Guidance Note for Strategic Noise Mapping (01/2025 May Draft)

Part 1: Requirements

For the

European Communities (Environmental Noise) Regulations 2018 (amended)

Published May 2025

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Draft Guidance Note for Strategic Noise Mapping

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Published by the Environmental Protection Agency, Ireland

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Purpose and scope of this Document

The objective of this guidance note is to provide practical information, advice and guidance to designated Noise Mapping Bodies on the development of strategic noise maps under the Environmental Noise Regulations.

Guidance is issued as applicable only to the development of strategic noise maps under the Regulations. The guidance updates, revises and replaces the previous Version 3 guidance of January 2025, and the revised Section 10 guidance of October 2017.

This first part of the guidance note provides an overview of the requirements set out within the Regulations, roles and responsibilities of the noise mapping bodies and action planning authorities, and sequence of activities to be undertaken during implementation of the Regulations. It also provides guidance on key tasks and decisions which commonly arise, publishing the strategic noise maps and reporting to the EPA under the Regulations.

This first part of the guidance is to be read alongside the other parts:

- Part 2: Calculation Methodology & Noise Modelling
- Part 3: Assessment of Noise Exposure & Harmful Effects
- Part 4: Publication and Reporting

This document should also be read in conjunction with the following:

- European Communities (Environmental Noise) Regulations 2018, S.I. No. 549 of 2018; and
- European Communities (Environmental Noise) (Amendment) Regulations 2021, S.I. No. 663 of 2021.

This Guidance Note should not be considered as a legal document, nor does it purport to provide comprehensive legal advice or guidance on all acoustical matters. If, in any circumstance, the recommendations contained in this guidance seem to be at variance with the Directive, or Regulations, then the text of the Directive must be applied in the first instance, or the Regulations in the second. In many situations it may be necessary to seek expert advice and assistance.

Contents

1 Introduction

1.1 Background

This guidance is designed to help relevant Noise Mapping Bodies (NMBs) designated under Regulation 6 of the European Communities (Environmental Noise) Regulations 2018, S.I. No. 549 of 2018, (Regulations), as amended, with their strategic noise mapping duties under Regulation 11.

It aims to support those noise mapping bodies in carrying out some of their duties under the Regulations. In particular, it covers the requirements for making strategic noise maps for agglomerations, major roads, major railways, and major airports as defined in the Regulations. Strategic noise maps have to be developed in the context of the Regulations and should have particular regard to the requirement to provide a suitable basis for the development of noise action plans.

A glossary of acoustic and technical terms used is set out in Appendix A.

1.2 Role of this Guidance

This document is designed to provide a guide to noise mapping bodies about the process and requirements of strategic noise mapping and the submission of the strategic noise maps to the Environmental Protection Agency (EPA).

This first part of the guidance is to be read alongside the other parts, namely:

- Part 2: Calculation Methodology & Noise Modelling
- Part 3: Assessment of Noise Exposure & Harmful Effects
- Part 4: Publication and Reporting

This document should also be read in conjunction with the following:

- European Communities (Environmental Noise) Regulations 2018, S.I. No. 549 of 2018[1];
- European Communities (Environmental Noise) (Amendment) Regulations 2021, S.I. No. 663 of 2021[2];
- 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, OJ L189/12-25, 18 July 2002[3];
- Directive (EU) 2015/996 of 19 May 2015 establishing common noise assessment methods according to Directive 2002/49/EC, OJ L168/1-823 of 1st July 2015;
- Corrigendum to Commission Directive (EU) 2015/996, OJ L5/35-46 of 10th January 2018[4]; and
- Commission Delegated Directive (EU) 2021/1226 of 21.12.2020 amending, for the

[1] Available at: https://www.irishstatutebook.ie/eli/2018/si/549/made/en/print [Accessed June 2022]
[2] Available at: https://www.irishstatutebook.ie/eli/2021/si/663/made/en/print [Accessed June 2022]
[3] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32002L0049 [Accessed June 2022]
[4] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32015L0996 [Accessed June 2022]

purpose of adapting to scientific and technical progress, Annex II of Directive 2002/49/EC of the European Parliament and the Council as regards common noise assessment methods, OJ L269/65-142 of 28th July 2021[5].

1.3 Structure of this Guidance

This second part of the guidance covers the implementation of the CNOSSOS-EU calculation methodology in Ireland. The document is set out in the following sections:

- Section 2: Regulatory Context;
- Section 3: Roles and Responsibilities;
- Section 4: Requirements for Strategic Noise Mapping;
- Section 5: Overview of the Strategic Noise Mapping Process;
- Section 6: Publication and Reporting.

- Appendix A provides a short glossary of acoustic terms.
- Appendix B provides a list of background reference material and information sources.

[5] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32021L1226 [Accessed June 2022]

2 Regulatory Context

The EU wide common approach to the assessment and management of environmental noise is set out within Directive 2002/49/EC.

2.1 Environmental Noise Directive

Directive 2002/49/EC of the European Parliament and of the Council relates to the assessment and management of environmental noise, and is commonly referred to as the Environmental Noise Directive or END[6] .

The aim of the Directive 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".*

And to that end an integrated noise management process is set out in three stages:

- Undertake strategic noise mapping to determine exposure to environmental noise;
- Ensure information on environmental noise and its effects is made available to the public;
- Adopt action plans, based upon the noise-mapping results, with a view to preventing and reducing environmental noise where necessary and particularly where exposure levels can induce harmful effects on human health and to preserving environmental noise quality where it is good.

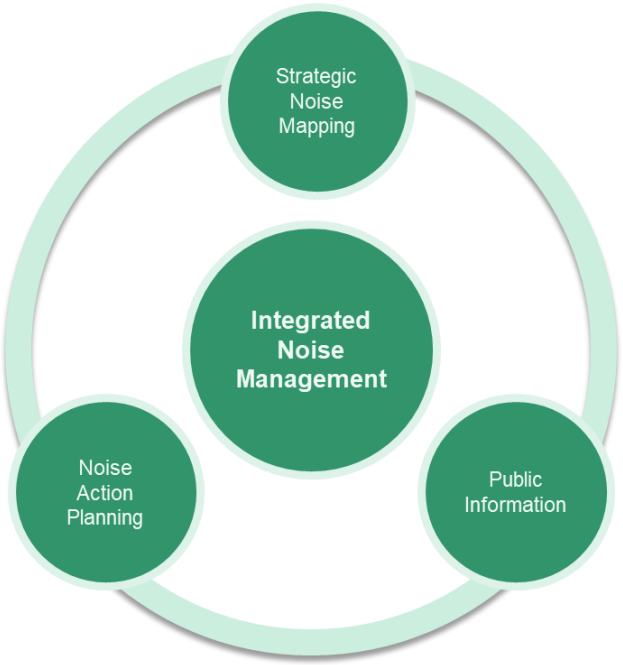

Figure 2.1: Integrated noise management process within the END

[6] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32002L0049 [Accessed June 2022]

The Directive defines noise mapping, strategic noise maps and action plans as:

- *'noise mapping' shall mean 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;*
- *'strategic noise map' shall mean 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;*
- *'action plans' shall mean plans designed to manage noise issues and effects, including noise reduction if necessary.*

The END requires Member States to conduct the three stages of the process each five years.

Strategic noise maps (SNM) are to be made or revised showing the situation in the preceding calendar year in 2007, 2012, 2017, 2022, 2027 etc[7].

Noise action plans (NAP) are to be drawn up, and designed to manage noise issues and effects, including noise reduction, if necessary, in 2008, 2013, 2018, 2024, 2028 etc. The public are to be consulted about proposals for action plans[8].

Strategic noise maps and noise action plans are to be made available to the public and disseminated in accordance with relevant Community legislation. This information shall be clear, comprehensible and accessible[9].

In addition to the main explanatory articles the Directive includes:

- Annex I – Noise Indicators
- Annex II – Assessment Methods for the Noise Indicators
- Annex III – Assessment Methods for Harmful Effects
- Annex IV - Minimum Requirements for Strategic Noise Mapping
- Annex V - Minimum Requirements for Action Plans
- Annex VI - Data to be Sent to the Commission

2.2 Amendments to the END

Since the END was published in 2002 there have been a number of subsequent amendments to the Directive. An overview of these amendments is set out below.

2.2.1 Directive 2015/996

In July 2015 the Commission published Directive 2015/996 establishing common noise assessment methods according to Directive 2002/49/EC of the European Parliament and of the Council. This replaced Annex II of the END, removed the recommended Interim Methods, and established the common noise assessment methods.

[7] END Article 7
[8] END Article 8, as amended by Regulation (EU) 2019/1010
[9] END Article 9

The Directive sets out the noise calculation methods (CNOSSOS-EU) in the Annex, and some guidance on aircraft modelling, and database tables of input data for roads, railways and aircraft in a series of Appendices. The Directive is an EC legal document which was to be transposed into law within each Member State by 31 December 2018. The CNOSSOS-EU methods set out within the Directive are to be used for strategic noise maps under the END from 31 December 2018. European Communities (Environmental Noise) Regulations 2018[10] (S.I. 549/2018) transposed Commission Directive (EU) 2015/996 into Irish law.

The CNOSSOS-EU methodologies within Directive 2015/996 may be summarised as follows:

- Road traffic source
- Railway traffic source
- Industrial noise sources
- Propagation model for road, railway and industrial sources
- Aircraft
- Exposure assessment

2.2.2 Corrigendum to CNOSSOS-EU 2018

Shortly after Directive 2015/996 was published in 2015, a number of typographical and formatting errors were identified. The majority of these related to the railway source model, and particularly the railway source database tables in Appendix G.

These errors were addressed within the Corrigendum[11] published in January 2018.

2.2.3 Regulation 2019/1010

Regulation 2019/1010 on alignment of reporting obligations in the field of legislation related to the environment, and amending Directive 2002/49/EC.

END Annex VI Data to be Sent to the Commission sets out the mandatory reporting requirements. Prior to Round 4 (R4), reporting was undertaken on a voluntary basis through the European Environment Agency (EEA) Reportnet 2.0 system.

Regulation 2019/1010 establishes the EEA as managers of a data repository and requires that a subsequent implementing act will establish a mandatory reporting mechanism for R4 in accordance with the INSPIRE Directive 2007/2/EC, and Directive 2003/4/EC on public access to environmental information.

It also provides for an additional 12 months for the development of R4 noise action plans, which are now due before 18 July 2024.

The European Environment Agency (EEA) has now developed Reportnet 3[12] which includes the R4 mandatory reporting templates and the final reporting formats. There are cross-checks between DF4_8 (noise sources) dataflow and DF1_5 (noise maps).

[10] https://www.irishstatutebook.ie/eli/2018/si/549/made/en/print [Accessed July 2022]
[11] Corrigendum to Commission Directive (EU) 2015/996 of 19 May 2015 establishing common noise assessment methods according to Directive 2002/49/EC of the European Parliament and of the Council, OJ L5/35 to L5/46 of 10th January 2018.
[12] https://reportnet.europa.eu/ [Accessed January 2023]

2.2.4 Directive 2020/367

Directive 2020/367 amending Annex III of the END and establishing health impact assessment methods.

