An tÚdarás Inniúil um Thorann Aerárthaí

Aircraft Noise Competent Authority

ANCA
Draft Regulatory Decision Report

November 11th 2021

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An tÚdarás Inniúil um Thorann Aerárthaí
Aircraft Noise Competent Authority

The services of Noise Consultants Ltd were retained by ANCA to support the work of the authority by undertaking technical assessments and providing expert advice in the areas of acoustics, aviation, and environmental assessments.

Noise CONSULTANTS

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GLOSSARY OF TERMS

Term	Definition
ABP / An Bord Pleanála	Ireland's national independent planning body that decides appeals on planning decisions made by local authorities as well as direct applications.
Act of 2019	The Aircraft Noise (Dublin Airport) Regulation Act of 2019 which ratifies the Aircraft Noise Regulation into Irish Law
Aircraft Noise Regulation	Regulation (EU) No. 598/2014 of the European Parliament 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.
ANCA	The Aircraft Noise Competent Authority – the Designated Competent Authority for the purposes of aircraft noise regulation at Dublin Airport.
The Applicant	The airport authority for Dublin Airport – who submitted planning application F20/0668.
ATM	Air Traffic Movement – the movement of an aircraft in or out of an airport.
The Balanced Approach	ICAO Balanced Approach – consists of identifying a noise problem at a specific airport and analysing various measures available to reduce noise. The Balanced Approach aims to address noise problems on an individual airport basis and identify the noise related measures that achieve maximum environmental benefit most cost effectively using objective and measurable criteria.
daa	The airport authority for Dublin Airport
dB	Decibels – a common unit of measuring sound
DRD	The Draft Regulatory Decision – this is the set of conditions proposed by ANCA for the planning authority to consider in the making of their decision on planning application F20/0668. It also supports the implementation of the Noise Abatement Objective. This decision is currently in *draft* format, pending the completion of the statutory consultation period.

EASA	The European Union Aviation Safety Agency
ECAC	The European Civil Aviation Conference – a European intergovernmental organisation that seeks to standardise civil aviation policies and practices amongst its member states.
EMRA	The Eastern and Midlands Regional Assembly – part of the regional tier of governance in Ireland, primarily focused on strategic planning.
ENG18	The World Health Organizations Environmental Noise Guidelines for Europe 2018
END / Environmental Noise Directive	Directive (EC) 2002/49/EC of the European Parliament relating to the assessment and management of Environmental Noise
ENR/ Environmental Noise Regulations 2018	Statutory Instrument No. 549/2018 European Communities (Environmental Noise) Regulations 2018 – gives effect to Directive (EC) 2002/49/EC relating to the assessment and management of Environmental Noise, as amended by Directive 2015/996 establishing common noise assessment methods.
EPA	The Environmental Protection Agency
EPNdB	Effective Perceived Noise in Decibels
FCC	Fingal County Council, the planning authority for the area concerning Dublin Airport.
HA	Highly Annoyed – Metric used to describe the number of people calculated to be Highly Annoyed by Aircraft Noise
HSD	Highly Sleep Disturbed – Metric used to describe the number of people calculated to be Highly Sleep Disturbed by Aircraft Noise
HSIP	Home Sound Insulation Programme – a home Insulation scheme for dwellings most impacted by *current* operations at Dublin Airport
IAA	Irish Aviation Authority – the body responsible for the management of Irish controlled airspace, the safety regulation of Irish civil aviation, and the oversight of civil aviation security in Ireland.
ICAO	The International Civil Aviation Organization – a specialised division of the United Nations which works with member states and industry

	groups to agree on international civil aviation standards and recommended practices and policies in support of a safe, efficient, secure, economically sustainable, and environmentally responsible civil aviation sector.
LAP	The Dublin Airport Local Area Plan
L_{night}	The long-term average sound level at night determined over all the night time (23:00-07:00) periods of a year.
L_{den}	The long-term average sound level determined across all of the day-evening-night (24-hour) periods of a year.
MPPA	Millions of Passengers per Anum that travel through an Airport
NAO	The Noise Abatement Objective – this is a policy objective for managing the long-term future of aircraft noise.
NAP	The Noise Action Plan developed by Dublin Airport
NNG09	The World Health Organisation Night Noise Guidelines of 2009
NIS	Natura Impact Statement – a report required to be produced as part of the Appropriate Assessment of Plans and Projects
NTK	Noise and Track Keeping System – this is the system used by an airport to record aircraft noise.
NQS	Noise Quota Scheme – a 'Noise Budget' for Dublin Airport that allocates a certain number of 'points' to be spent on the night time period across the year. Each aircraft carried a Quota Count ('points') depending on how noisy they are – the lounder the plane the higher the points. Each flight takes points off the total noise quota for the year.
The planning authority	The planning authority of Fingal County Council
Relevant Action	Refers to the proposed changes to planning permission applied for under F20/0668.
RNIS	Residential Noise Insulation Programme – an Insulation programme that applies to homes based on their location in relation to the planning permission granted for Dublin Airport's north runway under *current planning conditions.*

RSIGS	Residential Sound Insulation Grant Scheme – the sound Insulation grant scheme proposed for homes who will be affected by night time noise due to changes to the planning conditions as proposed by ANCA under the DRD.
Runway 10L/28R	The Dublin Airport **north** runway.
Runway 10R/28L	The Dublin Airport **south** runway.
Runway 16/34	The Dublin Airport **crosswind** runway.
SEA	Strategic Environmental Assessment – the formal, systematic evaluation of the likely significant effects of implementing a plan or programme before a decision is made to adopt the plan or programme.
Section 34C	Section 34C of the Planning and Development Act 2000, as amended by the Aircraft Noise (Dublin Airport) Regulation Act of 2019. This allows daa to make an application to the planning authority for the taking of a 'Relevant Action' (as is the case in planning application F20/0668).
Terminal Passenger Capacity Limit	The maximum capacity of Dublin Airport in terms of passenger numbers
WHO	World Health Organization

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Non-Technical Summary

1.1 Introduction

The Aircraft Noise Competent Authority (ANCA) is the designated competent authority for the regulation of aircraft noise at Dublin Airport.

In December 2020, the airport authority for Dublin Airport (daa) lodged a planning application (Ref. F20/0668) that seeks to change aircraft operating restrictions at Dublin Airport.

Following a preliminary noise assessment of the application, ANCA determined that it would lead to a noise problem at Dublin Airport. This triggered the process of aircraft noise regulation through the adoption of the International Civil Aviation Organization (ICAO) Balanced Approach.

ANCA has developed a Noise Abatement Objective (NAO) to reduce noise from Dublin Airport in the long-term. This is supported by the Draft Regulatory Decision (DRD), which sets out mitigation measures and operating restrictions to be used to achieve the objective. A Strategic Environmental Assessment and an Appropriate Assessment were carried out on these plans.

Public consultation on aircraft noise assessment outcomes is now open for 14 weeks. Following this, ANCA will make a Regulatory Decision that it will direct the planning authority (Fingal County Council), to include in its decision on the planning application.

1.2 The Noise Abatement Objective.

A Noise Abatement Objective (NAO) is **a plan** for managing the effects of aircraft noise on the surrounding communities and the environment.

It may guide **future decisions** that are needed to manage aircraft noise aspects of **aircraft operations** at an airport.

An NAO has been developed specifically for Dublin Airport.

Having regard to expected development at Dublin Airport, the NAO should be seen as a ***long-term objective*** for the reduction of aircraft noise.

The NAO for Dublin Airport has 5 constituent *parts:*

- ***Policy Objective***
- ***Explaining the Objective***
- ***Measurable Criteria***
- ***Expected Outcomes***
- ***Monitoring***

1.2.1 Measuring the impact of the NAO

A series of **required outcomes** are to be achieved against the NAO in order to reduce the number of people **'highly annoyed'** (HA) and **'highly sleep disturbed'** (HSD) by aircraft noise, particularly at night.

These are measured using World Health Organization (WHO) standards describing those chronically affected by aircraft noise.

The NAO aims to reduce the number of people highly sleep disturbed and highly annoyed so that compared to 2019 conditions, the number of people in these categories will reduce by:

- 30% by 2030
- 40% by 2035
- 50% by 2040

It also aims to reduce the number of people exposed to annual averaged aircraft noise above 55 decibels (dB) during the night time and 65 dB across a full 24-hour period compared to 2019.

ANCA will monitor the implementation of the NAO by requiring the daa to produce regular reports.

1.2.2 Achieving the NAO.

In order to successfully achieve the NAO, ANCA have identified **three conditions** that it proposes to direct the planning authority (Fingal County Council) to include in their decision on the planning application submitted by daa.

These three conditions form the **Draft Regulatory Decision**.

1.3 Particulars of any proposed noise mitigation measures and operating restrictions to be introduced – the Draft Regulatory Decision

Details of proposed noise mitigation measures and operating restrictions are contained in the Draft Regulatory Decision (DRD).

The making of a DRD is a statutory function of ANCA. The DRD outlines the proposed noise mitigation measures and operating restrictions to be introduced in order to address the noise problem at Dublin Airport.

The three conditions proposed are:

1. **The introduction of a Noise Quota Scheme (NQS).**
2. **No use of the north runway for take-off or landing between 00:00 and 06:00 except in limited circumstances.**
3. **A voluntary residential sound insulation grant scheme (RSIGS).**

1.3.1 The Draft Regulatory Decision – the three conditions

1.3.1.1 Condition 1 – The Introduction of a Noise Quota Scheme

This condition proposes a limit on night time aircraft noise at Dublin Airport through the introduction of a 'Noise Quota Scheme' between 23:00 and 07:00. This works like a 'noise budget' that Dublin Airport will have to operate within.

When the north runway becomes operational, there will be a limit of 65 flights that can arrive or depart from Dublin Airport during the night, regardless of the sound level emitted from the planes concerned.

This limit is proposed to be replaced by the Noise Quota Scheme (NQS).

Aircraft are allocated a number of points at production relating to the amount of noise they make. These points are called the Quota Count, or QC. The noisier the plane, the higher the QC. As planes take off and land at the airport at night time, their QC contributes to the total that is permitted for Dublin Airport. The proposed total is 16,260 points per year.

This system will promote the use of quieter aircraft at night, as they will have a lower QC.

1.3.1.2 Condition 2 – Operational Restrictions on the North Runway

This condition will allow for flights to take off and land on both of Dublin Airports runways between 00:00-05:59. Night flights on the north runway will be prohibited between 00:00-05:59 other than in limited circumstances, such as in the case of an emergency.

1.3.1.3 Condition 3 – the Voluntary Residential Sound Insulation Grant

Communities who will be newly affected by noise above a certain level at night time have been identified and will be eligible for a new grant scheme called the Residential Sound Insulation Grant Scheme (RSIGS).

This scheme will provide up to €20,000 in grant support to households for noise insulation in bedrooms.

The scheme will not apply to properties who have already availed of measures under the two existing insulation schemes – the Residential Noise Insulation Scheme (RNIS) or the Home Sound Insulation Programme (HSIP) – or to properties who had planning permission lodged after 9 December 2019.

1.3.2 How the Draft Regulatory Decision Compares to the daa Planning Application and the 2007 planning conditions

2007 Conditions	daa Planning Application	ANCA Draft Regulatory Decision
Condition 3(d) prohibits the use of North Runway between 11pm and 7am.	Use of North Runway from 6am to midnight[1], rather than 7am to 11pm as set out in the current planning conditions.	Runway 10L/28R [the north parallel runway] shall not be used for take-off-or landing between 00:00 and 05:59 (local time) except in cases of safety, maintenance considerations, exceptional air traffic conditions, adverse weather, technical faults in air traffic control systems or declared emergencies at other airports or where Runway 10L/28R length is required for a specific aircraft type.
Condition 5 limits the number of aircraft movements (ATMs) at the entire airport to 65 between 11pm and 7am.	Seeks a Noise Quota Count system from 11.30pm to 6am, rather than an airport-wide 65 ATM limit from 11pm to 7am as set out in the current planning conditions; The airport would be subject to an annual noise quota of 7990 'points' between the hours of 2330hrs and 0600hrs	The introduction of a Noise Quota Scheme (NQS), with an annual limit of 16,260 between the hours of 23:00-07:00 (local time) with noise-related limits on the aircraft permitted to operate at night.

[1] Except in cases of safety, maintenance considerations, exceptional air traffic conditions, adverse weather, technical faults in air traffic control systems, declared emergencies at other airports, or where the extra runway length is required for a specific aircraft.

	Introduce an enhanced noise monitoring framework.	Details of reporting metrics and frequency required are specified.
	Introduce a noise insulation grant scheme for those most impacted by the proposed amendments.	A voluntary residential sound insulation grant scheme (RSIGS) for residential dwellings shall be provided as detailed in Schedule B, for all homes forecast in 2025 to be exposed to aircraft noise at or above 55 dB L_{night} contour and experience a 'very significant' effect. Dwellings exposed to levels at or above 55 dB L_{night} shall be reviewed every two years commencing in 2027 and if applicable become eligible for the scheme. This scheme shall not apply to properties where works were undertaken under the existing Residential Noise Insulation Scheme (RNIS) or Home Sound Insulation Programme (HSIP) or to properties where a planning application was lodged after 9 December 2019, the date being the adoption of Variation No. 1 to the Fingal Development Plan 2017 – 2023 incorporating policies relating to development within Aircraft Noise Zones.

1.4 The reasons for the proposed introduction of noise mitigation measures and operating restrictions.

1.4.1 Noise Quota Scheme

The Noise Quota Scheme will limit the impact of aircraft noise at Dublin Airport on communities surrounding the airport. This measure is being introduced in the interests of achieving the Noise Abatement Objective.

1.4.2 Operational Restrictions on the North Runway

The proposed measure will facilitate the operation of runways at Dublin Airport in a manner that minimises the impact of night time noise on communities. The noise assessment determined that retaining Condition 3(d) and allowing aircraft to only use the south runway at night would lead to increases in the number of people exposed to aircraft noise above the night time priority. In this respect, single south runway operations would fail to achieve the NAO.

1.4.3 Residential Sound Insulation Grant Scheme

The residential sound insulation grant scheme is designed to reduce the impact of night time aircraft noise in the vicinity of Dublin Airport. This is in the interests of communities surrounding the airport and having regard for proper planning and sustainable development.

1.5 The Application of the Balanced Approach.

The process of Aircraft Noise Regulation required ANCA to make a Noise Abatement Objective, apply the Balanced Approach, and make a Regulatory Decision.

The Balanced Approach is international guidance developed by the International Civil Aviation Organization (ICAO). It is an approach to managing noise at an airport.

It is given its legal basis in Europe through Regulation (EU) 598/2014 (the Aircraft Noise Regulation), and in Ireland through the Aircraft Noise (Dublin Airport) Regulation Act of 2019 (the Act of 2019).

In applying the balanced approach, ANCA considered the various measures available to manage aircraft noise at the airport. These measures are broadly categorised into the four principal elements of the Balanced Approach. These are:

- Reduction of Noise at Source.
- Land-Use Planning and Management.
- Operational Procedures.
- Operating Restrictions.

ANCA approached the application of the Balanced Approach as follows:

1. Prepared list of available mitigation measures.
2. Reviewed available measures and considered potential impact and feasibility.
3. Evaluated and analysed feasible measures against the Noise Abatement Objective and the Noise Problem Aspects.
4. Identified the cost-effectiveness of measures.

1.6 The Identification of Additional or Alternative Measures that have been Considered.

ANCA has used the Balanced Approach to identify and select mitigation measures and operating restrictions. ICAO guidance recommends additional or alternative measures to consider when applying the process of aircraft noise regulation. ANCA considered these in the process of making its decision.

1.7 Measures Considered to Address any Noise Problem.

ANCA considered the available measures under the Balanced Approach. The process and application of the Balanced Approach requires that measures which fall under each element of the Balanced Approach be used to achieve the noise abatement objective.

The tables below provide an overview of the measures considered by ANCA. Further detail on ANCA's consideration of these measures is outlined in the DRD report:

1.7.1 Reduction of Noise at Source

The ICAO guidance states that in relation to reduction of noise at source, consideration should be given to:

- *integration into aircraft fleets, over time, of technology improvements meeting the latest standards;*
- *specific fleet modernization plans of airlines operating at an airport;*
- *national plans to adopt the latest noise standard;*
- *adoption by Contracting States of the latest ICAO noise recommendations.*

As such, any measures which are available to reduce noise at source need to have regard for whether they facilitate, encourage, or incentivise a greater proportion of aircraft meeting the latest noise standards to operate at Dublin Airport.

ANCA has undertaken an analysis of the fleet mix for the forecast relied by the Applicant for its assessment of relevant action in 2025 and more broadly. This work is presented in Appendix G.

The DRD also proposes a phased prohibition on the noisiest aircraft operating to and from Dublin Airport at night as part of the Noise Quota Scheme. Full details of this measure are detailed within the DRD.

1.7.2 Noise Abatement Operating Procedures

Measure	Part of Current measures	Proposed new/additional measure
Use of Noise Preferential Routes	Yes	No
Route Alternation	No	No
Use/Mandate of Noise Abatement Departure Procedures (NADP) and/or Thrust Managed Climb	Yes	No
Continuous Climb Operations	Yes	No
Continuous Descent Approaches	Yes	No
Steeper/Segmented Approach Procedures / GBAs	Yes	No
Automated (RNAV) Procedures / Performance Based Navigation	[Yes]	No
Preferential Runway Use	Yes	Yes – Condition 2
Landing Displaced Thresholds	[Yes]	No
Runway Use Respite / Alternate Runway Use	No	No

1.7.3 Land Use Planning and Management

Measure	Part of Current Measures	Proposed new/additional measure
Planning Measures and Noise Zoning	Yes	No
Encroachment Management	Yes	No
Sound Insulation Schemes	Yes	Yes – Condition 3
Relocation Assistance Scheme	Yes	No

1.7.4 Operating Restrictions

Measure	Part of Current Measures	Proposed new/additional measure
Aircraft Movement Cap	Yes	No (proposed to replace)
Runway Use Restriction	Yes	Yes – Condition 2
Aircraft Curfew	No	No
Aircraft Type Restriction	No	Yes – Condition 1
Noise Quotas	No	Yes – Condition 1
Noise Contour Area and Shape Restriction	No	No

1.8 An Evaluation of the Cost-Effectiveness of the Various Methods Considered.

ANCA has undertaken evaluation of the cost effectiveness of the proposed and alternative noise mitigation measures and operating restrictions. This is in order to determine the most cost-effective measure (or combination of measures) for achieving the NAO.

ANCA carried out the cost-effectiveness analysis in order to better understand the measures which could be introduced as a replacement for existing operating restrictions.

ANCA selected two 'effectiveness metrics' to evaluate how different measures perform against the NAO. The two metrics chosen by ANCA were:

- The number of people Highly Sleep Disturbed in 2025.
- The number of people exposed to a high noise impact in 2025 (i.e., noise levels over 55 dB on average at night).

These two metrics were used across the entire cost-effectiveness analysis.

Other than the measures considered by ANCA or proposed by the Applicant, no further measures were identified following this analysis.

1.9 The relevant technical information in relation to any proposed noise mitigation measures and operating restrictions to be introduced.

The relevant technical information pertaining to the proposed noise mitigation measure and operating restrictions are set out in the Schedules attached to the Draft Regulatory Decision.

1.10 Summary of the Data Examined

In the making of its Draft Regulatory Decision, ANCA has considered the data submitted on 18th December 2020 in support of the application for planning permission (ref. F20A/0668). ANCA issued a direction to provide information 24 February 2021. This information was sought to facilitate detailed analysis of the measures being proposed by the Applicant and to explore potential cost-effective alternatives to the options considered including the existing noise measures being relied on by the Applicant.

ANCA also requested and examined data in relation to Appropriate Assessment and Strategic Environmental Assessment.

An overview of the key documents and data which has been considered by ANCA as provided by the Applicant with the Application and in response to the Direction to Provide Information is summarised in Appendix A.

02

Draft Regulatory Decision Report

2 INTRODUCTION

2.1 Introduction to ANCA

Fingal County Council (FCC) was designated as competent authority for the purposes of aircraft noise regulation at Dublin Airport by the Aircraft Noise (Dublin Airport) Regulation Act of 2019.

Following this, the FCC Chief Executive proceeded to establish the unit as a separate Directorate – the Aircraft Noise Competent Authority (ANCA).

2.1.1 Legal Origin

Regulation (EU) No. 598/2014 of the European Parliament and of the Council of 16 April 2014 (the Aircraft Noise Regulation) establishes the rules and procedures which govern the introduction of noise-related operating restrictions at European Union airports.

The Aircraft Noise Regulation requires EU Member States to define a Competent Authority responsible for the execution of the International Civil Aviation Organization (ICAO) Balanced Approach and the adoption of any noise-related operating restrictions at airports.

The Aircraft Noise Regulation states that:

"The competent authority responsible for adopting noise-related operating restrictions should be independent of any organisation involved in the airport's operation, air transport or air navigation service provision, or representing the interests thereof and of the residents living in the vicinity of the airport. This should not be understood as requiring Member States to modify their administrative structures or decision-making procedures."[2]

The Aircraft Noise (Dublin Airport) Regulation Act 2019 (the Act of 2019) gives further effect to the Aircraft Noise Regulation on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions for Dublin Airport.

[2] This requirement is formalised under Article 3(2)

The Aircraft Noise Regulation and the Act of 2019 apply only to airports with more than 50,000 civil aircraft movements[3] per calendar year, with Dublin Airport the only airport in Ireland meeting this criterion.

2.1.2 ANCA Roles and Responsibilities

ANCA is responsible for ensuring that noise generated by aircraft activity at Dublin Airport is assessed in accordance with national and European legislation. ANCA is required to apply the Balanced Approach to manage any identified noise problem at Dublin Airport within the wider context of sustainable development.

ANCA's roles and responsibilities as described by the Act of 2019 are to:

- Regulate aircraft noise at Dublin Airport.
- Assess the noise situation at Dublin Airport and adopt the Balanced Approach where a noise problem is identified.
- Set a Noise Abatement Objective (NAO) for Dublin Airport where a noise problem has been identified.
- Assess for potential impacts of aircraft noise through the planning process to determine whether a noise problem may arise.
- Amend existing or impose new noise mitigation measures and/or operating restrictions to address aircraft noise from Dublin Airport as appropriate.
- Monitor the implementation of noise mitigation measures and operating restrictions at Dublin Airport.

ANCA is also a public authority for the purposes of the European Commission (EC) (Birds and Natural Habitats) Regulations 2011 and a Competent Authority for the purposes of the EC (Environmental Assessment of Certain Plans and Programmes) Regulations 2004. As such its functions also include:

- Appropriate Assessment Screening and Appropriate Assessment of any proposed NAO or Regulatory Decision.
- Strategic Environmental Assessment of any proposed NAO or Regulatory Decision.

[3] Where a movement is a take-off or landing (The Aircraft Noise Regulation Article 2(2))

2.1.3 ANCA's Role in the Planning and Development System

Under the Act of 2019 and through amendments to the Act of 2000 under Section 34C, the planning authority of Fingal County Council (FCC) refers any planning applications for development at Dublin Airport to ANCA to assess potential aircraft noise impacts. These referrals may include proposed new developments. ANCA reviews planning applications and decides as to whether a more detailed assessment is required. This determination is based on a screening exercise which seeks to identify whether the proposed development may give rise to a 'noise problem'. Where ANCA considers this to be the case, the process of aircraft noise regulation as described by the Act of 2019 is carried out.

In addition, the planning authority must refer to ANCA, any application for permission to revoke, amend or replace an operating restriction at Dublin Airport, in which case the process of aircraft noise regulation as described by the Act of 2019 must be carried out in relation to the proposed changes.

The ultimate responsibility for deciding whether a planning application for development at Dublin Airport should be granted or refused is the function of the planning authority of FCC. ANCA can only direct refusal of planning permission if inadequate provision has been made to deal with any noise problem identified and associated with the proposed development. Otherwise, it must identify the operating restrictions and/or noise mitigation measures that should be included in any decision to grant permission by FCC.

2.2 Introduction to Aircraft Noise

This section provides information on sound and noise to assist in the interpretation of the report. It addresses the technical aspects of sound and noise, whilst providing information as to how aircraft noise is measured and quantified.

2.2.1 Principles of Sound

Sound is the transfer of energy through the air resulting in changes in air pressure which are detected by our ears as sound. As the magnitude of sound energy that is transferred to the air particles increases, this results in the sound detected by our ears being perceived as being louder.

The rate at which these changes occur is called the 'frequency' of the sound and different frequencies of sound are detected by our ear as 'pitch'.

2.2.1.1 Sound Pressure Level

Sound pressure waves are measured in Pascals (Pa). However, the human ear can perceive a wide range of sound pressures, with typical sounds ranging from one 0.00002 Pa to 20,000 Pa. This range makes it difficult for the average person to relate the Pascal scale to real life events.

For this reason, the intensity of a sound is frequently expressed on a logarithmic (compressed) scale as a sound pressure level[4] which is measured in decibels (dB). Table 2.1 provides examples of sound pressure levels (dB) as described by the decibel scale, the equivalent RMS[5] sound pressure (Pa) and a description of an environment or event that is typical of each sound pressure level.

Table 2.1: Example sound pressure levels. Source: Bies & Hansen[6]

Sound Pressure Level (dB)	Sound pressure (Pa)	Description
0	0.00002	Threshold of hearing for a young person with normal hearing
20	0.0002	Recording studio, ambient level
40	0.002	Quiet residential room, ambient level
60	0.02	Department store or restaurant ambient level; conversational speech.
80	0.2	Near to a busy highway (dual carriageway); shouting
100	2	Blender, factory machinery operating
120	20	Rock concert
140	200	Fireworks at close range

[4] The term 'level' indicates that the quantity is expressed in decibels.

[5] Root-mean-squared is the method of averaging used to obtain a positive average value for sound pressure. This method is required because sound pressure is a time-varying quantity which can have positive and negative values.

[6] *Engineering Noise Control: Theory and Practice (4th ed., Abington: Spon Press, 2009), pp. 39-40*

Table 2.2 shows how changes in sound pressure level are perceived as changes in 'loudness'[7] by the human ear. These changes and their apparent perceptible change relate to conditions where two sounds occur immediately following one another. Table 2.2 also equates the change in sound pressure level to the increase or decrease in sound energy (or power[8]).

Table 2.2: Subjective effect of changes in sound pressure level. Source: Bies & Hansen[9]

Change in sound pressure level (dB)	Change in power		Change in apparent loudness
	Decrease	Increase	
3	1/2	2	Just perceptible
5	1/3	3	Clearly noticeable
10	1/10	10	Half or twice as loud
20	1/100	100	Much quieter or louder

2.2.1.2 Frequency

Although the ear can detect frequency as 'pitch', this term is often more useful in a musical context where a single note has a dominant frequency. In environmental situations however, sounds tend to be made up of a complex combination of frequencies and this combination of frequencies influences the character and 'quality' of the sound.

The ear responds to sound across a range of frequencies (20 Hertz (Hz)[10] – 20,000 Hz) but is more sensitive to some frequencies than others. Human response to frequency has been observed through equal loudness experiments. The experiments show that the human ear is most sensitive to sounds in the region between the 1,000 Hz and 10,000 Hz region and becomes less sensitive to sounds outside of this region.

[7] The quantity which describes how loud a sound is in terms of human perception.

[8] Power is defined as rate of change of energy.

[9] *Engineering Noise Control: Theory and Practice (4th ed., Abington: Spon Press, 2009), p. 85*

[10] Hertz (Hz) is a measure of the number of oscillations that occur every second and used use to measure the frequency of an individual sound wave.

When sound is measured by a microphone, this human response is not captured as microphones have a more uniform response over frequencies. To compensate for this, a number of 'frequency weightings' have been developed from research to allow sound levels as measured by microphones to better represent human hearing.

The most common weighting is the 'A-weighted' sound level. This weighting is used to consider environmental sound and is applied to the measurement of transportation noise, including aircraft noise.

The A-weighting may be written as dBA, i.e., decibels that have been A-weighted, or L_A i.e., L is the sound level that has been A-weighted. The A-weighting, like the human ear, effectively tapers off the lower and higher frequencies that the average person cannot hear as easily.

2.2.2 Human Exposure to Sound

Sound is what we hear, whereas noise is unwanted sound. Sounds that are perceived as pleasing to some can be considered unpleasant by others, thereby perceived as 'noise'. The magnitude and context are also relevant - sounds, such as music, that are considered pleasant at one loudness may cause annoyance at higher levels or a dog barking may be regarded as more annoying at night than during the day.

This difference depends upon who is experiencing the sound, their attitudes towards it and other characteristics of the sound.

How people experience sound and noise depends on three aspects:

- It's magnitude, i.e., how loud it is.
- The frequency content i.e., the pitch of the sound.
- The duration and occurrence i.e., how long it lasts for and how often it occurs.

These descriptors are used to help quantify and describe sound and noise. In combination, these aspects can be used to help describe how a noise may have an impact.

Whilst these characteristics are measurable, as outlined above, the way in which sound is perceived is subjective, and differs between people. Noise therefore has both objective (physical) and subjective (perception) components and subjective response to noise varies and is difficult to quantify.

2.2.3 Aircraft Noise Metrics

For aircraft there are a range of metrics which are used to describe noise. These may be used to describe the level of noise arising from certain aircraft events, such as a take-off or a landing. Additionally, other metrics can be used to describe relative levels of impact or 'exposure' to aircraft noise. These metrics usually express aircraft noise as an average level of noise.

It is important to understand what information is contained within each metric and the purposes for which it is most appropriate.

2.2.3.1 Describing Noise from a Single Aircraft Event

Maximum Sound Pressure Level - L_{Amax}

The L_{Amax} is the simplest descriptor of an aircraft noise event and relates to the event's maximum sound level. The L_{Amax} is the maximum sound level that is measured[11] during an aircraft noise event. It is measured in dBA which means that its frequency content has been adjusted to have regard for the 'A-weighting'[12].

The L_{Amax} has been used in a range of studies examining the relationship between aircraft noise events and potential interference with conversation and night time noise impacts such as sleep disturbance. In general, the higher the L_{Amax} level, the higher the likelihood that the event will lead to disturbance or intrusion.

Sound Exposure Level

The Sound Exposure Level (SEL or L_{AE}) is a means of describing the total amount of sound energy associated with an aircraft noise event.

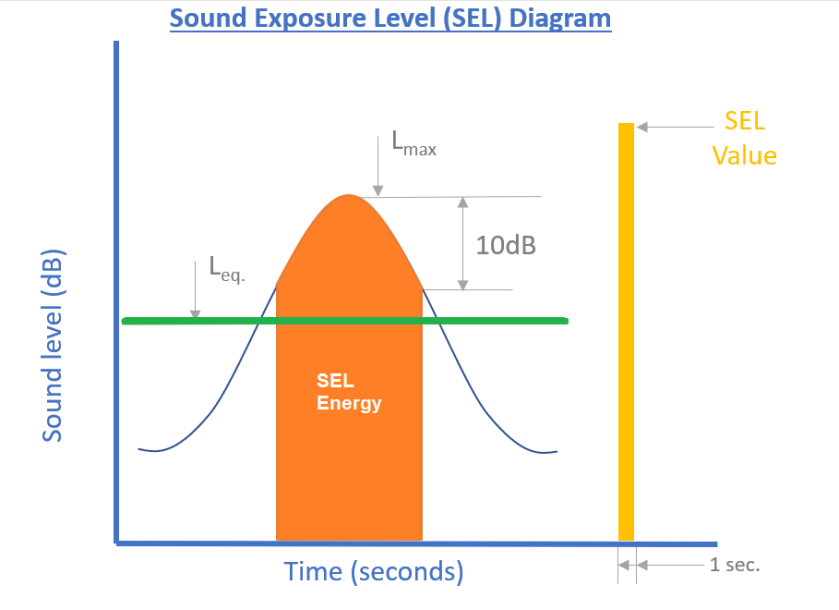
An event is defined as any occurrence which results in the total ambient sound level to increase by more than 10 dB over the prevailing ambient sound level. The magnitude of sound energy associated with that event is determined, as is the duration of the sound event. The sound

[11] Although L_{max} may not represent the largest magnitude of sound which occurred, it is the largest sound pressure level measured by the instruments RMS detector. The RMS detector has a built-in response delay (known as a time-weighting) to incoming signals. The fast time-weighting is commonly used for environmental sound measurements and has a time constant of 100ms. This is the same as the biological time constant of the human ear.

[12] A-weighting is the most commonly used family of frequency curves defined within International Standard IEC 61672 and other national standards with regards to the measurement of sound pressure levels. The A-weighting curve has been widely adopted for environmental noise measurement and assessment.

energy is then normalised in the time-domain to one second to determine the equivalent sound energy should that event have occurred for one-second.

In simple terms, the SEL is a measure of the total amount of sound energy from the entire aircraft noise event if it were to last for one second. The figure below presents an illustration of this against the L_{Amax} and the noise level experienced during an aircraft noise event.



For aircraft overflights, the SEL is always higher than the L_{Amax}. It is usually the case that the numerical difference between SEL and L_{Amax} is around 10 dB for aircraft on departure, and 8 dB for aircraft on arrival.

Like the L_{Amax}, the SEL can be used to identify the relative difference in sound level between different aircraft events and to indicate interference with task and/or other impacts from aircraft noise events such as risk of awakenings.

Although the human ear does not perceive sound at the SEL level, it is a common metric that allows sound exposures of different durations to be related to one another in terms of total acoustic energy.

2.2.4 Averaged Noise Exposure Metrics

Not all aircraft noise events are the same. They can vary depending upon aircraft type being flown and the procedures being followed in that flight. Furthermore, the locations that surround airports

may not always be affected by aircraft noise in the same way. For example, some locations may be affected mainly by departing aircraft but only those using a certain route or runway, which may only occur at particular times of the day.

Metrics are required to describe how much noise may be experienced at a location, considering the magnitude of the individual noise events, their duration and occurrence, and the period of interest. This is best described using equivalent continuous sound levels.

2.2.4.1 Equivalent Continuous Sound Level

The most common metric used to describe noise exposure from environmental sources is the equivalent continuous sound level (L_{eq}). This metric has been used extensively since the mid-1970s and uses the SEL of individual aircraft events along with their occurrence for each event and the period over which they occur (T) to provide an overall equivalent continuous sound level ($L_{eq,T}$) for the period (T). Therefore, when the $L_{eq,T}$ is considered, it is important that the circumstances and time for which it has been calculated are clearly understood and presented.

Table 2.3 below presents common examples of L_{eq} measures relied on for aircraft noise assessment purposes.

Table 2.3: Examples of equivalent continuous noise exposure metrics

Metric	Description
L_{day}	Annual average daytime equivalent sound level Representative of day period (07:00-19:00)
$L_{evening}$	Annual average evening equivalent sound level Representative of evening period (19:00-23:00)
L_{night}	Annual average night time equivalent sound level Representative of night period (23:00-07:00) Used as an indicator linking noise exposure to sleep disturbance by the EU for the definition of the Exposure Response Function (ERF) between noise and health effect.
L_{den}	Annual average day-evening-night level.

	The L_{den} unit is a level for the whole 24-hour period, however, depending on the period of the day the noise occurs, a different weighting is applied. If the noise occurs during the first 12 hours of the day (07:00 – 19:00), no weighting is applied. If it occurs during the evening (19:00-23:00) a weighting of +5 dBA is added and if the noise occurs during the night time period (23:00-06:00) a weighting of +10 dBA is added. Each L_{Aeq} period is calculated/measured separately, and respective weighting is applied to the evening and night L_{Aeq} values before the L_{den} can be calculated. This metric is used by the EU for the definition of the ERF between noise and health effect.
$L_{Aeq,16hr}$	16-hour daytime noise indicator for a period 07:00-23:00. This metric is used within the UK as a measure of aircraft noise exposure and has been used previously for assessment purposes at Dublin Airport. The metric is the equivalent sound level of aircraft noise in dBA for the 16-hour annual day. The UK metric is based on a 'summer average' which is based on the daily average movements that take place between 07:00 and 23:00 local time during a 92-day period 16 June to 15 September inclusive.
$L_{Aeq,8hr}$	8-hour night time noise indicator for a period 23:00-07:00. This metric is used within the UK as a measure of aircraft noise exposure. The metric is the equivalent sound level of aircraft noise in dBA for the 16-hour annual day. The UK metric is based on a 'summer average' which is based on the daily average movements that take place between 23:00 and 07:00 local time during a 92-day period 16 June to 15 September inclusive.

As indicated by the Table 2.3, L_{eq}-based noise exposure metrics correlate with describing long-term health effects. They are also used to inform noise intervention policies. This is the case with the L_{den} and L_{night} metrics. These have relevance to the management and assessment of aircraft noise under the regulatory framework.

In addition to single aircraft noise event and L_{eq}-based noise exposure metrics, aircraft noise can be described using alternative metrics. These are explored in the following chapters.

2.3 Use of L_{night} and L_{den} to Present the Impact of Aircraft Noise at Dublin Airport

This section describes the metrics used by ANCA to describe the impact of aircraft noise at Dublin Airport.

The European Communities (Environmental Noise) Regulations 2018 (ENR) requires noise exposure from Dublin Airport to be mapped every five years. Under the ENR, aircraft noise exposure must be reported using the annual average night time metric (L_{night}) and annual average day-evening-night metric (L_{den}). These metrics are also prescribed by the Aircraft Noise Regulation and are used as part of research and guidance in relation to impact of aircraft noise on health and quality of life.

Contour maps relating to situations or assessments carried out in accordance with these legislative standards will be in this format.

Many historical planning conditions relating to Dublin Airport (those relating to insulation schemes for example), relate to the 92-day day-evening summer period metric ($L_{Aeq,16hr}$). Legislation permits the use of additional metrics such as this where they are relevant to local circumstances.

A-weighting:
Noise can be measured and evaluated objectively but humans have a different response to different frequencies. A-weighting is an industry agreed adjustment that is made to sound measurements to replicate the response of a human ear. It is generally represented as dBA.

Noise Contours
Noise contours are lines on a map that connect points of the same levels of noise exposure. Contours are a standardised industry method of presenting the average aircraft related noise experienced (or projected to be experienced) by people living around an airport. They were traditionally calculated over a 16-hour period (07:00-23:00) during the busiest 92-day airport summer period from 16 June to 15 September for planning consents at Dublin Airport. Contours may present information on what occurred in the past or depict projected future conditions.

The use of average noise contours facilitates:

- An examination of noise exposure trends over time and the effects of aircraft noise.
- A comparison of different operating scenarios.
- An examination of the predicted impact of development proposals.

2.3.1 The Effects of Aircraft Noise

There is growing evidence to show a relationship between aircraft noise exposure and public health concerns.

The evidence base used in the regulatory framework for the assessment of environmental noise and its effects on health and quality of life is described by the World Health Organization (WHO) in its publication 'Environmental Noise Guidelines for the European Region 2018' (ENG18). The ENG18 is provided in support of the WHO publication 'Night Noise Guidelines for Europe 2009' (NNG09).

Both the ENG18 and NNG09 set health-based recommendations on average environmental noise exposure. In the case of the ENG18, these recommendations are provided for five relevant sources of environmental noise, including aircraft noise. Between the WHO publications, an evidence base is presented for several key health outcomes, including:

- Noise annoyance.
- Sleep disturbance.
- Cardiovascular health.
- Mental health, wellbeing, and quality of life.
- Children's learning.

2.3.1.1 Noise Annoyance

Noise annoyance may be considered the most widespread response across a population to aircraft noise.

Annoyance and the methods which may be used to describe it, are used throughout European policy to measure the impact of aircraft noise exposure on communities living around airports. These responses are described as Exposure Response Functions (ERF) and can be used to indicate

the percentage of the population Highly Annoyed (% HA) by aircraft noise. The same approach is used for all sources of environmental noise such as road traffic and railway noise.

Acoustic factors, such as the character of the sound source and its sound level, account for some of the annoyance responses presented within ERFs. Other factors are also known to contribute towards annoyance responses and are thought to explain some of the differences which may occur in reported annoyance around different airports. These factors are often referred to as 'non-acoustic' factors and include aspects such as a person's attitude associated with the noise source, their ability to cope, sensitivity to noise, as well as personal factors including age and status.

The WHO ENG18 reports an ERF for aircraft noise measured against the L_{den} metric which is summarised in Table 2.4 below.

Table 2.4: WHO ENG18 Exposure response function for annoyance

L_{den} (dB)	%HA
40	1.2
45	9.4
50	17.9
55	26.7
60	36.0
65	45.5
70	55.5

Alongside the ERF for aircraft noise annoyance, the ENG18 makes the following recommendation with regards to aircraft noise exposure. It states that:

"For average noise exposure, the Guideline Development Group strongly recommends reducing noise levels produced by aircraft below 45 dB L_{den}, as aircraft noise above this level is associated with adverse health effects."

"To reduce health effects, the Guideline Development Group strongly recommends that policy-makers implement suitable measures to reduce noise exposure from aircraft in the population exposed to levels above the guideline values for average and night noise exposure. For specific interventions the GDG recommends implementing suitable changes in infrastructure."

These recommendations are described as 'strong' recommendations. A strong recommendation is described as a recommendation which *"… can be adopted as policy in most situations"*.

This recommendation, and its strength, has not been without criticism with the approach taken in establishing guidelines being the subject of scrutiny. For example, the recommendation and

guideline are based on an idealised situation where nobody would ever be exposed to a level of aircraft noise which would affect a person's health and/or quality of life.

Academics have also raised concerns regarding the sampling approach used to gather data for the purposes of the systematic reviews underpinning the guidelines, whereas others point out that the guidelines themselves have not been the subject of a cost-benefit analysis. The regulatory framework surrounding environmental noise is underpinned by ENG18. European Directive 2020/367 describes the establishment of methods for harmful effects of environmental noise, stating:

"At the time of adoption of this Directive, the high quality and statistically significant information that could be used was that of the World Health Organization (WHO) Environmental Noise Guidelines for the European Region, presenting dose-effect relations for harmful effects induced by the exposure to environmental noise. Consequently, the dose-effect relations introduced in Annex III to Directive 2002/49/EC should be based on those guidelines. In particular concerning the statistical significance, the WHO studies were based on representative populations, and the results of these assessment methods are consequently considered relevant when applied to representative populations."

2.3.2 Sleep Disturbance

The effects of aircraft noise on sleep have been considered in a range of studies. These studies used several methods to evaluate the impact of noise on sleep using approaches such as self-reported sleep disturbance through to measurement of increased bodily movement using polysomnography.

Table 2.5, which is reproduced from the NNG09 describes the effect of night time noise exposure and the associated health effects as may be observed within the population.

Table 2.5: Effects arising from night time noise exposure (L_{night})

Average night noise level over a year (L_{night})	Health effects observed in the population
Up to 30 dB	Although individual sensitivities and circumstances may differ, it appears that up to this level no substantial biological effects are observed. $L_{night, outside}$ of 30 dB is equivalent to the no observed effect level (NOEL) for night noise.
30 to 40 dB	A number of effects on sleep are observed from this range: body movements, awakening, self-reported sleep disturbance, arousals. The intensity of the effect depends on the nature of the source and the number of events. Vulnerable groups (for example children, the chronically ill and the elderly) are more susceptible. However, even in the worst cases the effects seem modest. $L_{night, outside}$ of 40 dB is equivalent to the lowest observed adverse effect level (LOAEL) for night noise.
40 to 55 dB	Adverse health effects are observed amongst the exposed population. Many people have to adapt their lives to cope with noise at night. Vulnerable groups are more severely affected.
Above 55 dB	This situation is considered increasingly dangerous for public health. Adverse health effects occur frequently, a sizable portion of the population is HA and HSD. There is evidence that the risk of cardio-vascular disease increases.

ENG18 makes the following recommendation with regards to aircraft noise in relation to sleep disturbance. It states that:

"For night noise exposure, the GDG strongly recommends reducing noise levels produced by aircraft during nighttime below 40 dB L_{night}, as aircraft noise above this level is associated with adverse effects on sleep." And;

"As the evidence was rated moderate quality, the GDG made the recommendation strong."

The WHO ENG18 recommendations are based on evidence provided by the review of six studies which included a total of 6,371 participants. The outcome of these studies has been used to produce the ERF that can be used to indicate the percentage of the population Highly Sleep Disturbed (% HSD) at different levels of aircraft noise exposure. The model was based on outdoor L_{night} levels between 40 dB and 65 dB only; the lower limit of 40 dB set because of inaccuracies in

predicting lower noise levels. The WHO ENG18 ERF have now been adopted by the EC as the common approach for determining health effects under the revision of Annex III of the END.

The evidence reported from these studies has been rated as moderate quality. Table 2.6, which is reproduced from ENG18, shows the reported association between exposure to aircraft noise (L_{night}) and sleep disturbance (%HSD).

Table 2.6: Association between exposure to aircraft noise (L_{night}) and Sleep Disturbance (%HSD) as reported by WHO ENG18

(L_{night}) dB	%(HSD)	95% CL
40	11.3	4.72-17.81
45	15.0	6.95-23.08
50	19.7	9.87-29.60
55	25.5	13.57-37.41
60	32.3	18.15-46.36
65	40.0	23.65-56.05

Having regard to the impact on human health, management of aircraft noise should include measures to limit noise at the source where possible, protect noise sensitive locations, and give priority to the prevention of noise, prior to the implementation of measures to mitigate the impact of noise.

2.4 Noise Modelling

Airport noise assessments and the quantification of its impacts rely mainly on noise modelling. Noise modelling allows the metrics described above to be presented at individual locations or graphically using maps.

