considered disproportionate to the importance of the impact relative to other impacts.

- The impacts of measures such as changes in flight paths, ascent/descent rates and scheduling on **greenhouse gas emissions and air quality**). While it is theoretically possible to calculate the additional air miles (and hence emissions and impacts) accrued as a result of changes in flight paths and scheduling, this would necessitate the collection and analysis of a number of additional datasets from across the test cases. This was not considered proportionate to the outcomes at stake and the time available.

The quantitative analysis also does not consider other relevant benefits of the END in relation to:

- **Raising awareness of and stimulating discussions around environmental noise as an issue**. Data from noise mapping has supported assessments of the effects of changes in environmental noise on health, productivity and ecosystem services which in turn have been used to influence decision-makers.
- **Generating large and consistent datasets on noise** (through SNMs) that have been invaluable in advancing research on the effects of noise on health and productivity.
- **Supporting actions in other areas** (e.g. development of technical standards, emission levels and other Directives) that have a positive effect on noise levels, unless these can be explicitly linked to the END.

2) Collation of test case data

A comprehensive data collection and analysis template was developed to capture information on the costs and the benefits of END implementation across each of the 19 test cases (see Table 4).

Table 4: Test cases

	Agglomerations	Airports	Major roads	Major railways
1	Athens, Greece	Athens, Greece	Austria	Austria
2	Augsburg, Germany	Frankfurt, Germany	Greece	Slovakia
3	Bratislava, Slovakia	Glasgow, UK		
4	Bucharest, Romania	Stuttgart, Germany		
5	Düsseldorf, Germany	Vienna, Austria		
6	Essen, Germany			
7	Helsinki, Finland			
8	Malmö, Sweden			
9	Munich, Germany			
10	Nuremberg, Germany			

The information necessary to support the CBA comes from:

- a review of the relevant NAPs;
- interviews with the relevant implementing authorities in each Member State;
- a review of the wider literature; and
- estimations based on specialist expertise and professional judgement.

The sources of data and basis for any estimations (including any underlying assumptions) are set out in more detail in the input data sheets filed in Appendix L.

The information collected includes:

- **Projections (based on strategic noise mapping[8]) of the size of the population exposed to noise** (in 5 dB intervals) with and without measures implemented under the END. This information in turn supports the assessment (using established dose-response relationships) of the value of noise reductions in terms of changes in levels of annoyance, sleep disturbance, and cardiovascular diseases. Where population data was not available in the NAPs, this was estimated based on other available sources.
- The specific data sources used for each test case are described in Appendix L and the process for classifying the size of the exposed population in each noise band is described in the test case summary reports available in Appendix F. The size of the population exposed to harmful levels of noise (i.e. in excess of 50 dB L_{night} and 55 dB L_{den}) *before the implementation of measures* is taken either from the Round 1 Strategic Noise Mapping or from detailed analysis within the noise action planning procedure of the responsible authority. The population exposed *after the implementation of measures* is taken from Round 2 Strategic Noise Mapping (where appropriate given changes in the approach to noise mapping between Round 1 and Round 2) or is estimated using either detailed analysis of the noise action planning procedure of the responsible authority or the established techniques and professional judgement, assuming the full implementation of selected measures or combinations of measures.
- Data on the **administrative or compliance costs** associated with implementation of the END. In most cases, this information has been extracted from the relevant Noise Action Plans (see Appendix L) and includes information on:
  - **Human resource costs** – the costs incurred by national competent authorities and other public authorities at local, regional and national level for strategic noise mapping, the development of NAPs, the identification of suitable noise reduction/ mitigation measures and monitoring their implementation; and meeting EU reporting obligations under the END. Note that these costs are additional to the human resource costs that would otherwise have been incurred in the absence of the END.
  - **Financial costs** - in implementing the END, implementing authorities may also bear direct costs in relation to the procurement of external consultancy support to assist in strategic noise mapping, the development of NAPs and the costs associated with the implementation of noise mitigation or noise reduction measures (e.g. quieter road surfaces)[9].
  - Data on the **actual or estimated costs of implementation of both fully implemented and planned measures**. Where possible, this information has been obtained from the published Noise Action Plans but in other instances has been estimated on the basis of secondary information. The specific sources used in each case are detailed in the input data sheets in Appendix L.

In collating the costs of END implementation, the distinction between **one-off and recurring costs** (linked to the five year cycle) and the **incidence of costs** (i.e. in which year(s) they have been incurred) has also been considered.

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[8] The Noise Observation and Information Service for Europe (NOISE) contains data related to strategic noise maps delivered in accordance with the END. NOISE is maintained by the European Environment Agency (EEA) and the European Topic Centre for Air Pollution and Climate Change Mitigation (ETC-ACM) on behalf of the European Commission.

[9] It is arguable as to whether the costs of measures should be considered as direct or indirect costs since the END does not explicitly mandate the Member States to incur expenditure on noise reduction measures. However, it does imply that provision should be made for appropriate measures within in Article 1(1c) since Action Plans are required in order to reduce noise and preserve environmental noise quality where it is good.

In the majority of cases, the costs represent the total costs to completion for the selected measures, even if the measures have not yet been fully implemented. This is to allow for a like-for-like comparison of the costs and benefits given that, where information on beneficiaries is provided in the NAP, the number of beneficiaries corresponds to a situation in which the measure(s) has been fully implemented. Where it was not possible or not appropriate to use the costs to completion, this has been explicitly noted in the input data summaries (Appendix L).

Note that complete data for all test cases was not available and therefore in some instances costs have had to be estimated based on knowledge of similar agglomerations and major infrastructure elsewhere across the EU-28 countries (EU-28) and expert judgement. The specific sources of all costs (actual and estimates) are identified for each test case in Appendix L (input data sheets). The number of people to which the measures apply is determined by the number of persons affected by daytime noise levels > 55 L_{den} dB(A) or by night-time noise levels > 50 L_{night} dB(A). This information, in turn, is obtained from the NAPs or calculated (see Appendices L and E).

3) Analysis of the costs of END implementation

For each test case, the costs of END implementation are considered in terms of:

- The administrative costs incurred by the implementing authority in relation to Noise Action Planning and the END;
- The costs of measures; and
- The present value of the total costs discounted over a 25 year assessment period. A social discount rate of 4%[10] has been applied.

Note that costs are only included for those measures for which information on costs and number of people affected is available (from the NAPs, personal communications, other secondary sources or professional judgment) and for which it is possible to determine the number of beneficiaries (i.e. the number of people who benefit from reduced noise as a result of the measure or a package of measures). While estimates of beneficiaries can be made for individual measures, it is not possible where cost information is only provided for groups of measures (unless specifically stated in the NAP).

[10] This is the rate recommended by the European Commission. A social discount rate is used to convert all costs and benefits to "present values" so that they can be compared. This discount rate is a correction factor applied to costs and benefits expressed in constant prices. See: http://ec.europa.eu/smart-regulation/guidelines/tool_54_en.htm

4) Analysis of the benefits of END implementation

A number of adverse health impacts, both direct and indirect, have been linked to exposure to persistent or high levels of noise[11]. These include:

- Annoyance;
- Sleep disturbance;
- Cardiovascular diseases
- Tinnitus; and
- Cognitive impairment.

The health implications of environmental noise can be described as the number of people with (severe) annoyance and (severe) sleep disturbance and the number of residents with hypertension, hospital admissions due to cardiovascular disease and premature mortality related to noise exposure. These health effects are the most investigated non-auditory health endpoints of noise exposure.

Figure 3 illustrates the extent to which exposure to noise affects different elements of health and well-being. Within a proportion of a population exposed to elevated levels of noise, stress reactions, sleep-stage changes, and other biological and biophysical effects may occur. For some people, these may in turn lead to a worsening of various health risk factors such as blood pressure. For a relatively small part of the exposed population (as shown towards the top of the pyramid in Figure 3), the subsequent changes may then develop into clinical symptoms like insomnia and cardiovascular diseases that, as a consequence, can increase rates of premature mortality.

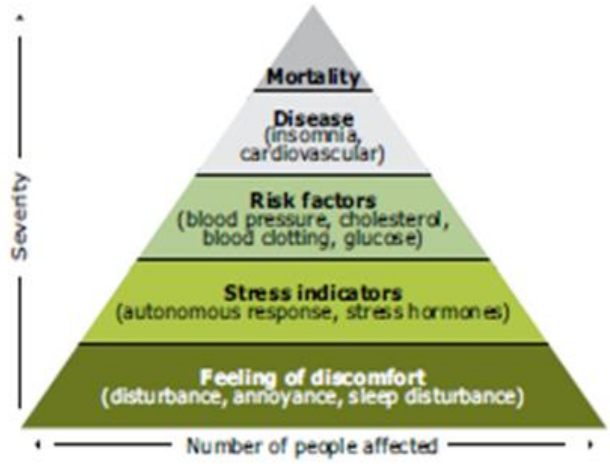
Sleep disturbance, cardiovascular diseases and annoyance, mostly related to road traffic noise, comprise the main burden of environmental noise. In 2007, CE Delft estimated (on the basis of several earlier studies) the social costs of traffic, rail and road noise across 22 countries in Europe at about €40 billion a year (about 0.4% of total EU GDP, in 2006 prices) of which 90% is related to passenger cars and goods vehicles[12]. However, it should be noted that this takes into account only effects related to noise levels above 55 dB(A) and is therefore likely to underestimate the actual costs as annoyance values have been shown to set in at around 40 dB(A)[13]. The Commission's Green Paper "Fair and Efficient Pricing in Transport" (albeit published almost a decade earlier and therefore potentially drawing on a more limited evidence base) had a somewhat lower estimate of 0.2% of GDP, which is within the same order of magnitude.

[11] WHO (2011) *Burden of disease from environmental noise. Quantification of healthy life years lost in Europe*, World Health Organization Regional Office for Europe, Copenhagen [online] available at http://www.who.int/entity/quantifying_ehimpacts/publications/e94888.pdf?ua=1

[12] CE Delft (2007) Traffic noise reduction in Europe. Health effects, social costs and technical and policy options to reduce road and rail traffic noise [online] available at http://www.transportenvironment.org/sites/te/files/media/2008-02_traffic_noise_ce_delft_report.pdf (last accessed 21/12/2015).

[13] CE Delft (2007) Traffic noise reduction in Europe. Health effects, social costs and technical and policy options to reduce road and rail traffic noise [online] available at http://www.transportenvironment.org/sites/te/files/media/2008-02_traffic_noise_ce_delft_report.pdf (last accessed 21/12/2015).

Figure 3: Pyramid of noise effects



Source: Babisch, 2002, based on WHO, 1972.

In addition, there is increasing scientific evidence regarding the harmful effects of noise on wildlife[14]. The CBA is, however, limited to those health end-points of environmental noise for which reliable dose-response relationships exist, i.e.:

- Annoyance (road, rail and air);
- Sleep disturbance (road, rail and air); and
- Cardiovascular disease (acute myocardial infarction for road only and hypertension for road and air)

Although dose-response relationships have been formulated for tinnitus and cognitive development in children, these are not used in the CBA. In the case of tinnitus, studies have suggested that environmental noise exposure with a $L_{Aeq,24h}$ of 70 dB(A) or below will not cause hearing impairment in the vast majority of people, even after a lifetime of exposure[15]. As such, social/leisure noise (such as personal music players, gun shooting events, music concerts, sporting events and the use of firecrackers) is likely to be the most relevant source of exposure in Europe although it is acknowledged that traffic noise may exceed 85 dB(A) in some urban settings. The extent to which noise impairs cognitive development, particularly in children, has been investigated using both experimental and epidemiological studies. These have generated sufficiently reliable evidence to indicate the adverse effects of chronic noise exposure on children's cognition, particularly in relation to aircraft noise. However, there is no generally accepted criterion for quantification of the degree of cognitive impairment into a disability weight.

[14] Dutilleux, G., 2012, *Anthropogenic outdoor sound and wildlife: it's not just bioacoustics!*, Proceedings Acoustics, 2301–2306, Nantes [online] available at https://hal.archives-ouvertes.fr/docs/00/81/07/95/PDF/hal-00810795.pdf

[15] WHO (2011) *Burden of disease from environmental noise. Quantification of healthy life years lost in Europe*, World Health Organization Regional Office for Europe, Copenhagen [online] available at http://www.who.int/entity/quantifying_ehimpacts/publications/e94888.pdf?ua=1

The benefits of END implementation are expressed in terms of the reduction in the number of people exposed to harmful noise levels, the corresponding decrease in morbidity and mortality (measured in terms of disability-adjusted life-years, or DALYs) and the value of these DALYs (measured using estimates of the value of a statistical life).

In order to estimate the benefits of reduced noise levels as a result of END, a quantitative risk assessment approach has been used. This is in line with guidance produced by the EEA (2009)[16], the WHO (2011)[17] and Defra (2014)[18]. There are nevertheless alternative approaches to valuing noise including both revealed and stated preference methods (see Box 1).

Box 1: Approaches to valuing noise nuisance

Revealed preference approaches

Noise nuisance has commonly been valued using hedonic pricing (HP), a revealed preference approach which uses the market for a particular good, in this case the housing market, to estimate the value of the different components of the good. The value of noise obtained is usually expressed in the form of a Noise Depreciation Index (NDI) or Noise Sensitivity Depreciation Index (NSDI) which indicates the percentage change in house prices that results from a 1 dB change in noise levels. The number of HP studies on aircraft noise is such that a number of meta-analyses have been carried out. Wadud (2013)[19] identified 65 NDI values ranging from 0 to 2.3% and included 53 estimates in a meta-analysis concluding that a 1 dB increase in aircraft noise levels leads to a fall in house prices of between 0.45% and 0.64%. This estimate is broadly consistent with meta-analysis by Nelson (2004)[20] and the earlier review by Nelson (1980)[21] though somewhat lower than the estimates of Schipper et al. (1998)[22] of 0.9% to 1.3%. Comparison of studies is difficult due to differences: in functional form, the quality and scope of data, definitions of variables and the level of discrimination of the impact being valued. There are fewer HP studies of road traffic noise, Bateman et al. (2001)[23] reviewed 18 studies mostly from North America finding a range from 0.08% to 2.22% and an average NSDI of 0.55%. More recent European studies fall within this range and tend to be reasonably consistent with this average[24]. Although the HP approach is broadly accepted and underpins many values used in public sector appraisals, the range of values is nonetheless large and, moreover, this variation is largely unexplained.

Furthermore, the revealed preference approach is based on the assumption that there is perfect labour and personal mobility and that individuals are well-informed about the risks they face in exposure to noise.

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[16] EEA (2010) Good Practice Guide on Noise Exposure and Potential Health Effects

[17] WHO (2011) *Burden of disease from environmental noise. Quantification of healthy life years lost in Europe*, World Health Organization Regional Office for Europe, Copenhagen [online] available at http://www.who.int/entity/quantifying_ehimpacts/publications/e94888.pdf?ua=1

[18] Defra (2014) Environmental Noise: Valuing impacts on: sleep disturbance, annoyance, hypertension, productivity and quiet

[19] Wadud Z. (2013) Using meta-regression to determine Noise Depreciation Indices for Asian airports. Asian Geographer, 30(2) 127-141.

[20] Nelson J.P. (2004) Meta-analysis of Airport Noise and Hedonic Property Values: Problems and Prospects. Journal of Transport Economics and Policy 38(1), 1-28.

[21] Nelson J.P. (1980) Airports and Property Values, Journal of Transport Economics and Policy 14(1) 37-52.

[22] Schipper Y., Nijkamp P. and Rietveld P. (1998) Why do aircraft noise value estimates differ? A meta-analysis. Journal of Air Transport Management 4(2), 117-124

[23] Bateman I., Day B., Lake I. and Lovett A. (2001) The effect of road traffic on residential property values: a literature review and hedonic pricing study. Report to the Scottish Executive.

[24] Bristow A.L. (2010) Valuing Noise Nuisance, paper to INTER-NOISE 2010, the 39th International Congress and Exposition on Noise Control Engineering, 13th -16th June, Lisbon.

Box 1: Approaches to valuing noise nuisance

The difficulty in fulfilling these requirements is thought to explain the variation in estimates produced by revealed preference studies[25].

The HP method is attractive because it has a basis in real decisions in the market place and underpins many values used in transport appraisals in Europe. However, the approach may be criticised in that purchasers may not have perfect knowledge of all the attributes of the different houses they choose between; the housing market is susceptible to other imperfections most notably transaction costs; explanatory variables suffer from correlation and it is difficult to measure some intangible influences and perceptions of them. HP is also limited in that it can only give a value of disturbance as experienced at home. Meta-analysis suggests that this cost may be capitalised through a house price discount of about 0.5% to 0.6% per dB (A). However, this cannot tell us what people might be willing to pay now for changes in the noise level experienced or how this might vary by time of day, day of week or season[26].

Stated preference approaches

Given the difficulties posed to the revealed preference approach by imperfect markets and a lack of data, economists have turned to stated preference approaches to value non-market goods. Within the class of stated preference methods, there are two alternative groups of techniques: **choice modelling** (CM) and **contingent valuation** (CV). In general, contingent valuation concentrates on the non-market good or service as a whole (e.g. WTP for a defined change in noise levels), while choice modelling seeks people's preferences for the individual characteristics or attributes of these goods and services (e.g. preferences for aircraft vs road noise or different levels or durations of noise, etc.). The advantage of contingent valuation questions is their ability to elicit exactly the information that is required.

The main challenge is the necessary assumption that individuals have a coherent set of preferences. A number of phenomena have been identified as evidence that such coherent preference may not be observed in practice, including: substitution effects; endowment effects; hypothetical bias; the influence of irrelevant cues, where respondents are influenced by the elicitation procedure, such as start-point bias, anchoring effects, focusing effects, embedding effects, and range bias[27]. CM techniques have been developed largely to take account of some of the shortcomings of CV and have been increasingly applied in this context.

This approach has grown in importance, especially in Europe, in part due to the still influential review by Navrud in 2002[28] which suggested a range of €2-€32 per household per decibel per year for road noise based on six studies. This led to the recommendation of a value of €25 per household per year by the EU Working Group on Health and Socio-economic aspects[29].

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[25] Dolan, P. and Metcalfe, R. (2007), Valuing non-market goods: A comparison of preference-based and experience-based approaches.

[26] Bristow, A.L. and Wardman, M. (2015) Comparing noise nuisance valuation estimates across methods, meta-analyses, time and space. Paper presented at The 22nd International Congress on Sound and Vibration, Florence (Italy) 12-16 July 2015.

[27] Dolan, P. and Metcalfe, R. (2007), Valuing non-market goods: A comparison of preference-based and experience-based approaches

[28] Navrud S. (2002) The State-of-the-Art on Economic Valuation of Noise. Final Report to European Commission DG Environment.

[29] EU Working Group on Health and Socio-economic Aspects, Valuation of Noise – Position Paper. http://ec.europa.eu/environment/noise/pdf/valuatio_final_12_2003.pdf (2003).

Box 1: Approaches to valuing noise nuisance

More recent work by Bristow et al (2015)[30] identified 62 SP studies of transportation noise extracting 258 comparable values from 49 of these to conduct the first meta-analysis of such data.

As might be expected, the SP valuations of noise nuisance assembled exhibit a wide range. This variation may be explained by variations in data type and survey method, the systematic influence of study and country specific factors and, importantly, intertemporal effects. Values per unit dB change in aircraft noise exceed those for road and rail reflecting evidence in the noise annoyance literature[31]. Moreover, those who experience higher noise levels or report high levels of annoyance have higher values. The study found an inter-temporal income elasticity close to one, somewhat larger than the cross-sectional income elasticity typically obtained from individual studies. The meta-analysis revealed a significant range in WTP depending on level of income, noise source, noise exposure and perceived annoyance. For road traffic noise, for example, those who are highly annoyed report values nearly nine times higher than those who are not annoyed.

Value of a life year

There is an increasing focus on the health effects of noise with growing evidence relating to hypertension and coronary heart disease[32]. Some efforts have been made to incorporate health effects into values used in the appraisal of transport schemes, for example, the values used in Sweden are based on local HP studies with the addition of 'a 42% mark-up is made to capture the value of "un-conscious" health effects, i.e. the effects of noise on residents' health that they are not aware of and hence are not reflected in house prices' (Eliasson, 2013, p6)[33]. A more formalised approach would be to use Disability Adjusted Life Years (DALY) and Quality Adjusted Life Year (QALY) to apply a health impact pathway to noise, as has been done in this CBA.

The Department for Environment, Food and Rural Affairs (Defra)[34] recommend this approach for the valuation of noise in UK economic appraisal including annoyance and sleep disturbance, and health effects associated with cardiovascular disease, strokes and dementia. Defra argues that estimating annoyance values on the same basis as the health values should avoid risks of double counting.

Although it may be argued that the inclusion of annoyance in this way may introduce a risk of double counting if, in health terms, it is simply a precursor to other health impacts., annoyance from noise clearly impacts on well-being and thus its inclusion is wholly compatible with the WHO 1946 definition of health as "… a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." (WHO, 1946)[35].

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[30] Bristow, A.L., M. Wardman and Chintakayala V.P.K. (2015) International Meta-analysis of Stated Preference Studies of Transportation Noise Nuisance, Transportation, January 2015, 42(1) 71-100.

[31] Miedema, H.M.E. and Oudshoorn C.G.M. (2010), Annoyance from transportation noise: relation-ships with noise exposure metrics DNL and DENL and their confidence intervals, Environmental Health Perspectives, 109 (4) 409-416

[32] Babisch, W. (2014), Updated exposure-response relationship between road traffic noise and coronary heart diseases: A meta-analysis, Noise and Health, 16 (68) 1-9.

[33] Eliasson J. (2013) International Comparison of Transport Appraisal Practice: Annex 4 Sweden Country Report, University of Leeds. Available at https://www.gov.uk/government/publications/international-comparisons-of-transport-appraisal-practice.

[34] Department for Environment, Food and Rural Affairs, Environmental Noise: Valuing impacts on: sleep disturbance, annoyance, hypertension, productivity and quiet. November 2014. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/380852/environmental-noise-valuing-imapcts-PB14227.pdf

[35]

Box 1: Approaches to valuing noise nuisance

Values derived from hedonic pricing studies may reflect annoyance and sleep disturbance but do not reflect current preferences of residents. Values derived from stated preference studies are likely to include the combined perceived amenity effects of annoyance and sleep disturbance.

It is less likely that the values from these approaches would include the more serious health effects as the relationships between noise and health are not widely understood, partly because the evidence base is still developing.

The implications of this that the approach adopted for this study, using DALYs, understates the benefits of reduced noise levels to the noise-affected population. The value of the benefits that have not been included will depend largely on the distribution of the population affected by noise at various levels - annoyance and hence WTP is higher at higher levels of noise.

The benefits relating to each health end-point are estimated using the following data:

- The distribution of environmental noise exposure within the population (and how this changes as a result of END implementation);
- The dose-response relationships for each health end-point;
- A population-based estimate of the incidence or prevalence of cardiovascular disease from surveys or routinely reported statistics; and
- The value of the disability weight (DW) for each health end-point. The DW is associated with each health condition and lies on a scale between 0 (indicating the health condition is equivalent to full health) and 1 (indicating the health condition is equivalent to death).
- The value of a life year (VOLY).

Each of these steps is briefly described below.

a) Estimate the prevalence of noise exposure within the population with and without/in absence of measures

The first step in the benefits estimation process is to identify the change in the size of the population exposed to harmful levels of noise. Data was therefore collected on the size of the population exposed to noise levels in 5dB increments (from 45 dB(A) to 80 dB(A) and using both L_{den} and L_{night} measures) under both the 'with END measures' and 'without END measures' scenarios. The difference between the two scenarios is then used to estimate the change in the size of the population affected by each of annoyance, sleep disturbance and cardiovascular disease.

As noted above, the size of the population affected by harmful levels of noise both before and after the implementation of measures and at each noise interval, is taken from the published NAPs or Strategic Noise Maps wherever possible. Where information on the distribution (across noise intervals) of the affected population after measures was not available in the NAP, this was estimated by applying widely accepted average noise reduction levels for each of the measures identified in the NAP (see Appendix E) and combining this with standard reference distributions used to determine the size of the population (before measures). Further details of the approach used for each of roads, railways and agglomerations are set out in Appendix F.

b) *Estimate the incidence (or prevalence) of annoyance and sleep disturbance as a result of noise exposure using relevant dose-response relationships*

Once the size of the population exposed to various noise levels has been established, the next step is to determine the proportion of that population that is moderately or highly annoyed, moderately or highly sleep disturbed or at risk of hypertension or cardiovascular disease (acute myocardial infarction and ischaemic heart disease) as a result of noise. For this, we make use of established dose-response relationships obtained from epidemiological studies. The derivation of these relationships is described in detail in WHO (2011)[36]

Annoyance and sleep disturbance

The specific dose-response functions used for each of sleep disturbance and annoyance are set out in the table below.

Table 5: Dose-response relationships for health effects of noise

Sleep disturbance	Roads	Moderate	$\%SD = 13.8 - 0.85L_{night} + 0.01670L_{night}^2$
		High	$\%HSD=20.8-1.05(L_{night})+0.01486(L_{night})^2$
	Rail	Moderate	$\%SD = 12.5 - 0.66L_{night} + 0.01121L_{night}^2$
		High	$\%HSD=11.3-0.55(L_{night})+0.00759(L_{night})^2$
	Air	Moderate	$\%SD = 13.714 - 0.807L_{night} + 0.01555 (L_{night})^2$
		High	$\%HSD=18.147-0.956(L_{night})+0.01482 (L_{night})^2$
Annoyance	Roads	Moderate	$\%A=1.795*10^{-4}(L_{den}-37)^3+2.110*10^{-2}(L_{den}-37)^2+0.5353(L_{den}-37)$
		High	$\%HA=9.868*10^{-4}(L_{den}-42)^3-1.436*10^{-2}(L_{den}-42)^2+0.5118(L_{den}-42)$
	Rail	Moderate	$\%A=4.538*10^{-4}(L_{den}-37)^3+9.482*10^{-3}(L_{den}-37)^2+0.2129(L_{den}-37)$
		High	$\%HA=7.239*10^{-4}(L_{den}-42)^3-7.851*10^{-3}(L_{den}-42)^2+0.1695(L_{den}-42)$
	Air	Moderate	$\%A=8.588*10^{-6}(L_{den}-37)^3+1.777*10^{-2}(L_{den}-37)^2+1.221(L_{den}-37)$
		High	$\%HA=-9.199*10^{-5}(L_{den}-42)^3+3.932*10^{-2}(L_{den}-42)^2+0.2939(L_{den}-42)$

[36] WHO (2011) *Burden of disease from environmental noise. Quantification of healthy life years lost in Europe*, World Health Organization Regional Office for Europe, Copenhagen [online] available at http://www.who.int/entity/quantifying_ehimpacts/publications/e94888.pdf?ua=1

Hypertension and cardiovascular diseases

Epidemiological studies on the relationship between transportation noise (particularly road traffic and aircraft noise) and cardiovascular effects have been carried out on adults and on children, focusing on mean blood pressure, hypertension and ischaemic heart diseases as cardiovascular end-points. While there is evidence that road traffic noise increases the risk of ischaemic heart disease, including myocardial infarction, there is less evidence for such an association with aircraft noise because of a lack of studies. However, there is increasing evidence that both road traffic noise and aircraft noise increase the risk of hypertension. Very few studies on the cardiovascular effects of other environmental noise sources, including rail traffic, are known and are, therefore, not considered further here.

Two meta-analyses (Van Kempen, (2002)[37] and Babisch (2006)[38]) combined a number of suitable primary studies to estimate exposure-response functions based upon the best available evidence at the time. These were then applied to population level data on noise exposure to estimate the health impacts of noise in the Netherlands and Germany. The exposure-response relationships that each of these studies derived have since been recommended for use by the WHO, Defra and EEA guidance. This earlier work has since been supplemented by a more recent meta-analysis (Babisch, 2014)[39] based on a more substantial body of evidence on the association between road traffic noise and coronary heart diseases. This more recent analysis concluded that studies of the associations between road traffic noise and the risk of coronary heart diseases show a significant increase in risk with increasing noise level. In particular, the meta-analysis revealed an 8% increase in risk per increase of the weighted day-night noise level L_{DN} of 10 dB (A) within the range of approximately 52-77 dB (A).

The WHO and EEA set out approaches to valuing hypertension and ischaemic heart disease separately while Defra recommends that, in order to reduce the risk of double counting, hypertension is not directly valued, but that instead its impacts are valued in terms of consequential health outcomes, namely strokes and dementia.

Defra therefore recommends a two-stage approach to valuing hypertension. Firstly, quantifying the impact of noise exposure and hypertension (using odds ratios derived by Babisch and Van Kamp (2009) and in accordance with the WHO and EEA guidance) and then between hypertension and dementia and strokes. The second stage values the expected incidents of hypertension by quantifying consequential changes in incidents of both dementia and strokes and then valuing these in terms of DALYs. The key steps in this approach are presented in detail in the Defra guidance.

For the purposes of the present CBA, hypertension has been valued using the odds ratios presented in WHO (2011) and established on the basis of a review by Berry et al (2009)[40] of the link between environmental noise and hypertension.

[37] Van Kempen, E et al (2002), The Association Between Noise Exposure and Blood Pressure and Ischaemic Heart Disease: a Meta-analysis.

[38] Babisch, W (2006) Transportation Noise and Cardiovascular Risk: Review and Synthesis of Epidemiological Studies [online] available at http://www.umweltbundesamt.de/sites/default/files/medien/publikation/long/2997.pdf

[39] Babisch, W., 2014. Updated exposure-response relationship between road traffic noise and coronary heart diseases: A meta-analysis. Noise and Health, 16(68), p.1.

[40] Berry, B. (forthcoming) Review of recent research on noise and hypertension. Berry Environmental Ltd.

For aircraft noise, the odds ratio was derived using the results of five studies on the relationship between aircraft noise and high blood pressure. When the coefficients of a linear trend from the five studies were taken together, the pooled estimate of the relative risk was 1.13 (95% CI 1.00–1.28) per 10 dB(A) for aircraft noise levels ranging between approximately 47 and 67 dB(A)[41].

Owing to the results of more recent studies, this pooled effect estimate was smaller than that obtained from an earlier meta-analysis where the estimate of the relative risk was 1.59 (95% CI 1.30–1.93) per 10-dB(A) increase in the noise level [42].

For road traffic noise, we have used the value recommended by Defra (2014)[43]. The Defra value is derived from evidence collated by Berry (forthcoming, cited in Defra, 2014)[44] and is set at 1.07 for a 10 dB increase above 50 dB.

The WHO and EEA guidance concur on the use of the Babisch (2006) polynomial for estimating the increase in risk of ischaemic heart disease (using acute myocardial infarction as a marker) for each unit increment in noise level:

$$OR = 1.629657 - 0.000613 * (L_{day,16h})^2 + 0.000007357 * (L_{day,16h})^3,\ R^2 = 0.96$$

c) Conversion to DALYs using disability weights

The impacts on each of the health end-points were then converted into a standard health metric using disability weights (DWs) and expressed in terms of deaths and/or duration of disability (in years) (see Box 2).

Box 2: DALYs

DALYs indicate the estimated number of healthy life years lost in a population from premature mortality or morbidity, i.e. the health burden.

The DALY is calculated as the sum of years of potential life lost due to premature mortality and the years of productive life lost due to disability. It can be calculated as follows:

DALY = YLL + YLD

Where YLL = ND (number of deaths) x DW (disability weight) x LD (standard life expectancy at age of death in years); and

YLD = NI (number of incident cases) x DW (disability weight) x LI (average duration of disability in years)

There are previous studies available that provide benchmark data on DWs, such as the WHO study on *the Burden of Disease from Environmental Noise.* This data has been used in the present CBA.

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[41] Babisch, W. and van Kamp I. Exposure–response relationship of the association between aircraft noise and the risk of hypertension. *Noise & Health*, 2009, 11(44):161–168.

[42] van Kempen EEMM. et al. The association between noise exposure and blood pressure and ischaemic heart disease: a meta-analysis. *Environmental Health Perspectives*, 2002, 110:307–317.

[43] Defra (2014) Defra (2014) Environmental Noise: Valuing impacts on: sleep disturbance, annoyance, hypertension, productivity and quiet.

[44] Berry, B., (forthcoming) 'Review of recent research on noise and hypertension' Berry Environmental Ltd.

Disability weights allow time lived in various non-fatal health states and death to be measured using a common unit using a scale that takes societal preferences into account. The recommended values for DWs for various disease states are set out in WHO (2011) and have been used to support this CBA. The specific values that have been used in the analysis for sleep disturbance and annoyance are shown in Table 6.

Table 6: Disability weights used in the analysis

Health endpoint	Recommended Value	Low	High	Notes
Sleep disturbance	0.07	0.04	0.10	Following the *Night noise guidelines for Europe*[45], 0.07 was chosen as the DW of noise-related sleep disturbance in the calculation of DALYs. This value takes into account both the medians and means of the DWs observed in various epidemiological studies. Given the skewed distribution of the DWs reported across the studies, the median of the study with the lowest DW was chosen as the low estimate, whereas the highest observed mean value (0.10) was chosen as a high estimate yielding the uncertainty interval 0.04-0.10.
Annoyance	0.02	0.01	0.12	Given the limited number of studies on a DW for annoyance, and the sensitivity of the environmental burden attributed to noise annoyance for small chances in DW, the WHO proposes a tentative DW of 0.02 with a relatively large uncertainty interval (0.01-0.12).

Note, however, that there are no published disability weights applicable to the low and moderately annoyed and sleep disturbed populations. As a result, the CBA only considers the value of changes in the highly annoyed and highly sleep disturbed populations.

In line with the approach presented in WHO (2011), we make use of WHO health statistics[46] for estimates of the DALYs relating to cardiovascular disease (acute myocardial infarction and hypertension) in each Member State. As DALYs for myocardial infarction are not published, we applied the values relating to ischaemic heart disease. Thus, for the sake of DALY calculation, we assume that road traffic noise has a similar impact on all ischaemic heart disease as on myocardial infarction.

Combining the data on noise exposure, the incidence of health outcomes as a result of noise and the appropriate disability weights, we are then able to provide an estimate of the health impact of sleep disturbance and annoyance (for the highly sleep disturbed and highly annoyed populations respectively) and cardiovascular disease expressed in terms of DALYs.

[45] WHO (2009) Night noise guidelines for Europe. Copenhagen, WHO Regional Office for Europe [online] available at http://www.euro.who.int/__data/assets/pdf_file/0017/43316/E92845.pdf

[46] WHO (2014) Health Statistics - Environmental Burden of Disease (2012). Online at http://www.who.int/healthinfo/global_burden_disease/estimates/en/index2.html

d) Estimate the health value

The value of these outcomes is then estimated by applying a derived value of a life year (VOLY). The derivation of the estimates the VOLY used in this analysis is described in more detail below.

The cost-savings through a reduction in the number of hospital admissions (and hence healthcare costs) and lost productive days at work (particularly relating to the incidence of acute myocardial infarction) should ideally be included in the analysis but it was not possible to do so with the available evidence. While it was possible to obtain marginal values for healthcare costs and absenteeism, more detailed research is required to determine the incidence rate of acute myocardial infarction across the population (which varies by age, gender, ethnicity) and how this changes in response to changes in exposure to noise. This is required in order to derive estimates of the total number of avoided hospital admissions and lost work days. The derivation of the marginal estimates for healthcare costs and absenteeism are nevertheless reported below.

Morbidity and Mortality

Opinion is divided on whether one should use the Value of a Statistical Life (VSL) or VOLY for mortality valuation. Some argue that the VOLY approach links more naturally to the quantified health impact. Others, however, argue that the VOLY concept lacks the strong empirical base developed by VSL estimates made over many years. A 2004 report for European Commission, DG Research, Technological Development and Demonstration (RTD) on an Assessment of External Costs from Energy Technologies (New EXT)[47] compares the Value of Statistical Life (VSL) and VOLY approaches for valuing the incidence of premature death (in this instance by air pollution) in different contexts and concludes that there is strong support for using VOLYs in cases where "the impact of air pollution is not instantaneous but the cumulative result after years of exposure, so that the number of deaths is not observable".

There is nevertheless some debate in the literature on what the most appropriate monetary value should be. In the absence of European studies directly focussing on the VOLY, the New EXT project carried out a study to provide an empirical basis for valuing mortality impacts. This made use of a relationship, established in Rabl (2003)[48], between changes in probabilities of death and changes to life expectancy. In essence, the relationship presents the equivalent change in life expectancy associated with a 5 in 1000 change in risk of premature death for different ages and sex, based on EU population statistics. Based on their calculations, the authors suggest that the implied mean and median values of a statistical life-year (VOLY) are €125,250 and €55,800 (in 2000 prices) respectively but that, "… given the uncertainties, this might safely be rounded to €50,000".

[47] IER (2004) New Elements for the Assessment of External Costs from Energy Technologies. Final Report to the European Commission, DG Research, Technological Development and Demonstration (RTD) [online] available at http://www.ier.uni-stuttgart.de/forschung/projektwebsites/newext/newext_final.pdf

[48] Rabl, A. (2003). Interpretation of air pollution mortality: number of deaths or years of life lost?. *Journal of the air & waste management association*, *53*(1), 41-50.

In 2005, AEA Technology[49] led a CBA of air quality related issues, in particular in the Clean Air for Europe (CAFE) Programme. The methodological report reviewed the available evidence relating to the valuation of morbidity and mortality effects, including those used in the new EXT study and estimates from a Defra study on WTP for a reduction in air pollution that would bring about a range of health benefits. The authors concluded that the newEXT median and mean values were most appropriate since they are more representative of the EU population and made use of a larger sample size.

A more recent report by EMRC on the CBA of the Air Quality Package for Europe[50] also makes use of the newEXT values. While these were challenged by stakeholders[51], the authors of the EMRC study argue that the newEXT values are representative of the broader literature in the area, including work by Desaigues *et al* (2011)[52] who argue that "[*for the EU] the VOLY is at least €25,000 and at the most €100,000"* and a more recent paper by Chanel and Luchini (2014)[53] which provides a further peer reviewed estimate for the VOLY based on analysis performed in France, of €140,000.

For the purpose of this CBA, a value in accordance with the recent CBA of the Air Quality Package for Europe[54], adjusted to 2014 prices using the Eurostat GDP deflator, of €110,987 has been used. This value has been applied across all Member States as it was considered neither practically possible nor politically appropriate to use different values and also because there is also the practical challenge of getting such values from Member States. For instance, a WTP for increasing life expectancy has been derived only for a couple of Member States. Furthermore, data requirements would weigh against pursuing a Member State by Member State approach. Finally, as the analysis is carried out at the EU level, it is justified to use the same average WTP values across all Member States. Sensitivity tests were also run using the lower - and upper-bound estimates provided by the Commission as having been used in other impact assessments with a range from €67,163 to €155,000.

Hospital admission costs

Ready et al (2004) reported generic unit costs for hospital health care in various EU Member States including both outpatient / emergency room and inpatient care. The CAFE CBA uses these values as a starting point to calculate mean values suitable for use as a first proxy for EU countries for which specific values do not exist. Generic hospital costs are taken as the average costs of a wide variety of specialist treatments, for use when precise information about the nature of the individual's hospital contact is not known. The mean inpatient costs were estimated at €620 per day and the outpatient costs as €35 per visit (both in 2000 prices).

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[49] AEAT (2005) Service Contract for Carrying out Cost-Benefit Analysis of Air Quality Related Issues, in particular in the Clean Air for Europe (CAFE) Programme Methodology for the Cost-Benefit analysis for CAFE:

Volume 2: Health Impact Assessment [online] available at http://ec.europa.eu/environment/archives/cafe/pdf/cba_methodology_vol2.pdf

[50] EMRC (2014) Cost-benefit Analysis of Final Policy Scenarios for the EU Clean Air Package Version 2 Corresponding to IIASA TSAP Report 11, Version 1 March 2014 [online] available at http://www.iiasa.ac.at/web/home/research/researchPrograms/MitigationofAirPollutionandGreenhousegases/TSAP_CBA_corresponding_to_IIASA11_v2.pdf

[51] See, for example, Concawe (2013) CONCAWE Comments on the Key Submissions Associated with 5th Stakeholder Expert Group of the Air Quality Policy Review held in Brussels, 3rd April 2013. Cost Benefit Analysis under the Microscope.

[52] Desaigues, B., et al (2011) Economic valuation of air pollution mortality: A 9-country contingent valuation survey of value of a life year (VOLY). *Ecological Indicators* 11 (2011) 902–910.

[53] Chanel and Luchini (2014)

[54] EMRC (2014) Cost-benefit Analysis of Final Policy Scenarios for the EU Clean Air Package Version 2 Corresponding to IIASA TSAP Report 11, Version 1 March 2014 [online] available at http://www.iiasa.ac.at/web/home/research/researchPrograms/MitigationofAirPollutionandGreenhousegases/TSAP_CBA_corresponding_to_IIASA11_v2.pdf

The EMRC (2014) study, however, uses information from the WHO's CHOICE database[55] which indicates that that the 'hotel' costs of hospitalisation are on average in the region of €280/day (2008 prices) for the EU. These estimates represent only the 'hotel' component of hospital costs, i.e. excluding the costs of drugs and diagnostic tests but including costs such as personnel, capital and food costs. WHO's Hospital Morbidity Database indicates 8.6 days for cardiovascular admissions as an average for EU countries. Combining these figures provides the total cost of a hospital stay.

For the purposes of this CBA, we have used the WHO estimates adjusted to 2014 prices. The average cost of admission to hospital is thus taken to be around €2,600. It can be further assumed that each episode of myocardial infarction results in a hospital admission. However, as explained above, it was not possible to obtain information on the absolute number of hospital admissions relating specifically to noise-induced illness in the baseline (i.e. before the introduction of noise-reduction measures), and therefore it is not possible to determine the change in the number of AMI admissions related to noise disturbance. From the information available, it is only possible to determine the change in the number of people at risk of myocardial infarction as a result of the implementation of noise-reduction measures under the END. The cost-savings from a reduction in the number of hospitalisations has therefore not been included in the cost-benefit analysis.

Employer costs (costs of absenteeism)

The costs of absenteeism adopted in this analysis are based on surveys conducted by the Confederation of British Industry (CBI, 2013)[56] and the CIPD (2013)[57]. This report is the outcome of a survey on absence conducted by the CBI. The direct cost of absence is based on information from a survey across a range of organisations from various sectors which seeks to establish the levels, causes and costs of absence in the UK. Direct costs include the salary costs of absent individuals, replacement costs (i.e. the employment of temporary staff or additional overtime), and lost service or production time. The indirect costs of absence (i.e. those relating to lower customer satisfaction and poorer quality of products or services leading to a loss of future business) are not included as there is insufficient information to provide a representative estimate.

The CBI reports a mean direct cost to business per employee as £975 (€1,209) in 2012 prices. However, the mean cost estimates are skewed (increased by the fact that a small number of employers have very high costs and therefore the median estimate (£622 or €771) is likely to be a better indicator of average costs. The survey also notes that the average absence level per employee is 5.3 days per year. Based on the median, the average cost per employee per day is therefore £117.36 (or €145.56 in 2012 prices). The CIPD survey reports an average of 7.6 days absence (trimmed mean) and median cost of absence of £595 (€738 in 2012 prices) giving an implied cost per day of £78.29 (or €97.10), somewhat below the CBI estimate. For the purposes of this CBA, we have used the average of the CBI and CIPD figures and adjusted these to 2014 prices.

[55] See http://www.who.int/choice/cost-effectiveness/inputs/health_service/en/

[56] CBI (2013) Fit for purpose: Absence and workplace health survey 2013 [online] available at http://www.cbi.org.uk/media/2150120/cbi-pfizer_absence___workplace_health_2013.pdf

[57] CIPD (2013) Absence Management, Annual Survey Report 2013 [online] available at https://www.cipd.co.uk/binaries/absence-management_2013.pdf

In order to derive country-specific estimates of the direct costs presented for the UK, we have used a EUROSTAT index of purchasing power parity[58] to scale the UK estimate up or down for each Member State and to derive a mean estimate that is then applied across the EU-28. The mean EU estimate is €111.82 per day (2014 prices). This figure is then multiplied by the average number of days absent from work for each person that suffers from noise-induced myocardial infarction.

This is equated to the length of hospital stay (8.6 days) plus the time spent at home recovering (15 days). The total cost to the employer for each incidence of myocardial infarction is therefore estimated to be €2,856 (2014 prices). For an EU-wide estimate, the costs per absent person then need to be applied to the average proportion of the working age population (65.9%) across the EU28 in each of part- and full-time employment (20.4% and 79.6% respectively)[59].

However, as noted above, the employer costs are not included in the analysis as it was not possible to obtain information on the change in the number of people that suffer from noise-related cardiovascular disease relative to the baseline.

It is only possible to derive estimates of the change in relative risk.

The following costs have also been excluded from the analysis as it was not possible (within the confines of the present study) to obtain estimates of the baseline values and hence cost-savings as a result of noise reduction measures: Emergency room visits

- General Practitioner (GP) visits
- Daily medication (e.g. for sleeplessness, hypertension, heart conditions, etc.)
- The opportunity cost of lost leisure (i.e. non-work) time

The value of cost-savings in relation to each of the items below is nevertheless considered small relative to the total benefits.

A summary of the relevant cost savings to be considered in the CBA is provided in Table 7 below. However, due to limited information from the literature, it was only possible to include those impacts which are shown in bold. Table 8 provides a summary of the base case estimates derived for each of VOLYs, hospital admissions and employer costs. It can be seen that hospital admissions and employer costs together constitute only around 5% of the value of mortality as measured by the VOLY.

Table 7: Health impact summary

	Road	Rail	Air	Health impacts
Annoyance	✓	✓	✓	• **Mortality from life years lost**
Sleep Disturbance	✓	✓	✓	• **Mortality from life years lost or premature death** • Costs of medication • GP visits • Lost productive time (employer costs)
Myocardial Infarction	✓			• **Mortality from life years lost or premature death** • Cardiac hospital admissions • Lost productive time (employer costs) • Emergency room visits • GP visits

58 http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tec00114&plugin=1
59 http://ec.europa.eu/eurostat/data/database

	Road	Rail	Air	Health impacts
Hypertension	✓		✓	• Costs of medication • **Mortality from life years lost or premature death** • GP visits • Costs of medication

Table 8: Valuation basis and central value for each of the health impacts included in the analysis

Health impact	Valuation basis	Central Value (2014 prices)
Hospital admission for acute myocardial infarction	WHO databases on inpatient costs and average length of hospital stay for cardiovascular conditions	€2,600 per stay
Mortality / morbidity	VOLY (from EMRC, 2014)	€110,987
Employer costs	CBI and CIPD surveys on workplace absence	€2,639 per incidence of myocardial infarction

e) Wider benefits

In addition to measures identified in individual NAPs, the analysis has also considered the influence of the END on other EU Regulations, Directives and Communications. These are also complemented by a whole host of national and local regulations and policies relevant to noise. It is, however, very difficult to precisely quantify the degree to which the END has influenced these national and local initiatives and therefore their individual effects have not been considered directly in the assessment. They are, however, at least partly accounted for through sensitivity tests around the degree to which the benefits can be attributed to the END.

The relevant Directives investigated are set out in the table below.

Table 9: Other relevant Directives and Regulations

Directive / Regulation	Entry into force
Roads	
EC regulation No 1222/2009 on the **labelling of tyres** with respect to fuel efficiency	1 November 2012
Regulation (EC) No 661/2009 concerning type-approval requirements for the **general safety of motor vehicles**, their trailers and systems, components and separate technical units intended therefor.	20 August 2009
Regulation 540/2014 on the sound level of motor vehicles and of replacement silencing systems	June 2015
Airports	
Directive 2002/30/EC on **noise management at airports** (and subsequent Regulation No. 1137/2008 relating to Article 6)	28 March 2002
Regulation 598/2014 on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Union airports within a Balanced Approach and repealing Directive 2002/30/EC	13 June 2016

Directive / Regulation	Entry into force
Railways	
Directive 2006/38 (revised) Charging heavy goods vehicles on motor- and freeways for infrastructure use. Basis: Allocated infrastructure costs plus mark-ups for noise and air pollution. This was the precondition set in Dir. 2001/14 for including noise costs in the rail track charging scheme.	
COM 2006/66 Technical Specifications for Interoperability related to the subsystem 'rolling stock-noise'. Functional and technical specification of the sub-system. Limits for pass-by and stationary noise. Limits for locomotives, multiple units and coaches. Measurement, assessment, application to new and existing rolling stock.	June 2006

5) Calculate the present value of benefits

The benefits of a reduction in noise levels are assumed to be persistent, i.e. they endure for as long as the noise levels remain below those that would have been experienced in absence of the END (i.e. the counterfactual scenario). For the purpose of this CBA, the benefits are assumed to be constant over the assessment period although in reality, these may be eroded over time as general noise levels increase. Consequently, even if individuals may continue to experience noise levels lower than without the intervention, they may end up back in the highly annoyed group. The analysis could therefore potentially overstate the size of the benefits. However, we also considered a counterargument put forward in this regard, namely the fact that if general noise levels increase over time, this would equally increase the adverse effects in the absence of the END. It is possible that the "gap" between the adverse effects experienced both under the END and in a counterfactual situation in the absence of the END would remain the same no matter what the general noise levels trends are.

The stream of benefits was assessed over a 25-year assessment period and discounted using the EC's recommended social discount rate of 4% to obtain a measure of the present value.

The estimate of the size of the benefits calculated has also taken into account, as far as possible and on the basis of contextual information provided during interviews, the extent to which the benefits linked to the implementation of measures in the NAPs (i.e. a reduction in environmental noise in decibels) can be attributed to the END, or would have happened anyway as a result of other policies and legislation and general pre-planned infrastructure upgrades.

6) Apply decision criteria

Net present values and cost-benefit ratios are then calculated for each measure by comparing the present value of costs and benefits.

7) Sensitivity testing

The sensitivity of the results to the underlying assumptions (e.g. around the value of disability weights, VOLYs or the extent to which the change in the size of the population exposed to noise can be attributed to the implementation of the END) were also systematically tested to reflect the confidence intervals (i.e. using the low and high points of ranges in, for example, disability weights and QALYs). More specifically, the parameters shown in Table 10 were tested.

Table 10: Parameters for sensitivity testing

	Base case	Test 1 (Low scenario)	Test 2 (High scenario)
Disability weight for annoyance	0.02	0.01	0.12
Disability weight for sleep disturbance	0.07	0.04	0.1
VOLY	€110.987	€67,163	€154,812

1.4.2 Stage 2 – Extrapolation to the EU level

The test case results were then aggregated and extrapolated to inform an indicative assessment of the costs and benefits of the END at the EU-wide level. To this end, the individual test case costs and benefit estimates were considered in light of:

- Their **representativeness** (i.e. are there factors that make the agglomeration, airport or other major infrastructure unique in terms of the selection of measures implemented and the associated costs and benefits or can it be considered broadly representative of other agglomerations or major infrastructure?)
- The **reliability** of the test case data (i.e. is the test case data complete and reliable or to what extent is it based on estimates).

Where considered necessary, the values applied across the EU-28 were adjusted to take account of:

- The **local context** (e.g. rural vs urban, largely to reflect the differences in population densities in these areas);
- The **size** of the agglomeration or airport, or length of road or railway in relation to that to which the values are being applied;
- The relative maturity of the implementing authority in terms of the noise measures that have been implemented (i.e. is the implementing authority in the test case likely to be ahead, or behind of the curve in relation to other implementing authorities). This is relevant as some authorities may already have implemented the most cost-effective measures and thus any further expenditure will result in lower net benefits;
- The **reliability of the information** on the costs of measures in the test cases when benchmarked against other agglomerations and infrastructure with similar characteristics.

The process of extrapolating the test case data for each of major airports, roads, railways and agglomerations, including any adjustments, is described in more detail in the following section. Various sensitivity tests were then applied using the same parameters as identified in Table 10, as well as an additional one that considered the degree of completeness of NAPs across the EU28 by only considering those Member States for which NAPs exist.

1.5 Aggregate assessment of the costs and benefits of END

1.5.1 Major airports

1.5.1.1. Context

Under the END, there is a requirement for noise exposure levels to be reported for all airports with more than 50,000 aircraft movements per year. According to the EEA Noise database[60], a total of 93 airports fulfil this criterion. These range in size (in terms of annual traffic movements) from 22,000 movements per year (Turku Airport, Finland) to almost 500,000 movements per year (London Heathrow, United Kingdom and Paris Charles de Gaulle Airport, France).

Based on European Environment Agency (EEA) data from 2013[61], it is estimated that around 0.66 million people in Europe are exposed to harmful levels of noise (L_{den}) from major airports.

In recent years there have been a number of policy and technological advances that have sought to reduce aircraft noise. In the past 15 years, a 75% reduction in aircraft noise (equivalent to a 6dB reduction) at source has been achieved, reflecting investment by manufacturers in R&D to reduce aircraft noise at source through a combination of improvements in aircraft design (e.g. advanced aerodynamics, lighter aircraft etc.) and engine design (e.g. next generation engines). This development has been supported by the increasingly stringent standards for noise at source set by the ICAO which date back to the 1970s. In addition, procedural operating efficiencies, such as Continuous Descent Approaches and Continuous Climb Operations reduce noise by flying aircraft higher, routing aircraft differently within the airspace and/or optimising the use of engine thrust). It is, however, challenging to separate out those improvements that have been at least influenced by the END and those which would have happened anyway. Other possible influences on noise reduction around airports include:

- The European Parliament and Council approved on April 16, 2014 **new aviation noise rules** (Regulation 598) that repeal a 2002 Directive on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Community airports[62]. The new regulation, which is due to take effect on June 13, 2016, puts the EU in line with the International Civil Aviation Organization's '**balanced approach**' to noise. This approach calls for cutting noise levels through the deployment of modern aircraft, land-use planning, quieter ground-control operations and restrictions on nighttime flying.
- **Advances in jet engine technology**. It is estimated that new generation jet engines are on average 75% quieter than their 20th century predecessors.

However, critics argue that these are likely to make little difference to noise levels as they are accompanied by an increase in the total number of flights and a demand for larger passenger planes[63] and because of a lack of a binding noise target[64]. It is nevertheless possible to attribute at least some of the reduction in noise to the END.

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[60]Accessed at http://forum.eionet.europa.eu/etc-sia-consortium/library/noise_database/index_html

[61] See http://www.eea.europa.eu/data-and-maps/indicators/exposure-to-and-annoyance-by-1/assessment

[62] Directive 2002/30/EC of the European Parliament and of the Council of 26 March 2002 on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Community airports (OJ L 85, 28.3.2002, p. 40).

[63] See http://www.euractiv.com/sections/aviation/aircraft-become-quieter-health-concerns-about-noise-grow-louder-303449

1.5.1.2. Methodology: Summary overview

The analysis that follows considers a number of test cases from which an indicative estimate of the costs and benefits across the EU28 was made.

The test cases covered five airports:

- Glasgow (United Kingdom)
- Stuttgart (Germany)
- Athens International (Greece)
- Vienna International (Austria)
- Frankfurt (Germany)

The figure and table below show the size of the test case airports in terms of annual number of aircraft movements in relation to all airports that are required to report under the END.

Figure 4: Distribution of airport sizes by number of aircraft movements across EU Member States

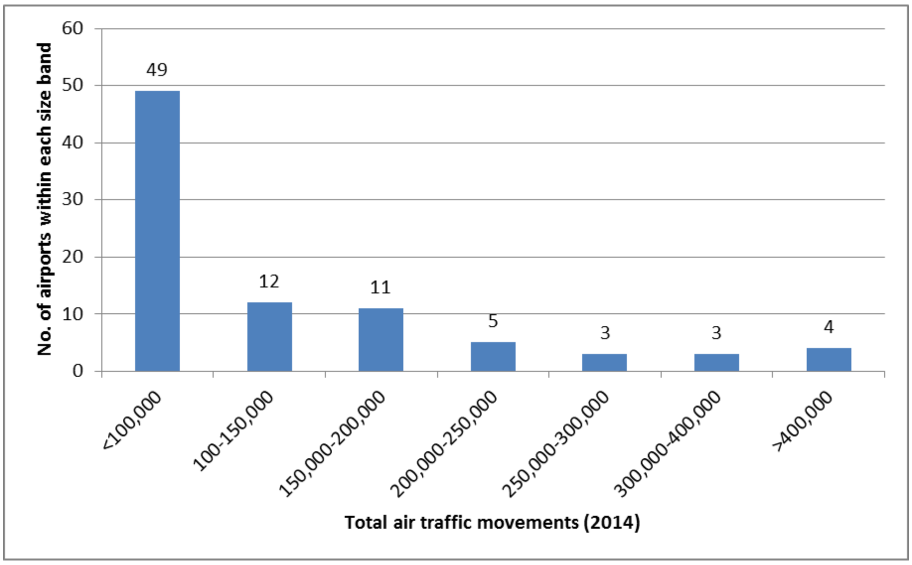


Table 11: Test case airports by size

Airport	Movements per year
Glasgow	83,999
Stuttgart	127,678
Athens	154,530
Vienna	249,989
Frankfurt	469,026

[64] See http://www.euractiv.com/sections/aviation/new-eu-rules-seen-too-timid-reduce-airport-noise-303427

This shows that the test case airports are larger (in terms of total air traffic movements, ATMs) than most of the major airports across the EU. Almost half (at least 29) of the 62 airports for which data is available, are smaller than Glasgow airport.

The test case data was then extrapolated to inform an assessment of the costs and benefits across the EU-28. For each test case, the number of people exposed above 55 dB L_{den} is used to derive per person estimates of costs and benefits. It is important to note that this cost or benefit per person is not the cost or benefit per single beneficiary of the noise reduction measures; rather, it is an averaged cost or benefit that considers both those people that benefited from the noise reduction measures and those that did not. The average benefit per person is therefore simply an indicator of the performance at airport level. It is not an assessment of the effectiveness of specific measures (i.e. the value of the benefit derived by those that directly benefit from the measure), as the beneficiary population is a subset of the total population affected by noise.

The size of the population exposed to noise levels greater than 50 dB L_{night} is also reported but not used for calculations.

Costs

Costs are divided into a) compliance/administrative costs, and b) costs of implementing the measures. Costs reported here are the total costs incurred (or planned) to date, discounted (at 4% per year) over a 25-year assessment period, and expressed in 2014 prices.

Costs are then averaged per person affected by more than 55 L_{den}, by dividing the present value costs (i.e. the sum of the discounted costs over 25 years) by the number of people exposed to noise levels higher than 55 dB L_{den}.

Benefits

Benefits are considered as the difference between the existing situation and the situation after the implementation of all the measures. They are monetised by means of the methodology of valuation of health effect described in Section 1.4.1. The benefits are assessed over a 25-year period, discounted at 4% per year and expressed in 2014 prices.

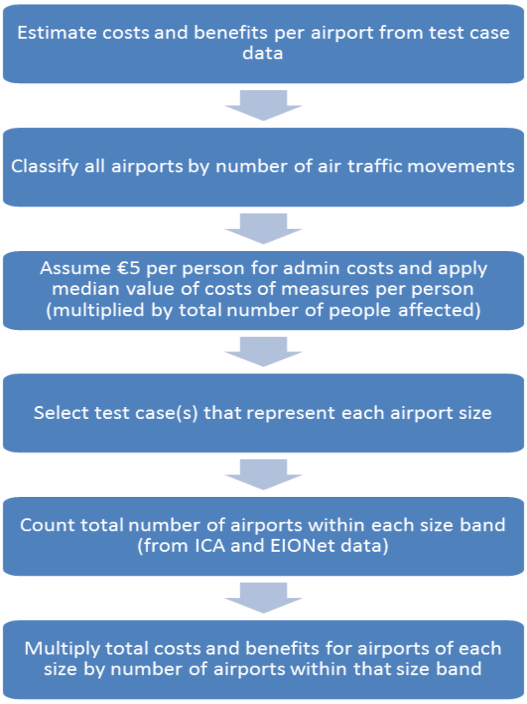
Benefits and benefits per person are then adjusted to consider the effect of measures that result in changes indoor noise levels (i.e., noise insulating windows/sound-proofing measures) that are not reflected in strategic noise mapping but which nevertheless result in a reduction in environmental noise levels.

Net present value

The net present value (NPV) is then calculated as the difference between the benefits (typically higher than costs) and the costs (both the compliance/administrative and the costs of measures) over the 25 year assessment period. The cost-benefit ratio is also presented to provide an idea of the overall value for money.

Figure 5 shows, in simplified form, the approach to extrapolating the test case findings across the EU-28 airports for which noise exposure data was available. A more detailed analysis of the test case findings and description of the extrapolation across the EU-28 is provided below.

Figure 5: Approach to extrapolation for major airports



1.5.1.3. Test case findings

A summary of the test case findings is provided in Table 12 overleaf. More detailed descriptions of each of the test cases and key findings are provided in Appendix F. Sources of information on costs and noise exposure are described in a series of input data sheets in Appendix L. The discounted cost and benefit estimates are calculated in a series of Excel workbooks which are available as separate files. The summary output pages for each test case are shown in Appendix G.

Table 12: Major airport test case summary

	Glasgow	Stuttgart	Athens	Vienna	Frankfurt
Key characteristics					
Location (urban / rural)	Peri-urban	Rural	Rural	Rural	Urban
Characteristics	Regional	Single runway	Dual runway; located near sea	Minor hub	Major hub
Size (ATMs, 2014)	83,999	127,678	154,530	249,989	469,026
Noise exposure					
Population exposed to noise > 55 dB L_{den}	68,800	44,200	14,970	12,300	238,700
Population exposed to noise > 50 dB L_{night}	22,700	5,700	4,710	1,100	107,500
Costs					
Compliance/administrative costs (€), discounted @4% p.a. over 25 years	101,127	120,362	51,776	70,367	2,600,849
Costs of measures (€), discounted @4% p.a over 25 years	287,759	54,366	523,979	21,965,699	12,449,063

	Glasgow	Stuttgart	Athens	Vienna	Frankfurt
Notes on costs	Costs of measures have been estimated using information contained in the Glasgow Airport Draft Masterplan (2011). The Masterplan notes that £60m has been spent on improvements since 2006 and over £200m will be spent over next 10 years. This covers all improvements. Improvements specifically aimed at reducing noise levels have been assumed to be 0.5% of the total value	Costs of measures are based on information from Stuttgart Airport. Costs are reimbursements for windows / ventilation systems only and do not cover other measures that may have been identified in the NAP and implemented	Cost information was requested but not provided. Administrative costs are therefore estimated €3 / affected person for SNM + €2/affected person for NAP. Costs of measures are taken as 10% of costs of measures at Frankfurt airport	Compliance costs are very low because the NAP is a short document written by a single person and with little or no public participation. The total cost of measures was obtained from the Noise Action Plans for 2008 and 2013	Compliance costs are significant because of the highly participatory process through which the NAP was developed Costs only available for soundproofing measures; have estimated costs of additional measures
Average total cost per person (€)	5.65	3.95	8.95	1,791.55	63.05
Benefits (assuming 100% attribution)					
Benefits (€)	339,878,384	2,530,786	98,278,030	8,752,186	1,045,671,376
Average benefit per person (€)	4,940	57	1,527	712	4,381

	Glasgow	Stuttgart	Athens	Vienna	Frankfurt
Adjusted Benefits (€). These take account of the effects of sound-proofing measures on indoor noise levels and hence sleep disturbance	340,298,823	37,003,009	107,003,800	54,485,999	1,045,671,376
Average benefit per person - adjusted (€)	4,946	837	1,662	4,430	4,381
Net Present Value (€)	339,909,937	36,828,281	106,428,044	32,449,933	1,030,621,463
Cost-Benefit Ratio	1:58	1:212	1:185	1:2	1:69
Sensitivity Testing					
Benefits: central estimates, 25% attribution (€, million)	84.97	0.63	24.57	2.19	261.42
Benefits: central estimates, 50% attribution (€, million)	169.94	1.27	49.14	4.38	522.84
Benefits: central estimates, 75% attribution (€, million)	254.91	1.90	73.71	6.56	784.25
High scenario - high values, 100% attribution (€, million)	1,371	8	236	49	2,702
Low scenario - low values, 100% attribution (€, million)	121	1	50	3	431
Low scenario - low values, 25% attribution (€, million)	30	0.31	13	1	108

For the purposes of extrapolating the test case data across all major airports, the costs and benefits of each of the test cases have been applied to other airports across the EU using information on both the airport size (total annual air traffic movements and size of the population exposed to harmful levels of noise (> 55 dB L_{den}). All EU-28 airports that are required to report and for which data exists have been classified into one of the size bands shown in Table 13. The table also shows which of the test cases correspond to each class. So, for example, Glasgow is taken to be broadly representative of all airports with fewer than 100,000 air traffic movements per year although, where considered necessary, further adjustments have been made to the test case data prior to extrapolation to account for any known anomalies (e.g. maturity in addressing noise issues or location) that may determine whether or not the test case estimates can be considered representative of other airports of that size.