In 2020, Ireland fully transposed the revised Annex III of the END. Directive 2020/637 establishes assessment methods for the harmful effects of environmental noise based on the dose-response relationship established in the WHO ENG 2018[13]. The health impacts to be assessed and reported are: no. of people Highly Annoyed (HA) & no. of people Highly Sleep Disturbed (HSD) for roads, railways and aircraft; and instances of Ischemic Heart Disease (IHD) for roads. These are required for agglomerations and major sources.

2.2.5 Commission Delegated Directive (EU) 2021/1226

Following the publication Directive 2015/996, and the Corrigendum of 2018, work continued across Europe on the implementation of the CNOSSOS-EU methodology. Through this work a number of amendments and adaptations were identified, which along with the publication of a new version of the European Civil Aviation Conference (ECAC) noise calculation method, called ECAC Doc 29 4th version.

Commission Delegated Directive 2021/1226[14] was published in December 2020, and published in the Official Journal on 28th July 2021. This introduces a number of amendments to CNOSSOS-EU (Annex II of the END), including the alignment of the aircraft noise section with ECAC Doc. 29 4th Edition.

Within this guidance, the consolidated version of CNOSSOS-EU, including Directive 2015/996, the 2018 Corrigendum and the 2021 Delegated Directive, is referred to as CNOSSOS-EU:2020 to clarify that it includes the revisions, as opposed to CNOSSOS-EU:2015 denoting the original version.

2.2.6 Commission Implementing Decision (EU) 2021/1967

Commission implementing decisions (EU) 2021/1967 setting up a mandatory data repository and a mandatory digital information exchange mechanism in accordance with Directive 2002/49/EC, fulfils the requirement under Regulation 2019/1010 for an implementing act to establish mandatory reporting under the END to the EEA Reportnet platform.

2.3 Environmental Noise Regulations

The END is transposed into law separately in each Member state of the EU. In Ireland, this Directive is transposed by the *European Communities (Environmental Noise) Regulations* 2018, S.I. No. 549 of 2018 (Regulations)[15], and this guidance makes specific reference to articles in these Regulations.

The regulations both revise and revoke the Environmental Noise Regulations 2006, S.I. 140/2006, & transpose Directive 2015/996. The 2018 Noise Regulations include the main

[13] WHO, Environmental Noise Guidelines for the European Region, https://www.who.int/europe/publications/i/item/9789289053563 [Accessed January 2023]
[14] Commission Delegated Directive (EU) 2021/1226 of 21.12.2020 amending, for the purpose of adapting to scientific and technical progress, Annex II of Directive 2002/49/EC of the European Parliament and the Council as regards common noise assessment methods, OJ L269/65 to L269/142 of 28th July 2021.
[15] Available at: https://www.irishstatutebook.ie/eli/2018/si/549/made/en/print [Accessed June 2022]

explanatory text as well as:

- 1st Schedule - Noise Indicators;
- 2nd Schedule - Assessment Methods for Harmful Effects;
- 3rd Schedule - Min. Requirements for Strategic Noise Mapping;
- 4th Schedule - Min. Requirements for Action Plans;
- 5th Schedule - Data to Be Sent to The Commission; &
- 6th Schedule - Agglomerations.

This guidance is issued by the Environmental Protection Agency, pursuant to the Regulations[16].

The Regulations were amended through the European Communities (Environmental Noise) (Amendment) Regulations 2021, S.I. No. 663 of 2021[17]. The amendment to the Regulations:

- Transposes Directive 2020/367 to the Second Schedule *"Assessment Methods for Harmful Effects"*;
- Transposes Commission Delegated Directive (EU) 2021/1226, amending Annex II of the END;
- Transposes EU Regulation 2019/1010 and the associated Commission Implementing Decision (EU) 2021/1967 relating to mandatory reporting under the END to the EEA Reportnet platform;
- The Sixth Schedule sets out revised definitions for the agglomerations of Cork, Dublin and Limerick, in light of urban developments over the last 15 years.

[16] Regulation 5
[17] Available at: https://www.irishstatutebook.ie/eli/2021/si/663/made/en/print [Accessed June 2022]

3 Roles and Responsibilities

The Regulations designate a number of roles responsible for undertaking activities in connection with the strategic noise mapping and noise action planning.

3.1 Overview of Roles and Responsibilities

An overview of the key designations are set out in Tables 3.1 to 3.3.

Table 3.1: Noise-Mapping Bodies[18]

Organisation	Responsibility
All 31 Local Authorities	• Making and approving strategic noise maps for major roads not designated as national roads.
Dublin City Council, Dun Laoghaire/Rathdown CC, Fingal CC, South Dublin CC, Kildare CC, and Wicklow CC.	• Making and approving strategic noise maps for the agglomeration of Dublin.
Cork City Council, and Cork County Council	• Making and approving strategic noise maps for the agglomeration of Cork.
Limerick City & County Council, and Clare CC	• Making and approving strategic noise maps for the agglomeration of Limerick.
TII	• Making and approving strategic noise maps for major roads designated as national roads; • Making and approving strategic noise maps for major railways (LUAS).
Irish Rail	• Making and approving strategic noise maps for major railways.
daa	• Making and approving strategic noise maps for the major airport.

Notes:

1. Strategic noise maps are to be made by the designated bodies on behalf of the action planning authority or authorities concerned[19].

Table 3.2: Action Planning Authorities[19]

Organisation	Responsibility
All 31 Local Authorities	• Making and approving action plans for: ○ major railways;

[18] Regulation 6
[19] Regulation 7

	○ major roads; or ○ major airports; • located within their functional area.
Dublin City Council, Dun Laoghaire/Rathdown CC, Fingal CC, South Dublin CC, Kildare CC, and Wicklow CC.	• Making and approving action plans for the agglomeration of Dublin.
Cork City Council, and Cork County Council	• Making and approving action plans for the agglomeration of Cork.
Limerick City & County Council, and Clare CC	• Making and approving action plans for the agglomeration of Limerick.

Notes:

1. Action plans are to be made in consultation with the Agency and the noise-mapping body for the noise-map involved[20].

Table 3.3: National Authority[21]

Organisation	Responsibility
Environmental Protection Agency (EPA)	• General supervision over the functions and actions of noise-mapping bodies and action planning authorities; • Provide guidance or advice to such bodies and authorities, where necessary; • Submit to the Commission the information required by Article 10(2) of the Directive.

Notes:

1. The requirement to provide action plans on specified dates as set out in Regulation 12 is a statutory function of an action planning authority in relation to environmental protection for the purposes of section 63 of the Act[22].
2. For the purposes of these Regulations, the powers conferred on the Agency by section 63 of the Act in relation to local authorities shall be exercisable by the Agency in relation to local authorities to whom noise-mapping functions are assigned in Regulation 6 and to whom action planning functions are assigned in Regulation 7[23].

[20] Regulation 7
[21] Regulation 5
[22] Regulation 5(4)
[23] Regulation 5(3)

3.2 Noise Mapping Bodies

The principal stakeholders in strategic noise mapping are the Noise Mapping Bodies (NMBs). These are designated in the regulations, and include all 31 local authorities, plus Transport Infrastructure Ireland (TII), Dublin Airport Authority (DAA) and Irish Rail (IR).

When making and approving strategic noise maps, the following task will need to be undertaken by the designated noise mapping bodies:

- Collect input datasets:
    - Airport infrastructure and aircraft movements
    - Licensed industrial facilities within the agglomerations
    - Railway infrastructure, traffic flows and speeds
    - Road infrastructure, traffic flows and speeds
        - TII count site data
        - NTA national transport model data
        - RMO MapRoad data
        - Local Authority traffic count data
        - OpenStreetMap data
    - OSi PRIME2 data
    - OSi LiDAR data, or Bluesky data
    - GeoDirectory data
    - CSO Census data
    - Met Eireann meteo data
- Collate and combine spatial and tabular data into noise model datasets
- Undertake calculations within noise modelling software
- Analyse results to produce graphical noise maps and exposure statistics
- Analyse results to produce assessment of health effects
- Publish the maps and exposure statistics
- Report the maps, exposure statistics and methodology to the EPA.

The noise mapping bodies will typically need the following technical capabilities in order to deliver strategic noise maps:

- Project Management
- GIS specialists
- Environmental noise engineers
- Environmental Health Officers / Environmental Scientists
- Noise calculation engineers

Dependent upon the sources to be mapped, there may also be requirements for:

- Road and traffic engineers
- Railway engineers
- Aircraft and airport specialists

A strategic noise mapping process typically takes between six and eighteen months, depending upon the area of coverage, the range of sources to be included, and the ease of availability to the required input datasets.

An overview of the strategic noise mapping process is presented in Section 5 below. The stages of work where the input datasets are collected, collated, and combined within GIS to develop the noise models typically takes between 50% and 75% of the complete project timescale.

Within the three agglomerations it is required that several Local Authorities, TII and Irish Rail (IR) combine data and activities in order to prepare the required strategic noise maps. Whilst TII and IR are designated as the strategic noise mapping bodies for all National major roads, and major railways inside the agglomerations, it is desirable to avoid separate maps being made by TII, IR and the Local Authorities. To date, a collaborative data sharing approach has been taken to enable noise map of roads and railways to be produced by the Local Authorities which include TII and IR sources.

Within the agglomerations, the Local Authorities are responsible for strategic noise mapping of industrial facilities, non-major roads, non-major railways, and non-major airports. However, in the case of non-major railways and non-major airports they will not have access to the source data necessary to make the strategic noise maps. To date, a collaborative data sharing approach has been taken to enable noise map of non-major railways to be produced by the Local Authorities which include Irish Rail sources. In the case of Cork airport, which is a non-major airport located within the Cork agglomeration, the Round 4 strategic noise mapping during 2022 was undertaken by daa on behalf of the agglomeration Local Authorities.

Outside of the agglomerations, TII is designated as the noise mapping body for National major roads, and Local Authorities for non-National major roads, e.g. Regional and Local roads. Again, it is seen as desirable to avoid separate maps being made by TII and the Local Authorities. To date, a collaborative approach has been taken, where the Local Authorities have provided data to TII for the Regional and Local major roads, and TII have included these within the noise mapping of National major roads. For example, during Round 4 in 2022 a centralised mapping approach to major roads was undertaken. This involved TII, the Roads Management Office (RMO), and 26 local authorities. The RMO developed tools for data capture for the modelling and issued guidance/specification documents to all relevant local authorities[24]. TII had agreed to run the noise models for each county. To assist the process the National Transport Agency (NTA) provided access to a national road traffic flow dataset.

Dublin airport is currently the only major airport to be mapped under the Regulations. DAA are the designated noise mapping body, and they have undertaken the noise mapping in each of the four Rounds to date.

[24] Road Management Office, *Round 4 Strategic Noise Mapping of Major Roads - Guidance and Specification*, June 2021.

3.3 Action Planning Authorities

The 31 Local Authorities are all designated as Action Planning Authorities under the Regulations. The Noise Action Plans (NAP) are to be made in consultation with the Agency, and the noise-mapping bodies.