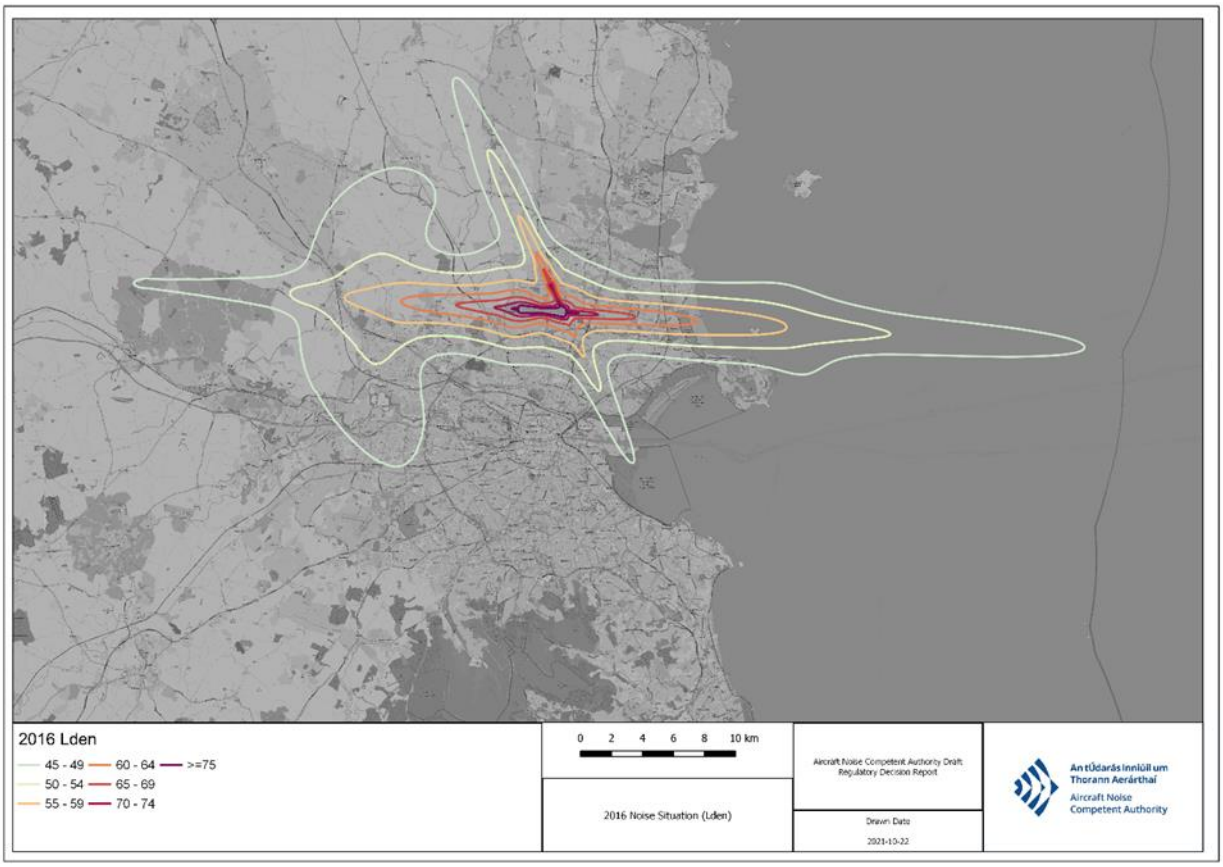


Figure 2.1: Sample Noise Contour for Dublin Airport (2016 L_{den})

Modelling can be used to calculate the noise situation at an airport based on data relating to current and historic conditions. Alternatively, it can be used to forecast a noise situation in the future having account for a development proposal or noise-related action.

Airport noise models are underpinned by noise calculation methodologies. The aircraft noise calculation methodology to be used in the context of the regulatory framework is essentially a version of the European Civil Aviation Conference-CEAC Doc. 29 4th Edition (ECAC Doc. 29) calculation methodology.

ECAC Doc 29 brings together recommended practices for aircraft noise modelling as published by the following aviation bodies:

- International Civil Aviation Organisation (ICAO)
- European Civil Aviation Conference (ECAC)
- Society of Automotive Engineers (SAE)

Each of these bodies provide guidance on how noise modelling should be undertaken using data supplied by aircraft manufacturers. The detail provided by the bodies differs, however there is a consensus on how noise modelling shall be carried out. This is reflected in ECAC Doc. 29.

ECAC Doc. 29 is a standard method used for computing noise levels around civil airports. Its Fourth Edition was adopted by ECAC-DGCA/147 on 7 December 2016 and allows for consistent computation of noise contours throughout ECAC States. Under the regulatory framework, it is the methodology used for the establishment of airport noise action plans, and under the Aircraft Noise Regulation.

ECAC Doc. 29 can be implemented within a software environment and there are specific tools which are commercially available to carry out airport noise calculations. In general terms, the calculation methodology can be used to calculate the SEL and/or L_{Amax} at a given receiver point for a combination of aircraft types, flight performance and flight paths. This is illustrated in Figure 2.2 below.

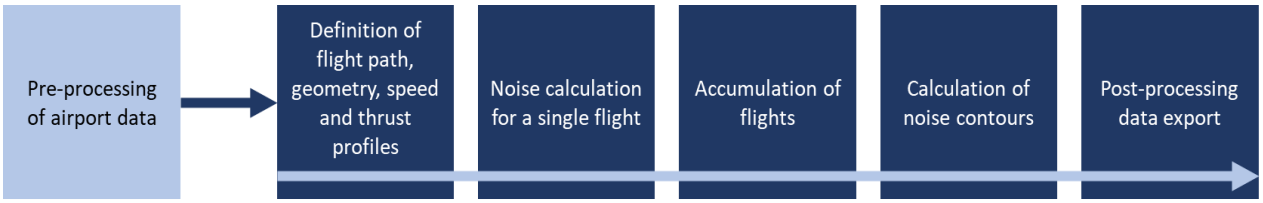


Figure 2.2: General Process for Calculating Aircraft Noise Level

As indicated in Figure 2.2 the calculation of aircraft noise levels requires airport data to be made available to the calculation. This includes the location of flight paths and the number and type of aircraft and their respective operations by time of day, which can be provided either as a record of activity or as a forecast.

Under the regulatory framework and the guidance provided by the three bodies set out above, it is recommended that aircraft noise modellers utilise the Aircraft Noise and Performance Database[13]. This database provides an international resource for noise modellers and marries

[13]https://www.easa.europa.eu/aircraft-noise-and-performance-anp-data

aircraft flight performance and aircraft Noise Power Distance data for use with ECAC Doc. 29 and associated guidance[14].

The aircraft performance data which is held within the Aircraft Noise and Performance Database describes how aircraft typically approach and take-off from an airport in the form of 'procedure profiles'. For arrivals, these profiles describe information such as speeds, flaps, and landing gear configurations, along with descent angles. For departures, similar information is held alongside engine power settings and rates of climb.

The Aircraft Noise and Performance Database therefore contains 'default' profiles and associated Noise Power Distance data which may or may not reflect the conditions at an airport. Under the regulatory framework, there is scope for competent authorities to use profiles and Noise Power Distance data which better reflect conditions at an airport.

In the UK, the UK Civil Aviation Authority (CAA) has established minimum standards for aircraft noise modelling[15] which describe the circumstances where it is necessary to adjust the noise and profile data for modelling purposes. This discusses and recommends the use of local noise monitoring terminals and local track keeping data to modify the Noise Power Distance and flight profile data.

Under the regulatory framework as it applies to the Aircraft Noise Regulation, the accuracy of noise modelling is also a consideration.

2.4.1 Noise and Track Keeping Systems and Community Engagement Tools

Day-to-day noise impacts from airport operations are often captured using Noise and Track Keeping systems (NTK). An NTK system works by matching radar data describing the flight paths of aircraft arriving and departing Dublin Airport with measurements from the Noise Monitoring Terminal (NMT) that are located around it.

Data obtained from NTK systems can be used for a variety of purposes. At Dublin Airport, the primary purpose of the NTK system is to monitor aircraft noise and aircraft track keeping in support of complaint handling. The data obtained from an NTK system can also be used to improve the quality and accuracy of a noise model by providing measurements of aircraft noise events and flight paths as part of a validation exercise.

[14] ICAO 9911

[15] CAP 2091 'CAA Policy on Minimum Standards for Noise Modelling'

More modern systems are used to support community engagement. Such systems are accessible to the public via the internet and allow noise and aircraft track information to be viewed and queried. Some systems can provide reports of how many and at what height aircraft have been operating over certain areas.

3 THE AIRPORT AUTHORITY FOR DUBLIN AIRPORT PLANNING APPLICATION

This section outlines the application by the airport authority for Dublin Airport (daa) to amend some of the existing conditions in the North Runway Planning Permission.

3.1 The Application

Planning application F20A/0668 (the Application) was submitted by daa (the Applicant) to FCC, as the planning authority, on 18 December 2020.

The Application is for Relevant action under Section 34C of the Act of 2000 to amend/replace operating restrictions set out in Conditions 3(d) and 5 of the North Runway Planning Permission (Fingal County Council Reg. Ref. No. F04A/1755, ABP Ref. No.:PL06F.217429) which was extended until 28 August 2022 by FCC (Reg. Ref. No. F04A/1755/E1) and amended by FCC (F19A/0023, ABP Ref. No. PL06F.305298) as well as proposing new noise mitigation measures.

3.2 The North Runway Planning Permission

Permission for Dublin Airport's north runway was granted in 2007 following an Oral Hearing and was subject to a total of 31 planning conditions.

Two of these conditions place restrictions on night flights and come into force upon completion of the construction of the north runway. These are:

- *Condition 3(d) "On completion of the runway hereby permitted … Runway 10L-28R (the 'North Runway') shall not be used for take-off or landing between 2300 hours and 0700 hours except in cases of safety, maintenance considerations, exceptional air traffic conditions, adverse weather, technical faults in air traffic control systems or declared emergencies at other airports."*
- *Condition 5 "On completion of construction of the runway hereby permitted, the average number of night time aircraft movements at the airport shall not exceed 65/night (between 2300 hours and 0700 hours) when measured over the 92 day modelling period"*

The origins of these operating restrictions are based on the Environmental Impact Statement (EIS) and other information that was supplied to the planning authority in the application for the North

Runway Planning Permission and the Applicant's response to an An Bord Pleanála (ABP) Request for Further Information.

Conditions 3(d) and 5 reflect the basis upon which the effects of the north runway and the wider operation of Dublin Airport were reported and assessed by ABP at the time of their decision in 2007.

The wider parts of Condition 3 of the North Runway Planning Permission introduce a form of preferential runway use during daytime periods (07:00-23:00). Condition 3(a) to 3(c) state that:

a) *the parallel runways (10R-28L and 10L-28R) shall be used in preference to the cross runway, 16-34,*

b) *when winds are westerly, Runway 28L shall be preferred for arriving aircraft. Either Runway 28L or 28R shall be used for departing aircraft as determined by air traffic control,*

c) *when winds are easterly, either Runway 10L or 10R as determined by air traffic control shall be preferred for arriving.*

This form of preferential use is known as 'Option 7b' as reported within the EIS and additional information as submitted to ABP.

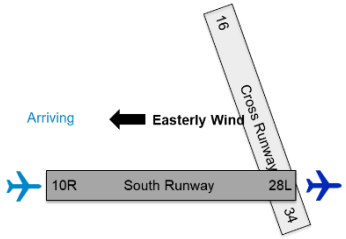
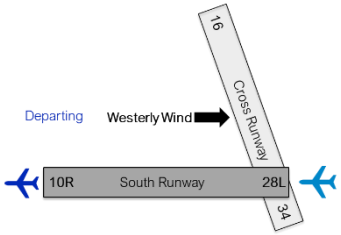
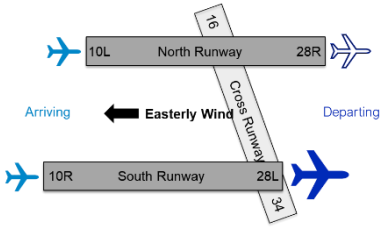
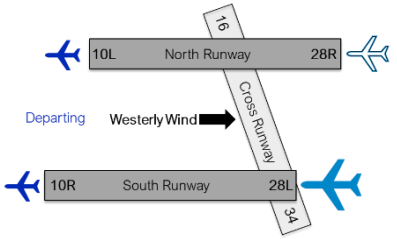
No such restrictions currently exist at Dublin Airport. In its current form as a two-runway operation, there are no operating restrictions relating to the use of Dublin Airport's runways or the numbers or types of aircraft which can fly. Dublin Airport is however restricted by virtue of the combined capacity of Terminal 1 and Terminal 2 and shall not exceed 32 million passengers per annum (mppa)[16]. This cap applies to both the current operation and the operation of the north runway. One of the effects of the terminal passenger capacity limit is to limit the number of passenger flights that can be operated from Dublin Airport.

A comparison of Dublin Airport's current form of runway operations and the form of runway operations which will be permitted once the conditions of the North Runway Planning Permission apply (i.e., on completion of the construction of the northern runway) and their respective constraints are presented in Table 3.1.

[16] This passenger capacity limit is set through the combined effect of Condition 3 of the Terminal 2 Planning Permission (FCC Reg Ref No F04A/1775; ABP Ref. No. PL06F.220670); and Condition 2 of the Terminal 1 Extension Planning Permission

Table 3.1: Overview of current and future (i.e., upon completion of the construction of the north runway) runway operations

<table>
<tr><th colspan="5">All operations subject to a Terminal Passenger Capacity Limit of 32 mppa</th></tr>
<tr><th rowspan="2"></th><th colspan="2">Current Two Runway Operations</th><th colspan="2">Consented Three Runway Operations</th></tr>
<tr><th>Easterly</th><th>Westerly</th><th>Easterly</th><th>Westerly</th></tr>
<tr><td>Daytime

07:00-23:00</td><td> 
</td><td> 
</td><td> 
</td><td> 
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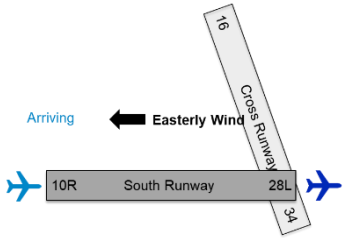
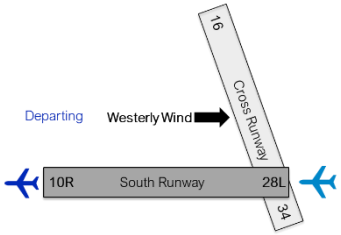
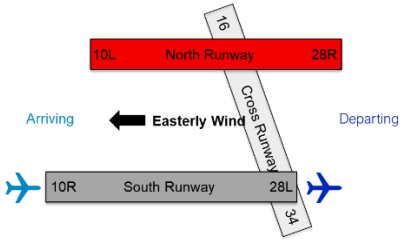
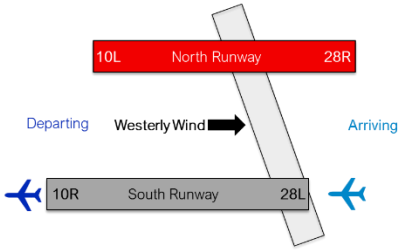
23:00-07:00</td><td> 
</td><td> 
</td><td> 

65/night movement cap</td><td> 

65/night movement cap</td></tr>
<tr><td colspan="5">Figure Notes:
• Larger aircraft indicated preferential use whereas smaller aircraft indicates non-preferential use.
• No aircraft indicates prohibited use save for exceptions such as emergencies.</td></tr>
</table>

3.3 Summary of the Application

The construction of Dublin Airport's north runway commenced in December 2016. Following the granting of the north runway permission in 2007 Dublin Airport has experienced strong growth. The Applicant states that[17]:

"The above referenced operating restrictions were imposed through Conditions 3(d) and 5 of the 2007 determination of An Bord Pleanála (ABP). Since then, further evidence and understanding on the impact of the restrictions has become available and it is evident that they will impact significantly on Dublin Airport's ability to meet the foreseeable need for aviation travel and safe expansion of air traffic at the airport. As such, it is considered that the operating restrictions are particularly limiting and will have the effect of unduly hindering growth of the Airport in line with the relevant Strategic Objectives of National, Regional and Local policies."

The Proposed Development therefore seeks to amend Conditions 3(d) and 5 of the North Runway Planning Permission. This is to remove the limit of 65 aircraft movements per night under Condition 5 and amend Condition 3(d) to allow aircraft to utilise the north runway during part of the night, subject to the night aircraft movements complying with a Noise Quota System.

The Applicant's Planning Report[18] states that changing the currently drafted planning conditions is:

"…imperative to the airport's ability to:

- *rebound post Covid-19;*
- *grow in line with government wide strategic direction which seeks to develop the airport as a hub, thereby enhancing Ireland's connectivity with key tourism and export markets;*
- *meet the demands of multi-trip passengers which in turn requires early morning and late evening flights;*
- *meet the operational demands of the predominantly short haul service based airline fleet at Dublin Airport and cargo operations at the airport;*

[17] Section 1.2, Planning Report – Planning Application for a Proposed Relevant Action (S.34C of P&D Acts) to Amend/Replace Operating Restrictions set out in Conditions No 3(d) and No 5 of the North Runway Planning Permission (ABP REF NO: PL06F.217429) as well as Proposing New Noise Mitigation Measures at Dublin Airport, Co. Dublin.

[18] Planning Report – Planning Application for a Proposed Relevant Action (S.34C of P&D Acts) to Amend/Replace Operating Restrictions set out in Conditions No 3(d) and No 5 of the North Runway Planning Permission (ABP REF NO: PL06F.217429) as well as Proposing New Noise Mitigation Measures at Dublin Airport, Co. Dublin.

- *maintain existing flight slots and connectivity to mainland Europe by facilitating early morning/late evening arrival and departures;*
- *facilitate the ability to attract high-value transatlantic and long-haul services; and*
- *maintain and facilitate growth in jobs and economic activity."*

The Application has been accompanied by a series of reports providing assessments of the potential noise impacts of the Proposed Development along with other environmental effects.

3.4 Overview of the Application Documents

The Application was made on 18 December 2020. Following ANCA's initial assessment of the Application, a direction to provide information and assessments for the purposes of an assessment of the noise situation at Dublin Airport was made by ANCA on 24 February 2021 ('Direction to Provide Information')[19].

This Direction to Provide Information sought to help ANCA analyse the measures being proposed by the Applicant, to explore potential alternatives to the options considered, and to confirm the details of the existing noise measures being relied on by the Applicant.

Information was also requested in relation to Appropriate Assessment, Strategic Environmental Assessment, the forecasts relied on by the Applicant, and the cost-effectiveness assessments.

An overview of the key documents and data which have been considered by ANCA, as provided by the Applicant with the Application and in response to the Direction to Provide Information, is summarised in Appendix A.

At a high level, the approach taken by the Applicant and their consultants has been assessment work to help identify the measures available as part of the Application and to then conduct a series of screening, feasibility, effectiveness and cost-effectiveness exercises to determine measures available[20].

To facilitate these assessments the Applicant prepared a 'Candidate' Noise Abatement Objective (cNAO). The summary objective of this cNAO prepared by the Applicant is:

[19] Appendix A, ANCA Direction to Tom Phillips

[20] Reported in Ricondo, Dublin Airport North Runway, Regulation 598/2014 (Aircraft Noise Regulation) Forecast Without New Measures and Additional Measures Assessment Report (Revision 1 – July 2021).

"To limit and reduce the adverse effects of long-term exposure to aircraft noise, including health and quality of life, so that long-term noise exposure, particularly at night, does not exceed the situation in 2018. This should be achieved through the application of the Balanced Approach."

The Applicant has undertaken their own cost-effectiveness assessment[21] of the measures available which has been used to determine the measures that are proposed under the Application.

The Applicant has submitted an Environmental Impact Assessment Report (EIAR) with the Application[22] and in response to the planning authority's Additional Information Request[23]. The EIAR assesses the likely significant effects arising from as proposed by the Applicant. While the EIAR is provided for the purposes of the FCC Planning Authority's EIA, ANCA has taken the information it contains into account for the purposes of this Report, as well as its Natura Impact Statement (NIS) and SEA Environmental Report.

3.5 Summary of the Relevant Action proposed by the Application

The relevant action and the measures proposed by the Applicant are summarised in the following chapter. A relevant action is a provision of Section 34C of the Planning and Development Act to amend or replace an operating restriction at Dublin Airport including the introduction of new noise mitigation measures.

It should be noted from the outset that the Application seeks changes to operating conditions which will affect future levels of night time aircraft noise following the commencement of north runway operations. The Application does not seek to change operating conditions during daytime periods i.e., 07:00-23:00.

Further details and discussion in relation to the Applicant's proposals are detailed in this report as part of ANCA's own assessment of the measures available.

[21] Ricondo, Dublin Airport North Runway, Regulation 598/2014 (Aircraft Noise Regulation) Cost Effectiveness Analysis Report (Revision 1 – July 2021)

[22] Dublin Airport North Runway Relevant Action Application Environmental Impact Assessment Report, Main Report, December 2020 and associated appendices

[23] Dublin Airport North Runway Relevant Action Application Environmental Impact Assessment Report, Main Report, September 2021 and associated appendices

3.5.1 Noise Quota Scheme

The Application proposes that Condition 5 be replaced with a Noise Quota Scheme.

Noise Quotas are restrictions which are designed to limit aircraft noise and encourage the use of quieter aircraft. Rather than restricting aircraft movements, a Noise Quota Scheme is designed to restrict the total amount of aircraft noise by setting a 'noise budget'. Noisier aircraft contribute more towards the noise budget than quieter ones therefore providing the incentive to Dublin Airport and airlines to operate quieter aircraft to allow more flights.

More details of the Applicant's proposals for the scheme were provided in response to the Direction to Provide Information.

The Applicant's proposal is that the Noise Quota Scheme be modelled based on the system adopted by the United Kingdom (UK) Department for Transport (DfT) in restricting night time aircraft noise at Stansted Airport. Under the approach taken by the UK DfT at Stansted Airport, a quota period is defined (the Noise Quota Period), aircraft performing take-offs and landings are each allocated a Quota Count and a total Noise Quota is set for the Noise Quota Period.

Under this system, the Quota Count of each aircraft is based on its certified noise levels. Aircraft noise certification is a requirement of all commercial aircraft. The procedure for noise certifying an aircraft is set out in Chapter 3 of ICAO Annex 1624 and is standardised. A key consideration to a Competent Authority such as ANCA is that under the Aircraft Noise Regulation decisions on noise-related operating restrictions shall be based on the noise performance of aircraft as based on this certification procedure[25]. Certified noise levels are published routinely by the European Union Aviation Safety Agency (EASA)[26]. Using certified noise levels, a 'noise classification' can be assigned from which its Quota Count can then be determined. Table 3.2 below sets out the Noise Classification and associated Quota Count used in the UK at Stansted Airport as referenced by the Applicant in their proposals.

[24] Annex 16 – Environmental Protection, Volume I – Aircraft Noise, ICAO, Eighth Edition, July 2017

[25] Article 7(1)

[26] Available here: https://www.easa.europa.eu/domains/environment/easa-certification-noise-levels

Table 3.2: Noise classifications and Quota Count in use by the UK Department of Transport (October 2021)

Noise Classification	Quota Count
Below 81 EPNdB	0
81 – 83.9 EPNdB	0.125
84 – 86.9 EPNdB	0.25
87 – 89.9 EPNdB	0.5
90 – 92.9 EPNdB	1
93 – 95.9 EPNdB	2
96 – 98.9 EPNdB	4
99 – 101.9 EPNdB	8
Greater than 101.9 EPNdB	16

Under the UK system the setting of noise quotas and any associated movement limits typically occurs every five years and involves a consultation. Under the UK system the period for which the noise quota applies is 23:30-05:59 time with total noise quota and associated aircraft movement restrictions set for summer and winter seasons.

The Applicant has proposed a Noise Quota Scheme (NQS) which would apply over the period 23:30-05:59 local time with a total annual noise quota for this period of 7,990. In response to the Direction to Provide Information, the Applicant has indicated that a series of exemptions would apply to aircraft movements counted towards the annual noise quota along with the ability to 'carry over' unused quota allowances from one year to the next. In the case of exemptions, these are circumstances where an aircraft operation is not to be counted towards the noise quota. This may be a situation where a landing takes place where there is a threat to life onboard the aircraft during the quota period.

The primary impact of these proposals would be to allow Dublin Airport to operate more than the 65 aircraft per 8-hour night (i.e., 23:00-06:59) as is currently provided for in the North Runway Planning Permission and in line with their forecasts. Dublin Airport has provided evidence in response to the Direction to Provide Information demonstrating how its proposed annual noise quota has been calculated[27].

[27] Appendix A, Dublin Airport North Runway Relevant Action Application, Draft – Initial Response to ANCA Further Information, June 2021

Such restrictions are not currently in place at Dublin Airport and at present there are no restrictions on the number/type of aircraft or amount of noise which can be produced by Dublin Airport.

3.5.2 Amendment of Condition 3(d)

The Application proposes that Condition 3(d) of the North Runway Planning Permission be revised to allow the use of the north runway between the hours of 23:00-23:59 and 06:00-06:59. This means that during the hours of 00:00-05:59 only the south runway would be available for aircraft taking off or landing.

The proposal by the Applicant constitutes an extension to the hours that apply to the runway operating preference described by Condition 3(a)-(c), i.e., the operating preference described in Conditions 3(a)-(c) would apply between 06:00-23:59 rather than 07:00-22:59.

3.5.3 Night time Residential Sound Insulation Grant Scheme (RSIGS)

There are currently two sound insulation schemes in place at Dublin Airport, both of which are based on daytime noise exposure using the $L_{Aeq,16hr}$ metric.

One of the measures proposed by the Application is a night time noise insulation grant scheme. Detail relating to the scheme was provided in response to the Direction to Provide Information[27].

The proposed scheme is called the Residential Sound Insulation Grant Scheme (RSIGS). It is proposed that under the scheme a grant of up to €20,000 will be made available to eligible properties for noise insulation measures. The proposal is that the RSIGS covers bedrooms only. This is due to the impact and effects of the Application being on night time noise exposure.

Under the proposed scheme eligible dwellings are identified if they meet either of the following noise-related criteria:

Criteria 1 - dwellings forecast to be exposed to night time noise levels of at least 55 dB L_{night} in 2025.

Criteria 2 - dwellings with a 'very significant'[28] rating arising from forecast noise levels of at least 50 dB L_{night} in the first full year when the relevant action comes into operation, with a change of at least +9 dB when compared with the current permitted operation in the same equivalent year.

Under the Applicant's proposal, eligibility for inclusion within the scheme under Criteria 1 would be reviewed every two years.

In response to the Direction to Provide Information, the Applicant has provided details of the types of sound insulation measures that could be made available under the RSIGS scheme. The Applicant has also indicated the typical cost of these measures and their performance. This information has been considered by ANCA in its own assessments.

3.5.4 Noise Reporting Framework

The Applicant has proposed a 'Noise Reporting Framework' as a new measure under the Application. The proposed Framework is intended to report associated compliance with the NAO developed for Dublin Airport and the noise mitigation measures and operating restrictions that are proposed in ANCA's draft Regulatory Decision. The Applicant's proposals for the Framework were summarised in response to the Direction to Provide Information[29].

The proposed framework as proposed includes:

- Monitoring and reporting of the effects of aircraft noise as measurable under Directive 2002/49/EC.

[28] As determined using the methodology documented in Chapter 13 of the Dublin Airport North Runway Relevant Action Application Environmental Impact Assessment Report main chapter, December 2020

[29] Section 3, Appendix A, Dublin Airport North Runway Relevant Action Application, Draft – Initial Response to ANCA Further Information, June 2021

- Aircraft noise exposure contours for the L_{den} and L_{night} metrics for the previous calendar year.
- Performance and compliance with the proposed Noise Quota Scheme.
- The number of eligible dwellings and grants made under the proposed RSIGS.
- Performance reporting against the NAO.

4 POLICY AND LEGISLATION OVERVIEW

This section outlines the Irish and international policy and legislation relevant to aircraft noise regulation at Dublin Airport.

4.1 Regulatory and Policy Framework

The management and assessment of aircraft noise is addressed in legislation as it applies to Dublin Airport. This legislation originates from several European regulations and directives which describe the processes and methods for the management and assessment of aircraft noise. These have been transposed into or given further effect by Irish law and are effective at Dublin Airport. The Act of 2019 also makes additional provision for the regulation of aircraft noise at Dublin Airport. All of the above legislation has been collectively described in this Report as the Regulatory Framework.

4.1.1 International Aviation Policy

The International Civil Aviation Organization (ICAO) is a specialised division of the United Nations that works with Member States and industry groups to reach consensus on international civil aviation standards and recommended practices and policies in support of a safe, efficient, secure, economically sustainable and environmentally responsible civil aviation sector.

Resolution A33/7 of ICAO introduces the concept of a Balanced Approach to address aircraft noise. The Balanced Approach is considered as the foundation of noise regulation for aviation as a global industry setting international rules and standards implemented in the EU under The Aircraft Noise Regulation[30]. While Resolution A33/7 is not, of itself, binding in Irish law, the Balanced Approach is an integral part of the Aircraft Noise Regulation, which is binding in Irish law.

Under the Balanced Approach, when noise-related actions are taken the combination of measures must reflect the most cost-effective measure or combination of measures[31]. In particular, these

[30] Recital 3 of the Regulation 598

[31] Article 5(3) of Regulation 598

measures should not be more restrictive than necessary to achieve the environmental noise abatement objectives set for that airport[32].

4.1.2 European Policy and Legislation

Policy and legislation in respect of aviation noise has been established by the European Commission (EC). Various European Union directives and regulations seek to define a common aviation policy in Europe and implement international regulations set by ICAO.

4.1.2.1 EU Council Directive 2002/34/EC (the Environmental Noise Directive)

EU Council Directive 2002/49/EC[33] (commonly referred to as the Environmental Noise Directive or the END) relates to the assessment and management of environmental noise. It is the main instrument of the EU to quantify noise pollution levels and trigger action within both Member States and at EU level. The END has the aim of establishing a common approach to avoiding, preventing or reducing the harmful effects due to exposure to environmental noise within the EU.

The aim 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."

The END focuses on three action areas:

- The determination of exposure to environmental noise.
- Ensuring that information on environmental noise and its effects is made available to the public.
- Preventing and reducing environmental noise where necessary and preserving environmental noise quality where it is good.

It should be noted that the END only applies to environmental noise to which humans are exposed.

Aircraft noise is a matter considered by the END which requires that Member States prepare and publish, at least once every five years, strategic noise maps and noise action plans for 'major

[32] Article 5(6) of Regulation 598

[33] The European Parliament and the Council of the European Union, 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 - Declaration by the Commission in the Conciliation Committee on the Directive relating to the assessment and management of environmental noise [online]. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32002L0049

airports', which are defined as those with more than 50,000 movements a year (including small aircraft and helicopters).

The END is supported by six annexes which describe the approaches and methods in support of delivering the aims and objectives of the END.

- **Annex I** describes the noise indicators for which noise exposure must be reported. These are the L_{night}, which is the A-weighted long-term average sound levels as defined in ISO 1996-2, determined over all of the night periods of a year; and the L_{den} which is calculated from the A-weighted long-term average sound levels determined over all the day, evening and night periods of a year. The Annex describes these metrics which should be formulated along with their reference periods. Annex I states that in addition to these metrics, where appropriate it *"may also be advantageous to use special noise indicators and related limit values"* suggesting alternative metrics such as, for example, where appropriate the L_{day}, $L_{evening}$, and the L_{Amax} and SEL, in the case of night period protection from noise peaks.
- **Annex II** describes the assessment methods that shall be used to establish the noise indicators set out in Annex I. Section 2 of Annex II sets out the noise calculation methodologies which shall be used. Annex II of the END was replaced by the Annex of Directive 2015/996, which was subsequently amended by a Corrigenda in January 2018 and a Commission Delegated Directive in December 2020. The latest version of the END Annex II assessment method for aircraft noise is a duplicate of ECAC Doc. 29 4th Edition.
- **Annex III** describes the assessment methods for harmful effects. Annex II was replaced by the Annex to Directive 2020/367 in March 2020. Annex III sets out methodologies for the assessment of the number of people HA and the number of people HSD due to aircraft noise. The methodology is based on the dose-response curves from WHO ENG18.
- **Annex IV** sets out the minimum requirements for strategic noise mapping required under the END. Annex IV clarifies that a strategic noise map is *"a presentation of data of an existing, previous or predicted noise situation in terms of a noise indicator".* It states that strategic noise maps may be presented to the public as graphical plots or numerical data in tabular or electronic form. Under Annex IV and having regard for the wider contents of the END, it states that strategic noise maps are to be reported for the L_{den} and L_{night} metrics in 5 dB bands from 55 dB L_{den} and 50 dB L_{night}.
- **Annex V** sets the minimum requirements for noise action plans. Noise action plans are to include: the results of the strategic noise mapping; any noise reduction measures in place or under preparation; actions intended to be taken in the next five years; long-term

strategy; financial information on budgets, cost-effectiveness and cost-benefits assessments, if available; and provisions on evaluation of results of the action plans.

- **Annex VI** describes the data which is to be sent to the European Commission.

The implementation of the END in Ireland is discussed below.

4.1.2.2 Commission Directive (EU) 2015/996

Commission Directive (EU) 2015/996 replaces Annex II of the END and describes the common noise assessment methodology for the END. The Directive describes methodology of calculation for noise from roads, railway, industry, and aircraft.

Directive 2015/996 has subsequently been amended by a Corrigenda in January 2018, and a Commission Delegated Directive in December 2020. The latest version of the END Annex II assessment method for aircraft noise is a duplicate of ECAC Doc. 29 4th Edition. The calculation method is described in Section 2.7 of the Directive and is supported by a set of appendices. Appendix I of the Directive describes what is in effect a version of the ANP database. This sets out the fundamental components which underpin the computation of aircraft noise levels. This information effectively constitutes 'default' aircraft performance and noise emission data and as such may lead to calculated noise levels which deviate from their true values.

Directive 2015/996 recognises this and states that:

"In cases where input data provided in Appendix F to Appendix I are not applicable or cause deviations from the true value that do not meet the conditions presented under 2.1.2 and 2.6.2, other values can be used, provided that the values used and the methodology used to derive them are sufficiently documented, including demonstrating their suitability. This information shall be made publicly available."

This statement cross-references the Directive's 'Quality Framework'. This sets a tolerance for the accuracy of the input values as they affect the noise emission levels at source i.e., the level of noise produced by aircraft and at a specific location, when performing a specific procedure. The Quality Framework requires that all input values affecting the emission level of a source shall be determined with at least the accuracy corresponding to an uncertainty of ± 2 dBA in the emission level of the source (leaving all other parameters unchanged). Regarding the use of default data, it is stated that input data shall reflect the actual use, and in general there will be no reliance on default input data values or assumptions, unless the collection of real data is associated with disproportionately high costs. Specifically for flight paths it is stated they should be derived from radar data whenever they exist of sufficient quality.

4.1.2.3 Commission Directive (EU) 2020/367

Commission Directive (EU) 2020/367 of 4 March 2020 replaces Annex III of Directive 2002/49/EC in describing the assessment of health effects under the END. Directive 2002/367 adopts the Exposure Response Functions (ERF) published within the WHO ENG18.

Directive 2020/367 reproduces the ERFs for the number of people HA and HSD from aircraft noise.

4.1.2.4 Regulation (EU) No. 598/2014 (the Aircraft Noise Regulation)

The Aircraft Noise Regulation concerns the establishment of rules and procedures with regards to the introduction of noise-related operating restrictions at European Union airports.

The Aircraft Noise Regulation applies where a 'noise problem' has been identified at an airport and sets procedures which must be followed for the introduction of noise-related operating restrictions at qualifying EU airports. Member States must ensure that where a noise problem has been identified that the Balanced Approach is adopted for the purposes of noise management at an airport.

The Balanced Approach originates from international practice through Resolution A33/7 of ICAO. The Balanced Approach is considered as the foundation of noise regulation for aviation as a global industry setting international rules and standards implemented in the EU under the Aircraft Noise Regulation.

The Aircraft Noise Regulation states that:

"The Balanced Approach should remain the foundation of noise regulation for aviation as a global industry. The Balanced Approach recognises the value of, and does not prejudge, relevant legal obligations, existing agreements, current laws and established policies. Incorporating the international rules of the Balanced Approach in this Regulation should substantially lessen the risk of international disputes in the event of third-country carriers being affected by noise-related operating restrictions."

When noise-related actions are taken, the combination of measures must reflect the most cost-effective measure or combination of measures. In particular, these measures should not be more restrictive than necessary to achieve the environmental noise abatement objectives set for that airport. Noise abatement objectives include health aspects, at the level of individual airports, while respecting relevant EU rules, in particular those laid down in the END, and the legislation within each Member State. One of the two objectives of the Aircraft Noise Regulation is to facilitate the achievement of such noise abatement objectives.

According to the Aircraft Noise Regulation competent authorities have to ensure that an assessment of the noise situation at airports for which they are responsible is conducted. Additional noise indicators may also be used providing these have an objective basis. If an assessment conducted under the END concludes that a new noise-related operating restriction may be required, the Aircraft Noise Regulation is triggered.

4.1.3 Irish Legislation

4.1.3.1 European Communities (Environmental Noise) Regulations 2018

These regulations (ENR) give effect to the European Union (EU) Directive 2002/49/EC, relating to the assessment and management of environmental noise, by transposing it into Irish law for matters relating to the assessment and management of environmental noise. The Regulations provide for the implementation in Ireland of a common approach within the European Community to avoid, prevent or reduce, on a prioritised basis, the harmful effects, including annoyance, due to exposure to environmental noise.

The ENR set out the approach to meeting the requirements of the END in Ireland and Dublin Airport is the only designated major airport in Ireland that currently falls under the scope of the END.

The ENR allocates the roles of preparing noise maps and noise action plans for Dublin Airport to daa and FCC respectively. daa is therefore the competent Noise Mapping Body for the production of strategic noise maps, and FCC is the competent Action Planning Authority responsible for the preparation of the Noise Action Plan.

Under the Regulation, the Environmental Protection Agency (EPA) is the designated national authority and shall exercise general supervision over the functions of Noise Mapping Bodies and Action Planning Authorities and provide guidance or advice to such bodies or authorities, where necessary. The EPA also submits information to the European Commission (EC) as required under the END on strategic noise mapping and noise action planning under the Regulations.

4.1.3.2 The Aircraft Noise (Dublin Airport) Regulation Act 2019

The Balanced Approach is given legal effect in the EU through the Aircraft Noise Regulation and in Ireland through the Act of 2019 which also makes additional provision for the regulation of aircraft noise at Dublin Airport. In addition to requiring ANCA to adopt the Balanced Approach where a noise problem is identified at Dublin Airport, the Act of 2019 amends the Planning and

Development Act to cater for a situation where development at Dublin Airport may give rise to an aircraft noise problem.

Fingal County Council (FCC) was designated as the competent authority for the purposes of aircraft noise regulation at Dublin Airport by the Act of 2019. Following this, the FCC Chief Executive established the authority as a separate Directorate – the Aircraft Noise Competent Authority (ANCA).

4.1.4 Relevant National Policy

4.1.4.1 A National Aviation Policy for Ireland 2015

Aviation policy for Ireland is established at national level through the 'National Aviation Policy for Ireland 2015'.

The primary objective of the National Aviation Policy is to facilitate and enhance Ireland's air connectivity in a safe, competitive, cost-effective and sustainable manner, in the wider context of supporting Ireland's economic and social goals. Section 4.5 of the Policy concerns the future capacity needs of Ireland's airports and states:

"Air transport requires a specific level of airport infrastructure, both in terms of quantity and quality, to facilitate the optimum level of air services for Ireland. This includes terminal and runway capacity as well as surface access to airports, and is particularly relevant to the development of Dublin Airport as a secondary hub."

"Existing capacity at State airports should be optimised in conjunction with timely planning to enable expansion of air service connections in all relevant markets delivering wider economic benefits for Ireland."

Specifically, regarding Dublin Airport, Action 4.5.1 states:

"The process to develop the second runway at Dublin Airport will commence, to ensure the infrastructure necessary for the airport's position as a secondary hub and operate to global markets without weight restrictions is available when needed."

The policy defines the specific policy positions and actions to demonstrate Ireland's commitment to working with its EU and international partners to mitigate the impacts of aviation on the environment and facilitate the sustainable growth of the sector with actions that support the implementation of the Aircraft Noise Regulation.

The National Aviation Policy sets out a need for technology improvements in aircraft and engine design to help combat aviation emissions; for effective land-use planning to balance the

operational needs of airports with protection for residents and amenities; and for implementation of the Balanced Approach to noise management at Irish airports.

4.1.4.2 Project Ireland 2040 – National Planning Framework 2017

In Ireland, the National Planning Framework and The National Development Plan combine to form Project Ireland 2040. The Project Ireland 2040 National Planning Framework[34] recognises high-quality international connectivity as crucial for overall international competitiveness and addressing opportunities and challenges from Brexit through investment in our ports and airport. This is in line with sectoral priorities already defined through National Ports Policy and National Aviation Policy and signature projects such as the north runway for Dublin Airport.

The Project Ireland 2040 National Planning Framework recognises the importance of proactive noise management which is implemented through the following objectives 52 and 65:

National Policy Objective 52

"The planning system will be responsive to our national environmental challenges and ensure that development occurs within environmental limits, having regard to the requirements of all relevant environmental legislation and the sustainable management of our natural capital."

National Policy Objective 65

"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."

4.1.4.3 National Policy Statement on Airport Charges Regulation (2017)

The Policy Statement seeks to ensure (amongst other things) that continued economic development/airport capacity is in the best interests of the customer/consumer and in the national interest. In terms of environmental requirements, the Policy Statement requires the regulator to have regard to Government policy on climate change and sustainability as part of the regulatory determination process. This is to ensure that future airport capacity development is advanced in accordance with the broad objectives of the National Mitigation Plan, which aims to enable transition to a low carbon, climate-resilient and environmentally sustainable economy by 2050.

[34] Government of Ireland. Project Ireland 2040 – National Planning Framework [online]. Available at: https://npf.ie/wp-content/uploads/Project-Ireland-2040-NPF.pdf (accessed 8 April 2021)

4.1.4.4 Policy Statement on Runway Development at Dublin Airport (2018)

This repeats the aims of the National Aviation Policy, i.e., that the Irish Government supports the building of a second runway at Dublin Airport and the development of Dublin Airport as a hub airport. In terms of environmental requirements, the Policy Statement outlines that the Government is required to ensure full compliance with the Aircraft Noise Regulation which governs the imposition of noise-related operating restrictions at airports. It additionally states that Fingal County Council must set out noise mitigation measures or abatement objectives for Dublin Airport to follow (in accordance with the Balanced Approach) and oversee the implementation of any such measures by daa.

4.1.4.5 National Development Plan 2021-2027

The National Development Plan supports the implementation of the NPF and also the National Aviation Policy, with particular reference to the importance of significant investment in the north runway.

4.1.5 Relevant Regional and Local Policy

This section describes regional and local policy as it relates to Dublin Airport.

The Eastern and Midland Regional Assembly (EMRA) is part of regional governance in Ireland, established under local government reform in January 2015. The Fingal and Dublin City regions fall within the Eastern & Midland Regional Assembly (EMRA) region and, therefore, EMRA Regional Spatial and Economic Strategies are implemented for the area. The Regional Spatial and Economic Strategies (RSES) 2019 – 2031[35] set out the strategic plan and investment framework for the EMRA region and includes specific policies relating to Dublin Airport. These are summarised in Table **4.1**: EMRA RSES Policy objectives relevant to Dublin Airport.

[35] Eastern & Midland Regional Assembly (EMRA). Regional Spatial & Economic Strategy (RSES) 2019 – 2031 [online]. available at: https://emra.ie/final-rses/ (accessed 8 April 2021)

Table 4.1: EMRA RSES Policy objectives relevant to Dublin Airport.

Policy ID	Policy Objective
RPO 8.17	Support the National Aviation Policy for Ireland and the growth of movements and passengers at Dublin Airport to include its status as a secondary hub airport. In particular, support the provision of a second runway, improved terminal facilities and other infrastructure.
RPO 8.18	Improved access to Dublin Airport is supported, including Metrolink and improved bus services as part of BusConnects, connections from the road network from the west and north. Improve cycle access to Dublin Airport and surrounding employment locations. Support appropriate levels of car parking and car hire parking.
RPO 8.19	Spatial planning policies in the vicinity of the airport shall protect the operation of Dublin Airport in respect to its growth and the safe navigation of aircraft from non-compatible land uses. Policies shall recognise and reflect the airport noise zones associated with Dublin Airport. Within the Inner Airport Noise Zone, provision of new residential and/or other noise sensitive development shall be actively resisted. Within the Outer Noise Zone, provision of new residential and/or other noise sensitive development shall be strictly controlled and require appropriate levels of noise insulation in all cases.
RPO 8.20	Spatial planning policies for areas located within the Public Safety Zones shall reflect the guidance set out in the ERM Report "Public Safety Zones, 2005" (or any update thereof) commissioned by the then Department of Transport and the Department of Environment, Heritage and Local Government, in assessing proposals for development falling within Airport Public Safety Zones.

The strategy recognises Dublin Airport as a key national asset to Ireland's economic success, which is linked with its global connectivity to trade and tourism markets and requires support to ensure it continues as an economic driver. This is balanced with a recognition that consideration of continued growth of Dublin Airport must include the environmental and safety considerations.

4.1.5.1 Fingal County Council Dublin Airport Central Masterplan (2016)

This Masterplan refers to a study on future aviation demand growth which suggests a doubling of aviation demand by 2050. As such it promotes and supports the role of Dublin Airport as the primary gateway to Ireland, and as an important employment hub and business location in the region. It does this through proposing land use planning which facilitates future airport capacity

needs as well as improved transport linkages to the city and region. The Masterplan also comprises a framework for the future development of lands located adjacent to Dublin Airport (for commercial purposes), covering an area of 21.7 hectares.

4.1.5.2 Fingal Development Plan 2017-2023

The Fingal Development Plan 2017 - 2023[36] identifies the need to minimise the adverse impact of noise without placing unreasonable restrictions on development, and to avoid future conflicts between the community and the operation of Dublin Airport. It is a Strategic Policy Objective of the Development Plan to:

"Safeguard the current and future operational, safety, and technical requirements of Dublin Airport and provide for its ongoing development within a sustainable development framework of a Local Area Plan. The plan shall take account of any potential impact on local communities and shall have regard to any wider environmental issues."

A number of specific Policy Objectives relate directly to Dublin Airport and these are stated in Table 4.2.

Table 4.2: Summary of relevant Fingal Development Plan 2017-2023 policy objectives

Policy ID	Policy Objective
ED11	Maximise sustainable economic opportunities associated with the presence of key infrastructural assets within the County including Dublin Airport, the national motorway network, railway services, and the close proximity to Dublin City and Dublin Port via the Port Tunnel.
ED30	Engage and collaborate with key stakeholders, relevant agencies and sectoral representatives to ensure that Dublin Airport is developed and promoted as a secondary hub to capitalise on the associated wider economic benefits for Fingal and the wider region.
ED31	Ensure that the required infrastructure and facilities are provided at Dublin Airport so that the aviation sector can develop further and operate to its maximum sustainable potential, whilst taking into account the impact on local residential areas, and any negative impact such proposed developments may have on the

[36] Fingal County Council (March 2017). Fingal Development Plan 2017 – 2023 – Written Statement [online]. Available at: https://www.fingal.ie/sites/default/files/2019-03/Fingal%20Development%20Plan%202017-2023%20-%20Written%20Statement_compressed_compressed.pdf (accessed 8 April 2021)

	sustainability of similar existing developments in the surrounding area, and the impact on the environment, including the climate.
ED33	Balance the impact of expansion of aviation and the important strategic issue of reducing carbon emissions.
ED97	The Dublin Airport Local Area Plan within the lifetime of the Development Plan in collaboration with key stakeholders, relevant agencies, sectoral representatives and local communities.
DA01	Facilitate the operation and future development of Dublin Airport, in line with Government policy, recognising its role in the provision of air transport, both passenger and freight.
DA02	Prepare and implement a new Local Area Plan for Dublin Airport which will accommodate the future sustainable growth and development of the airport lands while also facilitating the efficient and effective operation of Dublin Airport in accordance with the requirements of the Local Area Plan and proper planning and sustainable development.
DA03	Safeguard the current and future operational, safety, technical and developmental requirements of Dublin Airport and provide for its ongoing development within a sustainable development framework, having regard to both the environmental impact on local communities and the economic impact on businesses within the area.
DA09	Ensure that aircraft-related development and operation procedures proposed and existing at the Airport consider all measures necessary to mitigate against the potential negative impact of noise from aircraft operations (such as engine testing, taxiing, taking off and landing), on existing established residential communities, while not placing unreasonable, but allowing reasonable restrictions on airport development to prevent detrimental effects on local communities, taking into account EU The Aircraft Noise Regulation/2014 (or any future superseding EU regulation applicable) having regard to the 'Balanced Approach' and the involvement of communities in ensuring a collaborative approach to mitigating against noise pollution.