Table 13: Classification of test case airports by size

Airport	Representative of airports with annual air traffic movements
Glasgow	<100,000
Stuttgart	100-150,000
Athens	150-200,000
Vienna	200-250,000
Frankfurt	>250,000

Costs of END implementation for major airports

On the basis of the test case data, the discounted **administrative costs** of END implementation (noise mapping, consultants, etc.) vary between €52,000 (at Athens airport) and almost €3 million (at Frankfurt airport). The variation in costs can be explained, at least partly, by the level of effort (including extent of public consultation) invested in preparing the NAPs. For Vienna airport, for example, the NAP is a relatively simple document prepared by a single person over a short period of time. However, in other cases (e.g. Frankfurt), the process of preparing a NAP is an extensive exercise involving multiple people (which may include consultants) and public consultation. The cost per affected person has also been calculated using information on the total population exposed to noise levels in excess of 55 dB L_{den} before the implementation of measures.

The range of measures implemented across airports is quite similar and includes a mix of operational changes, flight time restrictions and noise insulation measures (sound proofing and ventilation). However, the costs of measures published in the NAPs vary significantly. There are a number of possible explanations for this. First, as noted earlier, in some Member States the costs of measures are estimated on the basis of all measures that could potentially be implemented while in others the costs relate only to those measures for which a specific budget has already been allocated. Second, the costs are likely to vary by the size of the population affected: the larger the total number of households affected, the greater expenditure is to be on sound-proofing measures (one of the most commonly applied measures to reduce noise from airports). And third, some airports (more than 15) will have introduced noise reduction measures some time ago in response to national legislation and can now only make marginal improvements while others will be starting from a completely different base.

Moreover, the costs presented in the test cases are not directly comparable because they cover different measures (e.g. Stuttgart only includes costs of soundproofing measures) while in others (e.g. Vienna) they are relatively complete. The actual costs of measures were not available for Glasgow or Athens and therefore these costs were estimated using secondary information (e.g. the Glasgow Airport Master Plan) and assumptions made on the basis of professional judgement (e.g. it is assumed that only 0.5% of the total costs of improvements at Glasgow Airport are related to measures to reduce noise levels) (see Table 12).

Table 14 provides a summary of the total costs as well as costs per person for each of the test case airports.

Table 14: Summary of costs from major airport test cases

	Glasgow	Stuttgart	Athens	Vienna	Frankfurt	Source
Size (ATMs, 2014)	83,999	127,678	154,530	249,989	469,026	From ICA (2015)
Representative class	< 100,000	100-150,000	150-200,000	200-250,000	>250,000	
Population exposed to noise > 55 dB L_{den}	68,800	44,200	14,970	12,300	238,700	Strategic Noise Mapping data
Costs of END implementation (administrative costs)						
Total costs of implementation (€)	101,127	120,362	51,776	70,367	2,600,849	Based on published or estimated costs, discounted at 4% over 25 year assessment period
Cost per affected person (€)	1.47	2.72	0.80	5.72	10.90	Total costs of implementation divided by the population exposed to noise > 55 dB L_{den}
Costs of measures						
Total costs of measures (€)	287,759	54,366	523,979	21,965,699	12,449,063	Based on published or estimated costs, discounted at 4% over 25 year assessment period
Cost per affected person (€)	4.18	1.23	8.14	1,785.83	52.15	Total costs of measures divided by the population exposed to noise > 55 dB L_{den}
Total costs (€)	**388,886**	**174,728**	**575,755**	**22,036,066**	**15,049,912**	Sum of administrative costs and costs of measures
Total costs per person (€)	**6**	**4**	**9**	**1,792**	**63**	Total costs divided by the population exposed to noise > 55 dB L_{den}

For the purposes of extrapolation, the test case estimates have therefore been adjusted to take account of:

- The reliability and completeness of the data in the test case (e.g. whether the costs have been obtained from primary sources, published information or estimated using secondary data and whether they cover the costs of all measures are only a selection of measures);
- The relative size (in terms of aircraft movements per year) of each of the test case airports in relation to other airports within that size band;
- The characteristics of the test case airport to which they apply (e.g. number of runways and density of surrounding population) relative to a 'typical' airport within the corresponding size band; and
- The extent to which the public was consulted in the development of the NAPs for each of the test case airports (where known) as this has a bearing on the administrative costs.

The administrative costs of END implementation are assumed to be the same for all airports and are estimated to be around €5 per noise-affected person. This is slightly higher than the median of the test case values but accounts for the fact that the per person costs at Glasgow and Stuttgart Airports are likely to be lower than at other airports as the total costs are spread across a much larger population while the opposite is true of Frankfurt airport.

For the costs of measures, the average (€919) of the estimates from the Vienna (€1,785) and Frankfurt (€52) test cases has been used. The Vienna and Frankfurt costs estimates are considered to be the most reliable as they are based on published information and cover a range of typical measures implemented at airports. The costs of measures for all the other airports are either incomplete (they cover only selected measures) or have been derived from secondary information. The per person estimates have then been scaled up to provide estimates of the total costs of measures based on the median size of the population exposed to noise levels exceeding 55 dB L_{den} for all airports in each size band.

A further distinction is then made between those airports that had noise legislation prior to the introduction of the END and those that did not. For those airports with pre-existing legislation, it is assumed that some of the costs of measures would have been incurred anyway in order to comply with domestic regulatory requirements. It is thus assumed that only 50% of the total costs can be attributed to END for airports within countries that had noise legislation prior to the introduction of the END.

The resulting costs used for the purposes of extrapolation are shown in Table 15.

Table 15: Total adjusted costs (used for extrapolation to the EU28) by size of airport

	< 100,000	100-150,000	150-200,000	200-250,000	>250,000
Size (TATMs, 2014)	83,999	127,678	154,530	249,989	469,026
Model	Glasgow	Stuttgart	Athens	Vienna	Frankfurt
Population exposed to noise > 55 dB L_{den}	68,800	44,200	64,364	12,300	238,700
Median population exposed to noise > 55 dB L_{den} for each size airport in Member States without pre-existing legislation, before measures	11,600	4,500	5,150	8,800	7,800
Median population exposed to noise > 55 dB L_{den} for each size airport in Member States with pre-existing legislation, before measures	1,100	12,500	15,000	2,000	34,400
Costs of END implementation (administrative costs)					
Cost per affected person (€)	5.00	5.00	5.00	5.00	5.00
Total costs of END implementation for airports in Member States without pre-existing legislation (€)	58,000	22,500	25,750	44,000	39,000
Total costs of END implementation for airports in Member States with pre-existing legislation (€)	5,500	62,500	75,000	10,000	172,000
Costs of measures					
Cost per affected person (€)	918.99	918.99	918.99	918.99	918.99
Total costs of measures in Member States without pre-existing legislation (€)	10,660,300	4,135,461	4,732,806	21,965,699.11	7,168,133
Total costs of measures in Member States with pre-existing legislation (€)	505,445	5,743,696	6,892,435	918,991	15,806,652
Total costs for a typical airport in a Member State without pre-existing legislation (€, millions)	**10.72**	**4.16**	**4.76**	**22.01**	**7.21**

	< 100,000	100-150,000	150-200,000	200-250,000	>250,000
Total costs for a typical airport in a Member State with pre-existing legislation (€, millions)	**0.51**	**5.81**	**6.97**	**0.93**	**15.98**
Total costs per person (€)	**924**	**924**	**924**	**924**	**924**

Finally, the total costs shown in Table 15 are extrapolated across all EU28 airports by assuming that all the airports within each size band will incur the same costs as the model or representative airport. So, for example, the total costs of END implementation (administrative costs plus costs of measures) at a 'typical' airport with fewer than 100,000 traffic movements will be €10.72 million for airports in Member States without pre-existing noise legislation or €0.51 million for airports in Member States with pre-existing noise legislation.

The total cost for the representative airport (for each of without and with pre-existing noise legislation) is then multiplied by the total number of airports within that size band to provide an indicative cost across the EU-28 major airports for which exposure data was available (see Table 16 below).

Table 16: Extrapolation of costs across the EU-28 major airports

Airport size	< 100,000	100-150,000	150-200,000	200-250,000	> 250,000	Total
No. of airports within class without pre-existing legislation	10	2	2	2	3	19
Total costs for all airports **without** pre-existing legislation (€, millions)	107	8	10	44	22	190.66
No. of airports within class **with** pre-existing legislation	27	9	9	3	7	55
Total costs for all airports with pre-existing legislation (€, millions)	14	52	63	3	112	243.40
GRAND TOTAL (€, millions)	**121**	**61**	**72**	**47**	**133**	**434.05**

The analysis was then further refined to take account of the status of NAPs for each of the major airports. It is assumed, for example, that in the case where an airport has not produced a NAP, then it should also be attributed a lower level of costs (and benefits). Similarly, for airports in Member States with no pre-existing noise legislation but where a NAP has been produced, then it is assumed that 100% of the costs (and benefits) can be attributed to the introduction of the END. The specific factors that have been used to attribute costs to END for each major airport type within each band are shown in Table 17.

Table 17: Factors used to attribute costs to major airports

Status	%
No legislation, NAP	100
No legislation, no NAP	25
Legislation, NAP	50
Legislation, no NAP	50

Similar to the approach described above, the costs for each model/representative airport are then multiplied by the number of airports within that category, (taking account of both NAP status and whether or not the airport is within a Member State with pre-existing noise legislation. More specifically, the total cost per person (€924 for airports with fewer than 100,000 movements) is multiplied by (a) the median value of the population exposed to noise levels higher than 55 dB L_{den} across all airports within that size band, and depending on whether or not they have a NAP and whether or not they are located within a Member State with pre-existing noise legislation (b) the number of airports within that category and (c) the proportion of costs that is assumed to be attributable to END (from Table 17). The resulting estimates are shown in Table 18.

Table 18: Median exposure across major airports in each category

Status (legislation and NAPs)	Size	Median exposure (L_{den})	No. of airports within category
None; NAP	<100,000	3,000	1
None; No NAP	<100,000	11,600	9
Pre-existing; NAP	<100,000	600	9
Pre-existing; No NAP	<100,000	3,000	18
None; NAP	100-150,000		
None; No NAP	100-150,000	4,500	2
Pre-existing; NAP	100-150,000	12,500	5
Pre-existing; No NAP	100-150,000	18,450	4
None; NAP	150,000-200,000	10,200	1
None; No NAP	150,000-200,000	100	1
Pre-existing; NAP	150,000-200,000	9,300	5
Pre-existing; No NAP	150,000-200,000	44,150	4
None; NAP	200,000-250,000	8,800	1
None; No NAP	200,000-250,000	49,700	1
Pre-existing; NAP	200,000-250,000	1,700	2
Pre-existing; No NAP	200,000-250,000	30,900	1
None; NAP	>250,000	1,000	1
None; No NAP	>250,000	25,550	2
Pre-existing; NAP	250,000-300,000	59,450	4
Pre-existing; No NAP	250,000-300,000	34,400	3

Table 19: Total costs of END implementation for major airports across the EU

Airport size	< 100,000	100-150,000	150-200,000	200-250,000	> 250,000	Total
No. of airports within class without pre-existing legislation and with a NAP	1	-	1	1	1	4
Total costs (€, millions)	2.77	-	9.42	8.13	1	21.25
No. of airports within class without pre-existing legislation and with no NAP	9	2	1	1	2	15.00
Total costs (€, millions)	24	2	0.0	11	12	49.50
No. of airports within class with pre-existing legislation and with a NAP	9	5	5	2	4	25
Total costs (€, millions)	2	29	21	2	110	164.29
No. of airports within class with pre-existing legislation and with no NAP	18	4	4	1	3	30
Total costs (€, millions)	25	34	82	14	48	202.59
GRAND TOTAL	**54.33**	**65.05**	**112.52**	**35.46**	**170.27**	**437.63**

Benefits of END implementation

The benefits associated with the implementation of noise reduction measures are driven largely by the change in the size of the exposed population and will therefore be more significant for those airports that have higher populations exposed to higher levels of noise and where measures to reduce harmful levels of noise have been introduced under the END. As noted in Section 4.1.1, the benefits of noise reduction at major airports relate to changes in welfare as a result of reductions in the population affected by annoyance, sleep disturbance and hypertension. The change in welfare is only valued for those populations that are highly annoyed, highly sleep disturbed or at risk of noise-related hypertension.

It is important to note that data from Strategic Noise Mapping (SNM) does not reflect the effects of sound-proofing measures. This is because noise measurements are taken at the external façade of buildings and thus do not take account of the reduction in indoor noise levels that would be obtained as a result of sound-proofing. Where necessary (i.e. where the change in the size of the exposed population is based on SNM data, the benefit estimates have been adjusted (by setting the population exposed to night-time levels in excess of 50 dB L_{night} after measures to zero) to take account of the reduction in indoor noise levels and thus sleep disturbance results. The original and adjusted values are shown in Table 12.

On this basis, the discounted total benefits over a 25-year assessment period range from €37 million at Stuttgart Airport to €1,046 million at Frankfurt airport – see Table 21. On a per person basis, and using the available test case data, the benefits range from €84 at Stuttgart to €495 at Glasgow. The per person estimates are calculated by dividing the total benefits at each test case airport by the population exposed to harmful levels of noise (without measures in place) at that airport. The central, low and high values refer to the corresponding estimates for VOLYs and disability weights defined in Table 21.

Table 20: Summary of test case benefits for major airports

	Glasgow	Stuttgart	Athens	Vienna	Frankfurt
Size (TATMs, 2014)	83,999	127,678	154,530	249,989	469,026
Representative class	< 100,000	100-150,000	150-200,000	200-250,000	>250,000
Population exposed to noise > 55 dB L_{den}	68,800	44,200	64,364	12,300	238,700
Health benefits of END implementation					
Total benefits - central values; 100% attribution	340	37	107	54	1,046
Benefit per person - central values; 100% attribution	494.62	83.72	166.25	442.98	438.07
Total benefits - low values; 100% attribution	121	1	50	3	431
Benefit per person - low values; 100% attribution	1,763.08	27.92	783.38	230.51	1,807.24
Total benefits - high values; 100% attribution)	1,371	8	236	49	2,702
Benefit per person - high values; 100% attribution	19,920.48	183.74	3,668.93	4,007.73	11,321.07

For the purposes of extrapolation, we have used the median value of the central, low and high values (€4,380.69, €783 and €4,008 respectively) of the benefits per person across the five test case airports. This is considered reasonable given that the values for Athens, Vienna and Frankfurt are quite similar and is not too different from the median or the mean when the per person benefits at Glasgow and Stuttgart are excluded. Note, however, that the median of the central values (€4,380.69) is higher than the median of the high values (€4,007.73). This is because the median rather than mean was used.

Similar to the approach used for the cost estimates, the per person benefit estimates are then scaled up to derive an estimate of total benefits based on the size of the median population exposed to noise levels in excess of 55 dB L_{den} for all airports within that size band (and for which data was available) and taking account of whether or not airports are located in Member States with pre-existing noise legislation.

The attribution factors applied within each of the scenarios are set out in Table 21.

Table 21: Attribution factors for estimating benefits from major airports

	Scenario		
	Low (% attribution)	**Base Case (% attribution)**	**High (% attribution)**
No pre-existing noise legislation	50	50	100
Pre-existing noise legislation	25	50	100
Values	Low	Central	High

Note that the median exposure values for airports with more than 250,000 air traffic movements (ATMs) are likely to be skewed heavily by the presence of Heathrow Airport within this class. More people are affected by noise at Heathrow than at any other major European airport. More than three times as many people fall within Heathrow's 55 L_{den} contour than at Frankfurt, which has the second highest number of people exposed to noise at this level[65]. The total benefits for airports within the > 250,000 size band may thus be somewhat exaggerated, particularly for those airports within fewer than 400,000 air traffic movements per year.

The total benefits per airport by size of airport and taking into account whether or not airports are in Member States with pre-existing noise legislation are shown in Table 22.

Table 22: Total benefits by size of airport (data for extrapolation)

	< 100,000	**100-150,000**	**150-200,000**	**200-250,000**	**> 250,000**
Size (TATMs, 2014)	83,999	127,678	154,530	249,989	469,026
Model	Glasgow	Stuttgart	Athens	Vienna	Frankfurt
Population exposed to noise > 55 dB L_{den}	68,800	44,200	64,364	12,300	238,700
Median population exposed to noise > 55 dB L_{den} for each size airport in Member States without pre-existing legislation, before measures	11,600	4,500	5,150	8,800	7,800
Median population exposed to noise > 55 dB L_{den} for each size airport in Member States with pre-existing legislation, before measures	1,100	12,500	15,000	2,000	34,400
Benefit per person -central values (median of central values from Table 17)	4,380.69	4,380.69	4,380.69	4,380.69	4,380.69
Benefit per person - low values (median of low values from Table 17)	783.38	783.38	783.38	783.38	783.38
Benefit per person -high values (median of high values from Table 17)	4,007.73	4,007.73	4,007.73	4,007.73	4,007.73
Health benefits of END implementation for a typical major airport in a Member State with no pre-existing noise legislation					
	€, millions	*€, millions*	*€, millions*	*€, millions*	*€, millions*
Total benefits - base case (central values; 100% attribution)	50.82	19.71	22.56	38.55	34.17
Total benefits - low scenario (low values; 50% attribution)	4.54	1.76	2.02	3.45	3.06
Total benefits - high scenario (high values; 100% attribution)	46.49	18.03	20.64	35.27	31.26

[65] http://www.aef.org.uk/issues/aircraft-noise/

	< 100,000	100-150,000	150-200,000	200-250,000	> 250,000
Health benefits of END implementation for a typical major airport in a Member State with pre-existing noise legislation					
	€, millions	*€, millions*	*€, millions*	*€, millions*	*€, millions*
Total benefits - base case (central values; 50% attribution)	2.41	27.38	32.86	4.38	75.35
Total benefits - low scenario (low values; 25% attribution)	0.22	2.45	2.94	0.39	6.74
Total benefits - high scenario (high values; 100% attribution)	4.41	50.10	60.12	8.02	137.87

The benefits per airport in each size category (from Table 22) are then extrapolated across all EU28 airports by multiplying the total benefits in each size band and under each scenario by the total number of airports in each category. So, for example, in the base case, the total benefits across all airports with fewer than 100,000 movements and where no noise legislation previously existed are calculated as €50.82 million multiplied by 10. The total benefits under each scenario and for all major airports across the EU for which data were available are shown in Table 23.

Table 23: **Extrapolation of benefits across the EU28**

Airport size	< 100,000	100-150,000	150-200,000	200-250,000	> 250,000	Total
Health benefits of END implementation for major airports in Member States with no pre-existing noise legislation						
No. of airports within class without pre-existing noise legislation	10	2	2	2	3	19
Total benefits (€, millions) - base case (central values; 100% attribution)	508.16	39.43	45.12	77.10	102.51	772.32
Total benefits (€, millions) - low scenario (low values; 50% attribution)	45.44	3.53	4.03	6.89	9.17	69.06
Total benefits (€, millions) - high scenario (high values; 100% attribution)	464.90	36.07	41.28	70.54	93.78	706.56
Health benefits of END implementation for major airports in Member States with pre-existing noise legislation						
No. of airports within class with pre-existing noise legislation	27	9	9	3	7	55
Total benefits (€, millions) - base case (central values; 50% attribution)	65.05	246.41	295.70	13.14	527.44	1,147.74
Total benefits (€, millions) - low scenario (low values; 25% attribution)	5.82	22.03	26.44	1.18	47.16	102.62
Total benefits (€, millions) - high scenario (high values; 100% attribution)	119.03	450.87	541.04	24.05	965.06	2,100.05

Airport size	< 100,000	100-150,000	150-200,000	200-250,000	> 250,000	Total
Total health benefits of END implementation for major airports in Member States						
Total benefits (€, millions) - base case	573.21	285.84	340.82	90.24	629.94	629.94
Total benefits (€, millions) - low scenario	51.25	25.56	30.47	8.07	56.33	56.33
Total benefits (€, millions) - high scenario	583.93	486.94	582.32	94.58	1,058.84	1,058.84

In the final step, and using the same approach as applied to estimating the costs, consideration has been given to whether or not each of the major airports had NAPs in place. As noted earlier, it is assumed that where a major airport is located in a Member State that had no pre-existing noise legislation and the airport has produced a NAP, then 100% of the benefits can be attributed to END. In contrast, where there is no pre-existing legislation and no NAP, then only 25% of the benefits are attributed to the END. This is considered a conservative assumption as it is possible that no measures have been implemented at airports for which neither domestic noise legislation nor NAPs exist.

The specific factors that have been used to attribute costs to END for each major airport type within each band are the same as those shown in Table 17. The benefits for each model/representative airport (from Table 20) are then multiplied by the number of airports within that category, (taking account of both NAP status and whether or not the airport is within a Member State with pre-existing noise legislation. More specifically, the benefit per person (e.g., €4,380.69 in the base case) is multiplied by (a) the median value of the population exposed to noise levels higher than 55 dB Lden across all airports within that size band, and depending on whether or not they have a NAP and whether or not they are located within a Member State with pre-existing noise legislation (see Table 21) (b) the number of airports within that category and (c) the proportion of benefits that are assumed to be attributable to END. The resulting estimates are shown in Table 24.

Table 24: Total benefits for major airports across the EU, taking NAP status and prior existence of noise legislation into account

Airport size	< 100,000	100-150,000	150-200,000	200-250,000	> 250,000	Total
Health benefits of END implementation for major airports in Member States with no pre-existing noise legislation and a NAP						
No. of airports within class	1	0	1	1	1	4.0
Total benefits (€, millions) - base case (central values; 100% attribution)	13.14	-	44.68	38.55	4.38	100.8
Total benefits (€, millions) - low scenario (low values; 50% attribution)	1.18	-	4.00	3.45	0.39	9.0
Total benefits (€, millions) - high scenario (high values; 100% attribution)	12.02	-	40.88	35.27	4.01	92.2
Health benefits of END implementation for major airports in Member States with no pre-existing noise legislation and no NAP						
No. of airports within class	9.00	2.00	1.00	1.00	2.00	15.0
Total benefits (€, millions) - base case (central	114.34	9.86	0.11	54.43	55.96	234.7

Airport size	< 100,000	100-150,000	150-200,000	200-250,000	> 250,000	Total
values; 25% attribution)						
Total benefits (€, millions) - low scenario (low values; 25% attribution)	20.45	1.76	0.02	9.73	10.01	42.0
Total benefits (€, millions) - high scenario (high values; 25% attribution)	104.60	9.02	0.10	49.80	51.20	214.7
Health benefits of END implementation for major airports in Member States with pre-existing noise legislation and a NAP-						
No. of airports within class	9.00	5.00	5.00	2.00	4.00	25.0
Total benefits (€, millions) - base case (central values; 50% attribution)	11.83	136.90	101.85	7.45	520.86	778.9
Total benefits (€, millions) - low scenario (low values; 25% attribution)	1.06	12.24	9.11	0.67	46.57	69.6
Total benefits (€, millions) - high scenario (high values; 100% attribution)	21.64	250.48	186.36	13.63	953.04	1,425.1
Health benefits of END implementation for major airports in Member States with pre-existing noise legislation and no NAP-						
No. of airports within class	18.00	4.00	4.00	1.00	3.00	30.0
Total benefits (€, millions) - base case (central values; 50% attribution)	118.28	161.65	386.82	67.68	226.04	960.5
Total benefits (€, millions) - low scenario (low values; 25% attribution)	10.58	14.45	34.59	6.05	20.21	85.9
Total benefits (€, millions) - high scenario (high values; 100% attribution)	216.42	295.77	707.76	123.84	413.60	1,757.4
Total health benefits of END implementation for major airports in Member States						
Total benefits (€, millions) - base case	269.41	445.30	635.31	175.56	1,328.12	2,853.7
Total benefits (€, millions) - low scenario	34.31	40.70	56.81	20.56	123.75	276.1
Total benefits (€, millions) - high scenario	376.33	805.75	1,121.46	236.16	2,374.88	4,914.6

The total costs and benefits for all EU28 airports for which data exists are shown in Table 25. This suggests that total benefits from END implementation at major airports lie within the range of €276 million to €4.9 billion. The Net Present Values (NPV) and cost-benefit ratios for the base case and high scenario are positive but negative under the low scenario. However, conservative assumptions have been applied in all cases such that the costs are likely to be somewhat overstated and the benefits somewhat understated. This implies that the cost-benefit ratio is possibly closer to 1 in the low scenario.

Table 25: Summary of costs, benefits and NPV for all EU28 airports

	Low Scenario (Worst Case)	Base Case	High Scenario (Best Case)
Total costs (€, million) – from Table 16)	437.63	437.63	437.63
Total benefits (€, million) – from Table 21	276.14	2,853.69	4,914.58
Net Present Value (€, million)	-161.48	2,416.07	4,476.95
Cost-Benefit Ratio	1:0.6	1:7	1:11

1.5.2 Major roads

The EEA's 2014 Noise in Europe Report notes that road traffic noise is the most significant source of transport noise "with an estimated 125 million people affected by noise levels greater than 55 decibels (dB) L_{den} (day-evening-night level)". This equates to one in four EU citizens. This is confirmed in WHO guidance[66], which notes that road traffic noise is the principal source of environmental noise.

According to the WHO[67], "results from epidemiological studies performed in past few years consistently indicate significant increases in the risk of myocardial infarction and elevated blood pressures among the population exposed to road or aircraft traffic noise". The WHO also notes in the same study that "one in three individuals is annoyed during the daytime and one in five has disturbed sleep at night because of traffic noise".

A report[68] by CE Delft in the Netherlands has sought to assess the health effects and social costs of environmental noise. Among the findings were that traffic noise is especially harmful to vulnerable groups, such as children, the elderly and the poor, who are disproportionately affected, being more likely than average to live in close proximity to major roads. The study also found that in the 22 countries covered by the research, the social costs of traffic noise were estimated at over EUR 40 billion a year.

The study estimated that "road and rail traffic noise are responsible for around 50,000 premature deaths per year in Europe".

Under the END, there is a requirement for Member States to report noise exposure levels for all major roads (regional, national or international) with more than three million vehicle passages per year.

According to the EEA Noise database[69], a total of 203,833km of roads across the EU28 fulfil this criterion. It was not possible to obtain information on the number of vehicle movements for each of the major roads reported but the lengths vary from 75 km in Greece to 48,585 km in Germany.

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[66] Burden of disease from environmental noise (quantification of healthy life years lost in Europe), WHO/JRC, 2011

[67] Burden of disease from environmental noise: Report on WG meeting, 14–15 October 2010

[68] Traffic noise reduction in Europe - Health effects, social costs and technical and policy options to reduce road and rail traffic noise, CE Delft, the Netherlands, 2007, Eelco den Boer, Arno Schroten.

[69]Accessed at http://forum.eionet.europa.eu/etc-sia-consortium/library/noise_database/index_html (last updated June 2015)

1.5.2.1. Methodology: Summary overview

Data was collated from two test cases to provide an indication of the costs and benefits associated with changes in noise levels along major roads as a result of the implementation of the END.

Similar to the approach used for airports, the costs and benefits of END implementation within each of the test cases was used to estimate the average costs and benefits per person for the population exposed to noise levels higher than 55 dB L_{den}. As noted previously, the per person costs and benefits are calculated as the total costs and benefits divided by the whole of the population affected by noise levels greater than 55 dB L_{den} and not just the beneficiaries of noise reduction measures.

Costs

Costs are divided into a) compliance/administrative costs, and b) costs of implementing the measures. Costs reported here are the total costs incurred (or planned) to date, discounted (at 4% per year) over a 25-year assessment period and expressed in 2014 prices. Costs are then averaged per person affected by more than 55 L_{den}, by dividing the present value costs (i.e. the sum of the discounted costs over 25 years) by the number of people exposed to noise levels higher than 55 dB L_{den}.

Benefits

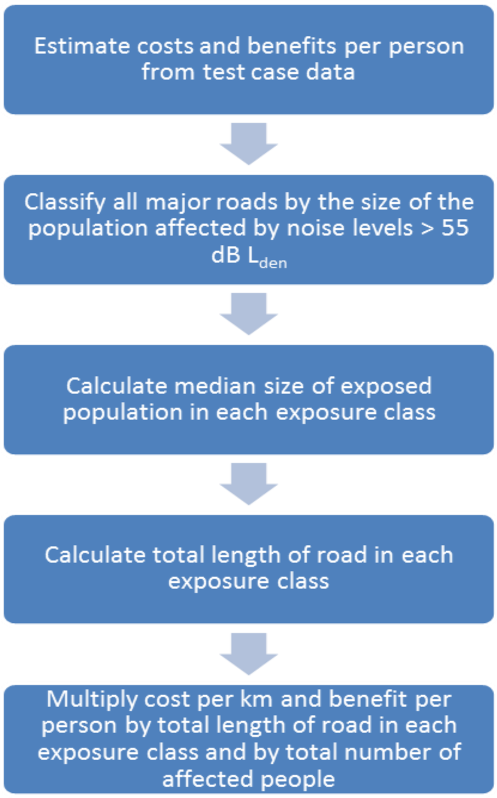
Benefits are considered as the difference between the existing situation and the situation after the implementation of all the measures. They are monetised by means of the methodology of valuation of health effect described in Section 1.4.1. The benefits are assessed over a 25-year period, discounted at 4% per year and expressed in 2014 prices.

Net present value

The net present value is then calculated as the difference between the benefits (typically higher than costs) and the costs (both the compliance/administrative and the costs of measures) over the 25 year assessment period. The cost-benefit ratio is also presented to provide an idea of the overall value for money.

A summary of the approach to the extrapolation is shown in Figure 6. A more detailed analysis of the test case findings and description of the extrapolation across the EU-28 follows.

Figure 6: Approach to extrapolation for major roads



1.5.2.2. Test case data

The test cases covered major roads in two countries:

Austria (2,500km)[70]

Greece (75km – the Attica Tollway)

The Attica Tollway serves as a ringroad for the greater metropolitan area of Athens and, as such, the population density along the road is relatively high. By contrast, the major roads in Austria traverse much of the country and pass through both highly populated and less populated areas. Where available, additional information on the costs of END implementation in Member States has been used to supplement the test case findings and to provide additional data points from which to extrapolate. In particular, the test case data was supplemented by information obtained from published information and through interviews with relevant stakeholders in England, France and Spain.

A summary of the test case findings is provided in Table 26 overleaf. More detailed descriptions of each of the test cases and key findings are provided in Appendix F.

[70] Note that although the total length of major roads reported in the EIONet Database is over 5,000 km, the test case only considers those roads that fall under the responsibility of the national authority. Roads that fall under the responsibility of federal authorities were not included in the test case.

Table 26: Test case summary – major roads

Test case	1	2
Country	**Austria**	**Greece**
Key characteristics		
Context	All motorways and highways	The Attica Tollway serves as a ringroad for the greater metropolitan area of Athens. It functions as a bypass and connects 30 municipalities of the Attica basin. The volume of traffic along the route has been declining since 2007 and is expected to continue this trajectory in reflection of the macroeconomic situation in the country.
Population along length of road network	714,000	28,000
Length of road network (km)	2,500	70
Population density (persons/km)	286	400
Noise exposure	-	-
Population exposed to noise > 55 dB L_{den} before measures	591,001	28,000
Population exposed to noise > 50 dB L_{night} before measures	713,329	28,000
Costs	-	-
Compliance/administrative costs (€), discounted @4% p.a. over 25 years	1,004,838	40,938
Costs of measures (€), discounted @4% p.a over 25 years	146,579,116	63,602,648
Notes on costs	There is no information available on the administrative costs of END implementation but given the simple design of the NAP and the simple public participation and discussion of measures, the costs of have been estimated on the basis of professional judgement as €2 per affected inhabitant	It was not possible to obtain detailed costs of noise reduction measures. The CBA thus only considers the costs and benefits associated with noise barriers. These have been constructed in 138 different sections of the motorway and covering a total area of 87,000 m^2.
Average cost per km (€)	59,034	909,194

Test case	1	2
Country	**Austria**	**Greece**
Ave cost per person (€)	207	2,273
Benefits (assuming 100% attribution)		
Benefits (€, million)	1,267	176
Average benefit per person (€)	1,775	6,303
Net Present Value (€, million)	1,120	113
Cost Benefit Ratio	1:9	1:3
Sensitivity testing		
Benefits: central values, 25% attribution (€, million)	317	44
Benefits: central values, 50% attribution (€, million)	634	88
Benefits: central values, 75% attribution (€, million)	950	132
Benefits: central estimates, 100% attribution (€, million)	1,267	176
High scenario - high values, 100% attribution (€, million)	5,238	409
Low scenario - low values, 100% attribution (€, million)	426	93
Low scenario - low values, 25% attribution (€, million)	107	23

Costs of END implementation for major roads

The total costs of END implementation (administrative costs plus costs of measures) vary substantially, ranging from €59,000 per km in Austria to over €900,000 per km in Greece. When considering the average population density along major roads, the costs range from around €250 per person per km in Austria to over €2,200 per person per km in Greece.

These costs are not, however, strictly comparable as they:

- cover different packages of measures. The Greek test case considers only the costs of a noise barrier while the Austrian test case considers a range of measures including implementation of barriers, walls and/or passive noise protection.
- apply to different lengths of railways and population densities along the railway. The average number of people per km of railtrack is almost twice as high in Greece as it is in Austria.

For the purposes of comparison, we have supplemented the test case data with information that was available (or could reliably be estimated) for Spain, France and England. These show an even higher degree of variability, with the total costs of END implementation ranging from approximately €2,457 per km in England to over €909,194 per km in Greece. This is likely to reflect the different stages that these countries are at in terms of addressing road traffic noise and therefore what levels of expenditure are still required to reduce exposure of the population to harmful levels of noise.

The cost estimates per km have been adjusted to make them more comparable with the benefit estimates by taking account of average population density in each case. On this basis, the costs per person are €11 in England and €2,273 in Greece. A comparison of costs between the two case studies, as well as some additional information from Spain, France and England, is shown in Table 27.

Table 27: Costs of END implementation along major roads

	Austria	Greece	Spain	France	England
Total length of road	2,500	70	19,552	24,972	25,472
Total population affected by noise (before measures)	591,001	28,000	1,243,600	3,492,200	5,704,000
Average population density (people per km)	236	400	64	140	224
Costs of END implementation (administrative costs)					
Total costs of implementation (€)	1,004,838	40,938	3,739,906	4,000,000	117,720.60
Total implementation costs per km (€)	401.94	584.83	191.28	160.18	4.62
Cost per affected person (€)	1.70	1.46	3.01	1.15	0.02
Costs of measures					
Total costs of measures (€)	146,579,116	63,602,648	178,335,906	178,335,906	62,470,750
Total costs of measures per km (€)	58,632	908,609	9,121	7,141	2,453
Cost per affected person (€)	248.02	2271.52	143.40	51.07	10.95

	Austria	Greece	Spain	France	England
Total costs (€)	**147,583,954**	**63,643,586**	**182,075,812**	**182,335,906**	**62,588,471**
Total costs per km (€)	**59,034**	**909,194**	**9,312**	**7,302**	**2,457**
Total costs per person (€)	**250**	**2,273**	**146**	**52**	**11**

The test case cost data was then scaled up to an EU level taking account of:

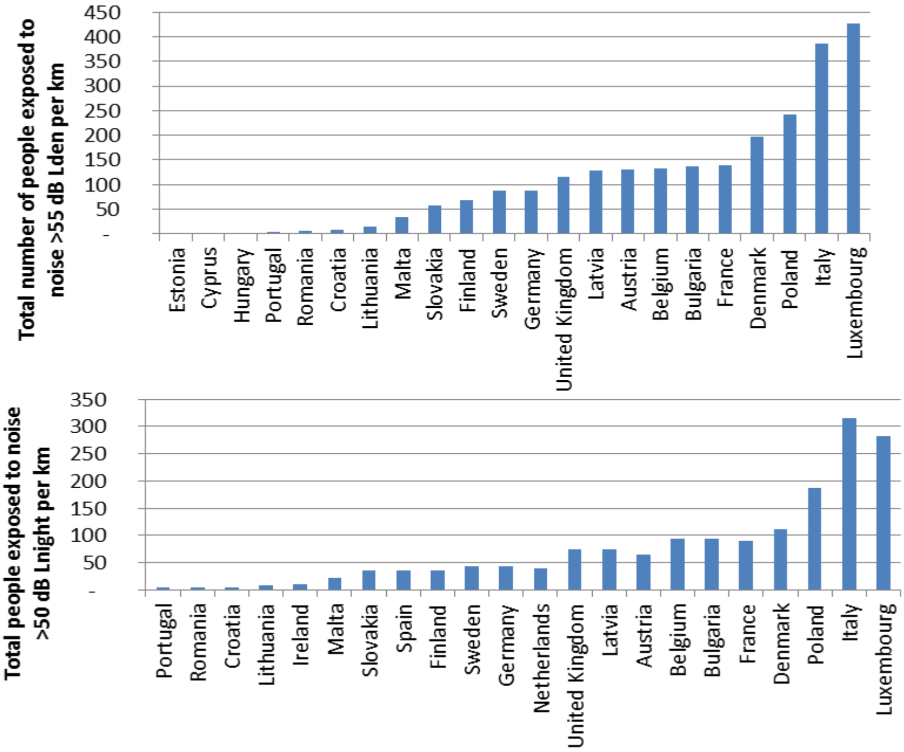
- The total length of major roads in EU Member States with more than 3 million vehicle movements per year;
- The availability of information on road noise exposure in those Member States that are required to report on road noise.

Based on information on major roads in the EIONET Noise Database[71], around 22 of the 28 Member States required to report on exposure to road traffic noise had actually done so. Non-EU Member States have been excluded from the analysis.

Member States were then classified into four broad groups according to the number of people exposed to noise levels in excess of 55 dB L_{den} or 50 dB L_{night}

The figure below shows the average number of people exposed to harmful levels of noise along major roads by day (> 55 dB L_{den}) and by night (>50 dB L_{night}) per kilometre for each Member State.

Figure 7: Average number of people exposed to harmful levels of noise along major roads in Member States for which exposure data was available.



[71] http://forum.eionet.europa.eu/etc-sia-consortium/library/noise_database/end_df4_df8_results_2012_150630

The total length of road in each exposure class, as well as the median exposure to harmful levels of noise for each of Lden and Lnight and for all Member States within each class is set out in Table 28. Median exposure to noise is calculated as the median value of the size of the population exposed to noise greater than 55 dB L_{den} or 50 dB L_{night} across all the Member States in each class.

Table 28: Classification of major roads in Member States by population density per km

Density	Member States	Total km	Median exposure per km (L_{den})	Median exposure per km (L_{night})
0-50	Portugal, Romania, Croatia, Lithuania, Ireland, Malta	24,489	12	6
50-150	Slovakia, Spain, Finland, Sweden, Germany, Netherlands, United Kingdom, Latvia, Austria, Belgium, Bulgaria, France	146,436	103	54
150-350	Denmark, Poland	439	219	148
>350	Italy, Luxembourg	812	406	299
Note that estimates are for those countries that reported data only and exclude non-EU Member States				

Using the costs per person from the test cases as a guide, the costs of END implementation, including both administrative costs and costs of measures, are extrapolated across the relevant EU Member States according to the approximate population exposed to harmful levels of noise along the total length of roads in each category shown in Table 28.

Low, central and high cost estimates per person are calculated using the three test case estimates shown in Table 29. (England = low, median of Austria, France, Spain and England = central; Greece = high).

Each density class is further subdivided according to whether or not each of the Member States within that class had pre-existing noise legislation. It is assumed that those Member States that had noise legislation prior to the introduction of the END[72] would most likely have incurred at least some of the costs associated with the implementation of measures irrespective of whether or not the END was introduced. For the purposes of this analysis, it is assumed that in the base case (central) scenario, only 50% of the total estimated costs in those Member States with pre-existing noise legislation can be attributed to the END. This is considered a conservative assumption given that in several of these Member States, many of the most cost-effective measures had already been implemented (or budgeted) prior to the END and thus the costs attributed solely to the END are likely to be relatively small. For those Member States that did not have any noise legislation prior to the END, it is assumed that 100% of the costs can be attributed to END in the base case (central) scenario.

[72] These are Czech Republic, Denmark, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Portugal, Slovakia, Sweden and UK. On the basis of the available information, it is inferred that the other 13 Member States had no noise legislation prior to the END.

For the purposes of sensitivity testing, low and high scenarios have also been defined. The low scenario uses the lowest of the test case cost estimates per person (from Table 29) and assumes that only 25% and 50% of the total costs can be attributed to END implementation in Members with and without pre-existing noise legislation respectively. The high scenario uses the highest of the test case cost estimates per person (from Table 29) and assumes that 100% of the total costs can be attributed to END regardless of whether or not Member States had pre-existing noise legislation.

The parameters used to define each of the cost scenarios are summarised in Table 29 and the resulting cost estimates under each scenario are shown in Table 30.

Table 29: Parameters for estimating total costs within each class

Existence of noise legislation prior to END	Low		Central		High	
	Attribution (% of total costs)	Cost estimate	Attribution (% of total costs	Cost estimate	Attribution (% of total costs	Cost estimate
Pre-existing	25	Low	50	Central	100	High
None	50	Low	100	Central	100	High

Table 30: Costs of END implementation for major roads across the EU

			LOW		CENTRAL		HIGH	
Existence of noise legislation prior to END	Density	Total length of road (km)	Ave costs per person(€)	Total costs (€, millions)	Ave costs per person (€)	Total costs (€, millions)	Ave costs per person (€)	Total costs (€, millions)
Pre-existing	0-50	18,839	10.97	0.54	99	9.81	2,272.99	448.97
None	0-50	5,650	10.97	0.37	99	6.63	2,272.99	151.82
Pre-existing	50-150	109,507	10.97	26.57	99	480.97	2,272.99	22,016.18
None	50-150	36,929	10.97	26.06	99	471.80	2,272.99	10,798.41
Pre-existing	150-350	1,043	10.97	0.56	99	10.17	2,272.99	465.73
None	150-350	9,822	10.97	13.06	99	236.39	2,272.99	5,410.39
Pre-existing	> 350	-	10.97	0.00	99	-	2,272.99	-
None	> 350	13,687	10.97	30.47	99	551.63	2,272.99	12,625.47
	TOTAL	**195,477**		**98**		**1,767**		**51,917**

Benefits of END implementation for major roads

The benefits of END implementation along major roads are estimated in respect of changes in the number of people exposed to harmful levels of noise as a result of the implementation of noise abatement measures and the associated improvements in health. In particular, the benefits are expressed in terms of the reduction in DALYs relating to the decline in noise-related annoyance and sleep disturbance.

For each test case, the total benefits have been estimated for a central (most likely) scenario and by varying the parameters to provide the extent of the range in which the value of benefits could potentially lie. The benefit estimates for each of the low, central and high scenarios for each of the test cases are shown in Table 31, together with estimates derived from averaging the test case values assuming that 100%, 50% and 25% respectively of the benefits can be attributed to the END. The numbers shown in bold represent the high, central and low estimates that are used to derive an estimate of the benefits of END implementation for major roads across the EU. The assumptions and parameters used to estimate the outcomes in each scenario are the same as those defined earlier (in Section 1.4.1) and repeated in Table 32 for ease of reference.

Table 31: Benefits of END implementation along major roads

		LOW (€)	CENTRAL (€)	HIGH (€)
Austria (100% attribution)	Total benefits	426,322,840.20	1,267,129,476.57	5,237,855,851.12
	Total benefits per km	170,529.14	506,851.79	2,095,142.34
	Total benefits per person	721.36	2,144.04	8,862.69
Greece (100% attribution)	Total benefits	92,652,769.89	176,476,819.12	408,858,146.76
	Total benefits per km	1,323,611.00	2,521,097.42	5,840,830.67
	Total benefits per person	3,309.03	6,302.74	14,602.08
Average (100% attribution)	Total benefits	259,487,805.05	721,803,147.84	2,823,356,998.94
	Total benefits per km	747,070.07	1,513,974.60	3,967,986.50
	Total benefits per person	2,015.19	**4,223.39**	**11,732.38**
Average (50% attribution)	Total benefits	129,743,902.52	360,901,573.92	1,411,678,499.47
	Total benefits per km	373,535.03	756,987.30	1,983,993.25
	Total benefits per person	**1,007.60**	**2,111.70**	5,866.19
Average (25% attribution)	Total benefits	64,871,951.26	180,450,786.96	705,839,249.73
	Total benefits per km	186,767.52	378,493.65	991,996.63
	Total benefits per person	**503.80**	1,055.85	2,933.10

Table 32: Parameters used to define scenarios

	Low	Central	High
Value of a QALY	€ 67,163	€ 110,987	€ 154,812
Disability Weight for Sleep Disturbance	0.04	0.07	0.1
Disability Weight for Annoyance	0.01	0.02	0.12

The test case data has then been used to derive an estimate of the average present value of benefits per person (per km) over a 25-year assessment period. Using the same approach as for the cost estimates, the test case benefit estimates have been scaled up on the basis of the total length of major roads across the Member States for which exposure data was available[73], and accounting for both differences in average population density along major roads in different Member States and whether or not each Member State had pre-existing noise legislation. The resulting benefits estimates under each of a low, central and high scenario are shown in Table 33. The scenarios (low, central, high) are defined using the same parameters as described in Table 32.

Table 33: Total benefits of END implementation for major roads

			LOW		CENTRAL		HIGH	
Existence of noise legislation prior to END	**Density**	**Total length of road (km)**	**Ave benefits per person (€)**	**Total benefits (€, millions)**	**Ave benefits per person (€)**	**Total benefits (€, millions)**	**Ave benefits per person (€)**	**Total benefits (€, millions)**
None	0-50	5,650	1,007.60	67.30	4,223.39	282.09	11,732.38	783.63
Pre-existing	0-50	18,839	503.80	99.51	2,111.70	417.12	11,732.38	2,317.46
None	50-150	36,929	1,007.60	4,786.85	4,223.39	20,064.33	11,732.38	55,737.75
Pre-existing	50-150	109,507	503.80	4,879.80	2,111.70	20,453.93	11,732.38	113,640.10
None	150-350	9,822	1,007.60	2,398.38	4,223.39	10,052.94	11,732.38	27,926.59
Pre-existing	150-350	1,043	503.80	103.23	2,111.70	432.69	11,732.38	2,403.96
None	> 350	13,687	1,007.60	5,596.77	4,223.39	23,459.15	11,732.38	65,168.41
Pre-existing	> 350	-	503.80	-	2,111.70	-	11,732.38	-
	TOTAL	**195,477**		**17,932**		**75,162**		**267,978**

[73] The estimate does not include Estonia, Cyprus, Slovenia, Hungary and Czech Republic as there was no data available for these Member States.

Combining the costs and benefits of END implementation for major roads, the net present value and cost-benefit ratios under each scenario are estimated as shown in Table 34.

Table 34: Cost-benefit summary – major roads (for all Member States for which data was available)

	Low	Central	High	High cost, low benefit
Total Present Value Costs (€, millions)	98	1,767	51,917	51,917
Total Present Value Benefits (€, millions)	17,932	75,162	267,978	17,932
Total Net Present Value (€, millions)	17,834	73,395	216,061	-33,985
Cost-Benefit Ratio	1:184	1:43	1:5	1:0.3

These findings suggest that the costs of END implementation justify the benefits for major roads in most cases, with cost-benefit ratios ranging from 1:5 (in cases where it assumed that 100% of benefits can be attributed to END and using high values for the VOLY and disability weights) to 1:184 (where between 25% and 50% of the benefits can be attributed to END depending on whether or not each Member State had pre-existing noise legislation, and using the low values). However, when combining the highest estimate of costs with the lowest estimate of benefits, the cost-benefit ratio is less than 1 (i.e. costs exceed benefits).

Further sensitivity tests were then applied to assess how the outcomes would change at an EU-wide level given the status of NAP implementation (i.e. differentiating between those Member States who have completed, or at least partially completed their NAPs and those who have not)[74]. The assumptions governing the level (%) of attribution of the total estimated costs and benefits in each scenario are set out in Table 35.

Table 35: Percentage of costs and benefits attributed to END in each scenario for major roads given Member States' status in terms of pre-existing noise legislation and NAP completion

	% costs and benefits attributed to END		
	Low scenario	Central scenario	High scenario
No pre-existing legislation; NAP submitted/underway	50	100	100
No pre-existing legislation; no NAP	25	25	25
Pre-existing legislation; NAP submitted/underway	25	50	100
Pre-existing legislation; no NAP	25	50	100
Cost / benefit values	Low	Central	High

[74] Based on information provided by DG Environment.

Tables 34 and 35 show the extrapolation and distribution of costs and benefits respectively across each density class for Member States with and without pre-existing noise legislation and NAPs. The average costs per person under each scenario are simply the low, central or high costs per person (from Table 29). These are then multiplied by the total length of road, the median number of people exposed to noise levels greater than 55 dB Lden and the applicable percentage attribution (from Table 35) to provide an estimate of total costs for the total length of road in each category. The average benefits per person in each category are determined according to pre-existing legislation and NAP status using the information from Tables 31 and 35.

The summary findings in terms of present value costs, present value benefits, NPV and cost-benefit ratio are shown in Table 36.

Table 36: Net Present Value and Cost Benefit Ratio for END implementation for major roads in Member States taking account of NAP status)

	Low	Central	High	HIGH COST LOW BENEFIT
Total Present Value Costs (€, millions)	356	1,202	8,545	8,545
Total Present Value Benefits (€, millions)	609	2,554	8,179	609
Total Net Present Value (€, millions)	254	1,351	-366	-7,935
Cost-Benefit Ratio	1:71	1:2	1:0.9	1:0.7

From the table above, it can be seen that the cost-benefit ratios become slightly less favourable when Member States' NAP status is also taken into account. This may, at least in part, be attributed to the fact that some of the Member States with relatively long lengths of major roads have (a) not yet submitted action plans (e.g. Belgium, Romania) and thus were attributed a lower level (25%) of both costs and, more importantly, benefits (compared to 50% attribution in Table 34 or (b) their NAPs only cover a small percentage of total segments (e.g. Spain, Poland); in the latter case the estimates of costs and benefits are determined in relation to the percentage of NAP completion (and whether or not the Member State had pre-existing noise legislation).

Note that these findings do need to be treated with caution as the estimates are based on a very limited sample and are based on a number of underlying assumptions. In particular, the costs of measures are known to be incomplete as these were only available for a limited selection of measures.

Table 37: Extrapolation of costs across major roads in the EU-28 taking account of existing legislation and NAP status

			LOW		CENTRAL		HIGH	
Pre-existing legislation & NAP status	**Density**	**Total length of road (km)**	**Ave costs per person (€)**	**Total costs (€, millions)**	**Ave costs per person (€)**	**Total costs (€, millions)**	**Ave costs per person (€)**	**Total costs (€, millions)**
None; NAP	0-50	1,275.97	10.97	0.10	99.31	1.89	2,272.99	43.20
None; No NAP	0-50	3,270.00	10.97	0.05	99.31	0.46	2,272.99	10.46
Pre-existing; NAP	0-50	17,799.50	10.97	0.48	99.31	8.72	2,272.99	398.98
Pre-existing; No NAP	0-50	-	10.97	-	99.31	-	2,272.99	-
None; NAP	50-150	5,361.03	10.97	2.71	99.31	48.97	2,272.99	1120.87
None; No NAP	50-150	5,406.00	10.97	1.98	99.31	17.91	2,272.99	409.93
Pre-existing; NAP	50-150	60,255.60	10.97	16.76	99.31	303.36	2,272.99	13,886.06
Pre-existing; No NAP	50-150	-	10.97	-	99.31	-	2,272.99	-
None; NAP	150-350	39.29	10.97	0.001	99.31	0.003	2,272.99	0.09
None; No NAP	150-350	-	10.97	-	99.31	-	2,272.99	-
Pre-existing; NAP	150-350	1,043.00	10.97	0.56	99.31	10.17	2,272.99	465.73
Pre-existing; No NAP	150-350	-	10.97	-	99.31	-	2,272.99	-
None; NAP	>350	-	10.97	-	99.31	-	2,272.99	-
None; No NAP	>350	-	10.97	-	99.31	-	2,272.99	-
Pre-existing; NAP	>350	-	10.97	-	99.31	-	2,272.99	-
Pre-existing; No NAP	>350	13,687.00	10.97	15.24	99.31	275.82	2,272.99	12625.47
	TOTAL	**108,137.39**		**37.88**		**667.29**		**28,960.80**

Table 38: Extrapolation of benefits across major roads in the EU-28 taking account of existing legislation and NAP status

			LOW		CENTRAL		HIGH	
Status	Density	Total length of road (km)	Ave benefits per person (€)	Total benefits (€, millions)	Ave benefits per person (€)	Total benefits (€, millions)	Ave benefits per person (€)	Total benefits (€, millions)
NAP	0-50	1,276	1,007.60	19.15	4,223.39	80.27	11,732.38	223.00
No NAP	0-50	3,270	503.80	9.27	1,055.85	19.43	2,933.10	53.97
NAP	50-150	5,361	1,007.60	496.87	4,223.39	2,082.67	11,732.38	5,785.56
No NAP	50-150	5,406	503.80	363.44	1,055.85	761.69	2,933.10	2,115.93
NAP	150-350	39	1,007.60	0.04	4,223.39	0.16	11,732.38	0.45
No NAP	150-350	-	503.80	-	1,055.85	-	2,933.10	-
NAP	> 350	-	1,007.60	-	4,223.39	-	11,732.38	-
No NAP	> 350	-	503.80	-	1,055.85	-	2,933.10	-
Pre-existing legislation		129,389	503.80	5,082.54	2,111.70	21,303.73	11,732.38	118,361.52
	TOTAL	**144,741**		**5,971**		**24,248**		**126,540**

1.5.3 Major railways

1.5.3.1. Context

Under the END, there is a requirement for Member States to report noise exposure levels for all major railways (regional, national or international) with more than 60,000 train passages per year. According to the EEA Noise database[75], a total of 46,667 km of railways across the EU28 fulfil this criterion.

Member State reports compiled by the European Environment Agency (EEA) in 2010 show that railway noise affects about 12 million EU inhabitants at day time, with a noise exposure above 55 dB(A), and about 9 million at night time, with a noise exposure above 50 dB(A). The actual figures are, however, likely to be higher since the EEA's European noise mapping initiative concentrates on agglomerations with over 250,000 inhabitants and on main railway lines with over 60,000 trains per year.

According to EEA data from the first round of noise mapping, the following states in Europe are most affected by railway noise in terms of the share of their population that is exposed to railway noise in excess of 55 dB(A) L_{den}: Austria (9.3%), Slovakia (9.0%), Switzerland (7.5%), France (5.5%), Germany (4.3%), Czech Republic (3.8%), the Netherlands (3.8%) and Latvia (3.0%). It is further estimated that about 85% of people affected by railway noise (over 55 dB(A) L_{den} or 50 dB(A) L_{night}) are located in the following six countries in Europe: Germany, France, UK, Austria, Poland and Switzerland. About 60% are located in Germany and France.

If only areas outside agglomerations are considered, the figures change significantly. In this case the six countries mentioned above represent 89% of affected people. The share of people affected in agglomerations and outside agglomerations differ very much between the countries. In Germany about 75% of affected people live outside agglomerations whereas in Poland this share is 0 (Switzerland: 15%, Austria: 59%, the UK: 17%, France: 44%).

In 2012, a study by the European Parliament investigated a range of measures, funding and regulations to reduce rail noise and concluded that the introduction of modern rolling stock would lower noise most significantly but that, in the short run, the replacement of cast iron by composite brake blocks on rail freight cars was most important[76]. Rail grinding has also been shown to have a significant effect (see Box 3).

[75] Accessed at http://forum.eionet.europa.eu/etc-sia-consortium/library/noise_database/index_html (last updated June 2015)

[76] European Parliament (2012) Reducing railway noise pollution. Directorate-General for Internal Policies; Policy Department B: Structural and Cohesion Policies [online] available at http://www.europarl.europa.eu/RegData/etudes/etudes/join/2012/474533/IPOL-TRAN_ET(2012)474533_EN.pdf?bcsi_scan_ab11caa0e2721250=0&bcsi_scan_filename=IPOL-TRAN_ET(2012)474533_EN.pdf (last accessed 21/12/2015).

Box 3: Reducing noise through improved track maintenance: Case Study

Rolling noise is currently the most important noise source associated with the railways in Great Britain (GB). It is generated by roughness of the wheel and rail. The combined roughness excites both the wheel and track, which then radiate noise. Wheel roughness tends to stabilise at a level determined by the vehicle braking system. Typical GB rolling stock has relatively smooth wheels due to the preference for composite brake blocks and disc brakes over cast iron brake blocks. Rail roughness tends to increase over time in proportion to the gross tonnage and can be controlled by grinding.

Between 2002 and 2004, Network Rail, the authority charged with running, maintaining and developing Britain's rail tracks, signalling, bridges, tunnels, level crossings and many key stations, developed a new preventative maintenance grinding strategy to address rolling contact fatigue.

This strategy is applied to lines carrying more than five million tonnes of traffic per year. From 2003 grinding was carried out based on curvature and tonnage and originally was carried out at every 15 Equivalent Million Gross Tonnes (EMGT) on curves <2500m radius and every 25 to 30 EMGT on curves and straight track > 2500m radius. This frequency was reviewed in 2007 and the frequencies of grinding changed to better reflect measured rail wear rates on straight track. From 2009, grinding of straight track was revised so that it was planned to be carried out every 45 EMGT with curves continuing to be ground every 15 EMGT.

A typical section of main line track might therefore be ground every one or two years on straight sections and every six months on curves. No cyclic grinding was undertaken on the network for the 10 year period prior to 2002. Grinding was limited to the use of small machines on a site-specific basis. While the purpose of the grinding is not to reduce noise, rail grinding is proven to reduce wayside rolling noise levels generated by the railway. It can therefore be expected that the grinding strategy introduced between 2002 and 2004 would have an effect of reducing wayside noise levels on main lines.

Based on measurements at three locations along the East Coast and West Coast Mainline routes, there is strong evidence to suggest that it has resulted in a significant improvement in Acoustic Track Quality (ATQ) across the GB network. In particular, the measurements have shown a large reduction of 8dB relative to 2004.

Source: Craven, N., Bewes, O., Fenech, B. and Jones, R. (2015) Investigating the Effects of a Network-Wide Rail Grinding Strategy on Wayside Noise Levels. N*oise and Vibration Mitigation for Rail Transportation Systems*. Proceedings of the 11th International Workshop on Railway Noise, Uddevalla, Sweden, 9–13 September 2013, pp369-376.

The European Parliament study distinguishes between three different sources of railway noise:

- **Engine noise** - largely generated by freight trains and trains containing older wagons or engines, and is particularly problematic during the night. Most relevant at lower speeds up to about 30 km/h.
- **Rolling noise** - generally higher from poorly maintained rail vehicles, and from trains running on poorly maintained infrastructure. Most relevant above speeds of 30km/h.
- **Aerodynamic noise -** particularly relevant for high speed lines where, in most cases, noise limiting measures like noise barriers are implemented; noise barriers reduce the impact of rolling noise, but are usually too low to have any effect on noise originating at the pantograph. Dominates above 200km/h.

The most important noise source is rolling noise, which affects all kinds of train.

To reduce railway noise pollution, passive measures at the place of disturbance can be distinguished from active measures at the noise source. The most important passive methods used to reduce the impact of railway noise on the environment are noise protection walls and insulating windows, and for the most part action plans and investments of the Member States concentrate on these methods. However, they are only locally effective, requiring huge investments to protect wider parts of railway networks. In contrast, source-driven measures lower noise across the whole railway system if they are widely introduced. As an example, the problem of noisy rail freight cars can be reduced by the replacement of cast iron brake blocks by composite brake blocks. This is currently being investigated by the railway industry and would affect about 370,000 old freight wagons. Also, wheel absorbers, aerodynamic design of pantographs and noise insulation of traction equipment (e.g., locomotive engines) are measures to reduce noise at source.

According to the current Technical Standard for Interoperability (TSI Noise), rolling stock introduced since the year 2000 (including engines and passenger coaches or passenger power cars) are required to lower noise emissions by about 10 dB(A) compared to the equipment of the 1960s and 1970s.

1.5.3.2. Methodology: Summary overview

Data was collated from two test cases to provide an indication of the costs and benefits associated with changes in noise levels along major railways as a result of the implementation of the END.

Similar to the approach used for airports, the costs and benefits of END implementation within each of the test cases was used to estimate the average costs and benefits per person for the population exposed to noise levels higher than 55 dB L_{den}. As noted previously, the per person costs and benefits are calculated as the total costs and benefits divided by the whole of the population affected by noise levels greater than 55 dB L_{den} and not just the beneficiaries of noise reduction measures.

Costs

Costs are divided into a) compliance/administrative costs, and b) costs of implementing the measures. Costs reported here are the total costs incurred (or planned) to date, discounted (at 4% per year) over a 25-year assessment period and expressed in 2014 prices.

Costs are then averaged per person affected by more than 55 L_{den}, by dividing the present value costs (i.e. the sum of the discounted costs over 25 years) by the number of people exposed to noise levels higher than 55 dB L_{den}.

Benefits

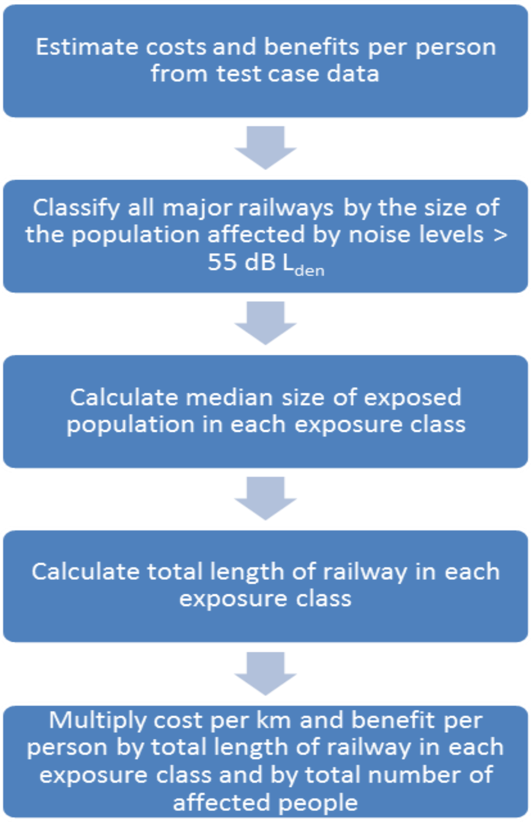
Benefits are considered as the difference between the existing situation and the situation after the implementation of all the measures. They are monetised by means of the methodology of valuation of health effect described in Section 1.4.1. The benefits are assessed over a 25-year period, discounted at 4% per year and expressed in 2014 prices.

Net present value

The net present value is then calculated as the difference between the benefits (typically higher than costs) and the costs (both the compliance/administrative and the costs of measures) over the 25 year assessment period. The cost-benefit ratio is also presented to provide an idea of the overall value for money.

A summary of the approach to extrapolation is shown in Figure 8. A more detailed analysis of the test case findings and description of the extrapolation across the EU-28 follows.

Figure 8: Approach to extrapolation for major railways



1.5.3.3. Test case data

For the purposes of the evaluation, two major railways were selected as test cases for analysis. These were selected on the basis that information on costs and benefits (in terms of changes in the number of people exposed to noise from rail traffic) was available.

The two test cases were:

- Austria (2,218 km)
- Slovakia (506 km)

Where available, additional information on the costs of END implementation in Member States has been used to supplement the test case findings and to provide additional data points from which to extrapolate.

A summary of the test case information and benefits estimates are provided in Table 39 overleaf. More detailed descriptions of each of the test cases and key findings are provided in Appendix F.