Inside the three agglomerations, it is required that several Local Authorities combine activities in order to make and approve the NAP for each agglomeration. The NAPs are to cover the whole of each agglomeration, and shall have regard of the results of the strategic noise mapping for aircraft, major aircraft, industrial facilities, railways, major railways, roads and major roads, as appropriate.

Outside the agglomerations, the NAPs are to cover all the major railways and major roads within their functional area which were included within the noise maps. This was confirmed by a judgement of the European Court of Justice[25], which stated that action plans must be drawn up for all sources and regions covered within the strategic noise mapping, regardless of the level of population within that area, and also that the quality of the acoustic environment must be preserved, when it is good.

Further guidance on noise action plans is provided by the EPA[26]. It is currently planned to update this guidance for Round 4.

3.4 National Authority

The EPA are to exercise general supervision over the functions and actions of noise mapping bodies and action planning authorities, and to provide guidance or advice, where necessary[27].

The EPA has published guidance on noise mapping in July 2009, which was revised and updated to Version 2 in May 2011. Section 10 of the guidance was revised in June 2012, and again in October 2017 during Round 3 strategic noise mapping. In March 2021 guidance[28] was issued on the strategic noise mapping of major roads, to assist the Local Authorities in collating the road infrastructure and traffic data required for the Round 4 mapping.

The strategic noise mapping guidance was revised and updated during Round 4 to Version 3 to take into account the change in assessment methods to CNOSSOS-EU. It has been published in four parts:

- Part 1: Requirements (This document)
- Part 2: Calculation Methodology & Noise Modelling

[25] Judgement of the Court (Eight Chamber) of 31 March 2022. European Commission v Portuguese Republic. Case C-687/20. Available here: https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:62020CJ0687 [Accessed March 2023]
[26] Guidance Note for Noise Action Planning For the first round of the Environmental Noise Regulations 2006, July 2009. Available at: https://www.epa.ie/our-services/monitoring--assessment/noise/noise-mapping-and-action-plans/ [Accessed January 2023]
[27] https://www.epa.ie/our-services/monitoring--assessment/noise/noise-mapping-and-action-plans/ [Accessed January 20223]
[28] Round 4 Strategic Noise Mapping of Major Roads For the fourth round of the Environmental Noise Regulations 2018 March 2021 (V2). Available at: https://www.epa.ie/our-services/monitoring--assessment/noise/noise-mapping-and-action-plans/ [Accessed February 2023]

- Part 3: Assessment of Noise Exposure & Harmful Effects
- Part 4: Publication and Reporting

The EPA also published guidance on action planning in July 2009. Several sections were updated in 2018 for Round 3 action planning. The guidance on noise action planning has also been revised and replaced for Round 4.

The EPA supervision of Round 4 strategic noise mapping has been carried out through collaboration, including regular bi-lateral meetings between ORM (Office of Radiation Protection and Environmental Monitoring), the EPA appointed noise contractor, and the different stakeholders involved in the noise mapping including; the NMBs, Road Management Office (RMO), National Transport Agency (NTA), County and City Management Agency, Airport Noise Competent Authority (ANCA) and DECC. These bilateral meetings with the stakeholders allow EPA to gauge progress and provide advice around the noise modelling and mapping work. ORM also hosts quarterly meetings of a 'Noise Technical Working Group' that comprises the noise mapping bodies and the agglomeration local authorities.

An 'Agglomeration Project Steering Board' at director level was established by the local authorities for mapping and noise action planning work in Dublin, Cork and Limerick. The Board, through the 'Air and Noise Project Team' within Dublin City Council, had overseen the tendering of a project to undertake the noise mapping of the three cities and noise action planning.

4 Requirements for Strategic Noise Mapping

4.1 Overview of Strategic Noise Mapping

A strategic noise map is designed for the assessment of noise exposure in a given area, resulting from strategic noise sources such as roads, railways, airports and industry. Just as an Ordnance Survey map may have contours indicating how ground level height changes across an area, a noise map can illustrate how environmental noise levels change across an area. Figure 4.1 shows a typical graphical presentation of a strategic noise map.

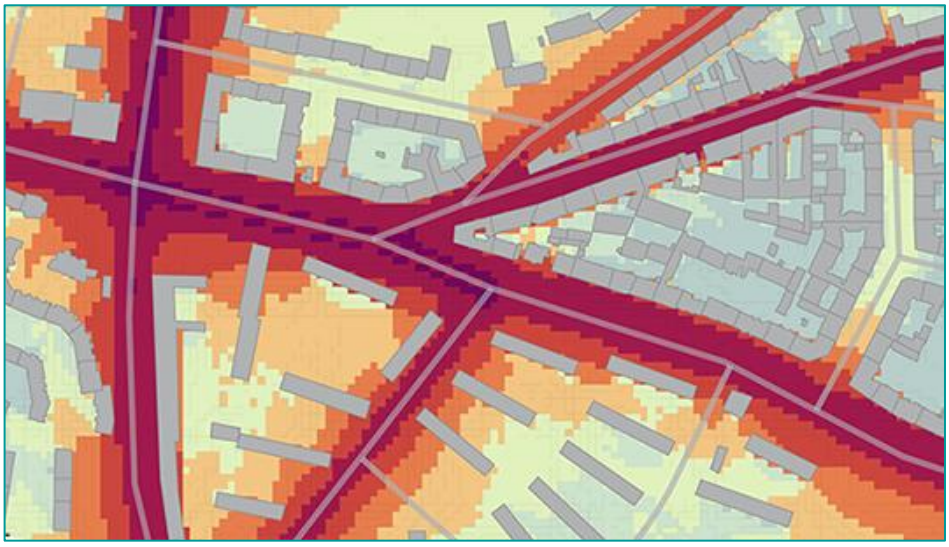

Figure 4.1: A graphical presentation of strategic noise mapping results (from Dr. Beate Tomio, coloringnoise.com)

The purpose of strategic noise mapping is primarily threefold:

- to provide information to the public and decision makers on noise exposure locally, nationally and internationally;
- to develop action plans for the purpose of managing noise exposure, by reducing noise levels where necessary, or preserving quiet areas where appropriate; and
- to provide the European Commission (EC) with strategic estimates of noise exposure across Europe to assist in the future development of European noise policy.

Strategic noise maps are normally produced by computer modelling techniques which calculate the noise level at specific points resulting from the sound emanating from the particular sources. The modelling software utilised source data such as traffic flow, type of road and rail, types of vehicles and the nature of industrial processes.

The source data is positioned within a three-dimensional (3D) computer model of the area of assessment. The 3D model includes features which can directly affect sound transmission, such as potential barriers, buildings, topography, weather conditions and how reflective or absorbent different surfaces can be.

The calculations produce noise levels at receptor points on the facades of buildings, and on a

10 metre grid, at a height of four metres above the ground, there will be more than 10,000 grid receptor points every 1 km^2, or more than grid 25,900 receptor points every square mile.

The process of making strategic noise maps is similar to the methodologies used within noise modelling for environmental impact assessments associated with major developments, such as extensions to the national or regional roads network, or expansions to airports. The key difference tends to be the significantly greater area to be covered by the strategic noise mapping within one assessment, and therefore the amount of information required to develop the required computer models. The amount of time and resources required to collect the necessary source and 3D data, build the models, run the calculations and derive the reporting information should not be underestimated. It is typical for a large regional or national scale project to take an experienced team between six and eighteen months to complete the process.

Whilst the process of making strategic noise maps may be similar to those used for EIS or local assessment, it is important to understand that the noise maps are produced for an annual average situation for use at a strategic level, for which they are likely to give an acceptable level of accuracy. Strategic noise maps are not designed to directly support environmental impact assessments, or to represent every situation at a local level, for which it is highly likely that a more detailed examination will be necessary, at heights other than 4m above local ground. Similarly, it is envisaged that the strategic noise models would be further refined for local assessments in support of the effectiveness of interventions proposed within the scope of noise action plans.

4.2 Scope of the Strategic Noise Maps

The Strategic Noise Maps are to be made as part of the first phase of work under the Directive. The Regulations set out to:

> *"provide for the implementation in Ireland of a common approach within the European Union intended to avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to exposure to environmental noise"*[29]

The Regulations are to apply to environmental noise to which people are exposed, in particular in built up areas, in public parks or other quiet areas in an agglomeration, in quiet areas in open country, near schools, near hospitals, and near other noise-sensitive buildings and areas[30].

The Regulations shall not apply to noise caused by the person exposed to the noise; noise from domestic activities; noise created by neighbours; noise at work places; noise inside a means of transport; or noise due to military activities in military areas[31].

In the context of the Regulations, environmental noise is defined as 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[32].

[29] Regulation 4 (1)
[30] Regulation 4 (2)
[31] Regulation 4 (3)
[32] Regulation 2 (1)

Box 1

Regulatory Requirements for Strategic Noise Mapping

Strategic Noise Maps must:

- Be reviewed by the noise-mapping body and, if necessary, revised not later than five years after the date on which it was made.
- Present data on an existing or predicted situation in terms of a noise indicator, including 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 noise indicator in a certain area.
- Satisfy the minimum requirements of the Third Schedule of the Regulations, see Section 4.3 below.
- Be completed for the L_{den} and L_{night} noise indicators.
- Put a special emphasis on the noise emitted by road traffic, rail traffic, airports, and industrial activity sites, including ports, for agglomerations.
- Include all areas affected by major airports, major railways and major roads.
- Be completed using data approved for such use by the EPA, and no more than three years old.
- Be completed using the common assessment methods contained in the Annex II to Commission Directive (EU) 2002/49/EC, as amended.

Additionally:

- Strategic Noise Maps may be completed for supplementary noise indicators provided that their use has prior approval from the EPA; and
- Noise-Mapping bodies shall calculate harmful effects in accordance with the Second Schedule.

Noise-mapping bodies shall co-operate, as appropriate, with their counterparts in neighbouring Member States of the European Union with regard to the strategic noise mapping of border areas.

Noise-mapping bodies shall provide the Agency with information required no later than one month after the date on which a map or revised map is made.

Furthermore, the Strategic Noise Maps do not cover the whole of Ireland; rather the areas covered by the Strategic Noise Maps are defined as those areas which are affected by environmental noise[33]. This is further discussed in Section 5.2 below.

[33] Regulation 11 (1)

The Strategic Noise Maps are then used to form the basis of Action Plans. These Action Plans must refer to places near the major roads, major railways and major airports, and within any relevant agglomeration[34], which means those places affected by noise from the major sources, as shown by the results of the noise mapping, and all locations within any relevant agglomeration.

4.2.1 Noise Indicators

The Regulations END specify two main indicators which must be used for the preparation of strategic noise maps[35]:

- L_{den} is the annual average noise level for the day, evening and night periods and is designed to indicate overall annoyance.
- L_{night} is the annual average noise level for night-time periods and is designed to indicate sleep disturbance.

The noise indicators are subject to approval by the Agency[36]. In line with the Regulations, the Agency recommends that supplementary noise indicators[37] are also produced.