Regarding Policy Objective DA02, the new Dublin Airport Local Area Plan provides the principal development management tool for the Dublin Airport area and will specify the long-term composition and mix of uses within the designated area together with the infrastructural development necessary to support these uses. On foot of this objective, the Dublin Airport Local Area Plan 2020 was adopted.

4.1.5.3 Fingal County Council Dublin Airport Noise Action Plan 2019-2023

This is the first Noise Action Plan (NAP) specifically prepared for Dublin Airport, and replaces the Dublin Airport section of the Dublin Agglomeration Noise Action Plan 2013-2018. This plan is required under the Environmental Noise Regulations 2006[37] (the 'Regulations') Statutory Instrument 140 of 2006 and therefore the END.

The NAP is primarily a tool for reporting the findings of the strategic noise maps, as produced by daa, the competent Noise Mapping Body (NMB). The NAP is prepared by FCC as the designated Action Planning Authority (APA) under the Environmental Noise Regulations.

Prior to this NAP, noise action planning in relation to Dublin Airport was addressed within the Dublin Agglomeration Noise Action Plan 2013-2018. This NAP sets the management of transportation noise as a key objective:

"to avoid, prevent and reduce, where necessary, on a prioritised basis the harmful effects, including annoyance, due to long term exposure to environmental noise from road traffic, rail and aircraft."

The Dublin Agglomeration Noise Action plan states that this key objective would be achieved by:

"taking a strategic approach to managing environmental noise and undertaken a balanced approach in the context of sustainable development."

The Dublin Airport Noise Action Plan 2018-2023 builds on this objective and presents a key objective specific to Dublin Airport. This is:

"to avoid, prevent and reduce, where necessary, on a prioritised basis the effects due to long term exposure to aircraft noise, including health and quality of life through implementation of the International Civil Aviation Organisation's 'Balanced Approach' to the management of aircraft noise as set out under EU Regulation 598/2014"

The NAP was subject to consultation. It presents the results of the strategic noise mapping which was reported in 2017 and is based on a relevant year of 2016. It summarises trends in the noise-related aircraft activity at Dublin Airport along with existing measures available and in place to reduce and manage noise.

Section 7 of the NAP describes the proposed actions to be taken, along with the long-term strategy. The long-term strategy presented in the NAP is linked to Objective DA09 of the Fingal Development Plan. With regards to noise from Dublin Airport, this states:

[37] Repealed and replaced by the European Communities (Environmental Noise) Regulations 2018

"Ensure that aircraft-related development and operation procedures proposed and existing at the Airport consider all measures necessary to mitigate against the potential negative impact of noise from aircraft operations (such as engine testing, taxiing, taking off and landing), on existing established residential communities, while not placing unreasonable, but allowing reasonable restrictions on airport development to prevent detrimental effects on local communities, taking into account EU Regulation 598/2014 (or any future superseding EU regulation applicable) having regard to the 'Balanced Approach' and the involvement of communities in ensuring a collaborative approach to mitigating against noise pollution."

The NAP includes thirteen actions in relation to noise. The extract from the NAP with these actions is shown in Table 4.3 below.

Table 4.3: Actions set out in Table 10 of the Noise Action Plan for Dublin Airport 2018-2023

Reduction of Noise at Source				
Actions	**Description**	**KPI**	**How Action Fulfils ICAO Requirement**	**When**
1	Encourage daa to work with airline partners to introduce quieter aircraft, particularly at night – including consideration of incentives.	Report issued.	Reduction of noise at source through use of quieter aircraft.	Annually
2	Encourage daa to promote quieter aircraft through incentives such as FlyQuiet programmes.	Report issued.	Reduction of noise at source by encouraging quieter operations such as pilots and air traffic controllers using preferential runways and flight tracks.	Ongoing
Land Use Planning and Management				

Actions	Description	KPI	How Action Fulfils ICAO Requirement	When
3	Keep under review land-use policies in relation to aircraft noise through the review of existing land use planning frameworks in so far as they relate to Dublin Airport.		Enable proactive management of noise through appropriate sensitive development.	
4	Monitor noise encroachment associated with Dublin Airport to ensure that airport noise policy is appropriately informed through land use planning frameworks in so far as they relate to Dublin Airport.	Encroachment Analysis Report.	Land use planning and management to avoid encroachment of sensitive development in relation to Dublin Airport.	2019 Onwards
Nosie Abatement Operating Procedures				
Actions	**Description**	**KPI**	**How Action Fulfils ICAO Requirement**	**When**
5	Request daa to undertake a review of Departure Noise Abatement Procedures and to publish the findings	Progress report issued.	Endeavour to achieve lower noise operating procedures through review of current Departure Noise Abatement Procedures.	Q3 2019
6	Request daa to monitor and publicly report key performance with respect to	Report issued.	Sustain noise operating procedures through monitoring and managing the current	Annually

	Dublin Airport's existing Noise Abatement Procedures.		Departure Noise Abatement Procedures.	
Monitoring and Community Engagement				
Actions	**Description**	**KPI**	**How Action Fulfils ICAO Requirement**	**When**
7	Request daa to produce annual noise contours and metrics and to share this information with interested parties.	Annual noise contour report	Monitoring and community engagement through production of annual report	2019 Onwards
8	Encourage daa to continue to operate noise complaining management systems and respond to all aviation -related noise complaints in a timely manner.	Submission of progress report using target of 95% of aircraft noise complaints responded to within 28 days.	Monitoring and community engagement through adequate response times to al aviation related noise complaints	Ongoing
9	Promote the introduction of live (or near live) flight reporting software (such as Webtrak)	Submission of progress report on status of publicly accessible flight tracing platform.	Monitoring and community engagement through community facing platform for reviewing airport flights and noise	2020

10	Engage proactively with communities through the Dublin Airport Environment Working Group (DAEWG) and the St. Margaret's Community Liaison Group.	Quarterly meeting and agreed minutes.	Monitoring and community engagement through quarterly meetings.	Ongoing
11	Promote the enhancement of the Noise Flight Track System to include where appropriate additional fixed and/or mobile noise monitoring terminals.	Submission of progress report outlining number of new locations.	Noise abatement operating procedures & Monitoring and community engagement	2019 Onwards
All				
Actions	**Description**	**KPI**	**How Action Fulfils ICAO Requirement**	**When**
12	Review any updates in advice from bodies such as the WHO and the European Environment Agency in relation to aircraft noise and its health and quality of life effects.	Internal Policy Development Report	All	
13	Request the Submission of an annual report by daa outlining measures undertaken to achieve actions listed in this table	Report		Annually

4.1.5.4 Variation No. 1 of the Fingal Development Plan 2017-2023

Variation No.1 of the Fingal Development Plan 2017-2023 (effective from 9 December 2019) includes key policy in relation to how aircraft noise from Dublin Airport will be managed through the planning system. This is addressed through the revision of the noise zones around Dublin Airport.

The noise zones are established by FCC with reference to wider policy as described in the Department of Housing, Planning and Local Government (DHPLG) National Planning Framework 2040. National Policy Objective 65 of the Framework set out the following:

"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".

The Variation cites the Aircraft Noise Regulation, referring to the key objective set by the Dublin Airport NAP.

The Variation states that having regard for this policy:

"There is a need to minimise the adverse impact of noise without placing unreasonable restrictions on development and to avoid future conflicts between the community and the operation of the airport."

Four noise zones are set out by the Variation, each with their own separate objectives. These are reproduced in Table 4.4 with Figure 4.1 presenting the respective extents of the zones.

Table 4.4: Aircraft Noise Zones as defined under Variation No. 1 of the Fingal Development Plan

Zone	Indication of Potential Noise Exposure During Aircraft Operations	Objective
D	≥ 50 and < 54 dB $L_{Aeq, 16hr}$ and ≥ 40 and < 48 dB L_{night}	**To identify noise sensitive developments which could potentially be affected by aircraft noise and to identify any larger residential developments in the vicinity of the flight paths serving the Airport in order to promote appropriate land use and to identify encroachment.**

		All noise sensitive development within this zone is likely to be acceptable from a noise perspective. An associated application would not normally be refused on noise grounds, however where the development is residential-led and comprises non-residential noise sensitive uses, or comprises 50 residential units or more, it may be necessary for the applicant to demonstrate that a good acoustic design has been followed. Applicants are advised to seek expert advice.
C	≥ 54 and < 63 dB $L_{Aeq, 16hr}$ and ≥ 48 and < 55 L_{night}	To manage noise sensitive development in areas where aircraft noise may give rise to annoyance and sleep disturbance, and to ensure, where appropriate, noise insulation is incorporated within the development Noise sensitive development in this zone is less suitable from a noise perspective than in Zone D. A noise assessment must be undertaken in order to demonstrate good acoustic design has been followed. The noise assessment must demonstrate that relevant internal noise guidelines will be met. This may require noise insulation measures. An external amenity area noise assessment must be undertaken where external amenity space is intrinsic to the development's design. This assessment should make specific consideration of the acoustic environment within those spaces as required so that they can be enjoyed as intended. Ideally, noise levels in external amenity spaces should be designed to achieve the lowest practicable noise levels. Applicants are strongly advised to seek expert advice
B	≥ 54 and < 63 dB $L_{Aeq, 16hr}$ and ≥ 55 dB L_{night}	**To manage noise sensitive development in areas where aircraft noise may give rise to annoyance and sleep disturbance, and to ensure noise insulation is incorporated within the development. Noise sensitive development in this zone is less suitable from a noise perspective than in Zone C.** A noise assessment must be undertaken in order to demonstrate good acoustic design has been followed. Appropriate well-

		designed noise insulation measures must be incorporated into the development in order to meet relevant internal noise guidelines. An external amenity area noise assessment must be undertaken where external amenity space is intrinsic to the developments design. This assessment should make specific consideration of the acoustic environment within those spaces as required so that they can be enjoyed as intended. Ideally, noise levels in external amenity spaces should be designed to achieve the lowest practicable noise levels. Applicants must seek expert advice.
A	≥ 63 dB $L_{Aeq, 16hr}$ and/or ≥ 55 dB L_{night}	**To resist new provision for residential development and other noise sensitive uses.** All noise sensitive developments within this zone may potentially be exposed to high levels of aircraft noise, which may be harmful to health or otherwise unacceptable. The provision of new noise sensitive developments will be resisted.
Notes: • 'Good Acoustic Design' means following the principles of assessment and design as described in *ProPG: Planning & Noise – New Residential Development*, May 2017. • Internal and External Amenity and the design of noise insulation measures should follow the guidance provided in British Standard BS8233:2014 '*Guidance on sound insulation and noise reduction for buildings'.*		

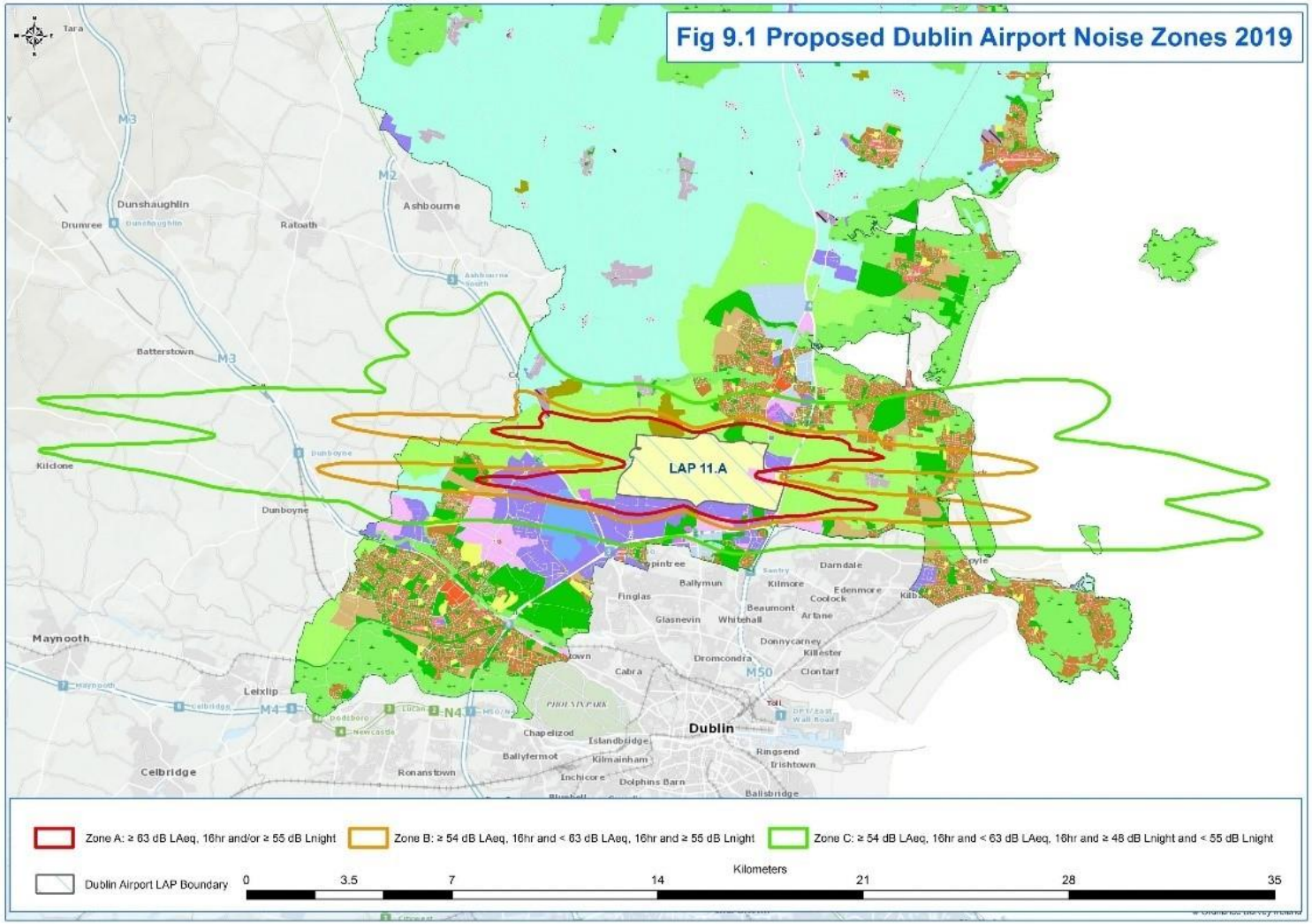


Figure 4.1: Dublin Airport Noise Zones 2019

The Variation includes wider objectives with regards to the management of airport noise from Dublin Airport. These are:

Objective NP-06
Developments for noise sensitive uses shall have regard to any future national planning guidance, or in the interim any local planning guidance developed under the Noise Action Plan.

Objective NP-07
Developments for noise sensitive uses shall have regard to the noise exposure maps contained within the Fingal Noise Action Plan 2018-2023 or any supplementary mapping prepared by Fingal County Council, and developers shall be required to produce a noise impact assessment and mitigation plans, where necessary, for any new noise sensitive development within these areas.

4.1.5.5 Dublin Airport Local Area Plan (LAP) (2020)

The strategic aims of the Dublin Airport LAP include supporting the continued sustainable growth of Dublin Airport, as well as timely delivery of required infrastructure to facilitate airport growth. In addition, the LAP sets the baseline passenger and Air Traffic Movements (ATM) forecasts for Dublin Airport at 40 million passengers per annum (mppa) and 265,000 ATMs by 2030, and 54 mppa and 365,000 ATMs by 2050 (the same figures as those in the Review of Future Capacity Needs at Ireland's State Airports). This document was published in 2018 for the Department of Transport, Tourism and Sport and considers the capacity of the existing infrastructure at Dublin Airport, and the priorities for development. It highlights the potential for a new terminal at Dublin Airport to satisfy demand.

The LAP also refers to the Review's identification of the need for a third terminal to facilitate growth beyond 40 mppa and suggests a target date of 2031 for the delivery of such.

Achieving the passenger and ATM forecasts is dependent on the following key infrastructure, as outlined in the LAP:

"Improved surface access; Expanded terminal capacity by way of reconfiguration and augmentation of existing facilities (at T1 and T2); Completion of the North Runway; [and] Additional aircraft parking stands supported by accompanying boarding gate and aircraft piers, particularly in the context of growing the hub function of the Airport."

The key strategic sustainability and environmental objectives of the LAP are as follows:

- Adopt a sustainable approach to airport development which responds to important environmental constraints associated with future development and includes mitigation where necessary and appropriate.
- To accelerate a transition to a low carbon economy by providing a reduction in CO_2 emissions.
- Reduce environmental impacts, build climate resilience and promote quality of life for neighbouring communities.
- All development proposals at Dublin Airport shall have regard to the requirement for environmental assessment including screening for Appropriate Assessment, Environmental Impact Assessment and Flood Risk Assessment in accordance with relevant legislation and guidelines.
- All proposals for development shall demonstrate compliance with relevant Fingal Development Plan provisions relating to sustainable development and the protection of the environment.
- Maintain and improve surface water quality at Dublin Airport.

4.1.5.6 Dublin Airport Capital Investment Programme 2020+

The Dublin Airport Capital Investment Programme (CIP) responds to the capacity constraint issues highlighted through the Review of Future Capacity Needs. In particular it refers to the following operational processors as critically requiring immediate enhancement.

The CIP states that *"Ireland will implement a 'Balanced Approach' to noise management at Irish airports in accordance with The Aircraft Noise Regulation on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Union airports".*

4.2 Section 34C of the Planning and Development Act 2000

The Act of 2019 provides for ANCA to discharge its functions under the Aircraft Noise Regulation on its own initiative or in response to any planning application by daa relating to:

"any noise problem that would arise from the carrying out of the development as proposed" (Section 34B) or

"any noise problem that would arise from taking [a] relevant action as proposed" (Section 34C), whereby the 'relevant action' consists exclusively of the revocation, amendment or replacement of an operating restriction contained in an existing planning permission, with or without the introduction of new noise mitigation measures and/or other conditions of the planning permission.

ANCA discharges its functions under the Aircraft Noise Regulation and the Act of 2019 by, among other things, making a 'regulatory decision' as is contained in this document.

The Applicant has made a planning application to modify Conditions 3(d) and 5 of the North Runway Planning Permission. These conditions limit access to or reduce the operational capacity of Dublin Airport and therefore constitute operating restrictions.

Section 34C of the Act of 2000, which was inserted by Section 11 of the Act of 2019, provides for planning applications that seek to modify noise-related operating restrictions contained in an existing planning permission. Such operating restrictions are regulated by the Aircraft Noise Regulation. In seeking to modify such operating restrictions, the applicant can seek to have noise mitigation measures imposed in place of or in addition to operating restrictions. The Applicant can also seek to change any other condition of the existing planning permission. Section 34C requires the planning authority of FCC to refer such applications to ANCA, which must apply the Balanced Approach (discussed in Section 4) to the noise problem that would arise from taking the relevant action as proposed.

Section 34C describes a process within which the regulatory decision shall be made. This is presented in Figure 4.2 below.

The process starts with a preliminary assessment of the noise situation at Dublin Airport. This was reported in February 2021. The preliminary assessment has taken account of information presented within the NAP and as provided with the Application. Having regard for this information, ANCA has to determine whether a noise problem would arise from the relevant action as proposed by the Application.

Under the process, where a noise problem has been identified, the Balanced Approach shall be applied.

ANCA's assessment of the noise impact of daa's Application is presented in this report, and considers all relevant legislation and policy.

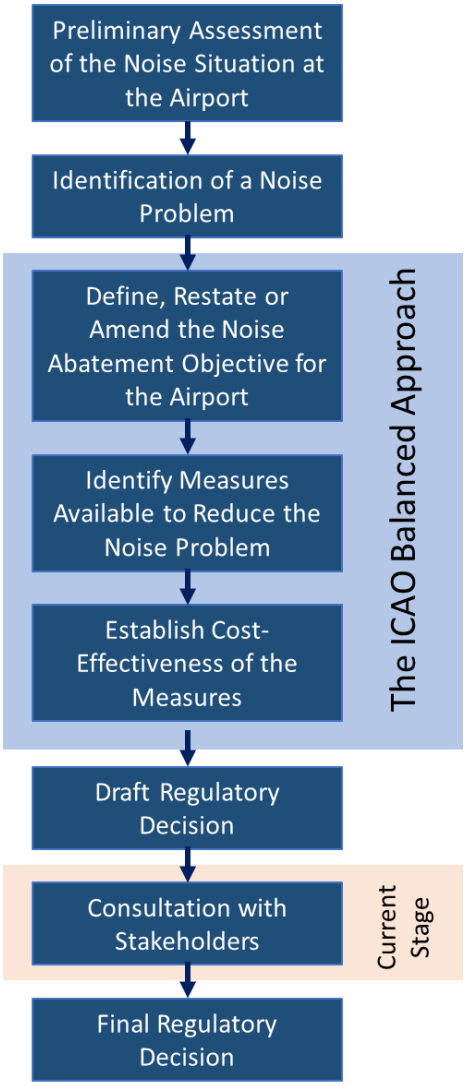


Figure 4.2: Process of Aircraft Noise Regulation as described under Section 34C

The process results in a Draft Regulatory Decision, which sets out the proposed noise mitigation measures. The draft regulatory decision is subject to consultation with feedback received from consultees taken into account before the final decision is made.

5 INTERNATIONAL CIVIL AVIATION ORGANIZATION AND THE BALANCED APPROACH

The Aircraft Noise Regulation and the Act of 2019 provide the basis for the implementation of the ICAO Balanced Approach to Aircraft Noise Management within the European Union and Ireland respectively.

The Balanced Approach is considered as the foundation for noise regulation of the aviation industry, setting international rules and standards.

This chapter discusses the Balanced Approach and provides examples of noise mitigation measures which can be identified and used under it.

5.1 Role and Function of ICAO

The International Civil Aviation Organization (ICAO) is a specialised division of the United Nations, operating as the aviation technical body of the UN.

It was created after the Chicago Convention on International Civil Aviation. This convention was signed by 52 countries in 1944 and ICAO was subsequently sanctioned and founded in 1947. The membership of ICAO now numbers 193 member states across the world.

Ireland is a signatory to the Chicago Convention and the Convention was given effect in domestic law through the Air Navigation and Transport Act 1946.

ICAO's primary role is to provide a set of standards to help regulate aviation across the world. ICAO classifies the principles and techniques of international air navigation, as well as the planning and development of international air transport to ensure safety, security, efficiency and regularity and environmental protection.

The international aviation standards are provided to the 193 Member States through a global forum in which they are expected to adopt and implement these standards. However, ICAO only provides the fundamental guidelines or SARPs (Standards and Recommended Practices), and do not act as a global regulator for civil aviation.

It is the responsibility of the member states to develop and enforce the necessary regulations, using guidance from ICAO. It is possible for each Member States/countries to modify and adjust these regulations, when necessary, under ICAO's approval.

5.2 The ICAO Balanced Approach

The Balanced Approach is a policy adopted by ICAO, which helps ICAO Member States to address aircraft noise problems at individual airports in an environmentally sensitive and economically responsible way.

The policy aims to respond to aircraft noise in such a way as to achieve the maximum environmental benefit in the most cost-effective way possible.

The Balanced Approach is designed to be flexible to allow for the identification of specific noise problems and the production of tailored solutions for individual airports. The Balanced Approach also allows for the maintenance of an open and transparent process.

The Balanced Approach provides a process for assessing a noise problem at individual airports. The process is constituted by the following steps as stated in ICAO Doc. 9829 – Guidance on the Balanced Approach to Aircraft Management[38]:

- Assessment of the current and future noise impact at an airport concerned, compared to the noise objective to be achieved.
- Evaluation of the likely costs and benefits of the various measures available.
- Selection of the measures aimed at achieving maximum environmental benefits most cost-effectively.
- Provision for dissemination of the evaluation results.
- Provision for consultation with stakeholders at different stages from assessment to implementation.
- Provision for dispute resolution.

The process under the Balanced Approach is described in more detail in following chapters.

[38] ICAO 9829: Guidance on the Balanced Approach to Aircraft Noise Management https://global.ihs.com/doc_detail.cfm?&input_search_filter=ICAO&item_s_key=00507943&item_key_date=890221&input_doc_number=9829&input_doc_title=&org_code=ICAO

The process described in the Balanced Approach requires setting a noise objective to help facilitate assessment and evaluation of measures and, if any, operating restrictions. ANCA is responsible for setting a NAO for Dublin Airport under the Act of 2019.

5.3 Assessment of the Noise Situation at an Airport

ICAO guidance[39] requires that the evolution of the noise climate at Dublin Airport and its surrounding community must be evaluated and compared against noise objectives. It follows that a noise problem exists if the evolution of the noise climate does not meet the noise objective. If a Noise Problem is identified, noise mitigation measures are to be implemented having regard for the Balanced Approach.

The Balanced Approach requires that the noise situation at an airport should be assessed based on objective and measurable criteria. ICAO guidance could, for example, include criteria such as the number of people who fall within a certain noise contour. This requires the production of noise contours. On this, ICAO Doc. 9829, states the following:

"In light of the many factors contributing to the noise situation at a particular airport, it is customary in airport noise studies to model "noise contours" that are averaged over a long period of time."

And: *"(Circular 205 – Recommended Method for Computing Noise Contours Around Airports) describes the major aspects of the calculation of noise contours of constant value of noise exposure for air traffic at an airport and presents several methods for calculating contours that some ICAO contracting States have adopted."*

It also advises that the aircraft noise assessment should have regard for the location of flight paths, the number of flights, and time distribution of those flight paths. This is a matter which is addressed in the modelling of aircraft noise and, under regulatory framework, is addressed within European legislation.

There are number of scenarios within ICAO guidance for consideration when applying the Balanced Approach. These are:

Noise Situation - The noise situation at an airport. It can be used to describe the current noise climate.

[39] ICAO 9829: Guidance on the Balanced Approach to Aircraft Noise Management

Forecast Situation – The noise situation in the future and presents the noise climate that would prevail without any changes being made i.e., without relevant action.

Forecast Without New Measures – A forecast where no measures are in place. This is described as the Forecast Without New Measures and best represents a scenario where there are no noise-related operating restrictions.

Forecast with New Measures – Once the noise situations and forecast without measures have been determined, these can be compared to the noise objective to determine if noise mitigation measures need to be implemented. It can also be compared to scenarios where potential measures are in place and to quantify any benefit/cost resulting from the application of a particular measure. These scenarios are described as a Forecast with New Measures.

5.4 Identification and Selection of the Measures

When the noise situation at an airport has been assessed, and it is determined that noise mitigation measures are required, the Balanced Approach is applied to help identify and select possible mitigation measures. These can be used to address any noise problem that has been identified and contribute towards meeting the noise objective.

The Balanced Approach divides the measures in four categories, or Principal Elements, which are, as follows:

Principal Elements of the Balanced Approach

- Reduction of Noise at Source
- Land-use Planning and Management
- Noise Abatement Operational Procedures
- Operating Restriction

Addressing or reducing the noise problem at an airport using the Balanced Approach may require a combination of these elements to achieve the noise objective. The Balanced Approach also

requires that interdependencies between the Principal Elements must be considered during the assessment.

An example of this would be where one measure may affect the distribution of noise around an airport and therefore have an impact on the cost and/or effectiveness of another measure.

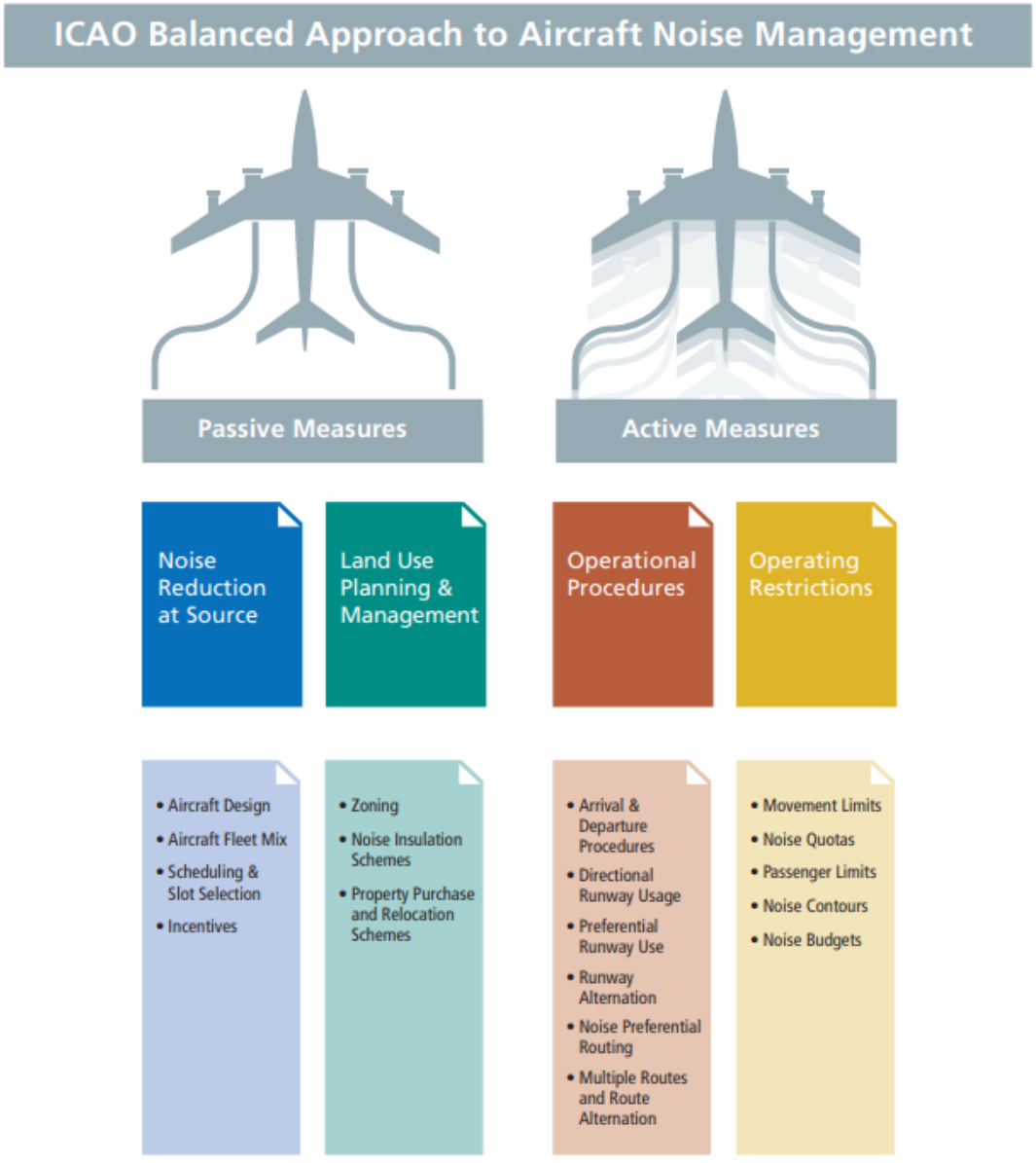


Figure 5.1: ICAO Balanced Approach

5.4.1 Reduction of Noise at Source

Since the 1970s, the control of aircraft noise has been undertaken by setting noise limits for aircraft. These limits are set out in the SARPs contained in Annex 16 of the Convention on International Civil Aviation – the Chicago Convention. These standards are also known as Chapters.

The aim of the Chapters is to ensure that the latest available noise reduction technologies are used for the design of new aircraft. This is achieved by creating procedures for the noise certification of the aircraft. The aircraft noise standards appear in in Volume I of Annex 16 of the Chicago Convention.

The final purpose is to ensure that noise reductions offered by technology are reflected in reductions in aircraft noise around airports.

The Chapters set noise limits as a direct function of Maximum Take-off Mass (MTOM) in order to recognise that heavier aeroplanes produce more noise than lighter aeroplane types. Over time, and as aircraft noise reduction technology has improved, ICAO have introduced more stringent limits, with the introduction of the Chapter 3 noise standard in 1977 and the Chapter 4 standard in 2001. In 2014 a new more stringent standard was introduced called Chapter 14, which is applicable to new aeroplane types submitted for certification on or after 31 December 2017, and on or after 31 December 2020 for aircraft of less than 55 tonnes in mass.

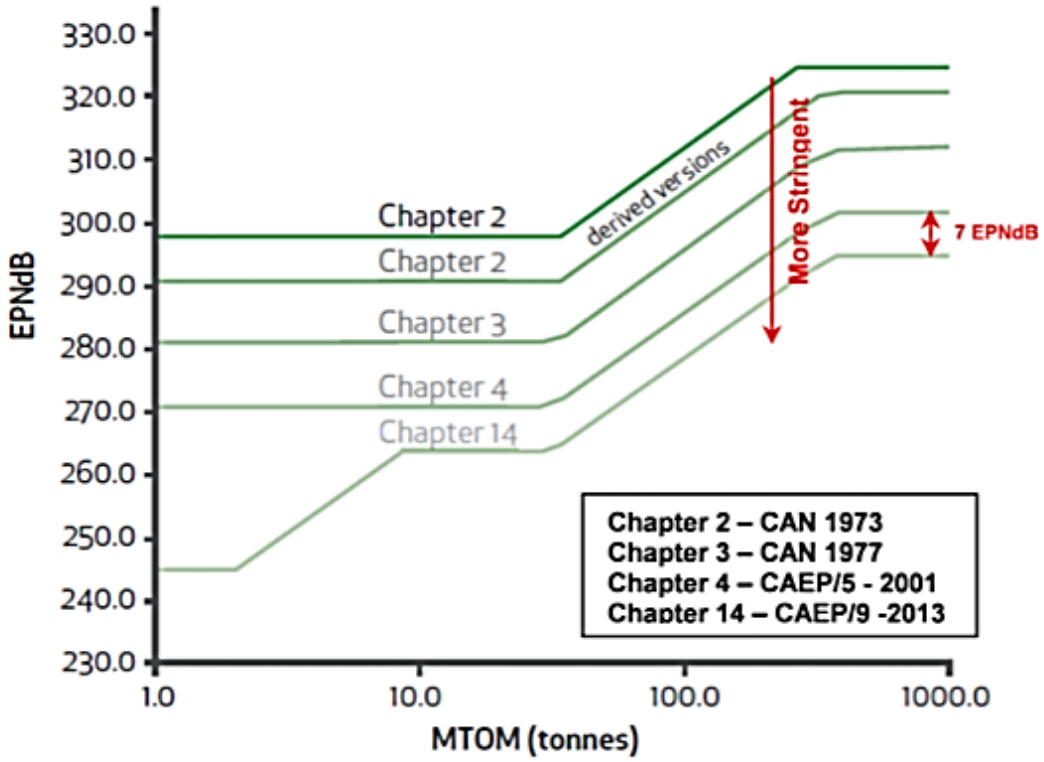


Figure 5.2: Progression of ICAO noise standards. The graphic represents the 'Effective Perceived Noise in decibels' against the Maximum Take Off Mass of an Aeroplane. It demonstrates the improvements in noise limits as ICAO standards have evolved.

The introduction of the Chapter 14 noise standard is expected to further reduce noise exposure into the future.

Under the Balanced Approach, when Reduction of Noise at Source is being implemented, ICAO Doc. 9829 states that the following considerations should be made:

- Integration into aircraft fleets, over time, of technology improvements meeting the latest standards.
- Specific fleet modernisation plans of airlines operating at an airport.
- National plan to adopt the latest noise standard.
- Adoption by contracting states of the latest ICAO noise recommendations.

The noise certification procedure which underpins the Chapters, as is discussed in Appendix B, is the only basis under the Aircraft Noise Regulation where decisions on noise-related operating restrictions take into account the noise performance of aircraft[40]. For this reason, the Chapters have become the basis of noise-related operating restrictions that seeks to limit or reduce airport noise through quotas or restrict certain types of aircraft landing and taking off due to their noise impact.

In the UK, the Department for Transport has set restrictions on the type of aircraft which can operate at night based on their Quota Count. This approach classifies aircraft based on the results of noise certification to assign a Quota Count. An EU-wide ban on the noisiest aircraft (Chapter 2) has been in place since 2002.

Table 5.1: Noise classifications and Quota Count in use by the UK Department of Transport (October 2021)

Noise Classification	Quota Count
Below 81 EPNdB	0.0
81 – 83.9 EPNdB	0.125
84 – 86.9 EPNdB	0.25
87 – 89.9 EPNdB	0.5
90 – 92.9 EPNdB	1.0
93 – 95.9 EPNdB	2.0
96 – 98.9 EPNdB	4.0
99 – 101.9 EPNdB	8.0
Greater than 101.9 EPNdB	16.0

In recent years it has been common for airport noise assessments to refer to different types by their 'generation' of noise reduction technologies. This approach seeks to categorise aircraft based on whether they are designed and complying to the latest noise standards i.e., Chapter 14, or were designed to comply with a previous set of standards. For future types of aircraft these can also be described in terms of 'generation'. The latest consensus approach to this is as follows:

Generation 0: Aircraft designed to comply with ICAO Chapters prior to Chapter 14. These aircraft are most likely to have been in service before 2014.

[40] Article 7(1)

Generation 1: The latest generation of aircraft designed to comply with ICAO Chapter 14 certification standard and are beginning to enter into service. These include the Airbus A319, A320 and A321 NEO (New Engine Option) variants and the Boeing 737-MAX family of aircraft.

Generation 2: Aircraft types that will ultimately replace Generation 1 types. These will most likely be designed to a new ICAO Chapter i.e., after Chapter 14. These types are unlikely to enter into service until the mid-2030s.

5.4.2 Land-Use Planning and Management

Land-use Planning and Management is an important tool to ensure that the activities near airports are compatible with aviation activity. This aims to minimise the population affected by aircraft noise by introducing **land-use zoning** around airports or to address issues through measures such as **sound insulation schemes.**

ICAO's main policies on land use planning and management are contained in Assembly Resolution A39-1[41], Appendix F. Through Resolution A39-1, ICAO set out a number of preventative measures to minimise aircraft noise problems, including:

- To locate new airports at an appropriate place, such as away from noise-sensitive areas.
- To take the appropriate measures so that land-use planning is taken fully into account at the initial stage of any new airport or of development at an existing airport.
- To define zones around airports associated with different noise levels taking into account population levels and growth, as well as forecasts of traffic growth and to establish criteria for the appropriate use of such land, taking account of ICAO guidance.
- To enact legislation, establish guidance or other appropriate means to achieve compliance with those criteria for land use.

[41] Resolution A39-1 – 'Consolidated statement of continuing ICAO policies and practices related to environmental protection – General provisions, noise, and local air quality' https://www.icao.int/environmental-protection/Documents/Resolution_A39_1.PDF

- To ensure that reader-friendly information on aircraft operations and their environmental effects is available to communities near airports.
- The Balanced Approach also includes noise charges (financial penalties) as a possible measure within the category of Land-Use Planning and Management. The policy relating to noise charges is included in ICAO's Policies on Charges for Airports and Air Navigation Services (Doc 9082)[42].

With respect to noise charges, ICAO states:

"The Council recognizes that, although reductions are being achieved in aircraft noise at source, many airports need to apply noise alleviation or prevention measures. The Council considers that the costs incurred may, at the discretion of [member] States, be attributed to airports and recovered from the users. In the event that noise-related charges are levied, the Council recommends that they should be levied only at airports experiencing noise problems and should be designed to recover no more than the costs applied to their alleviation or prevention; and that they should be non-discriminatory between users and not be established at such levels as to be prohibitively high for the operation of certain aircraft"

Therefore, under the Balanced Approach, while considering the land-use planning and management, consideration should be given to the preventative measures set out as above in Resolution 39A-1.

5.4.3 Noise Abatement Operating Procedures

Noise Abatement Operating Procedures can be a cost-effective measure for the reduction and/or redistribution of noise around an airport. Such procedures effectively require the aircraft to operate in a certain way.

Examples of noise abatement operating procedures currently adopted in ICAO Member States include:

- Noise preferential routes.
- Preferential runway use.
- Continuous descent approach (CDA).

[42] https://www.icao.int/publications/Documents/9082_8ed_en.pdf

5.4.4 Operating Restrictions

Operating Restrictions are defined under the Balanced Approach as *"any noise-related action that limits or reduces an aircraft's access to an airport".*

The Balanced Approach states that Operating Restrictions are only to be used as last resort, after consideration of the benefits gained from the other three Principal Elements. ICAO Doc. 9829 states:

"The assembly urges States not to introduce any operating restrictions at any airport on aircraft that comply with Volume I, Chapter 3 of Annex 16 before:

- *Completing the phase-out of aircraft which exceed the noise level in Volume I, Chapter 3 of Annex 16, at the airport concerned; and*
- *Fully assessing available measures to address the noise problem at the airport concerned in accordance with the balanced approach."*

Furthermore, ICAO Doc. 9829 states that restrictions:

- *Should be tailored to the noise problem of the airport concerned in accordance with the Balanced Approach.*
- *Should be limited to those of a partial nature wherever possible, rather than the complete withdrawal of operations at the airport.*
- *Take into account possible consequences for air transport services for which there are no suitable alternatives.*
- *Should be introduced gradually over time, where possible, in order to take into account the economic impact on operators of the affected aircraft.*
- *Give operators a reasonable period of advance notice; and*
- *Inform ICAO, as well as the other States concerned, of all such restriction imposed.*

5.5 Examples of Measures Available Under the Balanced Approach

The tables below outline examples of the measures that are available under the Balanced Approach to manage aircraft noise. The numbers in the tables (e.g., [1]), refer to the documents listed in Table 5.2.

5.5.1 Reduction of Noise at Source

1. Quieter Aircraft Design	
Noise Mitigation Measure / Description of the measure	
Better aircraft design has led to significant reductions in aircraft noise. Over more than fifty years of the jet age, technology has significantly improved aircraft noise performance, and aircraft are significantly quieter today. At an international level, ICAO progressively sets more stringent aircraft noise performance criteria.	
How the measure may contribute towards noise management and reduction (Pros)	**Potential disadvantages and drawbacks associated with the measures (Cons)**
The design and use of the quietest aircraft improves aircraft noise performance and can reduce aircraft noise exposure.	Designing new aircraft types is a slow and typically cyclical process. As such, quieter aircraft design is progressive.

2. Environmental Charging Proposals and Incentives	
Noise Mitigation Measure / Description of the measure	
The ability to mitigate noise impacts is dependent upon the uptake of quieter aircraft by airlines and the use of these aircraft during times when it matters most. Incentives to use quieter aircraft at airports can also take the form of reduced landing charges for aircraft with better environmental performance. The financial incentives designed to encourage airlines to use the quietest aircraft vary from airport to airport. Generally, airports levy significantly higher runway charges on the noisier aircraft types, compared to the charges on the quieter types.	
How the measure may contribute towards noise management and reduction (Pros)	**Potential disadvantages and drawbacks associated with the measures (Cons)**
The use of the quietest aircraft improves the aircraft noise performance within an airport's fleet and potentially reduces the aircraft noise contour area around an airport.	Environmental charging can add additional costs to airlines.

3. Scheduling and Slot Selection
Noise Mitigation Measure / Description of the measure
The impact and effects of aircraft noise are not the same across the day. Effects during the day are different to those during the night. Under the ENR, penalties are given to noise made in the evening and the night compared to the 12-hour day. Scheduling can be used to prioritise quieter

aircraft during times of the day where there is greater sensitivity to aircraft noise, such as during the night.	
How the measure may contribute towards noise management and reduction (Pros)	**Potential disadvantages and drawbacks associated with the measures (Cons)**
The use of the quietest aircraft during noise sensitive periods can reduce the impacts and effects of aircraft noise.	Such measures require coordination between airlines, airports and schedulers across the aviation network. Unless there are specific restrictions or other constraints then such measures can be overlooked.

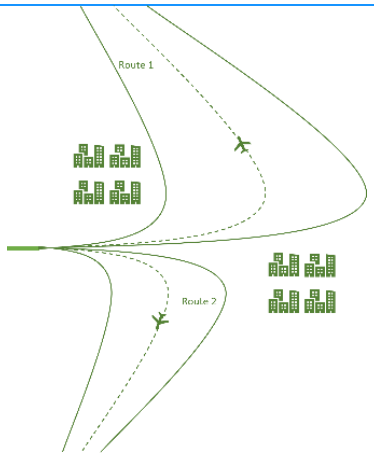
5.5.2 Noise Abatement Operating Procedures

1. Preferential Runway Usage	
Noise Mitigation Measure / Description of the measure	
For airports with multiple and equally capable runways, preferential runway use can be used to reduce the overall noise impact of an airport [1]. This can include using certain runways for only arrivals or departures to avoid or reduce impacts on certain areas. [1] This can be extended into setting rules, quotas, or targets for the use of certain runways to help manage noise impacts. [1]	
Illustration(s)	
	
How the measure may contribute towards noise management and reduction (Pros)	**Potential disadvantages and drawbacks associated with the measures (Cons)**

Preferred runway directions for take-off and landing, appropriate to the operation, are nominated for noise abatement purposes. The objective is to utilise, whenever possible, those runways that permit aircraft to avoid noise-sensitive areas during the initial departure and final approach phases of flights. [2] Flight safety should be the determining factor in runway selection when implementing noise abatement operational measures. Runways selected for preferential use should be equipped with suitable navigation aids. The use of a preferred runway according to quantity of traffic or aircraft performance criteria transfers the traffic from one direction to another. It reduces the length of the noise exposure contour in the first direction but then extends it in the second, thus re-shaping the noise contour, potentially resulting in a reduction in the number of people affected. [3].	Flight safety should be the determining factor in runway selection when implementing noise abatement operational measures. The Preferential Runway Usage is therefore not always achievable due to prevailing wind and runway conditions and would have to revert to conventional runway utilisation if: • The movement rate (intensity) required is too high to be supported by opposite direction operations. • The tailwind component is too high for landing or take-offs. Wet or contaminated runway conditions necessitate the use of reverse thrust, in which case it would have to operate on the into wind runway [3] [4].

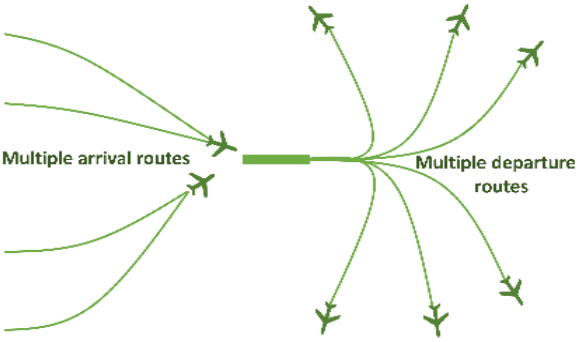
2. Use of Noise Preferential Routes[43]
Noise Mitigation Measure / Description of the measure
Sometimes known as ‘minimum noise routes’ these are specific flight paths which route aircraft to ensure that departing and arriving aircraft avoid overflying noise-sensitive areas in the vicinity of an airport [3] as far as practicable [6] in favour of areas which are considered to be less sensitive to noise, such as industrial and commercial land uses, or less populated areas. [1]
Illustration(s)

[43] The following list provides examples in Europe of where the measure is used at other airports [5]: Athens International, Bilbao, Bordeaux-Merignac, Stockholm Bromma, Bucharest Henri Canada Intl, Helsinki-Vantaa, Luxembourg International, Marseille-Provence Intl, Naples International, Amsterdam Schiphol, Toulouse-Blanca



How the measure may contribute towards noise management and reduction (Pros)	Potential disadvantages and drawbacks associated with the measures (Cons)
Noise preferential routes are established to ensure that departing and arriving airplanes avoid over-flying noise-sensitive areas in the vicinity of the aerodrome as far as practicable. [3]	Noise preferential routes can potentially increase the length of routes thus increasing fuel consumption and emissions.