Table 39: Test case summary – major railways

Test case	Austria	Slovakia
Key characteristics		
Context	National rail network covering 2,218km.	Malacky is an important regional transport hub connected to a highway and national road that services the Bratislava agglomeration. The main train line connecting Bratislava and the Czech Republic traverses the city.
Population along length of railway	968,877	16,400
Length of railway (km)	2,218	506
Population density (persons/km)	436.82	32.41
Noise exposure		
Population exposed to noise > 55 dB L_{den}	420,045	16,400
Population exposed to noise > 50 dB L_{night}	598,952	15,600
Costs		
Compliance/administrative costs (€), discounted @4% p.a. over 25 years	487,155	22,689
Costs of measures (€), discounted @4% p.a over 25 years	19,350,869	3,331,587
Notes on costs	• Costs published in the NAPs include costs of planning and implementation of measures. • Costs relate to a range of measures including rehabilitation of existing tracks by implementation of barriers, walls and/or passive noise protection	• Costs of measures are based on estimates prepared for the authorities by a consultant; they are not published. The only noise abatement measure considered is a noise barrier.
Average cost per km (€)	8,944	6,629

Test case	Austria	Slovakia
Ave cost per person (€)	20	205
Benefits (assuming 100% attribution)		
Benefits (€, million)	116.35	47.55
Average benefit per person (€)	120	2,899
Net Present Value (€, million)	97	44
Cost Benefit Ratio	1:4	1:10
Sensitivity testing		
Benefits: 25% attribution (€, million)	29.09	11.89
Benefits: 50% attribution (€, million)	58.18	23.77
Benefits: 75% attribution (€, million)	87.27	35.66
High scenario – high values, 100% attribution (€, million)	625.70	199.39
Low scenario – low values, 100% attribution (€, million)	37.56	15.73
Low scenario – low values, 25% attribution (€, million)	9.39	3.93

Costs of END implementation for major railways

The total costs (i.e. costs of compliance plus costs of measures) of END implementation per kilometre are broadly similar: Slovakia (€6,629 per km) and Austria (€8,944 per km). They are not, however, strictly comparable as they:

- cover different packages of measures. The Slovakian test case considers only the costs of a noise barrier while the Austrian test case considers a range of measures including implementation of barriers, walls and/or passive noise protection.
- apply to different lengths of railways and population densities along the railway. The average number of people per km of railtrack is approximately 14 times higher in Austria (437) than it is in Austria (32) and the number of people per kilometre exposed to noise levels in excess of 55 dB L_{den} is 26 times higher in Austria than it is in Slovakia.

The cost estimates per km have therefore been adjusted to make them more comparable with the benefit estimates by taking account of average population density in each case. On this basis, the costs per person are €20 in Austria and €205 in Slovakia. A comparison of costs between the two case studies, as well as some additional information made available from France, is shown in Table 40.

Table 40: Costs of END implementation along major railways

	Austria	Slovakia	France
Total length of railway (km)	2,218	506	7,239
Total population along length of railway	968,877	16,400	1,018,800
Average population density (noise-affected people per km)	437	32	141
Costs of END implementation (administrative costs)			
Total costs of implementation (€)	487,155	22,689	672,408
Total implementation costs per km (€)	219.64	44.84	92.89
Cost per affected person (€)	0.5	1.38	0.66
Costs of measures			
Total costs of measures (€)	19,350,869	3,331,587	700,000
Total costs of measures per km (€)	8,724	6,584	97
Cost per affected person (€)	20	203	0.69
Total costs (€)	**19,838,024**	**3,354,276**	**1,372,408**
Total costs per km (€)	**8,944**	**6,629**	**190**
Total costs per person (€)	**20**	**205**	**1.35**

The test case cost data was then scaled up to an EU level taking account of:

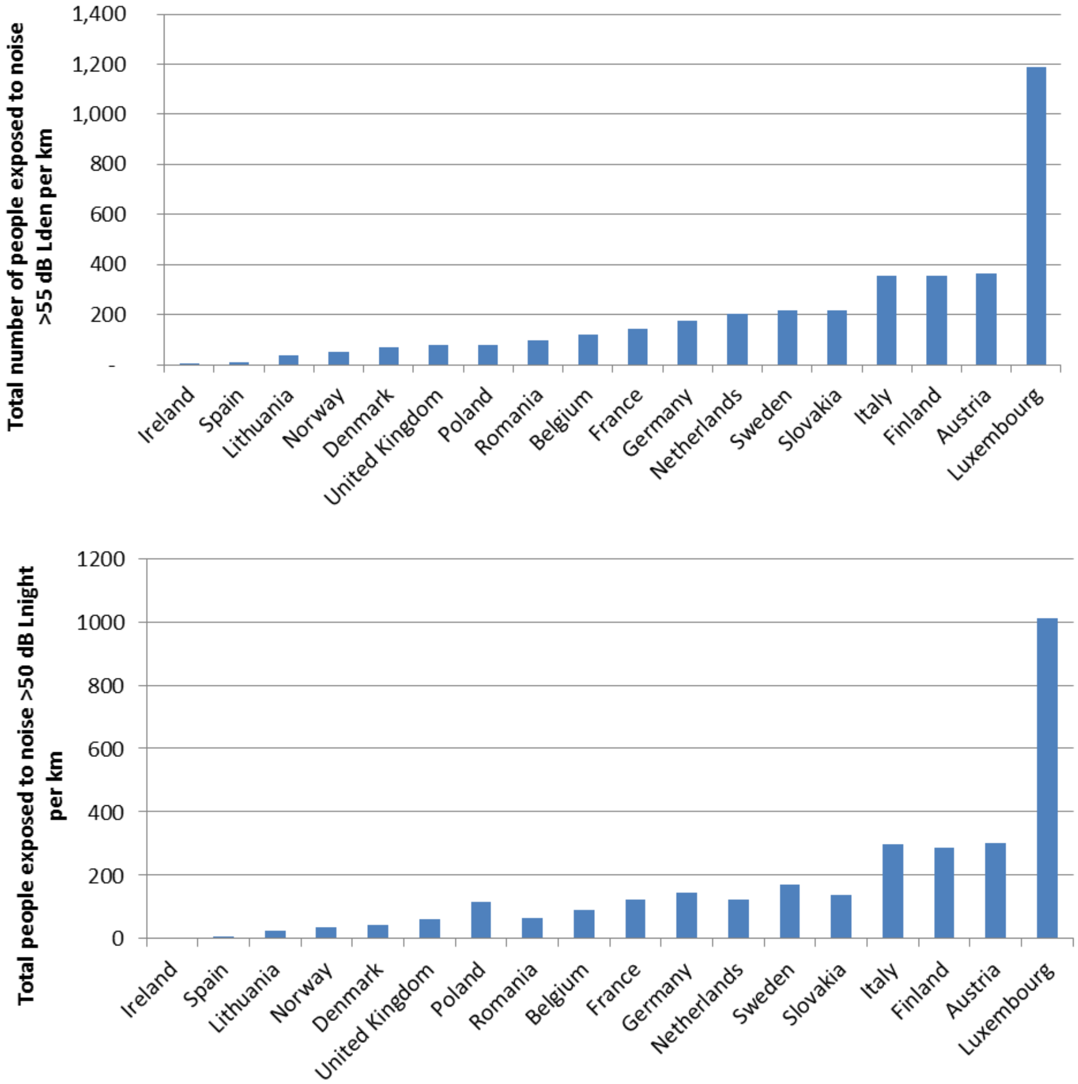
- The total length of railways in EU Member States with more than 60,000 passages a year;
- The availability of information on railways and noise exposure in those Member States that are required to report on railway noise.

Based on information on major railways in the EIONET Noise Database[77], around 17 of the 23 Member States required to report on exposure to railway noise had actually done so. Non-EU Member States have been excluded from the analysis.

[77] http://forum.eionet.europa.eu/etc-sia-consortium/library/noise_database/end_df4_df8_results_2012_150630

Member States were then classified into three broad exposure density groups according to the number of people exposed to noise levels in excess of 55 dB L_{den} or 50 dB L_{night}. The figure below shows the average number of people exposed to harmful levels of noise along major railways by day (> 50 dB L_{den}) and by night (>50 dB L_{night}) per kilometre for each Member State.

Figure 9: Average number of people exposed to harmful levels of noise along major railways in Member States for which exposure data was available.



The total length of railway in each class, as well as the median exposure to harmful levels of noise for each of L_{den} and L_{night} and for all Member States within each class is set out in Table 41. Median exposure to noise is calculated as the median value of the size of the population exposed to noise greater than 55 dB Lden or 50 dB Lnight across all the Member States in each class.

Table 41: Classification of major railways in Member States by population density per km

Density	Member States	Total km	Median exposure per km (L_{den})	Median exposure per km (L_{night})
0-150	Ireland, Spain, Lithuania, Denmark, United Kingdom, Poland, Romania, Belgium, France	18,537	78	60
150-300	Germany, Netherlands, Sweden, Slovakia,	19,631	209	141
>300	Italy, Finland, Austria Luxembourg	5,475	358	300
Total		43,643		
Note that estimates are for those countries that reported data only and exclude non-EU Member States				

Using the costs per person from the test cases as a guide, the costs of END implementation, including both administrative costs and costs of measures, are extrapolated across the relevant EU Member States according to the approximate population exposed to harmful levels of noise along the total length of railways in each category shown in Table 41.

Low, central and high cost estimates per person are calculated using the three test case estimates shown in Table 40 (France = low, Austria = central, Slovakia = high).

Using the same approach as that applied to major roads, each density class for major railways is further subdivided according to whether or not each of the Member States within that class had pre-existing noise legislation. It is assumed that those Member States that had noise legislation prior to the introduction of the END[78] would most likely have incurred at least some of the costs associated with the implementation of measures irrespective of whether or not the END was introduced. For the purposes of this analysis, it is assumed that in the base case (central) scenario, only 50% of the total estimated costs in those Member States with pre-existing noise legislation can be attributed to the END. This is considered a conservative assumption given that in several of these Member States, many of the most cost-effective measures had already been implemented (or budgeted) prior to the END and thus the costs attributed solely to the END are likely to be relatively small. For those Member States that did not have any noise legislation prior to the END, it is assumed that 100% of the costs can be attributed to END in the base case (central) scenario.

For the purposes of sensitivity testing, low and high scenarios have also been defined. The low scenario uses the lowest of the test case cost estimates per person (from Table 37) and assumes that only 25% and 50% of the total costs can be attributed to END implementation in Members with and without pre-existing noise legislation respectively. The high scenario uses the highest of the test case cost estimates per person and assumes that 100% of the total costs can be attributed to END regardless of whether or not Member States had pre-existing noise legislation.

The parameters used to define each of the cost scenarios are summarised in Table 42 and the resulting cost estimates under each scenario are shown in Table 43.

[78] These are Czech Republic, Denmark, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Portugal, Slovakia, Sweden and UK. On the basis of the available information, it is inferred that the other 13 Member States had no noise legislation prior to the END.

Table 42: Parameters for estimating total costs within each class

Existence of noise legislation prior to END	Low		Central		High	
	Attribution (% of total costs)	Cost estimate	Attribution (% of total costs	Cost estimate	Attribution (% of total costs	Cost estimate
Pre-existing	25	Low	50	Central	100	High
None	50	Low	100	Central	100	High

Table 43: Costs of END implementation for major railways across the EU

			LOW		CENTRAL		HIGH	
Existence of noise legislation prior to END	Density	Total length of railway (km)	Ave costs per person (€)	Total costs (€, millions)	Ave costs per person (€)	Total costs (€ millions)	Ave costs per person (€)	Total costs (€, millions)
Pre-existing	0-150	14,254	1.35	0.35	20.48	10.61	204.53	211.88
None	0-150	4,283	1.35	0.23	20.48	6.96	204.53	69.56
Pre-existing	150-300	18,777	1.35	1.36	20.48	41.37	204.53	826.41
None	150-300	854	1.35	0.12	20.48	3.54	204.53	35.34
Pre-existing	>300	3,231	1.35	0.84	20.48	25.52	204.53	509.88
None	>300	2,244	1.35	0.54	20.48	16.43	204.53	164.14
	TOTAL	**43,643**		**3**		**104**		**1,817**

Benefits of END implementation for environmental noise along major railways

As with major airports and roads, the benefits of END implementation along major railways are estimated in respect of changes in the number of people exposed to harmful levels of noise as a result of the implementation of noise abatement measures and the associated improvements in health. In particular, the benefits are expressed in terms of the reduction in QALYs relating to the decline in noise-related annoyance and sleep disturbance. There are no reliable dose-response relationships for cardiovascular diseases (acute myocardial infarction and hypertension) for railway noise.

For each test case, the total benefits have been estimated for a central (most likely) scenario and by varying the parameters to provide the extent of the range in which the value of benefits could potentially lie. The benefit estimates for each of the low, central and high scenarios for each of the test cases are shown in Table 44, together with estimates derived from averaging the test case values under assuming that 100%, 70% and 25% respectively of the benefits can be attributed to the END. The numbers shown in bold represent the high, central and low estimates that are used to derive an estimate of the benefits of END implementation for major railways across the EU. The assumptions and parameters used to estimate the outcomes in each scenario are the same as those defined earlier (in Section 1.4.1) and repeated in Table 45 for ease of reference.

Table 44: Benefits of END implementation along major railways

		Low	Central	High
Austria (100% attribution)	Total benefits (€)	37,564,616.42	116,353,698.65	625,700,440.99
	Total benefits per km (€)	16,936.26	52,458.84	282,101.19
	Total benefits per person per km (€)	38.77	120.09	645.80
Slovakia (100% attribution)	Total benefits (€)	15,732,021.85	47,546,769.30	199,389,129.28
	Total benefits per km (€)	31,090.95	93,965.95	394,049.66
	Total benefits per person per km (€)	959.27	2,899.19	12,157.87
Average (*100% attribution*)	Total benefits (€)	26,648,319.14	81,950,233.98	412,544,785.13
	Total benefits per km (€)	24,013.60	73,212.39	338,075.43
	Total benefits per person per km (€)	499.02	**1,509.64**	**6,401.84**
Average (*50% attribution*)	Total benefits (€)	13,324,159.57	40,975,116.99	206,272,392.57
	Total benefits per km (€)	12,006.80	36,606.20	169,037.71
	Total benefits per person per km (€)	**249.51**	**754.82**	3,200.92
Average (*25% attribution*)	Total benefits (€)	6,662,079.78	20,487,558.49	103,136,196.28
	Total benefits per km (€)	6,003.40	18,303.10	84,518.86
	Total benefits per person per km (€)	**124.76**	377.41	1,600.46

Table 45: Parameters used to define scenarios

	Low	Central	High
Value of a QALY	€ 67,163	€ 110,987	€ 154,812
Disability Weight for Sleep Disturbance	0.04	0.07	0.1
Disability Weight for Annoyance	0.01	0.02	0.12

The test case data have then been used to derive an estimate of the average present value of benefits per person (per km) over a 25-year assessment period. Using the same approach as for the cost estimates, the test case benefit estimates have been scaled up on the basis of the total length of major railways across the Member States for which exposure data was available[79], and accounting for both differences in average population density along major railways in different Member States and whether or not each Member State had pre-existing noise legislation.

[79] The estimate does not include Estonia, Cyprus, Slovenia, Hungary and Czech Republic as there was no data available for these Member States.

The resulting benefits estimates under each of a low, central and high scenario are shown in Table 46. The scenarios (low, central, high) are defined using the same parameters as described in Table 42.

Table 46: Total benefits of END implementation for major railways

			LOW		CENTRAL		HIGH	
Existence of noise legislation prior to END	**Density**	**Total length of railway (km)**	**Ave benefits per person (€)**	**Total benefits (€, millions)**	**Ave benefits per person (€)**	**Total benefits (€, millions)**	**Ave benefits per person (€)**	**Total benefits (€, millions)**
None	0-150	4,283	249.51	84.86	1,509.64	513.43	6,401.84	2,177.26
Pre-existing legislation	0-150	14,254	124.76	129.24	754.82	781.95	6,401.84	6,631.88
None	150-300	854	249.51	43.12	1,509.64	260.87	6,401.84	1,106.24
Pre-existing legislation	150-300	18,777	124.76	504.08	754.82	3,049.89	6,401.84	25,866.96
None	>300	2,244	249.51	200.23	1,509.64	1,211.50	6,401.84	5,137.51
Pre-existing legislation	>300	3,231	124.76	311.01	754.82	1,881.74	6,401.84	15,959.57
	TOTAL	**43,643**		**1,273**		**7,699**		**56,879**

Combining the costs and benefits of END implementation for major roads, the net present value and cost-benefit ratios under each scenario are estimated as shown in Table 47.

Table 47: Cost-benefit summary – major railways (for all Member States for which data was available)

	Low	Central	High	High cost, low benefit
Total Present Value Costs (€, millions)	3	104	1,817	1,817
Total Present Value Benefits (€, millions)	1,273	7,699	56,879	1,273
Total Net Present Value (€, millions)	1,269	7,595	55,062	-545
Cost-Benefit Ratio	1:370	1:74	1:31	1:0.7

These findings suggest that the costs of END implementation justify the benefits for major railways in most cases, with cost-benefit ratios ranging from 1:31(in cases where it assumed that 100% of benefits can be attributed to END and using high values for the VOLY and disability weights) to 1:370 (where between 25% and 50% of the benefits can be attributed to END depending on whether or not each Member State had pre-existing noise legislation, and using the low values). However, when combining the highest estimate of costs with the lowest estimate of benefits, the cost-benefit ratio is less than 1 (i.e. costs exceed benefits).

Further sensitivity tests were then applied to assess how the outcomes would change at an EU-wide level given the status of NAP implementation (i.e. differentiating between those Member States who have completed, or at least partially completed their NAPs and those who have not)[80]. The assumptions governing the level (%) of attribution of the total estimated costs and benefits in each scenario are set out in Table 48.

Table 48: Percentage of costs and benefits attributed to END in each scenario for major railways given Member States' status in terms of pre-existing noise legislation and NAP completion

% costs and benefits attributed to END			
	Low scenario	Central scenario	High scenario
No pre-existing legislation; NAP submitted/underway	50	100	100
No pre-existing legislation; no NAP	25	25	25
Pre-existing legislation; NAP submitted/underway	25	50	100
Pre-existing legislation; no NAP	25	50	100
Cost / benefit values	Low	Central	High

Tables 50 and 51 show the extrapolation and distribution of costs and benefits respectively across each density class for Member States with and without pre-existing noise legislation and NAPs. The average costs per person under each scenario are simply the low, central or high costs per person (from Table 40). These are then multiplied by the total length of railway, the median number of people exposed to noise levels greater than 55 dB L_{den} and the applicable percentage attribution (from Table 48) to provide an estimate of total costs for the total length of road in each category. The average benefits per person in each category are determined according to pre-existing legislation and NAP status using the information from Tables 44 and 47.

The summary findings in terms of present value costs, present value benefits, NPV and cost-benefit ratio are shown in Table 49.

Table 49: Net Present Value and Cost Benefit Ratio for END implementation for major railways in Member States taking account of NAP status)

	Low	Central	High	HIGH COST LOW BENEFIT
Total Present Value Costs (€, millions)	3	82	1,417	1,417
Total Present Value Benefits (€, millions)	2,238	7,317	26,004	2,238
Total Net Present Value (€, millions)	2,235	7,235	24,586	820
Cost-Benefit Ratio	1:815	1:89	1:18	1:1.6

[80] Based on information provided by DG Environment.

From the table above, it can be seen that the cost-benefit ratios become more favourable in the low and central scenarios and less favourable in the high scenario when Member States' NAP status is also taken into account. This is largely due to the fact that half (8) of the Member States for which exposure data was available had no noise legislation prior to the introduction of the END but five of these had produced NAPs and therefore at least 50% of the benefits (and costs) were attributed to the implementation of the END in the low scenario (compared to 25% in Table 47) and 100% in the central and high scenarios (compared to 50% and 100% for the central and high scenarios in Table 47). Since the benefits are typically higher than the costs, the net present value and cost-benefit ratio is correspondingly higher.

Note that these findings do need to be treated with caution as the estimates are based on a very limited sample and are based on a number of underlying assumptions. In particular, the costs of measures are known to be incomplete as these were only available for a limited selection of measures.

Table 50: Extrapolation of costs across major railways in the EU-28 taking account of existing legislation and NAP status

			LOW		CENTRAL		HIGH	
Pre-existing legislation & NAP status	**Density**	**Total length of railway (km)**	**Ave costs per person (€)**	**Total costs (€, millions)**	**Ave costs per person (€)**	**Total costs (€, millions)**	**Ave costs per person (€)**	**Total costs (€, millions)**
None; NAP	0-150	82	1.35	0.001	20.48	0.03	204.53	0.34
None; No NAP	**0-150**	4,088	1.35	0.11	20.48	1.66	204.53	16.60
Pre-existing; NAP	0-150	14,254	1.35	0.35	20.48	10.61	204.53	211.88
Pre-existing; No NAP	0-150	-	1.35	-	20.48	-	204.53	-
None; NAP	150-300	854	1.35	0.12	20.48	3.54	204.53	35.34
None; No NAP	**150-300**	-	1.35	-	20.48	-	204.53	-
Pre-existing; NAP	150-300	18,271	1.35	1.20	20.48	36.55	204.53	730.10
Pre-existing; No NAP	150-300	506	1.35	0.04	20.48	1.12	204.53	22.36
None; NAP	>300	2,244	1.35	0.54	20.48	16.43	204.53	164.14
None; No NAP	**>300**	-	1.35	-	20.48	-	204.53	-
Pre-existing; NAP	>300	3,210	1.35	0.38	20.48	11.59	204.53	231.55
Pre-existing; No NAP	>300	21	1.35	0.01	20.48	0.26	204.53	5.11
		43,529.95		**2.74**		**81.78**		**1,417.41**

Table 51: Extrapolation of benefits across major railways in the EU-28 taking account of existing legislation and NAP status

			LOW		CENTRAL		HIGH	
Status	**Density**	**Total length of railway (km)**	**Ave benefits per person**	**Total benefits (€, millions)**	**Ave benefits per person**	**Total benefits (€, millions)**	**Ave benefits per person**	**Total benefits (€, millions)**
NAP	0-150	82	249.51	1.36	1,509.64	8.23	6,401.84	34.89
No NAP	0-150	4,088	124.76	40.50	377.41	122.51	1,600.46	519.53
NAP	150-300	854	249.51	43.12	1,509.64	260.87	6,401.84	1,106.24
No NAP	150-300	-	124.76	-	377.41	-	3,200.92	-
NAP	>300	2,244	249.51	200.23	1,509.64	1,211.50	6,401.84	5,137.51
No NAP	>300	-	124.76	-	377.41	-	3,200.92	-
Pre-existing legislation		36,262	124.76	1,952.49	754.82	5,713.58	6,401.84	19,205.51
	TOTAL	**43,530**		**2,238**		**7,317**		**26,004**

1.5.4 Agglomerations

Under the END, there is a requirement for Member States to report noise exposure levels for all agglomerations. Agglomerations are defined by the END as "part of a territory, delimited by the Member State, having a population in excess of 100 000 persons and a population density such that the Member State considers it to be an urbanised area" (*Article 3k).*

According to the EEA Noise database[81], there are 471 agglomerations across Europe, 466 of which are within the EU-28. Of the 471 agglomerations required to prepare SNMs, all of them are required to report on road traffic noise, 460 on rail noise and 381 on aircraft noise. By 2012, only 62% had reported on road traffic noise and 57% and 44% on rail and aircraft noise respectively.

1.5.4.1. Methodology: Summary overview

For the purposes of the evaluation, 10 agglomerations were selected as test cases for analysis. These were selected on the understanding that information on costs and benefits (in terms of changes in the number of people exposed to noise from all transportation sources within agglomerations) was readily available, either from the published NAPs or directly from the relevant authorities and other published sources.

The information obtained was, however, incomplete and was not sufficiently comparable across the test cases to support a reliable extrapolation. More specifically, the test cases vary widely with respect to:

- The **types of measures implemented** (see Table 50), the degree of implementation of measures and the number of affected persons exceeding limit values (which are country specific);
- The **sources of environmental noise** (some are affected by road, railway and airport noise while others only by one or two principal sources of noise).
- The **extent to which cost and benefit information was available** for the principal noise sources. For instance, while Nuremberg is affected by noise from roads, railways and airports, it was not possible to determine the combined effects (costs and benefits) of measures to address noise from these sources. Separate analyses were conducted for individual measures implemented in each of the test case agglomerations.

This is compounded by further challenges in that the agglomerations that are required to report under the END, all differ with respect to:

- **Population size and density**. This has a bearing on the cost-effectiveness of measures, particularly measures of a 'public good' nature. (i.e. where the benefits of a measure extend beyond the specific population for which the measure was intended (non-excludable) and where there is no incremental cost of providing the measure to others (non-rivalrous);
- **The principal sources of environmental noise**. While road traffic noise is common to all agglomerations; noise from railways and airports does not apply to all agglomerations;
- The **completeness of information** on the size of the population exposed to harmful levels of noise (> 55 dB L_{den} or 50 dB L_{night}), particularly in relation to noise from airports.

[81]Accessed at http://forum.eionet.europa.eu/etc-sia-consortium/library/noise_database/index_html (last updated June 2015)

The costs and benefits of measures relating to each noise source (roads, railways, airports) ought to be treated separately in order to avoid the risk of double counting. This is because a number of households could potentially be exposed to noise from more than one source. Moreover, the benefits that households or individuals derive from the measures aimed at achieving a reduction in noise from each source are not additive (i.e. the cumulative effect will be less than the sum of the change in noise reduction from each source). However, it can also be argued that households are primarily affected by only one source. For example, people living on a main street are not normally affected by rail or airport noise at the same intensity and the dose-response relationships show an increasing share of annoyed persons at high noise levels.

Although the test cases have estimated the benefits for the single noise source situation (not total noise), it is nevertheless possible to add the benefits of measures relating to different noise sources with a relatively small risk of double counting. However, as Table 50 shows, no two test cases are the same in terms of the types of measures included and the scale at which they are implemented also varies widely. This limits the ability to reliably extrapolate the test case findings to the EU level.

For this reason, rather than extrapolating from the agglomeration test cases, an indicative assessment of the efficiency of END implementation within agglomerations is made by considering the cost-benefit ratios associated with specific measures that were identified in the NAPs for each of the test cases and for which cost and benefit data exists. The process for calculating costs and benefits of individual measures is similar to that described in section 1.4.1 (and repeated below for ease of reference) but differs with respect to the way in which costs and benefits per person are calculated.

Costs

Costs are divided into a) compliance/administrative costs, and b) costs of implementing the measures. Costs reported here are the total costs incurred (or planned) to date, discounted (at 4% per year) over a 25-year assessment period, and expressed in 2014 prices.

The costs per person are then calculated as the present value costs (i.e. the sum of the discounted costs over 25 years) divided by the number of people who benefited from the measure. This differs from the approach used for estimating the costs (and benefits) for groups of measures where costs per person were calculated as using the total number of people affected by noise levels higher than 55 dB L_{den}.

Benefits

Benefits are considered as the difference between the existing situation and the situation after the implementation of all the measures. They are monetised by means of the methodology of valuation of health effects described in Section 1.4.1. The benefits are assessed over a 25-year period, discounted at 4% per year and expressed in 2014 prices. Similar to the approach used for costs, the per person benefits for individual measures are calculated using the estimated number of beneficiaries of each measure rather than the total size of the population affected by noise levels exceeding 55 dB L_{den}.

Cost-benefit ratio

The cost-benefit ratio is then calculated to provide an overall indication of value for money of each of the measures. Where the ratio is greater than 1, this implies that the benefits exceed the costs and the measure is thus cost-efficient. Where the ratio is less than 1, the costs exceed the benefits and the measure.

A more detailed analysis of the test case findings and cost-benefit ratios of individual measures is provided below.

1.5.4.2. Test case data

The table below shows the test cases that were investigated, as well as their status with respect to completeness of data.

Table 52: Test case agglomerations

Test case	Noise sources covered	Completeness of data
Nuremberg, Germany	Road	• Incomplete data on the costs of measures, including rail grinding • Costs and benefits relate only to roads measures
Dusseldorf, Germany	Road	• No information on administrative costs • Analysis does not include the costs of noise abatement measures implemented by Dusseldorf airport or the national railway authority. While the costs and benefits of these measures are likely to be significant, many of these measures were implemented independently of the NAP. • The costs of measures relate only to city and federal expenditures on road and railway measures • Benefits relate to roads measures only
Essen, Germany	Road, rail	• Data on the costs of measures is largely incomplete. In particular, the costs of noise abatement measures implemented by the federal roads and national rail authorities are not included. The costs and benefits of these measures are likely to be significant • Many measures identified in the NAP have not yet been implemented or are still underway • If all measures identified in the NAP are implemented, the benefits (and costs) are likely to be significantly higher
Munich, Germany	Road, rail	• Cost information is only available for two of the measures, both of which are still underway. • No information on the total size of the population benefitting from the measures with known costs.
Augsburg, Germany	Road, rail	• Incomplete data on the costs of measures • Benefits relate to road and rail • Some measures still underway therefore benefit estimates over-estimate the benefits achieved to date
Athens, Greece	Road, rail	• No information on the costs of measures • Benefits relate to road measures only
Helsinki, Finland	Road, rail	• Costs only available for a selection of the 23 measures identified in the NAP. • The size of the populating benefitting from the measures for which cost data is available is unknown and therefore it is not possible to calculate benefit estimates.
Malmö, Sweden	Road	• Costs only available for a limited number (4) of the 15 measures identified in the NAP. • Benefits therefore only relate to these measures. • All measures are still underway and therefore the level of benefits estimated by the analysis is likely to over-state the actual benefits achieved to date. • If all measures identified in the NAP are

Test case	Noise sources covered	Completeness of data
		implemented, then the costs and benefits will be significantly higher than those in the test case.
Bratislava, Slovakia	Road, rail, air	• No information on the administrative costs of END. • No information available on the costs of measures. • While the Environmental Action Plan provides estimates of the change in the total number of people affected by noise (L_{den}) from measures along the road network, there is no information on the size of the population affected by the other measures identified in the NAP.
Bucharest, Romania	Road, rail, 2 airports	• No information on costs • No reliable information on benefits relating to measures identified in the provisional NAP • The first official NAP has not yet been published (anticipated end 2015). The draft NAP contains details for proposed measures but cost and benefit information is only available for two measures – a noise barrier along the railway and improved road surfacing along the D4 motorway.

A summary of the test case findings is provided in Table 53 overleaf. More detailed descriptions of each of the test cases and key findings are provided in Appendix F.

Table 53: Test case summary - agglomerations

Agglomeration	Nuremberg	Athens	Helsinki	Augsburg	Dusseldorf	Essen	Munich	Bucharest	Malmö	Bratislava
Country	**Germany**	**Greece**	**Finland**	**Germany**	**Germany**	**Germany**	**Germany**	**Romania**	**Sweden**	**Slovakia**
Noise sources	Roads, railways, tramways, airport and industry	Heavy exposure to noise from roads and railways	Road, rail, tram and metro	Inner-city noise; noise from two major motorways that cross the city. Connected to five train lines and a 76km long tram network. Noise from aviation is insignificant.	Road, rail and air	Road, rail and air	Road and rail	Road, rail, air	Road	Road, rail, air and industry
Noise sources covered in test case (costs and benefits)	Roads	Roads	Road (costs only)	Roads	Roads	Road, rail	Road, rail	Road, rail, air	Road	Road, rail
Key characteristics										
Context	Heavy exposure to environmental noise in densely populated area; several autobahn routes pass close to the city and a multi-lane motorway crosses the city	Densely populated area with heavy exposure to traffic noise from all sources.	The commercial port was relocated in 2008 and the old harbour area was developed for residential purposes. This resulted in a decrease in rail and heavy road traffic in the inner city and a correspondin g decrease in	Vibrant industrial city, smaller agglomeratio n	One of 10 largest cities in Germany; the city is an economic hub. Characterised by heavy traffic flows and an extensive road network. Densely populated with nearly as many workplaces as residents.	One of the 10 largest cities in Germany. Dense road network and highly congested expressway cuts across the city. Well-established public transport system, including buses, trams and railways. The	Third largest agglomeratio n in Germany. Dense inner-city road network; functions as a hub for long-distance traffic both on road and rail. Extensive public transport system. City road network connects to	Capital city of Romania. The city is connected to 5 train lines and has an underground network. It is also served by two international airports. Noise is a significant issue with over 3,800 buildings exceeding noise levels	Third largest city in Sweden and most densely populated area in Scandinavia.	Capital of Slovakia. The agglomeratio n is defined to lie within the boundaries of the municipal area whereas the greater metropolitan area includes another 100,000 people. Noise mapping covers roads, railways, industry and

Agglomeration	Nuremberg	Athens	Helsinki	Augsburg	Dusseldorf	Essen	Munich	Bucharest	Malmö	Bratislava
			noise levels.			population is also affected by aircraft noise due to proximity of Essen Mulheim airport.	an outer and an inner circular roads well as to seven motorways in the vicinity of the city. Noise from aviation not relevant as the airport is situated well away from the city.	above 65 dB, around 200 buildings exceeding noise levels above 70 dB and a number of buildings exceeding 75 dB L_{den}.		the international airport which is situated 9km from the city centre.
Population	520,000	701,852	560,905	276,542	598,686	569,884	1,407,836	1,931,000	318,107	460,000
Area (km2)	187	38	215	147	217	210	311	285	156	859
Population density (persons/km)	2,781	18,470	2,609	1,881	2,759	2,714	4,527	6,775	2,039	536
Noise exposure (Road)										
Population exposed to noise > 55 dB L_{den} (before measures)	122,600	701,821	No information	46,900	159,346	182,600	No information	No information	142,500	No information
Population exposed to noise > 50 dB L_{night} (before measures)	77,700	698,401	No information	29,000	113,510	118,400	No information	No information	82,460	No information
Noise exposure (Rail)										
Population exposed to noise > 55 dB L_{den} (before measures)	100,540	702,424	No information	39,060	131,067	75,240	No information	No information	n/a	No information
Population exposed to noise > 50 dB L_{night} (before measures)	80,450	702,424	No information	29,620	100,552	57,110	No information	No information	n/a	No information

Agglomeration	Nuremberg	Athens	Helsinki	Augsburg	Dusseldorf	Essen	Munich	Bucharest	Malmö	Bratislava
Noise exposure (Air)										
Population exposed to noise > 55 dB L_{den} (before measures)	3,400	n/a	n/a	n/a	7,112	n/a	n/a	No information	n/a	No information
Population exposed to noise > 50 dB L_{night} (before measures)	900	n/a	n/a	n/a	1,164	n/a	n/a	No information	n/a	No information
Costs										
Compliance/administrative costs (€), discounted @4% p.a. over 25 years	136,934	-	259,820	19,819	-	790,161	600,000	-	150,022	-
Total costs of measures (€), discounted @4% p.a over 25 years	23,045,738	-	6,508,854	4,710,245	13,125,969	9,271,764	12,242,764	-	18,084,436	-
Notes on costs	Costs only relate to measures to reduce noise from roads. This includes reductions in speed limits, quieter road surfaces and soundproof windows	No information available (or provided) on either the administrative costs associated with END or the costs of measures.		Costs (and benefits) relate to 2 roads measures only	Costs only available for measures within the responsibility of the city of the Dusseldorf and the federal government (state roads)	Costs relate primarily to roads measures; 2 rail measures also included	The total cost of the END implementation cannot be calculated to date, since not all measures are approved. However, the soundproof windows program as well as the action program "Mittlerer Ring" incur high costs and are underway.	No information available (or provided) on either the administrative costs associated with END or the costs of measures.	Cost data only available for a selection of measures - noise-proof windows, noise barriers and other noise-reducing activities in selected locations	Cost (and benefit) information only available for 2 proposed measures (noise barrier and low noise surface on motorway D4) within a single hotspot district (Petrzalka)

Agglomeration	Nuremberg	Athens	Helsinki	Augsburg	Dusseldorf	Essen	Munich	Bucharest	Malmö	Bratislava
							Only the cost of those two measures are included. Also not included are noise abatement measures implemented by the federal state government for federal roads and rail that account for high expenditures and significant effects.			
Ave cost per affected person (€)	189	-	12	101	45.19759278	39			128	
Benefits (assuming 100% attribution)										
Benefits (€)	658,804,377	86,576,856	Total benefit cannot be calculated as the number of residents benefiting from the implementati on of measures with known costs cannot be determined	71,159,384	865,480,746	1,644,855,489	Total benefit cannot be calculated as the number of residents benefiting from the implementati on of measures with known costs cannot be determined	No reliable information on the benefits relating to the full suite of measures identified in the Environment al Action Plan (2008). Costs and benefits associated with a reduction in L_{den} levels as	529,952,835	No information on benefits from measures applied across the whole of the agglomeratio n. Benefit estimates only available for the two measures described above and in a single

Agglomeration	Nuremberg	Athens	Helsinki	Augsburg	Dusseldorf	Essen	Munich	Bucharest	Malmö	Bratislava
								a result of improved road surfaces along 50km of the main road network have been estimated but are not included in the analysis because they relate only to a single measure.		hotspot area
Average benefit per person (€)	5,374	123	-	1,517	5,431	9,008	-	-	3,719	-
Net Present Value (€)	635,621,704	-	-	66,429,320	-	1,634,793,564	-	-	511,718,377	-
Cost Benefit Ratio	1:28			1:15		1:231			1:29	
Sensitivity testing										
Benefits: central estimates, 25% attribution	164,701,094	21,644,214	-	17,789,846	216,370,187	411,213,872	-	-	132,488,209	-
Benefits: central estimates, 50% attribution	329,402,188	43,288,428	-	35,579,692	432,740,373	822,427,744	-	-	264,976,417	-
Benefits: central estimates, 75% attribution	494,103,283	64,932,642	-	53,369,538	649,110,560	1,233,641,616	-	-	397,464,626	-
High scenario - high values, 100% attribution (€, million)	2,013,260,463	383,193,544		151,574,257	2,620,319,692	4,688,607,357			1,436,919,099	

Agglomeration	Nuremberg	Athens	Helsinki	Augsburg	Dusseldorf	Essen	Munich	Bucharest	Malmö	Bratislava
Low scenario - low values, 100% attribution (€, million)	289,104,020	31,018,046		38,381,061	442,536,679	789,916,032			191,209,212	
Low scenario - low values, 25% attribution (€, million)	72,276,005	7,754,511		9,595,265	110,634,170	197,479,008			47,802,303	
Measures considered										
Noise proof window campaign	x			x	x	x	x		x	
rehabilitation of roads/low noise road surfaces	x			x	x	x	x	x		x
Speed reduction	x									
Speed control	x			x		x	x			
re-distribution/reduction of number of Heavy trucks						x				
Barriers/walls			x		x		x			x
Embedded tracks for trams	x				x					
Acoustical grinding of tracks	x									
Vegetated tram tracks					x		x			
combination 3,4,5										

1.5.4.3. Efficiency of measures implemented in agglomerations

Noise Action Planning in agglomerations covers a broad range of measures utilised for the objective of the END. Most measures affect a clearly defined case study area in which the measure is implemented. Often more than one measure affects the population in a given case study area. Cumulative effects of packages of measures within test cases are only studied by way of example since the combination of measures varies by agglomeration. Cost-benefit assessments were carried out for 28 measures in 10 agglomerations.

The NAPs analysed contain a large variety of measures. For the CBA, a sample of these measures was selected taking into consideration evidence as to their effectiveness and whether such measures have actually been implemented during R1. Table 54 shows the measures that were selected for the analysis. The measures relevant to each test case agglomeration are identified at the bottom of Table 53.

Table 54: Measures implemented in agglomerations and for which CBAs were conducted

No.	Measure	Comment
1	Noise proof window campaign	Usually only available for affected residents over the threshold value e.g. L_{den}/night >70/60 dB(A).
2	Rehabilitation of roads / Low noise road surfaces	Measure primarily applied for road sections.
3	Speed reduction	Reduction by 20 km/h, e.g. Speed limit reduced from 60km to 40km or from 50km to 30km
4	Speed control	Measure primarily applied for road sections.
5	Re-distribution / Reduction of number of heavy trucks	Requires redesign of traffic flows for road systems within agglomerations.
6	Barriers / Walls	Frequently used for roads and rails but not usually for agglomerations.
7	Embedded tracks for trams	Often only implemented when replacing old tracks.
8	Acoustical grinding of tracks	---
10	Implementing Vegetation Systems in Tram Tracks.	---

Cost of measures

Conclusive information regarding the actual costs incurred of measures was only available for a few selected cases. The costs presented in NAPs are often estimates as only a few of the measures have been fully implemented and thus it is only for these measures that the actual costs are known. Where no detailed cost information was available for a measure, data from similar cases was collated, adjusted where necessary to account for local factors, and applied to the case. This made it possible to develop a generalised cost approach for each measure, as presented in Table 55.

Table 55: General unit cost estimates used for estimating total costs of measures

No.	Measure	Cost
1	SNM / NAP	2 € / resident in agglomeration
2	Noise proof window campaign	1,500 € / flat resp. 750 € / effected resident
3	Rehabilitation of roads / Low noise road surfaces	50 € / m² exchanged surface
4	Speed reduction	50 € / m road
5	Speed control	cost neutral due to revenue from speeding fines
6	Re-distribution / Reduction of number of heavy trucks	requires redesign of traffic concept approx. 250,000 € depending on size of agglomeration
7	Barriers / Walls	1,000 € / m² wall
9	Embedded tracks for trams	500 € /m double track
10	Acoustical grinding of tracks	1 € / m single track
11	Vegetated tram tracks	2,500 € / m double track

The total costs comprise both the SNM/NAP preparation expenditure per resident and the capital and ongoing maintenance costs associated with each measure.

Benefits

The effectiveness of a measure is measured by the reduction of noise level in the case study area. This information is generally provided in the NAPs. Where this is not the case, the degree of noise reduction is estimated using data from similar cases. As a result, generally accepted average noise reduction levels are available for each measure, as presented in Table 56.

Table 56: Reductions in noise levels achieved with each measure

No.	Measure	Effectiveness (reduction of noise level)
2	Noise proof window campaign	L_{den} = no effect L_{night} < 45 dB(A)
3	Rehabilitation of roads / Low noise road surfaces	$L_{den}/_{night}$ = -4 dB(A)
4	Speed reduction	$L_{den}/_{night}$ = -2 dB(A)
5	Speed control	$L_{den}/_{night}$ = -1 dB(A)
6	Re-distribution / Reduction of number of heavy trucks	reduction of effected residents by 20 %
7	Barriers / Walls	$L_{den}/_{night}$ = -3 dB(A)

No.	Measure	Effectiveness (reduction of noise level)
8	Embedded tracks for trams	$L_{den}/_{night}$ = -3 dB(A)
9	Acoustical grinding of tracks	$L_{den}/_{night}$ = -6 dB(A)
10	Vegetated tram tracks	$L_{den}/_{night}$ = -2 dB(A)

The benefits are then calculated based on the change in the number of people affected by noise within each 5 dB noise interval. A more detailed explanation of the process for calculating the change in the size of the population exposed to noise within agglomerations is provided in Appendix E.

Cost-benefit ratios

The resulting cost-benefit ratios for each of the measures in each test case are summarised in Table 57 below.

Table 57: Cost-benefit ratios for individual measures in each test case agglomeration

Overview CB-Ratios	Augsburg	Munich	Nuremberg	Essen	Düsseldorf	Malmö	Athens	Bucharest	Bratislava	Helsinki
Noise proof window campaign	1:11	1:8	1:14	1:25	1:18	1:15	-	-	-	-
rehabilitation of roads/low noise road surfaces	1:4	1:16	1:21	1:10	1:8	-	-	1:3	1:10	-
Speed reduction (speed limits)	1:119	1:335	1:301	1:112	-	-	-	-	-	-
Speed control (enforcement)	1:14,335	-	-	-	-	-	-	-	-	-
re-distribution/reduction of number of heavy trucks	-	-	-	1:6321	-	-	-	-	-	-
Barriers/walls	-	1:0.3	-	-	1:5	-	-	-	1:7	1:1.2
Embedded tracks for trams	-	-	1:6	-	1:3	-	-	-	-	-
Acoustical grinding of tracks	-	-	1:74	-	-	-	-	-	-	-
Vegetated tram tracks	-	1:1	-	-	1: 1	-	-	-	-	-

It is evident from the information presented in Table 54 that there is a wide degree of variation in the cost-benefit ratios for different measures, which is not unexpected. Speed control and re-routing of heavy vehicles are particularly cost-efficient because they involve low levels of capital expenditure yet yield high benefits. The cost estimates do not, however, include estimates of the costs that may be passed on to heavy vehicle users in the form of the opportunity costs of time and additional fuel costs from having to travel longer distances, or to society from the additional greenhouse gas emissions associated with additional fuel use. These are, nevertheless, anticipated to be small relative to the overall benefits associated with noise reductions.

The negative cost-benefit ratio associated with the construction of noise barriers in Munich can be attributed to the relatively low number of people benefitting from the measure (190 people along a length of road of approximately 500m) in comparison to the high costs (€1.8 million, undiscounted).

Assuming that the cost-benefit ratios presented above provide are broadly indicative of the cost-benefit ratios (at least of similar order of magnitude) that would be achieved in other agglomerations across the EU, then it can be concluded that the implementation of the END has been efficient and cost-effective overall in agglomerations.

1.5.5 Administrative costs at EU level

In addition to the costs incurred at Member State level, the costs of administration, reporting, research and evaluation at the supra-national level (i.e. by the European Commission, European Environment Agency and Joint Research Centre) also need to be taken into account.

The costs incurred to date (2002-2015) for each of the implementing authorities at European level are shown in Table 55.

Table 58: Costs of END implementation at supra-national level

	Staffing costs	Other costs (e.g. of meetings, missions, etc.)	Total costs
European Commission	2,112,000	462,000	2,574,000
European Environment Agency	1,815,000	not provided	1,815,000
Joint Research Centre (est.)	100,000	not provided	100,000

*Costs estimated as 0.5 FTEs over 4 years (2009-2012) reflecting time spent on contributing to the development of the CNOSSOS methodology

The administrative costs are then discounted (using the 4% social discount rate) over the 25-year assessment period to allow them to be compared to the benefits (and costs) of implementation at Member State level. The total of the discounted values is shown in Table 56 below.

1.5.6 Aggregate assessment

Combining the information on administrative costs and the outcomes from the analyses for each of airports, roads, railways and agglomerations, it is possible to provide an indicative assessment of the overall efficiency of the implementation of the END. The overall findings in the base case are summarised in Table 56.

Note that the benefits (and costs) are assessed over a 25-year assessment period and the analysis assumes that the same level of benefits will be delivered year-on-year from the time the expenditure on measures was made until the end of the assessment period. Shortening the assessment period, and thus the flow of benefits relative to the costs, will substantially reduce the NPV.

For example, if the assessment period were reduced to 18 years such that the effects of measures only endure for 5 years after the final year of investment, rather than the current 12 years, the NPV for major rail in Austria almost halves. It is likely that, at least in some cases, reducing the flow of benefits would result in negative NPVs and cost-benefit ratios.

The results shown in Tables 59 to 61 are considered indicative of the order-of-magnitude costs and benefits only and should be treated with caution. In particular:

The **cost and benefit estimates are partial.**

- They do not include the costs and benefits associated with measures to reduce harmful levels of noise in agglomerations. Cost-benefit ratios have not been calculated for agglomerations as the test cases did not provide a sufficiently representative sample from which to extrapolate. However, the test case data and the cost-benefit analyses for a range of typical measures employed in agglomerations suggest that the benefits of measures to reduce noise in agglomerations substantially outweigh the costs although the ratios vary significantly between measures.
- They only cover a subset of the total range of measures identified in Member States' NAPs. Only those measures for which reliable and comparable cost and benefit information was available were included.

The **benefit estimates are understated**.

- They only account for the benefits associated with noise reductions amongst the highly annoyed and highly sleep disturbed populations. They do not consider the benefits to those that experience low or moderate levels of sleep disturbance and annoyance.
- They do not include the benefits in the form of cost savings from a reduction in hospital admissions (costs borne by individuals) and lost productive days (costs to employers). These are nevertheless likely to be small in relation to the value of avoided DALYs.
- In contrast, while some of the measures included in the assessment have not yet been fully implemented, the benefits estimates are calculated assuming that the measures have been fully implemented*. The benefits associated with some measures are thus somewhat overstated*.

The **cost estimates, particularly in relation to roads and airports) are understated**.

- The indirect costs of measures (such as increases in transport costs and greenhouse gas emissions as a result of changes to routes, etc.) are not included. These are nevertheless likely to be low relative to the direct costs of measures.
- The **test case costs and benefits are not necessarily representative** of the situation across the EU and the extrapolation was performed using a limited sample.
- **The degree to which costs and benefits can be attributed to the END is unknown**. While different assumptions about the level of attribution have been tested in the sensitivity analyses, the assumptions that have been applied were formulated for the purposes of illustration only using professional judgement and may not accurately reflect the actual situation.

Notwithstanding the limitations, the outcomes suggest that the END is efficient overall. The NPV is positive under all scenarios (base case, best and worst case) and only negative for airports and roads under the worst case scenario (Table 60).

The corollary of this is that if the END did not exist, it can be assumed that some noise mitigation measures would still go ahead anyway because measures identified in NAPs were driven by national regulations or there were other primary regulatory drivers, such as introducing speed limits to help reduce pollution and comply with air quality limits. However, at least some measures would not have been identified and / or already implemented had it not been for the existence of the END. There would therefore have been a higher number of exposed persons to environmental noise, with significant implications for the health and well-being of those affected by noise as a result.

Table 59: Aggregate assessment of costs and benefits at the EU scale

	Total present value costs (€, million)	Total present value benefits (€, million)	Net present value (€, million)	Cost-benefit ratio
EU level	3	-	-	-
Major airports	438	2,854	2,416	1:7
Major roads	667	24,248	23,581	1:36
Major rail	82	7,317	7,235	1:89
TOTAL	1,190	34,418	33,228	1:29

The worst case scenario (Table 60) is modelled using the highest cost estimates and the lowest benefit estimates where the benefit estimates are in turn based upon the low values for the disability weights, VOLY and assuming that only 25% of the benefits can be attributed to the END in the case that noise legislation within the Member State pre-dated the introduction of the END. The benefits are, however, understated (for the reasons cited above) and thus the probability of such a situation actually arising is considered to be low and, for airports at least, the benefits may at least equal the costs.

Table 60: Worst case scenario

	Total present value costs (€, million)	Total present value benefits (€, million)	Net present value (€, million)	Cost-benefit ratio
EU level	3			
Major airports	438	276	-161	2:1
Major roads	28,961	5,971	-22,989	5:1
Major rail	1,417	2,238	820	1:2
TOTAL	30,819	8,485	-22,334	4:1

In contrast, the best case scenario (Table 61) is modelled using the low cost estimates and high benefit estimates and assumes that 100% of the calculated benefits can be attributed to the END except for those Member States in which there was no noise legislation prior to the introduction of the END and where no NAP has been published. As may be expected, under the best case scenario, both the NPV and cost-benefit ratios are positive, with a return on investment of approximately €327 for every €1 spent (excluding agglomerations). However, under a worst case scenario, only expenditure on measures to reduce noise from railways yields a positive NPV and cost-benefit ratio.

Table 61: Best case scenario

	Total present value costs (€, million)	Total present value benefits (€, million)	Net present value (€, million)	Cost-benefit ratio
EU level	3	-	-	-
Major airports	438	4,915	4,477	1:11
Major roads	38	126,540	126,503	1:3341
Major rail	3	26,004	26,001	1:9474
TOTAL	481	157,459	156,977	1:327

APPENDIX E – METHODOLOGY FOR THE CASE STUDIES

The methodology for the case studies by source is now summarised.

E.1 Agglomerations

Noise Action Planning in agglomerations covers a broad range of measures utilised for the objective of the END. Most measures affect a clearly defined explicit "case study area" in which the measure is implemented. Often more than one measure affects the population in a given case study area. Cumulative effects of several measures in one case study area are only studied by way of example since the combination of measures varies by agglomeration. Cost-benefit assessments (CBAs) were carried out for 28 measures in 10 agglomerations.

E.1.1 Evaluated measures

The NAPs analysed contain a large variety of measures. For the CBA, a sample of these measures has been selected taking into consideration evidence as to their effectiveness and whether such measures have actually been implemented during R1. The following table shows the measures that were selected for the analysis.

No.	Measure	Comment
1	Noise proof window campaign	Usually only available for affected residents over the threshold value e.g. L_{den}/L_{night} >70/60 dB(A).
2	Rehabilitation of roads / Low noise road surfaces	Measure primarily applied for road sections.
3	Speed reduction	Reduction by 20 km/h, e.g. Speed limit reduced from 60km to 40km or from 50km to 30km
4	Speed control	Measure primarily applied for road sections.
5	Re-distribution / Reduction of number of heavy trucks	Requires redesign of traffic flows for road systems within agglomerations.
6	Barriers / Walls	Frequently used for roads and rails but not usually for agglomerations.
7	Embedded tracks for trams	Often only implemented when replacing old tracks.
8	Acoustical grinding of tracks	---
10	Implementing Vegetation Systems in Tram Tracks.	---

E.1.2 Cost of measures

Conclusive information regarding the actual costs incurred of measures was only available for a few selected cases. Often, the costs presented in NAPs are estimates, since only a few measures have yet been fully implemented. Where no detailed cost information was available for a measure, data from similar cases was evaluated and applied to the case. This made it possible to develop a generalised cost approach for each measure, as presented in the following table.

No.	Measure	Cost
1	SNM / NAP	2 € / resident in agglomeration
2	Noise proof window campaign	1,500 € / flat resp. 750 € / effected resident
3	Rehabilitation of roads / Low noise road surfaces	50 € / m² exchanged surface
4	Speed reduction	50 € / m road
5	Speed control	cost neutral due to revenue from speeding fines
6	Re-distribution / Reduction of number of heavy trucks	requires redesign of traffic concept approx. 250,000 € depending on size of agglomeration
7	Barriers / Walls	1,000 € / m² wall
9	Embedded tracks for trams	500 € /m double track
10	Acoustical grinding of tracks	1 € / m single track
11	Vegetated tram tracks	2,500 € / m double track

The total cost of a measure is made up of the SNM/NAP preparation expenditure per resident and the costs of implementation and maintenance for the measure.

E.1.3 Effectiveness of measures (agglomerations)

The effectiveness of a measure is measured by the reduction of noise level in the case study area. This information is generally provided in the NAPs. Where this is not the case, the degree of noise reduction is estimated using data from similar cases. As a result, generally accepted average noise reduction levels are available for each measure, as presented in the following table.

No.	Measure	Effectiveness (reduction of noise level)
2	Noise proof window campaign	L_{den} = no effect L_{night} < 45 dB(A)
3	Rehabilitation of roads / Low noise road surfaces	L_{den}/L_{night} = -4 dB(A)
4	Speed reduction	L_{den}/L_{night} = -2 dB(A)

No.	Measure	Effectiveness (reduction of noise level)
5	Speed control	L_{den}/L_{night} = -1 dB(A)
6	Re-distribution / Reduction of number of heavy trucks	reduction of effected residents by 20 %
7	Barriers / Walls	L_{den}/L_{night} = -3 dB(A)
8	Embedded tracks for trams	L_{den}/L_{night} = -3 dB(A)
9	Acoustical grinding of tracks	L_{den}/L_{night} = -6 dB(A)
10	Vegetated tram tracks	L_{den}/L_{night} = -2 dB(A)

E.1.4 Residents in case study area

The number of residents in a case study area is often not clearly specified in the NAP. Where this is the case, the population is estimated based on other sources. The following estimation approaches were applied based on data availability and in order of preference:

1. Number of residents from case study area as explicitly stated in the NAP.
2. Number of residents in the first row of buildings on both sides of the road as retrieved from the noise calculation model.
3. Resident density in case study area multiplied by the case study area (length of road section x 100 m populated corridor).

In the majority of cases, the noise calculation model (2) was used to estimate the number of residents.

E.1.5 Categorising residents into noise level classes

Particulars of the distribution of residents in noise level classes in a specific case study area are usually incomplete. Many NAPs only present the number of residents exposed to noise exceeding a certain threshold value. This threshold may differ from case to case.

As a remedy, standard reference distributions for roads in agglomerations and for agglomerations in general were developed. Based on the noise calculation models of Augsburg and Munich agglomerations, the number of residents in the different noise level classes were determined for the residents in the first row of buildings of roads. This procedure allows to combine road sections with similar characteristics to develop three reference roads. The corresponding reference distributions D-1 to D-3 are therefore based on real road sections in agglomerations taken from NAPs. In order to apply the reference distributions to a certain case, the road characteristics are compared using the data in the following table.

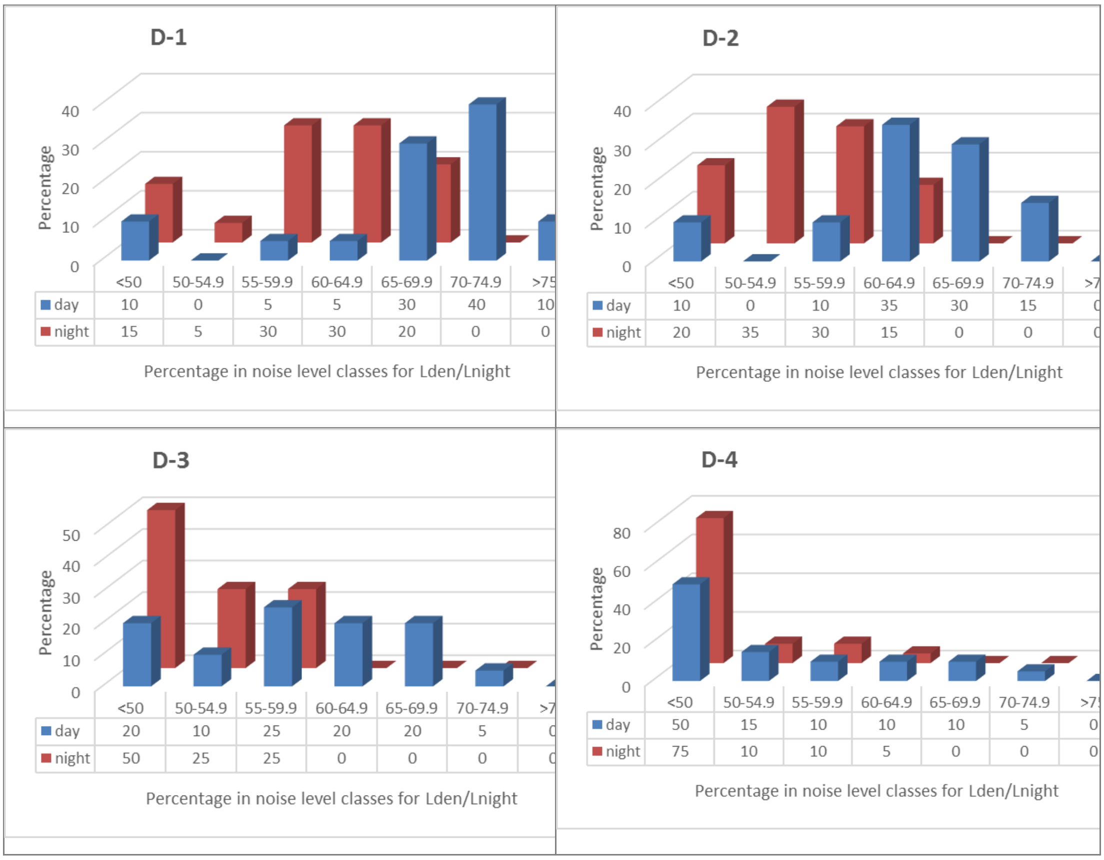
No. of distribution	Road characteristics				Based on
	Building structure	Building density	Distance to buildings	Building levels	
D-1	buildings on both sides of the road	highly compacted structure, rare gaps in between the buildings	+/- 20 metres	3 to 5	Landshuter Allee (Munich) Leopoldstr. (Munich) Fuerstenrieder Str. (Munich)
D-2		compact structure with gaps between the buildings	+/- 35 metres	1 to 3	Koenigsbrunner Str. (Augsburg) Friedberger Str. (Augsburg)
D-3	buildings on one side of the road / only few buildings on one side	loosely built, large gaps between the buildings	+/- 50 metres		Hans-Boeckler-Str. (Augsburg)

Following this approach makes it also necessary to compare the theoretical reference distribution with the given threshold values to assure the noise levels lie within the expected range.

In case the study area covers the entire agglomeration (e.g. redistribution of heavy trucks) the following reference distribution D-4 can be applied. However, data regarding the distribution of residents in noise level classes for the entire agglomeration is usually stated in the NAPs.

No. of distribution	Characteristics of agglomeration		Based on
	Density	Building structure	
D-4	high	dense	Munich/Augsburg agglomerations

The following graphs visualize the available reference distributions D-1 to D-4.



E.1.6 Establishing the number of residents benefitting from noise mitigation, abatement and reduction measures

Details on the number of residents that stand to benefit from measure(s) are usually only provided for one or two noise level classes above a certain threshold value. In addition to this information, most NAPs state the expected reduction of noise in dB(A). Using this information, the affected residents are reassigned to lower noise classes according to the specific reduction of the measure. The following example shows the approach applied for a reduction of 2.5 dB(A) with distribution D-2 (L_{den}):

Noise level class	Residents without measure	Residents with measure	Comment
<50	1,000	1,000	All residents below level of 50 dB(A).
50-54.9	0	500	Reduction of 2.5 dB(A) results in **shift** of 50 % of the residents to the lower 5 dB(A)-noise-class, whereas the remaining 50 % **stay** in the 5 dB(A)-noise-class.
55-59.9	1,000	1,750 + 500	
60-64.9	3,500	1,500 + 1,750	
65-69.9	3,000	750 + 1,500	
70-74.9	1,500	750	
>75	0	0	No residents in this class.
Total	**10,000**	**10,000**	**All residents benefit from the measure.**

For this example, it was assumed that all residents in the case study area experience an improvement due to the measure. This effect is expected with measures such as speed reduction, noise optimised surface or embedded tracks for trams. In other cases, only a subset of residents from a case study area may benefit from a measure, e.g. in case of noise proofing windows campaigns.

E.2 Road

Noise Action Planning for roads includes active measures such as speed reduction and passive measures such as noise-optimised windows. The measures usually relate to the residents/houses directly adjacent to the road sections with the highest noise levels.

CBAs were carried out for individual measures along a specified road section (Greece) and an entire road network (Austria).

E.2.1 Evaluated measures (roads)

The following table shows the measures evaluated.

No.	Measure	Comment
1	Combination of measures e.g. noise optimised surface, noise barriers	Applied for Action Plans of the entire road network (e.g. Austria).
2	Noise barriers	Single measure primarily selected for noise abatement along highways.

E.2.2 Cost of measures

The total cost of a measure comprises the SNM/NAP preparation expenditure per resident and the cost of implementation and maintenance of the measure.

The cost of the measures analysed is obtained from the NAPs or through an interview with the responsible authorities. A generalised cost approach was not developed.

E.2.3 Effectiveness of measure

The effectiveness of the measures is assessed based on the distribution of effected residents in 5 dB noise level classes. This data is derived either from the NAPs or through an interview with the responsible authorities. A generalized approach was not developed.

E.2.4 Residents in case study area

The number of affected residents is specified in the NAP or stated by the responsible authorities. Further classifications are not necessary.

E.2.5 Distribution of residents by noise level classes

The distribution of residents across the noise level classes is usually known for the entire road network in question. Population exposure data for individual measures was taken from the NAP or based on information provided through contact with the responsible authorities. Further classifications are not necessary.

E.2.6 Determination of the number of residents with reduced noise exposure

The number of residents that benefit from a reduced noise exposure is known for all analysed measures and can be categorised into 5 dB noise level classes from the NAP or other sources. Further classifications are not necessary.

E.3 Rail

Noise Action Planning for railways covers measures relating to the rail tracks, optimising train schedules and passive measures to tackle noise at receptor such as erecting noise barriers. The measures usually benefit the residents living directly adjacent to the tracks who are most affected by railway noise. Typical measures involve noise insulation of houses and residential buildings and installing noise barriers.

CBAs were carried out for an individual measure along a specified railway section (Slovakia) and the entire railway network (Austria).

E.3.1 Evaluated measures

The following table shows the measures evaluated.

No.	Measure	Comment
1	Combination of measures Barriers / Walls and Noise proof window campaign	Applied for Action Plans of the entire rail network (e.g. Austria).
2	Noise barriers / Walls	Single measure primarily selected for noise abatement along railways.

E.3.2 Cost of measures

The total cost of a measure is made up of the cost of preparing SNMs/NAPs per resident and the cost of implementing the measure (including maintenance).