Guidance Note 1:
It is recommended that in addition to L_{den} and L_{night}, the following supplementary noise indicators would be useful for the development of noise action plans:

- L_{day} is the annual average noise level for the daytime periods, from 07:00 to 19:00 hours;
- $L_{evening}$ is the annual average noise level for the evening periods, from 19:00 to 23:00 hours; and
- $L_{Aeq,\ 16hr}$ is the annual average noise level for the daytime/evening periods, from 07:00 to 23:00 hours.

4.2.2 Extent of Noise Mapping

The END specifies that exposure to noise above 55 dB L_{den} and 50 dB L_{night} must be reported to the Commission[38]. However it does not specify the extent of sources within agglomerations below the major thresholds, or the extent of noise levels to be considered within noise action plans, however as the objectives of the END *includes "avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to exposure to environmental noise"*, this clearly indicates that avoiding, preventing or reducing the harmful effects of noise should be the objective of the noise action plans, developed from the strategic noise mapping.

Noise is recognised by the World Health Organisation (WHO) and the European Environment Agency (EEA) as a key environmental and health issue. The WHO reports that long term

[34] Regulation 12(1)
[35] Regulation 8(1)
[36] Regulation 8(1)
[37] First Schedule, Part III
[38] END Annex VI

exposure to environment noise contributes to about 48,000 new cases of heart disease and 12,000 premature deaths every year in Europe. Based on the data reported under the Environmental Noise Directive (END), it is estimated that at least 18 million people suffer high annoyance, and 5 million people suffer high sleep disturbance due to long-term exposure to noise from transport. The adverse effects of noise on health is now better understood following publication of the 2018 WHO *Environmental Noise Guidelines for the European Region*[39], to supplement the previously published *"Community Noise Guidelines"* (CNG) from 1999[40], and *"Night Noise Guidelines for Europe"* (NNG) from 2009[41]. The main purpose of the guidelines is to provide recommendations for protecting human health from exposure to environmental noise originating from various sources: transportation (road traffic, railway and aircraft) noise, wind turbine noise and leisure noise. They provide public health advice underpinned by evidence, which is essential to drive policy action to protect communities from the adverse effects of noise. The significant health impacts of noise are most likely to be underestimated, with WHO evidence demonstrating effects at noise levels below the thresholds that which countries report against under the Environmental Noise Directive.

The WHO ENG 2018 guidelines formulated recommendations based on the available evidence, and exposure values based on a relevant risk increase of adverse health effects. Thus, the 2018 guideline values define an exposure level at which effects certainly begin. The WHO ENG 2018 guideline values for aircraft, railway and road traffic noise are all below the legal thresholds for strategic noise mapping set out within the END, as shown in Table 4.1. In order to support policy makers, and to more fully identify the adverse effects of noise, it would therefore be beneficial to extend the strategic noise mapping to include all areas within the agglomerations exposed to environmental noise above the WHO ENG 2018 guideline levels.

Table 4.1: Summary of WHO Guideline Values

Level of effect	Source	Level	WHO Guidelines
No effects on sleep are observed	Any	below 30 dB $L_{night,\ inside}$ below 42 dB $L_{Amax,\ inside}$	NNG 2009
Lowest observed adverse effect level (LOAEL) for night noise	Any	40 dB $L_{night,\ outside}$	NNG 2009
Noise above these levels is associated with adverse health effects and adverse effects on sleep	Aircraft	45 dB $L_{den,\ outside}$ 40 dB $L_{night,\ outside}$	ENG 2018
	Railways	54 dB $L_{den,\ outside}$ 44 dB $L_{night,\ outside}$	ENG 2018
	Roads	53 dB $L_{den,\ outside}$ 45 dB $L_{night,\ outside}$	ENG 2018
	Wind Turbines	45 dB $L_{den,\ outside}$	ENG 2018

[39] Environmental noise guidelines for the European Region, WHO 2019. Available at: https://www.who.int/europe/publications/i/item/9789289053563 [Accessed January 2023]
[40] Guidelines for community noise, WHO 1999. Available at: https://www.who.int/publications/i/item/a68672 [Accessed January 2023]
[41] Night noise guidelines for Europe, WHO 2009. Available at: https://apps.who.int/iris/handle/10665/326486 [Accessed January 2023]

The National Planning Framework 2040[42] includes a specific policy objective on Noise. National Policy Objective 65 states:

> *"Promote the pro-active management of noise where it is likely to have significant adverse impacts on health and quality of life and support the aims of the Environmental Noise Regulations through national planning guidance and Noise Action Plans."*

Guidance Note 2: Extent of noise mapping
To ensure that the statutory requirements of the END are met, and additionally more fully identify the adverse effects of noise on human health, and support National Planning Framework 2040 Objective 65, including national planning guidance and noise action plans.

a) Agglomerations - calculations and reports

Strategic noise maps for agglomerations (as defined in the Regulations) should take into account the following sources:

- all public roads, including major roads.
- all railways and light rail, including major railways.
- all IED licensed industrial facilities, including those within ports.
- all airports (where feasible)

The EPA propose that agglomeration results are generated above 50 dB L_{den} and 45 dB L_{night}, for roads, major roads, railways, major railways and licensed industrial facilities; while for airports it would propose that results are generated above 45 dB L_{den} and 40 dB L_{night}.

b) Outside agglomerations - calculations and reports

Strategic noise maps outside agglomerations should take into account major road, railway and airport sources (as defined in the Regulations).

The EPA propose that results for major sources are generated above:

- 53 dB L_{den} and 45 dB L_{night} for major roads;
- 54 dB L_{den} and 45 dB L_{night} for major railways; and
- 45 dB L_{den} and 40 dB L_{night} for major airports.

c) Reporting to the EEA

The EPA will report mandatory 55 dB L_{den} and 50 dB L_{night} levels to the European Environment Agency (EEA) for roads, rail and airports.

In advance of national planning guidance, a number of local authorities have introduced guidance on planning and noise through the noise action plans (NAP) or local development plans. These have often referenced, or been informed by, the English ProPG 2017

[42] National Planning Framework - Ireland 2040 Our Plan (NPF) (2018). Available at: https://www.gov.ie/en/publication/daa56-national-planning-framework-ireland-2040-our-plan-npf-2018/ [Accessed January 2023]

Professional Practice Guidance on Planning and Noise[43]. ProPG indicates increasing risk of adverse effects due to exposure to noise above 50 dB $L_{Aeq\ 16hr}$ and 40 dB L_{night}. Draft guidance[44] has also been developed by a working group of local authorities, which recommends a similar approach based on ProPG, along with an assessment of ventilation and potential for overheating in line with *Acoustics, Ventilation and Overheating Residential Design Guide*[45].

Additionally, EPA funded research Noise-Health[46] into the health effects of noise exposure has identified a lack of robust road traffic noise exposure data at low noise levels in Ireland, as one aspect which currently impacts upon a complete understanding of noise induced health impact in Ireland. A consistent and clear national approach to measuring roads to lower levels within the agglomerations is preferable as noted by the EPA funded research Noise-Adapt[47].

4.3 Third Schedule of the Regulations

The Third Schedule of the Regulations sets out the minimum requirements for strategic noise mapping alongside information and guidance. These minimum requirements are shown in Box 2.

Box 2
Minimum Requirements for Strategic Noise Mapping

1. A strategic noise map is the presentation of data on one of the following aspects:
   - an existing, a previous or a predicted noise situation in terms of a noise indicator,
   - the exceeding of a limit value,
   - the estimated number of buildings, schools and hospitals in a certain area that are exposed to specific values of a noise indicator,
   - the estimated number of people located in an area exposed to noise.

Guidance Note 4:
This defines a strategic noise map as several different methods of presenting results data, including actual assessed noise exposure levels, but also estimated numbers of exposed noise sensitive locations and people. The presentations listed link to the information which is to be reported to the EU using the mandatory EEA Reportnet 3 data repository. At present there are no statutory noise limit values in Ireland, therefore "the exceeding of a limit value" would not be used.

[43] Professional Practice Guidance on planning and noise: New Residential Development, IOA/ANC/CIEH, 2017. Available at: https://www.association-of-noise-consultants.co.uk/propg/ [Accessed January 2023]
[44] Draft National Guidance for the Consideration of Transportation Noise in the Design of New Residential Development, June 2021.
[45] The Acoustics, Ventilation and Overheating Guide, IOA/ANC, January 2020. Available at: https://www.association-of-noise-consultants.co.uk/avo-guide/ [Accessed March 2023]
[46] EPA Research Noise-Health: https://www.epa.ie/publications/research/environment--health/research-423.php [Accessed March 2023]
[47] EPA Research Noise-Adapt; See https://www.epa.ie/publications/research/environment--health/Research_Report_382.pdf [Accessed January 2023]

Box 2
Minimum Requirements for Strategic Noise Mapping

2. Strategic noise maps may be presented to the public as:
   - graphical plots,
   - numerical data in tables,
   - numerical data in electronic form.

Guidance Note 5:
This defines the means by which the indicated results may be presented to the public.

3. Strategic noise maps for agglomerations shall put a special emphasis on the noise emitted by:
   - road traffic,
   - rail traffic,
   - airports,
   - industrial activity sites, including ports.

Guidance Note 6:
Within agglomerations roads, railways and airports with annual movement totals below those of designated major sources are to be included within the assessment of noise exposure. All Industrial Emissions Directive (IED) licensed industrial facilities, including those within ports, are also to be assessed within agglomerations, whereas there is no requirement under the Regulations to assess noise exposure due to industrial facilities outside agglomerations.

4. Strategic noise mapping will be used for the following purposes:
   - the provision of the data to be sent to the Commission in accordance with Regulation 5(4) and the Fifth Schedule
   - a source of information for the general public in accordance with Regulation 13,
   - a basis for action plans in accordance with Regulation 12.

   Each of those applications requires a different type of strategic noise map.

Guidance Note 7:
This provides a clear statement that the strategic noise maps drawn up under the requirements of the Regulations are to be used to provide information for three main ends, and that each of these ends places a different need on the strategic noise mapping. The strategic noise mapping process must provide all the information required for the following purposes:
- Regulation 5(4) and the Fifth Schedule refer to the information which is to be submitted to the EU / EEA using the mandatory EEA Reportnet 3 data repository;
- Information to be presented to the public;

Box 2
Minimum Requirements for Strategic Noise Mapping

- Action Plans are to be based upon the results of the strategic noise mapping, which requires the strategic noise mapping to deliver the coverage, and noise indicators, relevant to the assessment criteria used within the Action Plans.

These requirements are discussed further in Guidance Notes 8 and 9 below.

5. Minimum requirements for the strategic noise maps concerning the data to be sent to the Commission are set out in paragraphs 1.5, 1.6, 2.5, 2.6 and 2.7 of the Fifth Schedule.