3. Route Alternation (and Multiple Routes)[44]	
Noise Mitigation Measure / Description of the measure	
Route alternation can be achieved by designing the local airspace to allow for multiple routes for noise management reasons.	
Illustration(s)	



How the measure may contribute towards noise management and reduction (Pros)	Potential disadvantages and drawbacks associated with the measures (Cons)

[44] No specific examples of route alternation at European airports could be found.

The routes are used to spread out aircraft - reducing the number of times certain locations are overflown. This provides communities with respite from aircraft noise. [1]	Route alternation can potentially increase the length of routes thus increasing fuel consumption, and emissions

4. Use / Mandate of Noise Abatement Departure Procedures (NADP) and/or Thrust Managed Climbs[45]
Noise Mitigation Measure / Description of the measure
Noise Abatement Departure Procedures (NADP) describe different ways in which an aircraft can climb away from an airport and are incorporated into the airlines' standard operating procedures. [1] Airplane operating procedures for the take-off climb shall ensure that the necessary safety of flight operations is maintained while minimising exposure to noise on the ground. [2] NAPD 1 [2]: This procedure involves a power reduction at or above the prescribed minimum altitude and the delay of flap/slat retraction until the prescribed maximum altitude is attained. At the prescribed maximum altitude, accelerate and retract flaps/slats on schedule while maintaining a positive rate of climb, and complete the transition to normal en-route climb speed. • The noise abatement procedure is not to be initiated at less than 240 m (800 ft) above aerodrome elevation. • The initial climbing speed to the noise abatement initiation point shall not be less than V2 + 20 km/h (10 kt). • On reaching an altitude at or above 240 m (800 ft) above aerodrome elevation, adjust and maintain engine power/thrust in accordance with the noise abatement power/thrust schedule provided in the aircraft operating manual.

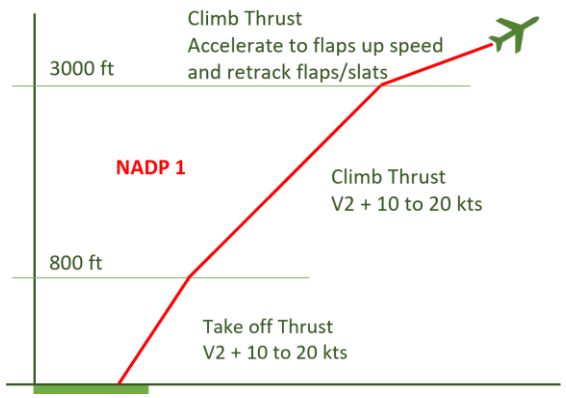
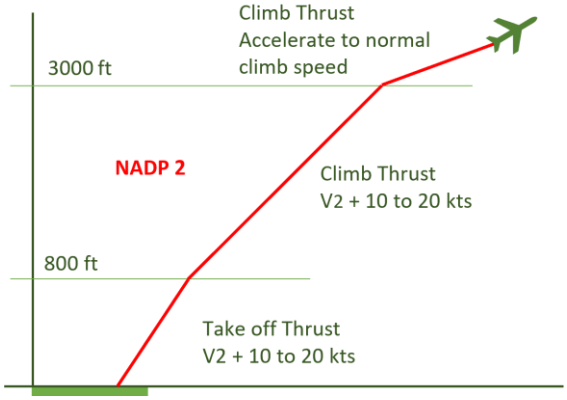
[45] The following list provide examples in Europe of where the measure is used at other airports [5]: Albacete, Athens International, Barajas-Madrid, Barcelona, Bergamo Orio al Serio, Bilbao, Billund, Bologna G Marconi, Bordeaux-Merignac, Bromma, Brussels, Budapest, Ciampino, Copenhagen, Copenhagen – Roskilde, Dusseldorf, Fiumicino, Francisco Sá Carneiro-Porto, Helsinki-Vantaa, Koln-Bonn, Leipzig Halle, Linate, Lisbon International, Luxembourg International, Lyon Saint Exupery, Malpensa, Marseille-Provence Intl, Munich, Naples International, Palma de Mallorca, Paris Charles de Gaulle, Prague Ruzyne, Riga International, Sofia, Stockholm-Arlanda, Stuttgart , Tenerife Sur-Reina Sofia, Torino Caselle, Toulouse-Blagnac, Venice Marco Polo, Vienna International, Wroclaw - Strachowice

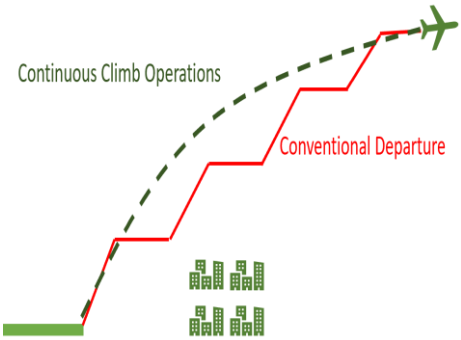
- Maintain a climb speed of V2 + 20 to 40 km/h (10 to 20 kt) with flaps and slats in the take-off configuration.
- At no more than an altitude equivalent to 900 m (3 000 ft) above aerodrome elevation, while maintaining a
- positive rate of climb, accelerate and retract flaps/slats on schedule.
- At 900 m (3 000 ft) above aerodrome elevation, accelerate to en-route climb speed. [2]

NAPD 2 [2]: This procedure involves initiation of flap/slat retraction on reaching the minimum prescribed altitude. The flaps/slats are to be retracted on schedule while maintaining a positive rate of climb. The power reduction is to be performed with the initiation of the first flap/slat retraction or when the zero flap/slat configuration is attained. At the prescribed altitude, complete the transition to normal en-route climb procedures.

- The noise abatement procedure is not to be initiated at less than 240 m (800 ft) above aerodrome elevation.
- The initial climbing speed to the noise abatement initiation point is V2 + 20 to 40 km/h (10 to 20 kt).
- On reaching an altitude equivalent to at least 240 m (800 ft) above aerodrome elevation, decrease aircraft body angle/angle of pitch while maintaining a positive rate of climb, accelerate towards VZF and either:
  a) reduce power with the initiation of the first flap/slat retraction; or
  b) reduce power after flap/slat retraction.
- Maintain a positive rate of climb and accelerate to and maintain a climb speed of VZF + 20 to 40 km/h (10 to 20 kt) to 900 m (3 000 ft) above aerodrome elevation.
- On reaching 900 m (3 000 ft) above aerodrome elevation, transition to normal en-route climb speed.
- An airplane should not be diverted from its assigned route unless:
  a) in the case of a departing airplane, it has attained the altitude or height which represents the upper limit for noise abatement procedures.
  b) It is necessary for the safety of the airplane (e.g., for avoidance of severe weather or to resolve a traffic conflict). [2]

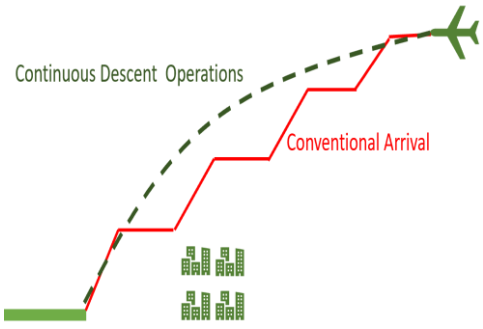
These procedures are designed by the operator in consultation with the airframe manufacturer, implemented in line with local airport practices and approved by the regulator authority of the operator. [3]

Illustration(s)	
	
How the measure may contribute towards noise management and reduction (Pros)	**Potential disadvantages and drawbacks associated with the measures (Cons)**
NADP can reduce noise on communities close or further away from an airport depending upon which procedure is selected. It is now becoming common practice at EU airports for these procedures to be used for certain routes or runways. [1] The objective is to optimise the distribution of the exposure to noise at a particular location on the ground while maintaining the required levels of flight safety. [3]	Airlines can adopt their own NADP however they are limited to use two NADP for each type of aircraft by EU regulation [7]. Airport's operators, cannot, therefore, enforce any own NADP (which may be designed to achieve best results on that particular airport) on airlines as it could cause an airline to breach EU regulations if the procedure directed by an airport was not one of the two adopted by the airline on a given aircraft type. [8] One procedure does not necessarily have a better overall noise impact than another. Instead, changing from one procedure to another tends to redistribute noise from one location to another, resulting in both noise decreases and noise increases. [8]

5. Continuous Climb Operations[46]	
Noise Mitigation Measure / Description of the measure	
Continuous Climbing Operations allow departing aircraft to continuously climb without interruption to the greatest possible extent by employing optimum climb engine thrust at climb speed until reaching the cruise flight level. [1] [9] CCO are facilitated by the airspace and associated procedures and are assisted by ATC by allowing the execution of a flight profile optimised to the performance of aircraft. This can lead to significant economy of fuel and environmental benefits in terms of noise and emissions reduction. [9]	
Illustration(s)	
	
How the measure may contribute towards noise management and reduction (Pros)	**Potential disadvantages and drawbacks associated with the measures (Cons)**
This procedure can be helpful in reducing noise on certain communities. [1] It is also possible for airspace to be designed to allow for 'high performance departures' allowing steeper climb gradients for aircraft which can perform these. [1] CCO may allow for potential authorisation of operations where noise limitations would	It is not always possible to fly a full-optimise CCO due to safety reasons. Depending on each situation, the CCO procedure may require a trade-off between different environmental requirements (i.e., noise, air quality, aircraft paths etc.) [9]

[46]The following list provide examples in Europe of where the measure is used at other airports [5]: Brussels, Bucharest Henri Coanda Intl, Helsinki-Vantaa, Orly

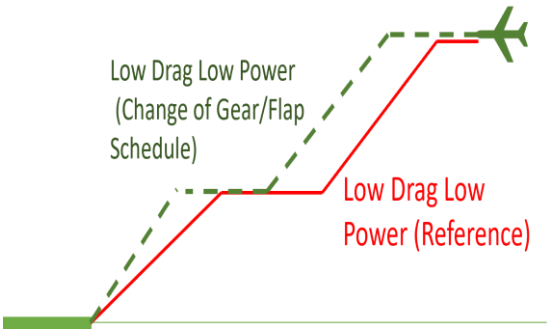
otherwise result in operations being curtailed or restricted. [9] Environmental benefits can be achieved through reduced fuel burn and potential aircraft noise mitigation through thrust and height optimisation. [9]	

6. Continuous Descent Approaches[47]
Noise Mitigation Measure / Description of the measure
Continuous Descent Approach (CDA) is an aircraft operation enabled by airspace design, procedure design and ATC facilitation [10] in which an arriving aircraft descends from an optimal position with minimum thrust [10], ideally in a low drag configuration and avoids inefficient periods of level flight to the extent permitted by the safe operation of the aircraft and compliance with published procedures and ATC instructions. [11] An optimum CDA starts from the top of descent and uses descent profiles that reduce segments of level flight, noise, fuel burn, emissions and controller/pilot communications, while increasing predictability to pilots and controllers and flight stability. [10] A CDA initiated from the highest possible level in the en-route or arrival phased of flight will achieve the maximum reduction in fuel burn, noise and emissions. [10]
Illustration(s)


[47] The following list provide examples in Europe of where the measure is used at other airports [5]: Brussels, Budapest, Frankfurt, Hamburg, Hannover-Langenhagen, Helsinki-Vantaa, Koln-Bonn, Munich, Nurnberg, Schiphol, Stockholm-Arlanda, Stuttgart, Toulouse-Blagnac

How the measure may contribute towards noise management and reduction (Pros)	Potential disadvantages and drawbacks associated with the measures (Cons)
Continuous Descent Approaches allow aircraft to be kept as high as possible for as long as possible and generally requires less engine thrust to maintain the level flight, reducing noise levels on the ground. Without CDA, some pilots may descend earlier than they need to and may need to use their engines more which can result in increased noise. [1] CDA reduces the noise experienced on the ground by reducing the overall thrust required during initial descent and keeping the aircraft higher for longer. In addition to the noise reduction, CDA can provide emission benefits [3] The objective of a CDA is to reduce the environmental impact of the arrival phase of flying by both maintaining a fuel optimal profile (thereby minimising gaseous emissions) and keeping engine and aircraft noise to a minimum, prior to intercepting the approach glide path at an appropriate altitude for the distance to touchdown. [12] Work by the European CCO / CDA Task Force indicates noise impact on the ground may be reduced by around 1-5 dB per flight. [12] By keeping the aircraft as high as possible for as long as possible, this ensures that the aircraft spends the least amount of time at non-optimal lower intermediate cruising levels. It should be noted that keeping the aircraft as high as possible for as long as	Introducing CDA may offer benefits in terms of reduced noise but may also change the nature or locations of noise impacts. Whilst the majority of the populated area may benefit from reduced noise, there might be a minority for whom the noise increases. External consultation with interested parties may therefore be required at the option selection stage and land-use planning zones may need to be altered. [10]

possible can be more effective at reducing noise impact on the ground than Low-Power/Low Drag (LP/LD) techniques alone even though they are complementary techniques: CDA will reduce the noise at intermediate distances from touchdown (8 to 25 NM) and LP/LD is applied on final approach. [12].	

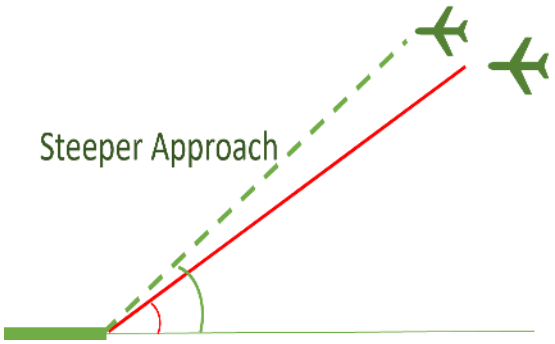
7. Use / Mandate of Low Power-Low Drag (LP/LD) Approach Procedures (including Gear and Flap Deployment Rules)[48]	
Noise Mitigation Measure / Description of the measure	
LP/LD is a noise abatement technique for arriving aircraft in which the pilot delays the extension of wing flaps and undercarriage until the final stages of the approach, subject to compliance with ATC speed control requirements and the safe operation of the aircraft. [12] The principle consists in delaying as much as possible wing flap extension and landing gear deployment, consistent with ATC speed, height clearance and safe operation. These techniques involve changes in engine power associated with changed aircraft configuration. [3]	
Illustration(s)	
	
How the measure may contribute towards noise management and reduction (Pros)	**Potential disadvantages and drawbacks associated with the measures (Cons)**
By delaying landing gear deployment and using a reduced landing flap both aerodynamic and	This procedure may not be as effective as keeping the aircraft as high as possible for as long as possible, which may be more effective

[48]The following list provide examples in Europe of where the measure is used at other airports [5]: Schiphol, Vienna International

engine noise for aircraft on approach can be reduced. [1]	at reducing noise impact on the ground than LP/LD techniques alone even though they are complementary techniques. [12]

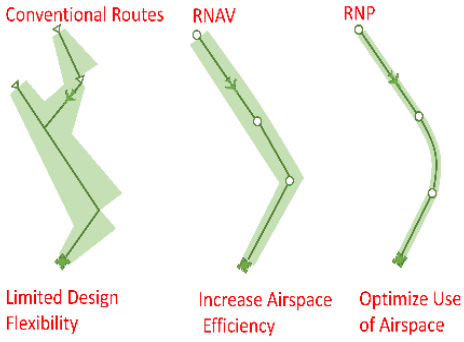
8. Steeper / Segmented Approach Procedures / GBAS[49]
Noise Mitigation Measure / Description of the measure
A steeper approach involves increasing the angle of aircraft on the final approach (from around 10 nautical miles before the landing threshold) resulting in aircraft being higher over the ground for longer. [13] A segmented approach is where an aircraft descends at multiple angles. In most instances, a higher decent angle can be flown before final approach. [1] The majority of approaches are flown at glideslope angles of 3.0°. Angles up to 3.5° are considered to be routine and within the capability of any certificated airplane. Approach angles greater than 3.5°, but less than 4.5°, are unlikely to produce significant problems in normal operations, and accordingly there are no specific requirements. Operators using these approach angles should consult the aircraft manufacturer and satisfy themselves that the performance and handling characteristics are acceptable. Approach angles of 4.5° or greater are defined as steep approaches. Any approach angle 4.5° or more requires specific approval. [14] A Ground Based Augmentation System (GBAS) is one which provides differential corrections and integrity monitoring of Global Navigation Satellite Systems (GNSS) data using as input data either three or four GNSS satellite signals received at three of four antennae. The differential correction message computed from this data is then continually broadcast omni-directionally (twice every second) by a ground transmitter using a VHF frequency broadcast which is effective within an approximate 23 nm radius of the host airport. [15]
Illustration(s)

[49]Currently, GBAS is implemented on more than 100 airports [15]. Airports where such procedures are implemented include e.g.: Bremen (EDDW), Malaga (LEMG), Frankfurt (EDDF), Zurich (LSZH), Newark (KEWR), Houston's George Bush (KIAH), Moses Lake (KMWH), Charleston (KCHS), Sydney (YSSY), Chennai (VOMM)Saint Helena (FHSH)



How the measure may contribute towards noise management and reduction (Pros)	Potential disadvantages and drawbacks associated with the measures (Cons)
Steeper Approach involves increasing the approach angle of the aircraft which can reduce noise. [1] A segmented approach procedure has high potential for noise reduction at communities further out and under the final approach because the aircraft stays at a higher altitude for a longer time. [1] Increasing an aircraft's glide path (angle of approach) reduces noise in two ways [13]: • It increases the height of the aircraft over the ground, increasing the distance over which sound travels before it reaches a population. • It increases an aircraft's rate of descent, reducing the amount of engine power required and helping to reduce the amount of noise emitted. GBAS is primarily used to facilitate GNSS-based precision approaches which are more flexible in design than is possible with Instrument Landing System (ILS). Whilst the main goal of GBAS is to provide signal integrity, it also increases signal accuracy, with demonstrated	Under ICAO rules, steeper and segmented approaches are only meant to be used to avoid obstacles rather than for environmental management purposes. This can pose challenged in getting such procedures approved. Any approach angle of 4.5° or more requires specific approval. Approvals for steep approach and landing (SAL) operations are stated in the Operations Specifications certificate issued in accordance with the EU Air Operations Regulations. Steep approach clearance for a particular type of aeroplane will not automatically permit all individual aircraft of that type to operate to the maximum approved angle [14]. This means that if a steeper approach is implemented it may constrain the types of aircraft which can land at an airport.

position errors of less than one meter in both the horizontal and vertical plane. One GBAS Ground Station at an airport supports aircraft approach and landing to multiple runway ends as well as departures from multiple runways and surface movement for all GBAS-equipped aircraft [15].	

9. PBN Navigation[50]	
Noise Mitigation Measure / Description of the measure	
Performance Based Navigation is an area of navigation based on performance requirements for aircraft operating along an Air Traffic System route, on an instrument approach procedure or in a designated airspace. [1] [16]. Performance requirements are expressed in navigation specifications (Area Navigation (RNAV) specification, Required Navigation Performance (RNP) specification) in terms of accuracy, integrity, continuity, availability and functionality needed for the proposed operation in the context of a particular airspace concept. [16]	
Illustration(s)	
	
How the measure may contribute towards noise management and reduction (Pros)	**Potential disadvantages and drawbacks associated with the measures (Cons)**
PBN represents a fundamental shift from sensor-based to performance-based navigation and offers a number of advantages	There could be conflicts in achieving noise reduction and fuel efficiency at the same time

[50]The following list provide examples where the measure is used at other airports [17]: Toronto International, London Stansted, Amsterdam Schiphol, Santa Ana, John Wayne.

over the sensor-specific method of developing airspace and obstacle clearance criteria, i.e.: allows for more efficient use of airspace (route placement, fuel efficiency and noise abatement); PBN can potentially enable operational benefits in the areas of safety, flight efficiency and airspace capacity, as well as improved cost-efficiency and reduced environmental impact. [16]	as longer routes to avoid overflight will result in less efficiency in fuel used and vice versa. PBN also means that aircraft will fly routes more accurately than those which are flown using conventional navigation. This means that PBN has the potential to increase overflight rates at certain locations but increasing the concentration of the flight path.

5.5.3 Land Use Planning and Management

1. Noise Zones and Planning Instruments[51]
Noise Mitigation Measure / Description of the measure
Land-use planning (and management) is an effective means to ensure that the activities nearby airports are compatible with both the current and future airport activities. [1] [18] Land and buildings surrounding airports can be planned and managed to mitigate aircraft noise at those locations. [1] It is also an instrument to ensure that the gains achieved by the reduced noise of the latest generation of aircraft are not offset by further residential development around airports. [18] Zoning can be used to ensure that aircraft noise is taken into account when planning decisions are made in areas around airports. Typically, zoning can help advise on the compatibility of a location for noise sensitive development. It can help to advise on, for example, what form of sound insulation is required for a development to be made compatible. [1]
Illustration(s)

[51]The following list provide examples in Europe of where the measure is used at other airports [5]: Athens International, Barajas-Madrid, Barcelona, Bologna G Marconi, Bordeaux-Merignac, Bromma, Brussels , Bucharest Henri Coanda Intl, Budapest, Rome Fiumicino, Frankfurt, Hamburg, Helsinki-Vantaa, Koln-Bonn, Leipzig Halle, Milan Linate, Lyon Saint Exupery, Malaga, Milan Malpensa, Marseille-Provence Intl, Nurnberg, Paris Orly, Paris Charles de Gaulle, Prague Ruzyne, Amsterdam Schiphol, Sofia, Toulouse-Blagnac.

How the measure may contribute towards noise management and reduction (Pros)	Potential disadvantages and drawbacks associated with the measures (Cons)
The main goal of land-use planning is to minimise the population affected by aircraft noise by introducing measures, such as land-use zoning around airports. [18] Planning noise contours can be used to define noise zone around an airport. The structure of noise zones should be inherently related to the particular situation where they are applied. In many jurisdictions, two zones (e.g., medium an high noise zones) are used, but in some cases more zones might be used (e.g. medium to very high): [18] • In *high-noise zones*, new noise-sensitive developments, such as residences, hospitals and schools might be prohibited. Those which already exist might be subject to sound insulation and ventilation retrofits. [18] • In a *medium-noise zone*, new developments might be allowed but subject to maximum density limits or specific sound insulation and ventilation requirements. [18]	An airport may not have any control or influence over the planning regulation and noise zoning. The sizing and location of the zones may over or under constrain development

Land-use planning and management measures can be categorised as [3]: • *Planning instruments*: comprehensive planning, noise zoning, subdivision regulations, transfer of development rights, and easement acquisition. • *Mitigation instruments*: building codes, noise insulation programmes, kind acquisition and relocation, transition assistance, real estate disclosure and noise barriers. • *Financial instruments*: capital improvements, tax inventive, and noise-related airport charges for revenue generation to assist in funding noise mitigation efforts. Noise problems can be addressed through preventive measures [19]: a) Location of new airports at an appropriate place, such as away from noise-sensitive areas. b) Taking the appropriate measures so that land-use planning is taken fully into account at the initial stage of any new airport or of development at an existing airport. c) Defining zones around airports associated with different noise levels taking into account population levels and growth as well as forecasts of traffic growth and establish criteria for the appropriate use of such land, taking account of ICAO guidance. d) Enacting legislation, establish guidance or other appropriate means to achieve	

compliance with those criteria for land use. e) Ensuring that reader-friendly information on aircraft operations and their environmental effects is available to communities near airports.	

2. Noise Insulation Schemes[52]	
Noise Mitigation Measure / Description of the measure	
Noise Insulation Schemes (NIS) measures offered by airports generally include uprated acoustic glazing (secondary glazing, standard thermal glazing, or high-performance acoustic glazing) and associated acoustic ventilation measures. There are also examples of NIS which offer options for loft and roof insulation. [21] Some schemes operate based on measures being provided without any cost to the owner / occupier of the property. Others may entail financial contributions towards the cost of the sound insulation.	
Illustration(s)	
	
How the measure may contribute towards noise management and reduction (Pros)	**Potential disadvantages and drawbacks associated with the measures (Cons)**
The objective of a NIS is to reduce the impact of airport noise on households, communities, and community facilities through the	A NIS can therefore only reduce noise within a building. [21]

[52] The following list provide examples of where the NIS measure is used at other airports: Aberdeen, Adolfo Suárez Madrid–Barajas, Arlanda, Barcelona–El Prat, Belfast International, Birmingham, Bristol, Charles de Gaulle, East Midlands, Edinburgh, Frankfurt am Main, Gatwick, Glasgow, Heathrow, Humberto Delgado, Leeds Bradford, Liverpool, Luton, London City, Milan-Malpensa , Manchester, Munich, Orly, Schiphol, Shannon, Son Sant Joan, Stansted, Vienna International

implementation of noise reduction measures installed within the building envelope. [21] This can help reduce the level of aircraft noise events inside a property which may reduce annoyance and sleep disturbance.	The financial aspects and measures available through a NIS and its execution can all be important in achieving uptake i.e., the number of households participating the schemes.

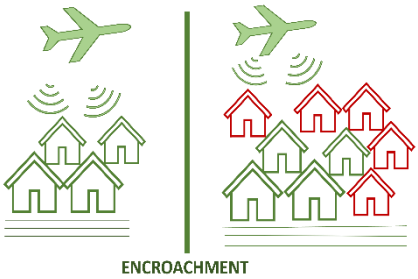
3. Relocation schemes[53]
Noise Mitigation Measure / Description of the measure
Property purchase and relocation schemes roughly fall into three categories: • Compulsory property purchase schemes • Voluntary property purchase schemes • Relocation schemes It is not uncommon for airports to offer variants of all three schemes, or combinations of relocation incentives and property purchase schemes. Eligibility for the various schemes generally falls into one or more of the following categories: • *Threshold Criteria* – related to a noise level, such as the likely level following a development at an airport. • *Temporal* – where dependency is upon the date at which a property is constructed or occupied, and also the time period that an eligible property can make a claim. • *Geographical* – where the scheme applies to land or properties within identified areas. • *Building Type* – where the scheme applies to buildings with specific uses, such as schools, or specific parts of a property. • *Other* – any airport specific eligibility criteria. [21]
Illustration(s)

[53]The following list provide examples of where the NIS measure is used at other airports: East Midlands, Edinburgh, Gatwick, Heathrow, Liverpool, Manchester

How the measure may contribute towards noise management and reduction (Pros)	Potential disadvantages and drawbacks associated with the measures (Cons)
Compulsory property purchase can lead to a reduction in the number of people within areas with aircraft noise exposure deemed incompatible for residential development.	Compulsory property purchase can lead to long evaluation process of the values of the land/property and possible contestation from the land/property owners. [21].

4. Monitoring of encroachment[54]
Noise Mitigation Measure / Description of the measure
The term “encroachment” is used to describe growth of residential development in areas that are incompatible or potentially incompatible with aircraft noise. [3] Incompatibility is defined in terms of noise exposure criteria generally established locally or nationally. [3] The analysis is straightforward when the boundary of a protected zone is demarcated to allow future airport growth. [3]
Illustration(s)

[54] The following list provide examples of where the measure is used at other airports [3]: Bologna international airport, Auckland International Airport

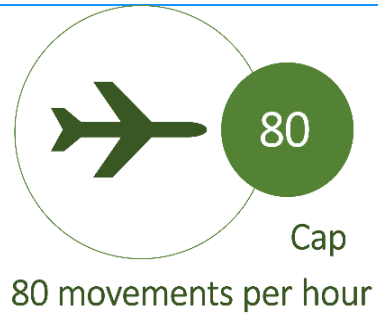


How the measure may contribute towards noise management and reduction (Pros)	Potential disadvantages and drawbacks associated with the measures (Cons)
Quantifying encroachment requires definition of an incompatibility zone. Such zones are usually established by defining noise exposure contours around an airport using a noise exposure metric know to correlate with health and welfare of people and a traffic forecast that anticipates some future growth scenario. [3] The boundary might be developed to reflect the planned ultimate capacity of an airport. [3]	Forecast capacity can change over time making the tracking of encroachment difficult. [3] Exact prediction of how growth will shape future contours is difficult because capacity enhancement plans can change over time. [3]

5.5.4 Operating Restrictions

1. Aircraft Movement Cap[55]
Noise Mitigation Measure / Description of the measure
Aircraft movements are arrivals or departures at an airport. Introducing a limit to the number of movements over a specified time period can act as a proxy for noise. [22]
Illustration(s)

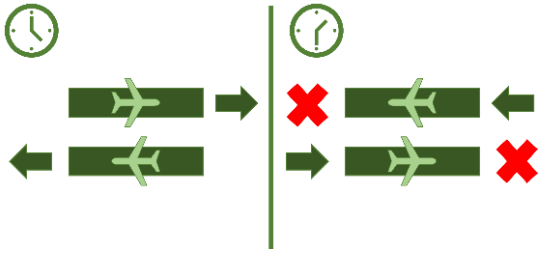
[55] The following list provide examples of where the measure is used at other airports [22]: Frankfurt am Main, Paris Charles de Gaulle Airport, Amsterdam Airport Schiphol, Sydney Airport, London Heathrow Airport, London City Airport



How the measure may contribute towards noise management and reduction (Pros)	Potential disadvantages and drawbacks associated with the measures (Cons)
Movement limits can be set at an agreed amount corresponding to an equivalent level of noise exposure around an airport which is not to be exceeded. Movement caps are simple and transparent; and reports of actual movements against the limit are easy to compile and understand, thus allowing compliance to be measured in a straightforward manner. Provides confidence to communities with concerns regarding the growth of an airport. [22]	The aviation industry views such restrictions as a 'blunt instrument'. Difficult to determine how high or low the movement cap should be set to. A movement limit does not take into account the noise being generated by aircraft, which means it cannot provide incentives for operators to introduce quieter aircraft. If the aim is to balance noise control; and sustainable development and growth at an airport, a movements cap may not provide for long-term operational flexibility, as it would not enable quieter aircraft to be used more frequently with an equivalent noise exposure. [22]

2. Runway Use Restrictions[56]
Noise Mitigation Measure / Description of the measure

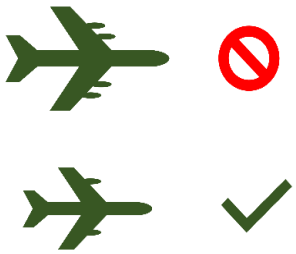
[56] The following list provide examples of where the measure is used at other airports [22]: Frankfurt am Main, Paris Charles de Gaulle Airport, Amsterdam Airport Schiphol, O'Hare International Airport, Sydney Airport

Runway use restrictions are generally a combination of Preferential Runway Usage and Aircraft Curfew.	
Illustration(s)	
	
How the measure may contribute towards noise management and reduction (Pros)	**Cons**
See Preferential Runway Usage and Aircraft Curfew sections	See Preferential Runway Usage and Aircraft Curfew sections

3. Aircraft Curfew[57]
Noise Mitigation Measure / Description of the measure
An aircraft curfew is a global or aircraft-specific partial operating restriction that prohibits take-off and/or landing during an identified time period. [3]
Illustration(s)


[57] The following list provide examples of where the measure is used at other airports [22]: Frankfurt am Main, Amsterdam Airport Schiphol, Sydney Airport, London City Airport

How the measure may contribute towards noise management and reduction (Pros)	Potential disadvantages and drawbacks associated with the measures (Cons)
Can provide clear breaks and respite from aircraft noise, and can be used to manage noise exposure. [22]	Can result in significant costs on airports and airlines. Airports Council International (ACI) released a 2015 report entitled 'Managing the Impacts of Aviation Noise' states: *"curfews and restrictions are a 'blunt instrument' and can severely impact the efficiency of operations such as the movement of freight"*.

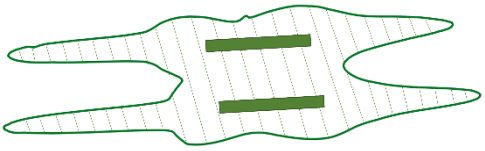
4. Aircraft Type Restrictions[58]	
Noise Mitigation Measure / Description of the measure	
Operating restriction that prohibits take-off and/or landing of aircraft-specific type on the basis of certified noise level [22]	
Illustration(s)	
	
How the measure may contribute towards noise management and reduction (Pros)	**Potential disadvantages and drawbacks associated with the measures (Cons)**

[58]The following list provide examples in Europe of where the measure is used at other airports [22]: Frankfurt am Main, Paris Charles de Gaulle Airport, Sydney Airport, London City Airport

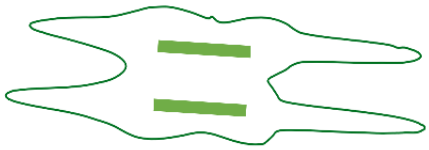
Can be used to manage the amount of noise experienced per aircraft event and help reduce noise exposure. [22]	If set incorrectly, can potentially discriminate certain airlines. Must align with aircraft noise certification requirements. [22]

5. Noise Quotas[59]	
Noise Mitigation Measure / Description of the measure	
Under a noise quota scheme, each aircraft type is assigned a 'noise classification' according to its noise performance: the noisier the aircraft, the greater the noise classification. The numbers of movements of each aircraft type, over a given period, are multiplied by the corresponding noise factors, and these 'noise factored movements' are counted against an overall noise quota (or noise budget) for an airport. Noise quotas may be set separately for winter and summer seasons; they may be sub-divided between arrivals and departures, or between types of services in other ways, depending on the degree of flexibility required within the permitted limits. Calculations are usually undertaken on forecast traffic to inform proposed budgets which are consulted upon before they are adopted. This may also include noise exposure contour calculations so that potential noise exposure can be reviewed as part of setting a budget. [22]	
How the measure may contribute towards noise management and reduction (Pros)	**Potential disadvantages and drawbacks associated with the measures (Cons)**
A noise quota scheme may provide a better proxy for noise exposure than numbers of movements alone. It can also be used to encourage the introduction of quieter aircraft to help increase the number of movements within the quota. [22]	Quotas can be more complicated to administer than a movement limit.

[59] The following list provide examples in Europe of where the measure is used at other airports [22]: London Heathrow Airport, London Gatwick Airport, London City Airport, Belfast City Airport

6.Noise Contour Area Limits	
Noise Mitigation Measure / Description of the measure	
Noise exposure contours are routinely used to assess long-term noise exposure at airports, including the 5-yearly strategic noise mapping under the END. They can however be used to restrict aircraft noise by setting requirements that the noise exposure shall not exceed a certain area or encroach into a certain area.	
Illustration	
	
How the measure may contribute towards noise management and reduction (Pros)	**Potential disadvantages and drawbacks associated with the measures (Cons)**
Noise exposure contours provide a way of describing the noise exposure in the vicinity of an airport and can be used to describe the area enclosed by a certain noise contour associated with a particular noise metric and level. The contour selected as a restriction usually has scientific or policy relevance. Being a single numerical value, it is straightforward to set a limit on contour area to restrict aircraft noise exposure in the vicinity of an airport and it is easy to understand and apply as a criterion. [22]	A contour restriction may not necessarily reflect perception of aircraft noise, and may only be confirmed using retrospective noise contours after any breach has occurred. The use of contours as a restriction requires the selection of a metric and associated threshold value which can often be subject to debate and may change over time with new developments. It also has the added complexity that the noise contour area used as a restriction may be confused with other noise contour areas around the airport, such as the areas reported from strategic noise mapping or used for land-use planning and management. This situation

	tends to occur when an airport is required to report several noise metrics. [22] A contour does not address the potential health impacts of aircraft noise.

7. Noise Contour Shape Limit[60]	
Noise Mitigation Measure / Description of the measure	
The pattern of noise around an airport can vary depending upon the form of operations. Depending on operations, the area of the noise contours can be measured and found to be the same, but their shapes, and the corresponding locations and communities that sit within that area can result in apparent differences in impact. The aim of this operating restriction is to fix a shape to safeguard local communities. [22]	
Illustration(s)	
	
How the measure may contribute towards noise management and reduction (Pros)	**Potential disadvantages and drawbacks associated with the measures (Cons)**
Very restrictive and can provide very clear safeguards to local communities. [22]	Significantly restricts operational flexibility at an airport and can lead to some unintended consequences [22]

8. Noise Budget[61]
Noise Mitigation Measure / Description of the measure

[60] The following list provide examples in Europe of where the measure is used at other airports [22]: Amsterdam Airport Schiphol

[61] The following list provide examples in Europe of where the measure is used at other airports [22]: Amsterdam Airport Schiphol, Paris Charles de Gaulle Airport

In order to control the runway preference system, and thereby control the distribution of noise around an airport, a noise budget restriction system is meant to set limits on noise exposure at specific locations. [22]	
How the measure may contribute towards noise management and reduction (Pros)	**Potential disadvantages and drawbacks associated with the measures (Cons)**
This system allows noise limits to be set based on certain communities Uses measured levels, therefore simple and transparent. [22]	Can be potentially challenging for new aircraft types and may inadvertently restrict new aircraft. Depending on the siting of the noise monitoring terminals, aircraft can be operated in ways which optimise low noise over the monitors, potentially resulting in higher noise elsewhere. Being based on measurements, breaches are identified retrospectively, so in theory, the mechanism cannot guarantee that there will be no breeches It can be quite complex to administer and manage. [22]

Table 5.2: Reference documents - Measures available under the Balanced Approach

[1] Aircraft Noise Competent Authority, Aircraft Noise Mitigation at Dublin Airport, Fingal County Council, 2020

[2] ICAO , “Aircraft Operations, Volume I (Doc 8168),” ICAO, 2006

[3] ICAO, “Guidance on the Balanced Approach to Aircraft Noise Management (DOC 9829),” ICAO, 2008

[4] Osprey Consulting Services Limited, “Review of Potential Noise Mitigation Measures,” RiverOak Strategic Partners, Manston, 2019

[5] Boeing, “Airport Noise and Emission Regulations,” http://www.boeing.com/commercial/noise/list.page

[6] Skybrary.aero, “Noise Preferential Routes,” www.Skybrary.aero

[7] European Commission, “Commission Regulation (EC) No 859/2008,” European Commission, 2008

[8] Civil Aviation Authority, “CAP1691 Departure Noise Mitigation: Main Report,” Civil Aviation Authority, 2018

[9] ICAO, “CCO Manual (DOC 9993),” ICAO

[10] ICAO, “CDO Manual (Doc 9931),” ICAO, 2010

[11] EUROCONTROL, “Continuous Climb and Descent Operations,” https://www.eurocontrol.int/concept/continuous-climb-and-descent-operations, 2020

[12] Skybrary.aereo, “Continuous Descending Operations,” www.skybrary.aereo.

[13] Heathrow Airport Limited, “SSA Consultation Document,” Heathrow Airport Limited, 2021

[14] CAA, “Steep Approach Approval Compliance Statement and Checklist.,” CAA, 2019

[15] Skybrary.aero, “Ground Based Augmentation System,” www.Skybrary.aero

[16] ICAO, “PBN Manual (Doc 9613),” ICAO, 2008

[17] CANSO, “Use of Performance based Navigation for Noise Management,” CANSO, 2020

[18] ICAO, “Airport Planning Manual Part II - Land Use and Environmental Management (DOC 9184),” ICAO, 2018

[19] ICAO, “Assembly Resolution A39-1, Appendix F

[20] Civil Aviation Authority, “R&D Report 9850: Night Time Ground Noise,” Civil Aviation Authority, 1998

[21] Noise Consultants Limited, “Noise Insulation Schemes in Europe,” 2020

[22] Noise Consultants Limited, “Examples and Current Trends in Noise-Related Operating Restrictions,” 2019

6 PRELIMINARY ASSESSMENT BY ANCA

This section provides a summary of:

- The noise problem as identified following ANCA's preliminary assessment.
- The requirement for an NAO.
- The role of the NAO.
- The NAO defined by ANCA for Dublin Airport.

6.1 Introduction

Following the referral of the Application to ANCA on 23 December 2020 by the Planning Authority of Fingal County Council, ANCA commenced its preliminary assessment through a screening exercise to identify whether the Application may give rise to a noise problem at Dublin Airport.

The screening exercise was supported by technical reviews undertaken by ANCA's experts. Copies of the documents and material supporting the preliminary assessment can be found in Appendix C. The outcome of that screening exercise was a determination by ANCA that a noise problem would arise if the Application is granted as proposed.

Following that determination, an NAO was defined, and is the subject of consultation along with the DRD. A report documenting the development of the NAO for Dublin Airport can be found in Appendix D.

6.2 Implications of the Application on Airport Operations

The preliminary assessment and screening exercise presented in Appendix C identified the implications of the Application on aircraft noise and highlighted recent trends in aircraft noise exposure using data provided with the Application and from the NAP. With respect to changes in the operation of Dublin Airport, the Application was found to result in:

- An increase in night time air traffic movements.
- A potential change in the night time airport fleet mix.
- Accelerate the recovery of Dublin Airport back to its pre pandemic numbers by around two years (from c. 2027 to 2025).

- Enable the use of the north runway and change the use of Dublin Airport's airspace at night.

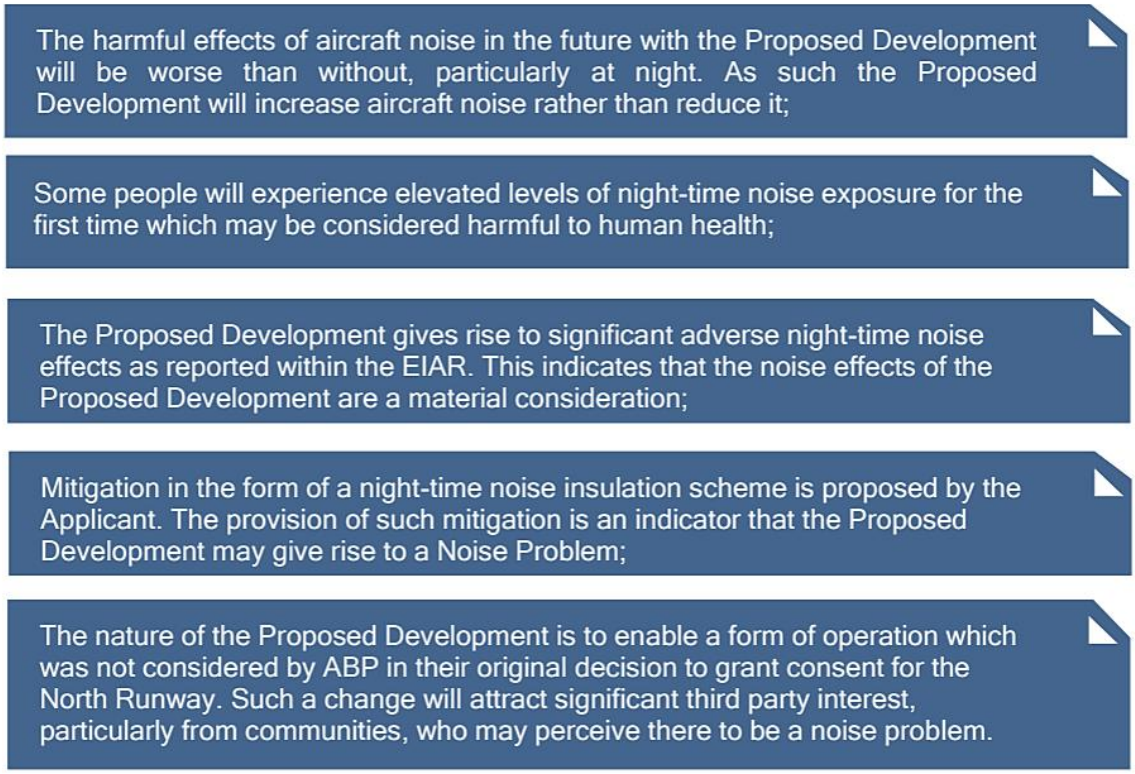
Whilst these implications were identified, ANCA noted that the Application is seeking to amend noise-related operating restrictions which are yet to apply to Dublin Airport but would come into force with the commencement of operations from the north runway. As such, the impact of these restrictions would be to limit Dublin Airport's ability to operate in the same way in which it can in its current form as a two-runway operation.

Having regard to the above factors, ANCA made a number of observations with respect to changes in aircraft noise exposure as a result of the Application.

6.3 Implications of Aircraft Noise Exposure

Based on the information provided in the NAP and with the Application, ANCA and its experts noted that over the period 2006 to 2019, noise exposure levels at Dublin Airport had been increasing, particularly at night. However, it was recognised that the Covid-19 pandemic has significantly reduced noise exposure from its peak 2019.

With respect to the impact of the Application itself and having regard for the implications of the relevant action, ANCA and its experts made a number of observations. These are summarised below.



[62]

6.4 Aspects of the Noise Problem determined by ANCA

Having regard for the outcomes of the preliminary assessment set out above, ANCA prepared a recommendation report for ascertaining a noise problem at Dublin Airport[63]. This report was published in February 2021 and identified three aspects of a noise problem which may arise from the Application. These aspects are set out below.

Aspect 1 – The Application proposes an increase in aircraft activity at night, when referenced against the situation that would otherwise pertain, which may result in higher levels of human exposure to aircraft noise.

This situation requires detailed evaluation in the context of the combined intent of environmental noise legislation. The Application should be assessed to ascertain whether an

[62] Preliminary Noise Assessment Identifying a Noise Problem at Dublin Airport, see Appendix C.

[63] ANCA, Ascertaining a Noise Problem at Dublin Airport, Recommendation report arising from planning application F20A/0668 for a Relevant Action, February 2021

acceptable balance can be achieved between the effective functioning of the Airport and the protection of the environment through the application of the Balanced Approach.

Aspect 2 – The Application proposes a situation where some people will experience elevated levels of night time noise exposure for the first time which may be considered harmful to human health.

The Application seeks to enable a form of operation which was not considered by ABP in their original decision to grant consent for the north runway. A detailed assessment should be undertaken through the application of the Balanced Approach to ascertain the significance of the impact of a change in noise exposure arising from the Application for a relevant action.

Aspect 3 - The EIAR accompanying the Application indicates that the proposed relevant action will give rise to significant adverse night time noise effects. This indicates that the noise effects of the Proposed Development are a material consideration. Mitigation in the form of a night time noise insulation scheme is proposed by the Application. The provision of such mitigation is an indicator that the Proposed Development may give rise to a Noise Problem.

This situation requires detailed evaluation in the context of the combined intent of environmental noise legislation. The Application should be assessed to ascertain whether an acceptable balance can be achieved between the effective functioning of Dublin Airport and the protection of the environment through the application of the Balanced Approach.

Based on the three aspects outlined above, ANCA prescribed the following:

1. The determination of a noise problem at Dublin Airport, in the context of the Act of 2019 and the Aircraft Noise Regulation, arising from the Application.
2. The establishment of an NAO for Dublin Airport.
3. The commencement of the process of aircraft noise regulation prescribed by Section 34C of the Act of 2000 including the application of ICAO Balanced Approach.