The costs of the measures analysed were obtained either from the NAPs or by interviewing the responsible authorities. It was not therefore necessary to develop a generalised cost approach to estimating the costs of measures.

E.3.3 Effectiveness of measures

The effectiveness of measures is assessed by distributing of affected residents across 5 dB noise level classes. The data needed is derived either from the NAPs or through an interview with the responsible authorities. A generalized approach was not developed.

E.3.4 Residents in case study area

The number of affected residents is specified in the NAP or stated by the responsible authorities. Further classifications are not necessary.

E.3.5 Distribution of residents across noise level classes

The distribution of residents across noise level classes is usually known for the entire track network regarding the individual measure area from the NAP or information from the responsible authorities. Further classifications are not necessary.

E.3.6 Determination of the number of residents with reduced noise exposure

The number of residents that benefit from reduced noise exposure is known for all measures analysed and distributed across 5 dB noise level classes from the NAP or other sources. Further classifications are not necessary.

E.4 Airports

Noise Action Planning for airports covers measures relating to the aircraft fleet, management and organisation of airport structures and passive measures such as noise-optimised windows. The measures usually relate to the entire area affected by air traffic noise. Often, more than one measure has an effect on the case study area. CBAs were carried out for combinations of measures at 5 airports. In addition, a CBA for the most common airport measure, the "Improvement of Windows/façades", was carried out at three airports, using generalised cost and benefit approaches.

E.4.1 Evaluated measures

The following table shows the measures considered in the analysis.

No.	Measure
1	SNM/NAP
2	Improvement of windows / facades
3	Combination of measures: • Low noise routing • Flight restriction by night • Engage with communities affected by noise impacts to better understand their concerns and priorities, taking them into account as far as possible in airport noise strategies and communication plans • Influencing planning policy to minimise the number of noise sensitive properties around airports • Re-organisation to manage noise efficiently and effectively • Achieving complete understanding of aircraft noise to inform priorities, strategies and targets • Adopt the quietest aircraft operations (balanced against other negative effects) as practicable

E.4.2 Cost of measures

A generalised cost approach is available for measures, as presented in the following table.

No.	Measure	Cost
1	SNM/NAP	2 € / affected person (> 55 dB L_{den})
2	Passive Noise control	2500 € / eligible person

The total cost of a combination of measures comprises the SNM/NAP preparation expenditure per resident and the cost of implementation and maintenance of the measure.

E.4.3 Effectiveness of measures

The effectiveness of measures depends significantly on the density and distribution of inhabitants in the areas immediately surrounding the airport and underneath the existing flight routes. Therefore, the effectiveness (measured as the number of persons less affected by noise) can only be estimated by subtracting the results of Round 2 and Round 1 mapping results. This approach assumes that other factors determining aircraft noise which are not affected by the measures have remained constant during the investigation period. Only in the case of window insulation measures within a "window insulation programme", the effectiveness can be assessed based on the level of reduction in noise in bedrooms (since sleep disturbance is a key health end data point. For this purpose, it can be assumed that measures reduce the average noise levels inside the bedroom to a level which prevents sleep problems. This effect can be simulated by using outdoor levels L_{den} without any effect and $L_{night} <$ 45 dB(A).

E.4.4 Residents in case study area

The number of affected residents is usually specified in the NAP since the entire area affected by air traffic noise is considered for measures. Further classifications are not necessary.

E.4.5 Distribution of residents to noise level classes

The distribution of residents to noise level classes is usually known for the area affected by air traffic noise from the NAP. Further classifications are not necessary.

E.4.6 Determination of the number of residents with reduced noise exposure

The number of residents that have reduced noise exposure is usually known for each noise level class by 5 dB threshold from the NAP. Further classifications are not necessary.

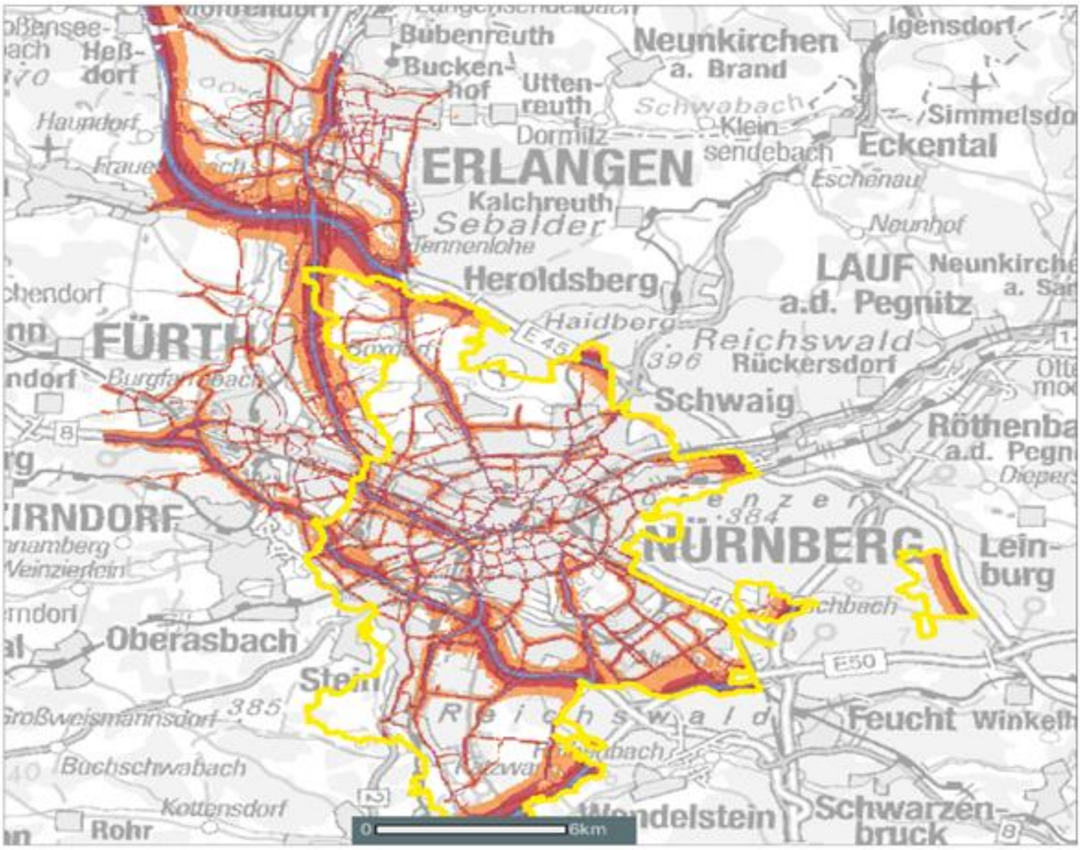
APPENDIX F – TEST CASE SUMMARIES

F.1 AGGLOMERATIONS

F.1.1 Case study – Nuremberg, Germany agglomeration

The city of Nuremberg, Germany is the center of the "European Metropolitan Area Nuremberg" and is a typical agglomeration of the Round 1 mapping with around 520,000 inhabitants. The city was chosen as a case study due to its comprehensive sources of traffic noise from roads, railways, tramways and industry. Besides several Autobahn routes that pass close by the city a multi-lane road, the so called "Frankenschnellweg", crosses the city. Due to the vicinity to Nuremberg airport the population is also affected by air traffic noise. The city of Nuremberg therefore presents a case study agglomeration heavily exposed to traffic noise of all types in a densely populated area.

Nuremberg was noise mapped in 2007 and 2012. The responsible authority for the development of the NAP is the Office for the Environment Nuremberg. Although the final NAP has not yet been approved, the city council agreed on a number of abatement measures to be implemented independently from the NAP. Measures include test tracks with noise optimized surfaces and speed restrictions in parts of the minor road network. The reconstruction of the Frankenschnellweg to achieve a disruption free traffic flow, is also seen as a noise abatement measure. Although the reason for this measure lies in the existing traffic constraints of the Frankenschnellweg.



L_{den} for roads in Nuremberg agglomeration

1. Costs

The total cost of END implementation incurred from 2010 onwards is presented in the table below. The total costs over a 25-year-assessment period are expected to amount to over € 23m.

Table 62 – Costs

Total costs of END Implementation (€, discounted)[82]	
Additional staff time	81,322.57
Consultants	55,611.90
(Mapping) Software	-
Reporting	-
Costs of measures (€, discounted)[83] over 25 years	
Total discounted capital costs of measures[84]	23,045,737.85
Total discounted maintenance costs of measures[85]	-
GRAND TOTAL COSTS (€, discounted)	23,182,672.32

The following table presents the measures taken outlined in the NAP adopted in 2015.

Table 63 – List of measures

Name of measure	Year of implementation	Status	Present value (€, 2014 prices)
Noise-reducing road surfaces in targeted areas	2014	underway	5,535,342.99
Speed reduction (-20km/h) at night in all metropolitan areas	2014	planned	810,810.80
Speed reduction all day in all metropolitan areas	2014	planned	810,810.80
Installation of noise reducing road surfaces under the road renovation programme	2015	planned	-
Installation of noise reducing road surfaces in the ten most polluted areas	2015	planned	6,533,263.98
Passive noise protection (sound insulating windows programme)	2014	planned	810,810.80
Undisturbed traffic flow on the Frankenschnellweg	2014	planned	6,237,006.18
M8a: Speed reduction all day	2014	planned	1,153,846.14

[82] These are the total discounted costs incurred by the relevant implementing authorities in implementing the requirements of the END

[83] These are the total costs of measures to reduce or minimise noise levels

[84] Note that these are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

[85] These are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

Name of measure	Year of implementation	Status	Present value (€, 2014 prices)
in all U- and B – regions with exceptions during the day at particularly significant major roads			
M8a without speed reduction during night period at particularly significant major roads	2014	planned	1,153,846.14
Environmental Noise Adapted beep "close doors" (rail)	2014	planned	-
Elastic embedding / mounting rails	2014	underway	-
Acoustic grinding (rail)	2014	planned	-

Most of the measures outlined have an implementation period of at least 10 years. The implementation has only partly begun. For example, three road sections were equipped with low-noise road surfaces. The installation on another 9 sections is planned shortly. This means that the impact of many of these measures will only materialise in the future, and the benefits presented further below need to be interpreted in that context. However, within the framework of short-term realizable individual measures with an implementation perspective of 5-7 years, a pilot project for a section of the southern city was designed to examine the effectiveness of the measures.

Cost estimates for the measures relating to the inner-city tramway network are not available. The extent and implementation date for those measures is indefinite.

2. Benefits

Through the planned measures, the number of very highly affected inhabitants with L_{den}> 70dB (A) or L_{night}> 60 dB (A) can solely be reduced by installation of noise reducing road surfaces. The other planned measures may bring an additional reduction in the number of people affected.

Using information from the Strategic Noise Maps produced in 2009, it is possible to determine the change in the number of people exposed to noise levels above 55 dB (A) L_{den} and 50 dB (A) L_{night}, as presented in table 3. Since air traffic related noise abatement is responsibility of Nuremberg Airport, this noise type is not included in the table.

Table 64 – Benefits – exposed population[86]

Noise interval	Change in the number of people exposed to noise at the following intervals as a result of noise reduction measures[87]	
	L_{den}	L_{night}
45-49.9 dB(A)	0	0
50-54.9 dB(A)	0	0
55-59.9 dB(A)	0	14,940
60-64.9 dB(A)	0	15,800
65-69.9 dB(A)	1,990	1,900
70-74.9 dB(A)	17,200	0
75-80 dB(A)	2,700	0

As the table above shows, noise reduction measures did reduce the number of people exposed above 65 dB by about 21,890 overall against a total population of about 500,000 in the agglomeration. The benefits were achieved due to noise reduction measures for roads. Since measures relating to the tramway networks are still in the planning process, the number of households exposed to noise is unchanged. Based on this information, and using established dose-response relationships for annoyance and sleep disturbance, the changed numbers of people highly annoyed or highly sleep disturbed is estimated and valued in terms of DALYs (see tables 4 and 5).

Table 65 – Benefits – annoyance

Change in size of the annoyed population[88]	Road	Total	DALYs per year
Annoyed[89]	11,882	11,882	
Highly Annoyed[90]	6,796	6,796	136

As the table above illustrates, the number of people annoyed was reduced by about 11,900 due to noise reduction measures, and the number of people highly annoyed was reduced by about 6,800 people, resulting in a decrease in disease-adjusted life years of 136.

[86] Note that negative numbers indicate an increase in the size of the population exposed to noise at that interval. This is most likely to be due to a reallocation of the population exposed to noise at higher intervals

[87] Note that these include noise reductions that may have been achieved independently of the END. It is not possible to distinguish between noise reductions that may be attributed to END versus noise reductions that may be attributed to other measures.

[88] This is an estimate of the burden of disease from noise-induced annoyance. It reflects the variety of negative responses (e.g. anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation or exhaustion) that people may experience. Noise exposure and annoyance has also been shown to be associated with stress-related psychosocial symptoms such as tiredness, stomach discomfort and stress.

[89] The Present Value represents the discounted stream of annual benefits over a 25-year assessment period

[90] Data below 45dB and above 75dB (Lden) were excluded because the risk of unreliable noise data is high at very low levels, whereas the risk of selection of "survivors" is high at very high levels.

Table 66 – Benefits – sleep disturbance

Change in size of the sleep disturbed population	Road	DALYs per year	Present Value (€)
Sleep Disturbed	7,720		
Highly Sleep Disturbed	3,852	270	266,006,585

Another benefit of the noise reduction measures in the Nuremberg agglomeration is that the number of people whose sleep is disturbed could be reduced by over 7,700 and the number of people whose sleep is highly disturbed could be reduced by another 3,900. This corresponds to a decrease in disease-adjusted life years of 270 and is valued at € 266 M over a 25-year assessment period.

The following tables summarise the effects of the noise abatement measures on cardiovascular disease and hypertension. The data available shows that a reduction in road noise has resulted in a reduction of DALYs of about 21,000 (over 25 years) valued at over € 250m.

Table 67 – Benefits - Cardiovascular disease

	Road	DALYs per year	Present Value (€)
Change in the % of the population suffering from ischaemic heart disease that is attributable to environmental noise[91]	0.744		
Change in the number of DALYs per year resulting from ischaemic heart disease and attributable to transport noise[92]	166.972	166.972	18,531,820
Total value of avoided DALYs from a reduction in the incidence of noise-induced AMI			225,451,985

Table 68 – Benefits – Hypertension

	Road	DALYs per year	Present Value (€)
Change in the % of the population suffering from hypertensive heart disease that is attributable to environmental noise[93]	0.601	0.601	
Change in the number of DALYs per year resulting from hypertensive heart disease and attributable to transport noise[94]	24.617	24.617	2,732,197
Total value of avoided DALYs from a reduction in the incidence of noise-induced hypertensive heart disease			33,238,998

[91] The numbers in this row show the change in the proportion of cases of myocardial infarction due to noise exposure

[92] The change in DALYs is calculated as the % of all DALYs from ischaemic heart disease in the relevant Member State that can be attributed to environmental noise. The Present Value is the number of DALYs multiplied by the value of a DALY.

[93] The numbers in this row show the change in the proportion of cases of hypertensive heart disease due to noise exposure

[94] The change in DALYs is calculated as the % of all DALYs from hypertensive heart disease in the relevant Member State that can be attributed to environmental noise. The Present Value is the number of DALYs multiplied by the value of a DALY

The benefit of the END implementation for the population of Nuremberg agglomeration amounts to:

Net Present Value (€): 635,621,704.

3. Cost Benefit Analysis of Individual Measures

3.1 Employed method

Below selected generally effective measures or measure combinations are evaluated in terms of cost and effectiveness in the case study area. Both planned and implemented measures were chosen to show the cost benefit relation of individual measures.

The calculation of costs is based on published noise action plans and interviews with the competent authorities. If no specific costs are available, cost estimates in accordance with recognized procedures and methods were employed (see Annex D).

The effectiveness of the measures was determined on the basis of measures outlined in the noise action plan in conjunction with recognized procedures set out in Annex E.

Initially an assessment of the reduction of noise affected people on the basis of 5 dB level classes was carried out. This forms the basis of a monetary evaluation of the reduction of noise damage based on the method described in Chapter D.

3.2 CBA of individual measures

The following tables present the results of the CBA performed for individual measures in Nuremberg agglomeration.

Noise proof window campaign

The city-wide program is available for affected residents with noise levels of L_{den} 67 dB (A) and L_{night} 57 dB (A). With the determined amount of € 100,000 funding per year more than 400 residents/year can be equipped with noise optimized windows. The total cost for the measure aggregates to 1,000 € per resident/year which equals a total of 400,000 €/year. The program is designed for a period of 26 years, in which all remaining 10,400 eligible residents are to be equipped with new windows.

The benefits of the measure exceed the costs of the measure by a factor of 17. The noise proof window campaign of Nuremberg agglomeration therefore rates in the mid-ranges of the CB-ratios of all assessed agglomerations.

The costs and benefits shown below present value prices based on 2014.

Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
400	€0.24 million	€3.4 million	€601	€8,655	1 : 14

Rehabilitation of roads / Low noise road surfaces

The goal of this measure is to equip all areas with the highest noise levels above L_{den} 75 dB (A) with noise reducing road surfaces. The implementation focuses on eight highly affected areas (more than 50 residents over L_{den} 75 dB (A)). The implementation of this measure is planned to be completed within a period of ten years.

Due to the dense building structure in the relevant road sections, the CB-rate of the measure rates as one of the highest compared to all assessed agglomerations. The costs and benefits shown below present value prices based on 2014.

Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
20,600	6.5million	138 million	317	6,696	1:21

Speed reduction

This measure assigns a speed reduction of 20 km/h during daytime on the roads in 59 study areas. The implementation is planned to be carried out on a medium to long term basis, within 10 to 20 years. Taking into account the total length of the considered road network considered of about 91 km the estimated cost amounts to about 260,000 €/year. Assuming that the reduced speed limit is respected and adhered to by road users, an improvement in the noise level by 2.5 dB (A) can be expected.

The benefits of the measure outweigh the costs by a multiple which is reflected in the high-CB ratio. The costs and benefits shown below present value prices based on 2014.

Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
81,800	0.8 million	244 million	10	2,985	1 : 301

Embedded tracks for trams

The aim of this measure is to minimize the elastic mounting of the rail to minimize ripple formation due to wear, which is responsible for the level of noise emissions between wheel and rail. For operational reasons, exchanges of tram tracks can usually only be carried out during maintenance. Embedded tracks can reduce the noise emissions by approximately 5 dB (A). The measure is to be performed in the defined study areas with high noise levels.

Due to the excellent noise improvement potential, the substantial costs of the measure also face high benefits.

The costs and benefits shown below present value prices based on 2014.

Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
24,400	7.1 million	42.3 million	293	1,737	1:6

Acoustical grinding of tracks

The aim is to minimize ripple formation through rail grinding during regular driving of the tram and so to reduce the level of noise emissions between wheel and rail.

The measure should particularly be employed in areas with high rail noise levels, but can be expanded at relatively low cost to the entire tram network.

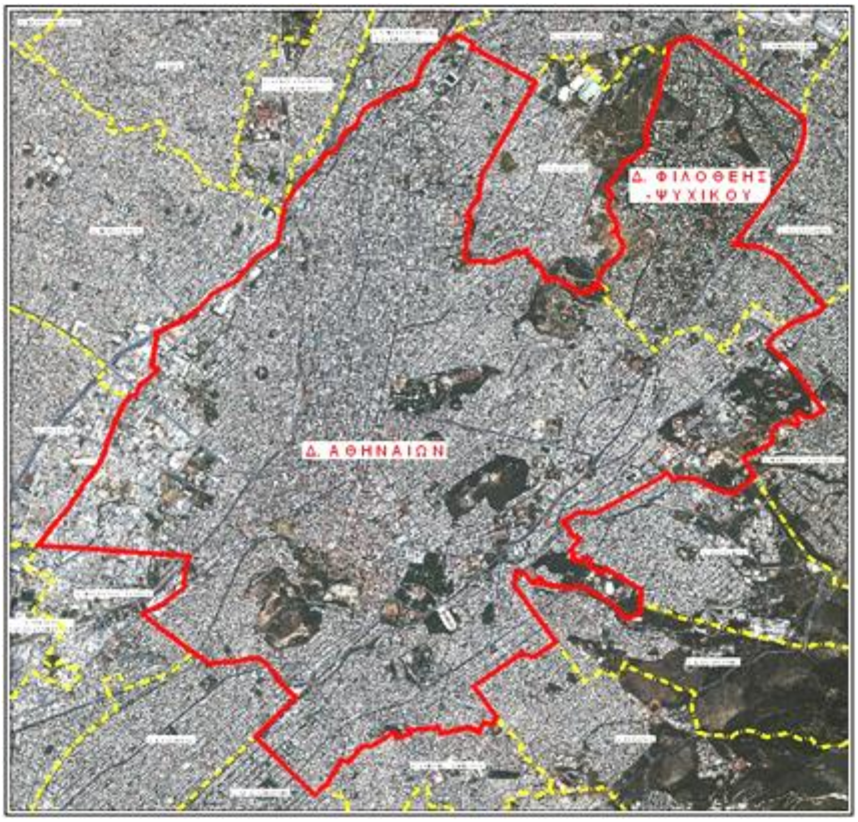
To date, the cost of such abrasive systems are not known. From the fact that these devices can be used in normal daily routine and therefore no additional cost from track closures, safeguards etc. arise, it is assumed that the measure is cost-effective. This is expressed by the high CB-ratio of the measure.

The costs and benefits shown below present value prices based on 2014.

Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
24,400	0.57 million	42.3 million	23	1,737 €	1:74

F.1.2 Case study – Athens, Greece agglomeration

The city of Athens in the capital of Greece and the largest and most populous city of the country. Covering an area of 39 km² in Athens live nearly 700,000 people. The agglomeration of Athens includes the municipalities of Athens and Filothei. Including other surrounding districts and suburbs about 3.7 million people live in the greater Athens area.



Geographical study area - Municipalities of Athens & Filothei – Psychiko

Source: Environmental Noise Assessment according to Directive 2002/49/EC, Athens Central Area, Final Report (Phase D)

Noise mapping in Athens includes the extensive road network, national railway, metro and tram lines. The city of Athens therefore presents a case study agglomeration heavily exposed to traffic noise of all types in a densely populated area.

1. Costs

It has not been possible to obtain information on costs of implementation of the END or costs of measures for Athens agglomeration. The following table presents the measures taken on the basis of the NAP for Athens. No details of the years of implementation, completion status or costs have been obtained for Athens.

Table 69 – List of measures

Name of measure
The Panepistimiou Street from Avenue Vas. Sofias to Omonia Square and Patission Street from Panepistimiou Street to Marni Str., modified on roads dedicated to pedestrian, bicycle and ground transportation (where appropriate). The movement of vehicles on Patission Rd. will be bidirectional with one lane in each direction, while on the Panepistimiou road will be unidirectional with one lane in each direction.
Aeolou Rd becomes one-way (segment from Panepistimiou Ave to Stadium Rd) towards the Stadium Rd. Permission only for public transport vehicles (PTVs), goods delivery vehicles, taxis and tourist buses.
Change traffic direction on Academias Rd (from Avenue Vas. Sofias to Canningos Rd) and Chalkokondyli street (from Canningos Rd to Marnis Rd). The movement of vehicles on the Academias Rd takes place in 3-lanes plus one bus lane between the Vas. Sofias and Homirou Rds and 2-lanes plus one bus lane between Omirou and Canningos Rds. The movement of vehicles on the Chalkokondyli street is placed in 3-lanes.
Changing the traffic direction from Marnis Rd, where the division between Tritis Septemvriou Str. is bidirectional, while the section between the streets Tritis Septemvriou Str and Nikiforou Rd is one way towards Nikiforou Rd.
The movement of vehicles on Marni Rd is performed in 2-lanes between Tritis Septemvriou and Patission Rd and 3-lane between Tritis Septemvriou and Nikiforou Rds.
One-way system is planned for Carolou Rd (from Nikiforou Rd to Platea Karaiskaki) towards the Platea Karaiskaki. The movement of vehicles on Carolou Str will take place in 3-lanes.
Extension of Omonia Square by removing the connecting portion of Panepistimiou Ave to Tritis Septemvriou Rd.
Changing the direction of Ag. Konstantinou Rd (from Platea Karaiskaki to Tritis Septemvriou). The movement of vehicles on Ag. Konstantinou Rd takes place in 2- lanes in each direction between Karaiskaki Square and Geraniou Str and 3-lane between Tritis Septemvriou and Socratous Rds.
Changing the direction of Socratous Rd (from Pireos Str to the Ag. Konstantinou Rd).
Remove the counter-flow bus lanes Avenue Vas. Amalias reduction of lanes (two lanes and one bus lane between the streets Philellinon and Othonos Str and three traffic lanes and one bus lane road between Othonos Str and Vas. Sofias Ave).
Avenue Vas. Sofias becomes one –way between Panepistimiou Rd and Academias street heading to the Academias Str and prohibition of left turn from Avenue Vas. Sofias to Academias Str. The movement of vehicles on Vas. Sofias Ave will be done in 1-lane and 2 bus lanes (one for the straight movement and one for the left movement).
Change of Benaki Rd direction (between Academias Str. and Stadiou Rd) towards the Stadium Rd.
Changing the direction of Themistocli Rd (between Academias Str and Stadiou Rd) towards Academias Str.
Omirou Street (between Academias street and Stadiou Rd) is turned to bus lane towards the Stadiou Rd, with exclusive use by PTVs, taxis, goods delivery vans and coaches.
Edward Lo Str (between Academy street and Stadiou Rd) is turned to bus lane towards Academias Street, with exclusive use by public transport vehicles, taxis, goods delivery vans and coaches.
Othonos Rd (between Filellinon Rd and Vas. Amalia Ave) is turned to bus lane towards Vas. Amalia Ave, for exclusive use of public transport vehicles, taxis, goods delivery vans and tourist

Name of measure
buses.
Repeal of the counter-flow bus lane on Pireos Str. between Aristotelous and Menandrou Rds.
The roads of : Kriezotou, Riga, Charilaou Trikoupi, Hippocratous, Gennadiou, Feidiou, Nikitara, Gamveta, Themistocleous, Veranzerou, Arsaki and Pesmatzoglou (between Stadiou Rd and Academias street), Ioulianou and Metsovou Rds (between Patision Rd and Mavromichali str) and Xenophontos Street (between the Phillellinon Rd and Vas. Amalias Ave) will be turned to calm traffic roads.
Avenue Vas. Olgas will be changed to dedicated pedestrian way and bicycle and public transport (where and when appropriate). The use of delivery goods vans, taxis and tourist buses is permitted. The vehicular traffic is bidirectional with 1- lane in each direction

2. Benefits

Using information from the National Action Plan "Final Report – Phase D" of 2014, it is possible to determine the change in the number of people exposed to noise, as presented in table 3.

Table 70 – Benefits – exposed population[95]

Change in the number of people exposed to noise at the following intervals as a result of noise reduction measures under the END:	L_{den}		
	Road	Rail	Total
45-49.9 dB(A)	90	-173	-83
50-54.9 dB(A)	-681	-237	-918
55-59.9 dB(A)	-5 804	25	-5 779
60-64.9 dB(A)	-5 213	0	-5 213
65-69.9 dB(A)	7 534	0	7 534
70-74.9 dB(A)	2 822	0	2 822
Change in the number of people exposed to noise at the following intervals as a result of noise reduction measures under the END:	L_{night}		
	Road	Rail	Total
45-49.9 dB(A)	-523	-20	-543
50-54.9 dB(A)	-3 439	20	-3 419
55-59.9 dB(A)	-2 842	0	-2 842
60-64.9 dB(A)	4 985	0	4 985
65-69.9 dB(A)	831	0	831
70-74.9 dB(A)	1 439	0	1 439

[95] Note that negative numbers indicate an increase in the size of the population exposed to noise at that interval. This is most likely to be due to a reallocation of the population exposed to noise at higher intervals

Based on this information, and using established dose-response relationships for annoyance and sleep disturbance, the changed numbers of people highly annoyed or highly sleep disturbed is estimated and valued in terms of DALYs (see tables 71 and 72).

Table 71 – Benefits – annoyance

Change in size of the annoyed population[96]	Road	Rail	Total	DALYs per year
Annoyed[97]	2,527	-21	2,506	
Highly Annoyed[98]	1,726	-5	1,721	34

As the table above illustrates, the number of people annoyed was reduced by 2,506 due to noise reduction measures, and the number of people highly annoyed was reduced by 1,721 people, resulting in a decrease in disease-adjusted life years of 34.

Table 72 – Benefits – sleep disturbance

Change in size of the sleep disturbed population	Road	Rail	Total	DALYs per year	Present Value (€)
Sleep Disturbed	998	0	999		
Highly Sleep Disturbed	619	0	620	43	42,790,767

Another benefit of the noise reduction measures in the Athens agglomeration is that the number of people whose sleep is disturbed could be reduced by 999, and the number of people whose sleep is highly disturbed could be reduced by another 620, corresponding to a decrease in disease-adjusted life years of 43 valued at € 43 M.

The following tables summarise the effects of the noise abatement measures on cardiovascular disease and hypertension. The data available shows that a reduction in road noise has resulted in a reduction of DALYs of 0.7, valued at € 772 M per year, and a total benefit of more than € 9 M. as a result of avoided DALYs.

[96] This is an estimate of the burden of disease from noise-induced annoyance. It reflects the variety of negative responses (e.g. anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation or exhaustion) that people may experience. Noise exposure and annoyance has also been shown to be associated with stress-related psychosocial symptoms such as tiredness, stomach discomfort and stress.

[97] The Present Value represents the discounted stream of annual benefits over a 25-year assessment period

[98] Data below 45dB and above 75dB (Lden) were excluded because the risk of unreliable noise data is high at very low levels, whereas the risk of selection of "survivors" is high at very high levels.

Table 73 – Benefits - Cardiovascular disease

	Road	Rail	DALYs per year	Present Value (€)
Change in the % of the population suffering from ischaemic heart disease that is attributable to environmental noise[99]	0.166	n/a		
Change in the number of DALYs per year resulting from ischaemic heart disease and attributable to transport noise[100]	0.696	n/a	0.696	772,517
Total value of avoided DALYs from a reduction in the incidence of noise-induced AMI				9,398,188

Table 74 – Benefits – Hypertension

	Road	Rail	DALYs per year	Present Value (€)
Change in the % of the population suffering from hypertensive heart disease that is attributable to environmental noise[101]	0.118	n/a	0.118	
Change in the number of DALYs per year resulting from hypertensive heart disease and attributable to transport noise[102]	0.317	n/a	0.317	35,135
Total value of avoided DALYs from a reduction in the incidence of noise-induced hypertensive heart disease				427,437

<u>Since no costs are available for the measures of the NAP the Net Present Value cannot be calculated for Athens agglomeration</u>. Instead, the total Present Value Benefit from the END implementation for the population of Athens was calculated to be:

Total Present Value Benefit (€): 86,576,856.

[99] The numbers in this row show the change in the proportion of cases of myocardial infarction due to noise exposure

[100] The change in DALYs is calculated as the % of all DALYs from ischaemic heart disease in the relevant Member State that can be attributed to environmental noise. The Present Value is the number of DALYs multiplied by the value of a DALY.

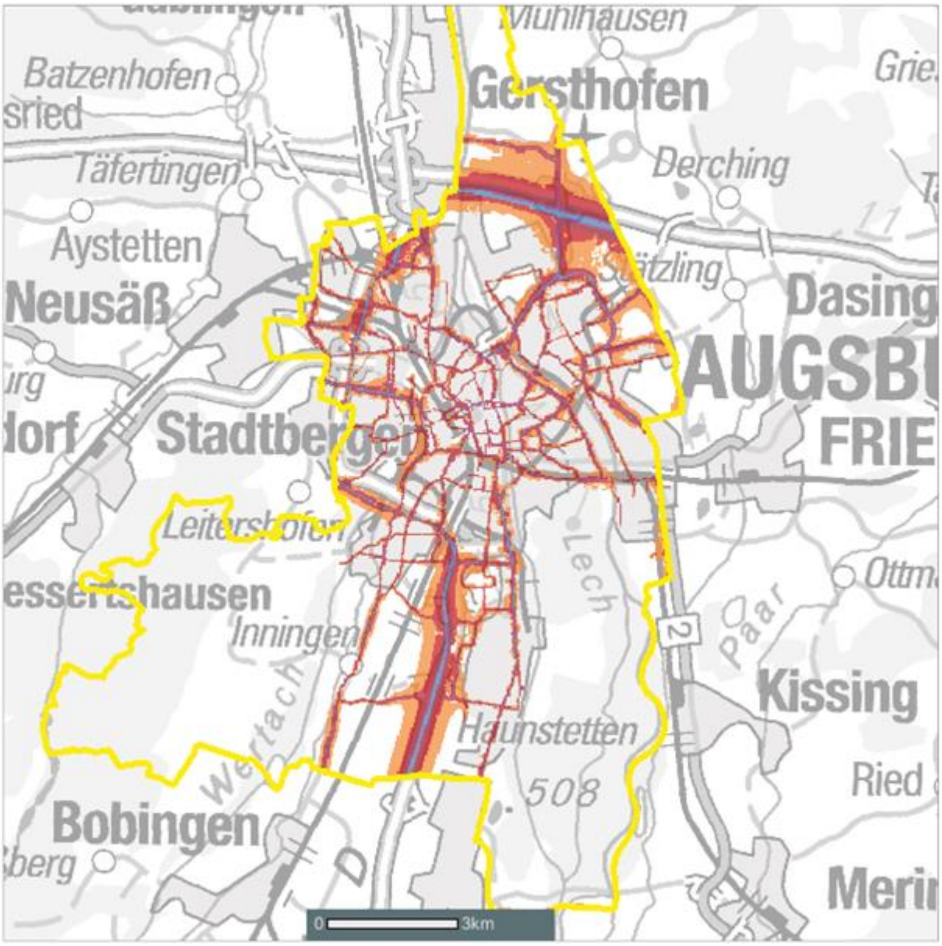
[101] The numbers in this row show the change in the proportion of cases of hypertensive heart disease due to noise exposure

[102] The change in DALYs is calculated as the % of all DALYs from hypertensive heart disease in the relevant Member State that can be attributed to environmental noise. The Present Value is the number of DALYs multiplied by the value of a DALY

F.1.3 Case study – Augsburg, Germany agglomeration

The city of Augsburg, Germany is a vibrant industrial city with about 270,000 inhabitants and an area of 150 km². Therefore it counts as a smaller agglomeration why it was chosen as a case study. Nevertheless especially inner-city noise as well as noise from two major motorways that cross the city is an issue. The mapped road network of the city has a length of about 450 km. Augsburg is connected to five train lines and has a tram network with a length of about 76 km. Due to the very low utilization of Augsburg airport, noise from aviation is not relevant to the city.

Responsible for the preparation of the NAP is the city Augsburg in consultation with the local county government. The 2008 NAP is in an ongoing implementation phase where the Round 2 NAP is currently under review and will be updated and approved on the basis of the Round 2 noise maps.



L_{den} for roads in Augsburg agglomeration

1. Costs

The total cost of END implementation incurred from 2008 onwards is presented in the table below. The total costs over a 25-year-assessment period are expected to amount to just over € 5.3 M.

Table 75 – Costs

Total costs of END Implementation (€, discounted)[103]	
Additional staff time	15,867
Consultants	1,824
(Mapping) software - noise calculation	2,128
Reporting	-
Costs of measures (€, discounted)[104] ***over 25 years***	
Total discounted capital costs of measures[105]	4,710,245
Total discounted maintenance costs of measures[106]	**-**
GRAND TOTAL COSTS (€, discounted)	**5,361,362**

The following table presents the measures taken on the basis of the NAP. In addition to the general development of the transport system, in particular short term measures such as speed limits and speed enforcement as well as long term measures such as noise optimized asphalt were planned. In addition to the measures for road transport, especially rail noise abatement was of importance to the city of Augsburg.

Table 76 – List of measures

Name of measure	Year of implementation	Status	Present value (€, 2014 prices)
Noise optimised asphalt	since 2008	Complete	2,913,871
Speed limits (roads)	since 2008	Complete	-
Speed enforcement with speed control (roads)	since 2008	Ongoing	-
Window sound insulation programme	2009 - 2010	Complete	1,796,374
Installation of rubber mats in the substructure (rail)	since 2008	Underway	-
Wheel-rail maintenance programme, elimination of irregularities	n.s.	-	-
On-board measures such as fitting of sound absorbers (rail)	n.s.	-	-
Lubrication systems for curves (rail)	2008	Complete	-

[103] These are the total discounted costs incurred by the relevant implementing authorities in implementing the requirements of the END
[104] These are the total costs of measures to reduce or minimise noise levels
[105] Note that these are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)
[106] These are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

For speed limit reduction measures and speed enforcement the costs are rather low and not quantifiable. Likewise, the costs of the measures on the tram line are not known.

Most of the measures listed above have been completed or are underway. Some measures are not yet finalised which means that the impact of some measures will only materialise in the future. The benefits presented further below need to be interpreted in that context.

2. Benefits

Using information from the Noise Action Plan 2008, it is possible to determine the change in the number of people exposed to noise levels above 55 dB L_{den} and 50 dB L_{night}, as presented in table 3.

Table 77 – Benefits – exposed population[107]

Change in the number of people exposed to noise at the following intervals as a result of noise reduction measures under the END:	L_{den}		
	Road	Rail	Total
45-49.9 dB(A)	0	0	0
50-54.9 dB(A)	0	0	0
55-59.9 dB(A)	2,600	7,830	10,430
60-64.9 dB(A)	800	1,820	2,620
65-69.9 dB(A)	700	40	740
70-74.9 dB(A)	-400	530	130
Change in the number of people exposed to noise at the following intervals as a result of noise reduction measures under the END:	**L_{night}**		
	Road	**Rail**	**Total**
45-49.9 dB(A)	0	0	0
50-54.9 dB(A)	1,700	6,270	7,970
55-59.9 dB(A)	800	450	1,250
60-64.9 dB(A)	-300	550	250
65-69.9 dB(A)	0	120	120
70-74.9 dB(A)	0	130	130

As the table above shows, the impact of noise reduction measures did reduce the number of people exposed above 55 dB (L_{den}) by more than 14,000 overall against a total population of about 280,000 in the agglomeration.

The main benefits were incurred due to noise reduction measures focussing on roads and railways, although road measures also increased the number of people exposed to certain noise levels, probably due to a reallocation of residents exposed to noise at higher intervals.

[107] Note that negative numbers indicate an increase in the size of the population exposed to noise at that interval. This is most likely to be due to a reallocation of the population exposed to noise at higher intervals

Based on this information, and using established dose-response relationships for annoyance and sleep disturbance, the changed numbers of people highly annoyed or highly sleep disturbed is estimated and valued in terms of DALYs (see tables 4 and 5).

Table 78 – Benefits – annoyance

Change in size of the annoyed population[108]	Road	Rail	Total	DALYs per year
Annoyed[109]	872	1,606	2,478	
Highly Annoyed[110]	335	528	863	17

As the table above illustrates, the number of people annoyed was reduced by about 2,500 due to noise reduction measures, and the number of people highly annoyed was reduced by nearly 900 people, resulting in a decrease in disease-adjusted life years of 17.

Table 79 – Benefits – sleep disturbance

Change in size of the sleep disturbed population	Road	Rail	Total	DALYs per year	Present Value (€)
Sleep Disturbed	342	737	1,079		
Highly Sleep Disturbed	150	293	442	31	30,533,023

Another benefit of the noise reduction measures in the Augsburg agglomeration is that the number of people whose sleep is disturbed could be reduced by more than 1,000, and the number of people whose sleep is highly disturbed could be reduced by another 442. This corresponds to a decrease in disease-adjusted life years of 31 and is valued at € 30.5 M.

The following tables 6 and 7 summarize the effects of the noise abatement measures on cardiovascular disease and hypertension. The data available shows that a reduction in road noise has resulted in a reduction of DALYs of about 4, valued at just under € 0.5 M., and a total benefit of more than € 54 M. as a result of avoided DALYs.

[108] This is an estimate of the burden of disease from noise-induced annoyance. It reflects the variety of negative responses (e.g. anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation or exhaustion) that people may experience. Noise exposure and annoyance has also been shown to be associated with stress-related psychosocial symptoms such as tiredness, stomach discomfort and stress.

[109] The Present Value represents the discounted stream of annual benefits over a 25-year assessment period

[110] Data below 45dB and above 75dB (Lden) were excluded because the risk of unreliable noise data is high at very low levels, whereas the risk of selection of "survivors" is high at very high levels.

Table 80 – Benefits - Cardiovascular disease

	Road	Rail	DALYs per year	Present Value (€)
Change in the % of the population suffering from ischaemic heart disease that is attributable to environmental noise[111]	0.006	n/a		
Change in the number of DALYs per year resulting from ischaemic heart disease and attributable to transport noise[112]	0.139	n/a	0.139	153,731
Total value of avoided DALYs from a reduction in the incidence of noise-induced AMI				1,870,240

Table 81 – Benefits – Hypertension

	Road	Rail	DALYs per year	Present Value (€)
Change in the % of the population suffering from hypertensive heart disease that is attributable to environmental noise[113]	0.946	n/a	1	
Change in the number of DALYs per year resulting from hypertensive heart disease and attributable to transport noise[114]	38.77	n/a	4	4,302,715
Total value of avoided DALYs from a reduction in the incidence of noise-induced hypertensive heart disease				52,345,409

The benefit of the END implementation for the population of Augsburg agglomeration amounts to:

Net Present Value (€): 97,048,234.

[111] The numbers in this row show the change in the proportion of cases of myocardial infarction due to noise exposure

[112] The change in DALYs is calculated as the % of all DALYs from ischaemic heart disease in the relevant Member State that can be attributed to environmental noise. The Present Value is the number of DALYs multiplied by the value of a DALY.

[113] The numbers in this row show the change in the proportion of cases of hypertensive heart disease due to noise exposure

[114] The change in DALYs is calculated as the % of all DALYs from hypertensive heart disease in the relevant Member State that can be attributed to environmental noise. The Present Value is the number of DALYs multiplied by the value of a DALY

3. Cost Benefit Analysis of Individual Measures

3.1 Employed method

Below selected generally effective measures or measure combinations are evaluated in terms of cost and effectiveness in the case study area. Both planned and implemented measures were chosen to show the cost benefit relation of individual measures.

The calculation of costs is based on published noise action plans and interviews with the competent authorities. If no specific costs are available, cost estimates in accordance with recognized procedures and methods were employed (see Appendix D)

The effectiveness of the measures was determined on the basis of measures outlined in the noise action plan in conjunction with recognized procedures set out in Appendix D.

Initially an assessment of the reduction of noise affected people on the basis of 5 dB level classes was carried out. This forms the basis of a monetary evaluation of the reduction of noise damage based on the method described in Appendix E.

3.2 CBA of individual measures

The following tables present the results of the CBA performed for individual measures in Augsburg agglomeration.

Noise proof window campaign

Eligibility for the campaign was derived from a priority rating based on the noise level. A total of 300 applications for funding were received and approximately 1,200 windows were covered by the campaign. In a rough approach that each window protects one inhabitant, approximately 1,200 inhabitants profited from an improved noise level.

The benefits of measure exceed the costs many times over. The noise proof window campaign of Augsburg agglomeration shows one of the best CB-Ratio of all assessed agglomerations.

The costs and benefits shown below present value prices based on 2014.

Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
1,200	0.85 million	9.4 million	712	7,865	1:11

Rehabilitation of roads/ Low noise road surfaces

Residents along five road sections in Augsburg profited from a noise optimized surface. A total of approximately 1,150 residents benefited from the measure which is assumed to lower the noise level by 4 dB(A).

The benefits of measure are smaller than for other measures but with a CB-ratio of 1:3 clearly positive. The use of noise-optimized asphalt in the Augsburg agglomeration shows one of the best CB-Ratio of all assessed agglomerations.

The costs and benefits shown below present value prices based on 2014.

Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
1,150	2.12 million	8.4 million	1,850	7,310	1:4

Speed reduction (in selected road sections)

Since 2008 residents along ten road sections in Augsburg profited from a speed limit reduction by 20 km/h (e.g. 50/30 or 70/50). A total of approximately 780 residents benefited from the measure which is assumed to lower the noise level by 3 dB(A).

Due to the low costs associated with the measure, the benefits exceed the costs many times over. Speed reduction therefore presents one of the most effective measure available in noise action planning.

The costs and benefits shown below present value prices based on 2014.

Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
780	0.33 million	4 million	43	5,107	1:119

Speed control

In areas of high noise exposure, the frequency of traffic surveillance was increased. The city of Augsburg mainly monitored street sections with a speed limit of 30 km/h near schools and kindergardens as well as accident black spots.

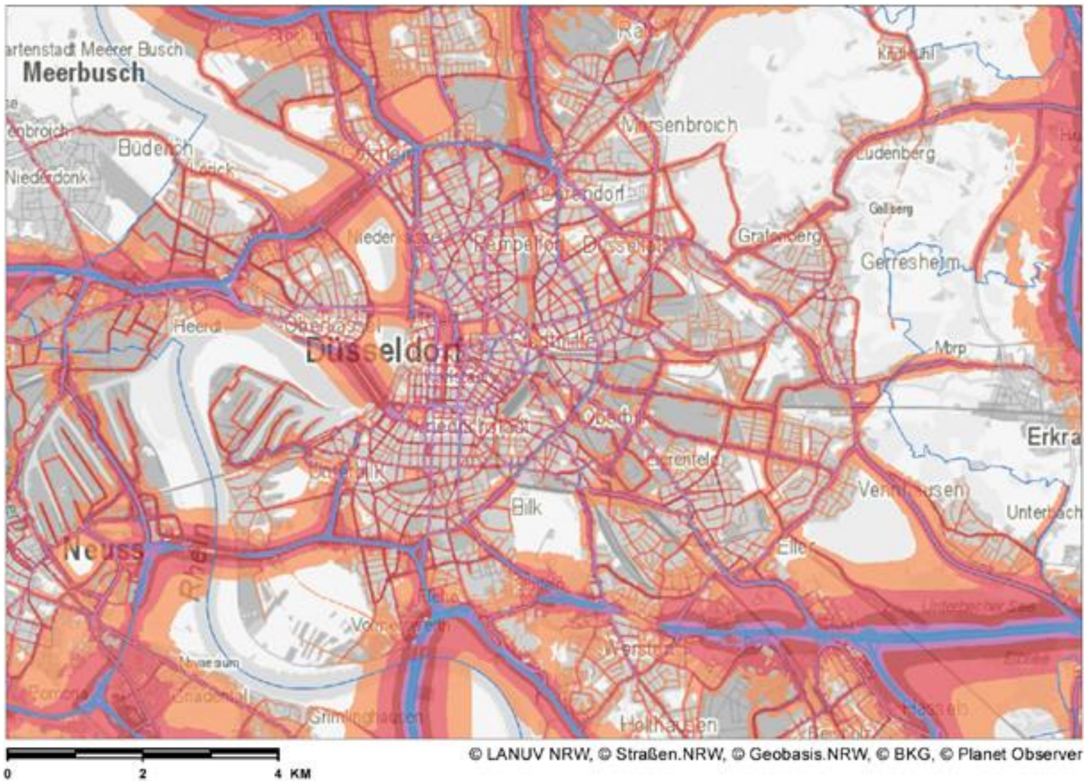
Since speed control is already performed in the city of Augsburg noise relevant road sections can be monitored as a priority. Therefore no measurable costs in addition to the proportion of costs for END implementation were incurred. This leads to a high CB-ratio that is not stated below, since the comparison with other cases is not practical.

The costs and benefits shown below present value prices based on 2014.

Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
370	34	0.4 million	0.1	1,300	-

F.1.4 Case Study – Duesseldorf, Germany Agglomeration

The city of Düsseldorf, Germany is the center of the Rhine-Ruhr metropolitan area and counts among the 10 largest cities in Germany. It covers an area of 217 km² with a population of about 600,000. The city is an economic hub with nearly as many workplaces as residents. Düsseldorf was chosen as a case study due to its dense traffic flow and extensive road network. The concentration of living and work space in the city leads to extensive noise conflicts at over 350 road sections. Düsseldorf has a well-established public transport system including busses, tramways and railways. Due to the vicinity to the Düsseldorf airport the population is also affected by air traffic noise. The city of Düsseldorf therefore presents a case study agglomeration heavily exposed to traffic noise of all types in a densely populated area.



L_{den} for noise from roads in Düsseldorf agglomeration and major roads

1. Costs

The total cost of END implementation incurred from 2008 onwards is presented in the table below. It has not been possible to obtain information on costs of implementation of the END in the city of Düsseldorf. Not included are noise abatement measures implemented by Düsseldorf Airport as well as the national railway authority that accounts for high expenditures and significant effects. However, those measures were partly realized outside the scope of the noise reduction plan.

Table 82 – Costs

Total costs of END Implementation (€, discounted)[115]	
Additional staff time	n.s.
Consultants	n.s.
(Mapping) software - noise calculation	n.s.
Reporting	n.s.
Total discounted capital costs of measures[116]	13,125,969
Total discounted maintenance costs of measures[117]	n.s.
GRAND TOTAL COSTS (€, discounted)	**13,125,969**

Over the past several years the city of Düsseldorf has conducted noise abatement programs and measures to reduce noise at the most affected streets in the city, including:

- Noise protection in urban and transport planning,
- Master plan to reduce road traffic noise,
- Soundproof windows program Düsseldorf,
- Built-in noise-reducing road surfaces.

Most of the individual measures are part of the Master plan "Reduction of road traffic noise in Düsseldorf". The following table presents those measures as well as the measures the federal railway authority, federal government (state roads) and the competent authority (airport) are responsible for. Costs are only available for measures that are in the responsibility of the city of Düsseldorf and the federal government (state roads).

[115] These are the total discounted costs incurred by the relevant implementing authorities in implementing the requirements of the END

[116] Note that these are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

[117] These are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

Table 83 – List of measures

Name of measure	Year of implementation	Status	Present value (€, 2014 prices)
Master plan to reduce road traffic noise on city roads including: • Noise optimized window programme • Noise optimized surfaces • vegetated tram tracks • barriers/walls • improvement of tram tracks	Since 2006	underway	9,844,476
Master plan to reduce road traffic noise on federal roads including: • Speed reduction • Speed control • Noise optimized surfaces • barriers/walls	since 2006	underway	3,281,492
Federal Railway noise remediation program (length of 15 km in Duesseldorf): • rail dampers • gabion noise barrier • padded sleepers • composite brake blocks in freight car (whispering)	-	n.s.	n.s.
Proposed reduction measures for air traffic noise by the city of Dusseldorf to the competent airport licensing authority: • soundproofed aerators for bedrooms • structural noise abatement measures for living rooms • financial compensation of 2% of the market value for real estate • optimizing departure routes	-	n.s.	n.s.

2. Benefits

Using information from the Strategic Noise Maps, it is possible to determine the change in the number of people exposed to noise levels above 50 dB, as presented in table 3.

Since air traffic related noise abatement is the responsibility of DüsseldorfAirport and railway noise from the federal railway network is covered by the Federal Railway Authority, those noise types are not included in the table. Data on the number of people profiting from tram track improvements are not specified.

Table 84 – Benefits – exposed population[118]

Noise interval	Change in the number of people exposed to noise at the following intervals as a result of noise reduction measures[119]	
	L_{den}	L_{night}
45-49.9 dB(A)	0	0
50-54.9 dB(A)	-49,413	-49,413
55-59.9 dB(A)	15,261	15,261
60-64.9 dB(A)	-1,095	-1,095
65-69.9 dB(A)	25,899	25,899
70-74.9 dB(A)	21,472	21,472

As the table above shows, noise reduction measures did reduce the number of people exposed above 49.9 dB by about 12,000 overall against a total population of about 600,000 in the agglomeration. The benefits were achieved due to noise reduction measures for roads, although the measures also increased the number of people exposed to certain noise levels, probably due to a reallocation of the population exposed to noise at higher intervals.

Based on this information, and using established dose-response relationships for annoyance and sleep disturbance, the changed numbers of people highly annoyed or highly sleep disturbed is estimated and valued in terms of DALYs (see tables 4 and 5).

Table 85 – Benefits – annoyance

Change in size of the annoyed population[120]	Road	DALYs per year
Annoyed[121]	18,739	
Highly Annoyed[122]	10,747	215

[118] Note that negative numbers indicate an increase in the size of the population exposed to noise at that interval. This is most likely to be due to a reallocation of the population exposed to noise at higher intervals

[119] Note that these include noise reductions that may have been achieved independently of the END. It is not possible to distinguish between noise reductions that may be attributed to END versus noise reductions that may be attributed to other measures.

[120] This is an estimate of the burden of disease from noise-induced annoyance. It reflects the variety of negative responses (e.g. anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation or exhaustion) that people may experience. Noise exposure and annoyance has also been shown to be associated with stress-related psychosocial symptoms such as tiredness, stomach discomfort and stress.

[121] The Present Value represents the discounted stream of annual benefits over a 25-year assessment period

[122] Data below 45dB and above 75dB (Lden) were excluded because the risk of unreliable noise data is high at very low levels, whereas the risk of selection of "survivors" is high at very high levels.

As the table above illustrates, the number of people annoyed was reduced by nearly 19,000 due to noise reduction measures, and the number of people highly annoyed was reduced by nearly 11,000 people, resulting in a decrease in disease-adjusted life years per year of 215.

Table 86 – Benefits – sleep disturbance

Change in size of the sleep disturbed population	Road	DALYs per year	Present Value (€)
Sleep Disturbed	2,756		
Highly Sleep Disturbed	1,340	94	85,233,960

Another benefit of the noise reduction measures in the Dusseldorf agglomeration is that the number of people whose sleep is disturbed could be reduced by 2,756, and the number of people whose sleep is highly disturbed has been reduced by another 1,340 This corresponds to a decrease in disease-adjusted life years of 94 per year and is valued at just over € 85 M over the 25-year assessment period.

The following tables 6 and 7 summarize the effects of the noise abatement measures on cardiovascular disease and hypertension. The data available shows that a reduction in road noise has resulted in a reduction of DALYs of about 452 per year, valued at just over € 50 M per year and a total benefit of more than € 584 M. as a result of avoided DALYs.

Table 87 – Benefits - Cardiovascular disease

	Road	DALYs per year	Present Value (€)
Change in the % of the population suffering from ischaemic heart disease that is attributable to environmental noise[123]	1.028		
Change in the number of DALYs per year resulting from ischaemic heart disease and attributable to transport noise[124]	230.780	23.078	25,613,633
Total value of avoided DALYs from a reduction in the incidence of noise-induced AMI			298,457,627

[123] The numbers in this row show the change in the proportion of cases of myocardial infarction due to noise exposure

[124] The change in DALYs is calculated as the % of all DALYs from ischaemic heart disease in the relevant Member State that can be attributed to environmental noise. The Present Value is the number of DALYs multiplied by the value of a DALY.

Table 88 – Benefits – Hypertension

	Road	DALYs per year	Present Value (€)
Change in the % of the population suffering from hypertensive heart disease that is attributable to environmental noise[125]	5.408	5.408	
Change in the number of DALYs per year resulting from hypertensive heart disease and attributable to transport noise[126]	221.519	22.152	24,585,763
Total value of avoided DALYs from a reduction in the incidence of noise-induced hypertensive heart disease			286,480,576

The benefit of the END implementation for the population of Düsseldorfagglomeration amounts to:

Net Present Value (€): 852,354,778.

[125] The numbers in this row show the change in the proportion of cases of hypertensive heart disease due to noise exposure

[126] The change in DALYs is calculated as the % of all DALYs from hypertensive heart disease in the relevant Member State that can be attributed to environmental noise. The Present Value is the number of DALYs multiplied by the value of a DALY

3. Cost Benefit Analysis of Individual Measures

3.1 Employed method

Below selected generally effective measures or measure combinations are evaluated in terms of cost and effectiveness in the case study area. Both planned and implemented measures were chosen to show the cost benefit relation of individual measures.

The calculation of costs is based on published noise action plans and interviews with the competent authorities. If no specific costs are available, cost estimates in accordance with recognized procedures and methods were employed (see Appendix D).

The effectiveness of the measures was determined on the basis of measures outlined in the noise action plan in conjunction with recognized procedures set out in Appendix D.

Initially an assessment of the reduction of noise affected people on the basis of 5 dB level classes was carried out. This forms the basis of a monetary evaluation of the reduction of noise damage based on the method described in Appendix E.

3.2 CBA of individual measures

The following tables present the results of the CBA performed for individual measures in Düsseldorf agglomeration.

Noise proof window campaign

The program for soundproof windows Dusseldorf was launched in 2004 and extends to residential buildings at selected road sections with a noise level of L_{den} > 70 dB (A) and L_{night} > 60 dB (A). After installation an inside daytime level of 40 dB (A) and 30 dB (A) at night can be achieved.

The program is particularly employed where active noise protection measures are not feasible or appropriate. Until April 2010, subsidies for soundproof windows with a total volume of 2 million € was paid for 270 households. The overall positive response from the affected households has led to an increase in the funding allocated.

The benefits of the measure exceed the costs by a factor of 21. The noise proof window campaign of Düsseldorf agglomeration therefore rates as one of the best CB-ratios of all assessed agglomerations.

The costs and benefits shown below present value prices based on 2014.

Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
1,900	1 million	20 million	578	10,479	1:18

Rehabilitation of roads / Low noise road surfaces

The aim of the measure is the continuous exchange of conventional standard road surface by new noise-reducing asphalt in the context of necessary road renewals.

On basis of investigations of the city Düsseldorfthe effectiveness of low-noise road surfaces was verified for two road sections. Due to the promising results with a noticeable reduction in noise emission in car tires by 4 dB and in truck tires by 1 to 2 dB, it is planned to extend the measure on other sections.

However the CB-ratio rates lower than in other agglomerations, possibly due to less dense building structures along the relevant road sections.

Rehabilitation of roads / Low noise road surfaces

The costs and benefits shown below present value prices based on 2014.

Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
4,350	2.7 million	22 million	628	5,073	1:8

Barriers / Walls

Noise protection using barriers and walls was defined in the Master Plan "Reduction of road traffic noise in Dusseldorf". It includes 9 road sections with a total length of 4 km set to be protected by the measure. The majority of these projects have already been implemented.

The CB-ratio of Barriers/Walls is not as good as for other measures but the benefit still outweighs the cost.

The costs and benefits shown below present value prices based on 2014.

Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
3,900	2.8 million	15.4 million	741	3,965	1:5

Embedded tracks for trams

The city of Dusseldorf has conducted over the past years in particular, a noise abatement program for rail sections of the tram lines. Embedded tracks for trams are currently in a trial phase. The trial is performed to determine the vibration behaviour and assessing the installation and maintenance properties as well as wheel and rail wear, so that in the long term the regular tracks can be exchanged.

Therefore the CB-Analysis was carried out for an exemplary track section of 450 m length.

The CB-ratio for this measure lies within the range of other agglomerations. In comparison other measures have a much higher CB-ration, however the benefit still outweighs the cost four times.

The costs and benefits shown below present value prices based on 2014.

Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
400	0.16 million	0.57 million	412	1,434	1:3

Vegetated tram tracks

Lawn tracks are unsealed tram routes sown with grass in the streets that do not act simultaneously as a road for vehicle traffic. A reduction in the noise level of at least 2 dB is assumed. So far 12 km tram tracks have already been fitted with lawn. In this context it should be noted that by far the largest share of the city tram tracks is shared with motor vehicle traffic and is therefore unavailable for this measure. As also shown in other case studies, the measure is cost neutral with a balanced CB-ratio.

The costs and benefits shown below present value prices based on 2014.

Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
6,350	8.2 million	7 million	1,297	1,107	1:1

F.1.5 Case Study – Helsinki, Finland Agglomeration

The city of Helsinki consists of a densely populated downtown area near the former port and surrounding suburbs that extend along the main roads and railway lines of the city. Large green spaces are located in between the suburbs.

The city covers an area of approximately 214 km² with an increasing population of about 560,000 in 2011. The average population density is slightly less than 2,800 inhabitants per square kilometer.

The city is affected by most of the typical noise types found in agglomerations such as road traffic, railway and tram lines as well as a metro system. **The** main land use changes were the relocation of the commercial port in 2008 and the redevelopment of the old harbor areas for residential purposes. This resulted in less rail and heavy road traffic in the inner city reducing traffic induced noise in densely build areas.

The current objectives of land-use planning - making community structures denser, preserving recreational areas and planning residential areas within the reach of good public transportation connections - are challenging from the perspective of noise prevention. The main objectives of the 2013 revision of the noise abatement action plan for improving the noise situation in Helsinki are as follows:

Noise will be considered in procurements and planning:

- The city will lead by example by, for instance, considering noise in the procurement criteria of new vehicles.
- Noise will be considered in land-use and traffic system planning.
- Noise effects will be assessed in traffic planning.
- The attractiveness of public transportation will be increased.
- Walking and cycling will be promoted.

Noise emissions and exposure will be reduced:

- Low noise pavement will be implemented within the target network.
- Noise barriers will be built on roads and near sensitive sites.
- Traffic speed control will be heightened.
- The use of hybrid and electric buses will be promoted.
- Technical conditions of rail traffic will be improved.

Property-specific noise reduction possibilities will be communicated to the public:

- More information will be provided on how to improve the sound insulation of the windows.
- More information will be provided on property barriers that residents can build to protect their lots from noise.

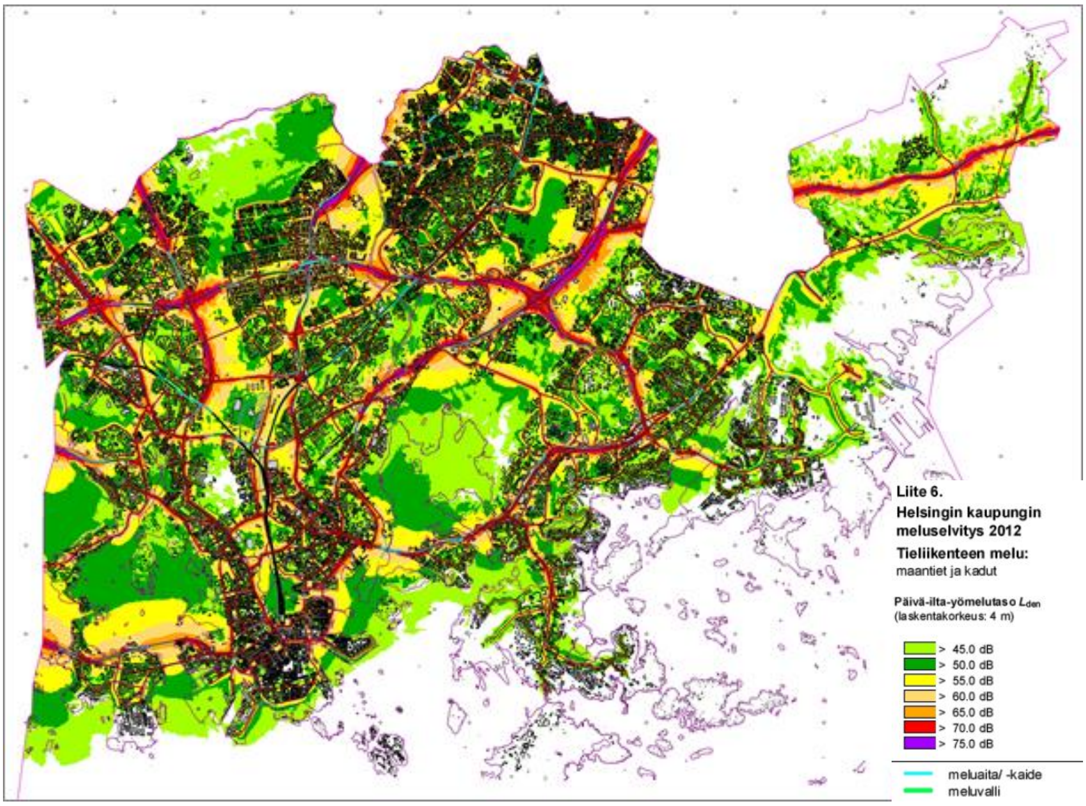
Quiet areas will be preserved and developed:

- The possibility of taking quiet areas into consideration in the new master plan will be studied.
- New, so called urban quiet areas will be developed.

People will be trained in quieter driving e.g. by offering training in eco-driving that reduces both noise and traffic emissions.

The effects of noise will be researched e.g. the annoyance of noise will be studied.