Guidance Note 8:
The requirements set out within the relevant paragraphs of the Fifth Schedule of the Regulations are now incorporated within the using the mandatory EEA Reportnet 3 data repository data flow DF4_8. The reporting templates provide for the submission of three types of data to the EEA under DF4_8; data for which there is a legal obligation under the END, and data which is optional. Provided that all the data fields are completed and returned for which there is a legal obligation under the END, these minimum requirements will have been met. The minimum requirements include the following information for each type of noise source to be assessed:

- The numbers of people exposed in specified L_{den} and L_{night} noise level bands within agglomerations;
- The numbers of people exposed in specified L_{den} and L_{night} noise level bands outside agglomerations; and
- The total area and total number of dwellings exposed to major sources in specified L_{den} noise level bands, including those within agglomerations.

The requirements for information to be reported to the EEA, as set out above, are a series of data tables providing numbers of people, dwellings or area by noise level bands and noise indicators.

Detailed further guidance is provided in Part 4 of the guidance on Publication & Reporting.

6. For the purposes of informing the general public in accordance with Regulation 13 and the development of action plans in accordance with Regulation 12, additional and more detailed information must be given, such as:
   - a graphical presentation,
   - maps disclosing the exceeding of a limit value,
   - difference maps, in which the existing situation is compared with various possible future situations,
   - maps showing the value of a noise indicator at a height other than 4 m where appropriate.

   The Agency may lay down rules on the types and formats of these noise maps.

Box 2
Minimum Requirements for Strategic Noise Mapping

Guidance Note 9:
The tables of results to be reported to the EEA are to be used for the purposes of informing the citizens, under Regulation 13, and developing Action Plans, under Regulation 12. In order to provide information to the public in a clear comprehensible and accessible format, Regulation 13 (2), it is also stated that graphical maps should be used as a means of presenting the results. Comparisons with limit values, with potential future scenarios, and with other assessment heights are also introduced as they may be relevant for a clearer public understanding, or to help support the Action Plans.

7. Strategic noise maps for local or national application must be made for an assessment height of 4 m and the 5 dB ranges of L_{den} and L_{night} as required in the Fifth Schedule.

Guidance Note 10:
This sets out the common assessment height for strategic noise maps, and again references the noise level bands which are to be reported, as set out in the Fifth Schedule.

8. For agglomerations separate strategic noise maps must be made for road-traffic noise, rail-traffic noise, aircraft noise and industrial noise. Maps for other sources may be added.

Guidance Note 11:
It is the minimum requirement that for all locations within agglomerations there should be strategic noise maps produced for roads, railways, aircraft noise and IED licensed industrial facilities. Strategic noise mapping of other sources may be undertaken should it be relevant within the agglomeration, and relevant to the needs of an Action Plan.

Detailed guidance on how each of these requirements may be met is set out within other parts of the Guidance Note on Strategic Noise Mapping:

- Part 2: Calculation Methodology & Noise Modelling
- Part 3: Assessment of Noise Exposure & Harmful Effects
- Part 4: Publication and Reporting

5 Overview of the Strategic Noise Mapping Process

5.1 Introduction

The workflow through which strategic noise mapping under the Regulations can be delivered is summarised in Figure 5.1 below as an eight-stage process.

Each stage of the process is defined by preceding stages such that requirements and specifications are captured ahead of the datasets. These datasets are then processed and concatenated, merged and linked together to develop the model datasets, which are checked and tested prior to the final assessment of noise levels.

It is recommended that the data processing is commenced within a GIS environment, then passed to the specialist noise mapping software environment for final sign-off and the calculation of noise levels. The results of this assessment are then passed back to the GIS environment for post processing, exposure assessments and mapping. Step 5 “Develop noise model datasets” starts within the GIS environment, and is completed within the noise mapping software.

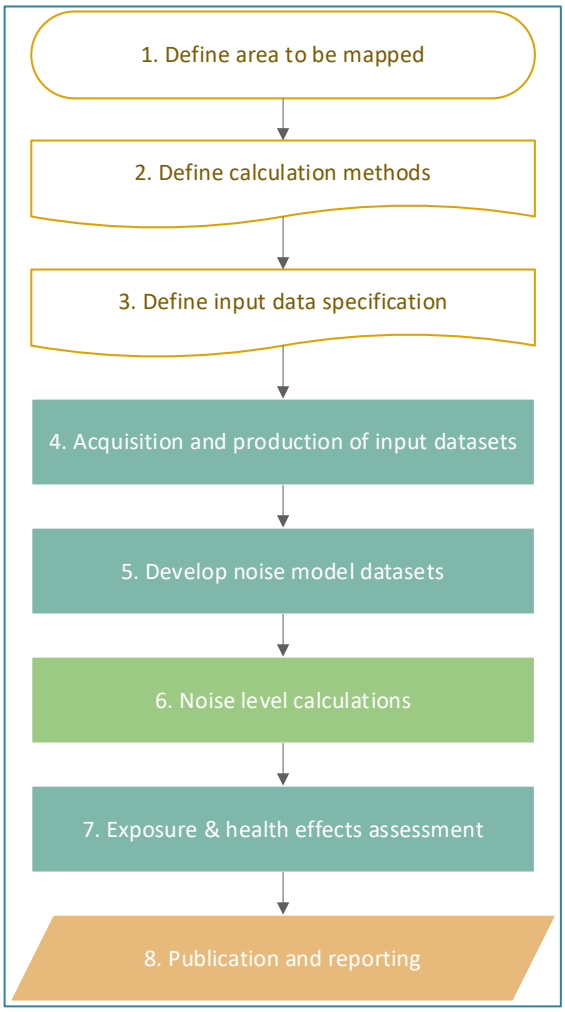

Figure 5.1: Overview of noise mapping process

Following the calculation of noise levels, the analysis is undertaken using datasets developed to present dwelling and population locations in order to deliver the statistics required by the EU for the reporting requirements defined by the European Environment Agency (EEA).

An overview of each stage of the process is presented below by means of an introduction, specific details and guidance associated with each stage is set out in Part 2 of the Guidance[48].

5.2 Stage 1 - Define Area to be Mapped

The first stage is to define the areas of interest for the requirements of the strategic noise mapping, which include:

- The area to be mapped:
  - The specific geographical area for which noise calculation results are required;
  - For agglomerations the areas are defined in the Sixth Schedule of the Regulations[49]; and
  - For major roads, major railways and major airports the sources which must be included are those designated under the Regulations[50]; the area to be mapped is less specific as it is effectively defined by the noise levels which must be reported under the Regulations, and possibly also any lower noise levels of interest to the Noise Mapping Bodies and Action Planning Authorities.

- The area to be modelled:
  - In order for the noise levels on the edge of the agglomeration area to be calculated accurately, it is important to consider the noise sources, and propagation screening objects, from an area beyond and outside the actual area to be mapped; and
  - For major roads, railways and airports the noise source is specifically spatially located, and the area to be modelled is generally the same area as the area to be mapped.

At the end of the stage there will be:

- A specification for the geographical areas for which noise levels will be calculated; and
- A specification for the geographical area for which the input datasets are required.

Figures 5.2 to 5.6 below present illustrations of the expected areas to be mapped during Round 4 strategic noise mapping, and the buffered model areas, for the three noise agglomerations, and the major roads, major railways and major airport.

[48] Guidance Note for Strategic Noise Mapping, *Part 2: Calculation Methodology & Noise Modelling* For the Environmental Noise Regulations 2018 (amended), Version 3, October 2024.
[49] European Communities (Environmental Noise) (Amendment) Regulations 2021, S.I. No. 663 of 2021
[50] European Communities (Environmental Noise) Regulations 2018, S.I. No. 549 of 2018

Table 5.1: Estimated extents of Round 4 Strategic Noise Mapping

Region mapped	Area/length mapped	Area modelled
Cork agglomeration	241 km^2	412 km^2
Dublin agglomeration	960 km^2	1,453 km^2
Limerick agglomeration	116 km^2	233 km^2
Major airports	188 km^2	188 km^2
Major railways	161 km	286 km^2
Major roads	6,288 km	11,403 km^2

Notes:

a. Agglomeration area, major road and railway length are based on extents reported to EEA in June 2020
b. Modelled area is based on a 2 km buffer for agglomeration and major roads, and 1 km buffer for major railways
c. Major airport area is based on Round 4 strategic noise maps
d. Calculated mapped and modelled areas exclude any extends beyond the coastline