6.5 Requirement for a Noise Abatement Objective

ANCA is required to commence the process of aircraft noise regulation as prescribed under Section 34C of the Act of 2000 following the identification of a noise problem. This process requires ANCA

to adopt the Balanced Approach to assess any noise mitigation measures or operating restrictions that may be required to address the noise problem. As highlighted in this report, the application of the Balanced Approach requires a NAO to be defined for Dublin Airport. As such, a NAO is required for ANCA to perform its functions under the Act of 2019.

6.6 Role of the Noise Abatement Objective

As highlighted above, a primary role of the NAO is to facilitate the application of the Balanced Approach, while having regard to the wider legislative and policy context

ANCA prepared the NAO Report, which sets out the background and setting of an NAO for Dublin Airport. The NAO Report is included at Appendix D of this Draft Regulatory Decision Report, and may be referred to in the context of consultation on the NAO.

The NAO Report states that:

"The Noise Abatement Objective (NAO) is a policy objective for managing the effects of aircraft noise emissions on the surrounding communities and environment at an airport where a noise problem has been identified. It is a plan to ensure that development at Dublin Airport occurs in the most sustainable manner possible to minimise the impact of aircraft noise."

In this sense, and as well as being required to support the application of the Balanced Approach, the NAO can be used to guide decisions that are needed to manage the aircraft noise aspects of future aircraft operations at Dublin Airport.

6.7 A Noise Abatement Objective for Dublin Airport

ANCA has developed an NAO for Dublin Airport and is undertaking consultation on this. The NAO is provided in Appendix D.

7 NOISE ASSESSMENT BY ANCA

This Chapter sets out the noise assessment carried out by ANCA in relation to the Application. In carrying out this assessment, ANCA has considered the documents and data supplied by the Applicant as recorded in Appendix A (including in response to ANCA's Direction to Provide Information).

This section also outlines the current inventory of noise management measures in place at Dublin Airport in line with the Balanced Approach; describes the NAO and aspects of the noise problem relevant to ANCAs Assessment.

7.1 Introduction

To support the reading of this section, Appendix E summarises the scenarios which have been modelled by the Applicant. In particular, Appendix E summarises the various forecast scenarios and runway use and restriction scenarios which have been considered.

All aircraft noise modelling relied on in this assessment has been carried out by the Applicant and reviewed by ANCA having regard for the methodology and approach taken by the Applicant and their consultants. Under the European Communities (Environmental Noise) Regulations S.I. 549 of 2018, the Applicant is designated as the noise-mapping body for the preparation and revision of strategic noise maps at Dublin Airport. As such, the Applicant has a statutory role in the preparation of information under the regulatory framework. Commentary on the Applicant's modelling is provided in Appendix F.

This section specifically:

- Provides a Description of Dublin Airport.
- Reports the Current Inventory of noise management measures in place in line with the Balanced Approach.
- Describes the NAO and the aspects of the noise problem relevant to ANCA's assessment.
- Sets out the Forecast Without New Measures scenario, which outlines the noise outcomes that are forecast in the absence of the measures and operating restrictions which are the subject of the Application.
- Presents ANCA's application of the Balanced Approach. This section provides a review of the measures available to reduce aircraft noise and those which have been taken forward for further assessment and analysis of cost-effectiveness. This section specifically reviews

the measures having regard to information provided by the Applicant and the assessment by ANCA. This section also reviews the performance of new measures against the NAO and aspects of the noise problem.

- Presents the wider environmental assessment which have been prepared in support of ANCA's assessment.
- Presents the cost-effectiveness assessment of the measures identified by ANCA.

7.2 Description of Dublin Airport

7.2.1 Current Situation

Dublin Airport is located approximately 10 km north of Dublin City Centre, and c.5km from the County town of Swords near the M50 and M1 motorways. It consists of lands of over 1,000 hectares and currently has two operational runways:

- The main 10/28 south runway (2,637m long) which runs in an east-west direction.
- The cross-wind runway 16/34 (2,072m long) which lies on a north-west to south-east orientation.

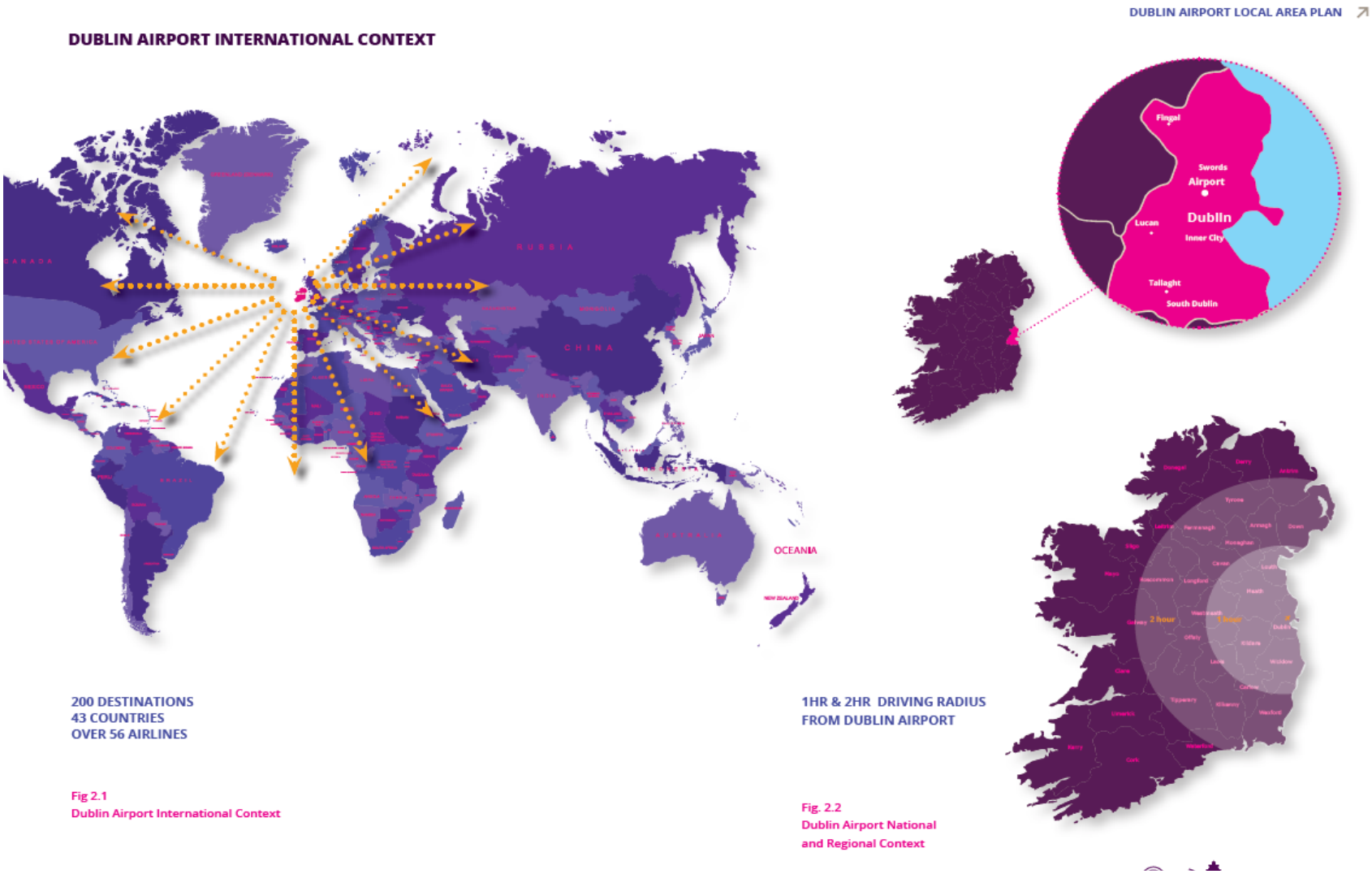


Figure 7.1: Dublin Airport International, National and Regional Context (Source: Dublin Airport Local Area Plan 2020)

The Noise Action Plan presents the current arrival and departure paths taken by aircraft using Dublin Airport. These are reproduced in Figure 7.2 and Figure 7.3 below.

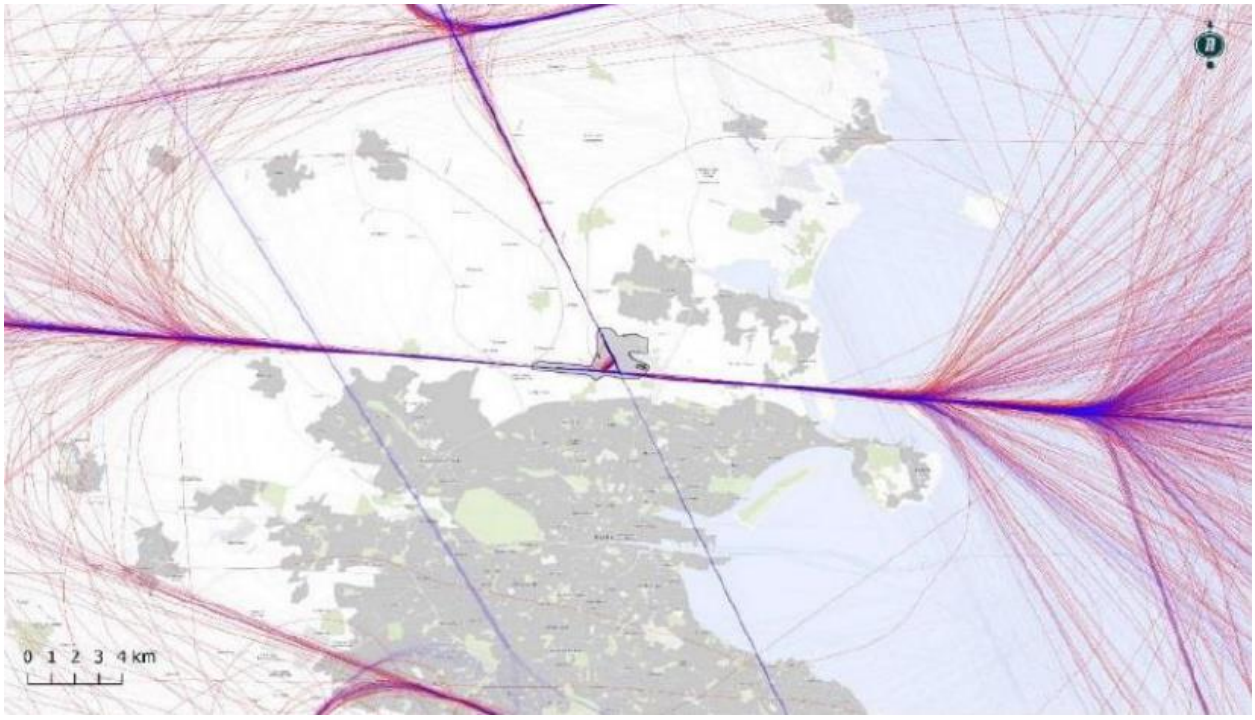


Figure 7.2: Dublin Airport Arrival Flight Paths are presented in the Dublin Airport Noise Action Plan 2018-2023 (Figure 5)

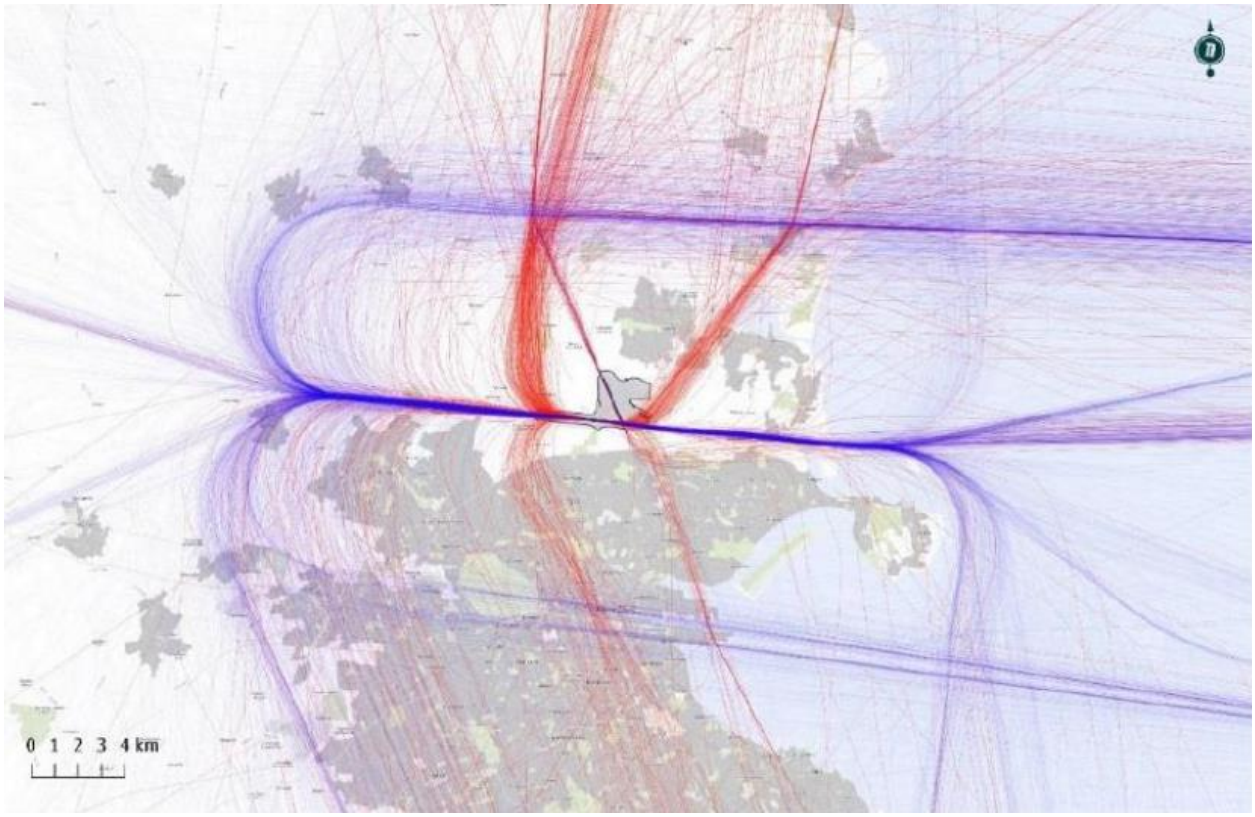


Figure 7.3: Dublin Airport Departure Flight Paths as presented in the Dublin Airport Noise Action Plan 2018-2023 (Figure 6)

The most recent data provided by the Central Statistics Office (CSO) shows that Dublin Airport handled 7.3 million passengers during 2020. This is down from a peak of almost 32.7 million passengers across 114,626 flight movements during 2019, due to the Covid-19 pandemic.

Dublin Airport is home to two major carriers, Ryanair and Aer Lingus which comprise most of the aircraft movements at Dublin Airport. Table 1 below summarises the fleet mix at Dublin Airport in 2019 as reported by the Applicant . This reporting has been expanded by ANCA to indicate the aircraft generation and respective noise chapter in this report.

Table 7.1: Fleet mix for Dublin Airport in 2019

Annual Movements in 2019						
Aircraft Type	Noise Chapter	Generation	Annual Day	Annual Eve	Annual Night	Annual 24hr
Airbus A300	3	G0	0	0	0	0
Airbus A306	4	G0	162	301	377	840
Airbus A319	4	G0	3,159	911	370	4,440
Airbus A320	4	G0	41,840	10,109	6,796	58,745
Airbus A320neo	14	G1	1,000	119	13	1,132
Airbus A321	3	G0	5,461	907	1,086	7,454
Airbus A321neo	14	G1	619	87	158	864
Airbus A330	4	G0	8,905	40	2,031	10,976
Airbus A330neo	14	G1	0	0	0	0
Airbus A350	14	G1	214	0	220	434
ATR 42	4	G0	2,124	273	2	2,399
ATR 72	4	G0	14,398	2,481	1,089	17,968
BAe 146/Avro RJ	14	G0	4,280	767	207	5,254
Boeing 737-400	4	G0	196	547	527	1,270
Boeing 737-500	4	G0	89	1	4	94
Boeing 737-700	4	G0	1,001	298	104	1,403
Boeing 737-800	4	G0	58,447	18,855	12,136	89,438
Boeing 737 MAX	14	G1	251	6	103	360
Boeing 757	4	G0	2,939	23	528	3,490
Boeing 767	3	G0	1,845	541	693	3,079
Boeing 777	4	G0	1,536	587	1,121	3,244
Boeing 777X	14	G1	0	0	0	0
Boeing 787	14	G1	2,576	63	947	3,586
Bombardier CS300	14	G1	1,030	5	3	1,038
Bombardier Dash 8	14	G0	2,363	921	6	3,290
Convair 580	N/A	G0	0	0	0	0
Embraer E190/195	4	G0	4,323	940	275	5,538
Embraer E190-E2	14	G1	10	0	0	10
HS748A	3	G0	0	0	0	0
Lockheed C130	3	G0	0	0	0	0
McDonnell Douglas	4	G0	6	0	0	6

MD83	4	G0	2	0	0	2
Piper PA34	10	G0	0	0	0	0
Shorts SD330/360	N/A	G0	0	0	0	0
Other	N/A	G0	9,155	19,69	524	11,648
Total			**167,931**	**40,751**	**29,320**	**238,002**

The annual average day, evening, night and 24-hour fleet mix for 2019 is summarised in Table 7.2 below.

Table 7.2: Fleet mix for 2019 by Noise Chapter and Generation

ICAO Chapter	Annual Day	Annual Eve	Annual Night	Annual 24hr
3	4.4%	3.6%	6.1%	4.4%
4	82.8%	86.8%	86.5%	84.0%
14	7.4%	4.8%	5.7%	6.7%
N/A	5.5%	4.8%	1.8%	4.9%
Generation	**Annual Day**	**Annual Eve**	**Annual Night**	**Annual 24hr**
G0	96%	99.3%	95.1%	96.9%
G1	3.4%	0.7%	4.9%	3.1%
G2	0.0%	0.0%	0.0%	0.0%
N/A	0.0%	0.0%	0.0%	0.0%

Table 7.2shows that over the course of 2019, Dublin Airport operated 29,320 aircraft movements during the night. These movements were not subject to any form of operating restriction and translate to approximately 80 movements per night over the 2019 calendar year. Data provided by the Applicant shows that over the summer months i.e., between mid-June and mid-September that the average number of aircraft movements at night was approximately 103.

The data presented in Table 7.2 shows that over the calendar year, the fleet mix at Dublin Airport was mainly comprised of Chapter 4[64] aircraft. In 2019, around 3.1% of the total operations were from the latest generation of aircraft i.e., Generation 1, Chapter 14 certified types.

Noise exposure data has been reported by the applicant for 2019. This data is summarised in Table 7.3 below.

Table 7.3: Noise exposure statistics for the current situation (2019)

Metric	Value	Population Exposure
L_{den}	>45	754,135
	>50	174,146
	>55	34,097
	>60	6,279
	>65	285
	>70	31
	>75	6
L_{night}	>40	344,912
	>45	59,307
	>50	13,838
	>55	1,533
	>60	110
	>65	13
	>70	0
Highly Annoyed (>45 dB L_{den})	Total	170,231
Highly Sleep Disturbed (>40 dB L_{den})	Total	61,298

Noise exposure contours for 2019 for the L_{den} and L_{night} metrics are presented in Figure 7.4 and Figure 7.5 respectively.

[64] The aim of the Chicago Convention Chapters is to ensure that the latest available noise reduction technologies are used for the design of new aircraft.

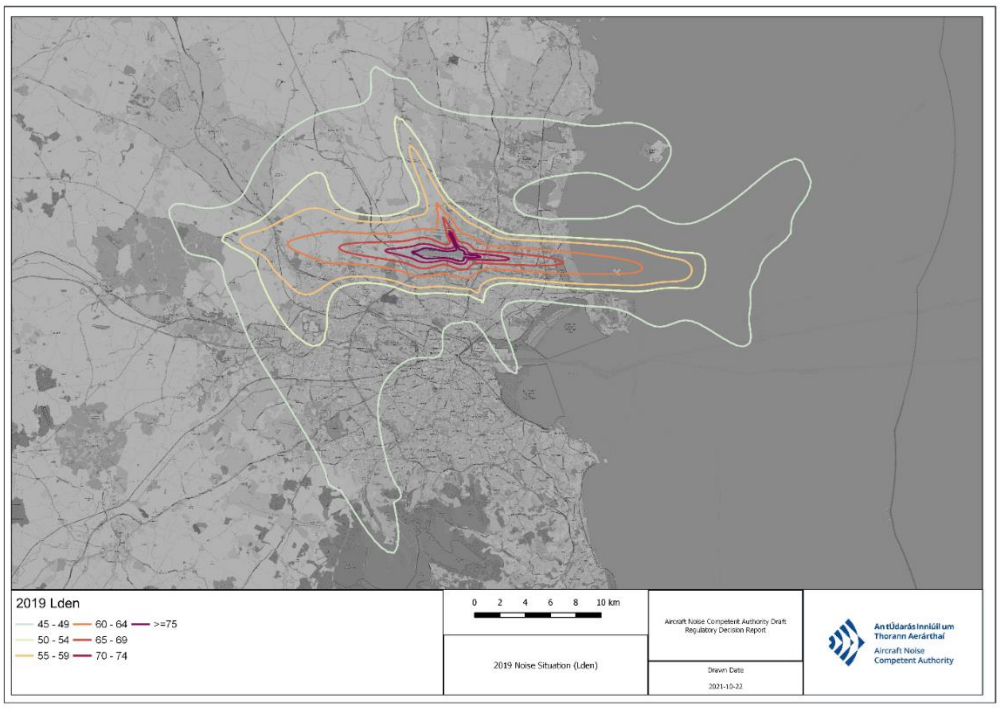


Figure 7.4: Day-evening-night Noise Exposure in 2019 (L_{den})

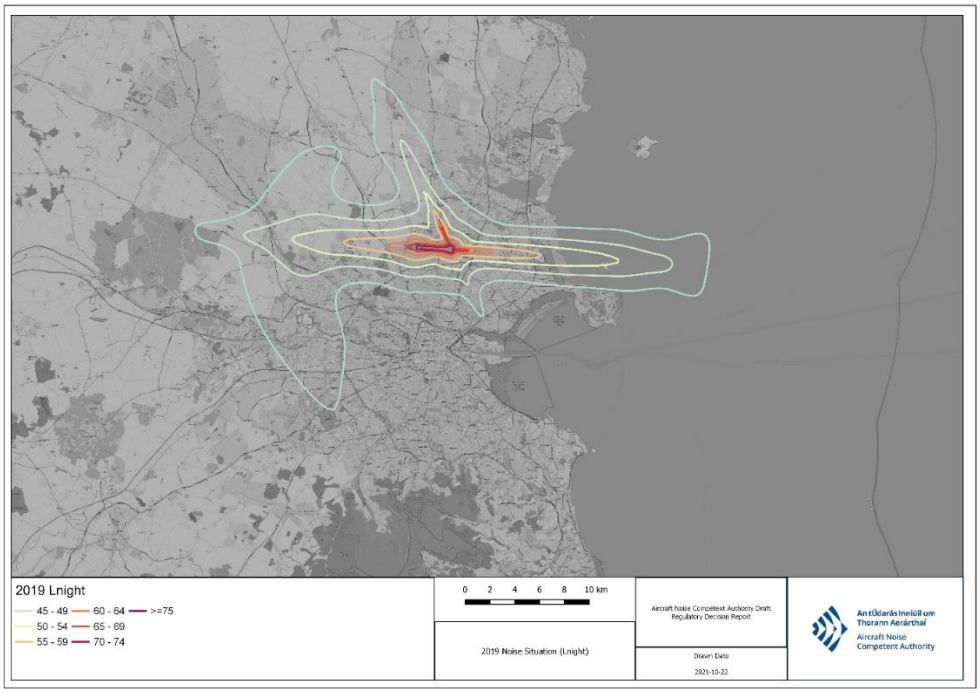


Figure 7.5: Night Noise Exposure in 2019 (L_{night})

The Covid-19 pandemic has resulted in a significant drop in air traffic and passenger numbers at Dublin Airport during 2020 and into 2021 which will have had a consequential effect on noise exposure. This outcome is reflected in a forecast situation provided by the Applicant for 2022, as is discussed below.

The Application discusses the relevant action in the context of recovery from the Covid-19 pandemic and how the recovery also coincides with the commencement of operations from the north runway[65].

The North Runway Planning Permission grants the Applicant permission to build a 3,110m long runway approximately 1.6 km north of the main existing 'south runway'. As noted above, that permission was granted in 2007. Construction of the new runway commenced in December 2016 and is due to be completed in 2022.

Table 7.4: Overview of planning consents

Fingal County Council Planning Authority Ref No.	An Bord Pleanála Ref No.	Permission Sought
F04A/1755	PL 06F.217429	10-year permission until August 2017
F04A/1755/E1		5 Year Extension of Duration until August 2022
F19A/0023	PL 06F.305298	Amendments to north runway

7.2.2 Evolution of the Noise Climate

This chapter considers the evolution of the noise climate without the relevant action as proposed in the Application. The analysis presented in this section commences with the noise situation in 2016 as this is the year for which noise exposure data was last reported under the ENR. It should be noted that at the request of ANCA the data presented in this section for 2016 has been updated by the Applicant[66]. This is to allow a direct comparison of noise exposure in 2016 given methodological changes, namely the use of a different noise model implementing ECAC Doc. 29

[65] Tom Phillips and Associates, Planning Report, Planning Application for a Proposed Relevant Action (S.34C OF P&D ACTS) to amend/replace operating restrictions set out in Conditions No. 3(d) and No. 5 of the North Runway Planning Permission (ABP Ref, No. PL06F.217429) as well as proposing new noise mitigation measures at Dublin Airport, Co. Dublin.

[66] CA452_1.0 ANCA Reporting Template 2021 Update - 2016 END.xlsx

3rd Edition, as was used to report 2016 data through the ENR. This is the predecessor to ECAC Doc. 29 4th Edition as adopted through Directive 2015/996.

The commencement of north runway operations requires compliance with 31 planning conditions attached to the planning permission which includes a range of noise mitigation measures, operating restrictions, and monitoring requirements.

Conditions 3, 4 and 5 of the North Runway Planning Permission set conditions on how Dublin Airport can use its runways during the day and night. With the commencement of north runway operations, Conditions 3, 4 and 5 have the effect of redistributing noise around Dublin Airport as well as placing restrictions on aircraft operations occuring during the night time period.

The Applicant expects *"strong sustained growth"* of passenger numbers post pandemic[67]. Without the relevant action, the forecast situation is that Dublin Airport will return to 32 mppa by 2027[68] even whilst operating as a three-runway system where during the night Dublin Airport will be restricted to no more than 65 aircraft movements on average with restricted use of the north runway.

ANCA has examined forecasts up to 2040 assuming that the 32 mppa terminal passenger capacity limit remains in place and that no relevant action is taken i.e., the Forecast Situation. Table 7.5 presents a summary of the historic and forecast aircraft movements and passenger numbers.

Table 7.5: Forecast and historic aircraft movements

	Annual Passengers	Annual Aircraft Movements			Summer Aircraft Movements	
Year	**24-hour**	**Day**	**Evening**	**Night**	**Day**	**Night**
2016	27.8	15,2283	36,938	24,753	53,188	7,800
2019	32.9	167,931	40,751	29,320	58,163	9,445
2022	19.6	115,668	34,851	15,322	45,170	4,598

[67] Page 16, Tom Phillips and Associates, Planning Report, Planning Application for a Proposed Relevant Action (S.34C OF P&D ACTS) to amend/replace operating restrictions set out in Conditions No. 3(d) and No. 5 of the North Runway Planning Permission (ABP Ref, No. PL06F.217429) as well as proposing new noise mitigation measures at Dublin Airport, Co. Dublin.

[68] Dublin Airport Operating Restrictions, Quantification of Impacts on Future Growth, Updated analysis in response to ANCA RFI, Version 1.2 (Final) May 2021

2025	30.4	163,653	43,598	19,521	57,432	5,410
2030	32.0	171,787	44,574	19,521	59,956	5,410
2035	32.0	171,787	44,574	19,521	59,956	5,410
2040	32.0	171,787	44,574	19,521	59,956	5,410

Table 7.5 shows that the Applicant expects Dublin Airport will recover from the pandemic and without new measures would reach 30.4 mppa in 2025. By 2030, Dublin Airport is forecast to have fully recovered to 32 mppa from which point the number of aircraft movements is forecast to stabilise.

Forecasts provided by the Applicant show that at night, the total number of night time movements would reach 19,521 where the 32 mppa terminal passenger capacity limit remains in place. The situation from 2025 is that the number of night time aircraft movements would be around a third lower than the number which occurred in 2019. During the summer months, the Applicant forecasts an average of approximately 59 movements during the night time period from 2025, a reduction from approximately 103 in 2019.

Noise exposure forecasts have been provided by the Applicant for the scenarios described above. These are reported in Table 7.6 below for the L_{den} and L_{night} metrics and assume no population growth.

Table 7.6: Noise exposure data for the noise situation in 2016 and 2019, and for the forecast situation in 2022, 2025, 2030, 2035 and 2040

Year	Value	2016 27.8 mppa	2019 32.5 mppa	2022 19.6 mppa	2025 30.4 mppa	2030 32.0 mppa	2035 32.0 mppa	2040 32.0 mppa
L_{den}	>45		754,135	336,611	421,417	331,456	217,006	175,709
	>50		174,146	77,349	96,889	76,873	55,979	45,276
	>55	20,286	34,097	12,850	19,213	14,326	9,630	8,130
	>60	1,781	6,279	1,513	2,006	1,641	1,486	1,391
	>65	299	285	94	119	100	71	63
	>70	31	31	13	19	13	6	0
	>75	6	6	0	0	0	0	0
L_{night}	>40		344,912	138,421	163,476	135,151	81,373	68,662

	>45		59,307	27,964	33,932	28,348	21,201	18,582
	>50	6643	13,838	3,482	6,080	4,486	3,280	3,071
	>55	431	1,533	222	280	243	203	184
	>60	56	110	28	31	31	23	19
	>65	10	13	0	6	0	0	0
	>70	0	0	0	0	0	0	0
Highly Annoyed	Total	n/a	170,231	50,603	64,241	50,243	33,437	27,105
	% reduction compared to 2019	n/a	0%	70.3%	62.3%	70.5%	80.4%	84.1%
Highly Sleep Disturbed	Total	n/a	61,298	18,789	22,500	18,461	11,374	9669
	% reduction compared to 2019	n/a	0%	89.0%	86.8%	89.2%	93.3%	94.3%

Table 7.6 illustrates that compared the 2019 situation and assuming no population growth that the population exposure to aircraft noise in the forecast situation, along with the numbers of people HA and HSD would reduce significantly. With Dublin Airport forecast to operate relatively stable numbers of aircraft movements from 2025 as a 32 mppa operation, this reduction would be driven by improvements in its fleet mix. To articulate this, Table 7.7 presents the proportion of aircraft within each noise generation category and in the forecast situations.

Table 7.7: Forecast fleet mix by Generation in 2022, 2025, 2030, 2053, and 2040

	24-Hour Annual			Night (23:00-07:00)		
Generation / Year	G0	G1	G2	G0	G1	G2
2022	91.3%	8.7%	0.0%	92.2%	7.8%	0.0%
2025	77.3%	22.7%	0.0%	85.0%	15.0%	0.0%
2030	51.0%	49.0%	0.0%	58.3%	41.7%	0.0%
2035	32.4%	67.6%	0.0%	33.3%	66.7%	0.0%
2040	16.7%	83.3%	0.0%	18.3%	81.7%	0.0%

Table 7.7 shows that over the period from 2022 to 2040, the Applicant is forecasting that G1 aircraft types would increase as a proportion of the overall fleet mix. No G2 aircraft are forecast. This is considered a generally conservative approach for the forecast years of 2035 and 2040

however ANCA's experts do broadly agree with the Applicant's fleet assumptions (see Appendix G). Nevertheless, the forecast reductions in population HA and HSD as presented in Table 7.6 are attributable to a reduction of noise at source through the introduction of quieter, G1, aircraft types.

7.3 Current Inventory

An inventory of the noise management measures in place at Dublin Airport has been provided by the Applicant and reviewed by ANCA. These measures are summarised in the following sections and are presented with respect to the categories of measures under the Balanced Approach.

7.3.1 Existing and Upcoming Noise Mitigation Measures

7.3.1.1 Reduction of Noise at Source

There are currently no specific measures seeking to reduce noise at source at Dublin Airport. However, Actions 1 and 2 of the Dublin Airport Noise Action Plan 2019-2023[69] ('the NAP') relate to initiatives which seek to promote and introduce quieter aircraft. These initiatives are set out in Table 7.8 below.

Table 7.8: Actions relating to the Reduction of Noise at Source as reported in the Dublin Airport NAP

Action	Description	KPI	When
1	Encourage daa to work with airline partners to introduce quieter aircraft, particularly at night – including consideration of incentives	Report	Annually
2	Encourage daa to promote quieter aircraft through incentives such as FlyQuiet programmes.	Report	Ongoing

The Applicant has provided an update on these actions[70] in response to the Direction to Provide Information. This response indicates that these actions are being addressed through an Environmental Charging Scheme and that an initial consultation on this was held with airlines in November 2020.

[69] Fingal County Council, Noise Action Plan for Dublin Airport, 2019 – 2023, December 2018

[70] Dublin Airport North Runway Relevant Action Application, Draft – Initial Response to ANCA Request for Further Information, June 2021, Appendix I

The Applicant has indicated that this scheme would be fully implemented during the Winter 2021/22 season. The Applicant has proposed that the Environmental Charging Scheme be informed by operational statistics, which will be available from Dublin Airport's new Airport Noise and Operations Monitoring System (ANOMS) and its Noise and Flight Track Management System (NFTMS).

ANCA is not party to the details of the proposed Environmental Charging Scheme and its incentives but is supportive of such initiatives which seek to promote and encourage the use of quieter aircraft at Dublin Airport. In the absence of the relevant action, and as is presented in Table 7.7, the Applicant is forecasting a change in fleet mix which that would see quieter aircraft introduced into the fleet. What is less clear is what influence the Environmental Charging Scheme would have on this outcome beyond organic fleet modernisation.

7.3.1.2 Noise Abatement Operating Procedures

The Applicant has identified eight noise abatement (NA) operating procedures which are currently in place at Dublin Airport. These procedures are set out in Table 7.9 below.

Table 7.9: Current inventory of Noise Abatement (NA) Operating Procedures (two-runway system)

Reference	Description
NA-01	**Two-runway Preferential Runway Programme** The aim of the measure is to use the runways in order to allow aircraft to avoid noise-sensitive areas during the phases of take-off and landing. The measure is subject to operational conditions, such as crosswind or tailwind component speed values over a certain threshold. During the daytime (06:00-23:00) RWY 28 and RWY 10 are the preferential runways. During the night time (23:00-06:00) runways will be prioritised for noise abatement purposes, when, subject to operational conditions, runway use is prioritized as follows: Arrival: 1st RWY 10, 2nd RWY 16, 3rd RWY 28, 4th RWY 34 Departure: 1st RWY 28, 2nd RWY 34, 3rd RWY 10, 4th RWY 16
NA-02	**Two-Runway Noise Preferential Routes (NPRs) or Environmental Noise Corridors and Track Keeping** The aim of the measure is to reduce overall impacts by directing aircraft along flight paths which are designed to avoid built-up areas. These paths are called Noise

	Preferential Routes (NPRs). All Aircraft taking off from Dublin Airport are required to follow specific NPRs. Once an aircraft reaches the end of the NPR, or at an altitude of 3,000 feet, the Irish Aviation Authority (IAA) Air Traffic Control (ATC) will begin turning aircraft onto a direct route to its destination.
NA-03	**Noise Abatement Departure Procedures (NADP) Climb Profile** On departure there are two noise abatement procedures where a stepped departure climb is being used. They are called "NADP 1" and "NADP 2". The NADP are based on the guidance included in ICAO's Procedures for Air Navigation Services Aircraft Operations Document 8168 Volume 1. This measure requires the use of NADP 2 with thrust cutback at 1,500 feet. The Applicant has provided details in response to the Direction to Provide Information to indicate the performance of the NADP in place at Dublin Airport[71].
NA-04	**Visual Approach** This measure is made by two parts: • Jet aircraft on visual approach must start the final approach procedures prior to reaching a distance from touchdown not lower than six nautical miles. • Jet aircraft on visual approach must follow a descend path higher or equal than the ILS approach path.
NA-05	**Continuous Decent Approach (CDA)** CDA is a procedure in which an aircraft descends from an optimal position with minimum thrust and avoids inefficient segments of level flight and keeps the aircraft as high as possible for as long as possible. This procedure is currently in place at Dublin Airport and aims to reduce the noise on the ground. The Applicant has confirmed that the current procedure is managed by the IAA in their role as the Air Navigation Service Provider (ANSP). Details of the CDA procedure were provided by the Applicant in response to the Direction to Provide Information[72].

[71] Dublin Airport North Runway Relevant Action Application, Draft – Initial Response to ANCA Request for Further Information, June 2021, Appendix J and RFI 118 Response

[72] Dublin Airport North Runway Relevant Action Application, Draft – Initial Response to ANCA Request for Further Information, June 2021, Appendix I and RFI 119 Response

NA-06	**Continuous Climb Operations (CCO)** CCO is a procedure designed to avoid inefficient segments of level flight during the climb profile reducing the noise experienced on the ground and fuel consumption. The Applicant has confirmed that the airspace designs at Dublin Airport facilitate this with the support of Air Traffic Control (ATC). Details of the CCO procedure were provided by the Applicant in response to the Direction to Provide Information[73].
NA-07	**Reverse Thrust** To reduce the night time noise impact, reverse thrust procedure must not be used at night, unless required for safety reasons. Reverse thrust is a temporary diversion of an aircraft engine's thrust used to help the deceleration of aircraft on landing. This noise abatement procedure is reported within the AIP[74].
NA-08	**Engine Ground Running** In order to reduce noise impact during the most noise sensitive hours, any engine tests are not allowed to be undertaken between 20:00 and 07:00. Only aircraft smaller than aircraft Code C are allowed to perform engine tests between 07:00 and 09:00. The rest of the aircraft types are allowed to perform tests only after 09:00. The AIP sets out specific locations and operational hours for aircraft engine test runs. Permission for all such tests need to be obtained from Dublin Airport[75].

The Applicant has noted that all noise abatement operating procedures in place at Dublin Airport are subject to monitoring and reporting. ANCA as the Competent Authority is responsible for monitoring compliance with noise mitigation measures and operating restrictions, and the introduction of operating restrictions at Dublin Airport.

NA-01 to NA-08 relate to measures currently in place at Dublin Airport in its current form as a two-runway system. With the commencement of north runway operations, the current two-runway preference (NA-01) and associated noise preferential routes (NA-02) will be replaced by the three-runway operating preference described in Condition 3 of the North Runway Planning Permission with associated NPRs coming into place. As such, abatement measures NA-01 and NA-02 will be replaced with NA-09 and NA-10 as described in Table 7.10 below.

[73] Dublin Airport North Runway Relevant Action Application, Draft – Initial Response to ANCA Request for Further Information, June 2021, RFI 125 Response

[74] Aeronautical Information Publication, EIDW AD 2-1, EIDW AD 2.21 NOISE ABATEMENT PROCEDURES, Paragraph 7

[75] Aeronautical Information Publication, EIDW AD 2-1, EIDW AD 2.20 LOCAL TRAFFIC REGULATIONS, Paragraph 5

Table 7.10: Current inventory of noise abatement operating procedures (three-runway system)

Reference	Description
NA-09	**Three-Runway Preferential Runway Programme** The aim of the measure is to use the runways in order to allow aircraft to avoid noise-sensitive areas during the phases of take-off and landing. During the daytime (06:00-23:59), preferable runways are selected based on wind directions and type of operation: • Westerly wind direction: RWY 28L for arrival and RWY 28L or 28R for departure operations. • Easterly wind direction: RWY 10L or 10R for arrival and RWY 10R for departure operations. During the night time (00:00-05:59) the south runway (10L-28R) must be avoided for any operations. The procedures above are subject to operational condition and safety reasons.
NA-10	**3-Runway Noise Preferential Routes (NPRs) or Environmental Noise Corridors and Track Keeping** The aim of the measure is to reduce impact by directing aircraft along paths which are designed to avoid built-up areas. These paths are called Noise Preferential Routes (NPRs). All Aircraft taking off from Dublin Airport are required to follow specific NPRs. Once an aircraft reaches the end of the NPR, or at an altitude of 3,000 feet, IAA-ATC will turn it onto a more direct heading to its destination.

7.3.1.3 Land Use Planning

The Applicant has identified five land use planning and management measures currently in place at Dublin Airport. These measures have been confirmed by ANCA and are set out in Table 7.11 below.

Table 7.11: Current inventory of land use planning and management measures (two runway system)

Reference	Description
LU-01	**Land Use Compatibility Management Framework** A noise zoning system has been developed and included in the Fingal County Council's (FCC's) County Development Plan 2017–2023 (Variation No. 1) and the

	Dublin Airport 2020 Local Area Plan (LAP). The goal of the zoning system is to ensure that land use is compatible with airport operations preventing, also, noise and safety concerns for surrounding communities. For Dublin Airport, the zones are based on potential noise exposure levels ($L_{Aeq,16hr}$ and L_{night} levels) due to Dublin Airport using either the new north or existing south runway.
LU-02	**Land Use Compatibility Management Review** The Applicant has stated in its inventory that Dublin Airport constantly reviews land-use policies in relation to aircraft noise related to the Dublin Airport activities[76]. ANCA has no reasons to challenge that the Applicant does not undertake such reviews as they relate to Dublin Airport.
LU-03	**Encroachment Management** The Applicant states that it monitors noise encroachment associated with Dublin Airport to ensure airport noise policy is appropriately informed through land-use planning frameworks[77]. The NAP also includes Action 4 which is to *"Monitor noise encroachment associated with Dublin Airport to ensure that airport noise policy is appropriately informed through land use planning frameworks in so far as they relate to Dublin Airport.".* The main KPI for this action is an Encroachment Analysis Report which is to be produced from 2019 onwards.
LU-04	**Sound Insulation (HSIP)** This is a voluntary sound insulation scheme has been offered to households located within the 2016 63 dB $L_{Aeq,16hr}$ noise contour. ANCA has already undertaken a review of this scheme to confirm eligibility. The extents of this scheme are presented in Appendix H along with details of the scheme itself.
LU-05	**Voluntary Dwelling Purchase Scheme** A Voluntary Purchase Scheme has been offered to households located within the predicted 69 dB $L_{Aeq,16hr}$ noise contour. Offers to purchase will include a 30% premium on the current market value of the residence, which will be evaluated based on the current activities at Dublin Airport, therefore, it will not be affected by the introduction of the new runway. The scheme will remain in effect until 2025.

[76] Ricondo, Dublin Airport North Runway 598/2014 (Aircraft Noise Regulation) Forecast Without New Measures and Additional Measures Assessment Report, Revision 1 – July 2021, Table 2-1

[77] Ricondo, Dublin Airport North Runway 598/2014 (Aircraft Noise Regulation) Forecast Without New Measures and Additional Measures Assessment Report, Revision 1 – July 2021, Table 2-1

	The extents of this scheme are presented in Appendix H along with details of the scheme itself.

With the commencement of north runway operations, the land use planning and management procedures currently in place at Dublin Airport will be expanded with three more procedures, which are set out in Table 7.12 below.

Table 7.12: Current inventory of land use planning and management measures (three runway system)

Reference	Description
LU-5	**Residential Noise Insulation Scheme (RNIS)** A Voluntary sound insulation scheme will be offered to households located within the 2022 63 dB $L_{Aeq,16hr}$ noise contour. Eligible properties must be completed before the new runway will be operational. This scheme is a requirement of Condition 7 of the North Runway Planning Permission. Condition 7 states that: *"Prior to commencement of development, a scheme for the voluntary noise insulation of existing dwellings shall be submitted to and agreed in writing by the planning authority. The scheme shall include all dwellings predicted to fall within the contour of 63 dB L_{Aeq16} hours within 12 months of the planned opening of the runway for use. The scheme shall include for a review every two years of the dwellings eligible for insulation."* The RNIS scheme was approved by FCC in 2016. Details of the scheme are available in Appendix H.
LU-6	**Schools Sound Insulation** A voluntary sound insulation scheme is available for all schools and registered pre-schools located within the predicted 60 dB $L_{Aeq,16hr}$ noise contour. This insulation is designed to grant that maximum noise levels within the school buildings shall not exceed 45 dB $L_{Aeq,8hr}$ where the 8-hour period relates to a "typical school day". This scheme is a requirement of Condition 6 of the North Runway Planning Permission which states: *"Prior to commencement of development, a scheme for the voluntary noise insulation of schools shall be submitted to and agreed in writing by the*

	planning authority (in consultation with the Department of Education and Science). The scheme shall include all schools and registered pre-schools predicted to fall within the contour of 60 dB $L_{Aeq\ 16\ hours}$ within twelve months of the planned opening of the runway to use and, in any event, shall include Saint Margaret's School, Portmarnock Community School, Saint Nicholas of Myra, River Meade and Malahide Road schools. The scheme shall be designed and provided so as to ensure that maximum noise limits within the classrooms and school buildings generally shall not exceed 45 dB $L_{Aeq\ 8\ hours}$ (a typical school day). A system monitoring the effectiveness of the operation of the scheme for each school shall be agreed with the planning authority and the results of such monitoring shall be made available to the public by the planning authority."

7.3.1.4 Operating Restrictions

At present, with Dublin Airport operating as a two-runway system and prior to the commencement of north runway operations, there are no operating restrictions in place at Dublin Airport limiting the hours or numbers of aircraft that can take off or land . However, with the commencement of north runway operations, two such operating restrictions will come into effect as set out in Table 7.13. The origin of these conditions was considered as part of ANCA's noise problem declaration which is provided in Appendix C.

Table 7.13: Current inventory of Operating Restrictions (OR) Three-runway System (as described in ICAO Doc 9829-AN/451)

Reference	Description
OR-01	**Night time Restriction on north runway Use (Condition 3(d) North Runway Planning Permission)** This restriction prohibits the use of the north runway during the hours of 23:00-07:00. This means that during the night time Dublin Airport is allowed to use only its South runway and crosswind runway when conditions dictate.
OR-02	**Night time Movement Restriction (Condition 5 North Runway Consent)** This condition sets an aircraft movement restriction of 65 per 8-hour night. Condition 5 states: *"On completion of construction of the runway hereby permitted, the average number of night time aircraft movements at the airport shall not exceed 65/night (between 2300 hours and 0700 hours) when measured over the 92*

	day modelling period as set out in the reply to the Direction to Provide Information received by An Bord Pleanála on the 5th day of March, 2007." This condition applies to Dublin Airport as a whole and not just the north runway.

7.4 Description of the NAO and aspects of the identified Noise Problem

The NAO for Dublin Airport policy objective is:

"Limit and reduce the long-term adverse effects of aircraft noise on health and quality of life, particularly at night, as part of the sustainable development of Dublin Airport."

The measures and outcomes that the NAO intends to achieve are key to the assessment undertaken by ANCA in this chapter. The NAO describes primary measurable criteria which relate to the number of people HSD and HA using the methodology described in Directive 2002/49/EC (as amended by Directive 2020/367), which is based on the WHO Environmental Noise Guidelines 2018. The NAO requires that these measures are calculated from 45 dB L_{den} and 40 dB L_{night} which reflect the WHO recommendations.