The action plan includes a total of 23 measures, with a responsible party defined for each. Most of the measures are continuous. The Regional Government authority, Centre for Economic Development, Transport and the Environment, is in charge of the noise control measures on the highways. Cities are in charge of the noise control measures on the roads and streets.



Helsinki Noise Level Map – Day – Road Traffic Noise, dB(A)

1. Costs

The costs of END implementation incurred from 2008 onwards are presented in the table below. Since costs can only be specified for certain measures a selection of the noise control measures is listed. These mainly relate to measures like noise barriers and noise optimized surfaces.

Furthermore, the Helsinki agglomeration implemented noise reduction projects to procure more silent public transport vehicles but costs for this measure are difficult to determine. The action program of the current NAP includes 23 actions, and these are expected to be continued in R2.

Table 89 - Costs (round 1 and 2)

Total costs of END Implementation (€, discounted)[127]	
Staff costs (City of Helsinki office work)	79,815
Consultation and (mapping) software - noise calculation	106,005
Consultation - noise action plan	70,906
Creation and print of info-brochures	3,094
Costs of measures (€, discounted)[128] over 25 years	
Total discounted capital costs of measures[129]	6,508,854
Total discounted maintenance costs of measures[130]	n.s.
GRAND TOTAL COSTS (€, discounted) [131]	6,768,674

Table 90 – List of measures supported in R1 NAP, Helsinki

Name of measure	Year of implementation	Status Complete/Underway/ Planned	Present value (€, 2014 prices)
Silent road surfaces (4 different destinations)	2009	Complete	210,600
A noise barrier in a new residential area	2009	Complete	853,851
Two noise barriers in collaboration with Regional Government authority* in existing residential areas	2009	Complete	1,753,656 (share of City of Helsinki: 600,000)
Silent road surfaces (4 different destinations)	2010	Complete	223,000
A noise barrier in a new residential area	2008-2010	Complete	156,677

[127] These are the total discounted costs incurred by the relevant implementing authorities in implementing the requirements of the END

[128] These are the total costs of measures to reduce or minimise noise levels

[129] Note that these are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

[130] These are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

[131] Included are quantifiable costs only.

Name of measure	Year of implementation	Status Complete/Underway/ Planned	Present value (€, 2014 prices)
A noise barrier in collaboration with the Regional Government authority in existing residential area	2009-2010	Complete	1,684,100 (share of City of Helsinki : 600,000)
Electronic speed signs to monitor drivers (in 20 different destinations)	2010	Complete	14,052
Quiet areas (analysing the material of quiet areas questionnaire for residents and producing mapping and descriptions of quiet areas)	2010	Complete	7,433 (+ office work)
Silent road surfaces (5 different destinations)	2014	Complete	177,272
A noise barrier in collaboration with the Regional Government authority in existing residential area (Secondary non-polluted soil placed to the noise embankment).	2012-2014	Complete	562,426
A noise barrier in a new residential area	2014-2015	Underway	796,361
A guide how to improve noise protection on real estates (Brochure made in collaboration with 3 other cities)	2015	Complete	n.s.

The NAP also proposes that the sites defined in the low noise pavement target network be paved with low noise pavement when the condition of the current pavement deteriorates to the point that repaving becomes necessary. As a result, 2–3 road sections are paved with noise optimized asphalt each year. The additional cost of repaving with low noise asphalt amounts to 100,000 € annually.

2. Benefits

Since the number of residents benefiting from the implementation of the measures outlined above is not calculated in the NAP the total benefit achieved cannot be calculated.

In Helsinki in particular noise barriers and noise optimized asphalt was implemented as a measure within the scope of END. Due to the construction of noise barriers from 2008 till 2012 the number of residents that fell below 55 dB(A) amounted to 7,200 people. In between 2013 and 2017 this number is calculated to be 2,000 people. This measure is analysed in the section below.

3. COST BENEFIT ANALYSIS OF INDIVIDUAL MEASURES

3.1 Employed method

Below selected generally effective measures or measure combinations are evaluated in terms of cost and effectiveness in the case study area. Both planned and implemented measures were chosen to show the cost benefit relation of individual measures.

The calculation of costs is based on published noise action plans and interviews with the competent authorities. If no specific costs are available, cost estimates in accordance with recognized procedures and methods were employed (see Appendix D).

The effectiveness of the measures was determined on the basis of measures outlined in the noise action plan in conjunction with recognized procedures set out in Appendix D.

Initially an assessment of the reduction of noise affected people on the basis of 5 dB level classes was carried out. This forms the basis of a monetary evaluation of the reduction of noise damage based on the method described in Appendix E.

3.2 CBA of individual measures

The following tables present the results of the CBA performed for individual measures in Helsinki agglomeration.

Box 4 Barriers / walls – measure description

Barriers / Walls

Noise barriers have already been implemented during 2008 and 2012 at several road sections in Helsinki. For the actual planning period 2013 to 2017 this measure is planned for 11 new areas throughout the city. Due to the measure 2,000 residents fall below the threshold value of L_{den} 55 db (A). Based on this figure it can be assumed that the total number of residents profiting from the measure sums up to about 8,300 people. The measure achieves a noise level reduction of 3 dB (A).

Due to the relatively low number of people profiting from the measure in comparison to the high expense, the CB-ratio for this measure only has a slightly positive effect.

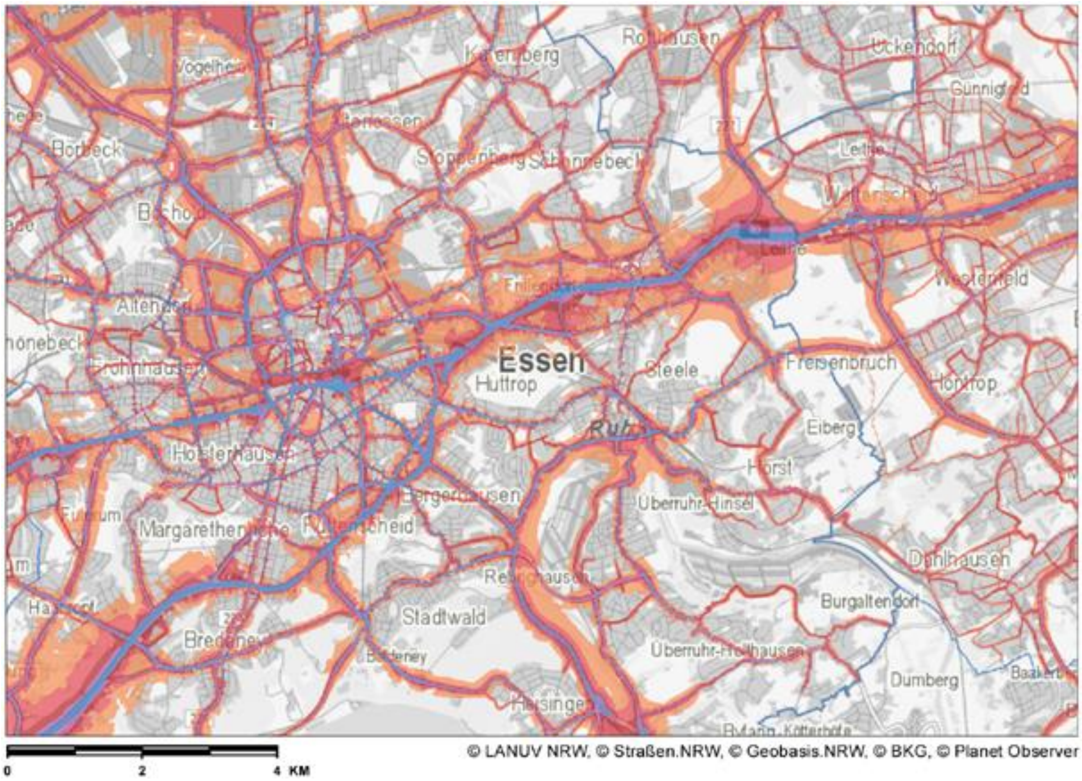
The costs and benefits shown below present value prices based on 2014.

Affected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
8,300	13.7 million	16.6 million	1,646	1,994	1:1.2

F.1.6 Case Study – Essen, Germany Agglomeration

The city of Essen, Germany is part of the Rhine-Ruhr metropolitan area and counts among the 10 largest cities in Germany. It covers an area of 210 km² extending 20 km from north to south und 17 km from east to west. Essen was chosen as a case study due to its dense road network of roughly 1,600 km and the highly congested Ruhr expressway cutting across the city. Another two motorways touch the city in the north and south. Essen has a well-established public transport system including busses, tramways and railways. Due to the vicinity to the airport Essen/Mülheim the population is also affected by air traffic noise. The city of Essen therefore presents a case study agglomeration heavily exposed to traffic noise of all types in a densely populated area.

Figure 10 - L_{den} for noise from roads in Essen agglomeration and major roads



1. Costs

The total cost of END implementation incurred from 2008 onwards is presented in the table below. The bulk of expenditure in the Essen agglomeration relates to human resources, although consultation and noise mapping also created considerable costs. The total costs over a 25-year-assessment period are expected to amount to over € 10 M.

Not included are noise abatement measures implemented by the federal roads authority as well as the national railway authority that account for high expenditures and significant effects. However, those measures were partly realized outside the scope of the noise reduction plan.

Table 91 – Costs

Total costs of END Implementation (€, discounted)[132]	
Staff costs (2 full time jobs)	463,457.89
Workplace costs and staff training	20,428.81
Consultation and (mapping) software - noise calculation	162,490.70
Consultation - noise action plan	70,208.69
Online consultation	69,880.67
Creation and print of info-brochures	3,694.37
Costs of measures (€, discounted)[133] over 25 years	
Total discounted capital costs of measures[134]	9,127,535.35
Total discounted maintenance costs of measures[135]	144,228.57
GRAND TOTAL COSTS (€, discounted)	10,061,925.04

The following table presents the measures taken or planned on the basis of the noise reduction plan.

[132] These are the total discounted costs incurred by the relevant implementing authorities in implementing the requirements of the END

[133] These are the total costs of measures to reduce or minimise noise levels

[134] Note that these are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

[135] These are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

Table 92 – List of measures

Name of measure	Year of implementation	Status	Present value (€, 2014 prices)
Noise optimised asphalt LOA 5 D	2007	Complete	2,312,220
Noise optimised asphalt LOA 5 D	2012	Complete	2,229,811
Speed limit on urban roads at night	2010	Underway	-
Noise monitoring / surveillance	2010	Planned	-
Speed display	2010	Planned	-
Passive noise protection (noise protective windows programme)	2009	Underway	215,726
Noise optimised asphalt LOA 5 D	2007	Underway	-
Further noise limits on urban roads at night	-	Planned	-
Continued passive noise protection programme	2012	Planned	-
Promote public transportation	2008	Planned	-
Promote cycling and walking			-
Truck guidance concept	2010	Planned	-
Other guidance concepts	2009	Complete	-
Mobility management	-	-	-
Activities promoting e-mobility in Essen (long-term impact)	2010	Planned	-
Support to homeowners to reduce noise	2007	Underway	7,200
Rail head treatment	2009	Complete	344,546
North Rhine Westphalia roads measures	2009	Underway	
DB Netz AG (German railways) measures	2013	Planned	4,162,260

Out of the 17 measures listed above, only four have indeed been completed, while five are underway but eight are only planned thus far. This means that the impact of many of these measures will only materialise in the future, and the benefits presented further below need to be interpreted in that context.

2. Benefits

Using information from the Strategic Noise Maps produced, it is possible to determine the change in the number of people exposed to noise levels above 55 dB, as presented in table 3. Since air traffic related noise abatement is responsibility of Essen Airport, this noise type is not included in the table.

Table 93 – Benefits – exposed population[136]

Change in the number of people exposed to noise at the following intervals as a result of noise reduction measures under the END:	L_{den}		
	Road	Rail	Total
45-49.9 dB(A)	0	0	0
50-54.9 dB(A)	0	0	0
55-59.9 dB(A)	19 400	0	19 400
60-64.9 dB(A)	19 400	-11 860	7 540
65-69.9 dB(A)	19 400	9 080	28 480
70-74.9 dB(A)	13 500	2 250	15 750
Change in the number of people exposed to noise at the following intervals as a result of noise reduction measures under the END:	L_{night}		
	Road	Rail	Total
45-49.9 dB(A)	0	0	0
50-54.9 dB(A)	20 100	0	20 100
55-59.9 dB(A)	20 100	-6 070	14 030
60-64.9 dB(A)	15 000	4 420	19 420
65-69.9 dB(A)	4 900	1 290	6 190
70-74.9 dB(A)	200	360	560

As the table above shows, noise reduction measures did reduce the number of people exposed above 50 dB by 77,600 (L_{den}) overall against a total population of about 570,000 in the agglomeration. The main benefits were incurred due to noise reduction measures focussing on roads and railways, although railways measures also increased the number of people exposed to certain noise levels, probably due to a reallocation of the population exposed to noise at higher intervals.

Based on this information, and using established dose-response relationships for annoyance and sleep disturbance, the changed numbers of people highly annoyed or highly sleep disturbed is estimated and valued in terms of DALYs (see tables 4 and 5).

[136] Note that negative numbers indicate an increase in the size of the population exposed to noise at that interval. This is most likely to be due to a reallocation of the population exposed to noise at higher intervals

Table 94 – Benefits – annoyance

Change in size of the annoyed population[137]	Road	Rail	Total	DALYs per year
Annoyed[138]	29,264	1,476	30,739	
Highly Annoyed[139]	14,684	824	15,508	310

As the table above illustrates, the number of people annoyed was reduced by nearly 31,000 due to noise reduction measures, and the number of people highly annoyed was reduced by around 15,500 people, resulting in a decrease in disease-adjusted life years of 310.

Table 95 – Benefits – sleep disturbance

Change in size of the sleep disturbed population	Road	Rail	Total	DALYs per year	Present Value (€)
Sleep Disturbed	12,664	290	12,954		
Highly Sleep Disturbed	6,147	155	6,301	441	435,192,999

Another benefit of the noise reduction measures in Essen, is that the number of people whose sleep is disturbed could be reduced by nearly 13,000 and the number of people whose sleep is highly disturbed could be reduced by another 6,300. This corresponds to a decrease in disease-adjusted life years of 441 and is valued at € 435 M.

The following tables 96 and 97 summarize the effects of the noise abatement measures on cardiovascular disease and hypertension. The data available shows that a reduction in road noise has resulted in a reduction of DALYs of nearly 669 per year, valued at over € 74 M per year, and a total benefit of more than € 900 M. as a result of avoided DALYs.

Table 96 – Benefits - Cardiovascular disease

	Road	Rail	DALYs per year	Present Value (€)
Change in the % of the population suffering from ischaemic heart disease that is attributable to environmental noise[140]	1.057	n/a		
Change in the number of DALYs per year resulting from ischaemic heart	237.127	n/a	237.127	26,318,154

[137] This is an estimate of the burden of disease from noise-induced annoyance. It reflects the variety of negative responses (e.g. anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation or exhaustion) that people may experience. Noise exposure and annoyance has also been shown to be associated with stress-related psychosocial symptoms such as tiredness, stomach discomfort and stress.

[138] The Present Value represents the discounted stream of annual benefits over a 25-year assessment period

[139] Data below 45dB and above 75dB (Lden) were excluded because the risk of unreliable noise data is high at very low levels, whereas the risk of selection of "survivors" is high at very high levels.

[140] The numbers in this row show the change in the proportion of cases of myocardial infarction due to noise exposure

	Road	Rail	DALYs per year	Present Value (€)
disease and attributable to transport noise[141]				
Total value of avoided DALYs from a reduction in the incidence of noise-induced AMI				320,177,946

Table 97 – Benefits – Hypertension

	Road	Rail	DALYs per year	Present Value (€)
Change in the % of the population suffering from hypertensive heart disease that is attributable to environmental noise[142]	10.549	n/a		
Change in the number of DALYs per year resulting from hypertensive heart disease and attributable to transport noise[143]	432.139	n/a	432.139	47,961,947
Total value of avoided DALYs from a reduction in the incidence of noise-induced hypertensive heart disease				583,489,159

The benefit of the END implementation for the population of Essen agglomeration amounts to:

Net Present Value (€): 1,634,793,564

[141] The change in DALYs is calculated as the % of all DALYs from ischaemic heart disease in the relevant Member State that can be attributed to environmental noise. The Present Value is the number of DALYs multiplied by the value of a DALY.

[142] The numbers in this row show the change in the proportion of cases of hypertensive heart disease due to noise exposure

[143] The change in DALYs is calculated as the % of all DALYs from hypertensive heart disease in the relevant Member State that can be attributed to environmental noise. The Present Value is the number of DALYs multiplied by the value of a DALY

3. Cost Benefit Analysis of Individual Measures

3.1 Employed method

Below selected generally effective measures or measure combinations are evaluated in terms of cost and effectiveness in the case study area. Both planned and implemented measures were chosen to show the cost benefit relation of individual measures.

The calculation of costs is based on published noise action plans and interviews with the competent authorities. If no specific costs are available, cost estimates in accordance with recognized procedures and methods were employed (see Annex D).

The effectiveness of the measures was determined on the basis of measures outlined in the noise action plan in conjunction with recognized procedures set out in Annex E.

Initially an assessment of the reduction of noise affected people on the basis of 5 dB level classes was carried out. This forms the basis of a monetary evaluation of the reduction of noise damage based on the method described in Chapter G.

3.2 CBA of individual measures

The following tables present the results of the CBA performed for individual measures in Essen agglomeration.

Passive noise protection programme (sound insulation windows, low noise fans)

The passive noise protection program is subsidized by the city of Essen and is open to all residential buildings along municipal main roads, whose facade level are L_{den} > 70 dB (A) and L_{night} > 60 dB (A). In a first phase 350,000 € were budgeted. Depending on the acceptance and availability of additional funds, the program is planned to be continued.

The benefits of the measure exceed the costs by a factor of 25. The noise proof window campaign of Essen agglomeration therefore rates as one of the best CB-ratios of all assessed agglomerations.

The costs and benefits shown below present value prices based on 2014.

Affected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
443	0.3 million €	7.9 million €	700	17,800	1 : 25

Rehabilitation of roads / Low noise road surfaces

The aim is to equip road sections with particular noise problems with noise optimized asphalt, if this can contribute to a substantial reduction in noise emissions. In 2009 the measure started with the surface renewal in 7 road sections. Another 22 sections are to follow in the future. Depending on the vehicle speed and percentage of trucks reductions by 3 to 5 dB (A) were measured.

The CB-ratio of this measure is significantly positive and rates in the mid-range of all studied agglomerations.

The costs and benefits shown below present value prices based on 2014.

Affected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
3,800	2.8 million €	19.8 million €	740 €	5,200 €	1 : 7

Speed reduction

In three road sections a speed limit of 30 km/h is planned during night time. Traffic counts, noise monitoring and speed measurements are to examine the effectiveness of the measure. The measure can reduce the noise level at night by about 2.5 dB (A). There are only marginal costs for signage, municipal traffic control and possibly for the purchase and installation of a speed display panel.

Due to the low costs associated with the measure, the benefits exceed the costs many times over. Speed reduction therefore presents one of the most effective measure available in noise action planning.

The costs and benefits shown below present value prices based on 2014.

Affected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
1,540	0.03 million €	3.9 million €	25 €	2,500 €	1 : 100

Re-distribution / Reduction of heavy trucks

A considerable proportion of heavy through traffic burdens urban roads. Restrictions in conjunction with truck steering systems can help the inner-city to reduce heavy truck traffic without the need to limit source / destination traffic. Halving the proportion of heavy traffic on urban roads can lead to noise level reductions of 4-6 dB (A).

Currently, two feasibility studies for the deflection of truck traffic in Essen are carried out, in which the feasibility of the measure is examined.

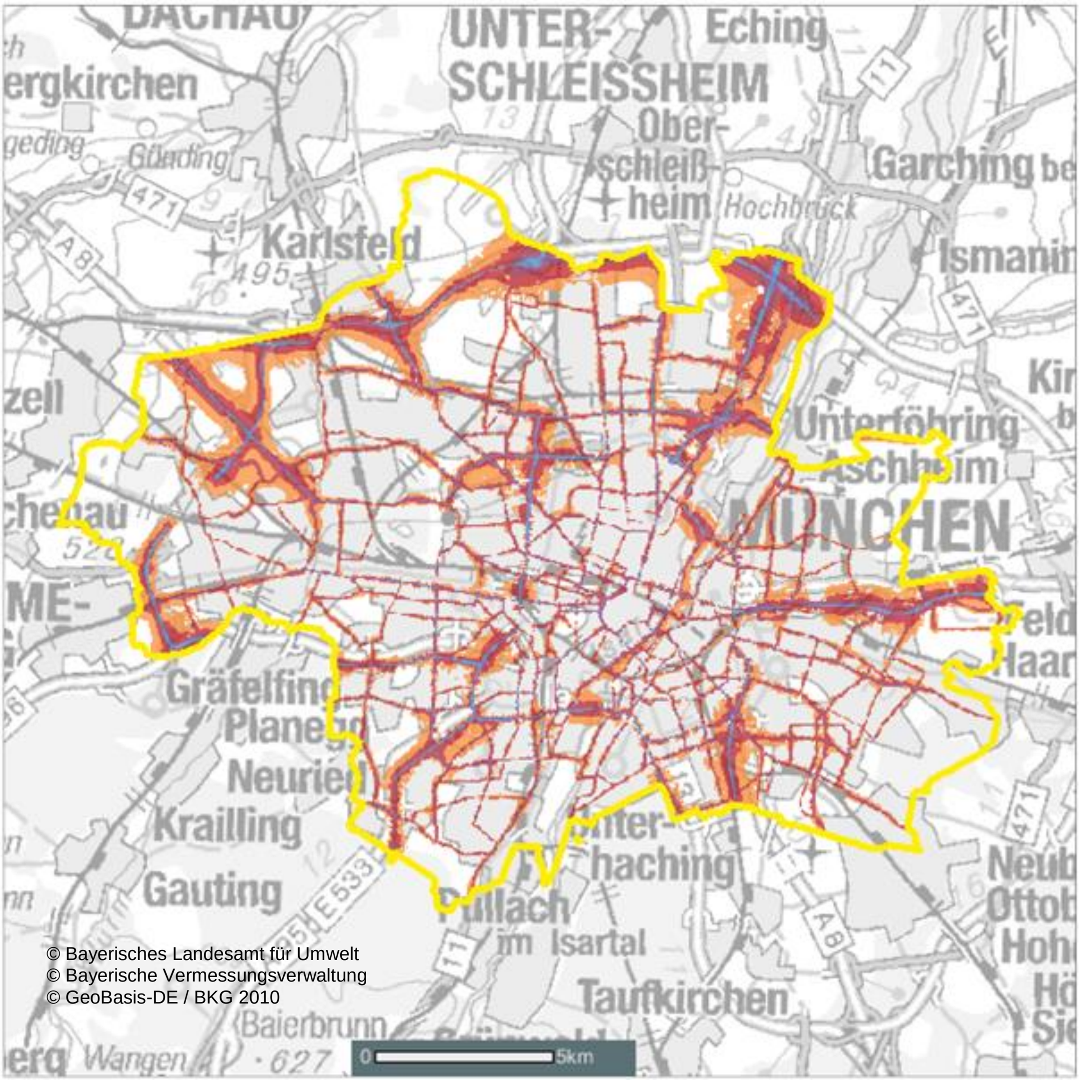
Due to the high number of improved residents the benefit of the measure outweighs the cost by a multiple.

The costs and benefits shown below present value prices based on 2014.

Affected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
570,000	1.2 million €	429.8 million €	2 €	750 €	1 : 375

F.1.7 Case Study – Munich, Germany Agglomeration

The city of Munich is the third largest agglomeration in Germany with a population of 1.3 million residents. It covers an area of 310 km² extending 21 km from north to south und 27 km from east to west. Munich was chosen as a case study due to its dense inner-city road network of roughly 2,800 km and its function as hub for long-distance traffic both on road and rail. The public transport network is extensive with 93 km subway, 66 km tramway, 442 km railway and various bus lines. The city road network connects to an outer and an inner circular road as well as to seven motorways in the vicinity of the city. Due to the distance of Munich to its airport, noise from aviation is not relevant for the agglomeration. The city of Munich therefore presents a case study agglomeration heavily exposed to traffic noise in a densely populated area.



L_{den} for noise from roads in Munich agglomeration

1. Costs

The total cost of END implementation incurred from 2008 onwards is presented in the table below. The bulk expenditure in the Munich agglomeration relates to human resources including consultants. A detailed allocation of costs is available and applied in the study but not presented in the table below.

The total costs of END implementation cannot be calculated to date, since not all measures have been approved. However, the soundproof windows program as well as the action program "Mittlerer Ring" incur high costs and are underway. Therefore, only the cost of those two measures are listed in the table below. Also not included are noise abatement measures implemented by the federal state government for federal roads and rail that account for high expenditures and significant effects.

Table 98 – Costs

Total costs of END Implementation (€, discounted)[144]	
Additional staff time	< 600,000
Consultants	
(Mapping) software - noise calculation	
Reporting	
Costs of measures (€, discounted)[145] over 25 years	
Total discounted capital costs of measures[146, 147]	12,242,764
Total discounted maintenance costs of measures[148]	-
GRAND TOTAL COSTS (€, discounted)	12,754,160

The following table presents the measures taken on the basis of the NAP. A total of 24 affected areas were defined in which the selected measures shown in the above table were implemented. Based on an evaluation matrix the appropriate measures were identified for each area. In most road sections passive measures such as noise optimized windows were proposed. In addition an overall strategic plan to reduce noise at city level was included. These general measures include optimized traffic flow, environmentally conscious traffic management, diversion of truck transit traffic, mobility management and improving public transport, parking facility management and others.

[144] These are the total discounted costs incurred by the relevant implementing authorities in implementing the requirements of the END

[145] These are the total costs of measures to reduce or minimise noise levels.

[146] Note that these are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

[147] Only costs from soundproof windows program as well as the action program "Mittlerer Ring"

[148] These are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

Table 99 – List of measures

Name of measure	Year of implementation	Status	Present value (€, 2014 prices)
Noise optimized surface (8 road sections)	-	evaluation phase	-
Noise protective windows (24 road sections) within the framework of a city-wide program	2013	underway	592,163
Enclosure for road (one road section)	-	-	-
Reduction of rolling noise and screeching in curves at tram line (one section)	2013	complete	n. s.
Overall strategic plan to reduce noise at city level	-	ongoing	n. s.
Support program „Wohnen am Ring" (Living along the city road circle)	2010	underway	11,659,601

2. Benefits

Since the number of residents benefiting from the implementation of the measures with known costs cannot be determined, the total benefit achieved cannot be calculated. However, the cost benefit for the individual measures are presented in the following section.

3. Cost Benefit Analysis of Individual Measures

3.1 Employed method

Below selected generally effective measures or measure combinations are evaluated in terms of cost and effectiveness in the case study area. Both planned and implemented measures were chosen to show the cost benefit relation of individual measures.

The calculation of costs is based on published noise action plans and interviews with the competent authorities. If no specific costs are available, cost estimates in accordance with recognized procedures and methods were employed (see Annex D).

The effectiveness of the measures was determined on the basis of measures outlined in the noise action plan in conjunction with recognized procedures set out in Annex E.

Initially an assessment of the reduction of noise affected people on the basis of 5 dB level classes was carried out. This forms the basis of a monetary evaluation of the reduction of noise damage based on the method described in Chapter G.

3.2 CBA of individual measures

The following tables present the results of the CBA performed for individual measures in Munich agglomeration.

Noise proof window campaign

The city-wide program for noise optimized windows is preferably used in the affected areas of the noise action plan, in which active noise protection measures are not possible. The program was extended to residents with a noise exposure exceeding L_{den} 70 dB(A) / L_{night} 60 dB(A).

Assuming the maximum grant of 3,000 € is made available to each applying household, about 270 flats can be fitted with noise optimized windows. On the basis of 1.6 residents per flat, about 430 people profit from the campaign.

The benefits of the measure exceed the costs of the measure by a factor of 10. The noise proof window campaign of Munich agglomeration has one of the lowest CB-ratio compared to all assessed agglomerations.

The costs and benefits shown below present value prices based on 2014.

Affected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
432	0.5 million	4.4 million	1,252	10,349	1:8

Rehabilitation of roads / Low noise road surfaces

Residents along eight road sections in Munich will profit from a noise optimized surface. A total of approximately 11,000 residents will benefit from the measure which is assumed to lower the noise level by 4 dB(A) in all noise level classes.

Due to the dense building structure in the relevant road sections, the CB-rate of the measure rates as one of the highest compared to all assessed agglomerations.

The costs and benefits shown below present value prices based on 2014.

Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
11,000	2.8 million	45.8 million €	259	4,164	1:16

Speed reduction
The introduction of speed limits is evaluated in the Noise Action Plan for some road sections, but is not selected as a measure for any road. However, in order to show the effect of the measure, the effect of speed reduction in Munich was evaluated as part of the CB-analysis. Speed reduction was evaluated for two sections of about 1.500 metre in a dense city structure with 3,600 affected residents. A noise reduction of 2,4 dB(A) is expected from lowering the speed level from 50 to 30 km/h for all noise classes. Due to the low costs associated with the measure, the benefits exceed the costs many times over. Speed reduction therefore presents one of the most effective measure available in noise action planning but is not the preferred option on main roads in Munich agglomeration. The costs and benefits shown below present value prices based on 2014.

Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
3600	0.026 million	9 million	7	2,497	1:335

Barriers / Walls
Since 2002 noise protection walls with a length of about 500 m were constructed to protect existing residential buildings. Due to the relatively low number of people effected by the measure in comparison to the high expense, the CB-ratio for the investigated barrier is negative. The actual NAP does only consider one similar concept of road enclosure since no other measures are suitable to reach the noise level target. The costs and benefits shown below present value prices based on 2014.

Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
190	1.5 million	0.5 million	7,654	2,355	3:1

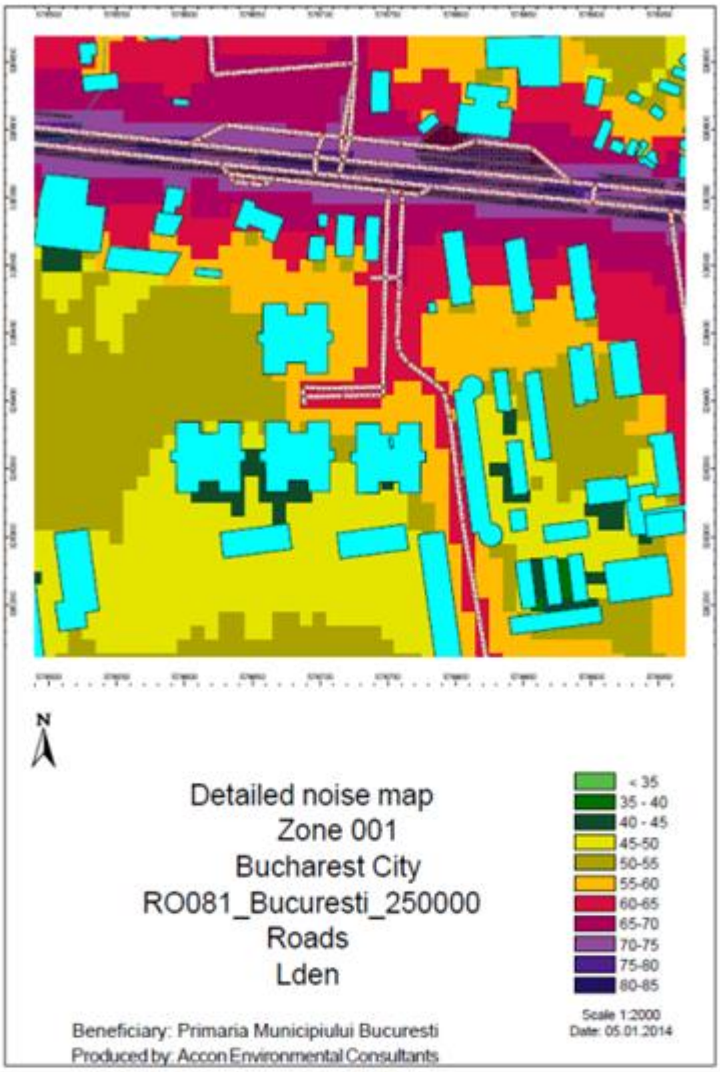
Vegetated tram tracks
A noise reduction can be achieved through the replacement of gravel with turf tracks. Although vegetated tram tracks are not included in the actual NAP, the effect was evaluated in the actual NAP. Conversion to a vegetated track is usually only feasible during the next revision (medium to long term measure). Since tram and vehicle traffic both have an impact on the noise level in the investigated road section, improvement of the noise level is reduced to L_{den} 1 dB(A) and L_{night} 2 db(A). The measure is associated with high costs compared to the noise level reduction reflected by a low CB-ratio. The costs and benefits shown below present value prices based on 2014.

Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
1,200	0.65 million	0.86 million	541	721	1:1.3

F.1.8 Case Study – Bucharest, Romania Agglomeration

The city of Bucharest is the capital city Romania with about 1.88 M inhabitants and an area of 228 km². It counts as a large agglomeration, especially taking into account the neighbouring localities with around 430,000 inhabitants and the fact, that Bucharest daily hosts three million people. The mapped road network of the city has a length of about 800 km. Bucharest is connected to five train lines and has an underground network with a length of about 71 km. The public transport network will be complemented by 70 bus lines, 16 trolley buses and 23 tram lines. Two international operating airports (Henri Coanda Airport and Aurel Vlaicu Airport) are situated within the agglomeration.

Most annoying in Bucharest is the road traffic noise. More than 3800 buildings exceeding the 65 dB limit, around 200 buildings that exceeds the limit of 70 dB and there are also a number of buildings exceeding 75 dB L_{den}. Responsible for the preparation of the NAP is the city Bucharest. In 2008 a "Local Environmental Action Plan" was developed, which also contains some specific actions to improve environmental quality in the municipality of Bucharest (including noise related issues). The new 2014 NAP according END is in public debate and describes proposed measures accompanied by cost-efficiency and cost-benefit assessments.



1. Costs

The total cost of END implementation incurred from 2008 onwards is not published. The Local Environmental Action Plan aiming at "Developing a specific action plan to improve environmental quality in the municipality of Bucharest" includes noise related issues, but no cost estimations. Also costs for implemented measures are not known.

The following presents selective measures taken from the "Environmental Action Plan" from 2008 and from the published NAP 2014. In addition to the general development of the transport system, in particular short term measures such as speed limits and speed enforcement as well as long term measures such as noise optimized asphalt were planned and implemented. In addition to the measures for road transport, especially rail noise abatement was of importance to the city of Bucharest.

Table 100 – List of measures

Name of measure	Year of implementation	Status	Present value (€, 2014 prices)
Noise optimised asphalt	since 2008	unknown	
Speed limits (roads)	in public discussion	-	-
Window thermal/sound insulation programme	since 2008	unknown	
Heavy traffic redistribution	since 2008	complete	-
Creation of cycle paths	since 2008	in progress	-
Creation of special lanes for public transport	since 2008	in progress	-
Traffic flow optimization	since 2008	in progress	-

2. Benefits

The "Environmental Action Plan" 2008 identifies a significant decrease of number of affected persons by noise levels exceeding administrative (L_{den}) limits from 112,137 persons to 50,510 persons arising from noise reduction measures at the main road network. Though, the available data are not suitable for a sound consideration of costs and benefits (in relation to noise action planning activities according END).

In the following section the planned specific measure to optimize the road surface along 50 km major roads will be considered.

3. Cost Benefit Analysis of Individual Measures

Below selected generally effective measure is evaluated in terms of cost and effectiveness in the case study area. The planned measure was chosen to show the cost benefit relation of an individual measure.

The calculation of costs is based on typical approved specific costs, in this case 50 € / m² road surface improvement.

The benefit of the measure was determined on the basis of the calculated reduction of affected inhabitant (within 5 dB bands). As there are only L_{den}-noise level data available, the reduction of noise damage costs can only be calculated on annoyance effects. This will lead to a strong underestimation of the monetized benefit, as the reduced number of sleep disturbed inhabitants will not be considered.

The following table present the results of the CBA of the surface optimization at Bucharest road network:

Surface optimization at main roads					
The improvement of the road surface along 50 km length leads to a reduction of 2,413 highly annoyed persons. This matches 4 % of the total number of highly annoyed persons (55,000) along the investigated network. The benefits of measure exceed the costs, although the benefit at night time was not considered.					
Effected Residents	**Total Present Value Costs**	**Total Present Value Benefits**	**Average present value cost per person**	**Average present value benefit per person**	**CB-Ratio**
55,492	22.4 million	66 million	405	1,185	1:3

F.1.9 Case study – Malmo, Sweden agglomeration

The city of Malmö, Sweden has about 320,000 inhabitants the third largest city in Sweden. Malmö covers an area of 158 km² and constitutes the transnational Øresund Region, the most densely populated area in Scandinavia. Responsible for the preparation of the NAP is the city of Malmö.

Figure 11 - Malmö agglomeration noise map - roads, daytime

1. Costs

The total cost of END implementation incurred from 2008 onwards is presented in the table below. The bulk of expenditure in the Malmö agglomeration relates to human resources including consultants. The total costs of the planned measures over a 25-year-assessment period are expected to amount to about € 18.2 M.

Table 101 – Costs

Total costs of END Implementation (€, discounted)[149]	
Additional staff time	65,863.32
Consultants	73,181.47
(Mapping) Software	7,318.15
Reporting	3,659.07
Costs of measures (€, discounted)[150] ***over 25 years***	
Total discounted capital costs of measures[151]	18,084,436.03
Total discounted maintenance costs of measures[152]	-
GRAND TOTAL COSTS (€, discounted)	**18,234,458.04**

The following table presents the measures planned and taken on the basis of the NAP.

Table 102 – List of measures

Name of measure	Year of implementation	Status	Present value (€, 2014 prices)
Continued development with coating	2014	On-going	-
Clearer link between traffic regulation related activities and noise impacts	2014	On-going	-
Monitor and follow up on noise from public transport (buses)	2014	On-going	-
Investigation into the use of electric buses	2015	On-going	-
Road related noise to be incorporated into public traffic campaigns	2015	On-going	-
Noise proof window campaign	2014	On-going	6,561,331
Guidelines aimed at property owners describing window campaign (see ID 6)	2014	On-going	
Raise noise barriers in identified locations	2014	On-going	305,865
Noise reducing activities at the most exposed pre-schools and schools	2014	On-going	3,288,221
Noise reducing activities in selected locations within parks, recreation areas and in squares	2014	On-going	7,929,019

[149] These are the total discounted costs incurred by the relevant implementing authorities in implementing the END
[150] These are the total costs of measures to reduce or minimise noise levels
[151] Note that these are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)
[152] These are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

Name of measure	Year of implementation	Status	Present value (€, 2014 prices)
(and other public places)			
Investigation into/identification of additional areas which would benefit from screens.	2014	On-going	-
Development of routines to secure guidelines for noise pollution when establishing new pre-schools and schools	2014	On-going	-
Continue work with identifying designated Quiet Areas	2014	On-going	-
Noise level requirements in public procurement	2014	On-going	-
Collaboration with other cities and actors	2014	On-going	-

Out of the 15 measures listed above, all are currently on-going. This means that the impact of many of these measures will only materialise in the future, and the benefits presented further below need to be interpreted in that context.

2. Benefits

Using information from the Noise Action Plan, it is possible to determine the change in the number of people exposed to noise. Data on effected residents was only presented in the NAP for selected noise level classes as presented in the table below.

Table 103 – Benefits – exposed population

Noise interval	Change in the number of people exposed to noise at the following intervals as a result of noise reduction measures[153]	
	L_{den}	L_{night}
45-49.9 dB(A)	0	0
50-54.9 dB(A)	22,000	0
55-59.9 dB(A)	0	64,410
60-64.9 dB(A)	16,500	0
65-69.9 dB(A)	0	0
70-74.9 dB(A)	0	0

As the table above shows, noise reduction measures did not have an impact on the number of people exposed to noise (L_{den}) up to 49.9 dB but did reduce the number of people exposed above 49.9 dB by 7,301 overall against a total population of 318,107 in the agglomeration. The main benefits were incurred due to noise reduction measures on roads.

Based on this information, and using established dose-response relationships for annoyance and sleep disturbance, the changed numbers of people highly annoyed or highly sleep disturbed is estimated and valued in terms of DALYs (see tables 4 and 5).

[153] Note that these include noise reductions that may have been achieved independently of the END. It is not possible to distinguish between noise reductions that may be attributed to END versus noise reductions that may be attributed to other measures.

Table 104 – Benefits – annoyance

Change in size of the annoyed population[154]	Road	DALYs per year
Annoyed[155]	8,095	
Highly Annoyed[156]	3,223	64

As the table above illustrates, the number of people annoyed was reduced by 8,095 due to noise reduction measures, and the number of people highly annoyed was reduced by 3,223 people, resulting in a decrease per year in disease-adjusted life years of 64.

Table 105 – Benefits – sleep disturbance

Change in size of the sleep disturbed population	Road	DALYs per year	Present Value (€)
Sleep Disturbed	12,972		
Highly Sleep Disturbed	6,155	431	425,074,207

Another benefit of the noise reduction measures in the Malmö agglomeration is that the number of people whose sleep is disturbed could be reduced by about 13,000, and the number of people whose sleep is highly disturbed could be reduced by another 6,155, corresponding to a decrease in disease-adjusted life years of 431 per year valued at € 425 M over the 25-year assessment period.

The following tables 6 and 7 summarize the effects of the noise abatement measures on cardiovascular disease and hypertension. The data available shows that a reduction in road noise has resulted in a reduction of DALYs of about 31, valued at over €3 M, and a total benefit of more than € 41 M as a result of avoided DALYs.

Table 106 – Benefits - Cardiovascular disease

	Road	DALYs per year	Present Value (€)
Change in the % of the population suffering from ischaemic heart disease that is attributable to environmental noise[157]	0.078		
Change in the number of DALYs per year resulting from ischaemic heart disease and attributable to transport noise[158]	1.795	1.795	199,174
Total value of avoided DALYs from a reduction in the incidence of noise-induced AMI			2,423,090

[154] This is an estimate of the burden of disease from noise-induced annoyance. It reflects the variety of negative responses (e.g. anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation or exhaustion) that people may experience. Noise exposure and annoyance has also been shown to be associated with stress-related psychosocial symptoms such as tiredness, stomach discomfort and stress.

[155] The Present Value represents the discounted stream of annual benefits over a 25-year assessment period

[156] Data below 45dB and above 75dB (Lden) were excluded because the risk of unreliable noise data is high at very low levels, whereas the risk of selection of "survivors" is high at very high levels.

[157] The numbers in this row show the change in the proportion of cases of myocardial infarction due to noise exposure

[158] The change in DALYs is calculated as the % of all DALYs from ischaemic heart disease in the relevant Member State that can be attributed to environmental noise. The Present Value is the number of DALYs multiplied by the value of a DALY.

Table 107 – Benefits – Hypertension

The benefit of the END implementation for the population of Malmö agglomeration amounts to:

	Road	DALYs per year	Present Value (€)
Change in the % of the population suffering from hypertensive heart disease that is attributable to environmental noise[159]	10.867		
Change in the number of DALYs per year resulting from hypertensive heart disease and attributable to transport noise[160]	28.773	28.773	3,193,462
Total value of avoided DALYs from a reduction in the incidence of noise-induced hypertensive heart disease			38,850,606

Net Present Value (€): 511,718,377.

[159] The numbers in this row show the change in the proportion of cases of hypertensive heart disease due to noise exposure

[160] The change in DALYs is calculated as the % of all DALYs from hypertensive heart disease in the relevant Member State that can be attributed to environmental noise. The Present Value is the number of DALYs multiplied by the value of a DALY

3. Cost Benefit Analysis of Individual Measures

3.1 Employed method

Below selected generally effective measures or measure combinations are evaluated in terms of cost and effectiveness in the case study area. Both planned and implemented measures were chosen to show the cost benefit relation of individual measures.

The calculation of costs is based on published noise action plans and interviews with the competent authorities. If no specific costs are available, cost estimates in accordance with recognized procedures and methods were employed (see Annex D).

The effectiveness of the measures was determined on the basis of measures outlined in the noise action plan in conjunction with recognized procedures set out in Annex E.

Initially an assessment of the reduction of noise affected people on the basis of 5 dB level classes was carried out. This forms the basis of a monetary evaluation of the reduction of noise damage based on the method described in Chapter G and in the efficiency section.

3.2 CBA of individual measures

The following table presents the results of the CBA performed for one individual measure of Malmö agglomeration.

Noise proof window campaign

The noise levels to participate in the programme have been further reduced, so that funding is already available at a noise level of 61 dB(A) on the facade and 31 dB(A) indoors.

The benefits of the measure exceed the costs of the measure by a factor of 18.

The costs and benefits shown below present value prices based on 2014.

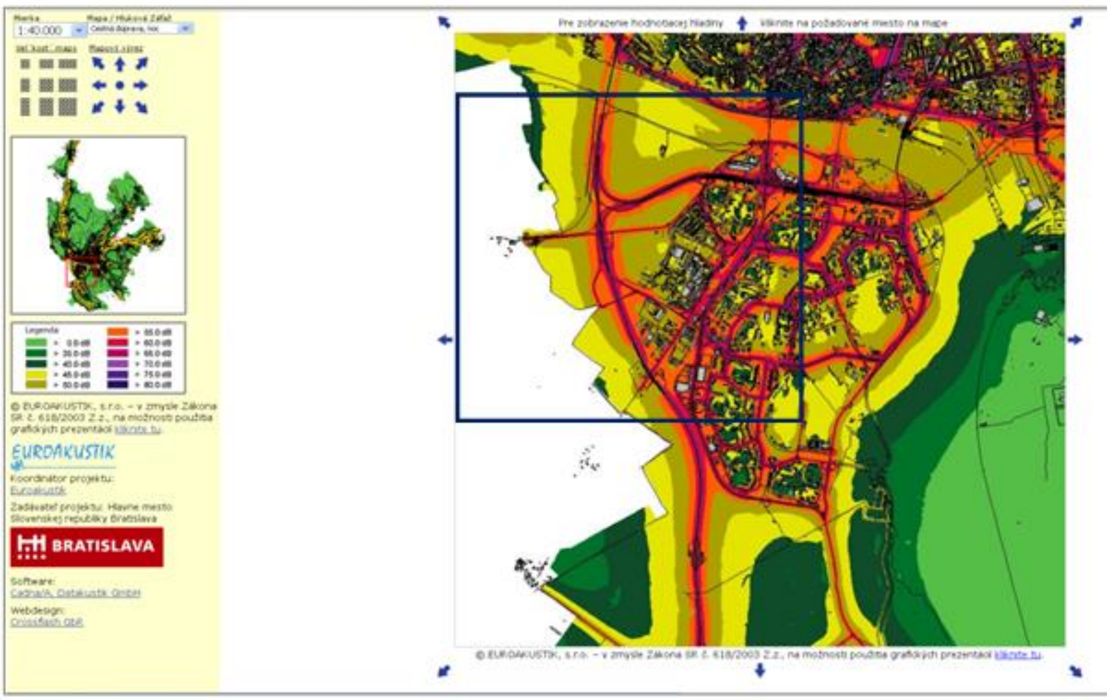
Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
1,920	0.6 million	9.7 million	329	5,064	1:15

F.1.10 Case Study – Bratislava, Slovakia Agglomeration

Bratislava is the capital of Slovakia with a population of 460,000. The agglomeration is defined within the bounds of the municipality (draft NAP 2015), whereas the greater metropolitan area includes another 100,000 people. The city of Bratislava covers an area of 368 km^2 with a population density of 1,250 inhabitants/km^2.

The mapped road network of the city has a length of about 840 km. The total length of roads with a traffic flow of more than 3 million vehicles per year is 290 km. Bratislava is connected to seven train lines. Noise mapping in Bratislava covered a total of about 3,300 km of roads, 311 km of railway and 79 km tram lines. In addition the international airport (M. R. Stefanik) situated 9 km outside the city as well as 31 industrial businesses were included in the noise mapping.

Responsible for the preparation of the NAP is the city of Bratislava. In 2007 and 2013 strategic noise maps were prepared. National action planning in accordance to END on the basis of year 2006 was prepared in 2009, but was not published. Between the first and the second round of noise mapping there were various activities and actions to reduce noise at identified hotspots within the city. The first "official" NAP according to END for the Bratislava agglomeration will be published towards the end of 2015. Although this NAP is not published yet, it entails actual hot-spots and describes proposed measures accompanied by cost-benefit assessments.



Strategic Noise Map of Bratislava for road traffic noise (L_{den}) in the district of Petržalka (http://www.laermkarten.de/bratislava/)

In the following section selected road and railway noise measures are analysed in regard to the cost-benefit relation.

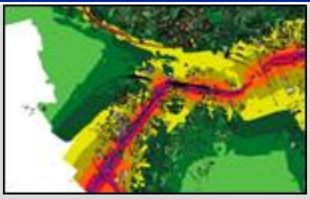
Two selected measures in the hotspot district Bratislava-Petržalka, which were considered within the NAP, were evaluated in terms of cost and effectiveness. The measures were chosen to show the cost benefit relation of specific measures chosen to reduce the number of residents effected by noise under the given circumstances in the case study area.

The costs of the measures are estimations by the author of the NAP.

The benefit of the measures was determined on the basis of the calculated reduction of effected residents (within 5 dB noise level classes).

The following tables present the results of the CBA for the analysed measures:

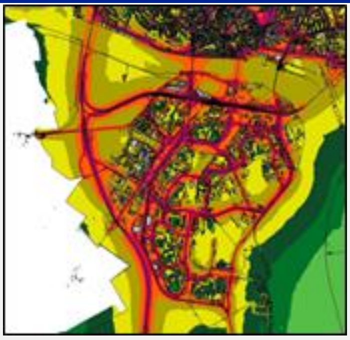
Noise barrier along the railway tracks at district Petržalka



The implementation of a noise barrier with an average high of 4 m and a total length of 5,300 m at both sides of the rail way track achieves to the following cost and benefits:

Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
17,306	5.4 million	36 million	380	2,985	1:7

Low Noise Surface on motorway D4 within the district of Petržalka



The improvement of the road surface along 50 km length leads to a reduction of 2413 highly annoyed persons. This matches 4 % of the total number of highly annoyed persons (55,000) along the investigated network.

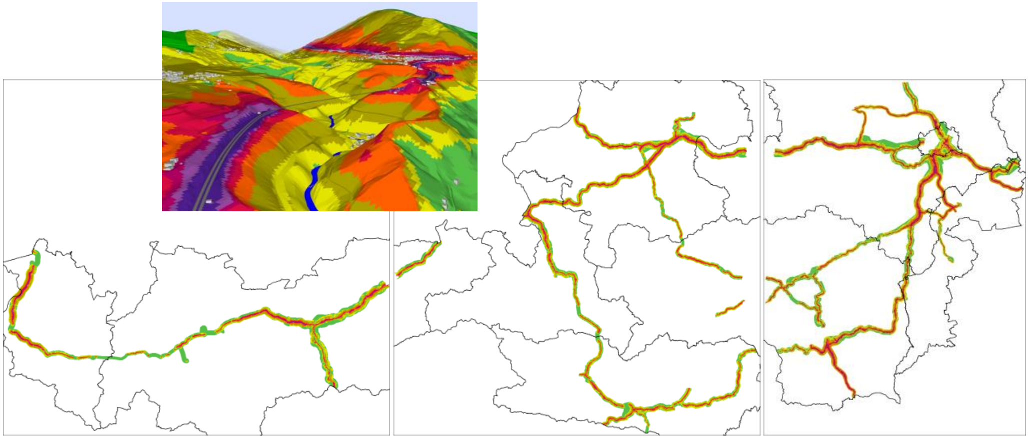
The benefits of measure exceed the costs, although the benefit at night time was not considered.

Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
38,675	1.4 million	14.2 million	45	405	1:10

F.2: ROADS

F.2.1 Case study – Austria Major Roads

Austria Major Roads were chosen as a case study, because the strategic noise maps were produced for all motorways and major highways under the responsibility of one authority (ASFINAG) and the strategic noise maps of the 1st and 2nd round were prepared by ACCON. Hence detailed mapping results were available. Considering a 2500 km road net and a mapped area of 8500 km² let expect hard knowledge of costs and benefits of measures. Also NAPS were published in time in 2008 and 2013.



The published NAP (2008) summarizes the implemented measures at the major road network since 1999 (according national programs) and shows planned measures and long-term strategies. Also a rough estimation of expenditure in the past and future costs is mentioned. The published NAP (2013) for the 2nd round also mentions an estimation of the benefit of the implemented measures within the period 2007-2012.

1. Costs

From the NAPs (2008 and 2013) it was possible to interpolate costs for existing noise abatement programs. It may be assumed, that the mentioned costs contain planning and realization of measures. There are no cost estimates for END implementation available, but taken into account the very simple design of the NAP and very simple public participation and discussion of measures, we may expect no relevant costs for END implementation.

Table 108 – Costs

Total costs of END Implementation (€, discounted)[161]	
Administrative costs (€, discounted)	
Additional staff time, consultants, reporting	1,004,838
Costs of measures (€, discounted)[162] over 25 years	
Total discounted capital costs of measures[163]	146,579,115.8
Total discounted maintenance costs of measures[164]	-
GRAND TOTAL COSTS (€, discounted)	147,583,953.67

The total costs of measures over a 25-year-assessment period are expected to amount to € 146.5 M. Together with the administrative costs associated with noise mapping and preparation of action plans, the total present value costs are € 147,583,953.67.

Table 109 – List of measures

Name of measure	Year of implementation	Status	Present value (€, 2014 prices)
Noise abatement measures along existing motorways and expressways (A1, A2, A4, A7,A8, A9, A10, A12, A14, A21, A22, S5, S36)	2008-2015	implemented	146,579,115.8
Noise abatement measures along existing motorways and expressways (A1, A2A8, A9, A10, A12, A13, A14, A23, S6, S16)	2015	ongoing	

[161] These are the total discounted costs incurred by the relevant implementing authorities in implementing the requirements of the END

[162] These are the total costs of measures to reduce or minimise noise levels

[163] Note that these are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

[164] These are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

2. Benefits

General notes on benefits:

1. Disability-Adjusted Life Years (DALYs) are the sum of the potential years of life lost due to premature death and the equivalent years of "healthy" life lost by virtue of being in states of poor health or disability.

2. The Present Value represents the discounted stream of annual benefits over a 25-year assessment period

The benefit of implemented measures until 2013 was estimated by ACCON based on statistics derived from the comparison of the 2007/2012 noise mapping results, as presented in table 3.

Table 110 – Benefits – exposed population[165]

Noise interval	Change in the number of people exposed to noise at the following intervals as a result of noise reduction measures[166]	
	L_{den}	L_{night}
45-49.9 dB(A)	0	46,377
50-54.9 dB(A)	0	43,171
55-59.9 dB(A)	52,122	29,041
60-64.9 dB(A)	42,042	14,078
65-69.9 dB(A)	24,377	662
70-74.9 dB(A)	10,216	6
>75.0 dB(A)	312	0
Total	129,069	133,335

As the table above shows, noise reduction measures have an impact on about 129,000 residents (L_{den}) and 133,000 residents (L_{night}) against total affected number of people of around 714,000.

Table 111 – Benefits – annoyance

Change in size of the annoyed population[167]	Road	DALYs per year	Present Value (€)
Annoyed[168]	39,603		
Highly Annoyed[169]	17,822	356	508,233,832

[165] Note that negative numbers indicate an increase in the size of the population exposed to noise at that interval. This is most likely to be due to a reallocation of the population exposed to noise at higher intervals

[166] Note that these include noise reductions that may have been achieved independently of the END. It is not possible to distinguish between noise reductions that may be attributed to END versus noise reductions that may be attributed to other measures.

[167] This is an estimate of the burden of disease from noise-induced annoyance. It reflects the variety of negative responses (e.g. anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation or exhaustion) that people may experience. Noise exposure and annoyance has also been shown to be associated with stress-related psychosocial symptoms such as tiredness, stomach discomfort and stress.

[168] The Present Value represents the discounted stream of annual benefits over a 25-year assessment period

[169] Data below 45dB and above 75dB (L_{den}) were excluded because the risk of unreliable noise data is high at very low levels, whereas the risk of selection of "survivors" is high at very high levels.

As the table above illustrates, the number of people annoyed was reduced by about 40,000 due to noise reduction measures, and the number of people highly annoyed was reduced by about 18,000 people, resulting in a decrease in disease-adjusted life years of 356.

Table 112 – Benefits – sleep disturbance

Change in size of the sleep disturbed population	Road	DALYs per year	Present Value (€)
Sleep Disturbed	21,428		
Highly Sleep Disturbed	9,683	678	966,474,887

Another benefit of the noise reduction measures for major Roads in Austria is that the number of people whose sleep is disturbed has been reduced by about 21,000, and the number of people whose sleep is highly disturbed has been reduced by another about 10,000, corresponding to a decrease in disease-adjusted life years of 678. This decrease is valued at € 966 M.

Table 113 – Benefits - Cardiovascular disease

	Road	DALYs per year	Present Value (€)
Change in the % of the population suffering from ischaemic heart disease that is attributable to environmental noise[170]	0.661		
Change in the number of DALYs per year resulting from ischaemic heart disease and attributable to transport noise[171]	15.99	15.99	
Total value of avoided DALYs from a reduction in the incidence of noise-induced AMI			4,056,100

The data available shows that a reduction in road noise has resulted in a reduction of DALYs of 15.99, valued at about € 1.78M per year and a total benefit of €4M as a result of avoided DALYs.

The net benefit of the END measure at Austria Major Road network for the population, and assuming 100% attribution, amounts to:

Net Present Value (€): 1,119,545,523.

[170] The numbers in this row show the change in the proportion of cases of myocardial infarction due to noise exposure

[171] The change in DALYs is calculated as the % of all DALYs from ischaemic heart disease in the relevant Member State that can be attributed to environmental noise. The Present Value is the number of DALYs multiplied by the value of a DALY.

F.2.2 Case study 2 – Greece Major Roads (Attica Tollway)

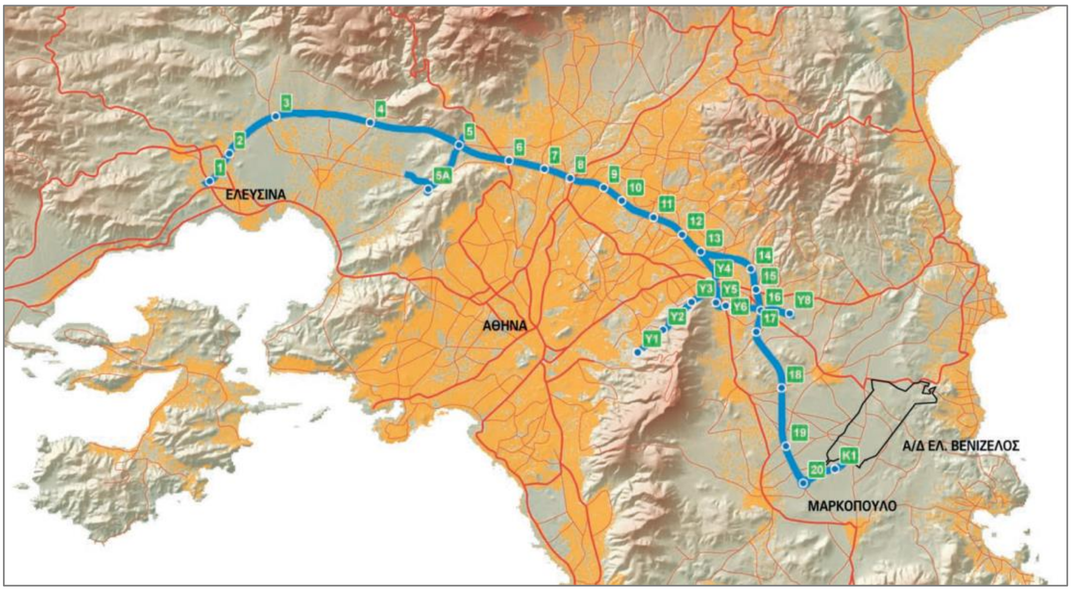
Attica Tollway serves as a ring road for the greater metropolitan area of Athens with a length of 70 km per direction. Due to the close location to the metropolitan area of Athens it functions as bypass road concentrating and routing traffic flows. It connects 30 municipalities of the Attica basin and meets the transportation needs of millions of people.

The average traffic has declined in 2008 to 2011 by about 7 % from 300,000 to 280,000 vehicles. In the subsequent years a further decline by 10 % is expected due to the financial situation of the country.

The motorway affects an area of about 19 million sqm in 16 municipalities. Due to different land uses a total of about 8,500 buildings are in the vicinity of the road thereof 70 % residential buildings. This accounts for about 28,000 residents living in the study area.

In the NAP 2010 noise barriers with a total surface area of 87,000 sqm were proposed for 138 different sections of the motorway with acoustically effective heights varying from 3.5 to 4.5 m. The implementation of the measure has already been completed. The results of this measure is outlined in the cost benefit analysis below.

In addition to the construction of noise barriers the implementation of partial covering of the motorway are planned to improve the situation further in some road sections. This will create a further benefit that is not considered in the case study analysis.



Attika Tollway, Source: Attiki Odos, Annual Report 2011

1. Costs

Detailed data on costs occurred from this measure are not available. A general assumption for costs usually associated with the construction of noise barriers is 1,000 € per sqm wall. The total surface area constructed totals to 87,000 sqm which amounts to costs of 87 million € (undiscounted) for this measure. In the table below the discounted costs, including the administrative costs of END implementation are presented.

Table 114 – Costs

Total costs of END Implementation (€, discounted)[172]	
Administrative costs (€, discounted)	
Costs associated with additional staff time, consultants, reporting, etc	40,938.17
Costs of measures (€, discounted)[173] over 25 years	
Total discounted capital costs of measures[174]	77,382,346
Total discounted maintenance costs of measures[175]	n.s.
GRAND TOTAL COSTS (€, discounted)	63,643,586.03

2. Benefits

Using information from the Strategic Noise Maps produced in 2009 and 2011, it is possible to determine the change in the number of people exposed to noise levels above 50 dB (A), as presented in table 3.

Table 115 – Benefits – exposed population[176]

Noise interval	Change in the number of people exposed to noise at the following intervals as a result of noise reduction measures[177]	
	L_{den}	L_{night}
45-49.9 dB(A)	-56	-1,204
50-54.9 dB(A)	-784	-1,064
55-59.9 dB(A)	-1,232	224
60-64.9 dB(A)	-1,092	868
65-69.9 dB(A)	532	1,428
70-74.9 dB(A)	896	392
>75.0 dB(A)	1,736	28
Total	840	672

[172] These are the total discounted costs incurred by the relevant implementing authorities in implementing the requirements of the END

[173] These are the total costs of measures to reduce or minimise noise levels

[174] Note that these are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

[175] These are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

[176] Note that negative numbers indicate an increase in the size of the population exposed to noise at that interval. This is most likely to be due to a reallocation of the population exposed to noise at higher intervals

[177] Note that these include noise reductions that may have been achieved independently of the END. It is not possible to distinguish between noise reductions that may be attributed to END versus noise reductions that may be attributed to other measures.

As the table above shows, noise reduction measures had an impact on 840 residents (L_{den}) and 672 residents (L_{night}) against total affected number of people of around 28,000.

Table 116 – Benefits – annoyance

Change in size of the annoyed population[178]	Road	DALYs per year	Present Value (€)
Annoyed[179]	1,174		
Highly Annoyed[180]	863	17	24,621,373

As the table above illustrates, the number of people annoyed was reduced by 1,174 due to the installation of noise barriers, and the number of people highly annoyed was reduced by 863 people, resulting in a decrease in disease-adjusted life years of 17.

Table 117 – Benefits – sleep disturbance

Change in size of the sleep disturbed population	Road	DALYs per year	Present Value (€)
Sleep Disturbed	609		
Highly Sleep Disturbed	361	25	36,040,530

Another benefit of the noise reduction measures at Attica Tollway is that the number of people whose sleep is disturbed has been reduced by 609, and the number of people whose sleep is highly disturbed has been reduced by another 361, corresponding to a decrease in disease-adjusted life years of 25. This decrease is valued at € 36M.

[178] This is an estimate of the burden of disease from noise-induced annoyance. It reflects the variety of negative responses (e.g. anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation or exhaustion) that people may experience. Noise exposure and annoyance has also been shown to be associated with stress-related psychosocial symptoms such as tiredness, stomach discomfort and stress.