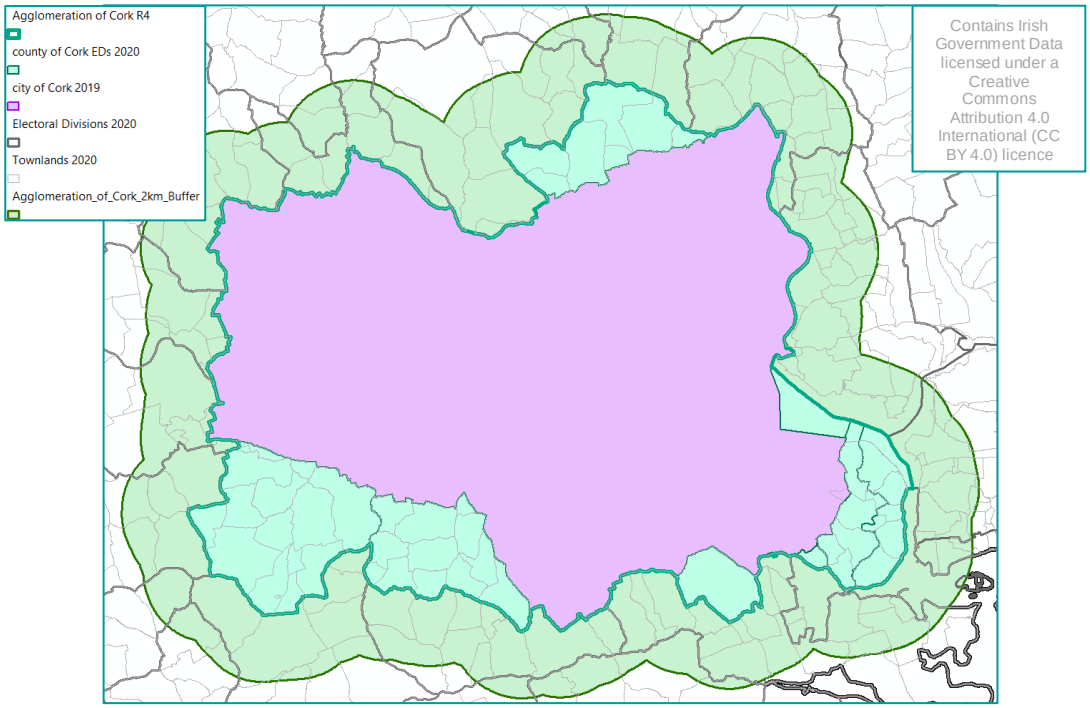

Figure 5.2: Cork noise agglomeration plus 2 km buffer model

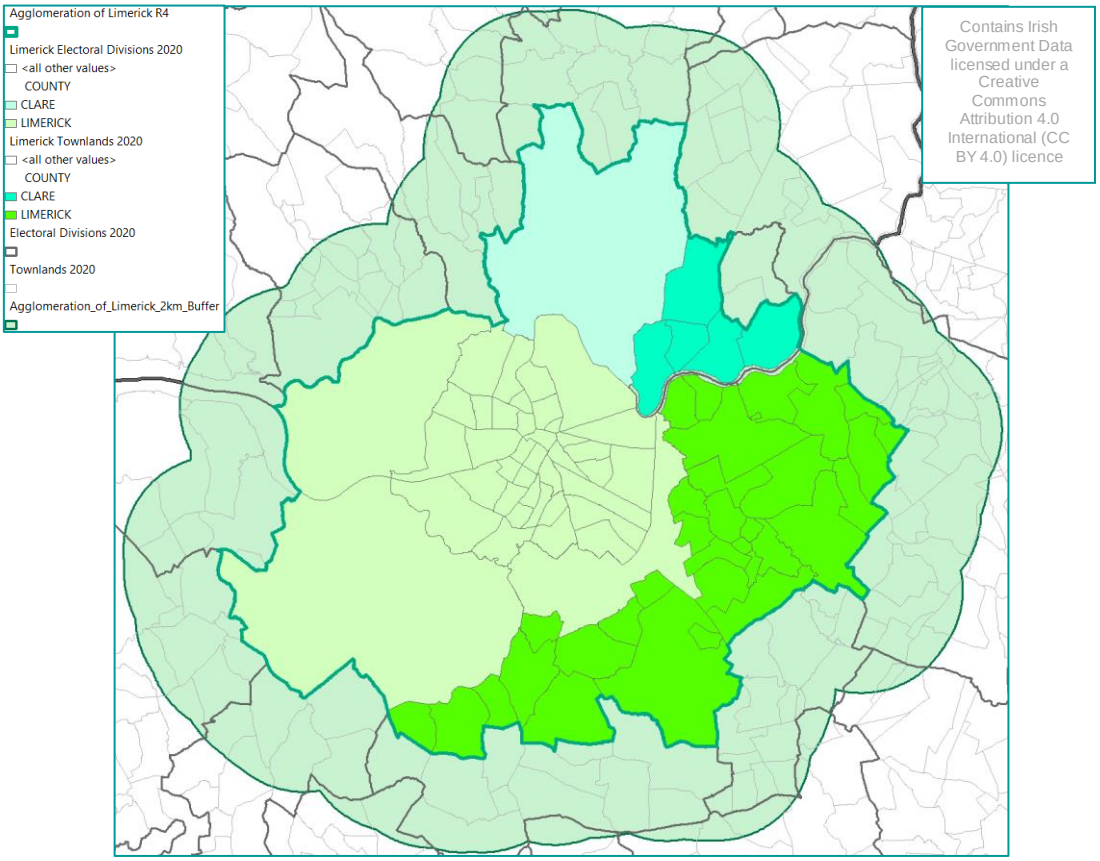

Figure 5.3: Limerick noise agglomeration plus 2 km buffer model area

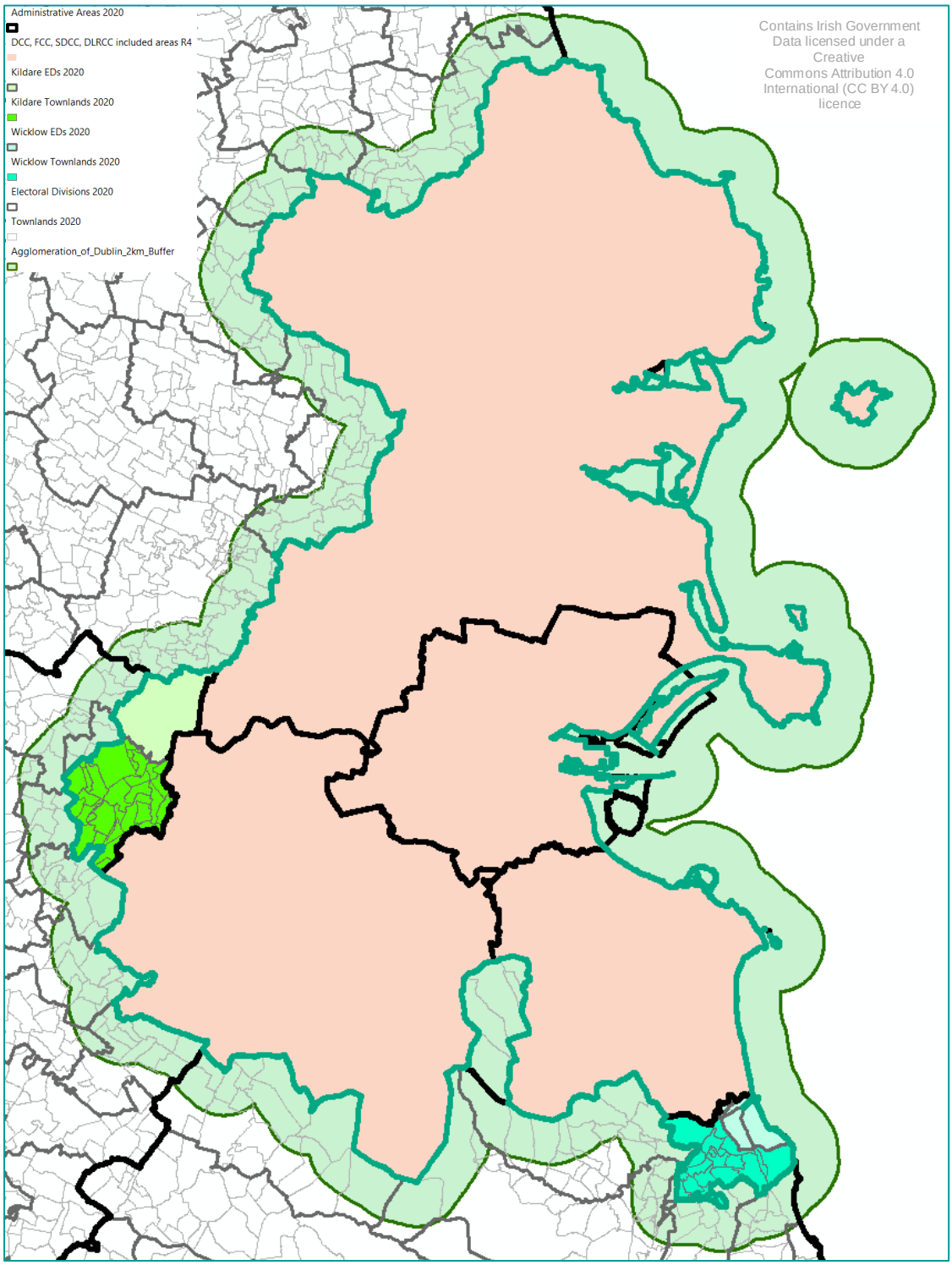

Figure 5.4: Dublin noise agglomeration plus 2 km buffer model area

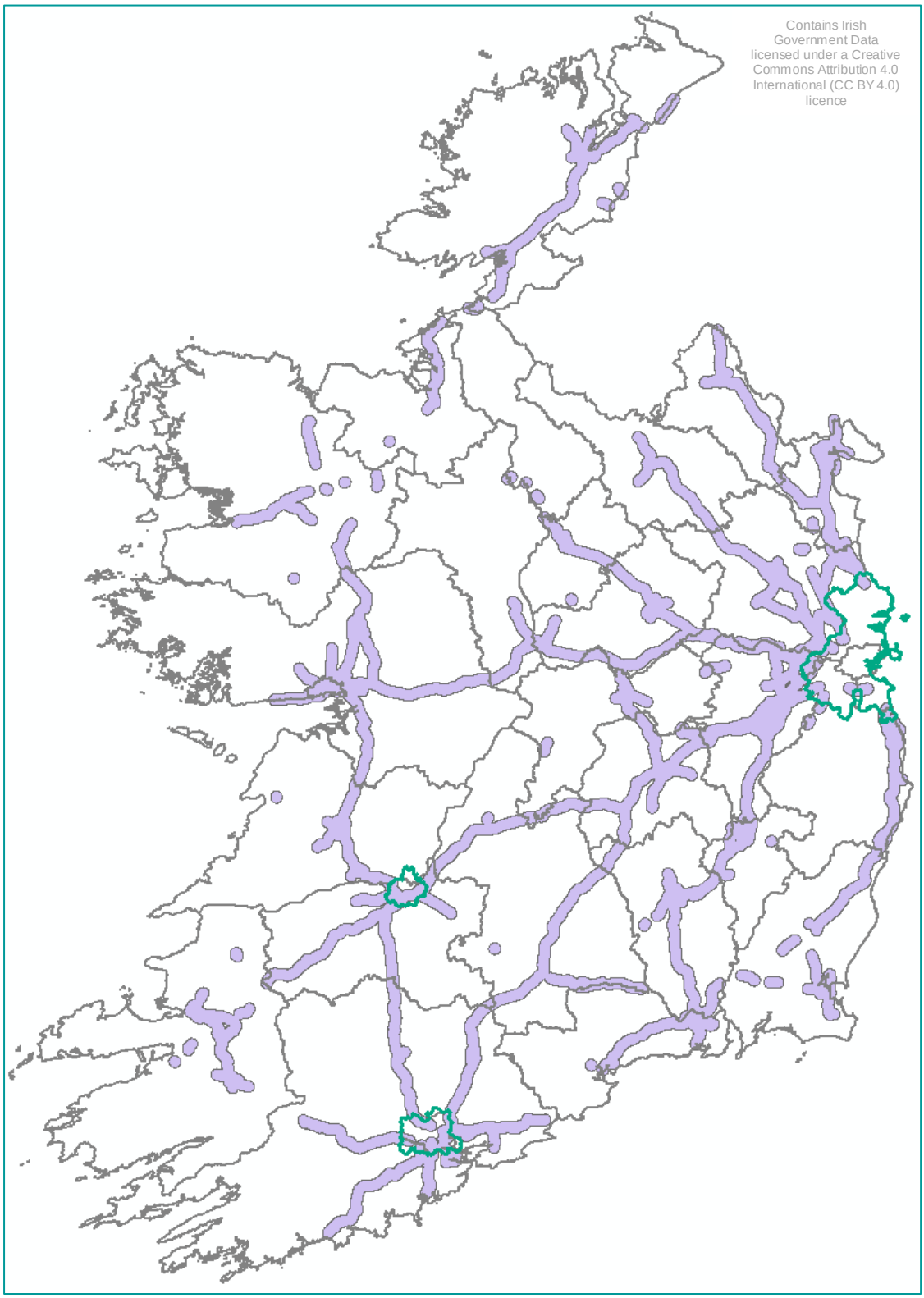

Figure 5.5: Major roads and major railways 2 km buffer model area

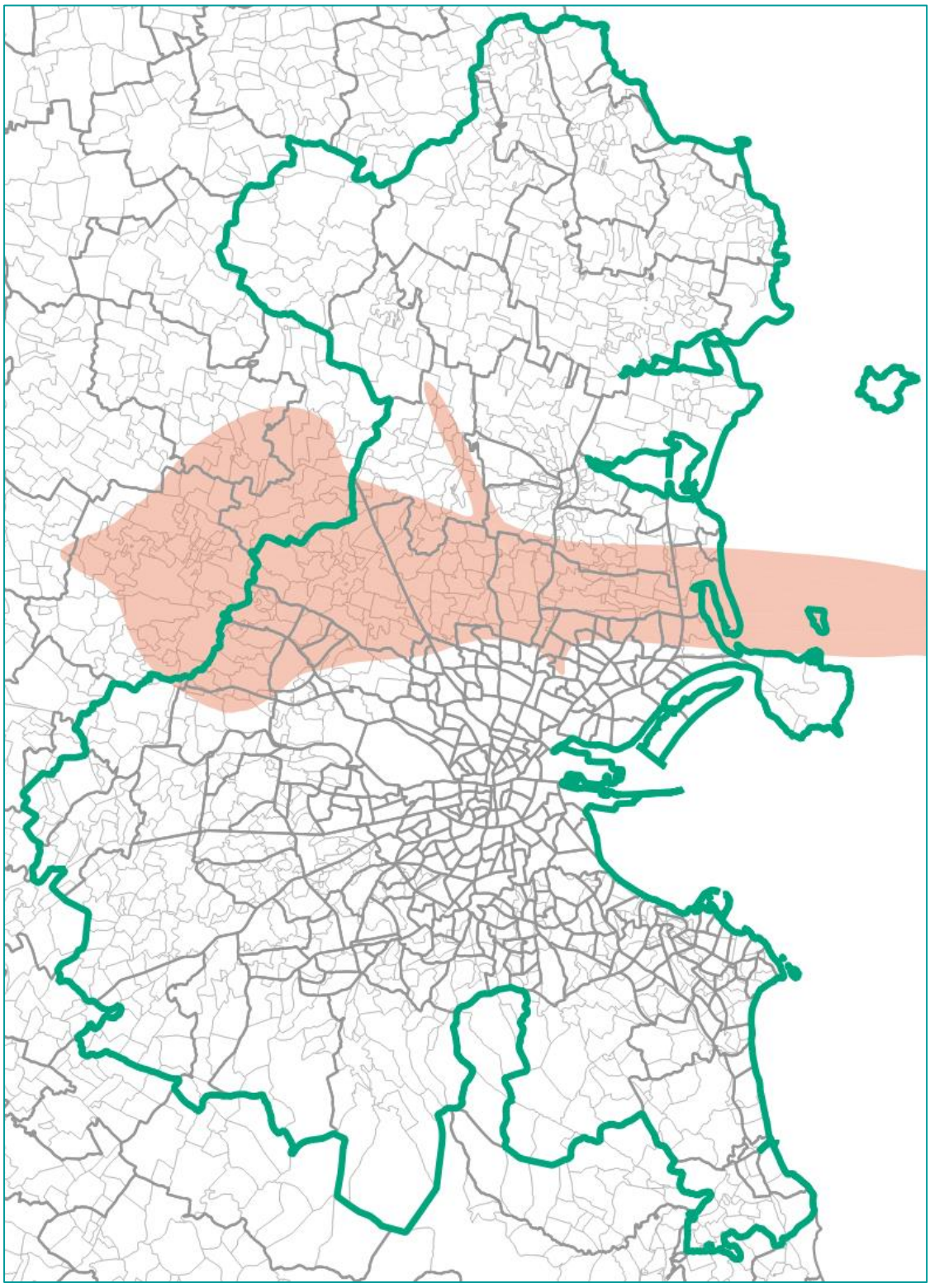

Figure 5.6: Estimated major airport model area (based on R4 L_{den} noise contours)

5.3 Stage 2 - Define Calculation Methods (CNOSSOS-EU)

The Regulations set out the calculation methods which are to be used for the production of the strategic noise maps[51]. The methodology set out in the latest version of Annex II of the END should be used.

When this guidance was prepared the common noise assessment methods for Europe (CNOSSOS-EU) were set out in the Annex to Commission Directive (EU) 2015/996 (CNOSSOS-EU), corrected by Corrigendum to Commission Directive (EU) 2015/996, OJ L5/35-46 of 10th January 2018, and amended by Commission Delegated Directive (EU) 2021/1226 of 21.12.2020.

In order to implement the CNOSSOS-EU calculation methods, a series of input datasets are required for roads, railways, industrial sources and aircraft sources, and the description of the propagation environment between the sources and the receivers. These requirements need to be analysed in order to develop a catalogue of input data requirements, including details such as objects, attributes and limiting values as appropriate.

Detailed guidance on the input data requirements for the CNOSSOS-EU calculation methodology are set out in Part 2 of the Guidance[52].

5.4 Stage 3 – Define Input Data Specification

Stages 1 and 2 provide a clear description of what data the calculation methods require, and for what locations that data is required. This information combines with the chosen data management strategy to draw up a series of dataset specifications for each of the layers of spatial and attribute data which are required within the noise mapping process.

The dataset specifications become an organised means of centrally managing and combining disparate generic spatial datasets and attribute databases. It also enables multiple organisations and stakeholders to supply data into a data repository to support interoperability, collaboration and the combining of work efforts.

The noise mapping process requires a wide range of input datasets, many of which need to be spatially referenced. An overview of the type of datasets required in order to carry out the noise level calculations is shown below:

- Road source:
  - Carriageway centreline;
  - Traffic flow;
  - Traffic speed;
  - %HGVs;
  - Road surface type; and
  - Road texture depth.

[51] Schedule 9(1)
[52] Guidance Note for Strategic Noise Mapping, *Part 2: Calculation Methodology & Noise Modelling* For the Environmental Noise Regulations 2018 (amended), Version 3, October 2024.

- Rail source:
  - Rail centreline;
  - Traffic flow;
  - Train speed;
  - Rail vehicle type;
  - Track support; and
  - Railhead roughness.

- Industry source:
  - Location;
  - Process type; and
  - Noise emission level.

- Aircraft Source:
  - Flight track;
  - Aircraft type; and
  - Power level along flight track.

- Propagation Model:
  - DTM – 3D terrain model;
  - DSM – 3D surface model, including tops of buildings and tree canopies;
  - Drape roads, railways and industrial facilities onto the DTM;
  - Embankments & Cuttings;
  - Breaklines;
  - Bridges / Underpasses;
  - Barriers;
  - Ground cover; and
  - Meteorology

- Develop exposure model datasets:
  - Residential school & hospital buildings;
  - Dwellings;
    - Including dwellings with special insulation against noise, where available.
  - People in dwellings;

The propagation datasets create a virtual three-dimensional model of the agglomerations, or other areas of interest around the major sources. Into this model are introduced the road, railway and industry sources, and the locations of dwellings, noise sensitive buildings, and people living in dwellings.

At this stage it is often most efficient to also select the noise calculation software which will be utilised in Stage 6, that way the specification drawn up can match the requirements of the

calculation software, and make the transition from GIS (geographic information system) to noise calculation environment as seamless as possible.

Detailed guidance on the required dataset specifications is set out in Part 2 of the Guidance[53].

5.5 Stage 4 – Acquisition and Production of Input Datasets

Within this stage the raw GIS datasets can be collected, collated and catalogued with the aim of carrying out a gap analysis and audit against the specifications drawn up within Stage 3.

The general areas which are addressed at this point are:

- An appraisal of the available data against the specification, looking into issues such as:
  - Coverage, resolution, accuracy, attributes, maintenance regime, format, metadata, fitness for purpose.
- A gap analysis is then carried out, resulting in details of the data required that is not currently available, and proposing mechanisms for the completion of the input datasets.
- During the process the licensing conditions associated with each of the available datasets is documented and appraised as confirmation of whether the current license enables the use of each dataset within the noise mapping project is required. Some of the licensing issues to be considered could include:
  - current and future IPR (Intellectual Property Rights), residual IPR, use for what purpose and restrictions on other users and sub-contractors, maintenance of data, duration of license term, residual rights after expiry, internet access, public availability etc.

Following the appraisal, gap analysis and resolution of licensing issues, the input datasets need to be completed in line with the approved approach. This could be via a number of different routes:

- Extended licensing of existing datasets for additional coverage or improved currency;
- Data capture programs to fill gaps in the available datasets; or
- Interpolation or processing of raw datasets to produce relevant derived data products.

Detailed guidance on the production of strategic noise mapping datasets is set out in Part 2 of the Guidance[52].

5.6 Stage 5 - Develop Noise Model Datasets

At the end of Stage 4 the input datasets should be completely populated for the total coverage of the area to be modelled. At this point the project will have a series of generic GIS datasets.

[53] Guidance Note for Strategic Noise Mapping, *Part 2: Calculation Methodology & Noise Modelling* For the Environmental Noise Regulations 2018 (amended), Version 3, October 2024

GIS data is collected for multiple purposes and this will generally not be specifically for the needs of acoustic calculation, hence it is seldom optimised for such a use. This leads to two generalised groups of issues which need to be resolved for the data to be optimised for the noise calculations:

- Tuning dataset resolution to acoustic calculation requirements; and
- Appending datasets to best exploit capabilities of the noise calculation software.

This processing may be carried out within a GIS environment, or within some noise modelling software, but needs to be designed in collaboration between GIS and noise modelling specialists in order to produce an optimised noise modelling dataset ready for the calculation process.

If the specification within Stage 3 was not focused towards a particular noise calculation software tool, the datasets will need to be processed at this stage in order to match into the chosen software tool.

Detailed guidance on steps typically used to optimise noise modelling datasets are set out in Part 2 of the Guidance[54].

5.7 Stage 6 - Noise Level Calculations

At this stage the final GIS input datasets are transferred into the noise calculation software. The elements of this stage are typically:

- Final manipulation of the input datasets to optimise for the noise calculation software;
- Selection of the user specified calculation settings within the software tool;
- Running of the noise calculations over the entire area to be mapped, using all the data from the model area; and
- Production of noise results datasets developed from the calculation process.

The resultant noise level datasets may remain within the noise calculation software environment, or more typically be passed to a third-party analysis tool or into a GIS system, for map production, secondary analysis and reporting.

Detailed guidance on the noise level calculations within the Softnoise Predictor-LimA[55] noise calculation software typically used in Ireland is set out in Part 2 of the Guidance[56].

5.8 Stage 7 – Exposure and Health Effects Assessment

Following the production of noise level results within Stage 6 the calculated levels need to be analysed in combination with other datasets in order to produce the results required by the Directive and the Commission.

[54] Guidance Note for Strategic Noise Mapping, *Part 2: Calculation Methodology & Noise Modelling* For the Environmental Noise Regulations 2018 (amended), Version 3, October 2024.
[55] https://softnoise.com/products/predictor-lima/ [Accessed January 2023]
[56] Guidance Note for Strategic Noise Mapping, *Part 2: Calculation Methodology & Noise Modelling* For the Environmental Noise Regulations 2018 (amended), Version 3, October 2024.

The Second Schedule of the Regulations sets out the assessment methods for harmful effects which the NMBs are to calculate[57], and the Fifth Schedule of the Regulations sets out the data which must be sent to the Commission, based on the results of the strategic noise mapping. Additional guidance on the assessment of noise exposure and harmful effects is set out in Part 3 of the Guidance[58].