Priorities are also set by the NAO. These relate to levels of noise exposure where populations may experience harmful effects. These are:

- 55 dB L_{night} (a level of night time noise exposure described by the WHO as representing a clear risk to health)
- 65 dB L_{den} (where a large proportion of those living around Dublin Airport can be considered HA)

The NAO requires aircraft noise to be modelled in accordance with Directive 2015/996 having regard for local noise and track keeping performance.

Under the NAO, noise exposure should be reduced compared to the situation in 2019 so that:

- *The number of people highly sleep disturbed and highly annoyed in 2030 shall reduce by 30% compared to 2019.*
- *The number of people highly sleep disturbed and highly annoyed in 2035 shall reduce by 40% compared to 2019.*
- *The number of people highly sleep disturbed and highly annoyed in 2040 shall reduce by 50% compared to 2019.*

- *The number of people exposed to aircraft noise above 55 dB L_{night} and 65 dB L_{den} shall be reduced compared to 2019.*

This assessment undertaken in section has regard for these outcomes.

ANCA determined a noise problem based on the Application and provided the following three aspects for this:

> **Aspect 1:** The Application proposes an increase in aircraft activity at night, when referenced against the situation that would otherwise pertain, which may result in higher levels of human exposure to aircraft noise.
>
> **Aspect 2:** The Application proposes a situation where some people will experience elevated levels of night time noise exposure for the first time which may be considered harmful to human health.
>
> **Aspect 3:** The EIAR accompanying the Application indicates that the proposed relevant action will give rise to significant adverse night time noise effects. This indicates that the noise effects of the Proposed Development are a material consideration. Mitigation in the form of a night time noise insulation scheme is proposed by the Application. The provision of such mitigation is an indicator that the Proposed Development may give rise to a Noise Problem.

The assessment undertaken in this section has also had regard for these aspects.

7.5 Forecast Without New Measures

Under the Balanced Approach and in line with the Aircraft Noise Regulation, a Forecast Without New Measures must be prepared[78]. This represents a scenario where there are no noise-related operating restrictions in place.

In the context of the Application, the Forecast Without New Measures requires consideration of airport operations during the night where Dublin Airport is unconstrained with respect to its ability

[78] Annex I Regulation 598

to deliver its forecast flight schedules and how it uses its runways. This approach was taken by the Applicant in its own assessments[79] and ANCA agrees with this approach.

The Application seeks to amend OR-01 and OR-02 and as such a Forecast Without New Measures is required to understand the consequences of removing these restrictions altogether.

Without new measures and without OR-01 and OR-02, Dublin Airport would be able to utilise its runways in an operationally efficient manner and would be capable of operating an unconstrained flight schedule. The Applicant's approach to considering a Forecast Without New Measures has been to make the following assumptions:

- There are no operating restrictions limiting the number and type of aircraft which can take off or depart during the night.
- That the use of Dublin Airport's main runways at night would be conducted in a manner which allows for an efficient operation. For the purposes of assessment, this has been modelled by the Applicant so that:
    - Departures modelled as using the north or south runway depending on destination.
    - Arrivals have been modelled assuming a 50/50 split between runways unless runway capacity exceeded.

Figure 7.6 presents a comparison against the change in population HA and HSD in 2025 with and without population growth with Dublin Airport operating at 32 mppa. The figure shows that compared to 2019, a reduction in the population HA and HSD can be achieved without new measures.

With reference to the modelled forecasts and scenarios presented in this section and as outlined in Appendix E, the Forecast Without New Measures is described as Scenario P06.

Figure 7.7 presents Forecasts Without New Measures extending to 2030, 2035 and 2040 with and without population growth and with Dublin Airport operating at 32 mmpa. This shows that under the Applicant supplied forecast circumstances, the population HA and HSD would continue to reduce over the period to 2040 and that it may be possible for Dublin Airport to meet a 30%, 40% and 50% reduction in HA and HSD over this period.

[79] Ricondo, Dublin Airport North Runway Regulation 598/2014 (Aircraft Noise Regulation) Forecast Without New Measures and Additional Measures Assessment Report (Revision 2 – September 2021), September 2021, Section 2

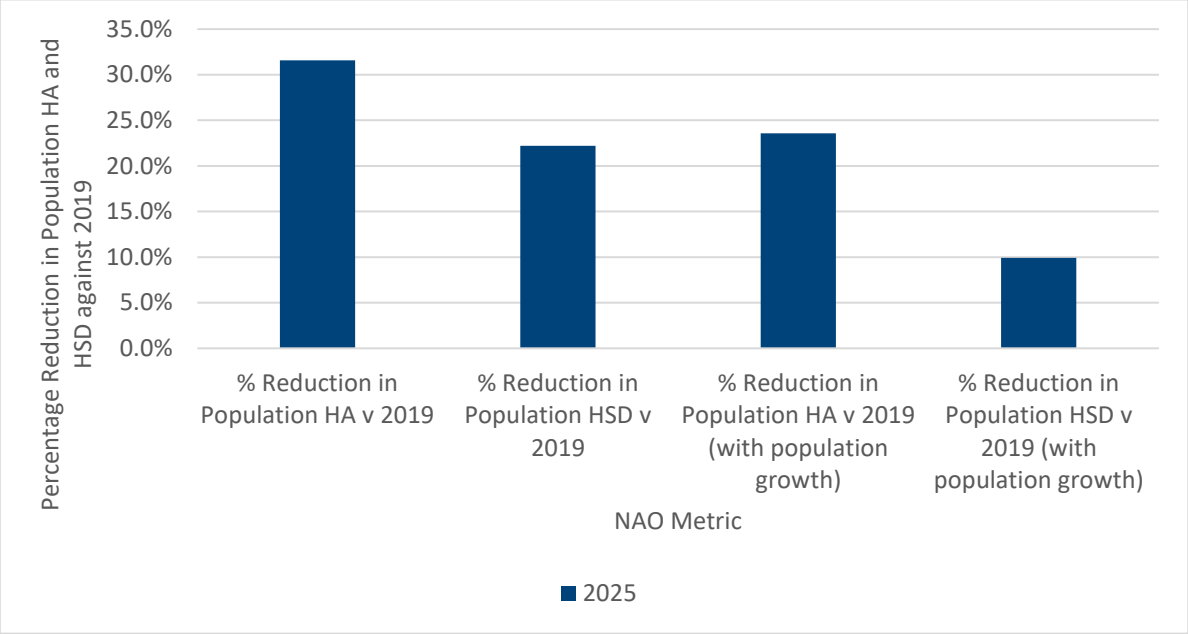


Figure 7.6: Percentage reduction in population HA and HSD in 2025 compared to 2019 for the forecast without new measures with and without population growth with Dublin Airport operating at 32 mppa.

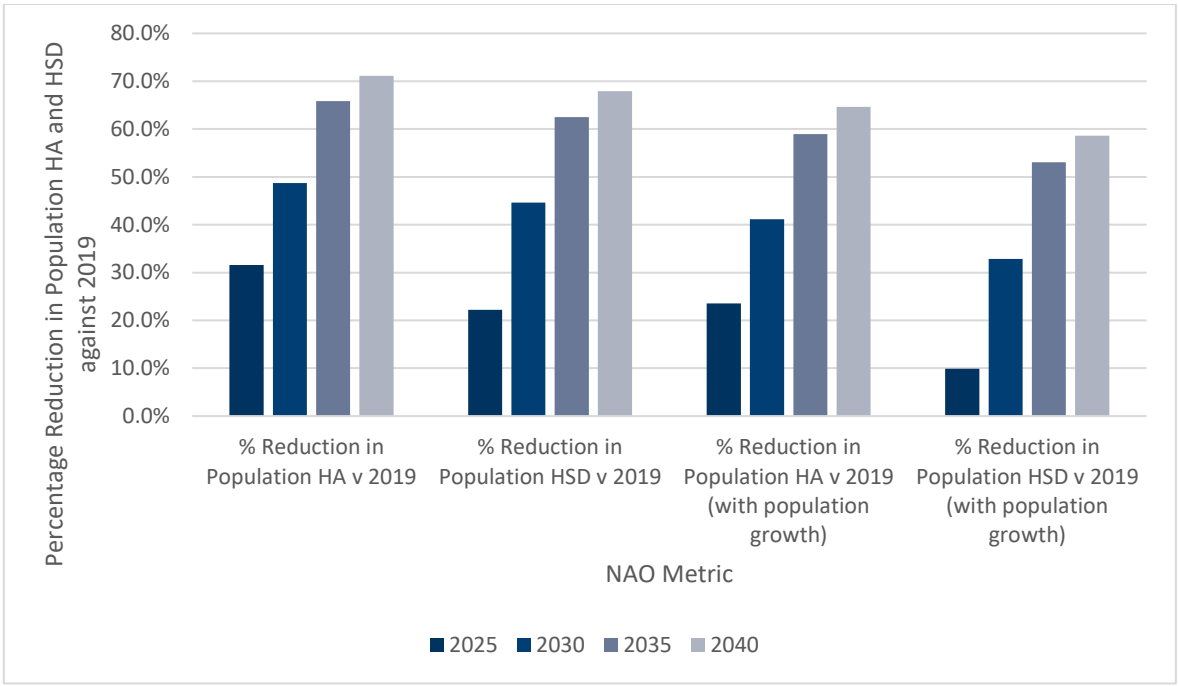


Figure 7.7: Percentage reduction in population HA and HSD in 2025, 2030, 2035 and 2040 compared to 2019 for the forecast without new measures and without population growth with Dublin Airport operating at 32mppa

When considering priorities, Figure 7.8 presents the population forecast to be exposed to levels of aircraft noise above 65 dB L_{den} and 55 dB L_{night}. This shows that with the terminal passenger capacity limit in place and assuming population growth, the number of people exposed to aircraft noise above the priorities values is forecast to reduce compared to 2019.

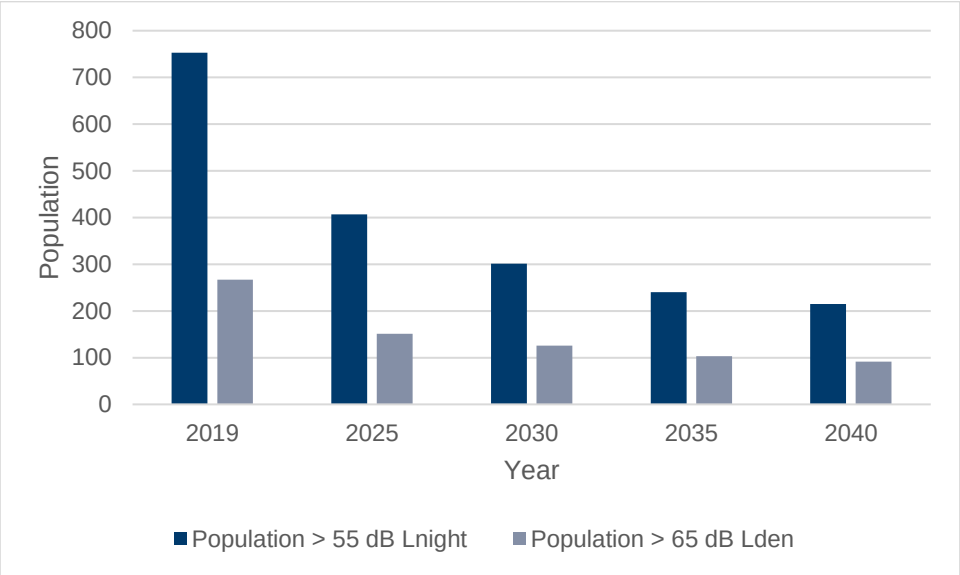


Figure 7.8: Population exposure to aircraft noise levels above 65 dB L_{den} and 55 dB L_{night} in 2025, 2030, 2035 and 2040 without new measures compared to 2019. Forecast for 2025 – 2040 include population growth.

Whilst the Forecast Without New Measures may in certain circumstances meet the requirements of the NAO, it does not provide any certainty as to how and which areas around Dublin Airport will be affected by aircraft noise. It also does not reflect the Application which seeks to replace and amend Condition 5 and Condition 3(d) respectively. By removing Condition 5, there would be no operational limit on night time noise which is counter to the policy objective of the NAO.

7.6 Application of the Balanced Approach

7.6.1 Background

The Application relates to a relevant action to amend Conditions 3(d) and 5 of the North Runway Planning Permission, as denoted OR-01 and OR-02 in the current inventory.

The process and application of the Balanced Approach therefore requires that measures which fall under each element i.e., the Reduction of Noise at Source, Noise Abatement Operating Procedures

and Land Use Planning and Management, be used to achieve the noise abatement objective in preference to operating restrictions. As the Application relates to a relevant action to amend two existing ORs it is incumbent upon ANCA to ensure that the Balanced Approach has been applied.

This has been undertaken as follows:

Table 7.14: Application of the Balanced Approach

Stage	Approach
1	**Prepare List of Available Mitigation Measures** A list of 'noise mitigation measures' is identified under each element of the Balanced Approach. This process has regard for the types of measure described below and discussed in this report.
2	**Review Available Measures and Undertake Analysis** For each of the measures identified, ANCA has had regard for whether such measures are already in place as part of the current inventory, the measures which have been proposed by the Applicant and the feasibility of considering alternative measures. This is discussed for each element of the Balanced Approach discussed in this report. This has entailed a review of the information provided by the Applicant and has considered the roles and responsibilities associated with developing and implementing each measure under the following headings: • Measures which reduce noise at source. • Noise abatement operating procedures. • Land use planning and management measures. • Operating restrictions. Where a measure is considered feasible and important in the context of this relevant action, it has been taken forward for further analysis and cost-effectiveness assessment.
3	**Identify Cost Effectiveness of Measures** For each of the measures taken forward, a cost-effectiveness assessment (CEA) has been undertaken. This is a requirement of the Aircraft Noise Regulation and is used to inform decision making.

7.6.2 Reduction of Noise at Source

7.6.2.1 List of Available Measures

ICAO guidance states that in relation to reduction of noise at source, consideration should be given to:

- *Integration into aircraft fleets, over time, of technology improvements meeting the latest standards*.
- *Specific fleet modernization plans of airlines operating at an airport.*
- *National plans to adopt the latest noise standard.*
- *Adoption by Contracting States of the latest ICAO noise recommendations.*

As such, any measures available to reduce noise at source need to have regard for whether they facilitate, encourage, or incentivise a greater proportion of aircraft meeting the latest noise standards to operate at Dublin Airport.

The Applicant has indicated that it is developing an Environmental Charging Proposal in response to Actions 1 and 2 of Dublin Airport's NAP. The Applicant has stated that:

"There are currently no plans to phase out aircraft based on their noise certification." and that it *"wishes to introduce noise charges as the first step an assess the impact of this measure before moving to an operating restriction such as phasing out of aircraft."*[80].

No detail has been provided on the Environmental Charging Proposal however the Applicant has indicated as part of its own CEA that a management measure addressing Actions 1 and 2 of the NAP would be in place in 2025[81]. It is therefore assumed that the Environmental Charging Proposal would be in place by 2025 and would help encourage and incentivise airlines to utilise aircraft conforming to the latest noise standards at Dublin Airport.

ANCA has undertaken an analysis of the fleet mix for the forecast relied upon by the Applicant for its assessment of relevant action in 2025 and more broadly. This work is presented in Appendix G and summarised for 2025 with respect to the aircraft noise generations below. A comparison is made considering the situation in 2025 should relevant action not occur. Comparisons to 2019 are also provided for context.

[80] Dublin Airport North Runway Relevant Action Application, Draft – Initial Response to ANCA Request for Further Information, June 2021, Response to RFI 123

[81] Response to RFI 77, Noise measures – existing, planned new

Table 7.15: Comparison of forecast ATMs by period between the situation in 2019, the 2025 situation and the 2025 forecast with new measures

	2019 Situation	2025 Situation	2025 with New Measures	Forecast Change in 2025 (2019)
	32.9 mppa	30.4 mppa	32.0 mppa	
Annual Day	167,931	163,653	163,003	-650 (-4,928)
Annual Evening	40,751	43,598	40,995	-2,603 (+244)
Annual Night	29,320	19,521	31,885	12,364 (+2,565)
Annual 24-hour	238,002	22,6772	235,882	9,110 (-2,120)
Summer Day (16hr)	58,163	57,432	56,530	-902 (-1,633)
Summer Night (8hr)	9,445	5,410	8,836	3,426 (-609)
Summer (24hr)	67,608	62,842	65,366	2,524 (-2,242)

Table 7.16: Comparison of the fleet mix between the situation in 2019, the 2025 situation and the 2025 forecast with new measures

Generation	Annual Day	Annual Eve	Annual Night	Annual 24hr	Summer Day	Summer Night
2019 Situation						
G0	96.6%	99.3%	95.1%	96.9%	96.3%	96.2%
G1	3.4%	0.7%	4.9%	3.1%	3.7%	3.8%
2025 Situation						
G0	75.9%	79.1%	85.0%	77.3%	76.6%	85.0%
G1	24.1%	20.9%	15.0%	22.7%	23.4%	15.0%
2025 with new measures						
G0	77.0%	78.6%	83.7%	78.2%	77.4%	83.7%
G1	23.0%	21.4%	16.3%	21.8%	22.6%	16.3%

Table 7.15 shows that with relevant action in 2025 the Applicant is forecasting an increase in aircraft movements with most of this occurring during the night time period. This is a consequence of revoking and replacing Condition 5. With reference to aircraft movements in 2019, the relevant action is forecast to result in more aircraft movements at night over the calendar year but fewer in

the summer months. The fleet mix comparisons presented indicate that in 2025 the proportion of G1 aircraft operating is forecast to increase substantially against 2019. At night, the 2025 forecasts indicate that although relevant action would increase the number of night time movements, the mix would include more G1 aircraft.

It is ANCA's view that any schemes which seek to encourage airlines to operate modern, quieter, and cleaner aircraft is good practice and that such measures should be introduced irrespective of the relevant action being sought under this Application and any restrictions which ANCA recommends in this regard.

ANCA is however conscious that aircraft noise performance and fleet mix is a key measure of reducing noise at source under the Balanced Approach. As such, any decision made by ANCA under this Application will require the reporting of information to help monitor fleet mix.

7.6.3 Noise Abatement Operating Procedures

7.6.3.1 List of Available Measures and Feasibility

The following tables present an overview of noise abatement operating procedures as they may be available to Dublin Airport. For each measure, the applicant's position and proposals are presented alongside ANCA's assessment.

Noise Preferential Routes	
Measure Part of Current Inventory	Yes
Responsibility for Measure	Irish Aviation Authority (IAA)
Applicants Position and Proposals	
The design of the airspace will play a significant role in which locations are overflown and are affected by aircraft noise. How the airspace is used and by which aircraft will also affect the level and pattern of noise around Dublin Airport. To service the north runway with Dublin Airport operating as a three-runway system, the IAA have prepared an associated airspace design. This design allows the north runway to be used during the day which is allowed under the North Runway Consent and has included a set of Noise Preferential Routes. Through further information, the applicant has confirmed that the airspace design and its associated NPRs have been developed to accommodate any preferential runway use at whatever time i.e., day and/or night. The airspace design has been the subject of consultation with main airport and community stakeholders in 2016 and 2017. The applicant	

has also noted that the airspace design was also the subject of safety assessment by the IAA in 2018 and 2019[82].

ANCA's Review and Opinion

It is the role of the IAA to design and operate the airspace at Dublin Airport. This is separate from the planning process. The north runway flight paths have been the subject of stakeholder engagement and safety assessment work[83].

Within the context of the Application, it is not considered feasible or within ANCA's competency to promote alternative airspace designs which relate to night time operations or to reconsider a re-design of the airspace for Dublin Airport as a three-runway system. ANCA's experts have indicated that should the airspace be re-designed then this could take a minimum of four years to design, test, consult and implement.

ANCA therefore is of the view that it is not feasible to consider alternative airspace designs within the context of this relevant action and as such the airspace design for Dublin Airport as a three-runway system as captured by measure NA-09 and NA-10 of the current inventory does not require further analysis.

However, given the influence and significance of the airspace design on noise exposure around Dublin Airport, ANCA considers it necessary for the operation of the airspace to be subject to monitoring.

Route Alternation	
Measure Part of Current Inventory	No
Responsibility for Measure	IAA
Applicants Position and Proposals	

[82] Dublin Airport North Runway Relevant Action Application, Draft – Initial Response to ANCA Request for Further Information, June 2021 - Response to 115

[83] Dublin Airport, North Runway Report, Consultation on Flight Paths and Change to Permitted Operations, February 2017 (available here: https://www.dublinairport.com/docs/default-source/north-runway-downloads/public-consultation-report--flight-paths-and-change-to-permitted-operations.pdf?sfvrsn=b06d628_2)

The Applicant has not brought forward route alternation as a mitigation measure as part this Application. The justification for this is on the basis that this would require the airspace to be redesigned by the IAA to facilitate such a measure.
ANCA's Review and Opinion
ANCA accepts that route alternation would require a different airspace design to those prepared by the IAA for the three-runway system. As outlined in our consideration of noise preferential routes, the designs which have been relied on by the applicant as part of their assessment work were originally the subject of consultation in 2016 and 2017 and have since been developed by the IAA and subject to safety assessment[84]. Any alternative designs including route alternation would also need to be the subject of consultation and further design work which given the opening of the north runway and the operation of Dublin Airport as a three-runway system is scheduled for 2022 alongside the implementation of the relevant action if approved, is unfeasible. As such, this measure has not been considered further as part of this relevant action and is therefore not progressed for further assessment.

Use / Mandate of Noise Abatement Departure Procedures (NADP) and/or Thrust Managed Climb	
Measure Part of Current Inventory	Yes
Responsibility for Measure	Airlines IAA daa
Applicants Position and Proposals	
The Applicant has indicated that the current departure procedures at Dublin Airport are based on the NADP2[85] procedure. The noise forecasts provided with the application and in response to the Direction to Provide Information are also based this departure procedure. The choice of NADP will affect the distribution of noise under departure flight paths. This may have an influence on whether certain communities, populations or locations are exposed to different levels of aircraft noise under departure routes.	

[84] Dublin Airport North Runway Relevant Action Application, Draft – Initial Response to ANCA Request for Further Information, June 2021 - Response to 115

[85] Reporting Template available on ANCA Website

ANCA requested that the applicant provide evidence to confirm that environmentally, NADP2 is the optimum departure procedure for Dublin Airport[86]. Minutes from a meeting between the Applicant, airlines and the IAA indicate that the current procedure being operated is currently not compliant either NADP1 or NADP2 and but is *"somewhere in between"*[87]. This procedure is currently described within Dublin Aiport's AIP[88]. The minutes provided by the Applicant confirm that Ryanair and Aer Lingus express a preference for NADP2. The applicant has advised in response to FI requests that the current NADP procedure is under review.

ANCA's Review and Opinion

SEL and L_{Asmax} footprints of an Airbus A320 and Airbus 330-300 departing the main north and south runways using the current NADP, and NADP1 and NADP2 have been provided by the Applicant[89]. These indicate that NADP1 has the potential to slightly reduce noise impacts closer to Dublin Airport but at the expense of resulting slightly higher noise levels further away. This information does not conclusively demonstrate which NADP is optimal for Dublin Airport but does provide sufficient evidence that the selection of the procedure is likely to influence noise exposure levels but in a marginal way. This does not change the relative performance of the scenarios considered by the Applicant with respect to the primary measures of the NAO.

It is ANCA's view that the differences due to selecting these procedures is marginal compared to the other measures available and considered by the Applicant, namely preferential runway use and noise insulation.

Whilst insufficient evidence has been provided for ANCA to identify which NADP should be recommended, the Applicant has demonstrated that work is ongoing with respect to the selection of a NADP. ANCA considers it appropriate that the work underpinning the selection of the departure procedures is reported in line with Actions 5 and 6 of the NAP

[86] Further Information Request 117

[87] Dublin Airport North Runway Relevant Action Application, Draft – Initial Response to ANCA Request for Further Information, June 2021 – Appendix J

[88] Aeronautical Information Publication, EIDW AD 2-1, EIDW AD 2.21 NOISE ABATEMENT PROCEDURES

[89] Dublin Airport North Runway Relevant Action Application, Draft – Initial Response to ANCA Request for Further Information, June 2021 – Appendix J

Continuous Climb Operations (CCO)	
Measure Part of Current Inventory	Yes
Responsibility for Measure	Airlines IAA
Applicants Position and Proposals	
The Applicant has indicated that Continuous Climb Operations are already in place at the Dublin Airport and would be operated in the future with or without relevant action[90]. The applicant has confirmed that the Instrument Flight Procedures (IFPs) contain minimum altitude constraints which enable CCO operations to take place. Although CCO is not a formal procedure, the Applicant states that ATC Officer training contains guidance to permit continuous climb departures. The Applicant claims that CCO routinely occurs with over 99% achieved.	
ANCA's Review and Opinion	
The Applicant has indicated that CCO occurs, however no evidence has been provided to confirm this. There is currently no formal definition of CCO and in the case of Dublin Airport there is no apparent or stated altitude to which any CCO would occur too. However, ANCA's experts have reviewed the airspace arrangements at Dublin Airport and have confirmed that all SIDs from all existing runways climb straight to at least FL90 for CAT C/D aircraft. The SIDs for Cat A/B aircraft do not do this and stop at 4000ft. As such, it is considered on balance that the vast majority of departures at Dublin Airport will be operating CCO to FL90. On this basis ANCA has concluded that CCO is already in place at Dublin Airport and as such there is no requirement to investigate the introduction of this measure as it is already in place.	

Continuous Decent Approaches (CDA)	
Measure Part of Current Inventory	Yes
Responsibility for Measure	Airlines IAA daa
Applicants Position and Proposals	

[90] Dublin Airport North Runway Relevant Action Application, Draft – Initial Response to ANCA Request for Further Information, June 2021 – Response to Request 125

The Applicant has confirmed that Continuous Decent Approaches (CDA) are currently in operation at Dublin Airport and have been incorporated into the airspace designs associated with the three-runway system[91]. The CDA at Dublin Airport commences at 7,000 or 8,000 ft depending upon demand. In line with the standard definition of CDA[92], a compliant approach is one where an aircraft flies no more than one level segment on approach. For a CDA to be considered compliant, additional rules such as the maximum length of a level segment and the minimum height at which this occurs may also apply.

The Applicant has provided information in response to the Direction to Provide Information which includes an indication of progress with respect to the monitoring of CDA at Dublin Airport. This response indicates that Dublin Airport is currently in the process of reviewing and validating criteria to facilitate CDA monitoring and that this has been implemented in line with international best practice into ANOMS. The response confirms that a trial period for this implementation will occur in Q2 and Q3 2021. The response states that:

"The ANOMS system will process all arrival operations for the airport against the proposed CDA rules detailed above to determine if a CDA has occurred. Details will be stored within the ANOMS database, from where the relevant metrics and reports can be generated to advise aviation stakeholder engagement following the trial period completion. Agreed rules will only be applied to ANOMS following this stakeholder engagement for all current operational runway approaches and North Runway"

ANCA's Review and Opinion

ANCA is satisfied that CDA is in place at Dublin Airport and is part of the airspace designs for the three-runway system. However, Dublin Airport's AIP does not declare any requirement for operators to perform a CDA although there is an overarching European requirement for CDA. CDA itself is an important noise mitigation measure. Airports which monitor CDA will often set associated key performance metrics and targets to monitor adherence. Given this best practice

[91] Dublin Airport North Runway Relevant Action Application, Draft – Initial Response to ANCA Request for Further Information, June 2021 – Response to Request 110, 119 and Appendix I

[92] ICAO CDO Manual Doc 9931 (para 1.1.1.1) states that "Continuous Decent Operations is an aircraft operating technique aided by appropriate airspace and procedure design and appropriate ATC clearances enabling the execution of a flight profile optimised to the operating capability of the aircraft, with low engine thrust settings and, where possible, a low drag configuration, thereby reducing fuel burn and emissions during descent. The optimum vertical profile takes the form of a continuously descending path, with a minimum of level flight segments only as needed to decelerate and configure the aircraft or to establish on a landing guidance system)

and given that Dublin Airport is working towards setting up its NTK systems to monitor CDA adherence, ANCA is of the view that a monitoring requirement is necessary to encourage good noise management at Dublin Airport and would therefore encourage the Applicant to routinely report CDA adherence.

Steeper / Segmented Approach Procedures / GBAS	
Measure Part of Current Inventory	No
Responsibility for Measure	IAA Airlines daa
Applicants Position and Proposals	
The Applicant originally ruled out the use of steeper approaches and/or segmented approaches as the *"need for additional detailed assessments related to feasibility and the anticipated low level of benefit"*[93]. In response to the Direction to Provide Information, the Applicant has cited ICAO Annex 10 (7th edition 2018) which recommends that the Instrument Landing System (ILS) glide path angle should be 3.0˚. This document also states that glide path angles exceeding 3.0˚ should not be used except where alternative means of satisfying obstruction clearance requirements are impracticable. The Applicant states that for this reason a steeper approach was not considered further. The Applicant has not considered segmented approach procedures or the use of GBAS.	
ANCA's Review and Opinion	
ANCA accepts ICAO's recommendation that glide slopes shall not exceed 3.0˚ except in the case of satisfying obstruction clearance requirements. Increasing the glide slopes beyond 3.0˚ could entail a significant amount of work and may require Dublin Airport to introduce additional ILS or GLS equipment. However, there is an international trend of moving towards slightly steeper approach procedures for noise management purposes. Recently Heathrow Airport proved that 3.2˚ approaches are safe, however this was for PBN approaches in CAT I conditions, and not using the ILS. As such this limits the total number of operations which can use them. In addition, Heathrow's Landing Distance Available (LDA) ranges from 3350m – 3882m. Likewise, Frankfurt	

[93] Dublin Airport North Runway Regulation 598/2014 (Aircraft Noise Regulation) Forecast Without New Measures and Additional Measures Assessment Report, Table 3-1

Airport who have a 3.2˚ ILS on their northern runway also have a 3.0˚ ILS and their LDA on that runway is 2800m. Dublin's LDA is currently 2637m for its south runway.

When taking this into account the feasibility and cost of introducing an alternative approach procedure at Dublin Airport makes this measure difficult to justify. The potential noise improvements from such a measure are also likely to be very limited.

ANCA is of the view that the influence of this measure in reducing noise in line with the requirements of the NAO is likely to be minimal compared to the other measures that are available under this relevant action. Given it is the view of ANCA's experts that the introduction of slightly steeper approaches would be difficult to justify, this measure is not considered feasible for further consideration as part of this relevant action.

Automated (RNAV) Procedures / Performance Based Navigation (PBN)	
Measure Part of Current Inventory	Yes
Responsibility for Measure	Airlines IAA
Applicants Position and Proposals	
The Applicant has confirmed in response to the Direction to Provide Information that the existing and future instrument flight procedures (IFPs) are all designed in accordance with ICAO (Doc 8168 Vol II) and are performance-based navigation (PBN) compliant with a navigation accuracy of RNAV-1 (in accordance with ICAO Doc 9613)[94]. The noise modelling which supports the Applicant's assessment has made assumptions with respect to the dispersion of aircraft around the nominal departure routes[95]. This dispersion will be affected by how aircraft are navigating their routes. This modelling has assumed the same patterns of dispersion as part of its three-runway airspace designs as occurred in 2016 and was reviewed again 2018. The Applicant's original CEA states that arrival and departure procedures and associated IFPs are the responsibility of the IAA and that *"far-reaching changes to existing RNAV SIDs and STARs*	

[94] Dublin Airport North Runway Relevant Action Application, Draft – Initial Response to ANCA Request for Further Information, June 2021 – Response to Request 112

[95] Dublin Airport North Runway Relevant Action Application, Noise Information – ANCA Request, February 2021, Page 83

were not considered at this stage"[96]. It also indicates that there is foreseeable increased use of RNAV with increased improvement in aircraft avionics and as part of the European Airspace Modernisation Programme.

ANCA's Review and Opinion

It is unclear from the information provided by the Applicant the degree to which increased use of RNAV procedures will change aircraft dispersion patterns around Dublin Airport. Based on the information provided by the Applicant, this has not been considered. Nevertheless, the arrival and departure routes at Dublin Airport are RNAV compliant and as such would facilitate the better use of Dublin Airport's NPRs.

ANCA agrees with the Applicant's assessment that RNAV procedures are not a noise mitigation measure which requires appraisal as part of the relevant action. However, ANCA is mindful of the potential implications of increased use of PBN as part of adherence to the three-runway system NPRs. For this reason, monitoring the dispersion of aircraft along its arrival and departure routes is considered appropriate and should be captured as part of the noise modelling undertaken by the either Applicant in response to the wider requirement set out in this decision document or as part of its obligations to produce strategic noise maps. This is in keeping with the monitoring aspects of the NAO.

Preferential Runway Use	
Measure Part of Current Inventory	Yes
Responsibility for Measure	daa IAA

Applicants Position and Proposals

Preferential Runway Use is both an existing noise abatement operating procedure and a procedure which is part of planning conditions set by North Runway Planning Permission.

The Applicant's proposals effectively constitute an amendment to Condition 3(d) of the North Runway Planning Permission which would allow Dublin Airport to make use of the North

[96] Dublin Airport North Runway, Regulation 598/2014 (Aircraft Noise Regulation) Forecast Without New Measures and Additional Measures Assessment Report (Revision 2 – September 2021), Table 3-1 (2 of 6)

Runway for two hours during the night. When in use, the north runway would be used in line with the existing preferential runway use described under Conditions 3(a)-(c).

The Applicant has provided forecast with new measures which include a series of different night time runway operating preferences which are alternatives to their proposals. These include some scenarios which include restrictions. Additional scenarios have been considered by the Applicant in response to the Direction to Provide Information.

ANCA's Review and Opinion

An amendment to Condition 3(d) of the North Runway Planning Permission will result in a redistribution of night time aircraft noise at Dublin Airport. This redistribution of aircraft noise a result of the relevant action is one aspect of the noise problem identified with the Application.

A significant amount of work has been undertaken by the Applicant to consider the relative performance of different runway use and runway restrictions scenarios at night. Much of this work has been considered alongside a change to Condition 5 and a proposal to replace this operating restriction with an alternative form of restriction, namely a night time quota system.

ANCA agrees that consideration should be given to different runway use patterns as part of identifying measures that either replace or revoke Condition 3(d). In response to the Direction to Provide Information, the Applicant has studied and provided analysis for a series of different approaches to using its runways during the night as part of this relevant action. These are described in Appendix E.

Runway usage measures have therefore been taken forward for further analysis.

Displaced Landing Thresholds	
Measure Part of Current Inventory	Yes
Responsibility for Measure	daa IAA

Applicants Position and Proposals

Displaced thresholds have the potential to reduce arrival noise levels at locations under arrival flight paths and close to the runway by increasing the height at which they overfly. The north

runway already includes displaced thresholds for both runway ends. The Applicant states that *"Further displacement of the landing thresholds is not expected to provide much additional benefit in reducing noise levels."* and that *"Increasing the displaced threshold distance will reduce available landing length and could also impact departure and arrival separation"*[97].

No consideration has been given to introducing displaced thresholds onto the south runway. On this basis the Applicant has not explored landing displaced thresholds as a noise mitigation measures as part of this relevant action.

ANCA's Review and Opinion

The North Runway has been designed to include landing displaced thresholds and, as discussed by the Applicant, any additional displacement is unlikely to yield much additional noise benefit but could impact on the ability of certain aircraft to use the runway. Whilst there may be potential to introduce landing displaced thresholds onto the south runway, ANCA recognises that to do so would likely require airspace design and infrastructure works which would introduce significant cost and could lead to potential disruption of Dublin Airport.

ANCA therefore agrees with the Applicant's assessment not to take forward landing displaced thresholds as a noise mitigation measure as part of this relevant action. However, this should not rule out such measures being investigated in the future.

Runway Use Respite	
Measure Part of Current Inventory	No
Responsibility for Measure	IAA
Applicants Position and Proposals	
Respite from aircraft noise can be delivered by alternating the which runways are in use. The Applicant has considered scenarios as set out in Appendix E which involve alternating runways.	
ANCA's Review and Opinion	
ANCA considers it appropriate that the Applicant has considered such measures as part of the runway usage scenarios considered. These have been subject to further assessment by ANCA.	

[97] Dublin Airport North Runway, Regulation 598/2014 (Aircraft Noise Regulation) Forecast Without New Measures and Additional Measures Assessment Report (Revision 2 – September 2021), Table 3-1 (3 of 6)

7.6.4 New Measures Taken Forward for Assessment

Noise Abatement Operating Procedures	
Measure	**Taken forward for further assessment?**
Use of Noise Preferential Routes	No – part of existing measures
Route Alternation	No – not considered feasible
Use/Mandate of Noise Abatement Departure Procedures (NADP) and/or Thrust Managed Climb	No – part of existing measures
Continuous Climb Operations (CCO)	No – part of existing measures
Continuous Decent Approaches (CDA)	No – part of existing measures
Steeper/Segmented Approach Procedures / GBAS	No – not considered sufficiently effective in the context of other measures taken forward
Automated (RNAV) Procedures/Performance Based Navigation (PBN)	No – part of existing measures
Preferential Runway Use	**Yes** – presented in Appendix E
Landing Displaced Thresholds	No – not considered feasible
Runway Use Respite/Alternate Runway Use	**Yes** – presented in Appendix E

7.6.5 Land Use Planning and Management

The following tables present an overview of land use planning and management measures as they may be available to Dublin Airport. For each measure, the Applicant's position and proposals are presented alongside ANCA's assessment.

Planning Measures and Noise Zoning	
Measure Part of Current Inventory	Yes
Responsibility for Measure	Planning Authorities
Applicants Position and Proposals	
The Applicant has identified the noise zones set out in the framework established by FCC through the County Development Plan 2017-2023 (Variation No. 1) and the Dublin Airport 2020 Local Area Plan (LAP) as being the means of managing new noise-sensitive development around	

Dublin Airport[98]. No further consideration of any alternative or additional planning and noise zoning measures have been given by the Applicant in their assessment.

ANCA's Review and Opinion

The noise zones established under the County Development Plan seek to ensure that aircraft noise from Dublin Airport is addressed appropriately during the planning process. Both the Local Area Plan and Variation No. 1 were open for statutory periods of public consultation.

The four zones established are based on forecasts provided by Dublin Airport to FCC at the time the County Development Plan Variation No. 1 was prepared. New noise-sensitive development is restricted in Zone A only. Development in the other noise zones is subject to various requirements in terms of acoustic assessment and the need for sound insulation. The zones therefore manage development to ensure aircraft noise is appropriately considered rather than prohibit it. As such, the zones seek to ensure that new noise-sensitive development is designed and built with suitable noise insulation measures.

The $L_{Aeq,16hr}$ and L_{night} metrics underpin the noise zones. The use of the L_{night} metric is compatible with the NAO however the $L_{Aeq,\ 16hr}$ does not strictly align with the L_{den} metric which is also part of the NAO. However, the guidance attached to planning and noise, along with the technical standards[99, 100] cited by Variation No. 1 relating to the design of sound insulations, utilise the $L_{Aeq,16hr}$ metric.

ANCA has reviewed the noise zones against the forecasts with and without new measures as provided by the Applicant. This review has been largely based on forecast noise exposure in 2025 which represents the highest levels of noise exposure identified in the Applicant's forecasts.

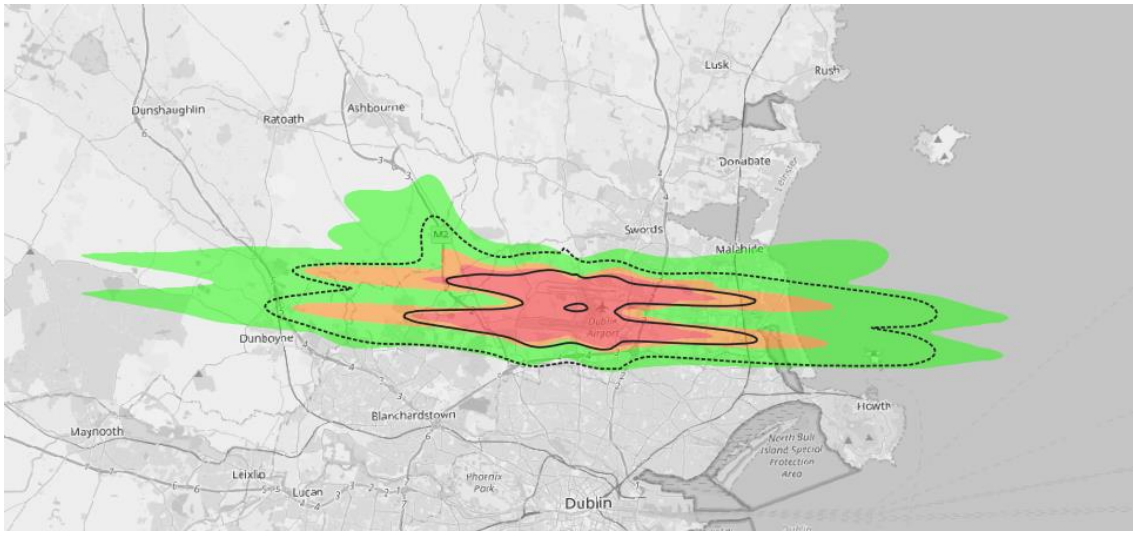
This review has focussed on night time noise exposure forecasts comparing the maximum extent of the L_{night} noise levels reported across the various forecasts provided by the Applicant in 2025 with the thresholds underpinning the noise zones. This has focussed on the night time boundaries between Zones B&C, and C&D i.e., 48 dB L_{night} and 55 dB L_{night}.

[98] Dublin Airport North Runway, Regulation 598/2014 (Aircraft Noise Regulation) Forecast Without New Measures and Additional Measures Assessment Report (Revision 2 – September 2021), Table 3-1 (5 of 6)

[99] British Standards Institute (BSI), BS8233:2014 'Guidance on sound insulation and noise reduction for buildings', 2014

[100] ProPG: Planning & Noise, Professional Practice Guidance on Planning and Noise, New Residential Development, May 2017

The diagram below shows that the maximum extent of the 48 dB L_{night} contour (black dotted) all 2025 noise forecasts sit mainly within Zone C[101] (green). Likewise, the figure shows that the extent of the 55 dB L_{night} (solid black) contours arising from the forecasts fall mainly within Zone B (orange) and A (red) reflecting the night time noise thresholds underpinning these zones.



ANCA's review of the noise zones has identified that the precautionary principle built into the zones has addressed most of the potential outcomes forecast by the Applicant as part of the Application.

Given the precautionary principle built into the extent of the zones, providing the Planning Authority manages the process described in Variation No. 1 then ANCA is satisfied that this will result in noise sensitive developments around Dublin Airport being appropriately considered and designed with respect to aircraft noise. This relies on the planning authority ensuring that aircraft noise is captured when such developments are brought forward, and that appropriate conditions are given to such developments to ensure they are afforded sound insulation.

[101] Fingal Development Plan

Encroachment Management	
Measure Part of Current Inventory	Yes
New Measure Proposed	No
Responsibility for Measure	Planning Authorities
Applicants Position and Proposals	
The Applicant has not considered any additional measures relating to encroachment management as a new measure as part of the Application. Instead, the Applicant has identified that encroachment management be captured through Action 4 of the Noise Action Plan.	
ANCA's Review and Opinion	
Encroachment is managed through the planning system. To this end the noise zones as defined by the County Development Plan 2017-2023 (Variation No. 1) as a means of achieving this. Action 4 of the NAP requires that encroachment analysis is undertaken from 2019 onwards. This action was set prior to Variation No. 1 of the County Development Plan and is the responsibility of the Planning Authority of Fingal County Council. An update on the actions arising from the NAP was provided in response to the Direction to Provide Information[102]. This states that the Applicant has made available data to facilitate encroachment analysis. Encroachment and future population growth is an important consideration and is part of the NAO. As such, future assessment of compliance with the NAO will require population data to be prepared which has regard for changes in the location and number of residential dwellings and associated population and dwelling occupancy estimates. This is no different to the requirements under the ENR.	

Sound Insulation Schemes	
Measure Part of Current Inventory	Yes
New Measure Proposed	Yes
Responsibility for Measure	daa
Applicant's Position and Proposals	

[102] Dublin Airport North Runway Relevant Action Application, Draft – Initial Response to ANCA Request for Further Information, June 2021 – Appendix I

There are currently two sound insulation schemes in place at Dublin Airport. These are the Residential Noise Insulation Scheme (RNIS) and the Home Sound Insulation Programme (HSIP). These schemes describe eligibility based on a 16-hour daytime noise exposure contours ($L_{Aeq,16hr}$).

As part of the measures brought forward by the Applicant as part of the Application, a new night time noise insulation scheme has been proposed. Detail relating to the proposed scheme was provided in response to the Direction to Provide Information[103]. The Applicant's proposed scheme is called the Residential Sound Insulation Grant Scheme (RSIGS). The scheme will make available a grant of up to €20,000 for insulation measures. RSIGS is intended for bedrooms only with eligible dwellings identified if they meet either of the following noise-related criteria.

- Criteria 1: Dwellings forecast to be exposed to "high" night time noise levels in 2025 of at least 55 dB L_{night}.
- Criteria 2: Dwellings with a "very significant" rating arising from forecast noise levels of at least 50 dB L_{night} in the first full year when the relevant action comes into operation, with a change of at least +9 dB when compared with the current permitted operation in the same equivalent year.

The Applicant proposes that Criteria 1 will be based on initial 2025 noise forecasts provided with the Application and that Criteria 2 will be based on forecasts for the first year of the relevant action. This has been assumed as 2022 in the Applicant's submissions, however the Applicant confirms that if this were to be later then the eligibility according to Criteria 2 will be revisited. In the case of Criteria 1, the Applicant proposes that RSIGS will be subject to bi-annual review reflecting the approach current in place for RNIS.

Under the Applicant's proposals RNIS will not include dwellings approved for construction after December 2020.

ANCA's Review and Opinion

[103] Anderson Acoustics Document 3870-RSGIS, Dublin Airport Residential Sound Insulation Grant Scheme (RSIGS) overview – DRAFT, July 2021

Dublin Airport's existing sound insulation schemes have been the subject of review by ANCA under Section 20(3) of the 2019 Act. This review was undertaken in 2020 and the two schemes (RNIS and HSIP) were found to be in place prior to the relevant day of 1 September 2019.

This review highlighted that eligibility to the RNIS scheme is a combination of the predicted 63 dB $L_{Aeq, 16hr}$ contour as defined by Condition 7 of the North Runway Consent, along with the predicted 63 dB $L_{Aeq, 16hr}$ as revised for a 2022 forecast. Eligibility to the HSIP scheme is based on the 2016 63 dB $L_{Aeq, 16hr}$ contour. The RNIS has regard for Dublin Airport operating as a three-runway system, with the HSIP considering it as a two-runway system. ANCA's review identified 125 properties eligible for insulation under the RNIS scheme and 77 properties eligible for insulation under the HSIP scheme.

The RNIS scheme differs from the HSIP scheme in that eligibility to the scheme is subject to biannual review under Condition 7 of the North Runway Planning Permission. This review results in the eligibility boundary of the scheme potentially being updated having regard for more recent exposure forecasts.