[179] The Present Value represents the discounted stream of annual benefits over a 25-year assessment period

[180] Data below 45dB and above 75dB (L_{den}) were excluded because the risk of unreliable noise data is high at very low levels, whereas the risk of selection of "survivors" is high at very high levels.

Table 118 – Benefits - Cardiovascular disease

	Road	DALYs per year	Present Value (€)
Change in the % of the population suffering from ischaemic heart disease that is attributable to environmental noise[181]	2.287		
Change in the number of DALYs per year resulting from ischaemic heart disease and attributable to transport noise[182]	95.68	95.68	10,619,313
Total value of avoided DALYs from a reduction in the incidence of noise-induced AMI			129,191,040

The data available shows that a reduction in road noise has resulted in a reduction of DALYs of 95.68, valued at € 10 M per year and a total present value benefit of € 129M as a result of avoided DALYs.

Combing the cost and benefit estimates, the net benefit of the measure, assuming 100% of the benefits attributed to END implementation is:

Net Present Value (€): 112,833,233.

3. Cost Benefit Analysis

Below the measure is valuated regarding the monetary ratio of costs and benefits. The calculation is based on the data provided in the previous chapters.

Barriers / Walls

For the measure described in the previous chapters a near balance of cost and benefits was reached. However, the cost still exceed the benefit. Due to the large amounts, the rounded CB-Ratio is even.

The costs and benefits shown below present value prices based on 2014.

Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
28,000	77.4 million €	75.5 million €	2,750 €	2,700 €	1:1

[181] The numbers in this row show the change in the proportion of cases of myocardial infarction due to noise exposure

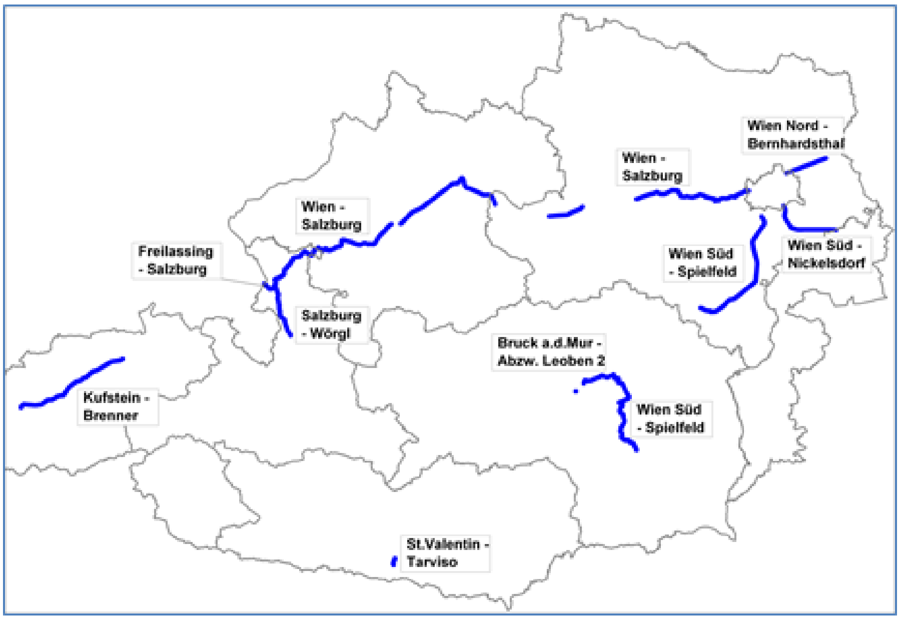
[182] The change in DALYs is calculated as the % of all DALYs from ischaemic heart disease in the relevant Member State that can be attributed to environmental noise. The Present Value is the number of DALYs multiplied by the value of a DALY.

F.3 RAIL

F.3.1 Case study – Austria Major Railways

Austria Major Rails were chosen as a case study, because the strategic noise maps were produced for all major railways under the responsibility of one authority (OEBB) and the strategic noise maps of the 1st and 2nd round were prepared by ACCON. Hence detailed mapping results were available. ACCON considered a 550 km rail net within the 1st round and a 2100 km rail net in the 2nd round. NAPS were published in time in 2008 and 2013. From the published "Umgebungslaerm-Aktionsplan Oesterreich 2008, Teil B11 – Schienenstrecken (bmvit)" the number of affected persons from planned measures within the years 2008-2013 could be estimated. From cost-statistics of the 2nd round noise mapping costs were estimated with € 0.6 M.

550 km rail within the round noise mapping Austria



net 1st

The published NAP (2008) summarizes the activities in relation to noise abatement at the major rail network since 1999 (according national programs) and shows planned measures and long-term strategies. Also a rough estimation of expenditure in the past and future costs is mentioned.

1. Costs

From the NAPs (2008 and 2013) it was possible to interpolate costs for existing noise abatement programs. It may be assumed, that the mentioned costs contain planning and realization of measures. There is also a rough cost estimates for END implementation available, that is mainly determined by known costs for data acquisition (GIS implementation) and contains also the very simple design of the NAP and very simple public participation and discussion of measures.

Table 119 – Costs

Total costs of END Implementation (€, discounted)[183]	
Additional staff time, Consultants, Reporting, land-survey/GIS	487,155
Costs of measures (€, discounted)[184] over 25 years	
Total discounted capital costs of measures[185]	19,350,869
Total discounted maintenance costs of measures[186]	-
GRAND TOTAL COSTS (€, discounted)	19,838,024

A breakdown of the costs of implementation of the END for the Major Railways in Austria has not been obtained.

The total costs of measures over a 25-year-assessment period are expected to amount to just over €19 M.

Table 120 – List of measures

Name of measure	Year of implementation	Status	Present value (€, 2014 prices)
Noise abatement measures targeting persons affected over highest four dB classes	Starting 2009	ongoing	19,350,869

[183] These are the total discounted costs incurred by the relevant implementing authorities in implementing the requirements of the END

[184] These are the total costs of measures to reduce or minimise noise levels

[185] Note that these are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

[186] These are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

2. Benefits

General notes on benefits:

1. Disability-Adjusted Life Years (DALYs) are the sum of the potential years of life lost due to premature death and the equivalent years of "healthy" life lost by virtue of being in states of poor health or disability.

2. The Present Value represents the discounted stream of annual benefits over a 25-year assessment period

The yearly benefit of implemented measures until 2009 was estimated by the responsible authority with 12,500 persons less affected by rail noise. This fact will lead to a total reduction of affected people by 62,500 until 2013. Assuming a weighted reduction of affected persons over all 5 dB bands (based on person distribution in 2008) the following benefit can be expected.

Table 121 – Benefits – exposed population[187]

Noise interval	Change in the number of people exposed to noise at the following intervals as a result of noise reduction measures[188]	
	L_{den}	L_{night}
45-49.9 dB(A)	0	(-32,411)
50-54.9 dB(A)	(-62,500)	19,398
55-59.9 dB(A)	35,729	8,606
60-64.9 dB(A)	17,937	2,851
65-69.9 dB(A)	5,943	1,085
70-74.9 dB(A)	1,991	472
>75.0 dB(A)	900	0
Total	**62,500**	**32,411**

As the table above shows, noise reduction measures did not have an impact on the number of people exposed to noise L_{den} up to 55 dB and 50 dB L_{night}. The increase of in these 5 dB bands are caused by a shifting of household to lower dB bands due to measures.

Table 122 – Benefits – annoyance

Change in size of the annoyed population[189]	Rail	DALYs per year
Annoyed[190]	6,224	
Highly Annoyed[191]	2,573	51

[187] Note that negative numbers indicate an increase in the size of the population exposed to noise at that interval. This is most likely to be due to a reallocation of the population exposed to noise at higher intervals

[188] Note that these include noise reductions that may have been achieved independently of the END. It is not possible to distinguish between noise reductions that may be attributed to END versus noise reductions that may be attributed to other measures.

[189] This is an estimate of the burden of disease from noise-induced annoyance. It reflects the variety of negative responses (e.g. anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation or exhaustion) that people may experience. Noise exposure and annoyance has also been shown to be associated with stress-related psychosocial symptoms such as tiredness, stomach discomfort and stress.

[190] The Present Value represents the discounted stream of annual benefits over a 25-year assessment period

[191] Data below 45dB and above 75dB (L_{den}) were excluded because the risk of unreliable noise data is high at very low levels, whereas the risk of selection of "survivors" is high at very high levels.

As the table above illustrates, the number of people annoyed was reduced by 6,224 due to noise reduction measures, and the number of people highly annoyed was reduced by 2,573 people, resulting in a decrease in disease-adjusted life years of 51.

Table 123 – Benefits – sleep disturbance

Change in size of the sleep disturbed population	Rail	DALYs per year	Present Value (€)
Sleep Disturbed	1,355		
Highly Sleep Disturbed	650	45	54,588,346

Another benefit of the noise reduction measures for Major Railways in Austria is that the number of people whose sleep is disturbed has been reduced by 1,355, and the number of people whose sleep is highly disturbed has been reduced by another 650, corresponding to a decrease in disease-adjusted life years of 45. This decrease is valued at around € 55 M.

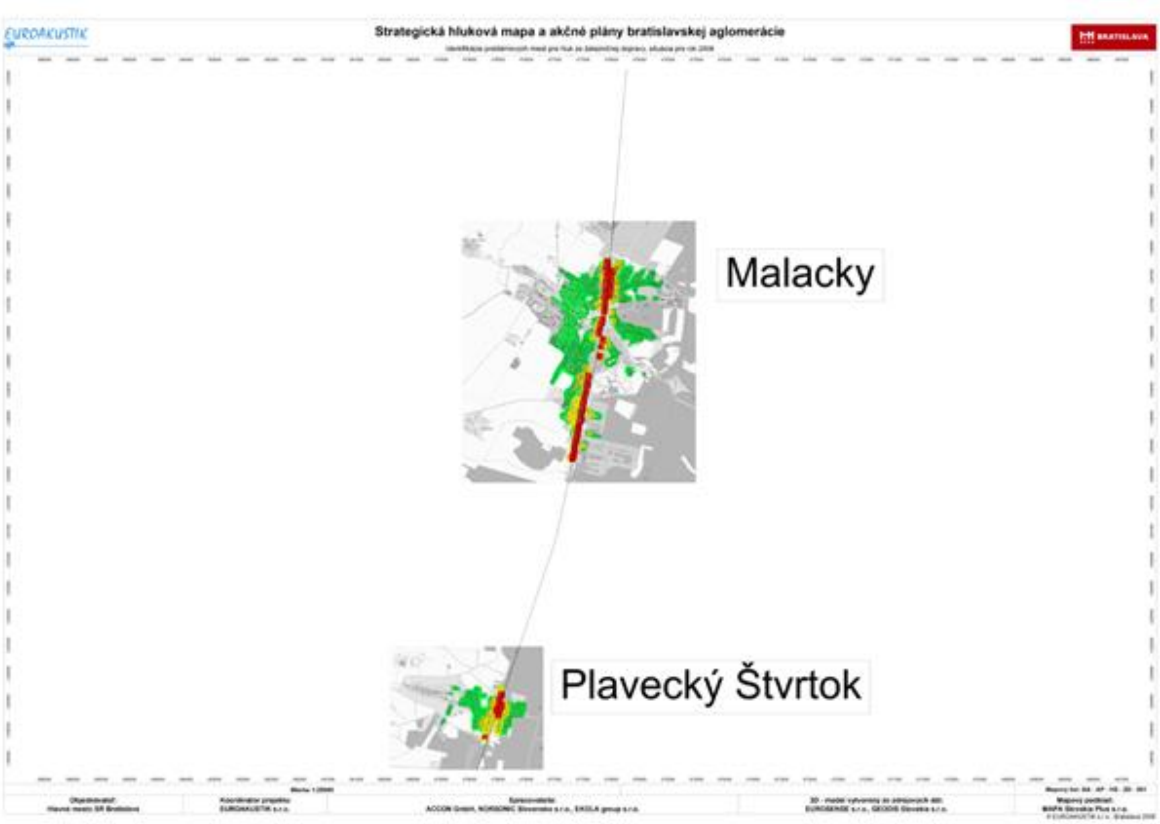
The benefit of the END implementation for major rails in Austria (assuming 100% of the benefits can be attributed to END implementation) amounts to:

Net Present Value (€): 96,515,675

F.3.2 Case study – Slovakia Major Railways

Malacky is an important regional transport hub connected to a highway and a national road that service the agglomeration Bratislava. The main train line connecting Bratislava and the Czech Republic traverses the city in north-south direction. The Malacky railway station is part of the Bratislava Integrated Public Transport System. The route is highly frequented and was therefore chosen as a case study.

For noise improvement along the Malacky rail route, various measures were analysed to improve the noise situation in the surrounding residential areas. As a result, the installation of a noise barrier was selected as the most effective measure. The publication of the results in the context of a noise action plan is still pending.



Noise map "hot spots" rail sections Malacky and Plavecky Stvrtok, 2006

1. Costs

The costs for the measure are based on estimates prepared for the authorities by a consultant and is not publicly available. It may be assumed, that the cost stated below contain planning and realization of the measure.

Table 124 – Costs

Total costs of END Implementation (€, discounted)[192]	
Additional staff time, Consultants, Reporting	22,688.68
Costs of measure (€, discounted)[193] over 25 years	
Total discounted capital costs of measures[194]	3,331,587
Total discounted maintenance costs of measures[195]	n.s.
GRAND TOTAL COSTS (€, discounted)	3,354,276

Table 125 – List of measures

Name of measure	Year of implementation	Status	Present value (€, 2014 prices)
Noise barrier, railway section Malacky	2016	planned	3,331,587

2. Benefits

General notes on benefits:

1. Disability-Adjusted Life Years (DALYs) are the sum of the potential years of life lost due to premature death and the equivalent years of "healthy" life lost by virtue of being in states of poor health or disability.

2. The Present Value represents the discounted stream of annual benefits over a 25-year assessment period

The total benefit of the implemented measure is estimated with 6,800 persons less affected by rail noise. Assuming a weighted reduction of affected persons over all 5 dB bands (based on distribution of effected residents from noise mapping in 2008) the following benefit can be expected.

[192] These are the total discounted costs incurred by the relevant implementing authorities in implementing the requirements of the END

[193] These are the total costs of measures to reduce or minimise noise levels

[194] Note that these are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

[195] These are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

Table 126 – Benefits – exposed population[196]

Noise interval	Change in the number of people exposed to noise at the following intervals as a result of noise reduction measures[197]	
	L_{den}	L_{night}
45-49.9 dB(A)	-	- 300
50-54.9 dB(A)	- 1,000	2,000
55-59.9 dB(A)	1,300	2,500
60-64.9 dB(A)	2,600	1,900
65-69.9 dB(A)	2,200	500
70-74.9 dB(A)	700	200
>75.0 dB(A)	400	-
Total	6,200	6,800

As the table above shows, noise reduction measures increased the number of people exposed to noise L_{den} up to 55 dB and 50 dB L_{night}. This is caused by a shift of effected residents to lower dB bands implicated by the measure.

Table 127 – Benefits – annoyance

Change in size of the annoyed population[198]	Rail	DALYs per year
Annoyed[199]	1,700	
Highly Annoyed[200]	684	14

As the table above illustrates, the number of people annoyed can be reduced by 1,700 due to the noise barrier, and the number of people highly annoyed was reduced by 684 people, resulting in a decrease in disease-adjusted life years of 14.

Table 128 – Benefits – sleep disturbance

Change in size of the sleep disturbed population	Rail	DALYs per year	Present Value (€)
Sleep Disturbed	874		
Highly Sleep Disturbed	371	26	31,135,803

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[196] Note that negative numbers indicate an increase in the size of the population exposed to noise at that interval. This is most likely to be due to a reallocation of the population exposed to noise at higher intervals

[197] Note that these include noise reductions that may have been achieved independently of the END. It is not possible to distinguish between noise reductions that may be attributed to END versus noise reductions that may be attributed to other measures.

[198] This is an estimate of the burden of disease from noise-induced annoyance. It reflects the variety of negative responses (e.g. anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation or exhaustion) that people may experience. Noise exposure and annoyance has also been shown to be associated with stress-related psychosocial symptoms such as tiredness, stomach discomfort and stress.

[199] The Present Value represents the discounted stream of annual benefits over a 25-year assessment period

[200] Data below 45dB and above 75dB (L_{den}) were excluded because the risk of unreliable noise data is high at very low levels, whereas the risk of selection of "survivors" is high at very high levels.

Another benefit of the noise barrier at Malacky railway section is that the number of people whose sleep is disturbed has been reduced by 874, and the number of people whose sleep is highly disturbed has been reduced by another 371, corresponding to a decrease in disease-adjusted life years of 26. This decrease is valued at around € 31 M.

The net benefit of the measure for the population along Malacky railway line, assuming that 100% of the benefits can be attributed to END implementation, amounts to:

Net Present Value (€): 44,192,494.

3. Cost Benefit Analysis

Below the measure is valuated regarding the monetary ratio of costs and benefits. The calculation is based on the data provided in the previous chapters.

Barriers / Walls

The Malacky rail noise barrier is planned to be implemented in 2016 or later. The expected cost of the measure in 2006 is calculated with € 6 M. The total number of residents profiting from the measure sums up to about 6,800 out of 16,400 people in the case study area.

Due to the high noise pollution from rail tracks the benefits of the planned noise barrier exceed the costs by a factor of 14. Noise barriers for railway tracks therefore offer a much better cost benefit ratio than barriers along roads.

The costs and benefits shown below present value prices based on 2014.

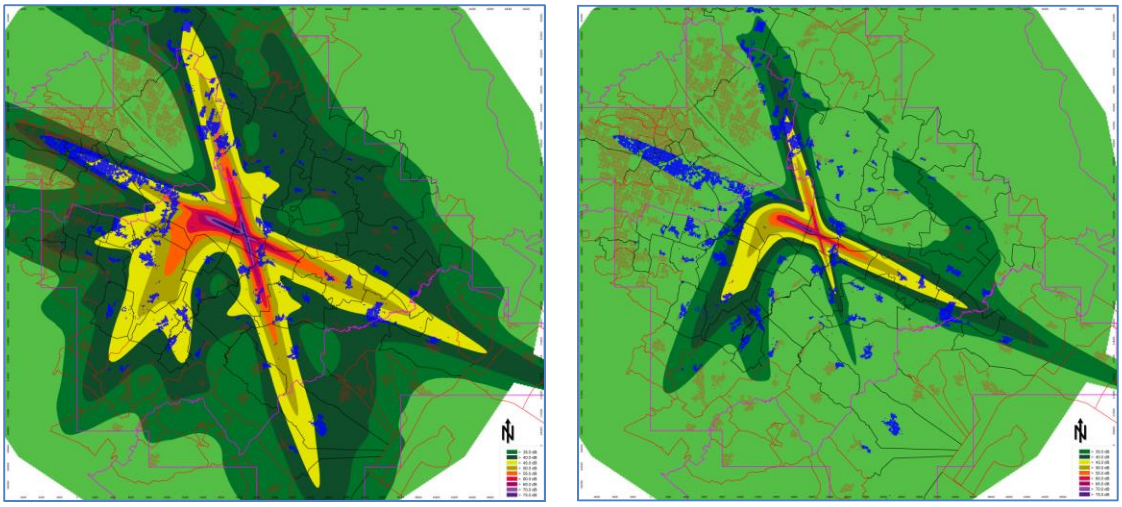
Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
16,400	4.0 million €	56.5 million €	250 €	3,400 €	1 : 14

F.4 AIRPORTS

F.4.1 Case study – Vienna Airport, Austria

Figure 12: Noise maps L_{den} and L_{night} for Vienna Airport

Vienna Airport was chosen as a case study, because the responsible authority has published NAPs for each of the reporting periods (2008 and 2013). Furthermore Vienna Airport is a typical hub airport but with comparatively small noise annoyance in the surrounding area due to its situation in a rural area with mean population density and compared to other hubs Vienna airport is less busy (in terms of aircraft movements). The results of this case study may be transferred to **<u>other airports</u>** **<u>exhibiting similar characteristics</u>**.



1. Measures

The NAP published in 2008 analyses the present noise situation and shows in connection with technical and legal framework in the past implemented noise reduction measures. The NAP does not name any long-term measures for the future. In the short term it is planned to define common regulations for limitations of the operation time together with all MS of the EU (based on 2002/30/EG from March 26th 2002). These restrictions will apply to all European airports (and as such would not result in displacement of movements to other airports).

2. Costs

From the published NAPs which also contain expenditures for actions undertaken prior to the introduction of the END, it was possible to estimate the full costs of existing ongoing noise abatement programs where the full costs of these ongoing measures had not been published. It may be assumed that the published costs cover both the planning and implementation of measures. There are no cost estimates for END implementation available (not published and not provided on request), but taking into account the very simple design of the NAP which didn't include any public participation or wider discussion of measures, we may expect that the costs of END implementation are less than €100,000 which are negligible in comparison to the €27 million to be spent on measures.

Table 129 – Costs

Total costs of END Implementation (€, discounted over a 25 year assessment period)[201]	
Additional staff time, consultants, software, reporting	70,367
Costs of measures (€, discounted)[202] over 25 years	
Total discounted capital costs of measures[203]	21,965,699
Total discounted maintenance costs of measures[204]	-
Costs of measures (€, discounted)[205] over 25 years	
Total discounted capital costs of measures[206]	21,965,699
Total discounted maintenance costs of measures[207]	-
GRAND TOTAL COSTS (€, discounted)	22,036,065.91

From the given information the total costs over a 25-year-assessment period are expected to amount to approximately € 28 million.

Table 130 – List of measures

Name of measure	Year of implementation	Status	Present Value Costs (€, 2014 prices)
Noise related compensation for take-off and landing	2009	implemented	**21,965,699**
Noise optimized departure and arrival procedures	2008	ongoing	
Checking of flight restrictions according *Balanced approach*, described in ICAO resolution A33-7 "Consolidated statement of continuing ICAO policies and practices related to environmental protection"	2008	ongoing	
Passive noise protection (e.g. soundproof windows)	Since 2005	ongoing	

No more details of completion status or costs have been obtained for Vienna Airport.

[201] These are the total discounted costs incurred by the relevant implementing authorities in implementing the requirements of the END

[202] These are the total costs of measures to reduce or minimize noise levels

[203] Note that these are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

[204] These are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

[205] These are the total costs of measures to reduce or minimize noise levels

[206] Note that these are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

[207] These are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

3. Benefits

The benefit of the measures is documented by the results of the Strategic Noise Mapping in 2012.

Table 131: Estimates of the change in the number of people exposed to harmful noise levels[208]

Noise interval	Change in the number of people exposed to noise at the following intervals as a result of noise reduction measures[209]	
	L_{den}	L_{night}
45-49.9 dB(A)	0	0
50-54.9 dB(A)	0	405
55-59.9 dB(A)	732	-105
60-64.9 dB(A)	53	0
65-69.9 dB(A)	-5	0
70-74.9 dB(A)	0	0
Total	**779**	**300**

As the table above shows, noise reduction measures had a significant positive impact on the number of households exposed to noise (L_{den}) exceeding 54.9 dB. However, the number of households exposed above 65 dB L_{den} also increased by 5 (negative number corresponds to an increase in the number of people exposed). The number of households with L_{night} levels above 55 dB also increased by 105 against a total number of affected households of around 15,000 in close proximity to Vienna Airport.

Table 132: Benefits associated with a reduction in the size of the annoyed and highly annoyed population

Change in size of the annoyed population[210]	Aircraft	Total	DALYs per year	Present Value Benefits (€, millions)
Annoyed[211]	490	490	Not applicable*	Not applicable
Highly Annoyed	208	208	4	5

** Note that there are no established disability weights for the annoyed population and therefore it is not possible to calculate DALYs.*

[208] Note that negative numbers indicate an increase in the size of the population exposed to noise at that interval. This is most likely to be due to a reallocation of the population exposed to noise at higher intervals

[209] Note that these include noise reductions that may have been achieved independently of the END. It is not possible to distinguish between noise reductions that may be attributed to END versus noise reductions that may be attributed to other measures.

[210] This is an estimate of the burden of disease from noise-induced annoyance. It reflects the variety of negative responses (e.g. anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation or exhaustion) that people may experience. Noise exposure and annoyance has also been shown to be associated with stress-related psychosocial symptoms such as tiredness, stomach discomfort and stress.

[211] The Present Value represents the discounted stream of annual benefits over a 25-year assessment period

As the table above illustrates, the number of people annoyed was reduced by 490 due to noise reduction measures, and the number of people highly annoyed was reduced by 208 people, resulting in a decrease in disease-adjusted life years of 4. The stated reduction of annoyed and highly annoyed persons is the net result of both a reduction in the 55-65 and an increase in the 65-70 band.

Table 133: Benefits associated with a reduction in the size of the sleep disturbed and highly sleep disturbed population

Change in size of the sleep disturbed population	Aircraft	Total	DALYs per year	Present Value Benefits (€, millions)
Sleep Disturbed	72	72	Not applicable*	Not applicable
Highly Sleep Disturbed	43	43	3	3.65

** Note that there are no established disability weights for the annoyed population and therefore it is not possible to calculate DALYs.*

Another benefit of the noise reduction measures in Vienna is that the number of people whose sleep is disturbed has been reduced by 72, and the number of people whose sleep is highly disturbed has been reduced by another 43, corresponding to a decrease in disease-adjusted life years of 3 per year. This decrease is valued at around € 3.65M over the 25 year assessment period.

The size of the benefits is, however, understated as the most effective noise reduction measure (soundproofing of windows) only has an effect on indoor noise levels which will not be picked up by the strategic noise mapping which is based on external noise measured at the most exposed façade. If we presume, that according to Austrian legislation all residential buildings, which are affected by aircraft noise (exceeding 55 dB by night) will be improved in a way, that no more sleep disturbance may be expected, the benefit will increase by around €45 million over the 25 year assessment period.

Combining information on the total costs and benefits of implementation of measures related to the END at Vienna airport generates a NPV of negative €13.2 million. This is because the measures implemented (at a discounted present value of €21.9 million) result in relatively small improvements. The average cost per person (based on L_{den} only) is in the order of €1,791 and only 12% of the population exposed to L_{den} levels above 55 dB(A) benefits.

4. Cost Benefit Analysis of individual measures

Employed method

Below selected generally effective measures or measure combinations are evaluated in terms of cost and effectiveness in the case study area. Both planned and implemented measures were chosen to show the cost benefit relation of individual measures.

The calculation of costs is based on published noise action plans and interviews with the competent authorities. If no specific costs are available, cost estimates in accordance with recognized procedures and methods were employed (see Appendix E).

The effectiveness of the measures was determined on the basis of measures outlined in the noise action plan in conjunction with recognized procedures set out in Appendix E.

Initially an assessment of the reduction of noise affected people on the basis of 5 dB level classes was carried out. This forms the basis of a monetary evaluation of the reduction of noise damage based on the method described in Appendix D.

CBA of individual measures

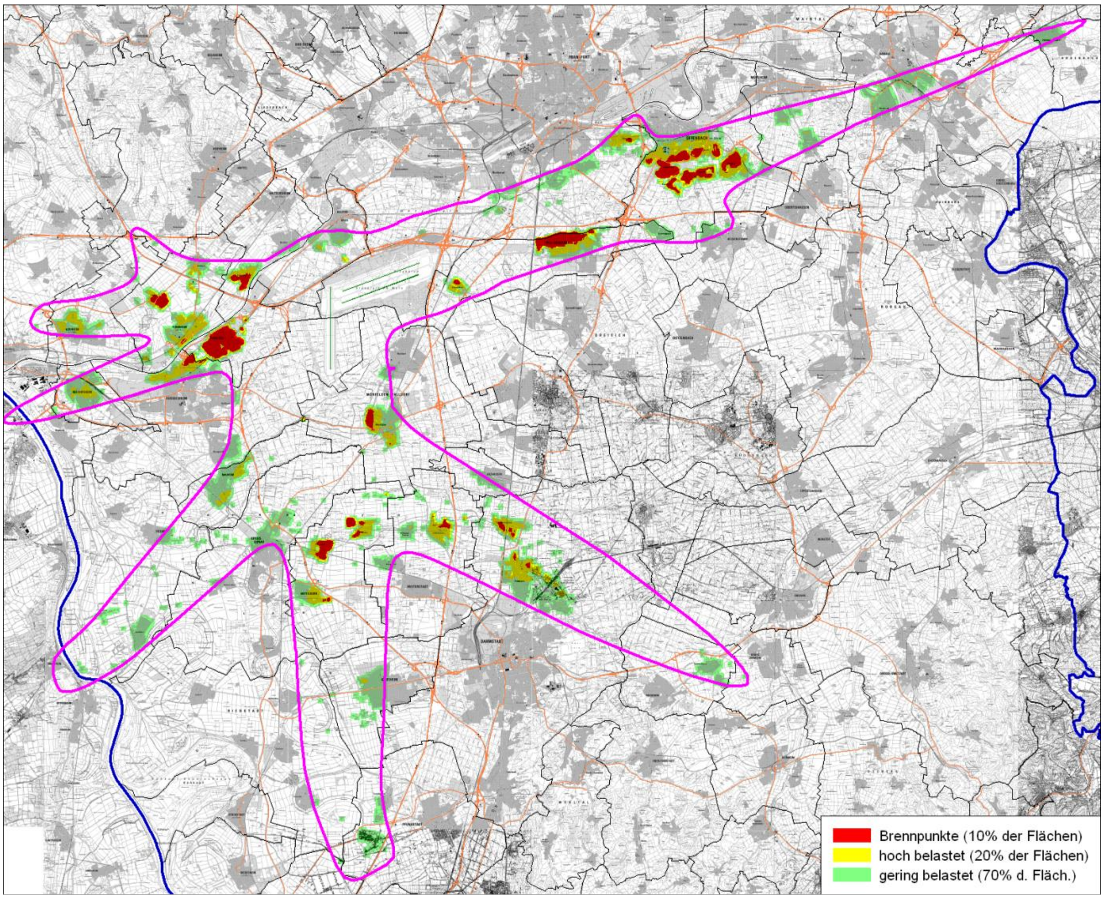
The following table present the results of the CBA performed for an individual measure at Vienna Airport.

Improvement of Windows/ façades					
Eligibility for the campaign was based on limiting noise levels according Austrian law. A total of around 122 applications for renewal were carried out and approximately 244 persons were covered by the campaign. The benefits of measure exceed the costs many times over. The noise proof window/façade campaign at Vienna Airport shows a positive CB-Ratio. The costs and benefits shown below present value prices based on 2014.					
Affected Residents	**Total Present Value Costs**	**Total Present Value Benefits**	**Average present value cost per person**	**Average present value benefit per person**	**CB-Ratio**
244	610.000	2.965.201,13	2.500,00	12.152,46	1 : 4,9

F.4.2 Case study – Frankfurt Airport, Germany

Frankfurt Airport was chosen as a case study because Frankfurt Airport is one of the busiest airports in Europe w2. ith comparatively high noise annoyance given its location in an urban area with high population density. The findings from the case study may be transferred to other major hub airports in Europe.

Figure 13: Detected hotspots of annoyance in the vicinity of Airport Frankfurt / Main



Note: The published NAP analyses the present and the future noise situation and shows in connection with technical and legal framework noise reduction measures, which were already implemented, are planned or are under discussion).

1. Planned and implemented measures

For the purposes of the CBA, it was only possible to include measures associated with the mandatory improvement of the sound insulation in residential buildings (e.g. soundproof windows) in accordance with the German aviation noise regulations (the "Fluglärmgesetz") as for this measure cost estimates were known. There were, however, a large number of measures, including flight or airport management optimizations, implemented over the last ten years, which have, according to the regularly updated noise maps, resulted in improvements. The costs of these measures have not, however, been included in the NAP and are therefore excluded from the analysis.

The improvement of sound insulation of residential buildings is one of the most effective measures in the short term, as noise reduction at source (aircraft) has to be agreed at the international level (ICAO) and require a change in the way in which aircraft fleets are operated.

These changes take much longer to implement and therefore the benefits (in the form of reduced noise levels) are less immediate.

Nevertheless, airports can incentivise the use of quieter aircraft and ban particular types as shown in the table below.

The table below shows the measures and status of implementation together with the total discounted capital costs of measures:

Table 134: List of measures

Name of measure	Year of implementation	Status	Present Value Costs (€, 2014 prices)
Restrictions for flights at night time	2004/2012	implemented	7,031,378
Restrictions for flight routes at night time	2007	implemented	
Noise related compensation for take-off and landing	2013/2014	implemented	
Noise optimized departure and arrival procedures	2007/2012	implemented	
Noise monitoring and tracking of distinctive noise events	2012	implemented	
Passive noise protection (e.g. soundproof windows)	ongoing since 2012	underway	5,417,685

Note – in Germany, it is common that cost estimates for groups of measures are provided rather than for individual measures.

The following chapters shows the costs and benefits of passive and active noise measures planned or implemented at Frankfurt airport.

2. Passive noise reduction measures

Costs

From interviews and additional written details from the responsible authority it was possible to interpolate costs for staff, consultants, public participation and the noise reduction measure itself. The costs are for the most part related to passive noise reduction and/or ventilation measures according to the 'Fluglärmgesetz' such as noise optimized windows.

The table below shows the accruing costs for END implementation and implemented passive noise measures.

Table 135: Costs

Total costs of END Implementation (€, discounted over a 25-year assessment period)[212]	
Staff Costs	2,244,442[213]
Consultants	37,617
Creation of the NAP draft, inventory	140,267
Creation of the NAP (Evaluation of questionnaires, publications, reporting)	178,522
Costs of measures (€, discounted)[214] over 25 years	
Total discounted capital costs of measures[215]	5,417,685
Total discounted maintenance costs of measures	-
GRAND TOTAL COSTS (€, discounted)	**8,018,533**

The total discounted costs over a 25-year-assessment period for passive noise measures are expected to amount to over € 10M.

Benefits

Table 136: Estimates of the change in the number of people exposed to harmful noise levels

Noise interval	Change in the number of people exposed to noise at the following intervals as a result of noise reduction measures[216]	
	L_{den}	L_{night}
45-49.9 dB(A)	0	0
50-54.9 dB(A)	0	34 652
55-59.9 dB(A)	0	1 514
60-64.9 dB(A)	0	0
65-69.9 dB(A)	0	0
70-74.9 dB(A)	0	0
Total	**0**	**36,166**

[212] These are the total costs incurred by the relevant implementing authorities in implementing the requirements of the END, discounted over a 25-year assessment period

[213] The responsible authority provided an estimate of 119, 000 hours and total personal costs between 2011 and 2015 of €3.1 million. The staff costs include the management of the measure "Passive noise protection at residential buildings" and the processing of 11,000 challenges from public participation.

[214] These are the total costs of measures to reduce or minimise noise levels

[215] Note that these are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

[216] Note that these include noise reductions that may have been achieved independently of the END. It is not possible to distinguish between noise reductions that may be attributed to END versus noise reductions that may be attributed to other measures.

Based on this information, and using established dose-response relationships for each of annoyance and sleep disturbance, the change in the size of the population that is sleep disturbed or highly sleep disturbed is estimated and the change in the *highly* sleep disturbed population valued in terms of DALYs (see Table 4).

Table 4 – Benefits associated with a reduction in the size of the sleep disturbed and highly sleep disturbed population

Change in size of the sleep disturbed population	Total	DALYs per year from a reduction in noise	Present Value Benefits (€, millions)
Sleep Disturbed	5,206	Not applicable*	Not applicable
Highly Sleep Disturbed	3,235	226	223

** Note that there are no established disability weights for the sleep disturbed population and therefore it is not possible to calculate DALYs.*

The present value represents the discounted value of DALYs over a 25-year assessment period. Note that this is a reflection of the value with the current range of measures in place. It does not take account of additional measures that could potentially be identified in future NAPs (and then implemented).

Another benefit of the noise reduction measures in Frankfurt Germany is that the number of people whose sleep is disturbed has been reduced by 5,206, and the number of people whose sleep is highly disturbed has been reduced by another 3,235, corresponding to a decrease in disability-adjusted life years of 226 per year. This decrease is valued at € 223 million over a 25 year assessment period.

The benefit of the passive noise reduction measures at Frankfurt airport amounts to:

Net Present Value (€): 208,388,541.

3. Active noise reduction measures

Costs

The airport estimates the costs for active noise reduction measures implemented between Round 1 and 2 are €1.5 M per year (2008-2011). In 2012 the costs amount to about € 4.2 M. This adds up to a total discounted cost (based on 2014) of € 8.5 M over a period of 5 years.

Benefits

Using information from the Strategic Noise Maps produced under each of the first and second rounds of reporting (2007 and 2012 respectively), it is possible to determine the change in the number of people exposed to noise levels above 55 dB L_{den} and 50 dB L_{night} at Frankfurt Airport (see Table 3).

Table 137: Estimates of the change in the number of people exposed to harmful noise levels

Noise interval	Change in the number of people exposed to noise at the following intervals as a result of noise reduction measures[217]	
	L_{den}	L_{night}
45-49.9 dB(A)	0	0
50-54.9 dB(A)	0	33,158
55-59.9 dB(A)	3,211	2,053
60-64.9 dB(A)	13,211	0
65-69.9 dB(A)	0	0
70-74.9 dB(A)	0	0
Total	**16,421**	**35,211**

Based on this information, and using established dose-response relationships for each of annoyance and sleep disturbance, the change in the size of the population that is highly annoyed or highly sleep disturbed is estimated and the change in the *highly* annoyed and *highly* sleep disturbed population valued in terms of DALYs (see Tables 5 and 6).

Table 138: Benefits associated with a reduction in the size of the annoyed and highly annoyed population

Change in size of the annoyed population	Total	DALYs per year as a result of noise reduction	Present Value Benefits (€, millions)
Annoyed	12,738	Not applicable*	Not applicable
Highly Annoyed	6,294	126	124

** Note that there are no established disability weights for the annoyed population and therefore it is not possible to calculate DALYs.*

As the table above illustrates, the number of people annoyed was reduced by 12,738 due to noise reduction measures, and the number of people highly annoyed was reduced by 6,294 people, resulting in a decrease in disability-adjusted life years (for the highly annoyed population) of 126 per year.

The present value represents the discounted value of DALYs over a 25-year assessment period. Note that this is a reflection of the value with the current range of measures in place. It does not take account of additional measures that could potentially be identified in future NAPs (and then implemented).

[217] Note that these include noise reductions that may have been achieved independently of the END. It is not possible to distinguish between noise reductions that may be attributed to END versus noise reductions that may be attributed to other measures.

Table 139 – Benefits associated with a reduction in the size of the sleep disturbed and highly sleep disturbed population

Change in size of the sleep disturbed population	Total	DALYs per year from a reduction in noise	Present Value Benefits (€, millions)
Sleep Disturbed	9,680	Not applicable*	Not applicable
Highly Sleep Disturbed	6,022	422	416

** Note that there are no established disability weights for the sleep disturbed population and therefore it is not possible to calculate DALYs.*

Another benefit of the noise reduction measures in Frankfurt Germany is that the number of people whose sleep is disturbed has been reduced by 9,680, and the number of people whose sleep is highly disturbed has been reduced by another 6,022, corresponding to a decrease in disability-adjusted life years of 422 per year. This decrease is valued at € 416 million over the 25 year assessment period.

The estimate of the total value of the beneficiary population that lives within the vicinity of Frankfurt is however considered to be understated for the following reasons:

- The tables above show changes in number of households and population affected above 55 dB (L_{den}) and 50 dB (L_{night}). These are the limits set to fulfil the minimum requirement for Strategic Noise Mapping and do not allow the conclusion of no effects at lower noise levels. More simply, the benefit estimates do not take account of those who may previously (prior to the END) have experienced noise levels at or below 55 dB L_{den} or 50 dB L_{night} and who have since experienced a further reduction in noise levels as a result of the END.

- The stated benefits do not take account of the effects of one of the most widespread and effective noise reduction measures (soundproofing of buildings). This is because strategic noise mapping measures noise at the most exposed façade of the building and therefore cannot take account of measures that improve indoor noise levels. If we assume that (in accordance with German legislation) all residential buildings that are affected by aircraft noise (exceeding 55 dB by night at the external façade) are sound-proofed such that no more sleep disturbance may be expected, the benefit will increase by approximately €10 million per year.

This benefit can easily calculated by reducing the number of affected persons in the 5 dB-band to 0, as after implementation of ventilation and improved windows and façades the indoor level will be reduced by at least 15 dB(A). This will lead to indoor levels, which will not cause sleep disturbance due to aircraft noise anymore.

The benefit of the active noise reduction measures at Frankfurt airport amounts to:

Net Present Value (€): 814,868,622.

4. Cost Benefit Analysis of individual measures

Employed method

Below selected generally effective measures or measure combinations are evaluated in terms of cost and effectiveness in the case study area. Both planned and implemented measures were chosen to show the cost benefit relation of individual measures.

The calculation of costs is based on published noise action plans and interviews with the competent authorities. If no specific costs are available, cost estimates in accordance with recognized procedures and methods were employed (see Appendix D).

The effectiveness of the measures was determined on the basis of measures outlined in the noise action plan in conjunction with recognized procedures set out in Appendix D.

Initially an assessment of the reduction of noise affected people on the basis of 5 dB level classes was carried out. This forms the basis of a monetary evaluation of the reduction of noise damage based on the method described in Appendix E.

CBA of individual measures

The following tables present the results of the CBA performed for individual measures at Frankfurt Airport.

Improvement of Windows/Facades

Eligibility for the campaign was based on limiting noise levels according German law (Fluglärmgesetz). A total of around 1600 applications for funding were received and approximately 3176 persons were covered by the campaign.

The benefits of measure exceed the costs many times over. The noise proof window/fassade campaign at Frankfurt Airport shows one of the best CB-Ratio of all assessed measures.

The costs and benefits shown below present value prices based on 2014.

Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
3,176	10.3 M €	322.9 M €	3,240 €	101,000 €	1: 31

Combination of all planned and implemented measures (low noise routing, flight restriction by night, land use planning, quietest practicable aircraft operations) including strategic Noise mapping and noise action planning

The NAP for Frankfurt Airport describes many activities and efforts of the airport operator, the communities in the surrounding of the airport and the responsible authorities. Besides research on optimized aircraft operations and health effects also an ongoing process of a dialog with affected inhabitants and representatives of communities were started many years ago.

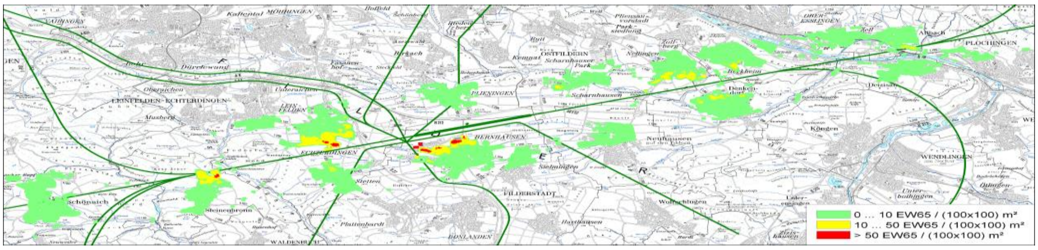
The costs and benefits shown below present value prices based on 2014.

Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio
240,000	21 M €	910 M €	88 €	3791	1: 43

F.4.3 Case study – Stuttgart Airport, Germany

Stuttgart Airport is a typical single runway airport, with comparatively small noise annoyance in the surrounding due to its situation in a rural area with mean population density. From the results of the case study we may expect transferable knowledge for other **European single runway airports**.

Figure 14: Detected hotspots in the vicinity of Stuttgart Airport



The published NAP analyses the present and the future noise situation and shows in connection with technical and legal framework noise reduction measures, which were already implemented, or are planned or are in discussion.

1. Planned and implemented measures

For the purposes of the CBA, it was only possible to include measures associated with the mandatory improvement of the sound insulation in residential buildings (e.g. soundproof windows) for the same reasons as for the Frankfurt airport.

The table below shows the measures and status of implementation together with the total discounted capital costs of measures:

Table 140: List of measures

Name of measure	Year of implementation	Status	Present Value Costs (€, 2014 prices)
Restrictions for flights at night time	2004/2012	implemented	120,362
Restrictions for flight routes at night time	2007	implemented	
Noise related compensation for take-off and landing	2013/2014	implemented	
Noise optimized departure and arrival procedures	2007/2012	implemented	
Noise monitoring and tracking of distinctive noise events	2012	implemented	
Improvement of windows and installation of ventilation	2013 ongoing	underway	54,366

2. Costs

From interviews and additional written details from the responsible authority it was possible to interpolate costs for staff, consultants, public participation and the noise reduction measure itself.

The table below shows the accruing costs for END implementation and implemented measures:

Table 141: Costs

Total costs of END Implementation (€, discounted over a 25 year assessment period)[218]	
Additional staff time	91,888
Noise mapping	9,484
Technical consultant	15,315
Public consultation	3,676
Costs of measures (€, discounted)[219] over 25 years	
Total discounted capital costs of measures[220]	54,366
Total discounted maintenance costs of measures[221]	-
GRAND TOTAL COSTS (€, discounted)	**174,727.96**

The bulk of expenditure at Stuttgart Airport to additional staff time and consultant costs. The total costs of measures over a 25-year-assessment period are expected to amount to just under €175,000.

3. Benefits

Based on the Strategic Noise Maps of the 1st round (2007) the change of affected people until 2012 was estimated. This was necessary, as the airport was not mapped in the second round of strategic noise mapping. The reason was that there were nearly the same number of movements and mix of aircrafts operating at the airport, so that the estimated small improvement of the noise situation did not justify a repeated calculation of the strategic noise indices.

Based on these estimated small "number of people affected in 5 dB noise bands" the "Change in number of households" affected by aircraft noise and the monetized change in "annoyance" and "sleep disturbance" can be calculated.

Based on this information, and using established dose-response relationships for each of annoyance and sleep disturbance, the change in the size of the population that is highly annoyed or highly sleep disturbed is estimated and the change in the *highly* annoyed and *highly* sleep disturbed population valued in terms of DALYs (see Tables 4 and 5).

[218] These are the total discounted costs incurred by the relevant implementing authorities in implementing the requirements of the END

[219] These are the total costs of measures to reduce or minimise noise levels

[220] Note that these are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

[221] These are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

The following tables show the benefit in detail:

Table 142: Estimates of the change in the number of people exposed to harmful noise levels

Noise interval	Change in the number of people exposed to noise at the following intervals as a result of noise reduction[222]	
	L_{den}	L_{night}
45-49.9 dB(A)	0	0
50-54.9 dB(A)	0	0
55-59.9 dB(A)	0	50
60-64.9 dB(A)	0	0
65-69.9 dB(A)	100	0
70-74.9 dB(A)	0	0
Total	**100**	**50**

As the table above shows, noise reduction due to measures had an impact on the number of people exposed to noise (L_{den}) exceeding 65 dB and on the number of people exposed to noise (L_{night}) exceeding 55 dB. This is in fact a small reduction against the total population affected by aircraft noise around Stuttgart Airport of 44,200 people.

Table 143: Benefits associated with a reduction in the size of the annoyed and highly annoyed population

Change in size of the annoyed population	Total	DALYs per year	Present Value Benefits (€)
Annoyed	54	Not applicable*	Not applicable
Highly Annoyed	32	1	622,290

** Note that there are no established disability weights for the annoyed population and therefore it is not possible to calculate DALYs.*

As the table above illustrates, the number of people annoyed was reduced by 54 due to noise reduction measures, and the number of people highly annoyed was reduced by 32 people, resulting in a decrease in disability-adjusted life years of 1 per year.

Table 144: Benefits associated with a reduction in the size of the sleep disturbed and highly sleep disturbed population

Change in size of the sleep disturbed population	Total	DALYs per year	Present Value Benefits (€)
Sleep Disturbed	9	Not applicable*	Not applicable
Highly Sleep Disturbed	6	0.426	420,438

** Note that there are no established disability weights for the sleep disturbed population and therefore it is not possible to calculate DALYs.*

[222] Note that these include noise reductions that may have been achieved independently of the END. It is not possible to distinguish between noise reductions that may be attributed to END versus noise reductions that may be attributed to other measures. These numbers do not, however, include the effects of sound-proofing and improved ventilation systems.

Another benefit of noise reduction measures for Stuttgart Airport is that the number of people whose sleep is disturbed has been reduced by 9, and the number of people whose sleep is highly disturbed has been reduced by another 6, corresponding to a decrease in disability-adjusted life years of 153. This decrease is valued at around € 420,000.

On the basis of the available information, the total Net Present Value is estimated to be around €2.4 million over the 25 year assessment period. This is, however, believed to understate the level of benefits as the most effective reduction measure "improvement of the sound insulation" only improves the indoor noise level and will not affect the (outdoor based) strategic noise indicators (at the most exposed facade). Therefore the real benefit in particular on reduction of sleep disturbance (which correlates with noise levels at the ear of the sleeper) is underestimated.

If we presume that according to German legislation all residential buildings, which are affected by aircraft noise (exceeding 55 dB by night) will be improved in a way, that no more sleep disturbance may be expected, the benefit will increase by around €1.4 million per year.

4. Cost Benefit Analysis of individual measures

Employed method

Below selected generally effective measures or measure combinations are evaluated in terms of cost and effectiveness in the case study area. Both planned and implemented measures were chosen to show the cost benefit relation of individual measures.

The calculation of costs is based on published noise action plans and interviews with the competent authorities. If no specific costs are available, cost estimates in accordance with recognized procedures and methods were employed (see Appendix D).

The effectiveness of the measures was determined on the basis of measures outlined in the noise action plan in conjunction with recognized procedures set out in Appendix D.

Initially an assessment of the reduction of noise affected people on the basis of 5 dB level classes was carried out. This forms the basis of a monetary evaluation of the reduction of noise damage based on the method described in Appendix E.

CBA of individual measures

The following table present the results of the CBA performed for an individual measure at Stuttgart Airport.

Improvement of Windows/ façades

Eligibility for the campaign was based on limiting noise levels according German law. A total of around 25 applications for renewal were carried out and approximately 50 persons were covered by the campaign.

The benefits of measure exceed the costs many times over. The noise proof window/façade campaign at Vienna Airport shows a positive CB-Ratio.

The costs and benefits shown below present value prices based on 2014.

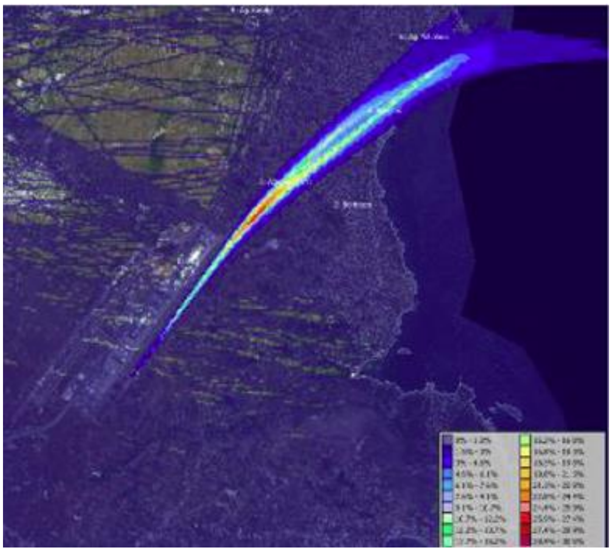
Effected Residents	Total Present Value Costs	Total Present Value Benefits	Average present value cost per person	Average present value benefit per person	CB-Ratio

50	66.144,79	607.623,18	1.322,90	12.152,46	1: 9.2

F.4.4 Case study 4 – Athens Airport, Greece

Athens International Airport is a typical south European major 2-runways airport, with comparatively small noise annoyance in the surrounding due to its situation in a rural area with mean population density and close to the sea. From the results of the case study we may expect transferable knowledge for other **European 2- runway airports**.

Figure 1: Detected take-off movements in the vicinity of Athens



The published NAPs from 2007 and 2012 analyses the present noise situation and shows implemented noise reduction measures at the airport. Most of the measures are operational noise abatement procedures, which have been established prior to the operation of the airport in cooperation with the Helenic Civil Aviation Authority. The procedures have been published in the AIP Greece and include measures concerning runway use including restrictions during night, the aircraft engine testing and Auxiliary Power Unit (APU) usage.

Planned and implemented measures

For the purposes of the CBA, only measures planned or implemented within the first and second round strategic noise mapping according END will be considered.

The table below shows the measures and status of implementation together with the total discounted capital costs of measures:

Table 145: List of measures

Name of measure	Year of implementation	Status	Present Value Costs (€, 2014 prices)
Flight restrictions for quiet noise marginally accepted Chapter 3 aircrafts on runway 03R for take-off and runway 21 L for landing	2010	implemented	Not published
Flight restrictions for military aircrafts on runway 03R for take-off and runway 21 L for landing	2011	implemented	Not published
Implementation of noise reducing take-off and landing procedures (unless necessary for safety reasons)	2011	implemented	Not published

1. Costs

Based on an interview with the responsible consultant for the preparation of the NAPs and knowledge about the comparable costs at other airports the total costs for staff, consultants, public participation and the noise reduction measure itself were estimated.

The table below shows the accruing costs for END implementation and implemented measures:

Table 146: Costs

Total costs of END Implementation (€, discounted over a 25 year assessment period)[223]	
Additional staff time	51,776
Consultants	
(Mapping) Software	
Reporting	
Costs of measures (€, discounted)[224] over 25 years	
Total discounted capital costs of measures[225]	523,979 (assumed to be 10% of Frankfurt airport costs)
Total discounted maintenance costs of measures[226]	-
GRAND TOTAL COSTS (€, discounted)	575,755.17

2. Benefits

Based on the Strategic Noise Maps of the 1st round (2007) and the 2nd round (2012) it is not possible to quantify exactly the effects of the implemented measures within this period, as there was also a general decrease of flight movements due to economic crisis.

The table below show the change of aircraft group specific movements which ends in an overall reduction of about 15.000 movements per year.

Table 147: aircraft group specific movements in 2006 and 2011

SNM	P1	P 2.1	P 2.2	S 5.1	S 5.2	S 5.3	S 6.1	S 6.2	S 6.3	S 7	TOTAL YEAR
2006	4.805	39.134	399	25.662	97.100	3.953	10.667	176	2.395	303	**184.594**
	2.6%	21.2%	0.2%	13.9%	52.6%	2.1%	5.8%	0.1%	1.3%	0.2%	**100.0%**
2011	1.807	38.284	347	12.963	108.323	496	6.242	366	376	269	**169.473**
	1.1%	22.6%	0.2%	7.6%	63.9%	0.3%	3.7%	0.2%	0.2%	0.2%	**100.0%**

NB * military and other special flights as well as helicopters are not included

Nevertheless compared to the noise situation in 2006 a significant decrease of affected persons in the surrounding of the airport can be recognized.

[223] These are the total discounted costs incurred by the relevant implementing authorities in implementing the requirements of the END

[224] These are the total costs of measures to reduce or minimise noise levels

[225] Note that these are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

[226] These are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

Table 148: Distribution of affected residents at Athens Airport 2011

NOISE ZONE		DISTRIBUTION OF REAL POPULATION IN NOISE ZONES FOR L_{den}	
from	To	No of residents	No of residents in hundreds
55	60	9.605	96
60	65	1.320	13
65	70	0	0
70	75	0	0
	>75	0	0

NOISE ZONE		DISTRIBUTION OF REAL POPULATION IN NOISE ZONES FOR L_{night}	
from	to	No of residents	No of residents in hundreds
50	55	1435	14
55	60	0	0
60	65	0	0
	>65	0	0

Table 149: Distribution of affected residents at Athens Airport 2006

NOISE BUFFER ZONE		DISTRIBUTION OF REAL POPULATION PER NOISE INDEX (%)	
from	to	Lden	
	<55	49.394	76,7%
55	60	12.676	19,7%
60	65	2.294	3,6%
65	70	0	0,0%
70	75	0	0,0%
	>75	0	0,0%
TOTAL OF REAL POPULATION for the urban land uses of the study area		64.364	100,0%
NOISE BUFFER ZONE		DISTRIBUTION OF REAL POPULATION PER NOISE INDEX (%)	
from	to	Lnight	
	<50	59.654	92,7%
50	55	4.518	7,0%
55	60	192	0,3%
60	65	0	0,0%
	>65	0	0,0%
TOTAL OF REAL POPULATION for the urban land uses of the study area		64.364	100,0%

Using this noise data, and using established dose-response relationships for each of annoyance and sleep disturbance, the change in the size of the population that is highly annoyed or highly sleep disturbed is estimated and the change in the *highly* annoyed and *highly* sleep disturbed population valued in terms of DALYs. The following tables show the benefit in detail:

Table 6: Estimates of the change in the number of people exposed to harmful noise levels

Noise interval	Change in the number of people exposed to noise at the following intervals as a result of noise reduction[227]	
	L_{den}	L_{night}
45-49.9 dB(A)	-	-
50-54.9 dB(A)	0	3083
55-59.9 dB(A)	3071	192
60-64.9 dB(A)	974	0
65-69.9 dB(A)	-	-
70-74.9 dB(A)	-	-
Total	**4045**	**3275**

As the table above shows, noise reduction due to measures and general reduction of number of flight movements had an impact on the number of people exposed to noise (L_{den}) exceeding 55 dB and on the number of people exposed to noise (L_{night}) exceeding 50 dB. This is in fact a significant reduction against the total population affected by aircraft noise around Athens Airport of 14,970 people.

Table 7: Benefits associated with a reduction in the size of the annoyed and highly annoyed population

Change in size of the annoyed population	Total	DALYs per year	Present Value Benefits (€)
Annoyed	1.417	Not applicable*	Not applicable
Highly Annoyed	631	13	18.005.509

** Note that there are no established disability weights for the annoyed population and therefore it is not possible to calculate DALYs.*

As the table above illustrates, the number of people annoyed was reduced by 1,417 due to noise reduction measures and general decrease of flight movements, and the number of people highly annoyed was reduced by 631 people, resulting in a decrease in disability-adjusted life years of 13 per year.

Table 150: Benefits associated with a reduction in the size of the sleep disturbed and highly sleep disturbed population

Change in size of the sleep disturbed population	Total	DALYs per year	Present Value Benefits (€)
Sleep Disturbed	474	Not applicable*	Not applicable
Highly Sleep Disturbed	295	21	20,361,207

** Note that there are no established disability weights for the sleep disturbed population and therefore it is not possible to calculate DALYs.*

[227] Note that these include noise reductions that may have been achieved independently of the END. It is not possible to distinguish between noise reductions that may be attributed to END versus noise reductions that may be attributed to other measures. These numbers do not, however, include the effects of sound-proofing and improved ventilation systems.

Another benefit of noise reduction measures for Athens Airport is that the number of people whose sleep is disturbed has been reduced by 474, and the number of people whose sleep is highly disturbed has been reduced by another 295, corresponding to a decrease in disability-adjusted life years of 21 per year. This decrease is valued at just over € 20 m over the 25 year assessment period.

On the basis of the available information, the total Net Present Value is estimated to be around €98 million over the 25 year assessment period. This is, however, significantly influenced by a decrease of flight movements in the past. This effect is not caused by the implemented noise reduction measures itself.

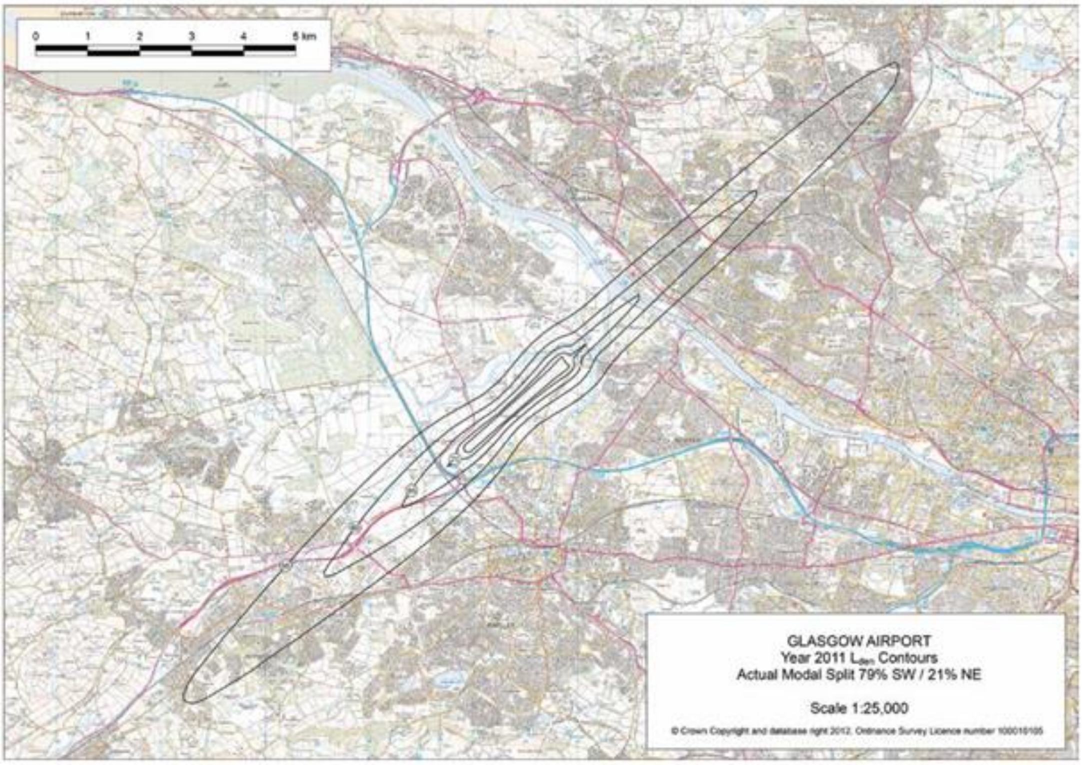
3. Cost Benefit Analysis of individual measures

A reliable statement of a CB-ratio of single measures or combinations of measures is not possible due to data deficiencies in the database at Athens Airport and the fact that the noise reductions after implementation of measures are significantly influenced by a reduction of flight movements due to economic reasons (i.e. the economic crisis in Greece).

F.4.5 Case study 5 – Glasgow Airport, UK

Glasgow Airport was chosen as a case study because it is a good example for a remote but at the same time very frequented airport. Glasgow airport handles 7 to 8 million passengers per year serving the Glasgow area but also providing transatlantic connections. Located 11 km west of Glasgow city centre it still affects some urban areas of the city. The findings from the case study may be transferred to other regional airports in Europe.

The airport has published NAPs for Round 1 and 2 of the END. All noise abatements measures of NAP 2008-2012 were implemented by the year 2012. Further measures and ongoing efforts are outlined in the NAP 2013-2018.



Lden Noise Map Glasgow Airport 2011, Source: Draft Noise Action Plan 2013-2018, Aug. 2013

1. Costs

The total cost of END implementation incurred from 2008 onwards is presented in Table 1 below. The bulk of expenditure of implementation of the END for Glasgow Airport relates to staff, computer and equipment costs. The costs of measures were not provided as separate costs although a general statement on the investment in improvements was obtained.

The following information on investment in improvements was obtained:

> '*Since 2006, more than £60 million has been invested in developing and improving Glasgow Airport to create an airport of which Glasgow and Scotland can be proud. This is an on-going process which is being undertaken at no cost to the taxpayer. It is anticipated that over £200 million will be invested over the next 1O years to build on these improvements'* (Glasgow Airport Draft Master Plan 2011"; "draft-master-plan-web-small-4.pdf", page 28).

The total costs over a 25-year-assessment period are expected to amount to approximately € 128,000.

Table 151 – Costs

Total costs of END Implementation (€, discounted)[228]	
Staff Costs	49,091
Computer Costs	26,509
Equipment Costs	19,636
Publications	4,909
Fines	982
Costs of measures (€, discounted)[229] over 25 years	
Total discounted capital costs of measures[230]	5,755,179
Total discounted maintenance costs of measures[231]	-
GRAND TOTAL COSTS (€, discounted)	5,856,305.65

[228] These are the total discounted costs incurred by the relevant implementing authorities in implementing the requirements of the END
[229] These are the total costs of measures to reduce or minimise noise levels
[230] Note that these are total estimated costs taken from published NAP
[231] These are total discounted costs (i.e. total projected costs discounted over a 25-year assessment period)

The following table presents the measures taken on the basis of the noise action plans 2008 and 2012.