The analysis to be carried out delivers a number of sets of results including:

- No. of dwellings exposed within defined noise bands;
- No. of people in dwellings exposed within defined noise bands;
- No. of people in dwellings with special noise insulation exposed within defined noise bands (where known);
- No. of people in dwellings with a quiet façade exposed within defined noise bands (where known);
- No. of school and hospital buildings exposed within defined noise bands;
- Total area exposed within noise bands;
- No. of people suffering harmful effects due to environmental noise; and
- Documentation on the process undertaken to produce the reported analysis results.

Detailed guidance on the noise level calculations within the Softnoise Predictor-LimA[59] noise calculation software typically used in Ireland is set out in Part 2 of the Guidance[60].

[57] Regulation 9(2)
[58] Guidance Note for Strategic Noise Mapping, *Part 3: Assessment of Noise Exposure and Harmful Effects* For the Environmental Noise Regulations 2018 (amended), Version 3, October 2024.
[59] https://softnoise.com/products/predictor-lima/ [Accessed January 2023]
[60] Guidance Note for Strategic Noise Mapping, *Part 2: Calculation Methodology & Noise Modelling* For the Environmental Noise Regulations 2018 (amended), Version 3, October 2024.

6 Stage 8 - Publication and Reporting

On completion of the strategic noise maps, there is a statutory requirement to publish the maps and exposure results[61], and report them to the Agency[62], within one month.

Following the completion of the seven stages of the strategic noise mapping process, the results datasets will include the following:

- Calculated noise levels at receptors on a regular grid across the area mapped;
- Calculated noise levels at receptors on the exposed facades of residential buildings;
- Strategic noise maps showing areas exposed within defined noise bands;
- Exposure statistics including:
  - No. of dwellings exposed within defined noise bands;
  - No. of people in dwellings exposed within defined noise bands;
  - No. of people in dwellings with special noise insulation exposed within defined noise bands (where known);
  - No. of people in dwellings with a quiet façade exposed within defined noise bands (where known);
  - No. of school and hospital buildings exposed within defined noise bands;
  - Total area exposed within noise bands;
  - No. of people suffering harmful effects due to environmental noise; and

Outputs generated from the strategic noise mapping process are to be published, and reported to the EPA to support reporting at national level and onward reporting to the EEA.

6.1 Access to Information

Within the context of the Regulations, and the Directive, the strategic noise maps are to serve as a public statement of the extent to which environmental noise currently affects the area covered by the maps, and to provide the basis of evidence for the development of noise action plans.

Strategic noise maps are to be made available to the public in accordance with the provisions of the European Communities (Access to Information on the Environment) Regulations 2007 (S.I. No. 133 of 2007)[63] (as amended 2011, 2014 & 2018). These Regulations give effect in Ireland to the AIE Directive, which was adopted to give effect to the Access to Information pillar of the Aarhus Convention. In 2013, DCCAE (now DECC) published guidance to accompany the regulations, alongside a flow chart illustrating the process of requesting information[64].

As well as giving you the right to access environmental information, the AIE Regulations also obliges public authorities to be proactive in disseminating environmental information to the public. Public authorities must inform the public of their rights and provide information and

[61] Regulation 13
[62] Regulation 11(5)
[63] Available from: https://www.irishstatutebook.ie/eli/2007/si/133/made/en/print [Accessed January 2023]
[64] Available from: https://www.gov.ie/en/organisation-information/1e52cb-access-to-information-on-the-environment-aie/#guidelines [Accessed January 2023]

guidance on exercising those rights. They must also make reasonable efforts to maintain environmental information and have it in a form that is accessible and can be reproduced.

Dissemination to the public should be via any appropriate means, including through the use of available information technologies[65], and should be in accordance with relevant Union legislative acts, in particular, Directives on public access to environmental information (Directive 2003/4/EC[66]) and INSPIRE (Directive 2007/2/EC[67]), and in conformity with the Third and Fourth Schedule to the END (Directive 2002/49/EC).

To this end information for the public on strategic noise maps, should be clear and comprehensible, and include a summary setting out the most important points[68].

European Commission Working Group Assessment of Exposure to Noise (WG-AEN) developed a Position Paper on "Presenting Noise Mapping Information to the Public", March 2008[69]. This provides clear guidance, advice and examples of best practice on how to publish noise mapping information. One important aspect which the position paper covers is the need for suitable supporting information and explanation alongside the noise mapping results in order for the relevance and context of the results to be conveyed.

Further guidance of publication of the results of the strategic noise mapping are set out in *Part 4: Publication and Reporting* of this guidance[70].

6.2 Reporting to the EPA

The results of the strategic noise mapping are to be submitted to the EPA by the NMBs using the templates from the EEA mandatory reporting mechanism, Reportnet 3[71], or other templates provided by the EPA, along with metadata, and a report on the noise mapping process.

Reportnet 3 is an electronic reporting mechanism that combines the requirements of the END and INSPIRE. Fundamentally it is a data model documentation of a series of related datasets. In total there are around 130 noise data deliveries required for Round 4 reporting.

The EEA have provided extensive documentation, templates, examples and training videos to support Round 4 reporting under the new Reportnet 3 platform. The primary format for the reporting of strategic noise mapping results will be GeoPackages under Dataflow DF4_8. The GeoPackage encoding standard is an open format developed by the Open Geospatial

[65] Regulation 13(1)
[66] Available from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32003L0004 [Accessed January 2023]
[67] Available from: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32007L0002 [Accessed January 2023]
[68] Regulation 13 (2)
[69] Available from: http://circa.europa.eu/Public/irc/env/noise_map/library?l=/wg-aen_001_2008doc/_EN_1.0_&a=d [accessed May 2011]
[70] Guidance Note for Strategic Noise Mapping, *Part 3: Publication and Reporting* For the Environmental Noise Regulations 2018 (amended), Version 3, October 2024.
[71] EEA Eionet Portal – Noise. Available at: https://www.eionet.europa.eu/reportnet/docs/noise [Accessed January 2023]

Consortium (OGC)[72], and a GeoPackage is a SQLite container for the GeoPackage encoding standard, and may contain vector data, tables of attribute data, raster maps and extensions all within one package.

The Agency is to report the results of the strategic noise maps to the Commission within 6 months of the dates set out in Regulation 11 and 12[73] using the mandatory EEA Reportnet 3 data repository. In the event that the Agency wants to update information, it shall describe the differences between the updated and original information and the reasons for the update when making the updated information available to the data repository.

Further guidance of reporting the results of the strategic noise mapping to the EPA are set out in *Part 4: Publication and Reporting* of this guidance[74].

[72] Open Geospatial Consortium (OGC), GeoPackage. Available at: https://www.geopackage.org/ [Accessed January 2023]
[73] Regulation 14(1)
[74] Guidance Note for Strategic Noise Mapping, *Part 3: Publication and Reporting* For the Environmental Noise Regulations 2018 (amended), Version 3, October 2024.

Appendix A: Glossary of Acoustic and Technical Terms

Term	Definition
Agglomeration	Major Continuous Urban Area as set out within the Regulations
Attribute Data	A trait, quality, or property describing a geographical feature, e.g. vehicle flow or building height
CNOSSOS-EU	Common Noise Assessment Methods for Europe, Directive 996/2015
Data	Data comprises information required to generate the outputs specified, and the results specified
dB	Decibel
DEM	Digital Elevation Model
DSM	Digital Surface Model
DTM	Digital Terrain Model
EC	European Commission
END	Environmental Noise Directive (2002/49/EC)
GIS	Geographic Information System
Irish National Grid (ING)	Superseded spatial referencing system of Ireland
Irish Transverse Mercator (ITM)	The official spatial referencing system of Ireland
ISO	International Standards Organisation
Metadata	Descriptive information summarising data
NA	Not Applicable
Noise Bands	Areas lying between contours of the following levels (dB): L_{den} <55, 55 – 59, 60 – 64, 65 – 69, 70 – 74, ≥75 L_d <55, 55 – 59, 60 – 64, 65 – 69, 70 – 74, ≥75 L_e <55, 55 – 59, 60 – 64, 65 – 69, 70 – 74, ≥75 L_n <45, 45-49, 50 – 54, 55 – 59, 60 – 64, 65 – 69, ≥70 Notes: It is recommended that class boundaries be at .00, e.g. 55 to 59 is actually 55.00 to 59.99 The assessment and reporting of the 45 – 49dB band for Lnight is optional under the Regulations
Noise Levels	Free-field values of L_{den}, L_d, L_e, L_n, and $L_{Aeq,16h}$ at a height of 4m above local ground level
Noise Level - L_d - Daytime	L_d (or L_{day}) = $L_{Aeq,12h}$ (07:00 to 19:00)
Noise Level - L_e - Evening	L_e (or $L_{evening}$) = $L_{Aeq,4h}$ (19:00 to 23:00)
Noise Level - L_n - Night	L_n (or L_{night}) = $L_{Aeq,8h}$ (23:00 to 07:00)
Noise Level - L_{den} – Day/Evening/Night	A combination of L_d. L_e and L_n as follows: $L_{den} = 10 * \log 1/24 \{12 * 10^{((L_{day})/10)} + 4 * 10^{((L_{evening}+5)/10)} + 8 * 10^{((L_{night}+10)/10)}\}$
Noise Mapping (Input) Data	Two broad categories: (1) Spatial (e.g. road centre lines, building outlines).

Term	Definition
	(2) Attribute (e.g. vehicle flow, building height – assigned to specific spatial data)
Noise Mapping Software	Computer program that calculates required noise levels based on relevant input data
Noise Model	All the input data collated and held within a computer program to enable noise levels to be calculated.
Noise Model File	The (proprietary software specific) project file(s) comprising the noise model
Output Data	The noise outputs generated by the noise model
OSI	Ordnance Survey for Ireland
Processing Data	Any form of manipulation, correction, adjustment factoring, or other adjustment of data to make it fit for purpose. (Includes operations sometimes referred to as 'cleaning' of data)
QA	Quality Assurance
Spatial (Input) Data	Information about the location, shape, and relationships among geographic features, for example road centre lines and buildings.
WG - AEN	Working Group – Assessment of Exposure to Noise

Appendix B: Bibliography and References

Legislation

European Communities (Environmental Noise) (Amendment) Regulations 2021, S.I. No. 663 of 2021.

Commission Delegated Directive (EU) 2021/1226 of 21.12.2020 amending, for the purpose of adapting to scientific and technical progress, Annex II of Directive 2002/49/EC of the European Parliament and the Council as regards common noise assessment methods, OJ L269/65-142 of 28th July 2021.

European Communities (Environmental Noise) Regulations 2018, S.I. No. 549 of 2018.

Corrigendum to Commission Directive (EU) 2015/996, OJ L5/35-46 of 10th January 2018.

Directive (EU) 2015/996 of 19 May 2015 establishing common noise assessment methods according to Directive 2002/49/EC, OJ L168/1-823 of 1st July 2015.

European Communities (Access to Information on the Environment) Regulations 2007 (S.I. No. 133 of 2007).

Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE).

Directive 2003/4/EC of the European Parliament and of the Council of 28 January 2003 on public access to environmental information.

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WHO, Night noise guidelines for Europe, 2009.

WHO, Guidelines for community noise, 1999.