Both the RNIS and HSIP are designed so that all costs associated with the insulation works are met by Dublin Airport. Under the scheme, the measures available include: the replacement of existing windows with acoustic windows; installation of acoustic vents to allow for background ventilation; acoustic loft insulation and chimney dampers where these are necessary. The RNIS scheme entails an individual assessment of each dwelling with a target of improving the insulation performance of the building envelope by 5 to 10 dB. Review of eligibility is to occur every two years with a sample of dwellings selected to confirm the effectiveness of the insulation works.

In response to the Direction to Provide Information, the Applicant has provided information regarding the effectiveness of the insulation measures available under RNIS[104]. This shows that airborne noise insulation at surveyed dwellings improved by at least 5 dB and on average improved the insulation by an average of 7.7 dB. Analysis provided by the Applicant shows that many of the insulation measures which are available, and which could achieve this level of reduction would be available within the €20,000 grant for properties with a certain number of bedrooms.

[104] Dublin Airport North Runway Relevant Action Application, Draft – Initial Response to ANCA Request for Further Information, June 2021 – Response to Request 130

One aspect of the noise problem which may arise as a result of the Application is a change in night time noise exposure resulting in dwellings becoming exposed to night time noise exposure levels that represent a clear risk to health i.e. 55 dB L_{night}. Another aspect is that the Application would give rise to significant effects as presented in the EIAR[105] and identified as the third aspect of the noise problem identified by ANCA.

The Applicant's proposed RSIGS attempts to address these two aspects of the noise problem arising from the Application. Firstly, the Criteria 1 aligns with the threshold above which effects may be considered night time noise exposure is a clear risk to health i.e. 55 dB L_{night}. This threshold is also the night time priority as set by the NAO. Secondly, Criteria 2 seeks to addresses those experiencing a 'very significant' effect as defined within the EIAR.

ANCA agrees that these eligibility thresholds are appropriate however notes that Criteria 2 may result in a situation where some dwellings receive insulation at lower levels of aircraft noise exposure than others. For example, a dwelling falling under Criterion 2 may observe noise exposure at 53 dB L_{night}, whereas elsewhere there may be dwellings experiencing 54 dB L_{night} which are not eligible under either Criteria 1 or Criteria 2.

Unlike the RNIS and HSIP scheme, the Applicant's proposed scheme is a grant scheme which means that insulation measures and works under the proposed scheme will be subject to a cap of €20,000. The proposed scheme would apply to bedrooms only rather than all habitable rooms as is the case for the RNIS and HSIP schemes.

In response to the Direction to Provide Information the Applicant suggests that the measures available under the proposed scheme could include primary or secondary glazing, rooflights, passive vents, mechanical vents and loft insulation[106]. However, analysis provided by the Applicant indicates that only a selection of these measures could be afforded under the grant depending upon the number of bedrooms in each eligible dwelling. This is reproduced in the figure below and is based on RNIS insulation programme tender rates[107].

[105] Dublin Airport North Runway Relevant Action Application, Environmental Impact Assessment Report, Volume 2 – Main Report, September 2021

[106] Dublin Airport North Runway Relevant Action Application, Draft – Initial Response to ANCA Request for Further Information, June 2021 – Response to Request 93 and 130

[107] Dublin Airport North Runway Relevant Action Application, Draft – Initial Response to ANCA Request for Further Information, June 2021 – Response to Request 136

Ref	Item	Typical Base Rate	1 bed	2 bed	3 bed	4 bed	5 bed	6 bed
1	Access Equipment and Scaffolding	300	300	600	900	1,200	1,500	1,800
2	Glazing – Primary Window	4,300	4,300	8,600	12,900	17,200	21,500	25,800
3	Glazing – Secondary Glazing	870	870	1,740	2,610	3480	4,350	5,220
4	Glazing – Roof Light	3,400	3,400	6,800	10,200	13600	17,000	20,400
5	Passive Vent	690	690	1,380	2,070	2760	3,450	4,140
6	Mechanical Vent	1,350	1,350	2,700	4,050	5400	6,750	8,100
7	Loft Insulation	290	290	580	870	1160	1,450	1,740
8	Chimney Baffle	520	520	1,040	1,560	2,080	2,600	3,120
9	Ceiling Over-boarding	4,200	4,200	8,400	12,600	16,800	21,000	25,200

Ref	Permutations	1 bed	2 bed	3 bed	4 bed	5 bed	6 bed
1+2+5	Total: primary + passive vent	5,290	10,580	15,870	21,160	26,540	31,740
1+2+5+7	Total: primary + passive + insulation	5,580	11,160	16,740	22,320	27,900	33,480
1+2+4+5+7	Total: primary +passive + insulation + rooflight	8,980	17,960	26,940	35,920	44,900	53,880
1+2+6	Total: Primary + Mechanical Vent	5,950	11,900	17,850	23,800	29,750	35,700
1+2+6+7	Total: Primary + Mechanical + insulation	6,240	12,480	18,720	24,960	31,200	37,440
1+2+4+6+7	Total: Primary + Mechanical + insulation + Rooflight	9,640	19,280	28,920	38,560	48,200	57,840

1+3+5	Total: Secondary + passive vent	1,860	3,720	5,580	7,440	9,200	11,160
1+3+5+7	Total: Secondary + passive + insulation	2,150	4,300	6,450	8,600	10,750	12,900
1+3+4+5+7	Total: Secondary + Passive + Insulation + Rooflight	5,550	11,100	16,650	22,200	27,750	33,300
1+3+6	Total: Secondary + Mechanical Vent	2,520	5,040	7,560	10,080	12,600	15,200
1+3+6+7	Total: Secondary + Mechanical Vent + Insulation	2,810	5,620	8,430	11,240	14,050	16,860
1+3+4+6+7	Total: Secondary + Mechanical Vent + Insulation + Rooflight	6,210	12,420	18,630	24,840	31,050	37,260

What is apparent from the Application is that the proposed noise insulation scheme has only been considered as part of the Applicant's preferred and proposed runway use and restriction scenario (Scenario P02) as part of its own CEA. Consideration of the total number of dwelling eligible for the scheme should another form of night time runway use pattern or restriction be adopted has not been considered by the Applicant. ANCA believes that insulation is a consideration that should be made when considering the various runway use and restrictions measures available.

ANCA also notes that there are alternatives to the years being considered as part of Criteria 2. This may also make a difference with respect to the number of dwellings which are eligible and may also better reflect changes in noise over time. The two years considered as part of this are 2022 and 2025. The year 2022 reflects the Applicant's forecast year for the relevant action commencing with 2025 being the year where noise output is expected to be at its highest with Dublin Airport operating at its 32 mppa terminal passenger capacity limit.

On this basis, a night time noise insulation scheme has been considered for further analysis by ANCA with the following options explored. As part of exploring these options, consideration has been given to whether eligible dwellings under the proposed RSIGS are likely to be eligible for the existing RNIS and HSIP schemes.

It is ANCA's view that these existing schemes are more comprehensive than the proposed RSIGS scheme as they cover all habitable rooms and are fully funded. As such, ANCA's view is that both the cost and effectiveness of the RSIGS scheme can only be established if they are not already eligible for insulation under the existing schemes.

ANCA therefore undertook further analysis as part of its CEA with respect to the following insulation eligibility options.

- Eligibility Option A: > 55 dB in 2022 for properties not captured by HSIP or RNIS
- Eligibility Option B: > 55 dB in 2025 for properties not captured by HSIP or RNIS
- Eligibility Option C1: > 55 dB in 2022 and a change of 9 dB above 50 dB compared to conditions in 2018 for properties not captured by HSIP or RNIS
- Eligibility Option C2: > 55 dB in 2025 and a change of 9 dB above 50 dB compared to conditions in 2018 for properties not captured by HSIP or RNIS
- Eligibility Option C3: > 55 dB in 2022 and a change of 9 dB above 50 dB compared to conditions in 2019 for properties not captured by HSIP or RNIS
- Eligibility Option C4: > 55 dB in 2025 and a change of 9 dB above 50 dB compared to conditions in 2019 for properties not captured by HSIP or RNIS
- Eligibility Option C5: > 55 dB in 2022 and a change of 9 dB above 50 dB compared to conditions forecast for the situation in 2022 for properties not captured by HSIP or RNIS
- Eligibility Option C6: > 55 dB in 2025 and a change of 9 dB above 50 dB compared to conditions forecast for the situation in 2025 for properties not captured by HSIP or RNIS

These different eligibility options have been explored to understand (a) the best forecast year to set the eligibility of any scheme, and to (b) understand the different approaches to determining eligibility how this may have a bearing on the effectiveness of insulation measures on those exposed above the night time priority and on sleep disturbance.

Relocation Assistance Scheme	
Measure Part of Current Inventory	Yes
New Measure Proposed	No
Responsibility for Measure	daa
Applicants Position and Proposals	
Under Condition 9 of the North Runway Planning Permission, scheme for the voluntary purchase of dwellings scheme is required. This scheme includes all dwellings which are predicted to fall within the 69 dB $L_{Aeq, 16hr}$ contour within 12 months of the planned opening of the runway for use. This scheme was approved by Fingal County Council as part of discharging Condition 9. The scheme is known as the Voluntary Dwelling Purchase Scheme. The Applicant has not proposed any additional voluntary purchase scheme or amendments to the existing scheme under the Application.	
ANCA's Review and Opinion	
Under Variation No. 1 of the County Development Plan, Zone A requires the new provision of residential and other noise sensitive development to be resisted. This relates to noise exposure levels of ≥ 63 dB $L_{Aeq, 16hr}$ and/or ≥ 55 dB $L_{night.}$ The value of 55 dB L_{night} is a priority set by the NAO and as part of this, ANCA is of the view that noise insulation should be provided where exposure occurs above this threshold. The Local Area Plan 2020 states that *"Under no circumstances shall any dwelling be permitted within the predicated 69 dB $L_{Aeq, 16hr}$ noise contour"*. ANCA made a specific request as part of the Direction to Provide Information[108] to ascertain how night time noise exposure levels at dwellings located around Dublin Airport were forecast to change with reference forecast $L_{Aeq,16hr}$ noise exposure levels as they relate to the Voluntary Dwelling Purchase Scheme. The Applicant provided a specific response to this request[109]. This considers the location of dwellings in the vicinity of Dublin Airport, identifying those which are in the existing Voluntary Dwelling Purchase Scheme and its boundary, along with the forecast boundary of the Voluntary	

[108] Request for Further Information 128

[109] Bickerdike Allen Partners, A11267_12_MO028_2.0, ANCA RFI Response 128, 28 July 2021.

Dwelling Purchase Scheme in 2025 and how this relates to L_{night} noise exposure levels for each of the modelled night time runway pattern scenarios as summarised in Appendix E.

The information presented in this response highlights the impact of the Application with respect to increasing night time noise exposure levels above those experienced in 2018 at locations in the vicinity of the north runway.

In the vicinity of the south runway, noise exposure levels in the forecasts are comparable to those experienced in 2018 under certain runway use and restriction scenarios. This indicates that any new or amended Voluntary Dwelling Purchase Scheme would need only consider changes in night time noise exposure around the north runway.

The data provided also shows that in 2018 there are properties within the existing Voluntary Dwelling Purchase Scheme which experienced lower levels of night time noise than some that are not. The data shows that some properties could experience night time aircraft noise above 60 dB L_{night} under certain runway preference and restriction scenarios. However, this level of impact occurred in 2018 at some properties around the south runway that are not in the Voluntary Dwelling Purchase Scheme.

The data does highlight that should the Applicant's preferred runway use and restriction scenario (Scenario P02) be adopted as part of the relevant action, this more likely to lead to consistency with respect to the existing Voluntary Dwelling Purchase Scheme.

Whilst the data provided by the Applicant highlights the potential for elevated levels of night time noise well above the night time priority set by the NAO, the expectation would be that through noise insulation that this level of exposure could in effect be reduced. This needs to be considered alongside data provided by the Applicant which shows a reduction in aircraft night time noise exposure beyond 2025.

For these reasons, ANCA has not considered it appropriate to revisit the Voluntary Dwelling Purchase Scheme.

7.6.6 Operating Restrictions

ICAO guidance encourages *"not to apply operating restrictions as a first resort, but only after consideration of the benefits to be gained from the other three principal elements of the Balanced Approach"* noting that this obligation is also reflected in the Act of 2019 (Section 9(3)(d)) and in the Aircraft Noise Regulation (Article 5(3)(d))

As such, benefits that can be gained from operating restrictions should only be considered once other measures from the Balanced Approach have been analysed.

The Applicant has made proposals which include operating restrictions. The following tables explore these and possible alternative forms of operating restrictions that are available in principle in respect of Dublin Airport.

Aircraft Movement Cap	
Measure Part of Current Inventory	**Yes**
New Measure Proposed	No – proposal is to replace the existing night time aircraft movement cap set under Condition 5 of the North Runway Planning Permission with a Noise Quota Scheme
Responsibility for Measure	daa
Applicant's Position and Proposals	
The Applicant is applying to remove an aircraft movement cap which is in place through Condition 5 of the North Runway Planning Consent. The Applicant has not proposed an aircraft movement cap as part the operating restrictions brought forward within the Application. The Applicant's proposals are to replace Condition 5 with a noise quota scheme which would apply over the period 23:30-05:59.	
ANCA's Review and Opinion	
A movement cap is a simple and transparent way of restricting aircraft operations for noise reasons. It is also a more straightforward measure to manage with respect to compliance. However, a movement limit does not take into account the noise being generated by the aircraft themselves. This means that a G0 aircraft is treated in the same manner as a G1 aircraft. There are therefore no incentives for airlines to introduce quieter aircraft. The NAO set by ANCA seeks to reduce aircraft noise in the context of the sustainable development of Dublin Airport. As such, a movements cap does not necessarily provide for long-term operational flexibility. With sustainability in mind, ANCA's view is that operating restrictions which are set for Dublin Airport should take the form of noise-related limits, rather than blanket restrictions on the aircraft themselves such is the case with a movement limit. A noise quota scheme will have the effect of limiting aircraft movements but within the scope of scheduling aircraft within an overall 'noise budget'. This is considered a more preferable form of restriction and one which aligns better the wider sustainability aspects of the NAO. For these	

reasons, a movement limit which seeks to replace an existing movements limit has not been considered.

Runway Use Restriction	
Measure Part of Current Inventory	Yes
New Measure Proposed	Yes – as part of proposal to amend Condition 3(d) of the North Runway Planning Permission

Applicant's Position and Proposals

The Applicant is applying to remove a runway use restriction as imposed through the North Runway Planning Permission. The Applicant has proposed that the existing restriction be amended so that the north runway shall not be used for take-off or landing between 00:00-05:59 except in *"cases of safety, maintenance considerations, exceptional air traffic conditions, adverse weather, technical faults in air traffic control systems or declared emergencies at other airports or where Runway 10L-28R length is required for a specific aircraft type."*

The Applicant's proposed amendment follows their own assessment work having regard for the provisions of the Aircraft Noise Regulation. As part of this several alternatives were considered by the Applicant in their December 2020 Application, with a further three considered following the Direction to Provide Information.

ANCA's Review and Opinion

Having regard for the current form of the North Runway Planning Permission and the restrictions imposed, ANCA agrees that runway preferences which incorporate runway use restrictions are a measure which should be given consideration.
Such restrictions have therefore been considered for further analysis. The runway use and runway restriction scenarios which have been considered for further analysis include:

- P02 – which prohibits north runway use between the hours of 00:00-06:00
- P09 – which restricts south runway use between the hours of 00:00-06:00
- P11 – which restricts the north runway during the night as per Condition 3(d) of the North Runway Planning Permission
- P12 – which restricts north runway use between the hours of 23:00-06:00
- P13 – which restricts north runway use between the hours of 23:30-05:00

It should be noted that Scenario P11 does not constitute a change to Condition 3(d) however has been considered so to allow ANCA to understand the impact of relevant action in relation to Condition 5 of the North Runway Planning Permission in isolation from the relevant action proposed in relation Condition 3(d).

Aircraft Curfew	
Measure Part of Current Inventory	No
New Measure Proposed	No
Responsibility for Measure	N/A
Applicant's Position and Proposals	
The Applicant has not brought forward proposals for a curfew and nor has one been considered within the documents supporting the Application.	
ANCA's Review and Opinion	
Curfews can be either a global or aircraft-specific partial restriction which prohibit aircraft movements during identified times. Airports Council International (ACI) state in their guidance that[110]: *"… curfews and restrictions are a 'blunt instrument' and can severely impact the efficiency of operations such as the movement of freight. Noise quotas or limits on certain movements can allow some activity while placing a limit on noise impact."*. Aircraft movement profiles provided by the Applicant[111] show that in 2019 aircraft movements occurred in each hour of the night albeit during the period 01:00-04:59 there were a total of 5,394 aircraft movements over the calendar year. The majority of night time movements occurred outside of these hours. A similar trend is shown in each of the other forecasts provided with the busiest periods of the night occurring between 23:00-00:00, and between 05:00-06:59. As such, records of existing aircraft movements along with the schedules utilised by the	

[110] Airports Council International, Managing the Impacts of Aviation Noise, A Guide for Airport Operators and Air Navigation Service Provides, September 2015

[111] Reporting template available on ANCA website

Applicant in its forecasts indicate a relatively low number of aircraft operating during the period 00:00-05:00.

It is the view of ANCA's experts that an overly restrictive curfew at Dublin Airport has the potential to significantly impact airline operations, and in particular the profitability and future growth of low-cost operators (Appendix G). A curfew may also impact the competitiveness of Dublin Airport as a hub airport and the viability of some long-haul routes to North America could also be negatively impacted. Given the night time demand during the hours of 23:00 to midnight and between 05:00-06:59, a curfew could only be considered between these hours.

The NAO assesses aircraft noise using an 8-hour noise exposure metric measured over the period 23:00-06:59. Using these metrics any curfew on the aircraft landing and taking off at Dublin Airport during hours of 00:00-04:59 is unlikely to significantly change overall night time noise exposure this but would result in an adverse impact on Dublin Airport and the airlines.

It is noted that the Applicant's proposals effectively result in a partial curfew by restricting the use of the north runway between 00:00-05:59. For these reasons, ANCA has determined that a partial curfew in the form of a runway restriction is a measure which should be given consideration as part of this relevant action.

Aircraft Type Restriction	
Measure Part of Current Inventory	No
New Measure Proposed	No
Responsibility for Measure	N/A
Applicant's Position and Proposals	
There are currently no restrictions on the types of aircraft which can land or depart at Dublin Airport during the day, evening or night based on their noise impacts, except for where these are banned through existing European legislation. The Applicant has not brought forward any proposals which seek to restrict specific aircraft types based on the noise levels.	
ANCA's Review and Opinion	
Under the Aircraft Noise Regulation and the Act of 2019, measures such as aircraft-specific restrictions, including the withdrawal of marginally compliant aircraft, are operating restrictions.	

The Aircraft Noise Regulation is clear that restrictions which concern restrictions on aircraft types based on noise must be based on their noise certification.

The Applicant has proposed a noise quota scheme, which is discussed in the following review. ANCA has reviewed noise quota restrictions at other airports and notes that these often include restrictions on aircraft types which can operate at night[112].

Such restrictions are therefore considered relevant to the Applicant's proposals and have been subject to further analysis as part of proposals for a Noise Quota Scheme.

Noise Quotas	
Measure Part of Current Inventory	No
New Measure Proposed	Yes
Responsibility for Measure	Airport Airlines Fingal County Council
Applicant's Position and Proposals	

The Applicant has brought forward proposals for a noise quota scheme[113]. The Applicant's proposal is that this scheme shall apply annually over the period 23:30-05:59. The Applicant's proposal is based on the quota system in place in the UK at Stansted Airport. This system uses noise certification data to establish a quota count for an aircraft arrival and departure having regard for take-off weight and engine variant.

The Applicant's proposal is that an Annual Noise Quota of 7,990 be used to limit aircraft noise and movements between the hours of 23:30-05:59 over a calendar year. The proposed quota scheme includes a carry-over and overrun arrangement for which the Applicant is proposing that an allowance from the quota could be carried over into future years. The Applicant's proposed carry-over and overrun provisions are:

- *"If required, a shortfall in use of noise quota in one year of up to 10% may be carried over to the next year;*

[112] Example includes the restrictions in place in the UK at the 'noise designated' London Airports. Further information can be found here: https://nats-uk.ead-it.com/cms-nats/export/sites/default/en/Publications/aip-supplements/EG_Sup_2021_049_en.pdf

[113] Dublin Airport North Runway Relevant Action Application, Draft – Initial Response to ANCA Request for Further Information, June 2021 – Appendix A

- *Conversely, up to 10% of an overrun in noise quota usage in one year (not being covered by carryover from the previous year) will be deducted from the corresponding allocation in the following year;*
- *An overrun of more than 10% will result in a deduction of 10% plus twice the amount of the excess over 10% from the corresponding allocation in the following year;*
- *The absolute maximum overrun is 20% of the original limit in each case."*

ANCA has considered other similar quota schemes and confirms that such provisions are common practice. In addition to the carry-over and overrun provisions of the proposals, dispensations have also been proposed as part of the scheme. These preclude certain movements from being counted towards the noise quota allowance. The Applicant has modelled its proposals for dispensations on those which are set by UK Department for Transport's guidance[114]. This sets four circumstances that allows operators to grant dispensations, which are:

- *"Emergencies;*
- *Widespread and prolonged air traffic disruption;*
- *Delays as a result of disruption leading to serious hardship and congestion at the airfield or terminal;*
- *The Secretary of State can also grant dispensations where movements relate to matters of the state."*

As part of the Direction to Provide Information ANCA requested information to better understand how Dublin Airport's noise quota proposals were developed, understand the potential configuration of a noise quota scheme that applies the 8-hour night time period i.e. 23:00-07:00 instead of 23:30-06:00, and to identify the utilisation of the noise quota beyond the main assessment year relied on by the Applicant of 2025, extending out to 2040 assuming Dublin Airport continues to operate at in line current 32 mppa terminal passenger capacity limit and if this were to increase.

[114] UK Department for Transport, Annex F: Guidelines on Dispensations, July 2014

ANCA also sought the views of the Applicant through the Direction to Provide Information on approaches to review and reduce the noise quota over time. The Applicant's response was that given recovery from the pandemic and the associated uncertainties, reductions in the proposed Annual Noise Quota have not been proposed or considered. However, this could be achieved through review and has indicated that such a review could be undertaken as part of a review five years after the noise quota scheme becomes operational.

ANCA's Review and Assessment

The information provided by the Applicant has demonstrated that its proposed Annual Noise Quota of 7,990 applying over the period 23:30-05:59 would allow Dublin Airport to operate in line with its forecasts beyond 2025 and to 2040 with or without growth above and beyond its existing 32 mppa terminal passenger capacity limit[115]. A similar analysis undertaken by the Applicant, considering ANCA's request to explore a noise quota extending over the 8-hour night time period presents a similar trend, but instead sets the quota at 16,260.

The analysis therefore demonstrates that a noise quota set based on the Applicant's forecast fleet mix and night time movements in 2025 will be sufficient to allow Dublin Airport to meet its forecasts beyond 2025, with or without growth in passenger numbers.

ANCA is therefore conscious that under the Applicant's proposals, whilst the noise quota sets an operating restriction, it does not inhibit the ability of Dublin Airport to meet its forecasts for passenger and ATM growth in the future. This is due to the proposal setting the noise quota at a value for which the introduction of quieter aircraft will cater for more aircraft to be operated within the same noise quota in the future. As such, the proposed noise quota provides the incentive for Dublin Airport to use quieter aircraft in return for additional movements. This is only possible as the proposals do not include an aircraft movement limit, and providing Dublin Airport continues to meet the NAO.

The Applicant's proposals include allowances for carry-overs and overruns which would allow the noise quota in one year to be increased by as much as 10%. However, ANCA notes that the

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Applicant's proposed quota values already includes some headroom. The dispensations offered by the Applicant are noted and are accepted as these form part of other similar quota schemes.

There are two differences between the Applicant's proposals and other noise quota schemes, particularly in the UK. The first is that it does not include an associated aircraft movement limit however there are quota schemes that do not include these, and as outlined, such a restriction potentially affects the sustainable growth of Dublin Airport. The second is that no restrictions are imposed on certain aircraft types due to noise. Restrictions such as these are in place at other airports and at Stansted, Dublin Airport upon which the Applicant has based its noise quota scheme proposals. At Stansted, aircraft with a QC of 4.0 or more are not permitted to take off or land during the hours of 23:30-05:59 as determined through a UK Department of Transport's recent decision on revisions to their night flying restrictions[116]. The fleet mix provided with the Applicant's forecasts for 2025 indicate that throughout the 8-hour night period there are no aircraft with a QC of 4.0 or more on take-off or a QC of 2.0 or more on landing are forecast to operate. This indicates that Dublin Airport could potentially operate within such restrictions. If such restrictions were made progressively more restrictive in 2030 to restrict aircraft with a QC of 2.0 or more on take-off and a QC of 1.0 or more on landing, this would preclude a number of types forecast to operate during the night in 2030 and beyond. These types are mainly G0 aircraft such as the Airbus A330, Boeing 737-400/500 and Boeing 757/767/777. In 2030, these types are forecast to make up approximately 12% of the forecast 8-hour night time movements. As such, a progressively tighter restriction of this nature would influence the forecasts.

ANCA is of the view that such a restriction should be given consideration and that further consideration should be given to making this type of restriction progressively more stringent in line with the NAO's objective of reducing aircraft noise at night.

With respect to the Applicant's proposals for a review of the noise quota, ANCA has given consideration to this proposal in the context of the Act of 2019. Under the Act of 2019 any amendment of a noise quota scheme or another form of operating restriction can only be achieved through one of the following routes:

1. A planning application which is brought forward to change the noise quota.

[116] UK Department for Transport, Night Flight Restrictions at Heathrow, Gatwick and Stansted, July 2021

2. A noise problem being declared by ANCA having regard for Dublin Airport's performance against the outcomes defined within the NAO.

No other formal mechanism for amending the noise quota has been identified however the NAO provides clear outcomes that require aircraft noise to be reduced over the period to 2040. This will set an overarching framework within which Dublin Airport will need to operate.

The Applicant has determined that time period for their proposed noise quota is a 6.5-hour period between 23:30-05:59. This aligns with the approach taken by the UK Department for Transport. ANCA notes that this period does not align with the definition of night under EU or Irish noise policy. ANCA notes that during the UK Department of Transport's consultation on its night flight restrictions[117] it requested views on moving to an 8-hour noise quota period to align with the 8-hour noise policy period. This consultation sought views on this change as part of changes beyond 2024. It is noted that the movement restriction imposed by Condition 5 of the North Runway Planning Permission is an 8-hour night time restriction. It is for this reason that ANCA requested through the Direction to Provide Information that information be provided in relation to a potential 8-hour noise quota scheme[118]. Information was provided by the Applicant[119].

Based on the above ANCA determined that the following noise quota restrictions be considered for further analysis. These are outlined below.

- The Applicant's Proposal – a 6.5-hour annual noise quota set at 7,990 apply over the period 23:30-05:59.
- An alternative developed by ANCA: an 8-hour annual noise quota set at 16,260 should apply over the period 23:00-06:59 with restrictions on aircraft types based on their quota count as outlined above.

[117] UK Department for Transport, Night Flight Restrictions Consultation Outcome, July 2021 – available here: https://www.gov.uk/government/consultations/night-flight-restrictions-at-heathrow-gatwick-and-stansted-airports-between-2022-and-2024-plus-future-night-flight-policy/night-flight-restrictions

[118] Further Information Request 72

[119] Dublin Airport North Runway Relevant Action Application, Draft – Initial Response to ANCA Request for Further Information, June 2021 – Appendix A

Noise Contour Area and Shape Restriction	
Measure Part of Current Inventory	No
New Measure Proposed	No
Responsibility for Measure	N/A
Applicant's Position and Proposals	
The Applicant has not proposed a noise contour area or shape restriction.	
ANCA's Review and Opinion	
Noise contour area restrictions provide a means of restricting and limiting noise impacts. However, such a restriction or condition already forms part of the outcomes which have been set by ANCA in the NAO. A noise contour area restriction will restrict the 'noise output' of an airport. The NAO extends this further by restricting the effects of Dublin Airport. For this reason, ANCA considers that a noise contour restriction does not add any additional benefit that what is expected from Dublin Airport through the NAO.	

7.6.7 Forecast with New Measures

The implementation of the Balanced Approach as discussed in previous chapters has highlighted options for new measures to be taken forward for consideration as part of the relevant action. These are summarised as follows:

7.6.7.1 New Measures to be Considered

Table 7.17 presents the noise quota and aircraft type restrictions considered as part of the forecast with new measures. Having regard to the information provided by the Applicant, ANCA is of the view that these restrictions are unlikely to have a major bearing on the noise forecasts i.e., each of these forms of restriction are likely to result in similar levels of noise exposure as forecast by the Applicant. As such these measures have been the subject of a cost-effectiveness assessment.

Table 7.17: Noise Quota and Aircraft Type Restrictions

Noise Quota and Aircraft Type Restrictions	
Applicants Proposal	6.5-hour Annual Noise Quota set at 7,990 apply over the period 23:30-05:59.

Alternative	8-hour Annual Noise Quota set at 16,260 apply over the period 23:00-06:59 with the following restrictions on aircraft types: • No aircraft with a Quota Count of 4.0 or more shall be permitted to take off at Dublin Airport during the Noise Quota period. • No aircraft with a Quota Count of 2.0 of more shall per permitted to land at Dublin Airport during the Noise Quota Period. • No aircraft with a Quota Count of 2.0 or more shall be permitted to take off at Dublin Airport during the Noise Quota Period from 1 January 2030. • No aircraft with a Quota Count of 1.0 or more shall be permitted to land at Dublin Airport during the Noise Quota Period from 1 January 2030.

Table 7.18 presents the preferential runway use and runway restriction scenarios which have been considered. Scenario P06 relates to the Forecast Without New Measures with Scenario P01 reflecting a forecast situation should no relevant action be taken i.e., Dublin Airport operates in line with the North Runway Planning Permission.

All the scenarios outlined in Table 7.18 below have assumed different approaches to using Dublin Airport's runways at night with the exception of Scenario P11. This scenario relates to a forecast where relevant action is taken with respect to Condition 5 of the North Runway Planning Permission however the north runway remains restricted throughout the night. This scenario has been considered specifically to understand the benefit in allowing scheduled use of the north runway at night. All forecasts provided by the Applicant for the scenarios outlined below have assumed that Condition 5 of the North Runway Planning Permission has been replaced with a noise quota scheme and that Dublin Airport is capable of meeting its unconstrained forecasts. On this basis, the further analysis provided by ANCA in the subsequent sections has focussed on the relative performance of these measures with respect to the NAO and its priorities.

Table 7.18: Preferential Runway Use and Runway Restriction Scenarios considered for further analysis

Preferential Runway Use and Runway Restriction Scenarios			
Scenario	**Forecast Type**	**Night time Runway Use and Restrictions**	**Requires Restriction?**

P02	Forecast with New Measures	South runway preferred 00:00-06:00. Otherwise as per Condition 3(a)-(c)	Yes – north runway restricted between 00:00 and 06:00
P03	Forecast with New Measures	As per Condition 3(a)-(c)	No – however pattern effectively extends Condition 3(a-c) of the north runway Consent to apply irrespective of time of day
P04	Forecast with New Measures	Reverse of Condition 3(a)-(c) i.e. Runway 10L and Runway 28L preferred for departures, Runway 10R and Runway 28R preferred for arrivals	No
P05	Forecast with New Measures	Alternation between Patterns P03 and P04	No
P07	Forecast with New Measures	Departures operate from the north or south runway depending on destination. Arrivals operate as per Condition 3(b) and Condition 3(c) unless runway capacity exceeded	No
P08	Forecast with New Measures	Departures modelled as per Condition 3(b) and 3(c). Arrivals modelled as 50/50 split between runways unless runway capacity exceeded	No
P09	Forecast with New Measures	north runway preferred 00:00-06:00. Otherwise as per Condition 3(b) and 3(c).	Yes – south runway restricted between 00:00-06:00
P10	Forecast with New Measures	Alternate between Patterns P02 and P09	No

P11[120]	Forecast with New Measures	South runway only	Yes – north runway restricted between 23:00-07:00
P12	Forecast with New Measures	South runway preferred 23:00-06:00. Otherwise as per Condition 3(a)-(c)	Yes – north runway restricted between 23:00-06:00
P13	Forecast with New Measures	South runway preferred 23:30-05:00. Otherwise as per Condition 3(a)-(c).	Yes – north runway restricted between 23:30-05:00

The preferential runway use and runway restriction scenarios outlined in Table 7.18 will lead to a different pattern and distribution of aircraft noise around Dublin Airport at night. This will have a consequential effect on the numbers of people who may be eligible for noise insulation under proposed the Residential Sound Insulation Grant Scheme (RSIGS). This measure has also been considered having regard for different approaches to determine eligibility. This has had regard for the following criteria as outlined in Table 7.19 below.

Table 7.19: Residential Sound Insulation Scheme eligibility options considered for further analysis

RSIGS Eligibility Options	
Eligibility Option **A**	> 55 dB L_{night} in 2022 for dwellings not captured by HSIP or RNIS
Eligibility Option **B**	> 55 dB L_{night} in 2025 for dwellings not captured by HSIP or RNIS
Eligibility Option **C1**	> 55 dB L_{night} in 2022 and a change of 9 dB above 50 dB compared to conditions in 2018 for dwellings not captured by HSIP or RNIS
Eligibility Option **C2**	55 dB L_{night} in 2025 and a change of 9 dB above 50 dB compared to conditions in 2018 for dwellings not captured by HSIP or RNIS
Eligibility Option **C3**	> 55 dB L_{night} in 2022 and a change of 9 dB above 50 dB compared to conditions in 2019 for dwellings not captured by HSIP or RNIS
Eligibility Option **C4**	> 55 dB L_{night} in 2025 and a change of 9 dB above 50 dB compared to conditions in 2019 for dwellings not captured by HSIP or RNIS

[120] P11 has been used to reflect a scenario where Condition 5 has been amended by Condition 3(d) remains in place

Eligibility Option **C5**	> 55 dB L_{night} in 2022 and a change of 9 dB above 50 dB compared to conditions forecast for the situation in 2022 for dwellings not captured by HSIP or RNIS
Eligibility Option **C6**	> 55 dB L_{night} in 2025 and a change of 9 dB above 50 dB compared to conditions forecast for the situation in 2025 for dwellings not captured by HSIP or RNIS

7.6.8 Noise Exposure from 2022 to 2025, and 2025 as the main year of assessment

The data provided by the Applicant shows that for all scenarios noise exposure is forecast to increase from 2022 to 2025 before beginning to reduce. This is explored further in later sections where the forecasts and scenarios prepared by the Applicant are considered more broadly against the NAO accounting for factors such as future development and growth in passenger numbers and populations.

As the data submitted by the Applicant points to noise exposure levels being at their highest in 2025 and that is the year when the Applicant forecasts that Dublin Airport returns to 32 million passengers (i.e., at its terminal passenger capacity limit) with the relevant action, ANCA has made the assessment year of 2025 its primary focus when considering forecasts with new measures. This is also reflected in the assessment period adopted in the cost-effectiveness analysis.

7.6.9 Impact of Relevant Action in relation to Condition 5

In line with the first two aspects of the noise problem identified with the Application, any modification of Condition 5 that allows more aircraft than the 65 per night that is currently permitted is likely to result in increased night time noise. The best illustration of this is the comparison between Scenario P01 and Scenario P11. In these scenarios the only difference is the replacement of the 65 per night movement restriction with a quota scheme that facilitates Dublin Airport's forecasts.

Table 7.20 shows that in 2025 with Dublin Airport operating at 32 mppa in Scenario P11 and with Dublin Airport operating at 30.4 mppa in Scenario P01, the population HA and population HSD would increase, along with the number of people exposed to levels above the priorities set by the NAO.

Table 7.20: Population HSD, HA and exposed above the NAO priorities in 2019 and in Scenarios P01 and P11 in 2025

Scenario	Population HSD	Population > 55 dB L_{night}	Population HA	Population > 65 dB L_{den}
2019 Situation	47,045	1,533	115,738	285
2025 P01 30.4 mppa	22,500	280	64,241	119
2025 P11 32.0 mppa	35,799	1,535	77,630	236

This is also illustrated in Figure 7.9 below which presents the night time priority level of 55 dB L_{night}.

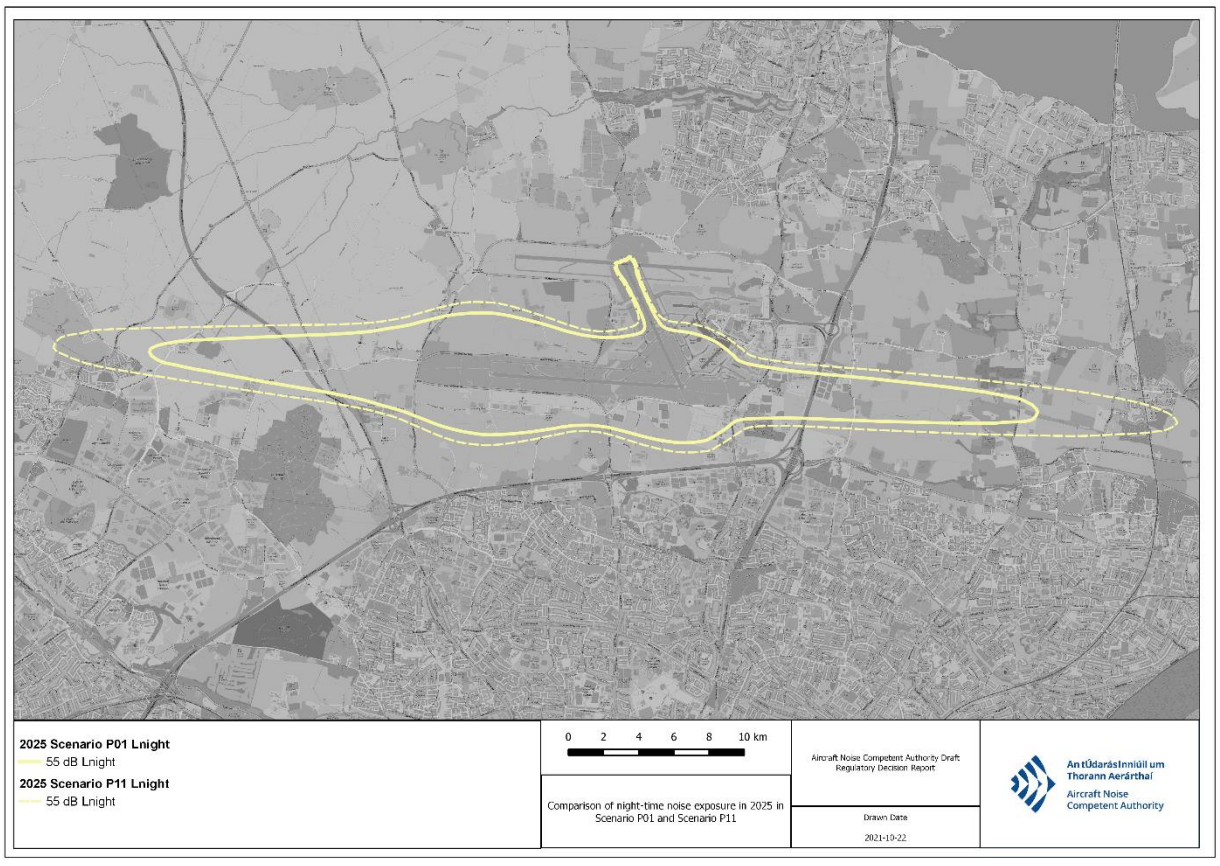

Figure 7.9: 2025 Scenario P01 and Scenario P11 55 dB L_{night} exposure contours

ANCA's analysis shows that irrespective of the preferential runway and runway restriction scenarios which have been considered, there will be an increase in noise exposure compared to

the forecast situation. As such it has been necessary for ANCA to consider the cost-effectiveness of the existing restriction i.e., Condition 5 alongside the alternative noise quota scheme options.

If the south runway were to be used at night and Condition 5 is replaced with a noise quota scheme enabling the Applicant's forecasts, this would still result in a reduction in the number of people HSD and HA compared to 2019. However, the number of people experiencing night time noise above the priority value of 55 dB L_{night} could potentially exceed the number which occurred in 2019. Table 7.20 assumes no population growth, however if the population grows, the forecasts provided by the Applicant indicate that the number of people exposed to levels above the night time priority under Scenario P11 could exceed 4,000. This will not achieve the outcomes of the NAO which require the number of people exposed to aircraft noise above 55 dB L_{night} to be reduced compared to 2019.

7.6.10 Impact of Relevant Action in Relation to Condition 3(d) and Condition 5

As established in the previous section, amending Condition 5 of the North Runway Planning Permission to facilitate the Applicant's forecasts will lead to increased aircraft noise exposure compared to the situation where the relevant action is not taken. The effect of the relevant action in relation to both Condition 3(d) and Condition 5 is therefore two-fold. Firstly, it will allow for increased aircraft noise exposure, and secondly it will have the effect of redistributing aircraft noise depending upon how the runways are to be used at night.

Table 7.21 shows how in 2025 the various preferential runway usage and runway restrictions scenarios combined with the Applicant's forecasts as part of replacing Condition 5 with a noise quota scheme perform against the key measures of the NAO. In Table 7.21, population growth has not been taken into account.

Table 7.21 shows that the outcomes are dependent upon how the runway can be used at night and in particular the sensitivity and variation in the population exposed to levels above the night time priority.

Table 7.21: Population HSD, HA and exposed above the NAO priorities in 2019 and in 2025 for the modelled runway use and restriction scenarios

Scenario	Population HSD	Population > 55 dB L_{night}	Population HA	Population > 65 dB L_{den}
2019 Situation	47,045	1,533	115,738	285
2025 P01 30.4 mmpa	22,500	280	64,241	119
2025 P02 32.0 mppa	37,080	1,059	79,405	196

2025 P03 32.0 mppa	35,757	1,055	77,962	201
2025 P04 32.0 mppa	35,260	737	78,838	167
2025 P05 32.0 mppa	36,363	412	78,774	151
2025 P07 32.0 mppa	36,699	989	78,921	192
2025 P08 32.0 mppa	35,784	422	78,301	161
2025 P09 32.0 mppa	34,896	528	77,553	163
2025 P10 32.0 mppa	36,463	426	78,686	158
2025 P11 32.0 mppa	35,799	1,535	77,630	236
2025 P12 32.0 mppa	37,159	1,119	79,641	199
2025 P13 32.0 mppa	36,275	1,055	78,606	189

What is apparent from Table 7.21 is that the main differentiator between the various runway use and runway restriction scenarios is the population exposed to the priority values, particularly at night. In relative terms, these change more considerably than the population HA or population HSD.

Table 7.21 highlights that for Scenario P11 where the south runway is used throughout the night, this results in a higher number of people being exposed above the night time priority value than in the other scenarios where the north runway is being used during the night to various degrees or as part of a wider pattern of use. It is however noted that the population HSD from using only the south runway at night is lower than for many of the other scenarios considered.

A further consideration is the fact that allowing the north runway to be used at night will result in changes in aircraft noise exposure, which may lead to potentially significant effects using the methodology used by the Applicant in the EIAR. This is highlighted in the third aspect of the noise problem determined from the Application as summarised in this report.

Appendix E presents night time noise change maps which help demonstrate the change in noise exposure for the various runway use and runway restriction scenarios in 2025 compared to the forecast situation (Scenario P01). Examples are presented in the following figures for Scenario P02, P10 and P13.

These figures illustrate that use of the north runway at night has the potential to result in increases of 9 dB in noise exposure and above in locations immediately under the north runway arrival and departure routes. In the case of Scenario P02 where the runway is used only for departures at night as shown in Figure 7.10 these increases are limited to the departure routes.

This is also the case for Scenario P13 as shown in Figure 7.12 for Scenario P10, increases occur under both the arrival and departure routes. However, in this scenario there is a clear reduction in noise under the south runway arrival and departure routes.