Table 152 – List of measures

Name of measure	Year of implementation	Status	Present value (€, 2014 prices)
Quietest Fleet Practicable	2009	completed	-
Quietest practicable aircraft operations, balanced against NOX and CO2 emissions	2008	partly completed /underway	-
Effective and credible noise mitigation schemes	2008	ongoing	-
Engage with communities affected by noise impacts to better understand their concerns and priorities, reflecting them as far as possible in airport noise strategies and communication plans	2008	On-going	-
Influencing planning policy to minimise the number of noise sensitive properties around our airports	2008	On-going	-
Organising ourselves to manage noise efficiently and effectively	2008	On-going	-
Achieving a full understanding of aircraft noise to inform our priorities, strategies and targets	2008	On-going	-
Aircraft technology	2012	On-going	-
Quieter operation procedure	2012	On-going	-
Noise insulation and land use planning	2012	On-going	-
Operating restrictions	2012	On-going	-

All measures listed above are underway; however the degree of completion is unknown as most of the actions are on-going management efforts and organisational changes. This means that the impact of many of these measures will only materialise in the future, and the benefits presented further below need to be interpreted in that context.

2. Benefits

Using information from the Strategic Noise Maps produced under each of the first and second rounds of reporting, it is possible to determine the change in the number of people exposed to noise levels above 55 dB L_{den} and 50 dB L_{night}, as presented in table 3.

Table 153 – Benefits – exposed population

Noise interval	Change in the number of households exposed to noise at the following intervals as a result of noise reduction measures[232]	
	L_{den}	L_{night}
45-49.9 dB(A)	-	-
50-54.9 dB(A)	-	-
55-59.9 dB(A)	26,950	21,100
60-64.9 dB(A)	8,550	1,550
65-69.9 dB(A)	400	-
70-74.9 dB(A)	-	-
>75.0 dB(A)	-	-
Total	35,900	22,650

As the table above shows, the impact of noise reduction measures on the number of people exposed to noise (L_{den} and L_{night}) up to 54.9 dB was not estimated, but did reduce the number of people exposed above 54.9 dB by about 35,900 overall against a total affected population of about 68,000 in the study area.

Based on this information, and using established dose-response relationships for annoyance and sleep disturbance, the changed numbers of people highly annoyed or highly sleep disturbed is estimated and valued in terms of DALYs (see tables 152 and 153).

Table 154 – Benefits – annoyance

Change in size of the annoyed population[233]	Aircraft	Total	DALYs per year	Present Value (€)
Annoyed[234]	12,657	12,657	n/a	n/a
Highly Annoyed[235]	5,668	5,668	113	111,833,249

[232] Note that these include noise reductions that may have been achieved independently of the END. It is not possible to distinguish between noise reductions that may be attributed to END versus noise reductions that may be attributed to other measures.

[233] This is an estimate of the burden of disease from noise-induced annoyance. It reflects the variety of negative responses (e.g. anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation or exhaustion) that people may experience. Noise exposure and annoyance has also been shown to be associated with stress-related psychosocial symptoms such as tiredness, stomach discomfort and stress.

[234] The Present Value represents the discounted stream of annual benefits over a 25-year assessment period

[235] Data below 45dB and above 75dB (L_{den}) were excluded because the risk of unreliable noise data is high at very low levels, whereas the risk of selection of "survivors" is high at very high levels.

As the table above illustrates, the number of people annoyed was reduced by 12,657 due to noise reduction measures, and the number of people highly annoyed was reduced by 5,668 people, resulting in a decrease in disease-adjusted life years of 113 per year and is valued at € 112m over 25 years..

Table 155 – Benefits – sleep disturbance

Change in size of the sleep disturbed population	Aircraft	Total	DALYs per year	Present Value (€)
Sleep Disturbed	4,323	4,323	n/a	n/a
Highly Sleep Disturbed	2,822	2,822	198	194,860,300

Another benefit of the noise reduction measures for Glasgow Airport is that the number of people whose sleep is disturbed could be reduced by 4,323, and the number of people whose sleep is highly disturbed has been reduced by another 2,822. This corresponds to a decrease in disease-adjusted life years of 198 and is valued at € 282 M.

Another benefit of the noise reduction measures for Glasgow Airport is that the number of people whose sleep is disturbed could be reduced by 4,323, and the number of people whose sleep is highly disturbed has been reduced by another 2,822. This corresponds to a decrease in disease-adjusted life years of 198 per year and is valued at € 282m over 25 years.

Table 6 – Benefits – Hypertension

	DALYs per year	Present Value (€)
Change in the number of DALYs per year resulting from hypertensive heart disease and attributable to transport noise[236]	34	3,733,107
Total value of avoided DALYs from a reduction in the incidence of noise-induced hypertensive heart disease		33,184,835

The benefit of the END implementation for the population around Glasgow Airport amounts to:

Net Present Value (€): 334,022,079.

3. Cost Benefit Analysis of individual measures

The database at Glasgow Airport does not allow a reliable statement of a CB-ratio of single measures or combinations of measures is not possible.

[236] The change in DALYs is calculated as the % of all DALYs from hypertensive heart disease in the relevant Member State that can be attributed to environmental noise. The Present Value is the number of DALYs multiplied by the value of a DALY

APPENDIX G - CHALLENGES IN IMPLEMENTING THE REVISED ANNEX II (DIRECTIVE 2015/996) AND THE EXTENT OF TECHNICAL AND SCIENTIFIC PROGRESS

The terms of reference for this study set out a number of questions relating to assessing progress towards the objective of a common approach. One of the main elements of a common approach, although by no means the only one, was the development of common noise assessment methods through CNOSSOS. In this annex, we review the following:

- The development of the CNOSSOS methodology - and examination of the extent to which the common noise assessment method was adapted to technical and scientific progress.
- Outstanding challenges in implementing the revised Annex II, Directive 2015/996 based on the CNOSSOS methodology.
- Implementation challenges – strategic noise mapping.

The development of CNOSSOS – and extent to which the common noise assessment method was adapted to technical and scientific progress

In addressing EQ7(a), the following question has been considered: **EQ7e - Has the Directive been adapted to technical and scientific progress?** There is a requirement in the END to take into account state of the art and technical and scientific developments in the development of common noise assessment methods[237]. This is relevant in particular to the revision of Annex II (common noise assessment methods) and Annex III (assessment methods for harmful effects).

The assessment of the extent to which the development of a common approach has taken into account technical and scientific progress drew on stakeholder feedback from the interviews and desk research to review the process of developing CNOSSOS (how it was organised, the extent to which relevant expertise was drawn upon etc.).

The development of the CNOSSOS-EU methodology was the result of **in-depth technical consultation between relevant stakeholders,** notably the EC services, the EEA, the European Aviation Safety Agency (EASA), the World Health Organization (WHO-Europe) and nearly 150 noise experts. By 2015, work to develop CNOSSOS provided the technical basis for preparing a Directive to revise Annex II of the END.

[237] In accordance with Art. 6.2 of the END, the EC developed the common noise assessment framework (CNOSSOS-EU) for road, railway, aircraft and industrial noise for the purpose of strategic noise mapping (Art. 7).

Many elements of the development of CNOSSOS were of a technical nature. An overview of the roadmap for the development of CNOSSOS is reproduced below to help facilitate an understanding of the complexity of the development of the CNOSSOS-EU methodological framework and the scientific, technical and technological challenges:

Table 156 - Roadmap for the development of the CNOSSOS-EU methodological framework

1	The assessment of the equivalence of existing noise assessment methods in the EU;
2	The definition of the target quality and input value requirements for strategic noise mapping;
3	The establishment of requirements and criteria for the screening, rating and pre-selection amongst existing assessment methods in the EU, the USA and Japan that best cover the needs and requirements of the END;
4	The conceptualisation of a 'fitness for purpose' framework allowing for the application of CNOSSOS-EU methodology at two levels of detail and conformity, depending on the objectives of the assessment (i.e. strategic noise mapping on a mandatory basis — first level of application, and action planning on a voluntary basis — second level of application);
5	The selection of components for common noise assessment methods through a series of dedicated workshops, benchmarking/testing exercises and meetings with European noise experts;
6	The drafting of the CNOSSOS-EU methodological framework including guidelines for its use for strategic noise mapping and associated requirements for input data collection and modelling;
7	The preparation of the operational part of CNOSSOS-EU and long-term planning to assist EU MS to implement CNOSSOS in the context of the future rounds of strategic noise mapping in Europe.
8	The legal act to revise Annex II of the END and for subsequent enforcement of CNOSSOS-EU in EU Member States.

Source: JRC and DG ENV - http://www.sciencedirect.com/science/article/pii/S0048969714001934

The steps above required an ongoing assessment of technical and scientific state of the art, and regular liaison with the 150 noise experts that assisted in the CNOSSOS process which involved technical input to develop a common assessment method for each source. The noise experts contributed to the development of the technical part of CNOSSOS relating to the modelling of noise emissions.

The results of EU-funded research projects to identify state of the art were also incorporated into CNOSSOS' development, namely through the **Harmonoise project**[238] and the **IMAGINE project**[239], which aimed to harmonise the assessment of environmental noise for improved noise mapping through a holistic approach to mapping and modelling noise pollution. Both projects were funded through FP6's Support to Policies Programme (SPP).

[238] FP6 - HARMONOISE (Harmanised Accurate and Reliable Methods for the EU Directive on the Assessment and Management of Environmental Noise).

[239] https://ec.europa.eu/research/fp6/ssp/imagine_en.htm

The **HARMONOISE model** requires impedance values to be assigned to all surfaces in the propagation path, including vertical walls and facades. A comparative assessment was undertaken of the advantages of the HARMONOISE method in comparison with alternative methods and was considered by the Commission's ENV and the JRC to be superior to the NMPB 2008 and ISO 9613-2 methods. The results from the **IMAGINE project** (IMAGINE WP 1, 2007) were used relating to the classification of noise barriers according to the EN 1793-1 standard. These were then converted these back into DLα values into equivalent impedance values. The integration of the results of 'state of the art' research projects into CNOSSOS' development demonstrates that **due account has been taken of scientific and technological state of the art.**

A research paper[240] was produced relating to the challenges encountered in the development of CNOSSOS which emphasised that a number of specific challenges of a scientific and technical nature were taken into consideration in its development. Overall, the Directive has been adapted to technical and scientific progress in noise assessment and has drawn on existing best practice in this area from the Member States.

Outstanding challenges in implementing the revised Annex II, Directive 2015/996

Whilst recognising the considerable achievements of CNOSSOS, it is important to examine the outstanding challenges to its full and effective implementation and also to consider any less positive feedback from END stakeholders.

A number of areas of weakness were identified that still need to be addressed before a common approach can be regarded as having been fully realised. It was observed by a number of END stakeholders interviewed that although the development of a common approach is an important step, this will only lead to comparable data across the EU in R4 (2022) at the earliest, since the implementation of CNOSSOS at national level will only be voluntary in R3.

The stakeholders interviewed pointed out that this means that it will be more difficult to **achieve comparable data**:

- ***Between EU countries*** – the EEA needs comparable population exposure data across EU28 in order to fulfil its reporting obligations under the END and for the preparation of the Noise in Europe report. Data produced on a comparable basis will not however be available until R4.
- ***Between END implementation rounds –*** until CNOSSOS is fully implemented in R4 (2022), it will not be possible to make comparisons of changes in population exposure on a consistent basis across each five year cycle. A dataset comparable between rounds will only be possible in R5 (2027), when there will then be two successive rounds of noise mapping using CNOSSOS (i.e. R4 and R5).

Interviewees in smaller countries also raised the issue about the need for **greater caution in making cross-country comparisons without suitable contextualisation** even once data comparability between countries has been improved.

Several stakeholders also noted that perceptions of environmental noise at receptor may vary depending on local-specific factors. This was mentioned for instance by a European aviation association and a number of acoustics consultants interviewed.

[240] Advances in the development of common noise assessment methods in Europe: The CNOSSOS-EU framework for strategic environmental noise mapping, Stylianos Kephalopoulos, Marco Paviotti1, Fabienne Anfosso-Lédée, Dirk Van Maercke, Simon Shilton, Nigel Jones. www.sciencedirect.com/science/article/pii/S0048969714001934

A technical issue raised relating to how the effectiveness of CNOSSOS might be further strengthening was the **lack of standardised input data**. A small number of stakeholders observed that although input databases have been developed by source (e.g. road, rail) in the CNOSSOS-EU database of input data, there is limited standardised input data available, which means that post-CNOSSOS implementation, output data may not always be comparable. Some stakeholders thought that over the longer term, input data should be harmonised. However, other stakeholders pointed out that it is difficult to harmonise input parameters, for instance because standardised input data may not be appropriate for some sources. The difficulty in standardising input data was confirmed in research papers[241] and in the CNOSSOS methodology itself.

A few stakeholders stated that CNOSSOS fell short of their expectations and would not be able to fully substitute some interim methods currently used. Specifically, the Nord2000 method, which is used in some Scandinavian countries, was mentioned. Although some countries such as **Denmark** and **Sweden** will continue to use their own national mapping methods alongside CNOSSOS for their own purposes, other than strategic noise mapping and reporting, this is not expected to exacerbate the problem of comparable data provided they also implement CNOSSOS in parallel. In such cases, however, the administrative costs of providing data under CNOSSOS for EU reporting purposes and under an interim method to meet national reporting requirements may be high.

A small number of END stakeholders, including two competent authorities, expressed concern that CNOSSOS goes **beyond the concept implied by '<u>strategic</u> noise mapping'** because it requires mapping that some Member States regard as being more detailed than the minimum that would be necessary to provide the data needed to develop action plans for the management of environmental noise. There were concerns that increasingly detailed mapping could be required by the EC in future, with limited benefits for noise action planning. One stakeholder suggested that whilst CNOSSOS was a positive step forward, they would have preferred it to be less detailed and complicated.

More generally, there were concerns among some national competent authorities about the **additional one-off administrative costs of the transition to implementing CNOSSOS-EU**, given that R1 and R2 have been implemented using a combination of national and interim methods (e.g. mentioned in France, Denmark and Sweden).

Implementation challenges – strategic noise mapping

There are a number of **implementation challenges** identified in relation to Strategic Noise Mapping through the research, which are now examined.

Firstly, perhaps the most crucial limitation to full implementation relates to **data quality.** Ensuring **access to reliable input data** is vital for the measurement of noise, since producing reliable output data is pre-conditioned on the availability of quality input data. In R1, there was a general problem with regard to the lack of availability of input data and / or the poor quality of inputs data. In R2, although some interviewees made clear that the quality of input data had improved, the lack of adequate input data remained an important issue (11 MS – **BG, CZ, EE, FR, HR, HU, LV, LT, NL, RO** and **SE**).

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[241] Advances in the development of common noise assessment methods in Europe: the CNOSSOS-EU framework for strategic environmental noise mapping, Stylianos Kephalopoulos, Marco Paviotti, Fabienne Anfosso-Lédée, Dirk Van Maercke, Simon Shilton and Nigel Jones http://www.sciencedirect.com/science/article/pii/S0048969714001934

Examples of the specific problems that were identified are: assigning accurate population data to estimate the average number of people per dwelling, inaccuracies in input data and in some cases outstanding data gaps. Such challenges have made it difficult to calculate noise exposure accurately, even when the number of buildings is known.

There remains a **challenge in measuring the actual population exposure,** rather than the **number of people <u>potentially exposed</u>.** Examples of the types of challenges that need to be considered that influence the accuracy of population exposure data are now outlined.

Table 157 - Noise measurement issues – producing accurate exposure data (selected examples).

Noise measurement issue	Description
The average number of people per dwelling	Since actual demographic data on the number of inhabitants per dwelling is often unavailable, estimates are commonly produced by consultants to measure the exposed population. Whilst this is a practical solution given the lack of data, there are risks that when actual data is obtained, the number of persons exposed may be distorted, such that the data is not fully comparable between Rounds. Similar problems can arise when public authorities produce estimates of the number of persons per dwelling at national level, but there are many region and city-specific variations.
dB(A) levels outside and inside dwellings	Data collected through noise mapping is based on the number of exposed persons *outside* dwellings. It was pointed out that there can be a significant difference in the level of noise outside and inside dwellings, especially given that current mapping methods cannot be distinguish whether noise insulation measures have been implemented.

Feedback on the problems identified above was received through the interview programme and written responses to the working papers presented at the validation workshop. For instance, in relation to the problem of the average number of people per dwelling, a stakeholder in the **Netherlands** mentioned that there is a legal requirement to use an average figure of 2.3 inhabitants per dwelling in reporting procedures to the Ministry of the Environment (and for EU reporting purposes). However, in Rotterdam, for instance, data has been obtained that there are only 2.1 inhabitants per dwelling. If actual data were to be used, however, this would have resulted in non-comparable data between R1 and R2 of noise mapping, so the data estimates were instead used in both rounds.

In relation to the issue that the END measures noise outside dwellings, whereas the health effects linked to dose responses inside dwellings which are not presently captured through noise mapping, a European industry association in the aviation field which commented in a written response that there is a significant difference between inside and outside levels of noise. "The WHO selected an average insulation value of 21 dB to differentiate between inside and outside noise, which takes into account slightly open windows".

A similar point was raised by an acoustic consultant in the UK active in supporting the implementation of the END commented that *"given population growth, and the expansion of housing stock, there is a need to collect more sophisticated data and information on numbers of exposed properties that have good acoustic design or special insulation against noise, otherwise reported data will give a misleading impression".*

With regard to the **level of detail of SNM**, differences in approach between Member States were identified, with **Luxembourg** going beyond the minimum requirements in the END and providing noise maps that report on dB thresholds below 50dB L_{night} and 55dB L_{den}.

A participant from **Romania** in the validation workshop held in September 2015 pointed out that local authorities may have more detailed mapping data on noise but noted that this is not used in SNMs at national level. A Slovenian stakeholder pointed out that input data can be unreliable when it builds on the number of permanent residents in any given area when in fact many are temporary residents.

Consequently, using only permanent residents for population metrics can result in implausible data. Participants from Germany maintained that data protection is an issue that limits the accuracy, and consequently the utility, of population exposure data.

Several stakeholders attested to the problem that updating data on population exposure between Rounds using different thresholds (i.e. transitional and definitive) in R1 and R2 can lead to misunderstandings among citizens and politicians, who perceive from the data that the problem of high levels of noise is getting significantly worse. Since the applicable thresholds changed between R1 and R2 for major rail, major roads and agglomerations, it may appear from at first sight of population exposure that there has been a significant increase in population exposure. However, this may simply be due to greater volume of noise mapping due to changes to the scope of the END now that the definitive reporting thresholds are applicable. Equally, other changes between Rounds may also complicate the use and interpretation of the data, such as a change in the population or in traffic volumes.

Issues relating to the utility of the data produced through strategic noise mapping in further detail in the evaluation part of this report (see Section 3.2.3 on effectiveness).

Utility of data collected on population exposure through noise mapping

The utility of the data from the perspective of different stakeholders is now considered.

At **EU level**, although the END has already had a positive impact on source legislation revised since 2014, as shown in detail later in Section 3.2.3.6 (Progress in achieving the END's second objective), the END's role has primarily been in providing a strategic reference point for source legislation to highlight the problem of environmental noise.

In the views of EU policy makers from DG GROW and DG MOVE responsible for EU source legislation, population exposure data by dB band produced through the END has strong potential utility, but is not yet sufficient to be used to inform source legislation, since there remain gaps in data completeness in some EU countries (see Section 2 – implementation review) and outstanding comparability issues until CNOSSOS is fully implemented.

However, it was acknowledged by EU policy makers that once comparability challenges have been addressed, END data will have significant utility to inform the review and possible legislative revision of different pieces of source legislation, for instance by citing END source-specific population exposure data in impact assessments and in technical studies relating to source legislation.

However, some END stakeholders were adamant that the data should already be used. For example, a national competent authority commented that in their opinion, "the data collected through noise mapping is already good enough to be used to inform source legislation and should not be used as an excuse by EU policy makers responsible for different transport sources to delay reviewing existing source legislation".

The argument was made that existing END data collection on noise at receptor by source already provides a strong enough evidence base to assess the scale of the problem. Similar concerns were expressed during the workshop, reflecting the considerable level of effort made to date in END data collection that EU policy makers responsible for source legislation should make full use of existing population exposure data and not wait until 2022, since data collection started in R1 in 2007.

Data collected through the END will also be **highly useful in assessing the health effects of environmental noise at EU level**. However, the data's utility will only be fully realised once comparable data is available and once Annex III has been developed based on revised WHO guidance on dose-response relationships.

The EEA commented that END data is already useful for EU **monitoring and reporting purposes**. Under Art. 11 of the END, the Commission has to report on population exposure data collected through strategic noise mapping across the EU. The data collected was seen as highly useful by the EEA in helping the Commission to fulfil their monitoring and reporting responsibilities not only in respect of the END and also in meeting their wider role in reporting on the state of the environmental situation in the EU. END data already feeds into reporting by the EEA on progress towards the EU strategic policy goals set out the 6th and 7th Environment Policy Action Programmes.

Population exposure data was already seen as very **useful for a wide variety of decision makers at national, regional and local levels.** According to many interviewees and workshop participants, the data is significantly better than what existed before. A number of participants in the workshop expressed the view that although CNOSSOS's full implementation would strengthen the quality and utility of the data by improving confidence intervals compared with the current population exposure dataset collected in R2, until CNOSSOS is fully implemented in all 28 EU MS, it will not be possible to determine what the error margins will be.

In respect of **local authorities**, there was a difference in perception as to the utility of the data depending on the size of urban area concerned. A general trend observed in the interview feedback was that local authorities In cities and in larger towns within agglomerations tended to view the collection of population exposure data by dB threshold through the END as being very useful, since it fed into strategic planning across a number of different policy areas (e.g. urban development, local transport planning, prioritisation of noise mitigation measures at local level).

Conversely, in the discussions with national competent authorities (e.g. in **FR, DK and NL**), it was observed that local authorities in smaller municipalities did not view noise maps as being that useful, since it was clear to them what the main sources of noise were, and they did not understand the value added of mapping relative to the cost. This was especially the case when mapping in France, where mapping for agglomerations was required in smaller communes, which may have as few as 2000 inhabitants.

With regard to the utility of the data for the **private sector**, although a few specific examples were identified of such actors downloading maps and looking at the data, the level of interest in terms of the number of downloads was seen as disappointing by stakeholders interviewed, compared with initial expectations when the END was adopted.

From a citizen perspective, several stakeholders mentioned that the **lack of aggregated data on *cumulative* environmental noise exposure** in a particular area may **undermine the practical utility of noise maps** from a citizen engagement point of view**.** According to a small number of stakeholders, (e.g. in **DK, IE** and NL), it is unlikely that anyone but a technical specialist audience would utilise noise maps relating to a single source. Efforts to engage the public in noise mapping results had not succeeded because SNM were not regarded as being sufficiently user-friendly or of practical use to citizens. However, acoustic consultants pointed out that it remains the case that because of **differences in dose response relationships for different sources of noise**, there are practical reasons for not showing cumulative noise maps. Moreover, there would be higher costs in producing such maps, in addition to the source-specific maps needed to inform source legislation.

A general concern among END stakeholders, expressed in several EU countries, was that the two key noise indicators used in the END (L_{den} and L_{night}) are conceptually difficult for a non-technical audience to understand. This may limit the audience among EU citizens for accessing such data and information. Given the high costs involved in producing such data, the small number of downloads of SNMs was mentioned as a concern (e.g. **DK, NL**).

Overall, END data is already useful for different policy making and reporting purposes. However, it is not yet being utilised by policy makers responsible for source legislation. Its utility will be strengthened over time as the data becomes more comparable.

Whilst the main purposes of the END is to collect population exposure data through noise mapping to inform the identification of measures for NAPs and secondly to information legislation, the evaluation feedback identified END population exposure data was useful for wider purposes for different types of stakeholders, namely:

- **EU policy makers** – informing source legislation (once comparability issues overcome), informing EU noise policy more generally, and EU-level environmental monitoring and reporting by the EEA for the Noise in Europe Report and 7th Environmental Action Programme.
- **National and regional policy makers** –prioritising noise mitigation measures in areas with high levels of population exposure. It can also be used across different areas such as urban development, land use planning, long-term infrastructure development planning etc. The data can also potentially be combined with other datasets, such as air quality, spatial data for land use planning, public health datasets for epidemiological studies etc.
- **Local authorities –** prioritising environmental noise mitigation, strategic planning, etc.
- **Local community groups and NGOs** interested in information and data about environmental noise at receptor by source. Maps disaggregated by source are seen as highly useful to inform policy debates.
- **Private sector stakeholders,** such as investors, developers, planners and architects.

APPENDIX H – LIST OF EVALUATION AND EVALUATION SUB-QUESTIONS

Table 158 - List of evaluation questions and sub-questions

Evaluation questions	Evaluation sub-questions
Relevance	
EQ 1- Are the objectives of the Directive still relevant?	EQ1a - How far does the Directive meet identified policy needs? (e.g. high levels of environmental protection, human health)?
Coherence	
EQ2 – How far is the END coherent and consistent with other EU legislation on noise (e.g. noise at source legislation (including by transport type i.e. automotive, railways, aviation)?	
EQ3 - Are there any specific legal gaps, overlaps and inconsistencies identified between the END and other EU legislation?	
EQ4 - How does the Directive relate to national noise policies and legislation? Is it consistent and to what extent – if at all - does it duplicate existing requirements?	
EQ5 - Are there any elements of the Directive (e.g. specific Articles, definitions of key terms, requirements for public authorities) that are unclear?	Are there any provisions that are obsolete and if yes, why?
EQ6 - To what extent is the Directive sufficiently clear in setting out the obligations of Member States at the level of (i) the Competent Authority and (ii) other stakeholders involved in national implementation?	
Effectiveness (and impacts)	
EQ7 - What progress have Member States made towards achieving the objectives set out in the Directive?	EQ 7a – What progress has been made in respect of Article 1(1) – strategic noise mapping EQ 7b - What progress has been made in respect of Article 1(1)b) - making information on environmental noise and its effects is made available to the public? EQ 7c - How much progress has been made towards Article 1(1)c - the Adoption of Noise Action Plans by the Member States, based upon noise mapping results? EQ7d - How effective have public consultations been in informing noise action planning processes and in the finalisation of NAPs? EQ7e - Has the speed of progress been in line with expectations? EQ7f - Has the Directive been adapted to technical and scientific progress?

Evaluation questions	Evaluation sub-questions
EQ8 – What progress has been made towards the second objective of the END - "to provide a basis for developing Community measures to reduce noise at source" (Article 1(2))?	E8a - What is the extent of the END's influence on noise at source legislation? EQ8b - Has the speed of progress been in line with expectations?
EQ9 - What are the main impacts of the Directive?	EQ9a How far has the Directive achieved any significant changes (positive or negative)? EQ9b Has the Directive contributed to ensuring that by 2020 noise pollution has significantly decreased? EQ9c Can any unexpected or unintended consequences be identified? EQ9d. To what extent can these be quantified?
EQ10 - How have the provisions of the Directive been accepted by the stakeholders? In particular, how have each of the following END provisions been accepted?	EQ10a - Noise measurement through a system of common indicators and a common methodology (CNOSSOS); EQ10b - Noise mapping; EQ10c - The preparation of action plans; EQ10d - Information and consultation of the public; and EQ10e - Reporting to the Commission / EEA and reporting by them under Art. 11.
Efficiency	
EQ11 - How far are the administrative costs of END implementation proportionate?	EQ11a – How far do administrative costs differ between Member States and what are the reasons for this? EQ11b - What factors cause the greatest administrative burdens?
EQ12 - To what extent is the END reporting mechanism efficient?	
EQ13 - To what extent does the Directive demonstrate cost-effectiveness based on an assessment of the costs and benefits to date?	This EQ addresses the findings from the CBA.
EU added value	
EQ14 - What has been the overall EU added value of the Environmental Noise Directive?	EQ14a - To what extent did Member States have environmental noise legislation in place to address noise at receptor prior to the END?" EQ14b - If particular MS already had mitigation measures at receptor in place, how far, if at all, has there been a change in the level of attention among policy makers and politicians, the budget allocated and types of measures being supported?
EQ15 - Do the issues addressed by the Directive continue to require action at EU level?	
EQ16 - Are there are any ways in which the European added value of the END could be further enhanced?	
EQ17 - What would happen if the END were to be repealed?	

Evaluation questions	Evaluation sub-questions
Prospective questions	
EQ18 - Is the scope of the Directive (as laid down in Art. 2) appropriate or does it need to be modified?	
EQ19 - Are there gaps where further EU noise legislation is required in order to achieve the objectives of the Directive?	

APPENDIX I - ASSESSMENT OF UTILITY EU FUNDED RESEARCH PROJECTS ON ENVIRONMENTAL NOISE

The study team identified a number of examples of END-relevant EU research projects in the environmental noise field, often funded through the EU RTD Framework Programme (FP6 and FP7, but also through other funding programmes such as LIFE+. An illustration of the types of projects supported – and where there is potential to strengthen the effectiveness of END implementation. In reviewing EU research projects, the main question considered was:

To what extent could previous EU funded research projects on environmental noise be useful in strengthening the effectiveness and Union added value of END implementation?

Where appropriate, comments are made by the consultancy team's evaluators and acousticians to highlight the potential utility of particular EU funded projects to strengthening END implementation:

Table 159 - Examples of END-relevant EU funded research projects

Funding programme	Project name	Description and commentary - why relevant to strengthening END implementation? Website links
FP5	NOPHER	The Noise pollution health effects reduction project covered research on noise pollutions and its impact on health through intra-disciplinary cooperation amongst European researchers. Its results include a consensus on the strength of causal relationships between environmental noise and health effects, a new international journal Noise and Health, and wider range of publications.
FP6	The HEATCO project "Developing Harmonised European Approaches for Transport Costing and Project Assessment" http://heatco.ier.uni-stuttgart.de/	Description: Development of improved methodologies for noise impact assessment, monetary valuation of health impacts, the treatment of values over time and the calculation procedures for measuring environmental noise. Comment: HEATCO is highly END-relevant, especially in terms of how health impacts are monetised, how values are treated over time e.g. discounting to reach a NPV when assessing the costs and benefits of noise mitigation and abatement measures.
FP6	The IMAGINE & HARMONOISE projects	Description: The HARMONOISE and IMAGINE project built a database for road, rail, aircraft and industrial noise at source. They also developed propagation models. The objective was to support the development of a common assessment method used for strategic mapping as defined by the END. The European Harmonoise algorithm has been developed over more than 10 years, and offers a consistent method for prediction of noise levels under arbitrary meteorological conditions. It is implemented in open-source code, and has been validated to some extent in Europe. The outputs extended to technical and practical guidelines, a database of different sources of noise, and a harmonised and reliable method for estimating noise levels of these sources. Comment: The issue of harmonised data remains an important one for the effective implementation of the END. The development of guidelines was also important, especially in the early period of END implementation, in the period before

Funding programme	Project name	Description and commentary - why relevant to strengthening END implementation? Website links
		national guidelines had been developed.
FP6	QCITY project - http://www.qcity.org/	Description: the QCITY project was a FP6 research project, under the 6th FP has developed an integrated technology infrastructure for the efficient control of road and rail ambient noise by considering the attenuation of noise generation at source at both vehicle/infrastructure levels. The activities support European noise policy to eliminate harmful effects of noise exposure and decrease levels of transport noise creation, especially in urban areas. Comment: – the project was END-relevant and explored what could actually be done about the problem of environmental noise particularly in an urban environment.
FP6	CANTOR	CANTOR brought together a number of the major European academic/research institutes in acoustic research, and engaged a series of experts from government agencies and the vehicle manufacturing industry chain to focus on a way of improving vehicle noise performance. The co-operation among the laboratories in CANTOR enforced common best-practice protocols and experimental techniques in their work. The outputs may evolve into noise standards and reference materials, which may be later proposed to European institutions for further unified use in industry normalisation activities and environmental noise control.
FP6	CALM II	The focus of the CALM II project was directed towards cross-sectoral coordination of the European transport noise research facilitating the networking of organisations, the coordination of activities and the exchange and dissemination of knowledge. A further focus was the updating of the noise research strategy plan. One of the outcomes was the Strategy Paper 'Research for a Quieter Europe in 2020' describing future research in covering road, rail and air as well as outdoor equipment as the major sources of environmental noise.
FP6	SILENCE	The SILENCE project (Quieter surface transport in urban areas) addressed urban noise issues from first principles, taking a longer-term scientific perspective. The participants aimed to develop integrated methodologies and technologies for improving the control and coordination of surface transport, to reduce human-generated noise in urban areas. The project provided relevant technologies, innovative strategies and concrete action plans for urban transport noise abatement along with practical tools for their implementation.
FP7	The Cityhush project - www.cityhush.eu/. CityHush Acoustically Green Road Vehicles and CityAreas.	Description: The 3 year Cityhush research project - was designed to support European noise policy to eliminate harmful effects of noise exposure and to decrease levels of transport noise creation, especially in urban areas, deriving solutions that would ensure compliance with the constraints of legislative limits. A major objective was to provide municipalities with the tools to establish noise maps and action plans in accordance with Directive 2002/49/EC and to provide them with a broad range of validated technical solutions for the specific hot-spot problems they encounter in their specific city. Comment: this project appears to be well known among stakeholders in the environmental noise field. The focus on tackling noise in hotspots is in accordance with the approach in the END to using noise maps and population exposure data for

Funding programme	Project name	Description and commentary - why relevant to strengthening END implementation? Website links
		prioritising measures in Noise Action Plans.
FP7	ENNAH – European Network on Noise and Health (www.ennah.eu/network-structure)	Description: the ENNAH project - was a co-ordinating network of the health effects of research. Among the recommendations made through the project are to: • Strengthen the evidence on existing exposure effect relationships and to use more robust methods such as longitudinal rather than cross sectional studies. It is particularly relevant to the research on environmental noise and hypertension and coronary heart disease and on studies of noise and children's learning. • Encourage new research increasingly relevant for policy that will test whether interventions to reduce noise are effective and cost optimized and also whether they have a measurable impact on health. • Assess where new investment is needed in noise research, whether this relates to previously non- or poorly studied health outcomes or improvements in the noise and health methodological framework. Comment - END-relevant. Strengthening understanding of the health effects will help to underpin the achievement of the aims relating to Article 1(2) – EU Noise at Source.
The LIFE + Programme	The QUADMAP project (QUiet Areas Definition and Management in Action Plan). http://www.quadmap.eu/	Description: The QUADMAP project www.quadmap.eu/ - aims to deliver a method and guidelines regarding identification, delineation, characterisation, improvement and managing Quiet Areas in urban areas as meant in the END. The focus on strengthening knowledge / understanding about quiet urban areas through the QUADMAP project has helped to develop insights into the importance of designating quiet urban areas. Comment - since quiet areas have been one of the more problematic areas of END implementation, QUADMAP has helped to advance state of the art in this area. Only 5 MS have designated more than a few quiet areas (see Task 1 – EU level synthesis assessment of END implementation). This is partly because they are not obligatory, but also because of difficulties in the definition and delimitation of quiet areas Quiet areas have been a problematic area of END implementation.
5th PRCR R&D Framework Program.	SILENCE(R)[242]	The SILENCE(R) project focused on tackling noise at source through research in the field of aircraft noise reduction technologies. The project brought together representatives from the European aviation industry such as Airbus, Rolls-Royce, MTU Aero Engines and Snecma, along with the research community and universities. The objective was to validate individual technologies and to produce a cost/benefit analysis of technological applications across the product range. Large-scale noise reduction solutions regarding various noise-generating aircraft elements were validated including: • Engine– research on engine noise spanned fan, compressor, turbine and jet noise.

242 http://www.xnoise.eu/fileadmin/user_upload/Projects/SILENCER_FinalExecutivePublishableSummary-1.pdf

Funding programme	Project name	Description and commentary - why relevant to strengthening END implementation? Website links
		• Nacelle (engine housing) – research focused on both nacelle geometry and acoustic liners. • Airframe– extensive airframe noise tests focused on technologies to reduce landing gear noise and noise generated by high-lift devices (flaps, etc.). Combined with innovative low-noise operational procedures studied in parallel with SILENCE(R), the project achieved a 5 dB noise reduction. This meets the medium-term objective of the European Commission's PCRD R&D Framework Programs, and was a significant advance towards ACARE1's research goal of a 10 dB reduction in aircraft noise by 2020. More than 35 prototypes were tested as part of the SILENCE(R) program, along with studies of improved operational procedures to reduce aircraft noise.
FP7	QUIESST	The Quietening the Environment for a Sustainable Surface Transport project addressed surface transport noise abatement (road and rail), considered cost benefit analysis and addressed the END objectives, covering true holistic noise abatement solutions through wave propagation and systems for passive compensation.

A number of interviewees commented that there are **valuable methodologies that have been developed and interesting research outcomes** through previous EU research projects.

The national competent authorities in the UK and in NL for instance raised the possibility of the EU having a role to play in ensuring the further dissemination of research results. Given the number of implemented and existed projects, there is already a lot of information available. The European Commission / EEA could play a useful role in synthesising some of the research results and in drawing out especially relevant aspects for competent authorities involved in END implementation. These activities would also have the benefit of promoting the uptake of EU-funded research results more generally (which is a key issue).

Prospective issues

Greater consideration could therefore be given in future as to how the results from EU funded research projects relevant to environmental noise could be centrally co-ordinated and then more widely disseminated in order to support the Member States in improving the effectiveness of END implementation. Each project will have disseminated its findings.

One suggestion is for the EU to increase the exchange of best practices between sectors and Member States and provide further guidance on designing NAPs – this has already been regarded as helpful but could be enhanced (as confirmed by interview with Italian authority). Another relates to tightening timelines and obliging Member States to make available budget to implement corrective measures. Another idea would be to embed the END in a wider EU noise policy strategy. The period of devising a NAP could perhaps be extended in future to 1-2 years to allow sufficient time for public consultation.

APPENDIX J – QUALITATIVE CASE STUDIES

The purpose of the case studies, which were undertaken in addition to the formal requirements for this assignment, is to provide interesting examples of good practices that can be used to support and illustrate particular points in addressing the evaluation issues. The case studies could be integrated into the main report, and/ or could be included in a standalone compendium of good practices.

A further possibility is that the validation workshop in September 2015 could be used as an opportunity to generate further ideas on good practices. Participants could be asked to semi-complete the case study template with the study team then undertaking follow-up to complete the case studies.

Case study no. 1 & title	**Publication of online FAQs relating to the interpretation of Strategic Noise Maps**
Member State	Ireland (IE)
Public authority / economic operator	Irish Rail (Iarnród Éireann)
Purpose of case study	The purpose is to demonstrate that public authorities need to provide appropriate context when making Strategic Noise Maps (SNMs) accessible online. The case study is concerned with an examination of effective practice in disseminating the results of Strategic Noise Mapping
Description (including rationale / objectives of measure)	Irish rail produced a set of FAQs to help citizens and other end users in the interpretation of the rail noise maps http://www.irishrail.ie/media/strategicnoicemapfaq1.pdf?v=gr5ucqy . Among the specific FAQs posed include "What is the baseline year of the maps?", "What do the contour levels mean?", "What is L_{den} and L_{night}?", "What are the noise maps for?", "How were the maps made?", "How accurate are the maps?" and "Do noise maps show how noisy it is where I live?" Irish Rail's rationale for producing a set of FAQs was that outside of environmental noise specialists, citizens and public authorities often have difficulty in interpreting (or misinterpret) SNMs. Secondly, a key aim was to minimise the risk that the maps are taken out of context. There are reputational risks for mapping bodies if SNMs are not well understood or are misrepresented. Among the possible unintended consequences of publishing SNMs without contextualising these is the increased risk of generating additional noise-related complaints from citizens. Complaints about environmental noise already require expending considerable human resource for many transport organisations in Ireland, including Irish rail. Appropriate disclaimers are needed to avoid noise maps being presented as evidence in legal cases about noise. A disclaimer has therefore been added in the website FAQs that "the noise maps have been produced for use at a strategic level and give an acceptable level of accuracy. They will not however necessarily properly represent the situation at a local level and the results of the noise mapping should not be used alone for any land use planning or location-specific assessments". The disclaimer included in the website FAQs makes clear that: "The maps are only intended to be used for strategic assessment of noise levels in any given area. They should not be used to attempt to determine, represent or imply precisely the noise levels at individual locations (e.g. individual houses, windows)". It is also emphasised that noise maps are calculated using a modelling approach to arrive at an average value over a year. They do not represent actual noise levels at a particular point in time using modelling data.

Effectiveness and added value	Providing an explanation to users of SNMs as to how noise maps should be interpreted and their advantages and limitations was viewed as an effective means of strengthening understanding of strategic noise mapping and enhancing the utility of the maps for Irish citizens, policy makers and local level decision-makers (e.g. planning and transport authorities). It is important to convey to citizens and stakeholders that noise maps are only an approximation, rather than an actual reading.
Transferability/ replicability potential	**High.** A number of stakeholders in other countries also confirmed that it is a common problem that stakeholders (especially citizens) misunderstand and misinterpret noise maps. There is a lack of familiarity with what the L_{den} and L_{night} indicators measure.
Impacts	• Strengthened accessibility for citizens to information about SNM. • Reduced risk of noise maps being interpreted erroneously and/ or misrepresented.

Case study 2 & type	**Environmental noise reduction measure - railways (noise at source)**
Case study title	Methodological enhancements to more accurately measure rail roughness so as to better assess the contribution of enhanced railway grinding to reduced environmental noise emissions.
Member State	UK
Public authority / economic operator	Network Rail and the Rail Safety and Standards Board (RSSB)
Purpose of case study	The purpose of this case study is twofold, namely to: • Analyse an example of a measure where environmental noise is a secondary consideration, but where there are major indirect benefits in terms of reducing rolling noise emissions. • Examine progress made in improving the accuracy of the measurement of noise due to rail roughness to complement the CRN method. This could in future be used as part of a "common approach" to measuring railway noise under the technical guidelines for CNOSSOS.
Description (including rationale / objectives of measure)	There are three main contributors to operational railway noise at source – rolling noise, traction noise and aerodynamic noise. Of these, railhead roughness has a significant influence on the level of rolling noise. Network Rail (NR) operates the UK's rail infrastructure network. It has made significant changes to its rail grinding strategy in the UK, mainly for safety reasons. However, there was a recognition that more frequent rail grinding also has benefits in reducing rolling noise emissions by tackling railhead roughness. A strengthened rail grinding system was put in place by Network Rail (NR) between 2002 and 2004 as part of a new preventative maintenance grinding strategy to address rolling contact fatigue. This involved the purchase of three new grinding machines. The frequency of rail grinding was then reviewed in 2007 and changes were made to better reflect measured rail wear rates on straight track. From 2009, grinding of straight track was revised so that it was planned to be carried out every 45 Equivalent Million Gross Tonnes (EMGT) with curves continuing to be ground every 15 EMGT. Although environmental noise reduction was a secondary driver, there were expected to be major benefits in reducing noise at source due to the measure being implemented. Due to the existence of the END, NR was very interested in measuring the level of benefit i.e. the magnitude of noise reductions. This required further methodological improvements to strengthen the quality of input data relating to railway noise.

	In 2004, a study was completed on behalf of Defra (by AEA Technology) to consider the implications on noise predictions of a level of rail roughness different from that assumed in the UK "Calculation of Railway Noise 1995" (CRN) interim method, through the development of a new indicator to measure the "Acoustic Track Quality" (ATQ). Rail roughness was measured using sound level measured on board a train, close to a smooth wheel, as a proxy. The system was calibrated with measurements at the trackside to establish the under-floor level that occurred when the trackside vehicle noise emission was the same as that predicted by CRN. A large amount of data was gathered over a significant proportion of the UK rail network. By establishing a network-wide average level, correction factors could then be applied to calculate the actual level of acoustic track roughness rather than that assumed using CRN, the UK chosen method. The study found that, on average, CRN under-estimated the level of rail roughness, as measured in terms of ATQ, by 4dB. The estimations for Round 1 noise mapping were then corrected using an algorithm to reflect the improved accuracy of measured railway noise roughness. A follow-up study was then carried out for Network Rail in 2012. In the second study, the ATQ roughness indicator had gone down by more than 4dB on average across the rail network. This fed into 2nd round of noise mapping. Improvements to the methodology for measuring railway noise stimulated by the END were presented at a workshop.243 The second study found that the impact of rail grinding had been very positive and that this had eradicated the additional 4dB of noise roughness identified in the earlier study using an improved methodology for capturing railway noise. It should be noted that the reductions in ATQ reflect rail roughness reduction, not necessarily the resultant noise. For smooth wheels, ATQ reduction = rolling noise reduction. For rough wheels, the reduction will be smaller, or non-existent.
Effectiveness and added value	Although rail grinding was undertaken for safety reasons, the END has clearly played an important role in encouraging NR to take a closer interest in the benefits of rail grinding than would otherwise have been the case.
Transferability/ replicability potential	The new methodology for measuring rail roughness has been presented at a workshop to peers in 2012 and has been accepted as adding to the accuracy of noise measurement. It could therefore be used to assist in deciding appropriate CNOSSOS rail roughness values in future.
Impacts	• The change in UK-wide policy at NR on rail grinding has led to a significant and measurable reduction in environmental noise attributable to a reduced rail roughness of at least 4dB compared with 2004. • Strengthening the accuracy of the measurement of noise from rail roughness. • It should be noted that the use of better quality attribute data for railways in R2 mapping showed that the R1 maps had rather underestimated noise exposure. A consequence is that despite the acoustic benefit from railhead grinding, the noise levels indicated in noise maps and in the reported exposure data appeared to increase between R1 and R2.

[243] Responding to the Environmental Noise Directive by demonstrating the benefits of rail grinding on the GB railway network, Nick Craven, Network Rail, Oliver Bewes, Arup, Benjamin Fenech, Arup, and Rick Jones, Independent Consultant. Web - pif.sagepub.com/content/early/2013/07/11/0954409713494948 Paper presented at RRUKA Annual Conference, 7 November 2012

Good practice guidance

Case study type	**Good practice guidance**
Case study title	Role of good practice guidance in promoting the mitigation of environmental noise by tackling noise at source.
Member State	IE
Public authority / economic operator	National Road Authority (IE)
Purpose of case study, rationale / objectives of measure	The purpose of the case study is to: • Demonstrate the role of the development and dissemination of good practice guidelines and guidance documents in ensuring that environmental noise issues are taken into account in the design of transport infrastructure (in this case roads). • Illustrate the importance of incorporating European and international best practice and lessons learned into the implementation of the END as part of a process of continuous improvement.
Description	In 2008, the NRA commissioned Atkins Ireland to undertake a study to review Environmental Impact Statements of national road schemes after the 2004 publication of the *Guidelines for the Treatment of Noise and Vibration in National Road Schemes*[244]. The study led to the publication of update guidelines in 2014. The research study also focused on Constraints Studies, Route Selection Studies, present practice in other countries both in Europe and beyond, and published revisions to the UK DMRB which contains advice on noise prediction. The purpose of the review was to evaluate the effectiveness of the Guidelines, (including the effectiveness of noise mitigation measures) in achieving the NRA's noise design goal set out in the Guidelines "to ensure that the current roads programme proceeds on a path of sustainable development". The guidelines cover the Constraints, Route Corridor Selection and Environmental Impact Assessment stages. A further aim of the review was to identify good practice and potential deficiencies in current practice, and to provide advice on the practice to be adopted in the planning of national road development proposals. The NRA also commissioned a noise research study with Trinity College Dublin to "*Examine the design of noise barriers and the development of a method for assessing the effectiveness of noise barriers in-situ".* The 2004 guidelines have been supplemented in 2014 through the publication of new *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes*[245]. The guide is meant to be in used conjunction with the 2004 guidelines. It is based on the lessons learned from the two studies mentioned above. The new guidance "provides advice for the information and use by acousticians, which also has some relevance for traffic, motorway and pavement engineers. The advice amplifies and supplements the Guidelines, and should be read in conjunction with them". The guidance incorporates a number of headings such as a phased approach to acoustic design, monitoring activities and noise monitoring requirements, making noise predictions and computer-based modelling, and crucially, *acoustic design, amelioration and mitigation*. The guidance aims to encourage and facilitate the positive acoustic design of road schemes from the earliest planning stages through to construction so as to minimise the need for local mitigation at a later stage in the design process.

[244] http://www.nra.ie/environment/environmental-planning-guidelines/Guidelines-or-the-Treatment-of-Noise-and-Vibration.PDF
[245] http://www.nra.ie/environment/new-noise-good-practice-g/GPG_SB_20122013.pdf - March 2014

	The rationale is that wherever noise amelioration takes place at an early stage in the design process, a wider range of options remain open. For instance, at the design stage, a noise-sensitive horizontal and vertical alignment may be adopted. During the construction stage, a low noise road surface may be utilised. Low-noise road surfacing may be used as a mitigation measure to deal with localised noise problems. The guidance stresses that if an early decision is made to adopt a low noise road surface throughout the length of a scheme, then this should have widespread benefits. Local noise mitigation measures may still be required at a later stage, but on a smaller scale. A key premise is that amelioration is *part of the scheme design*, whilst *mitigation is an add-on* to address any residual problems that the scheme creates.
Effectiveness and added value	The guidance has been effective in enhancing understanding of environmental noise considerations and increasing their visibility among acousticians, engineers, road authorities, local authorities, etc. One of the elements highlighted that adds value is the fact that the guidance is technical but non-prescriptive, since it will need to be applied differently depending on the type of individual road scheme in question. Each section of the guidance ends with a checklist, whose objective is not to tick particular boxes, but rather to help make a positive contribution to the development of noise-sensitive road schemes. Since noisy road surfaces can be a major contributing source of noise, incorporating due consideration at the design stage of new road infrastructure has helped to raise awareness about the issue. This is in keeping with the concept of a sharing of the burdens between public authorities responsible for roads (and noise from road surfaces) and tyre and automotive manufacturers who are responsible for noise at source legislation. The fact that the 2014 guide is based on lessons learned through the implementation of the guidelines over a 10 year period is an effective approach because it demonstrates an ongoing commitment to continuous improvement. The development of practical guidance has added value by providing concrete examples of European and international good practices to decision makers within road authorities.
Transferability/ replicability potential	High. Whilst the EEA has produced a good practice guidance document on noise and the potential health effects for action planning authorities[246] and a separate good practice guide on quiet areas[247], there is as yet no guidance on ensuring that noise is taken into account in the design of different types of transport infrastructure. The guidance from Ireland could be adapted and replicated elsewhere.
Impacts	• The 2004 guidelines have been taken into account by the NRA and other stakeholders in road planning. • The availability of and updating of the guidance has facilitated the exchange of good practices with other EU countries. • Greater consideration of environmental noise as an issue in road design from the outset.

[246] EEA, Good practice guide on noise exposure and potential health effects, http://www.eea.europa.eu/publications/good-practice-guide-on-noise

[247] Guide on quiet areas (EEA), Tech 04 2014, http://www.eea.europa.eu/publications/good-practice-guide-on-quiet-areas/download

Role of good practice guidance in promoting the mitigation of environmental noise by tackling noise at source.

The National Road Authority (NRA) in Ireland developed *Guidelines for the Treatment of Noise and Vibration in National Road Schemes*[248] in order to provide technical support for acousticians and road planning authorities as to how to incorporate environmental noise as an issue in road design from the outset of the design process. The guidance is technical but is purposely non-prescriptive, since it will need to be applied differently depending on the type of individual road scheme in question.

With regard to the practical application of the guidelines, a stakeholder in IE provided an example of how the END has played an indirect role in tackling environmental noise problems in respect of major roads. The M50 scheme was a planned road upgrade – road widening, extra lanes, free flow junctions etc. where incorporating noise into design requirements was important. The noise control measures weren't implemented due to 2002/49/EC *per se*. However, since noise was a contentious issue, there was a desire to work to the highest relevant (and practicable) standards.

The biggest problem in assessing the benefits was the lack of post-construction data for the purposes of evaluating the efficacy and residual impacts. Furthermore, some alignments have been changed and speed limits modified since the scheme was completed. Therefore, any actual "before and after" measurements to assess the change in noise levels would not be comparable.

Reference should be made to the full length case study in Appendix F.

Although the development of technical guidelines at Member State and EU level to facilitate the implementation of the END has clearly played a positive role in strengthening the effectiveness of implementation, the importance of ensuring that guidelines developed are **practical and user-friendly** was emphasised. For instance, in France, a number of different sets of guidelines have been developed, but in the views of stakeholders, one particular guidance document on quiet areas was viewed as being too theoretical and not fit for purpose.

Case study type	**Good practice example from Member State & EU projects**
Case study title	Quiet Urban Areas
Member State	Netherlands & EU level
Public authority / economic operator	European Commission; Dutch Ministry of Infrastructure and Environment and other Member State institutions
Purpose of case study, rationale / objectives of measure	To showcase good practices in an area in which progress in many Member States has been limited to date
Description	The CityHush project financed by the European Commission identified a number of significant shortcomings in National Action Plans in relation to quiet areas, such as: a) A poor correlation between hot spots with annoyance and complaints; b) Most measures lead to increased emissions; c) Only indoor noise comfort is addressed. d) Hot spots, which show high correlation with annoyance and complaints CityHush also identified optimum sizes of quiet zones within cities. Moreover, it developed a methodology for cost benefit analysis before setting up quiet zones.[249]

[248] http://www.nra.ie/environment/environmental-planning-guidelines/Guidelines-or-the-Treatment-of-Noise-and-Vibration.PDF

[249] Parry, Graham and Markus Petz. 2012. Cost/benefit analysis of mitigation measures against potential benefits for local residents and park visitors

	Some of the aforementioned weaknesses could have been addressed by another project financed by the EU (under the programme LIFE+): The QUADMAP project (QUiet Areas Definition and Management in Action Plans). The aim here is to develop a harmonised methodology for the selection, assessment and management of quiet urban areas (QUAs). Best practices, lessons learned and empirical study data are assessed in order to define – acoustic and other – parameters relevant for the perception and evaluation of quiet urban areas by the citizens. Tools are made available for local stakeholders, such as (noise policy) decision makers, urban planners, and citizens, in order to assess and manage QUAs. A number of different assessment tools are developed through the project, including a. questionnaire for visitors about the soundscape and other qualities of the quiet (urban) area. As one output of QUADMAP, the city of Rotterdam, along with project participants in Belgium, Norway, and the UK, came up with a good practice guide. According to the report[250], the UK is best in class when it comes to precise identification of quiet urban areas. It emerges that "The relative quietness of the area" and "Visual attributes" are the two most important criteria when it comes to identifying quiet urban areas. In the Netherlands, surveys are carried out and factors such as functionality and safety taken into account. A resulting finding was that higher noise levels in a particular area would not be of much concern to the public. Legislation is followed up by government commitments and policies in the Netherlands and the UK. In the Netherlands, the impact of noise reduction on city attractiveness and businesses such as restaurants is also considered. In Rotterdam in particular, a surveys was carried out (250 interviewees) in the context of QUADMAP on the soundscape of selected areas (urban parks) to add human perception data to acoustic data already collected. As a result, motorised 2-wheelers were identified as particularly annoying sources of noise.[251] Dutch stakeholders consulted for this study conceded that the accessibility and visibility of quiet areas could be improved, and enforcement and monitoring are virtually non-existent to date. Generally, designating quiet zones in urban areas is still more challenging than in rural ones.
Effectiveness and added value	The surveys and clear methodology in identifying quiet urban areas has achieved several things: 1. Awareness of such areas was raised where before the focus lay on quiet areas in rural regions 2. The involvement of citizens ensured acceptance of the results and increased pressure on politicians to follow up 3. In many cases, survey findings differed from previous assumptions about noise and the relative annoyance of various sources of it 4. The importance of addressing noise outdoors in general was highlighted 5. The CBA methodology developed under the CityHush project should facilitate planning and maximise efficiency of any measures adopted
Transferability/ replicability potential	Given the involvement of several European countries in the projects discussed the findings are by default transferable to other countries.
Impacts	TBC

[250] Gezer, Sevgi. Noise Department DCMR EPA. Silence & the City. WPA2: Data collection and analysis in The Netherlands, Belgium, Norway and United Kingdom.

[251] Weber, Miriam. 2012. Quiet Urban Areas: repositioning local noise policy approaches – questioning visitors on soundscape and environmental quality

Good practice guidance

Case study type	**Noise mapping method**
Case study title	Nord2000
Member State	Denmark, Sweden, (Norway)
Public authority / economic operator	Environmental Protection Agency (Denmark), Environmental Protection Agency (Sweden)
Purpose of case study, rationale / objectives of measure	Details some sophisticated noise modelling methods that have already been applied in several Member States
Description	Initially developed from 1996-2001 by DELTA (Denmark, project leader), SINTEF (Norway), and SP (Sweden), Nord2000 is a calculation method for prediction of noise propagating outdoors. The method may be applied to a wide variety of noise sources, and covers most major mechanisms of attenuation. The Nord2000 method can be used for predicting short term noise levels in one-third octave bands from 25 Hz to 10 kHz when sound is propagating over ground from a source to a receiver. The method can be used for any terrain shapes including screens and can be applied to a variety of weather conditions, allowing a precise annual average to be determined. Complicated terrain is handled by a concise procedure, so the interpretation of terrain shapes by skilled personnel that earlier used to be necessary is now abandoned, and the method can be applied to automated noise mapping without loss of accuracy. The propagation part of the Nord2000 method has been validated by more than 500 propagation cases based on measurements as well as reference results obtained by accurate numerical prediction methods. In Denmark, the guidelines no. 4/2006 prescribe Nord2000 as the noise calculation method for mapping of road and rail noise.
Effectiveness and added value	In some cases, the Nord2000 method led to re-evaluation of noise abatement measures. For example, under Nord2000, road surface conditions are taken into account by correcting default values for the pavement lifetime average condition. Noise barriers now seem to come out slightly less effective than before, when noise levels were predicted for conditions of a slight downwind perpendicular to the road.
Transferability/ replicability potential	**High**: The team responsible for Nord2000 took part in the EU funded Harmonoise project, where the Nord2000 model formed a basis for the development of the Harmonoise Engineering model. Several of the findings from this project have been subsequently introduced in an update of Nord2000 and the data from both projects are assumed to be comparable.
Impacts	The Nord2000 model may be more widely introduced across Europe under the Harmonoise project in subsequent rounds of the END implementation. In this case, the impact on noise maps and resulting action plans can be large. An important issue will be data comparability.

APPENDIX K - IMPLEMENTATION REPORT - 28 COUNTRY REPORTS

The full set of 28 country reports is bound as a standalone document.

APPENDIX L - INPUT DATA SHEETS

The full set of supporting Input Data Sheets for roads, railways and airports are provided as input data sheets in Excel as separate attachments.

European Commission

Evaluation of Directive 2002/49/EC relating to the assessment and management of environmental noise

Executive Summary

Second Implementation Review and Evaluation of the Environmental Noise Directive

The Centre for Strategy & Evaluation Services LLP
July – *2016*

Centre for Strategy & Evaluation Services

AECOM

accon ENVIRONMENTAL CONSULTANTS

EUROPEAN COMMISSION

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Executive Summary

Second Implementation Review and Evaluation of the Environmental Noise Directive

Directorate-General for Environment
Knowledge, Risks and Urban Environment

August 2016

CONTENTS

1. INTRODUCTION

This Executive Summary sets out the findings and conclusions from the second implementation review and evaluation of the Environmental Noise Directive (the "END"). The study was undertaken by the Centre for Strategy & Evaluation Services and ACCON, supported by AECOM.

1.1 Directive 2002/49/EC

Directive 2002/49/EC (the Environmental Noise Directive, "END") is the EU legislative instrument for the assessment and management of environmental noise[1]. The Directive was adopted on 25 June 2002, and came into force on 18 July 2002. The END has two objectives:

- Art. 1(1) - Achieve a **common European approach** to **avoid, prevent** or **reduce** the effects of exposure to environmental noise harmful for health, which includes annoyance; and
- Art. 1(2) – to provide a basis for developing **Community measures to reduce noise emitted by major sources**, in particular road and rail vehicles and infrastructure, aircraft, outdoor and industrial equipment and mobile machinery.

The END is being implemented over 5-yearly cycles (rounds). Round 1 took place from 2007-2012 and Round 2 is taking place between 2012-2017.

1.2 Objectives of the second implementation review

Under Article 11(1), a review of the Directive's implementation is required once every five years. A technical study[2] to inform the first implementation review of the END was undertaken in 2010 and the European Commission ("EC") published a Report outlining the findings from the first implementation review in 2011[3]. The second implementation review assessed progress over the most recent five-year implementation period, taking into account the evolution in implementation (and any changes in administrative approaches and in national transposition legislation) between R1 and R2. The objectives of the second implementation review of the END were to:

- Assess the legal and administrative implementation of the Directive and its key provisions across EU28 and by Member State ("MS"); and
- Identify difficulties experienced by competent authorities in implementing these provisions.

The extent to which challenges and outstanding issues identified in the first implementation review have remained or been addressed in R2 through remedial actions was examined. The research also assessed how far any new challenges or implementation issues have emerged during R2.

[1] Environmental noise is defined in the Directive as "unwanted or harmful outdoor sound created by human activities, including noise emitted by transport, road traffic, rail traffic, air traffic and from sites of industrial activity".

[2] Final Report on Task 1, Review of the Implementation of Directive 2002/49/EC on Environmental Noise, May 2010, Milieu

[3] COM (2011) 321 final of 1st June 2011, http://eur-lex.europa.eu/legal-content/EN/TXT/DOC/?uri=CELEX:52011DC0321&from=EN

1.3 Objectives and scope of the evaluation

The European Commission ("EC") announced in 2013 in its Communication on Regulatory Fitness and Performance (REFIT)[4] that an evaluation of the END would be undertaken, an evidence-based assessment as to whether EU actions are proportionate and delivering on defined policy objectives. The objective was to evaluate the Directive within the REFIT programme framework[5]. The evaluation was undertaken drawing on methodological guidance on evaluation[6] and a detailed set of evaluation questions were assessed, based on the criteria of *relevance, coherence, effectiveness, efficiency* and *European Added Value*. In a REFIT context, checking whether the END is 'fit for purpose' and provides a *"simple, clear, stable and predictable regulatory framework"* is an issue cutting across each of these evaluation criteria. The evaluation scope covered the period from the Directive's adoption in 2002 until late 2015.

1.4 Methodology

The study methodology was structured over three phases, an inception phase, a core data collection phase and an analysis and reporting phase. The research methods used to collect and analyse the data are summarised in the following table:

Table 1 Research methods for data collection – Second implementation review and evaluation of the END
Interview programme – interviews with 104 END stakeholders (e.g. competent authorities, EU industry associations, acoustics consultants, NGOs and community organisations).
Online survey - three online surveys were carried out between March-May 2015 with (i) public authorities (ii) NGOs/ community groups and (iii) acoustics consultancies.
Validation workshop – three working papers were presented and discussed at the workshop on (1) the second implementation review (2) the REFIT evaluation of the END and 3) on the proposed methodology for the cost-benefit assessment ("CBA"). Input was collected from stakeholders participating in and following the workshop.
Desk research – literature from the EU and national sources was examined such as the Directive's legal text, good practice guidance documents (e.g. on quiet areas, noise mapping) a review of a sample of Strategic Noise Maps ("SNMs") and Noise Action Plans ("NAPs") was undertaken, and an assessment of 'state of the art' methodologies to quantify the costs and benefits of environmental noise and their health effects.
Case studies – for the assessment of costs and benefits (which informed the CBA), 19 case studies examining noise reduction measures were undertaken for airports (5), major railways (2) and major roads (2). Less data was available for agglomerations (10). The purpose was to identify the costs/ benefits.

[4] COM(2013)685 final

[5] http://ec.europa.eu/smart-regulation/refit/index_en.htm

[6] See http://ec.europa.eu/smart-regulation/evaluation/docs/20131111_guidelines_pc_part_i_ii_clean.pdf and *Evaluating EU Activities: A practical guide for Commission services (2004)*

2. KEY FINDINGS - SECOND IMPLEMENTATION REVIEW

The main findings from the Second Implementation Review of the END are now summarised.

2.1 The overall approach to END implementation and legislative transposition

- Considerable differences between "MS" were identified in respect of END implementation approaches, such as more centralised and decentralised approaches. The administrative level at which implementation takes place (i.e. national, regional and local) was found to vary between agglomerations, roads, railways and airports. This reflects the fact that the END is implemented under the subsidiarity principle.
- The transition to the definitive thresholds of the END between R1 and R2 has increased the scope of END coverage, with a significant increase in the volume of km's (major roads, major railways) and in the number of agglomerations and airports covered.
- There have continued to be considerable delays in END implementation in R2 in ensuring that all EU MS submit SNMs and NAPs by the dates stipulated in the Directive (c.f. Art. 7, Art. 8). However, similar difficulties were also encountered in R1.
- The END and its definitions have generally been correctly transposed into national legislation, either through the adoption of new implementing regulations or through adjustments to existing legislation.
- However, in some EU MS, there have been problems in ensuring that national legislation transposing the END correctly transposes all the definitions of key terms and that the terminology used is sufficiently close to the concepts described in the END (e.g. quiet areas in an agglomeration).

2.2 Designation and delimitation of agglomerations, major roads, major railways and airports

- No significant problems were identified in the designation of major roads, major railways, airports and agglomerations that fall within the scope of the END, since the definitions of thresholds were regarded as being clear.
- However, in some MS, there remain practical challenges within agglomerations, relating to the delimitation of administrative responsibilities between national bodies and local authorities for the purposes of producing SNMs. This is especially the case for major railways and major roads situated within agglomerations.

2.3 Noise limits and targets

- Although the END does not set any source-specific limit values ("LVs") at an EU level, establishing national LVs was viewed as being helpful by national Competent Authorities ("CAs") in many EU MS, since exceedance was often used as the basis for prioritising noise mitigation measures.
- Whilst mandatory noise LVs have been set in 21 EU MS, and non-binding targets in a further 4 EU MS[7], there was limited evidence of their effective enforcement either in R1 or R2. However, since national LVs are a MS responsibility, this is outside the END's scope.

[7] Denmark has both binding and indicative values in place, depending on noise source.

2.4 Quiet areas

- Although many MS have made progress in developing definitions of quiet areas (in agglomerations and open country) and in defining selection criteria to designate quiet areas, less than half of all EU MS (13) have yet designated any quiet areas.
- Nevertheless, in those EU MS that have formally designated or identified quiet areas, their number has increased considerably between R1 and R2.
- There remains a perceived need among stakeholders for the EC to develop further practical guidance on quiet areas, regarding their initial designation, the types of measures that could be implemented to ensure their subsequent protection and how to preserve areas of 'relative quiet' within urban areas.
- A reluctance was identified in some MS to designate quiet areas due to uncertainty with regard to whether the process could be reversed in future and also whether a designated quiet area could be subject to legal challenges (e.g. by developers, local authorities etc.).

2.5 Strategic Noise Maps (SNMs)

- Across EU-28, good progress has been made in undertaking strategic noise mapping and in collecting data on population exposure to high levels of environmental noise, defined as L_{den}>55 dB(A) and L_{night} >50 dB(A).
- The L_{den} and L_{night} indicators are being used by CAs responsible for noise mapping across the EU and these indicators, sometimes complemented by additional national noise indicators.
- There have been significant delays in some EU MS in both R1 and R2 in the submission of SNMs to the EC (and also instances of non-submission). It is difficult to compare data completeness between rounds however, since this would be dependent on having comparable data with a similar cut-off date.
- Problems remain with regard to the late submission of SNMs in respect of aircraft noise within agglomerations (only 52% complete) and major railways and airports in general. Major delays in carrying out strategic noise mapping and in reporting SNMs to the EC were generally recognised as a problem by CAs in those MS concerned.
- Ongoing barriers to producing SNMs on a more timely basis identified are: a lack of human and financial resources within CAs in EU MS with a highly decentralised implementation structure, overly complex administrative arrangements leading to difficulties in ensuring effective coordination and a lack of political will at local level to allocate resources, especially where no central government funding was available.
- In both R1 and R2, most CAs outsourced noise mapping to acoustics consultants. Nevertheless, CAs gained experience in coordinating the production of SNMs in R1 and in better defining their procurement needs.
- In some EU MS, evidence was identified that there were cost reductions in R2 implementation as a result of the strengthening capacity to procure such services.
- Over half of MS attested to discernible improvements in R2 in the quality and availability of input data in R2 compared with R1. In other MS, difficulties remain in respect of the lack of input data in both rounds.
- Examples were identified of delays in the procurement of noise mapping services in R2 due to delays in the political approval of budgets for noise mapping due to the economic and financial crisis, and delays in the timely availability of input data (especially population census data).

Common assessment methods and data comparability

- Ensuring adequate continuity and consistency between rounds in input data collection was identified as being important to ensure comparability of output data during strategic noise mapping. Some stakeholders argued that input data needs to become more standardised to strengthen its comparability. However, other stakeholders questioned whether this was realistic, since the required data is context-specific.

- There was broad recognition that the development of common noise assessment methods through the development of the CNOSSOS-EU methodology between 2009 and 2015 was a major achievement. The replacement of Annex II of the Directive with Commission Directive (EU) 2015/996 should, over time, lead to more comparable data which is a pre-requisite in order to better inform the development / revision of source legislation by transport source.
- Ensuring data comparability between rounds for the same source and between EU MS will remain a challenge until Commission Directive (EU) 2015/996 has been implemented on a mandatory basis from R4 onwards. Currently, there are differences in the noise modelling software and computation methods used for mapping the same source between rounds in some EU MS, such that consistent comparability cannot yet be ensured across EU-28.

2.6 Noise Action Plans and Public Consultations

The completeness of reporting data and information - NAPs

- There have been delays in the submission of R2 NAPs in several MS (for instance, in CZ, EL, ES, FR, LU, MT, PT and RO). The most recent reporting information on data completeness shows that more than 2 years after the formal reporting deadline for R2, NAP submission completeness is below 50% across all sources[8], with pronounced gaps for major railways and airports.
- However, it should be emphasised that the delays encountered in reporting to the EC are not unique to R2. Delays were also encountered in R1 NAP submissions in several MS (including several that have also experienced delays in R2).
- Delays in the finalisation of R2 SNMs in several MS have had a knock-on effect in terms of the timeframe for the drawing up and submission of NAPs to the EC.
- The timeframe of 12 months between the formal reporting deadline to the EC for the submission of SNMs and NAPs was viewed by the majority of stakeholders as being too short to allow sufficient time for NAP finalisation.
- Stakeholders pointed to the need to allow adequate time to organise public consultation processes, to review consultation submissions and to give adequate consideration to the integration of feedback into the finalisation of NAPs.
- A particular problem was identified in respect of the timeliness of the completion of NAPs in agglomerations. In MS that have adopted a decentralised approach to END implementation, it was found that when many different actors are involved, it can be difficult to coordinate the development and finalisation of NAPs in an efficient and timely manner.
- There are divergent approaches to action planning between MS due to the fact that the END is implemented under subsidiarity. This is reflected in the types of noise mitigation, abatement and reduction measures identified, the balance between expenditure/ non-expenditure measures[9] and the extent to which there is a strategic or operational focus.

[8] However, this depends on what is meant by data completeness, since some competent authorities have understood that they should only formally submit a summary of the NAP, as opposed to the complete NAP.

[9] Soft measures that do not require expenditure, such as encouraging greater use of public transport and promoting walking and cycling are a feature of some NAPs.

- Although some R2 NAPs include cost-benefit information, others include no data at all, or only partial data, for instance, on the estimated costs but nothing on the anticipated benefits, required under the 'financial information' section in Annex V *(minimum requirements for NAPs)*.
- There was not found to be a major improvement in the quality of cost-benefit information and data between rounds. Stakeholders attributed this to the complexity of assessing costs and benefits at measure level.

Public Consultations of NAPs

- The quality of consultation responses to the publication of draft NAPs was found to vary. Whilst some CAs were satisfied with the quantity and quality of feedback received, others had received little input from relevant stakeholders, despite informing on the consultation in advance.
- NGOs that have participated in consultations stated that although NAPs often include a summary of the consultation responses, it is often unclear how these responses have been taken into account in NAP finalisation.
- Examples of good practices in carrying out consultations were identified, such as ensuring that the draft version of the NAP is published at the outset of the consultation process (and/ or before it is launched), and running the consultation for a minimum period of 2 months to allow sufficient time for stakeholders to review the draft NAP and to develop a considered response. Proper assessment of responses lengthens the time for the preparation, development and finalisation of NAPs, which is not currently taken into account in EU reporting timelines.

The implementation of NAPs

- A difficulty in respect of measure implementation within agglomerations was that the CAs responsible for developing the NAP (often local authorities) do not have strategic or budgetary decision-making powers to determine whether measures included within NAPs are realistic, feasible and can be funded. This was less of a problem for other sources, such as major railways and major roads, where the responsible CA for action planning sometimes also has budgetary or decision-making powers.
- NAPs are meant to report on the previous 5 year period of implementation, but many NAPs do not report systematically on the achievements of the previous 5 year cycle in terms of which measures have gone ahead in full, partially or not at all.

Information accessibility of SNMs and NAPs

- Almost all EU MS have made SNMs available and accessible to the public online. Noise maps have been made available through different website information portals at national, city and municipal levels. From a citizen's perspective, it is important to have access to SNMs covering a given locality at a local level of governance.
- However, continued delays in the submission of reporting data and information for noise mapping and action planning in R2 mean that in some EU MS, SNMs and NAPs are still not being made accessible online until several years after they were meant to be completed and publicised.
- It would also be useful from the point of view of monitoring the overall implementation position at an EU level (and also for policy makers) to provide in addition access to SNMs and NAPs prepared at national level (e.g. especially for major railways and major roads) through a single information portal to avoid the over-fragmentation of information.

3. EVALUATION FRAMEWORK AND KEY FINDINGS

3.1 Key Evaluation Findings

The evaluation findings are now presented grouped under the key evaluation criteria.

3.1.1 Relevance

Art 1(1) of the END, of *"defining a common approach to* ***avoid, prevent*** *or* ***reduce*** *the effects of exposure to environmental noise harmful for health"*, remains highly relevant. Collecting comparable data/ information based on a common, EU-wide approach to assessing the extent of population exposure at specific dB(A) thresholds is a pre-requisite to achieving the END's second objective, informing the development of noise measures through EU source legislation. Stakeholders also recognised that the Directive's second objective remains highly relevant since EU policy makers responsible for the revision of existing environmental noise-at-source legislation are dependent on the availability of EU-wide, reliable population exposure data at receptor, for instance, to help set appropriate Limit Values in source legislation.

Whilst the Directive's two core objectives remain relevant, Art. 1(1) sets out an intermediate objective of defining a "common approach", but lacks a more strategic objective pertaining to what the Directive's implementation should ultimately lead to, such as setting a target for reducing environmental noise exposure in Europe by a particular percentage relating to the number of people exposed to high noise levels. The ultimate goal, alleviating the adverse impacts on public health, is presently implicit in the recitals, rather than explicit in the objectives. This makes it difficult to directly attribute measure implementation and the resulting level of noise reduction to the END itself.

3.1.2 Coherence

In relation to '**internal coherence',** the Directive was found to be generally **consistent and coherent**. However, there remain minor inconsistences in the legal text. In addition, some of the definitions provided in Art. 3 *(e.g. agglomeration, quiet area in an agglomeration and quiet area in open country)* were regarded as being in need of revision or further clarification to strengthen the internal coherence of the text.

With regard to **'external coherence'**, the END was found to be strongly coherent with EU noise-at-source legislation. No major inconsistences or duplications were identified in the assessment of different legal texts. However, since the END was adopted 14 years ago, when the legal text is reviewed at some point in future and updated to ensure consistency with changes to primary legislation (e.g. the entry into force of the Lisbon Treaty in December 2009).

National noise control legislation has been transposed in a way that is coherent with the END, although in the early stages of the Directive's transposition, there were practical challenges in the 13 countries that already had such legislation in place prior to the Directive's adoption to update and ensure consistency with national legislation.

3.1.3 Effectiveness and Impacts

There has been **significant progress in defining a 'common approach'** (Art 1(1)). In particular, the development of common noise assessment methods through CNOSSOS-EU[10] and the replacement of Annex II of the END with Commission Directive (EU) 2015/996 is a major achievement and was acknowledged as such by END stakeholders. The study found evidence that **scientific and technical progress in noise measurement** had been taken into account in the phased development of

[10] https://ec.europa.eu/jrc/sites/default/files/cnossos-eu%2520jrc%2520reference%2520report_final_on%2520line%2520version_10%2520august%25202012.pdf

CNOSSOS-EU (2009-2015). A long timeframe was required, reflecting its technical complexity and the need to allow sufficient time for MS to make the transition from the use of interim and national approaches to common assessment methods.

However, the full implementation of a common approach is dependent on the implementation of Commission Directive (EU) 2015/996 from R4, when SNMs will be produced on a common basis. Population exposure data was found to be not yet fully comparable across EU-28 between rounds. The data should become comparable in future however. In terms of progress towards a common approach in measuring the **harmful effects of noise**, the EC has commenced work to develop assessment methods on dose-response relationships for Annex III. However, finalising Annex III is dependent on the WHO finalising their own guidance on dose-response relationships, expected in 2017.

The late submission of **SNM and population exposure data and of the submission of action plans to the EC** through reporting processes in at least some EU MS in R1 and R2 has undermined the effectiveness of implementation. A lack of timely data and information completeness across EU-28 makes it more difficult to utilise MS submissions, for instance, for the EC, to report on the situation across the EU (Art. 11) and to inform source legislation (Art. 1(2)).

In relation to the **second objective,** the research identified evidence that the END has already played an important role in informing the development of source legislation. The END provides a strategic reference point, and has been referred to in the recitals of other EU noise-related legislation and in relevant impact assessments. Source legislation revised in the past three years has made explicit reference to linkages between source legislation and the END. However, exposure data collected through the END has not yet been directly used by EU source policy makers.

The research found that activities relating to the first objective of the END have had a number of **positive impacts**, such as promoting a more strategic approach to environmental noise management, mitigation and reduction through action planning, strengthening the visibility of environmental noise and the adverse health effects of high levels of noise (at receptor) for EU citizens, and increasing policy attention at MS level.

Awareness has been heightened among policy makers not specialising in environmental noise (e.g. transport planning, infrastructure development, urban development and planning) about the importance of building in environmental noise mitigation and abatement from the outset of the legislative development, policy-making and the programme design process, with evidence of more "joined-up" working between different stakeholder organisations that have different roles and responsibilities.

Enforcement was an aspect of END implementation where weaknesses were identified. Although the EC could potentially take action against EU MS for the late submission of legally-required reporting information and data to the EC through infringement procedures, according to MS CAs interviewed in 2015, the EC has not yet done so.

3.1.4 Efficiency

The **administrative costs** of implementing the END were found to have remained stable between rounds in absolute terms with at least €75.8m each spent by 23 EU MS who provided data. When extrapolated to EU28 aggregate level, the total costs would be €80.3m in R1 and €107.4m in R2. Given the increased volume of noise mapping and action planning requirements in R2, which has approximately doubled due to the transition to the definitive END thresholds, this points to a reduction in the costs of procuring external noise mapping services and the absence of one-off regulatory implementation costs (such as familiarisation with the legislative requirements and information obligations) in R2. The median costs per inhabitant (out of the **total population** of 11 EU MS who provided the necessary data) for noise mapping – circa €0.15 – and for action planning - €0.03 – were low. The estimated costs per **affected inhabitant** estimated by acoustics consultancies were €0.50 – €1.00 (noise mapping only) and €1.50 - €2.00 (noise mapping, action planning and the organisation of public consultations, but only in instances where external technical support was procured to assist competent authorities).

Given that END implementation costs are borne by public administration, and ultimately by the taxpayers in each country, it seems more appropriate to use the competent authority data of €0.15 and €0.03 figures as a benchmark for the administrative costs of END implementation, since this applies to the total population, not only the exposed population. However, even the estimate of €1.50-€2.00 per affected inhabitant shows that when looking at the affected population in isolation, the administrative costs were found to be proportionate relative to the benefits (for a quantitative assessment of benefits, see CBA below, for a qualitative assessment, see effectiveness section in main report).

A **cost-benefit analysis (CBA)** was conducted to quantify (in monetary terms) the cost-effectiveness of the END. The benefits are mainly gained by the population affected by excessive noise. It was not possible to quantify some of the strategic benefits of the END, such as its role in stimulating awareness of noise as an issue, facilitating the generation of large and consistent spatial datasets on noise exposure and supporting actions in other areas (e.g. development of technical standards). The CBA is therefore based primarily on an assessment of the contribution made by measures identified in R1 NAPs to reducing exposure to harmful levels of noise.

The analysis revealed that the END has made a positive contribution to reducing population exposure to high levels of environmental noise. Whilst the **magnitude of costs and benefits** of noise mitigation measures was found to vary between countries and sources, a positive cost-benefit relationship was identified under a range of scenarios, where the scenarios reflect both differences in the underlying assumptions regarding the extent to which costs and benefits can be attributed to the END and the range of uncertainty in relation to the value of impacts on human health. The base case scenario results in a favourable cost-benefit ratio (of 1:29) overall, although the ratios vary substantially between measures. The benefits are likely to be understated, since the analysis only considered the effects of noise reduction on the 'highly annoyed' and 'highly sleep disturbed' populations. It should be noted that whilst the CBA is an important element of assessing efficiency, measure-level data only provides a proxy, since NAP measure implementation is not compulsory and does not take into account the strategic, qualitative benefits of the END (see impacts under "effectiveness").

The END has already made a **positive contribution to reducing noise through the implementation of (voluntary) measures in NAPs** that have either been fully or partially implemented. These estimates suggest that the benefits from efforts to reduce noise from all sources across the EU-28 are substantial, even if only a proportion of the total benefits can be attributed to the END (since other policy drivers can explain why some measures not directly targeting noise reduction go ahead e.g. air quality, planned transport infrastructure development). Less positively, fewer R1 measures went ahead than expected due to the global economic and financial crisis, which affected the budget available for noise mitigation in many EU MS.

The END Reporting Mechanism ("ENDRM") was found to be **generally efficient in collecting SNMs (and population exposure data) and NAPs from EU MS** since competent authorities that are members of EIONET can already access Reportnet for broader environmental reporting purposes. However, there is scope to simplify reporting processes and to make Reportnet more user-friendly for national competent authorities and the ease of data extraction at EU level could be improved. Further clarification is also needed as to which types of data within, and outside agglomerations should be submitted under each source, since presently, there are some areas where the lack of clarity as to what information is meant to be reported could lead to inconsistencies in data comparability.

3.1.5 European Added Value ("EAV")

Overall, the END demonstrates strong EAV, by providing an **EU-wide regulatory framework to collect noise mapping data on population exposure on environmental noise at receptor on a common basis**. There was found to be a clear EAV for EU policy makers responsible for source legislation since they need complete and comparable population exposure data at EU level to inform the development of source legislation. The END has also added value through the collection of population exposure data across EU-28 so as to better monitor and assess the impact of environmental noise at receptor on health (previously, at national level, population exposure data was not generally available to the public).

The research identified differences among END stakeholders in perceptions of EAV between EU MS where national legislation on noise was already in place prior to the END (13), and MS where there was previously no legislative framework (15). In MS without any prior environmental noise legislation, the END has helped to enhance the visibility of environmental noise domestically and has made environmental noise issues more prominent in national policy-making and made noise mitigation more visible in national and regional public expenditure programmes (e.g. road building and transport infrastructure development, urban planning and land use). Where national legislation on noise was already in place prior to the END, there was still perceived to be strong added value, since it was recognised that a European approach had facilitated data collection across the EU and promoted the exchange of experiences and benchmarking.

Putting in place a five-yearly noise action planning process through the END has added value by **promoting a more strategic approach to environmental noise management and mitigation** across the EU than existed previously in most countries, including those that already had a national regulatory framework. MS were positive about the usefulness of action planning and appreciated the considerable flexibility in national implementation approaches that the END allows, reflecting subsidiarity. Even though END stakeholders recognised that there are still various ways in which the END might be improved in future, they were strongly against the "counterfactual scenario" of the Directive's possible repeal, examined in the context of the Fitness Check.

3.1.6 Overall conclusions

The evaluation has involved a detailed assessment of key evaluation issues relating to the END's implementation to date. The conclusions are that:

- The END is fit for purpose overall, although there are a number of ways in which its effectiveness and impacts might be improved in future, as detailed in the "future perspectives" section of the final report.
- The longer-term objective as to what the END is ultimately trying to achieve (reducing the incidence of high levels of environmental noise) across different transport sources needs to be made more explicit.
- The Directive overall and the specific requirements relating to the achievement of the first objective of the END (noise mapping and action planning under Article 1(1)), are widely accepted by stakeholders.

- Whilst significant progress has been made towards the first objective of the END of a "common approach" (under Article 1(1)), especially in respect of the use of common assessment methods, the lack of time availability of a complete reporting information dataset on SNMs and NAPs in both R1 and R2 continues to undermine the END's full and effective implementation.
- Although the use of public consultation is effective in some countries, the role of public consultation could be strengthened in others.

- The lack of EU-level enforcement actions to date to ensure the timely delivery of reporting information in respect of SNMs and NAPs has arguably hindered achieving the END's full impact. However, in the view of the evaluators, launching infringement proceedings may not always be an appropriate mechanism when delays occur, given that national CAs in some EU MS face resource constraints to implement the END, and some stakeholders pointed to cumbersome data entry reporting procedures for submission to the EC.
- Without the existence of the END, there would be less attention to tackling the problem of high levels of environmental noise across EU-28 as a whole, some EU MS would not have introduced any legislation and only minimum numbers of noise maps and population exposure data would have been made publicly available.
- The measure-level assessment has identified positive cost-benefit relationships for investing in noise mitigation, abatement and reduction measures across all transport sources – major railways, major roads and airports.
- Overall, the END was found to be cost-effective, although its full potential has not yet been reached, but this will be strengthened once the data is fully comparable, and is being actively used by EU policy makers responsible for source legislation.

Évaluation de la Directive 2002/49/EC relative à l'évaluation et à la gestion du bruit dans l'environnement

Résumé analytique

Deuxième examen sur la mise en œuvre et évaluation de la directive sur le bruit dans l'environnement

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2016

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1. INTRODUCTION

Le présent Résumé analytique présente les résultats et les conclusions du deuxième examen de la mise en œuvre et de l'évaluation de la Directive relative à l'évaluation et à la gestion du bruit dans l'environnement (« END »). L'étude a été effectuée par le Centre pour la Stratégie et les Services d'Évaluation et par ACCON, avec l'appui d'AECOM.

1.1 Directive 2002/49/EC

La Directive 2002/49/EC (Directive sur la gestion du bruit dans l'environnement, « END ») est l'instrument législatif de l'UE pour l'évaluation et la gestion du bruit dans l'environnement[1]. La directive a été adoptée le 25 juin 2002, et est entrée en vigueur le 18 juillet 2002. La directive END a les deux objectifs suivants :

- Art. 1(1) - Établir une **approche européenne commune** afin d'**éviter**, de **prévenir** ou de **réduire** en priorité les effets nuisibles, y compris la gêne, de l'exposition au bruit dans l'environnement ; et
- Art. 1(2) – fournir une base pour mettre au point des **mesures communautaires destinées à réduire les émissions sonores provenant des principales sources**, en particulier les véhicules et les infrastructures routiers et ferroviaires, les aéronefs, les matériels extérieurs et industriels et les engins mobiles.

La mise en œuvre de la directive END s'effectue par cycles de 5 ans (échéances). La 1ère échéance couvre la période 2007 à 2012, la 2ème échéance la période 2012-2017.

1.2 Les objectifs du deuxième examen de la mise en œuvre

Conformément aux dispositions de l'article 11(1), un examen de la mise en œuvre de la directive doit être effectué tous les cinq ans. En 2010, une étude technique[2] a été effectuée pour documenter le premier examen de la mise en œuvre, et la Commission européenne (CE) a publié un rapport présentant une synthèse des résultats du premier examen de la mise en œuvre, en 2011[3]. Le deuxième examen de la mise en œuvre s'est penché sur les progrès réalisés au cours de la période de mise en œuvre de cinq ans la plus récente, en tenant compte de l'évolution dans la mise en œuvre (et d'éventuels changements au niveau de l'approche administrative et du droit national de transposition) entre les échéances R1 et R2. Les objectifs du deuxième examen de la mise en œuvre de la directive END étaient les suivants :

- Évaluer la mise en œuvre juridique et administrative de la Directive, et ses principales dispositions dans l'UE-28 et par État membre ; et
- Identifier les difficultés rencontrées par les autorités compétentes lors de la mise en œuvre de ces dispositions.

On s'est penché sur la mesure dans laquelle les problèmes et les questions en suspens, identifiés au cours du premier examen de mise en œuvre, n'ont toujours pas été résolus, ou ont été soulevés au cours de la 2ème échéance (R2) par le biais de

[1] Le « bruit dans l'environnement » est défini comme un « *son extérieur non désiré ou nuisible résultant d'activités humaines, y compris le bruit émis par les moyens de transport, le trafic routier, ferroviaire ou aérien, et provenant de sites d'activité industrielle*. »

[2] Rapport final sur la Tâche 1, Examen de la Mise en Œuvre de la Directive 2002/49/CE sur le Bruit dans l'Environnement, Mai 2010

[3] COM (2011) 321 final du 1er juin 2011, http://eur-lex.europa.eu/legal-content/EN/TXT/DOC/?uri=CELEX:52011DC0321&from=EN

mesures correctives. La recherche a également évalué dans quelle mesure de nouveaux problèmes ou difficultés ont surgi au cours de la 2ème échéance (R2).

1.3 Objectifs et champ d'application de l'évaluation

La Commission européenne (« CE ») a annoncé, en 2013, dans sa communication relative à une réglementation affûtée et performante (REFIT)[4] qu'une évaluation de la directive END serait effectuée, à savoir une évaluation factuelle visant à établir si les mesures de l'UE sont proportionnées et à même de permettre la réalisation des objectifs de politique définis. L'objectif était d'évaluer la directive dans le cadre du programme REFIT[5]. L'évaluation fut effectuée sur la base des conseils méthodologiques sur l'évaluation[6] et un ensemble détaillé de questions sur l'évaluation ont été évaluées, sur la base de critères de *pertinence, cohérence, efficacité, efficience et valeur ajoutée européenne.* Dans le contexte de REFIT, l'établissement de l'« aptitude aux fins recherchées » de REFIT, et de la façon dont elle apporte un cadre réglementaire à la fois « simple, claire, stable et prévisible », est une question concernant chacun de ces critères d'évaluation. La portée de cette évaluation couvrait la période allant de l'adoption de la directive jusqu'à la fin de 2015.

1.4 Méthodologie

La méthodologie de l'étude était axée sur trois phases : une phase de démarrage, une phase de collecte des données de base, et une phase de présentation de rapport. Les méthodes d'essai utilisées pour la collecte et l'analyse des données sont résumées dans le tableau suivant :

Tableau 1 Méthodes de recherche pour la collecte de données – Deuxième examen sur la mise en œuvre et évaluation de la directive END
Programme d'entrevues – entrevues avec 104 parties concernées par la directive END (p.ex. autorités compétentes, associations industrielles de l'UE, experts en acoustique, organisations non gouvernementales et organisations communautaires).
Sondages en ligne - on a procédé, au cours d'une période allant du mois de mars au mois de mai 2015, à trois sondages en ligne avec (i) des pouvoirs publics, (ii) des organisations non gouvernementales/groupes communautaires, et (iii) des sociétés de conseil en acoustique.
Atelier de validation – trois documents de travail ont été présentés et discutés au cours d'un atelier sur (1) le deuxième bilan sur la mise en œuvre (2) l'évaluation REFIT de la directive END, et (3) la méthodologie proposée pour l'évaluation coûts-bénéfices. Les informations ont été recueillies auprès des parties concernées participant à l'atelier, et à la suite de cet atelier.
Recherche documentaire – on a procédé à l'examen d'une documentation de l'UE et de sources nationales, par exemple le texte juridique de la Directive, des guides sur les bonnes pratiques (p.ex. sur les endroits tranquilles, la cartographie du bruit), un examen d'un exemple de carte de bruit stratégiques (SNM »), et des Plans d'Action pour le Bruit), ainsi qu'à une évaluation de méthodologies à la pointe de la technologie pour quantifier les coûts et les bénéfices du bruit et leurs effets sur la santé.
Études de cas – pour l'évaluation des coûts et des bénéfices (qui sont à la base de l'évaluation coûts-bénéfices), on a procédé à 19 études de cas à niveau de mesure pour des aéroports (5), de grands réseaux ferroviaires (2), et de grand axes routiers. On disposait de moins de données pour les agglomérations (10).

[4] COM(2013)685 final

[5] http://ec.europa.eu/smart-regulation/refit/index_en.htm

[6] cf. http://ec.europa.eu/smart-regulation/evaluation/docs/20131111_guidelines_pc_part_i_ii_clean.pdf et *Évaluation des activités de l'UE: guide pratique des services de Commission (2004)*

2. PRINCIPALES CONSTATATIONS – DEUXIÈME BILAN SUR LA MISE EN ŒUVRE

Sont maintenant résumées les principales conclusions du deuxième examen de la mise en œuvre de la directive END.

2.1 L'approche globale pour la mise en œuvre de la directive END et sa transposition législative

- On relève des différences considérables entre les États membres en ce qui concerne les approches pour la mise en œuvre de la directive END : par exemple des approches plus centralisées et plus décentralisées. On a relevé que le niveau administratif (national, régional ou local) auquel la directive est mise en œuvre varie entre les agglomérations, les routes, les chemins de fer et les aéroports. Ceci reflète le fait que la directive est mise en œuvre selon le principe de la subsidiarité.
- La transition aux seuils définitifs de la directive END entre les échéances 1 et 2 (R1 et R2) a augmenté le champ d'application de la directive END, y compris une augmentation significative du volume de km (grands axes routiers et ferroviaires) et du nombre d'agglomérations et d'aéroports couverts.
- On a assisté à la persistance de retards considérables, lors de la mise en œuvre de la directive END au cours de R2, dans la présentation, par tous les États membres de l'UE, de cartes de bruit stratégiques et de PPBE dans les délais stipulés dans la directive (cf. Art. 7, Art. 8). Toutefois, on avait également rencontré des difficultés similaires au cours de R1.
- D'une manière générale, la directive END et ses définitions ont généralement été transposées correctement dans la législation nationale, soit à travers l'adoption de nouvelles réglementations mises en œuvre, soit par le biais d'amendements de la législation existante.
- On a toutefois assisté, chez certains États membres, à des difficultés pour assurer que la législation nationale transposant la directive END transpose correctement toutes les définitions des termes essentiels, et que la terminologie utilisée soit suffisamment proche des concepts décrits dans la directive END (p.ex. des zones calmes dans une agglomération).

2.2 Désignation et délimitation des agglomérations, des grands axes routiers, des grands axes ferroviaires et des aéroports

- On n'a signalé aucun problème significatif concernant la désignation de grands axes routiers, de grands axes ferroviaires, d'aéroports, et d'agglomérations comprise dans le champ d'application de la directive END, étant donné que les définitions des seuils sont considérées comme étant claires.
- Il subsiste toutefois, dans certains États membres, des difficultés de nature pratique, au sein des agglomérations, concernant la délimitation de responsabilités administratives entre organismes nationaux et administrations locales aux fins de la production de cartes de bruit stratégiques, notamment pour les grands axes ferroviaires et routiers situés dans des agglomérations.

2.3 Limites de bruit et objectifs

- Bien que la directive END n'établisse pas, à l'échelon de l'UE, de valeurs limites spécifiques à la source, l'établissement de valeurs limites nationales est considéré comme une mesure utile par l'autorité compétente dans de nombreux États membres, étant donné que les dépassements servent souvent de base pour donner priorité aux mesures de réduction du bruit.
- Même si des valeurs limites obligatoires ont été fixées dans 21 États membres de l'UE, et des objectifs non obligatoires dans 4 autres États membres de l'UE, on

relève bien peu d’indices de leur application efficace au cours de la 1ère échéance (R1) ou de la 2ème (R2). Toutefois, du fait que les valeurs limites nationales sont placées sous la responsabilité des États membres, elles sont exclues de l’objectif de la directive END.

2.4 Les zones calmes

- Bien qu’un grand nombre d’États membres ait avancé dans le développement de la définition de zones calmes (dans les agglomérations et en rase campagne) et la définition de critères de sélection pour désigner des zones calmes, moins de la moitié de tous les États membres de l’UE (13) ont, jusqu’à présent, désigné des zones calmes.
- Cependant, dans les États membres de l’UE qui ont désigné ou identifié officiellement des zones calmes, leur nombre a augmenté considérablement entre la 1ère échéance (R1) et la 2ème (R2).
- Il subsiste, parmi les parties concernées, une perception de la nécessité du développement, par la CE, de nouvelles consignes pratiques sur les zones calmes, concernant leur désignation initiale, les types de mesure qui pourraient être mises en œuvre pour assurer leur protection ultérieure, et la façon de préserver des zones de « calme relatif » dans des zones urbaines.
- On dénote, dans certains États membres, une réticence à désigner des zones calme, en raison d’une part de l’incertitude sur la possibilité d’inverser ce processus dans l’avenir, d’autre part de la possibilité qu’une zone calme puisse faire l’objet de contestations judiciaires (p.ex. de la part de promoteurs immobiliers, d’administrations municipales etc).

2.5 Cartes de bruit stratégiques

- Dans les 28 États de l’UE, on a bien progressé dans l’établissement d’une cartographie du bruit, et dans la collecte de données sur l’exposition de la population à des niveaux élevés de bruit dans l’environnement, définis de la façon suivante : L_{den}>55 dB(A) et L_{night} >50 dB(A).
- Les indicateurs L_{den} et L_{night} sont utilisés par l’autorité compétente responsable de la cartographie du bruit dans l’UE et ces indicateurs, complétés dans certains cas par des indicateurs de bruit nationaux supplémentaires.
- La soumission, dans certains États membres de l’UE, de cartes de bruit stratégiques à la CE, au cours de R1 et R2, s’est effectuée avec des retards significatifs (auxquels on doit ajouter également des cas de non soumission). Il est toutefois difficile de comparer l’intégralité des données entre les échéances, car on devrait, pour cela, disposer de données comparables avec une date d’échéance similaire.
- Il subsiste des problèmes au niveau de la présentation tardive de cartes de bruit stratégiques, concernant le bruit des avions dans les agglomérations (on n’en a reçu que 52%), et, de façon générale, dans les grands axes ferroviaires et les aéroports. Les autorités compétentes des États membres concernés considèrent que les retards importants dans la réalisation d’une cartographie de bruit stratégiques et dans la communication de cartes de bruit stratégiques à la CE constituent un problème.
- On a identifié les obstacles actuels suivants à la production plus rapide de cartes de bruit stratégiques : insuffisance des ressources humaines et financières dans les autorités compétentes des États membres de l’UE présentant une structure de mise en œuvre fortement décentralisée ; complexité excessive des dispositions administratives , donnant lieu à des difficultés pour assurer une coordination efficace; et manque de volonté politique à l’échelon local, en ce qui concerne l’affectation des ressources, en particulier en l’absence de tout financement du gouvernement central.

- Au cours des échéances R1 et R2, la plupart des autorités compétentes ont externalisé la cartographie du bruit à des spécialistes en acoustique. Toutefois, les autorités compétentes ont acquis de l'expérience dans la coordination de la production de cartes de bruit stratégiques au cours de R1, et dans une meilleure définition de leurs exigences d'approvisionnement.
- Dans certains États membres de l'UE, on a relevé des cas de réduction des de mise en œuvre au cours de R2, en raison d'une capacité renforcée de la prestation de ces services.
- Plus de la moitié des États membres confirment que des améliorations sensibles ont été obtenues au cours de R2, sur le plan de la qualité et de la disponibilité de données saisies au cours de R2 par rapport à R1. Dans d'autres États membres, il subsiste des difficultés au niveau de données saisies au cours des deux échéances.
- On a identifié des exemples de retards dans l'approvisionnement en services de cartographie du bruit au cours de R2, dus à des retards dans les autorisations politiques relativement aux budgets pour la cartographie du bruit attribuables à la crise économique et financière, et dans la disponibilité ponctuelle de données saisies (notamment des informations relatives aux recensements).

Méthodes d'évaluation communes, et comparabilité des données

- On a établi qu'il est important d'assurer une continuité et une harmonisation adéquates entre les échéances en ce qui concerne la collecte de données saisies, afin de permettre la comparabilité de données produites au cours de la cartographie stratégique du bruit. Certaines parties concernées estiment qu'il est nécessaire d'accroître l'harmonisation entre les données saisies, afin de renforcer les comparaisons entre elles, tandis que d'autres se demandent si, du fait que les données requises sont spécifiques au contexte, une telle initiative serait réaliste.

- On reconnaît de toutes parts la grande réussite que représente le développement de méthodes communes d'évaluation du bruit par le biais du développement de la méthodologie CNOSSOS-EU, de 2009 à 2015. La substitution de l'Annexe II de la Directive par la Directive (UE) 2015/996 de la Commission devrait éventuellement engendrer des données plus comparables, condition préalable nécessaire pour assurer que le développement / la révision de la législation de base dispose de meilleures informations provenant du secteur des transports.
- Assurer la comparabilité des données d'une échéance à l'autre, pour une même source et entre des États membres de l'UE, restera difficile, jusqu'à l'application obligatoire de la directive 2015/996 de la Commission à partir de R4. On relève actuellement certaines différences dans le logiciel de modélisation et les méthodes de calcul du bruit utilisées pour la cartographie de la même source entre échéances, dans certains États membres de l'UE, en raison desquelles une comparabilité régulière entre les 28 pays de l'UE ne peut encore être assurée.

2.6 Plans de prévention du bruit dans l'environnement et consultations publiques

Intégralité des données et informations des rapports - Les PPBE

- On relève, chez certains États membres (p.ex. CZ, EL, ES, FR, LU, MT, PT et RO) des retards dans la soumission de PPBE au cours de R2. Les informations des rapports les plus récents sur l'intégralité des données montrent que plus de 2 ans après le délai officiel pour les rapports, au cours de R2, l'exhaustivité des soumissions de PPBE est inférieure à 50% pour toutes les sources[7], les lacunes les plus flagrantes étant celles qui se rapportent aux grands axes ferroviaires et aux aéroports.

- Il convient toutefois de souligner que les retards relevés pour les rapports à la CE ne sont pas uniques à R2. On a également relevé des retards dans les soumissions de PPBE, au cours de R1, dans plusieurs États membres (plusieurs desquels ont également connu des retards au cours de R2).
- Les retards de finalisation de cartes de bruit stratégiques au cours de R2, dans plusieurs États membres, ont eu effet de « domino » au niveau des délais pour l'élaboration et la soumission de PPBE à la CE.
- Le délai de 12 mois, entre l'échéance officielle pour la présentation à la CE du rapport concernant la soumission de cartes de bruit stratégiques et de PPBE était considéré, par la majorité des intervenants, comme étant trop serré pour disposer d'un temps suffisant pour la finalisation des PPBE.
- Certains intervenants ont souligné la nécessité de prévoir le temps nécessaire pour organiser des processus de consultation publique, examiner les soumissions de consultation, et tenir compte de façon adéquate du feedback dans la finalisation des PPBE.
- Un problème particulier a été identifié au niveau de la rapidité de l'achèvement des PPBE dans les agglomérations. Dans les États membres qui ont adopté une approche décentralisée pour la mise en œuvre de la directive END, on a noté qu'en présence de nombreux acteurs divers, il est parfois difficile de coordonner le développement et la coordination de PPBE de façon efficace et opportune.
- On relève différentes approches, entre les États membres, pour la planification des mesures, du fait que la directive END est mise en œuvre conformément au principe de la subsidiarité. Ceci se reflète dans les types de mesures de réduction du bruit qui sont identifiées, l'équilibre entre les mesures avec et sans dépenses[8], et la mesure dans laquelle on suit une orientation stratégique ou opérationnelle.
- Bien que certains PPBE dans R2 comprennent des informations sur les coûts-bénéfices, d'autres ne comprennent pas de données, ou bien, par exemple, des données partielles seulement sur les coûts estimatifs, mais aucune sur les bénéfices prévus, conformément aux dispositions contenues dans la section « Informations financières » dans l'Annexe V (*prescriptions minimales pour les PPBE*).
- On n'a relevé aucune amélioration sensible dans la qualité des informations et des données sur les coûts-bénéfices entre les échéances, ce que les intervenants attribuent à la complexité de l'évaluation des coûts et bénéfices à l'échelon des mesures.

Consultations publiques des PPBE

- La qualité des réponses à la consultation concernant la publication du projet de texte des PPBE s'est avérée être variable. Alors que certaines autorités compétentes étaient satisfaites de la quantité et la qualité des commentaires reçus, d'autres avaient reçu bien peu de commentaires des intervenants concernés, lesquels avaient pourtant été informés à l'avance de cette consultation.
- Les organisations non gouvernementales qui ont participé à des consultations ont déclaré que bien que les PPBE comprennent souvent un récapitulatif des réponses à

[7] Ceci dépend toutefois de ce que l'on entend par « exhaustivité » des données, car certaines autorités compétentes estiment qu'elles ne sont tenues que de fournir un récapitulatif du PPBE, et on pas le PPBE complet.

[8] Mesures dites « douces » ne nécessitant pas de dépenses : par exemple, certains PPBE sont caractérisés par l'encouragement d'un plus grand emploi des transports en commun, ainsi que la marche à pied et le vélo

la consultation, il est, dans de nombreux cas, difficile d'établir de quelle façon on a tenu compte de ces réponses dans la finalisation des PPBE.

- Des exemples de bonnes pratiques, dans l'exécution des consultations, ont été identifiées : par exemple, on s'est assuré que la version provisoire du PPBE a été publiée au tout début du processus de consultation (et/ou avant son lancement), et on a poursuivi la consultation pendant une période minimum de 2 mois afin de donner aux intervenants le temps suffisant pour examiner le projet de PPBE, et élaborer une réponse réfléchie. Une bonne évaluation des réponses augmente les délais nécessaires pour la préparation, le développement et la finalisation des PPBE, ce dont on ne tient actuellement pas compte dans les délais de rapports de l'UE.

La mise en œuvre des PPBE

- Une des difficultés pour la mise en œuvre des mesures dans les agglomérations est que l'autorité compétente chargée du développement du PPBE (il s'agit souvent des administrations municipales) ne jouit pas des pouvoirs décisionnaires stratégiques ou budgétaires pour déterminer quelles mesures comprises dans les PPBE sont réalistes, viables et finançables. Ce problème est moins prononcé pour d'autres sources, par exemple de grands axes ferroviaires et routiers, où l'autorité compétente responsable de la planification des mesures dispose également de pouvoirs budgétaires ou de décision.
- Bien que les PPBE soient censés présenter un compte rendu sur la période de mise en œuvre précédente de 5 ans, un grand nombre de PPBE ne rendent pas compte systématiquement des réalisations du précédent cycle de 5 ans, en ce qui concerne les mesures qui ont été entièrement, partiellement ou pas du tout réalisées.

Accessibilité de l'information sur les cartes de bruit stratégiques et les PPBE

- Presque tous les États membres de l'UE ont mis, en ligne, des cartes de bruit stratégiques à la disposition du public, qui est en mesure d'y accéder. Des cartes de bruit ont été rendues disponibles par le biais de différents portails d'information Internet, à l'échelon national, régional et municipal. Du point de vue du citoyen, il est important que celui-ci puisse accéder à des cartes de bruit stratégiques couvrant une certaine localité à un niveau de gouvernance local.
- Toutefois, en raison de retards persistants dans la soumission de données et informations de rapports pour la cartographie du bruit et la planification des mesures dans R2, les cartes de bruit stratégiques et les PPBE ne sont toujours pas disponibles en ligne dans certains États membres de l'UE, plusieurs années après la date à laquelle ils sont censés avoir été achevés et médiatisés.
- Il serait également utile, du point de vue du contrôle de la situation globale en ce qui concerne la mise en œuvre à l'échelon de l'UE (et des responsables politiques) de pouvoir accéder également aux cartes de bruit et aux PPBE élaborés à l'échelon national (en particulier pour les grands axes ferroviaires et routiers) par le biais d'un simple portail d'information, afin d'éviter la fragmentation excessive de l'information.

3. CADRE DE L'ÉVALUATION ET PRINCIPALES CONCLUSIONS

3.1 Principales conclusions de l'évaluation

Les conclusions de l'évaluation, groupées par les principaux critères d'évaluation, sont présentées ci-après.

3.1.1 Pertinence

L'article 1(1) de la directive END, qui précise que cette dernière « *vise à établir une approche commune destinée à éviter, prévenir ou réduire en priorité les effets nuisibles de l'exposition au bruit dans l'environnement* », reste fortement pertinent. La collecte de données/informations comparables, basées sur une approche commune pour tous les États membres de l'UE pour l'évaluation de l'importance de l'exposition de la population à des seuils de dB(A) spécifiques, est une condition préalable à la réalisation du deuxième objectif de la directive END, qui est de documenter le développement de mesures contre le bruit par le biais d'une législation sur la source, dans l'UE. Les intervenants reconnaissent en outre que le deuxième objectif reste extrêmement pertinent, étant donné que les décideurs, dans l'UE, responsables de la révision de la législation sur le bruit à la source dans l'environnement, sont tributaires de la disponibilité, au récepteur, de données fiables pour l'ensemble de l'UE, sur l'exposition de la population, ce qui contribue à la définition de valeurs limites appropriées dans la législation sur la source.

Bien que les deux principaux objectifs de la Directive restent pertinents, l'Art. 1(1) définit un objectif intermédiaire de définition d'une « *approche commune* » ; lui fait défaut toutefois un objectif plus stratégique concernant l'objectif éventuel de la mise en œuvre de la Directive, par exemple la fixation d'un objectif pour la réduction, d'un certain pourcentage, de l'exposition au bruit dans l'environnement en Europe en ce qui concerne le nombre de personnes exposées à des niveaux de bruit élevés. L'objectif final, à savoir la réduction de l'incidence négative sur la santé publique, est actuellement implicite dans ses dispositions, plutôt qu'explicite dans ses objectifs, ce qui rend difficile l'attribution directe à la directive END d'une réduction effective du bruit en raison de la mise en œuvre des mesures. étroitement .

3.1.2 Cohérence

En ce qui concerne la « **cohérence interne** », la Directive s'est avérée être, d'une manière générale, **cohérente et logique**. Il subsiste néanmoins certaines incohérences secondaires dans le texte juridique, et certaines définitions contenues dans l'art. 3 (p.ex. : *agglomération, zone calme dans une agglomération*, et *zone calme en pleine campagne*) devraient être révisées, ou tout au moins clarifiées, afin de renforcer la cohérence interne du texte.

Pour ce qui est de la « **cohérence externe** », la Directive END est jugée fortement cohérente avec la législation de l'UE sur le bruit à la source. Lors de l'évaluation des différents textes juridiques, on n'a pas relevé d'incohérences ou duplications majeures. Toutefois, étant donné que l'adoption de la directive END remonte à 14 ans, lorsque l'on procèdera à la révision éventuelle du texte juridique dans l'avenir, on devra le mettre à jour afin d'assurer qu'il reflète les modifications apportées à la législation primaire (p.ex. l'entrée en vigueur du Traité de Lisbonne, en décembre 2009).

La législation nationale sur la réduction du bruit a été transposée afin qu'elle soit cohérente avec la directive END, même si, dans les premiers temps de la transposition de la Directive, certaines contestations de nature pratique avaient été soulevées par les 13 pays dans lesquels cette législation était déjà en place préalablement à l'adoption de la directive, afin de la mettre à jour et d'assurer son harmonisation avec la législation nationale.

3.1.3 Efficacité et Impacts

Des **progrès significatifs** ont été réalisés pour la **définition d'une « approche commune »** (Art. 1(1)). En particulier, le développement de méthodes communes d'évaluation du bruit par le biais de CNOSSOS-EU[9] et le remplacement de l'Annexe II

[9] https://ec.europa.eu/jrc/sites/default/files/cnossos-eu%2520jrc%2520reference%2520report_final_on%2520line%2520version_10%2520august%25202012.pdf

de la directive END par la Directive 2015/996 de la Commission (UE) représente une grande réalisation, et a été reconnue comme telle par des intervenants de la directive END. L’étude a révélé que l’on a tenu compte du **progrès scientifique et technique dans la mesure du bruit** dans le développement progressif de CNOSSOS-EU (2009-2015). Ceci nécessite des délais importants, reflétant sa complexité technique, ainsi que la nécessité de prévoir le temps nécessaire pour permettre aux États membres d’effectuer la transition de l’emploi d’approches intérimaires et nationales à des méthodes d’évaluation communes.

Toutefois, la mise en œuvre intégrale d’une approche commune est tributaire de la mise en œuvre de la Directive 2015/996 de la Commission (UE) à compter de R4, lorsque des cartes de bruit stratégiques seront produites de façon commune. On a établi que des données sur l’exposition de la population ne permettent pas encore d’effectuer une comparaison intégrale dans les 28 pays de l’UE entre les échéances. Toutefois, les données devraient devenir comparables à l’avenir ; en ce qui concerne l’avancement vers une approche commune pour la mesure des **effets nuisibles du bruit**, la CE a lancé des travaux pour le développement de méthodes d’évaluation sur des rapports de dose-réponse pour l’Annexe III. Toutefois, la finalisation de l’Annexe III est fonction de la finalisation, par l’OMS, de ses propres lignes directrices sur les rapports de dose-réponse, prévus pour 2017.

La présentation tardive à la CE de **cartes de bruit stratégiques et de données sur l’exposition de la population, ainsi que de plans d’action**, par le biais des procédures de compte rendus dans au moins certains États membres de l’UE, au cours de R1 et R2, a entravé l’efficacité de la mise en œuvre. L’insuffisance de données ponctuelles, et de l’exhaustivité de l’information dans les 28 pays de l’UE, rend l’utilisation des soumissions par les États membres encore plus difficile : par exemple, en ce qui concerne la CE, la présentation d’un compte rendu sur la situation dans l’intégralité de l’UE (Art. 11) et la fourniture d’informations pour la législation sur les sources (Art. 1(2)).

Pour ce qui est du **deuxième objectif**, la recherche a identifié des éléments démontrant que la directive END a déjà joué un rôle important avec la fourniture d’informations pour le développement d’une législation sur les sources. La directive END représente un point de référence stratégique, et est mentionnée dans les dispositions d’autres législations de l’UE relatives au bruit, ainsi que dans des évaluations pertinentes des impacts. La législation sur les sources, révisée au cours des trois dernières années, fait spécifiquement référence à des liens entre la législation sur les sources et la directive END. Toutefois, les données sur l’exposition, recueillies à travers la directive END, n’ont pas encore été utilisées directement par les décideurs de l’UE sur la politique relative aux sources.

La recherche a établi que des activités relatives au premier objectif de la directive END ont eu un certain nombre d’**effets positifs**, par exemple la promotion d’une approche plus stratégique pour la gestion, la mitigation, et la réduction du bruit dans l’environnement par le biais de la planification de mesures, du renforcement de la visibilité du bruit dans l’environnement, et des effets nocifs, pour la santé, de hauts niveaux de bruit (au récepteur) pour les citoyens de l’UE, et l’augmentation d’une attention pour la politique à l’échelon des États membres.

Les décideurs non spécialisés dans le bruit dans l’environnement (p.ex. ceux de la planification des transports, du développement de l’infrastructure, du développement urbain et de l’urbanisme) ont été sensibilisés sur l’importance de l’incorporation de certains aspects, par exemple la mitigation et la réduction du bruit dans l’environnement, dès le tout début de l’élaboration de la politique, du processus décisionnel, et des modalités de conception du programme ; on relève déjà un renforcement de l’intégration entre différentes organisations concernées, exerçant des rôles et responsabilités divers.

L'application est l'aspect de la mise en œuvre de la directive END où des lacunes ont été relevées. Même si, d'après certaines autorités compétentes d'États membres interviewées en 2015, la CE pourrait, potentiellement, prendre des mesures à l'encontre d'États membres de l'UE pour la présentation tardive, à la CE, d'informations et de données légalement obligatoires pour la présentation de rapports, cette dernière n'en a encore rien fait.

3.1.4 L'efficacité

On a relevé des coûts administratifs de la mise en œuvre de la directive END stables pour chaque échéance à 75,8 millions, d'après des données reçues de 23 États membres de l'UE. Lorsqu'ils sont extrapolés à l'UE-28, ces coûts se chiffrent à 80,3 millions d'€, (R1) et €107,4 million d'€ (R2), respectivement. Si l'on tient compte de l'augmentation du volume de la cartographie du bruit et des exigences de la planification des mesures au cours de R2, qui a pratiquement doublé en raison de la transition aux seuils définitifs de la directive END, cela implique des réductions des coûts de l'approvisionnement en services extérieurs de cartographie du bruit, ainsi que l'absence de coûts ponctuels au cours de R2. Les coûts médians par habitant (sur la **population totale** des 11 États membres de l'UE qui ont fourni les données nécessaires) pour la cartographie du bruit – environ 0,15€ - et pour la planification des mesures – 0,03€ - sont bas. Les coûts estimés par **habitant affecté**, estimés en fonction des conseils en acoustique, se chiffrent à 0,50€ à 1,00€ (pour la cartographie du bruit seulement), et 1,50€ - 2,00€ (cartographie du bruit, planification des mesures et organisation de consultations publiques, seulement dans les cas où un soutien technique externe a été financé pour aider les autorités compétentes).

Étant donné que les coûts de mise en œuvre de la directive END sont à la charge de l'administration publique, et sont, au bout du compte, imputés aux contribuables de chaque pays, il semble plus opportun d'utiliser, à titre de référence pour les coûts administratifs de la mise en œuvre de la directive END, les données de l'autorité compétente, à savoir 0,15€ et 0,03€, ces chiffres s'appliquant à l'intégralité de la population, et non pas seulement à la population exposée. Toutefois, même l'estimation de 1,50€ - 2,00€ par habitant affecté montre que lorsque l'on considère exclusivement la population affectée, les coûts administratifs s'avèrent être proportionnels aux bénéfices (pour une évaluation quantitative des bénéfices, voir CBA ci-dessous, tandis que pour une évaluation qualitative, voir la section sur l'efficacité dans le rapport principal).

On a procédé à une **analyse des coûts-bénéfices** afin de quantifier (en termes monétaires) la rentabilité de la législation END. Le principal bénéficiaire est la population affectée par le bruit excessif. Il n'a pas été possible de quantifier certains des bénéfices stratégiques de la législation END, par exemple son rôle pour stimuler la sensibilisation au bruit en tant que problème, réaliser des jeux de données spatiaux homogènes sur l'exposition au bruit, et les mesures à l'appui dans d'autres zones (p.ex. le développement de normes techniques). En conséquence, l'analyse des coûts-bénéfices est basée principalement sr une évaluation de la contribution apportée par des mesures identifies dans les PPBE de R1 à la réduction de l'exposition à des niveaux de bruit nuisibles.

L'analyse à révélé que la législation END a contribué de façon positive à la réduction de l'exposition de la population à des niveaux élevés de bruit dans l'environnement. Bien que l'on ait noté que la **magnitude des coûts et des bénéfices** des mesures de mitigation du bruit varie entre les pays et les sources, on a identifié un rapport coûts-bénéfice dans toute une gamme de scénarios, ces scénarios reflétant à la fois des différences dans les hypothèses sous-jacentes concernant la mesure dans laquelle les coûts et les bénéfices peuvent être attribués à la législation END, et la gamme d'incertitudes relative à la valeur des incidences sur la santé de l'homme. Le scénario de base engendre un rapport coûts/bénéfices dans l'ensemble raisonnable (1/29), bien que ces rapports varient substantiellement d'une mesure à une autre. Dans l'ensemble, les bénéfices sont susceptibles d'être sous-estimés, étant donné que l'analyse n'examinait que les effets de la réduction du bruit sur des populations « fortement gênées » et au « sommeil fortement perturbé ».

Il convient de noter que, bien que l'analyse des coûts-bénéfices soit un élément important pour l'analyse de l'efficacité, les données relatives au niveau de mesures ne fournissent que des informations approximatives, étant donné que la mise en œuvre des mesures du PPBE n'est pas obligatoire, et ne tient pas compte des nombreux avantages stratégiques de la législation END (voir *impacts*, sous *efficacité*) qui ne peuvent être évalués que qualitativement.

La législation END a déjà **contribué de façon positive à la réduction du bruit par le biais de mesures (volontaires) dans les PPBE**, qui ont été entièrement ou partiellement mises en œuvre. Ces estimations indiquent que les bénéfices découlant d'initiatives visant à réduire le bruit de toutes les sources dans l'EU-28 sont substantiels, même si une partie seulement de l'ensemble des bénéfices puisse être attribuée à la Directive END (étant donné que d'autres facteurs de politique peuvent expliquer la raison pour laquelle certaines mesures ne ciblant pas directement la réduction du bruit sont adoptées ; p.ex. qualité de l'air, développement planifié de l'infrastructure des transports). Sur un plan moins positif, moins de mesures que prévu ont été adoptées au cours de R1, en raison de la crise économique et financière mondiale, qui a affecté le budget disponible dans de nombreux États membres de l'UE.

Le mécanisme de communication de l'information de la Directive END (« ENDRM ») est **dans l'ensemble efficace pour la collecte de cartes de bruit stratégiques (et de données sur l'exposition de la population) et de PPBE dans des États membres de l'UE**, étant donné que les autorités compétentes qui sont membres d'EIONET ont déjà accès à Reportnet à des fins de communications plus générales sur l'environnement. Il serait toutefois possible de simplifier le processus de communication, de renforcer la convivialité de Reportnet pour les autorités compétentes nationales, et de faciliter encore davantage l'extraction de données à l'échelon de l'UE. En outre, des clarifications supplémentaires s'imposent en ce qui concerne les types de données dans et hors des agglomérations que l'on doit soumettre sous chaque source, étant donnée qu'à l'heure actuelle, le manque de clarté dans certains secteurs concernant les informations devant être communiquées risque d'engendrer des incohérences en ce qui concerne la comparabilité des données.

3.1.5 Valeur ajoutée européenne (« EAV »)

Dans l'ensemble, la Directive END fait preuve d'une forte valeur ajoutée européenne, en fournissant **un cadre réglementaire à l'échelle de l'Europe pour la collecte de données sur la cartographie du bruit concernant l'exposition de la population au bruit dans l'environnement, au récepteur, sur une base commune**. Les décideurs politiques de l'UE ont relevé une valeur ajoutée européenne incontestable pour une législation sur la source, étant donné qu'il leur faut des données complètes et comparables, à l'échelon de l'UE, sur l'exposition de la population afin de fournir des informations pour le développement de la législation sur la source. La législation END présente également une valeur ajoutée par le biais de la collecte d'informations sur la population dans l'EU-28, afin de mieux contrôler et évaluer l'impact du bruit dans l'environnement, au récepteur, sur la santé (jusqu'à présent, les données sur l'exposition de la population, à l'échelon national, n'étaient généralement pas disponibles pour le public).

La recherche a mis en lumière, parmi les parties concernées par la Directive END, des différences au niveau des perceptions sur la valeur ajoutée européenne entre États membres de l'UE, lorsque la législation nationale sur le bruit était déjà en place préalablement à la Directive END (13), et les États membres dépourvus auparavant de tout cadre législatif (15). Pour les États membres dépourvus d’une législation préalable sur le bruit dans l’environnement, la Directive END a contribué au renforcement de la visibilité du bruit dans l’environnement à l’échelon national, tout en soulignant l’importance des prises de décision à l’échelon national, et en rendant la mitigation du bruit plus visible dans les programmes d’investissement à l’échelon national et régional (p.ex. construction de routes et développement de l’infrastructure des transports, urbanisme, et occupation des sols). Là où une législation nationale était déjà en place préalablement à la Directive END, la présence d’une forte valeur ajoutée était encore perçue, étant donné que l’on reconnaissait qu’une approche européenne avait encouragé la collecte de données à l’échelon de l’UE et facilité la mise en commun des expériences et des analyses comparatives.

La mise en place d’un processus de plan d’action sur cinq ans, par le biais de la Directive END, a ajouté de la valeur par le biais de la **promotion d’une approche plus stratégique, pour la gestion et la mitigation du bruit dans l’environnement**, à l’échelon de l’UE, que celle qui était en place précédemment dans la plupart des pays, y compris ceux chez lesquels il existait déjà un cadre de réglementation national. Les États membres sont optimistes sur l’utilité de la planification de mesures, et se félicitent de la flexibilité considérable qu’apporte la Directive END au niveau de la politique de mise en œuvre à l’échelon national, en reflétant la subsidiarité.

Enfin, même si des parties concernées par la Directive END reconnaissent que la Directive END pourrait être encore perfectionnée de différentes façons dans l’avenir, ces mêmes parties sont vivement opposées au « scénario contrefactuel » de l’abrogation éventuelle de la Directive, qui a été examiné dans le contexte des contrôles d’aptitude (*Fitness Check*).

3.1.6 Conclusions générales

L’évaluation a comporté un examen détaillé des principaux problèmes d’évaluation relatifs à la mise en œuvre de la Directive END jusqu’à présent. Les conclusions sont les suivantes :

- La directive END répond, dans l’ensemble, à ses objectifs, même si son efficacité et son impact pourraient être renforcés de différentes façons dans l’avenir, de la façon illustrée dans la section « Perspectives futures » du rapport final.
- Il est nécessaire d’exprimer de façon plus explicite les objectifs à plus long terme que la Directive END s’efforce de réaliser (réduction de l’incidence de hauts niveaux de bruit dans l’environnement) pour les différents modes de transport.
- Dans son ensemble, la directive, ainsi que les exigences spécifiques relatives à la réalisation du premier objectif de la Directive END (cartographie du bruit et planification des mesures, contenues dans l’Article 1(1)), sont largement acceptées par les parties concernées.
- Bien des progrès considérables ont été effectués pour la réalisation du premier objectif de la Directive END, à savoir une « approche commune » (cf. Article 1(1)), en particulier en ce qui concerne l’emploi de méthodes d’évaluation communes, l’insuffisance des délais alloués pour un ensemble complet de données et d’informations pour la présentation de rapports sur les cartes de bruit stratégiques et les PPBE, au cours de R1 et R2, continue d’entraver la mise en œuvre intégrale et efficace de la Directive END.
- Bien que l’on procède, de façon efficace, à l’emploi de consultations publiques dans certains pays, le rôle de la consultation du public pourrait être renforcé dans d’autres.
- L’absence, jusqu’à présent, de mesures d’application à l’échelon de l’UE, afin d’assurer la fourniture rapide d’informations pour des rapports concernant des cartes de bruit stratégiques et des PPBE, a, dans une certaine mesure, entravé la

réalisation des objectifs de la Directive END. Toutefois, les évaluateurs estiment que le lancement de procédures d'infractions n'est peut-être pas toujours un mécanisme approprié en cas de retard, étant donné que, dans certains États membres de l'UE, des autorités compétentes nationales sont confrontées à un manque de ressources pour l'application de la Directive END ; en outre, certaines parties concernées font état de la lourdeur des procédures de communication des données, pour les soumissions à la CE.

- Sans l'existence de la Directive END, on se pencherait beaucoup moins sur la résolution du problème des niveaux élevés de bruit dans l'environnement, dans l'ensemble de l'UE-28, certains États membres de l'UE n'auraient introduit aucune législation, et seul un nombre minimum de cartes de bruit et de données sur l'exposition de la population aurait été mis à la disposition du public.
- L'évaluation du niveau de mesures a identifié des rapports coûts / bénéfices positifs pour des investissements dans les mesures de mitigation et réduction du bruit dans tous les modes de transport : grands axes ferroviaires, grands axes routiers et aéroports.
- Dans l'ensemble, la Directive END s'est avérée être une directive rentable, même si elle n'a pas encore atteint son potentiel intégral ; elle sera renforcée dès que les données seront entièrement comparables, et est déjà activement utilisée par les décideurs de l'UE chargés de la législation sur les sources.

European Commission

Evaluation of Directive 2002/49/EC Relating to the Assessment and Management of Environmental Noise

Study Summary
July 2016

A Brief Summary

This study presents the findings from the second implementation review and the evaluation of the Environmental Noise Directive ("END"), carried out under the EC's REFIT programme.

The study has drawn on desk research, an online survey, an interview programme with more than 100 stakeholders across all EU Member States and a workshop (September 2015) to validate the results.

The Directive's objectives were found to remain relevant to identified policy needs, and coherent with other EU and national legislation (although internal coherence within the legal text could be improved). Regarding effectiveness, it was found that progress has been made towards the two core objectives of the END (a "common approach" to noise management and informing EU noise-at-source legislation), but implementation has been delayed in many MS, especially regarding action planning. The research also identified evidence of a favourable cost-benefit ratio at measure level, implying that the Directive has been efficient, as well as strong European Added Value. Whilst the Directive demonstrates fitness for purpose overall, there are a number of ways in which its effectiveness and impacts might be improved in future.

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