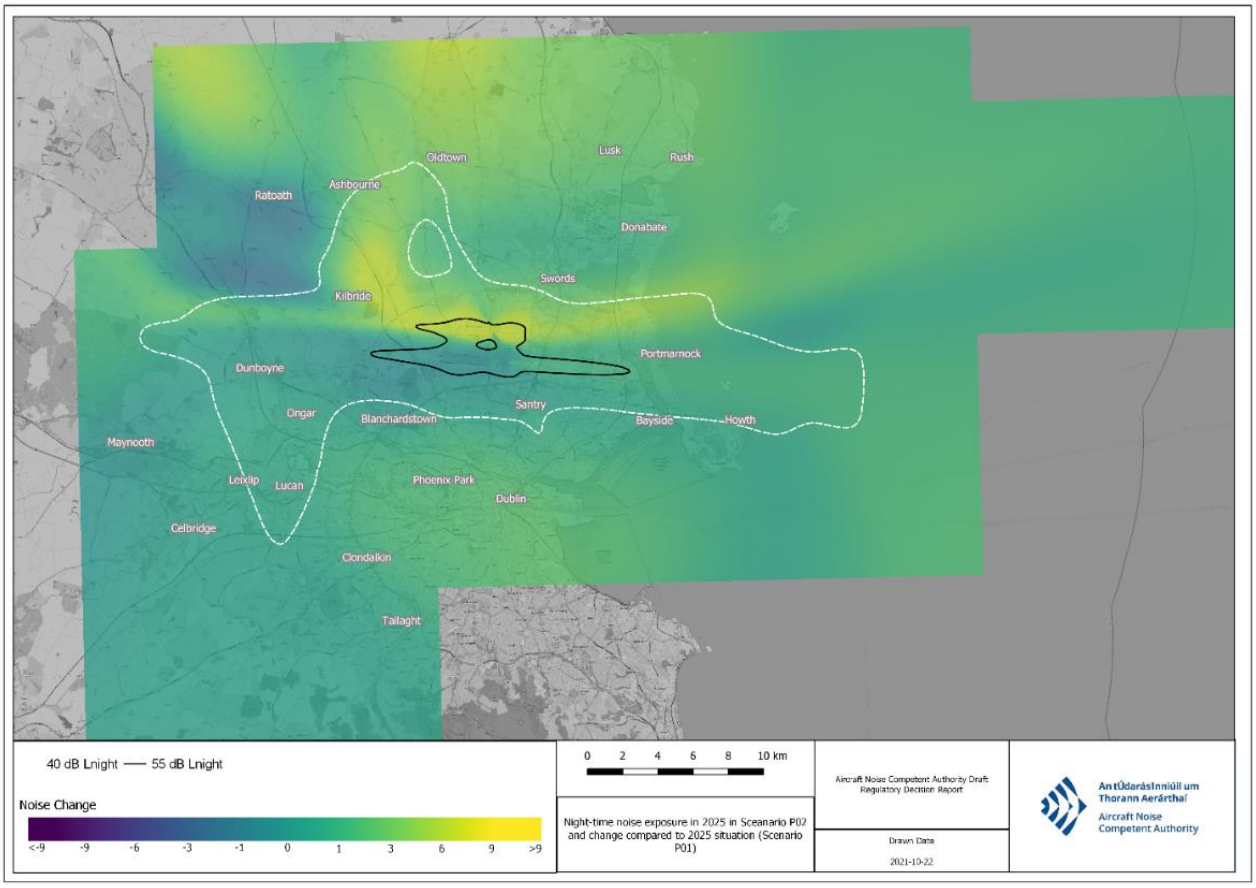

Figure 7.10: 55 dB L_{night} and 40 dB L_{night} in 2025 Scenario P02 with noise exposure changes compared to 2025 Scenario P01 (the noise situation in 2025)

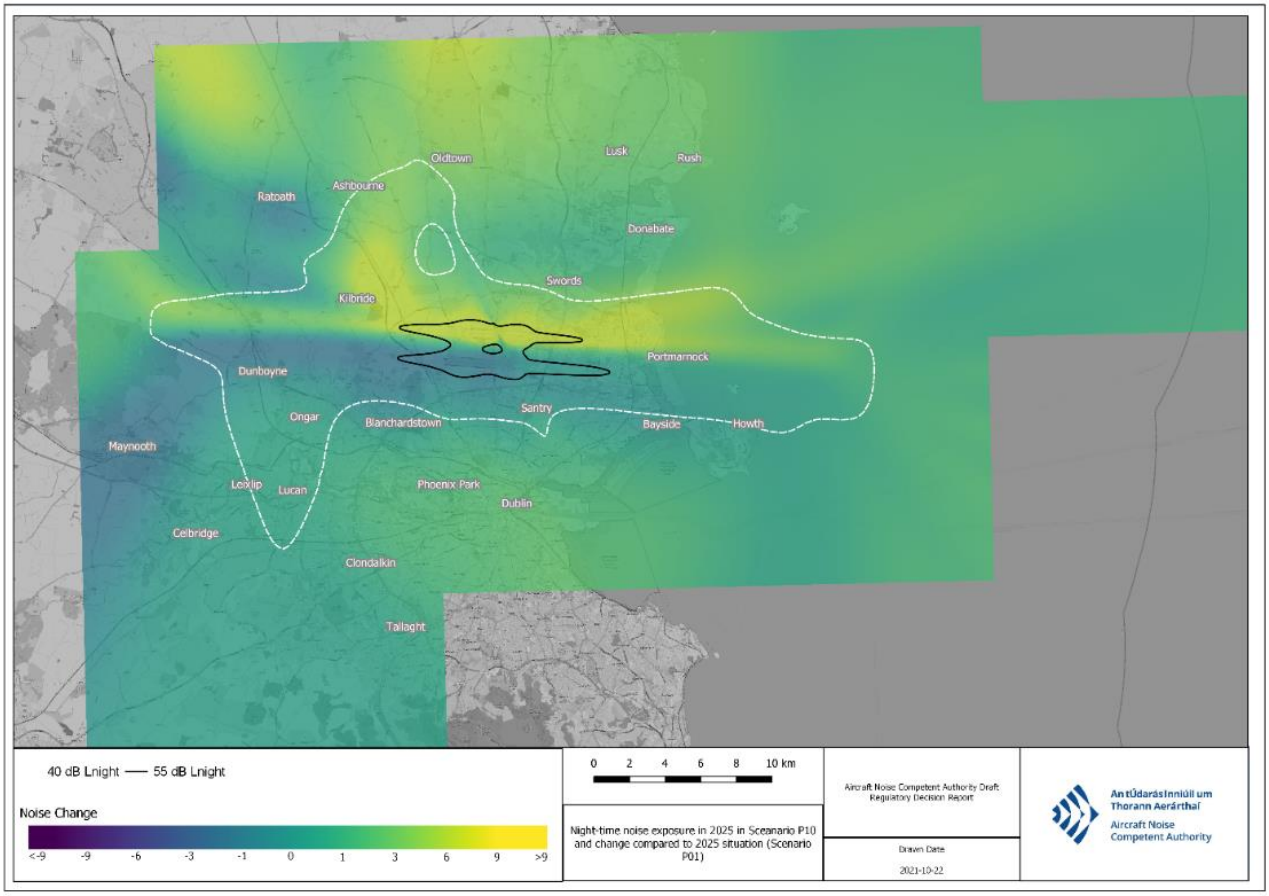

Figure 7.11 55 dB L_{night} and 40 dB L_{night} in 2025 Scenario P10 with noise exposure changes compared to 2025 Scenario P01 (the noise situation in 2025)

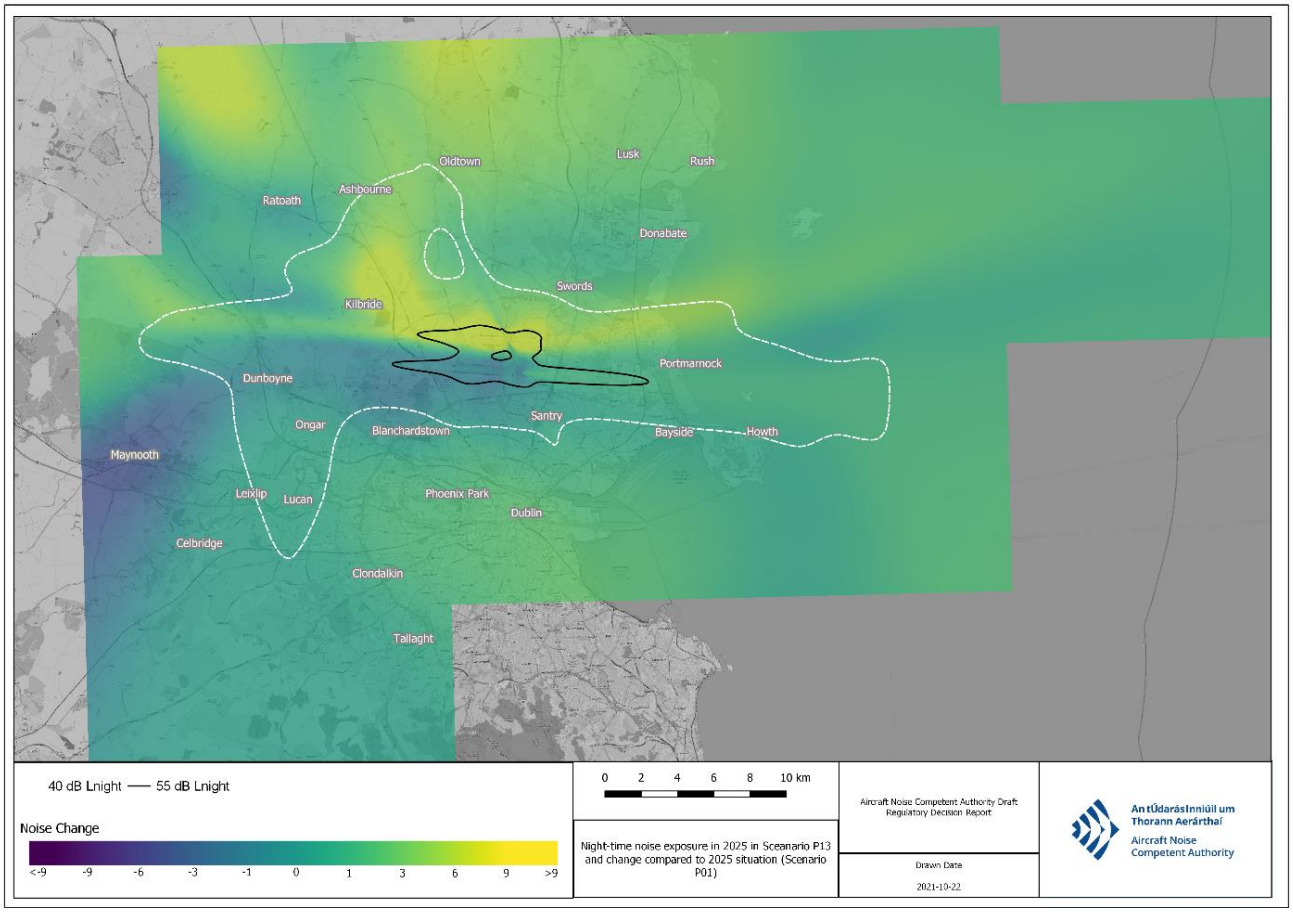

Figure 7.12: 55 dB L_{night} and 40 dB L_{night} in 2025 Scenario P13 with noise exposure changes compared to 2025 Scenario P01 (the noise situation in 2025)

The Applicant has provided data which indicates the number of people that would experience significant effects using the EIAR methodology. This data does not include scenarios P11, P12 or P13 however it does highlight general trends with respect to how differences in the use of the north runway could lead to significant adverse effects. This is reproduced in Table 7.22Table 7.22: Population experiencing significant adverse effects due to changes in night time noise exposure in 2025 below.

Table 7.22: Population experiencing significant adverse effects due to changes in night time noise exposure in 2025

Scenario	Population Experiencing Significant Night time Noise Effects in 2025 arising from changes in aircraft noise exposure as per the EIAR significance criteria[121]
2025 P01 30.4 mmpa	0
2025 P02 32.0 mppa	1,879
2025 P03 32.0 mppa	3,677
2025 P04 32.0 mppa	23,414
2025 P05 32.0 mppa	17,547
2025 P07 32.0 mppa	17,050
2025 P08 32.0 mppa	4,629
2025 P09 32.0 mppa	14,984
2025 P10 32.0 mppa	22,379

Table 7.22 shows that for the scenarios where this analysis has been provided, Scenario P02 results in the fewest number of people experiencing adverse effects due to changes in noise exposure from the relevant action in 2025. ANCA's analysis is that adverse changes in noise exposure are expected to occur where the north runway is used. Where the north runway is utilised more, there will be greater adverse effects with respect to changes in exposure. However,

[121] At least 40 dB L_{night} and at least 9 dB increase

At least 45 dB L_{night} and at least 6 dB increase

At least 50 dB L_{night} and at least 3 dB increase

At least 55 dB L_{night} and at least 2 dB increase

At least 60 dB L_{night} and at least 1 dB increase

At least 40 dB L_{night} and at least 9 dB increase

At least 45 dB L_{night} and at least 6 dB increase

At least 50 dB L_{night} and at least 3 dB increase

At least 55 dB L_{night} and at least 2 dB increase

At least 60 dB L_{night} and at least 1 dB increase

such outcomes also need to be offset against the overall number of people forecast as HSD and exposed to noise above the priority of 55 dB L_{night}.

The number of people experiencing significant adverse changes in noise exposure is not a metric which is part of the NAO. However, this is an aspect of the noise problem identified as part of the Application. For this reason, ANCA has had regard for this in its decision making.

The data provided by the Applicant as reviewed by ANCA highlights that any decision which is made with respect to the form of operation or pattern of runway use that occurs by either setting a night time runway preference and/or runway restriction will have a consequential effect on the location and number of dwellings eligible under any proposed sound insulation scheme. For this reason, ANCA has had regard for how each potential runway use and runway restriction scenario potentially influences the eligibility and cost in relation to noise insulation. This assessment, along with the effectiveness of such measures is addressed within the cost-effectiveness assessment.

7.6.11 Review of Forecasts Against the NAO

The Applicant has provided data which allows consideration to be given to the performance of the various scenarios against the NAO. The Application originally provided data for 2022 and 2025. In response to the Direction to Provide Information, ANCA specifically requested forecasts which extend beyond 2025, and consider noise exposure in 2030, 2035 and 2040. These forecasts have also had regard for whether Dublin Airport would be operating at and above its current 32 mppa terminal passenger capacity limit.

It is stressed that the Application does not seek to remove or amend the existing terminal passenger capacity limit however this information is considered helpful in understanding under what circumstances Dublin Airport can meet the NAO. The information provided by the Applicant has also allowed consideration to be given to the potential impact of population growth on meeting the NAO. The following sections summarise ANCA's review of these forecasts.

7.6.11.1 2025 Forecasts

Figure 7.13 shows that in 2025 with Dublin Airport operating at 32 mppa with the relevant action, all runway usage and restriction scenarios would result in outcomes that are better than 2019 with respect to the population HA and population HSD.

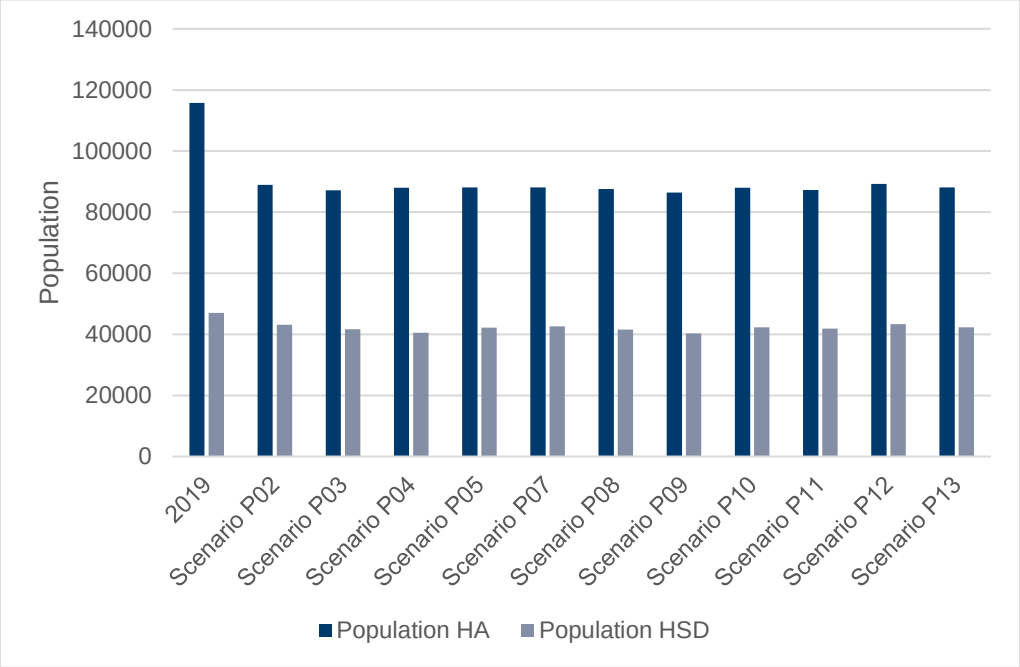

Figure 7.13: Population HA and HSD in 2025 under different runway use and restriction scenarios

Figure 7.14 presents the same analysis with respect to the night time priority value of 55 dB L_{night}.

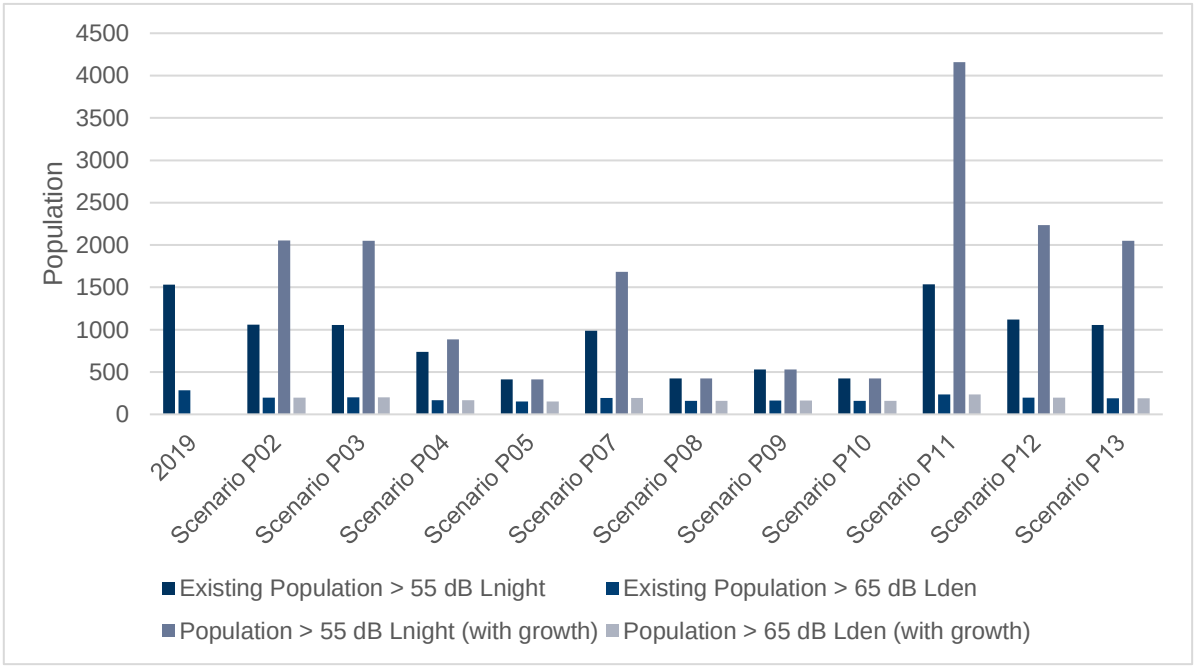

Figure 7.14: Population exposed to levels above the NAO priorities under different runway use and restriction scenarios with and without potential population growth

7.6.11.2 Forecasts beyond 2025 with the 32 mppa Terminal Passenger Capacity Limit

Figure 7.14 shows that, with respect to the priorities, without population growth, only Scenario P11 (south runway only) would result in more people being exposed to the night time priority value than occurred in 2019. With population growth, several scenarios have the potential to result in more people being exposed to the night time priorities than in 2019. However, this relies on all foreseeable development occurring and being built out over the period 2022 to 2025.

Figure 7.15 shows how each of the scenarios perform over the period from 2025 to 2040 with Dublin Airport operating at its 32 mppa terminal passenger capacity limit as per the Application. It should be noted that forecasts for Scenarios P04, P05, P09 and P10 have not been made available by the Applicant beyond 2025. This is considered a proportionate approach given the focus of the assessment is on 2025 and that the forecasts beyond 2025 have been used to identify how the noise climate may evolve into the future if relevant action is taken, in line with the NAO.

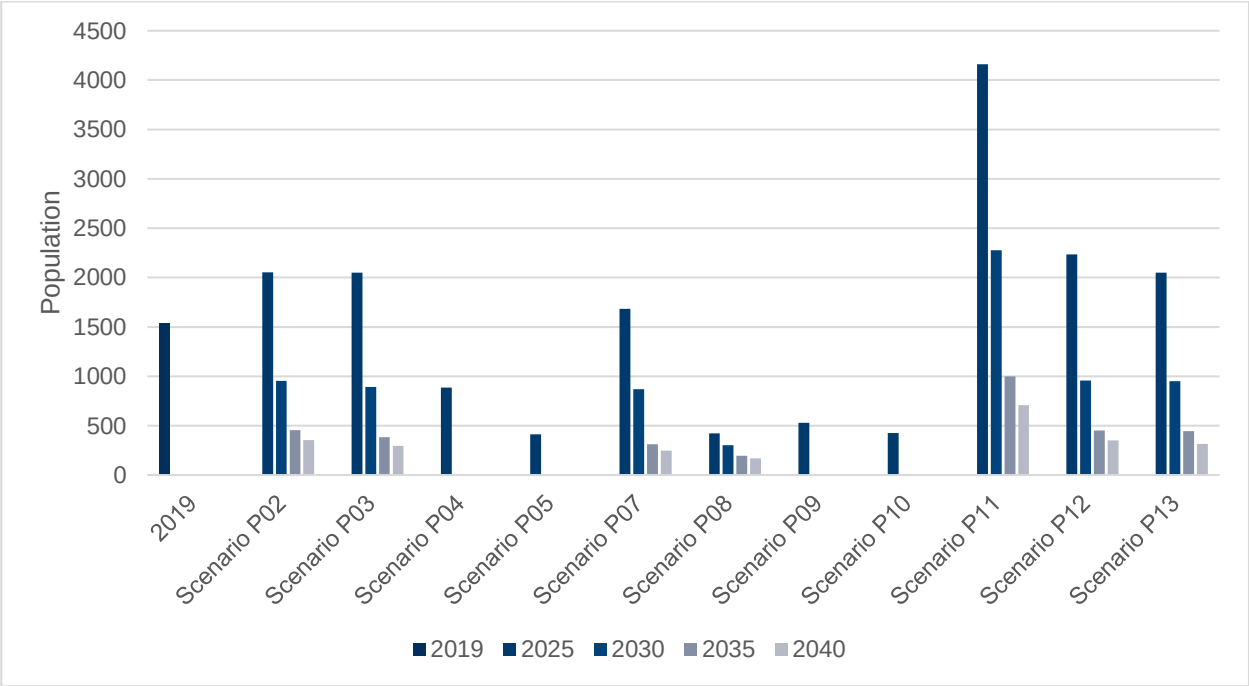

Figure 7.15: Population exposed to levels above the NAO night time priority of 55 dB L_{night} under different runway use and restriction scenarios with potential population growth over the period 2025 to 2040

Table 7.15 demonstrates that, when accounting for potential population growth, the number of people that may be exposed to aircraft noise above the night time priority will be lower in 2030 than it was in 2019, (with the exception of Scenario P11 – south runway only).

The population growth assumptions utilised by the Applicant are documented[122]. What is important to note is that these are estimates only and rely on an analysis of permitted developments and allocating lands zoned for residential development with an assumed number of dwellings and population per hectare. In preparing the analysis presented in Figure 7.15 above, it has been assumed that all forecast population growth has already occurred. ANCA's view is that this is unlikely to have occurred by 2025 but that it may have occurred by 2030. For this reason, ANCA has not ruled out any scenario which exceeds the night time priority in 2025 when accounting for potential population growth except for Scenario P11.

It is important to note that any zoned land which is exposed to night time aircraft noise of above 55 dB L_{night} would need to be subject to a planning application and a noise assessment with the specification of appropriate sound insulation. This is a requirement under Variation No. 1 of the County Development Plan. As such, the population which may be exposed to aircraft noise above the night time priority in the future will be influenced by planning decisions.

When having regard for the reduction in the population HA and HSD, Figure 7.16 and Figure 7.17 show that, with the 32 mppa terminal passenger capacity limit in place, and when assuming population growth, all scenarios can achieve the outcomes set by the NAO for 2030 (30%), 2035 (40%) and 2040 (50%) with respect to the percentage reduction in HA and HSD respectively. In the case of Scenario P02, this only just meets the NAO in 2030 (by 0.3% for population HSD) with the population growth assumed. In the case of Scenario P12 the percentage reduction is 29.9% in 2030.

[122] Dublin Airport North Runway Relevant Action Application, Noise Information – ANCA Request February 2021, June 2021 – Appendix B

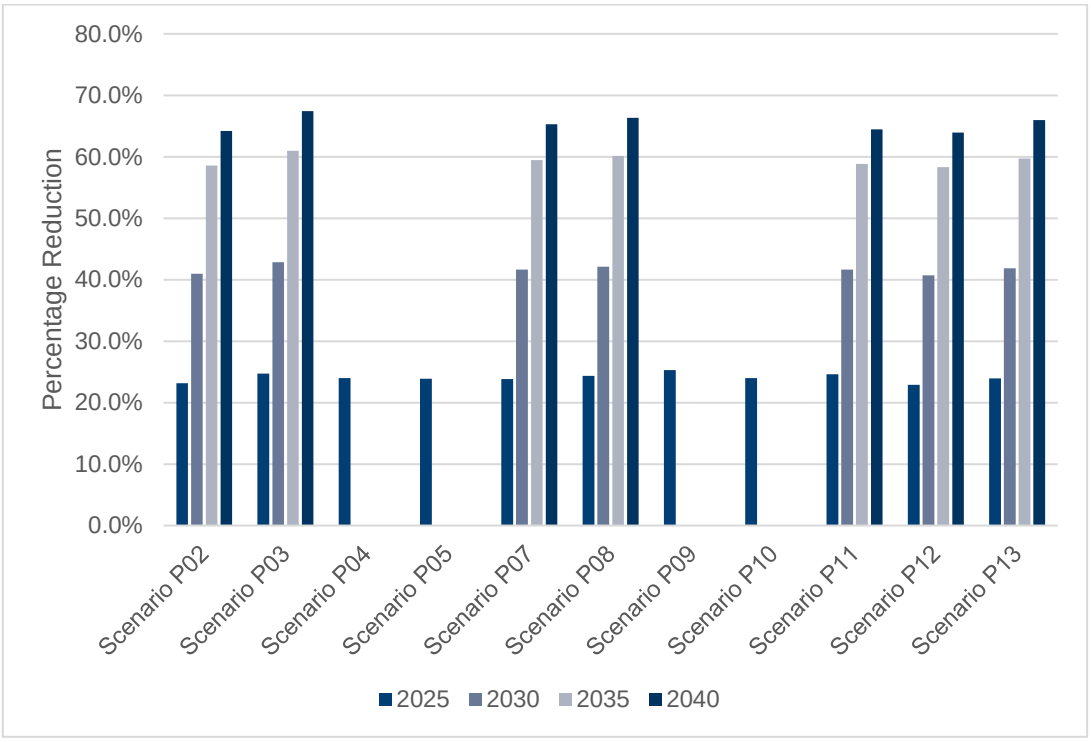

Figure 7.16: Percentage reduction in population HA for runway use and restriction scenarios over the period to 2040

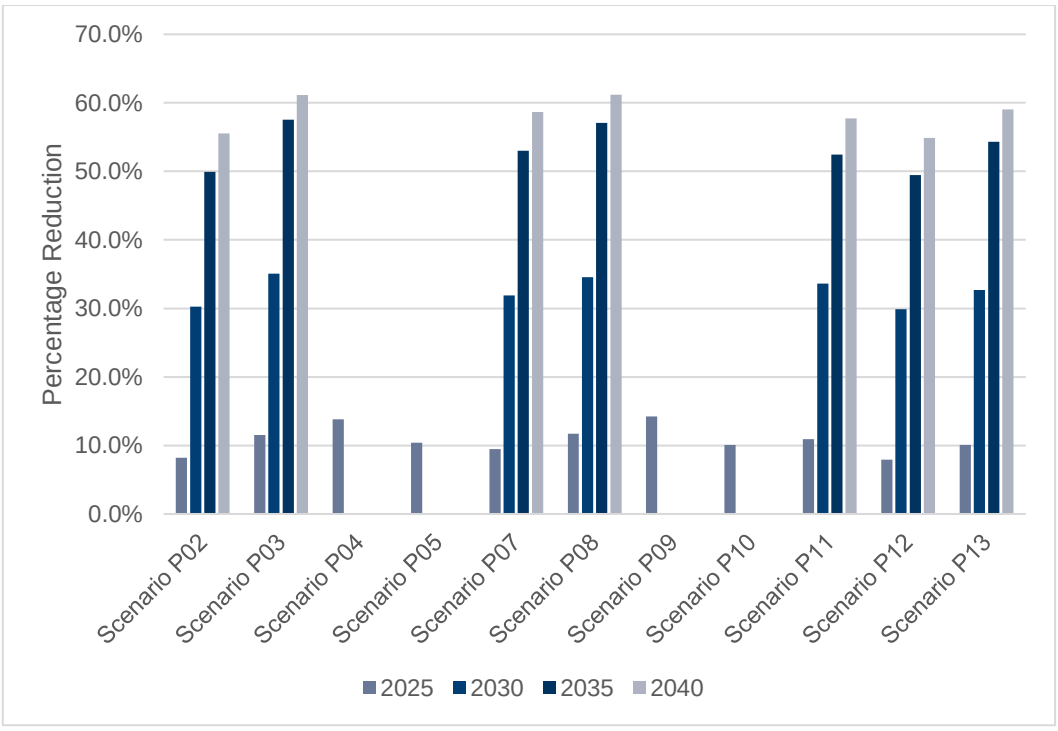

Figure 7.17: Percentage reduction in population HSD for runway use and restriction scenarios over the period to 2040

In reviewing the forecasts provided by the Applicant for the forecast years of 2025 to 2040 where the 32 mppa terminal passenger capacity limit remains in place, the Applicant has not forecast any increase in night time aircraft movements beyond 2025. In all forecasts the total number of aircraft movements during the night is forecast at approximately 32,884 in each of the forecast years. This should be compared to a total of 29,320 night time movements in 2019 and should be placed in context against the forecast of 19,521 night time movements if Condition 5 remained in place.

7.6.11.3 Forecasts beyond 2025 and without the 32 mppa Terminal Passenger Capacity Limit in Place

In response to the Direction to Provide Information, the Applicant has provided forecasts which extend beyond 2025 and study the impact of further growth in passenger numbers. Under scenarios where the relevant action is taken to replace Condition 5 of the North Runway Planning Permission with a noise quota scheme, and scheduled operations are allowed from the north runway at night, along with a further planning application to either lift or increase the 32 mppa terminal passenger capacity limit, the Applicant has forecast that by 2040 Dublin Airport could achieve a passenger throughput of 46.6 mppa.

These forecasts do not apply to the Application as has been made as the Applicant is not seeking to lift the 32 mppa terminal passenger capacity limit. However, the wider policy context upon which the NAO has had regard to anticipates growth at Dublin Airport. ANCA has therefore considered these forecasts against the outcomes set by the NAO in 2030, 2035 and 2040. It is stressed that this analysis does not form part of the assessment undertaken by ANCA with respect to the relevant action as applied for but is considered helpful to identify the potential performance against the NAO in a growth setting. In the analysis presented in Figure 7.18 and Figure 7.19 below, the reduction in population HA and population HSD compared to 2019 is presented for a selection of runway preference and runway restriction scenarios. The analysis has had regard for potential population growth and has adopted forecasts where Dublin Airport has a passenger throughput of 39.6 mppa in 2030, 43.4 mppa in 2035 and 46.6 mppa in 2040.

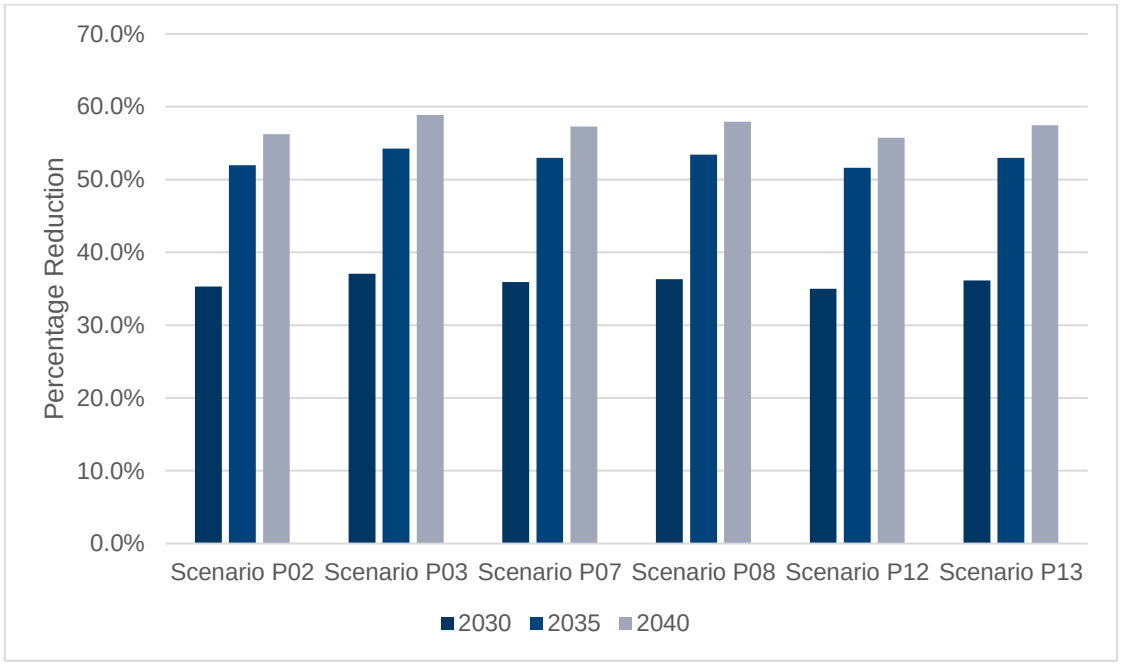

Figure 7.18: Percentage reduction in population HA for runway use and restriction scenarios over the period to 2040 with Dublin Airport operating above its current 32 mppa terminal passenger capacity limit

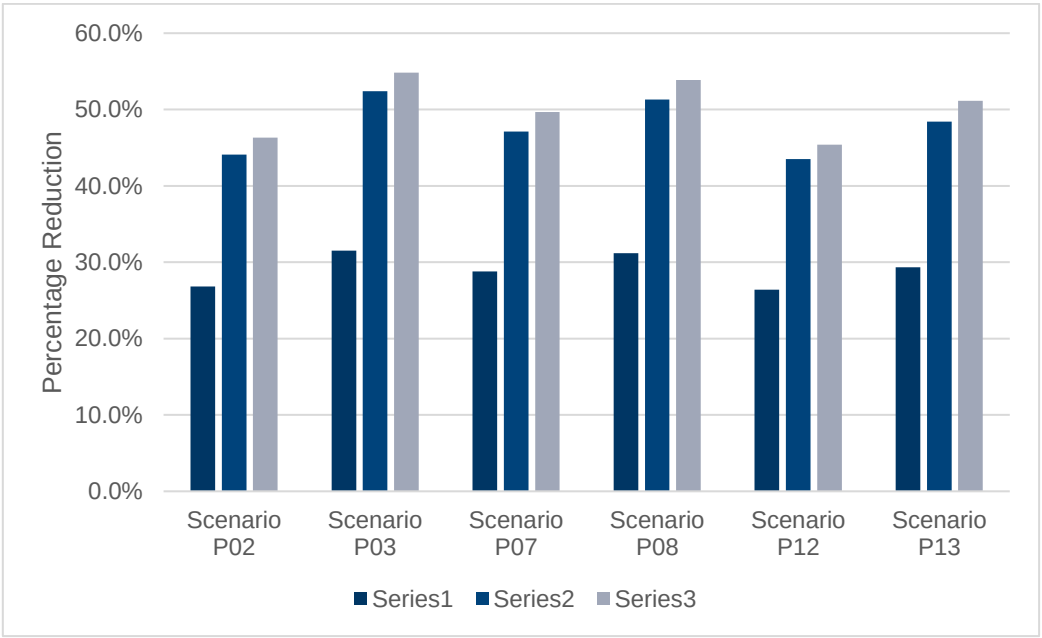

Figure 7.19: Percentage reduction in population HSD for runway use and restriction scenarios over the period to 2040 with Dublin Airport operating above its current 32 mppa terminal passenger capacity limit

This analysis shows that there are circumstances where the primary measures of the NAO cannot be met if growth in passenger numbers and the population occurs. This is the case for night time impacts where Figure 7.19 shows that under Scenario P02, P07, P12 and P13 that the NAO would not be met in 2030.

As set out above, the Applicant has not made an application to increase its 32 mppa terminal passenger capacity limit. However, the analysis presented in this section highlights that if such an application were to be brought forward and the population were to increase as the forecasts indicate it may be necessary for further measures such as additional incentives to introduce quieter aircraft at night to be put in place.

8 ENVIRONMENTAL ASSESSMENTS

8.1 Appropriate Assessment (AA)

ANCA has prepared a Natura Impact Statement (NIS) for the purposes of carrying out Appropriate Assessment of the Draft Regulatory Decision and the NAO in accordance with the European Communities (Birds and Natural Habitats) Regulations 2011 (the Regulations of 2011).

An Appropriate Assessment is an examination of the effects that a plan or project has on designated "European sites" (also known as "Natura 2000 sites") and in particular, whether the relevant plan or project has the potential to adversely affect their 'integrity'. Natura 2000 sites are important ecological sites that occur across the European Union and that are given special protective status to ensure the long-term survival of Europe's most valuable and threatened species and habitats. They are comprised of areas known as Special Protection Areas (SPAs) and Special Areas of Conservations (SACs). Each of these sites is designated because of their specific biodiversity value: for SPAs this is because of their value for wild birds; for SACs, it is because of the important habitats and species that they support.

8.1.1 Need for Appropriate Assessment

Article 6 (3) of the EU Habitats Directive (92/43/EEC) states that:

Article 6(3) – Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.

The Regulations of 2011, which transpose the Habitats Directive into Irish law, require that 'Appropriate Assessment' (AA) be carried out where a plan is likely to have a significant impact on a Natura 2000 site.

In particular, the Regulations of 2011 provide that AA is required if it cannot be excluded, on the basis of objective scientific information following screening, that the plan, individually or in combination with other plans or projects, will have a significant effect on a European site.

A Screening exercise was undertaken to establish whether the implementation of the NAO and Regulatory Decision had the potential to create such effects. ANCA, in its role as Competent Authority, was required to make a Screening Decision on whether AA was required. On 18 August 2021, having regard for the information provided in the AA Screening Report (published on ANCA's website), ANCA determined that there was the potential for impacts on European sites to occur as a result of implementing the NAO and RD.

8.1.2 What work has been undertaken related to Appropriate Assessment?

Following the determination that AA was required in relation to the NAO and Regulatory Decision, ANCA prepared a Natura Impact Statement (NIS) for the purposes of AA, in accordance with the Regulations of 2011. The NIS documents the findings of an assessment undertaken of the effects of implementing the NAO and Regulatory Decision on relevant Natura 2000 sites. Undertaking this assessment has also allowed AA considerations to influence the development of the NAO itself. The NAO Report sets out in more detail how AA considerations informed the development of the NAO. The NIS prepared for the purposes of AA is included with this DRD, and is subject to public consultation along with the DRD and related matters.

In summary, however, the NIS identifies the following potential impact pathways as a result of implementing the NAO and Regulatory Decision:

- The effects of increases in the level and frequency of noise, and visual disturbance events caused by increases in aircraft overflying of Natura 2000 sites and potentially, also by this overflying occurring at differing times of the day and night.
- The effects of changes to air quality, particularly increases in the concentrations of NOx and levels of nitrogen deposition, caused by increased numbers of aircraft overflying Natura 2000 sites.
- The effects of potential emergency fuel dumping from overflying aircraft affecting Natura 2000 sites directly, or indirectly through surface water pathways.

The NIS concludes that the NAO and RD will not have an adverse effect on the integrity of any Natura 2000 site. This conclusion is due to a number of reasons, including the following:

- Increases in overflying when compared with the likely future baseline are generally quite small.
- The qualifying interests and protected species of the Natura 2000 sites have already become habituated to noise and overflying more generally, and any increase as a result of implementation of the NAO and RD is unlikely to have further effects.

- That although increases in night time flights will occur, this increase will not result in a significant effect on the conservation objectives of the Natura 2000 sites within the 15km Zone of Influence identified for the purposes of carrying out AA.
- That increased numbers of flights are low enough that changes in air quality will also be small and will not affect the habitats within the relevant SACs (and SPAs) such that there is deterioration.
- That fuel dumping will be infrequent and subject to control measures by the Airport which will reduce the likelihood for effects albeit the potential for such will be assessed in future planning applications or similar related for, for example, growth or airspace redesign.

The NIS had regard to the fact that the NAO and RD are not sufficient of themselves to unlock growth up to the limits of existing policy and that a future application for planning permission will be needed in that regard, which will require screening for AA and full AA where necessary. Much is unknown about the future operations of the Airport at this point, and will have to be detailed and assessed in those planning applications, particularly should daa choose to make an application to remove the 32 mppa capacity limit. Furthermore, there is the potential, as the implementation of the NAO and RD seeks to establish to overfly fewer people, that daa will seek to change the way the airspace is operated, with a focus on overflying less densely populated areas that are currently not overflown or overflying these same areas more frequently than is currently the case.

It is, however, important to note that more detailed changes in overflying will be assessed in future planning applications and by the competent authority responsible for planning airspace design that will be necessary to achieve the growth anticipated in existing policy, including importantly whether as a result of airspace re-design that might occur to help meet the requirements of the NAO and RD, routes over an SPA or SAC become more used than others. The assessment of those impacts is a matter for assessment when the relevant plans are adopted or planning is sought for relevant proposed developments and they are not constrained at this stage by the NAO or RD.

As per the Key Strategic Objectives (Section 4.2) of the Dublin Airport LAP 2020.

"All development proposals at Dublin Airport shall have regard to the requirement for environmental assessment including screening for Appropriate Assessment, Environmental Impact Assessment and Flood Risk Assessment in accordance with relevant legislation and guidelines".

8.2 Strategic Environmental Assessment (SEA)

ANCA has prepared a Draft Environmental Report for the purposes of SEA of the Draft Regulatory Decision and the NAO, in accordance with the European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004 (the "Regulations of 2004") following notice to the prescribed environmental authorities as required under Article 11 of the Regulations of 2004.

SEA is a systematic process to assess the environmental, social and economic effects of a proposed plan or programme. SEA allows environmental, as well as social and economic, considerations to be fully integrated into the preparation of plans and programmes prior to their final adoption. The objectives of an SEA are to promote sustainable development as it assesses the extent to which a plan or programme helps to achieve relevant environmental, social and economic objectives. In order to be most effective, an SEA should be integrated into the preparation of plans or programmes at their earliest stages thereby allowing the SEA process to influence the final output.

8.2.1 Need for Strategic Environmental Assessment

Directive 2001/42/EC (hereinafter referred to as the SEA Directive) requires Member States to ensure that certain plans and programmes are subject to a requirement for SEA. The Regulations of 2004 transpose the SEA Directive into Irish legislation.

In terms of the requirement to carry out environmental assessment, the SEA Regulations state:

'9. (1) Subject to sub-article (2), an environmental assessment shall be carried out for all plans and programmes (a) which are prepared for agriculture, forestry, fisheries, energy, industry, transport, waste management, water management, telecommunications and tourism, and which set the framework for future development consent of projects listed in Annexes I and II to the Environmental Impact Assessment Directive, or (b) which are not directly connected with or necessary to the management of a European site but, either individually or in combination with other plans, are likely to have a significant effect on any such site.

(2) A plan or programme referred to in sub-article (1) which determines the use of a small area at local level or a minor modification to a plan or programme referred to in sub-article (1) shall require an environmental assessment only where the competent authority determines that it is likely to have significant effects on the environment and, for this purpose, the competent authority shall make any necessary determination.

(3) A competent authority shall determine whether plans and programmes other than those referred to in sub-article (1), which set the framework for future development consent of projects, are likely to have significant effects on the environment.'

A 'development consent' in Irish law includes a planning permission for projects listed in Annexes I and II to the EIA Directive.

The Regulatory Decision that will be made in response to the planning application relates to transport. Even though the Regulatory Decision will be incorporated into an individual planning permission, it is imposing operating restrictions and mitigation measures that will determine whether or not future planning applications for development consent at Dublin Airport potentially give rise to the potential for a noise problem. It thereby guides the decisions that ANCA and the planning authority will make on those future applications. It also results from an assessment against an NAO; it cannot be more restrictive than necessary to achieve the NAO. Accordingly, the NAO and RD may set the framework for future development consent of projects listed in Annexes I and II to the EIA Directive, including changes or extensions to airfields and airports with a basic runway length of 2,100 metres or more. The 'Plan' addressed through this SEA Draft Environmental Report therefore comprises the NAO and the RD, as two interlinked components, the NAO setting a framework for the RD, which in turn sets the framework for future applications for planning permission at Dublin Airport.

The specific purpose of SEA is to ensure that early consideration is given to environmental aspects when a plan or programme is in development. However, a plan or programme that determines the use of a small area at local level or a minor modification to a plan or programme only requires SEA if implementation of the plan or programme is considered likely to lead to significant environmental effects. Determining whether significant effects are considered to be likely, and therefore whether SEA applies, is completed through a process known as Screening.

ANCA, in its role as Competent Authority, was therefore required to make a Screening Determination on whether SEA applies. On 15 April 2021, having regard to information provided in the SEA Screening Report (published on ANCA's website), and submissions and observations provided by the prescribed Environmental Authorities, ANCA determined that there is potential for likely significant environmental effects to occur as a result of implementing the NAO and RD.

With ANCA having determined that the NAO and RD requires SEA, an SEA Scoping Report (published on ANCA's website) was subsequently produced to set out the proposed scope of the detailed environmental assessment and to facilitate consultation with the prescribed Environmental Authorities in that regard.

8.2.2 What work has been undertaken related to Strategic Environmental Assessment?

Following the determination that SEA was required in relation to the NAO and Regulatory Decision, and the subsequent scoping exercise, ANCA prepared an Environmental Report for the purposes of SEA, in accordance with the Regulations of 2004. The Draft Environmental Report is included with this DRD, and will be subject to public consultation along with the DRD and related matters.

ANCA prepared this Draft Environmental Report as part of its legal duty to carry out an SEA, but equally importantly the SEA process has informed the evolution of the NAO and DRD, ensuring that the environmental, social and economic implications of the proposals have been considered throughout the development of those plans.

For example, the SEA process has fed into the development and selection of alternatives for both the NAO and the RD, ensuring that each alternative put forward for assessment is reasonable and realistic. The SEA alternatives assessment itself has enabled ANCA to understand the implications of the different noise measures for each of the environmental aspects (including particularly air quality, biodiversity, climate change, cultural heritage and landscape), ensuring that these are taken into account alongside noise, health and cost considerations.

The SEA assessed a total of five different alternatives for the NAO, with the best realistic alternative considered to be Alternative (1), with a specific short-term, health-based outcome reduction of 30% set for 2030 (following EC guidance), with further, more stringent outcome reductions of 40% and 50% set for 2035 and 2040 respectively. These latter outcome reductions go beyond EC guidance, yet are considered to be achievable, and will incentivise further initiatives and measures to reduce noise at Dublin Airport (including efficiency measures that will have broader environmental benefits). The best NAO alternative in SEA terms is therefore also the preferred alternative identified by ANCA through application of the Balanced Approach.

Further details of the SEA process in the context of the development of the NAO are set out in the NAO Report.

The SEA process has fed into the development and selection of alternatives for the NAO, ensuring that each alternative put forward for assessment is reasonable and realistic. The SEA alternatives assessment itself has enabled ANCA to understand the implications of the different noise measures for each of the environmental aspects (including particularly air quality, biodiversity, climate change, cultural heritage and landscape), ensuring that these are taken into account alongside noise, health and cost considerations. The key environmental changes which would

occur as a result of having the airport operate with amended night restrictions associated with the NAO are reported in the Environmental Report.

The SEA assessed a total of ten different alternatives for the RD. The best realistic alternative to Condition 5 was considered to be Alternative (iv), as not only would the proposed noise quota operate throughout the eight hours of the night, but there would be additional noise-related limits on the types of aircraft permitted to operate at night. The preferred alternative to Condition 5 identified by ANCA is therefore also the best alternative in SEA terms. The alternatives to Condition 3(d), i.e. the different runway use patterns, perform similarly in environmental terms, as the overall level of noise (and number of ATMs) remains the same, while the spatial distribution differs. In some locations overflying and noise levels increase, whereas in other locations overflying and noise levels decrease. The preferred alternative of ANCA, Alternative (vi) (i.e. runway use pattern 2) is therefore acceptable in SEA terms. Finally, ANCA's preferred alternative of the two considered in relation to the proposed voluntary residential sound insulation grant scheme for residential dwellings also performed best in the SEA.

The key environmental changes which would occur as a result of having the airport operate with amended night restrictions associated with the NAO and RD are detailed below.

The main cause of adverse environmental effects is that, compared to the future baseline, the assessment case used in the SEA includes a c. 10% increase in passenger numbers (of 4.6 mppa by 2040) associated with the daa planning application; all of which are expected to occur at night. With the 32 mppa cap still in place, the increase in passenger numbers is restricted to 1.6 mppa (in 2025), again all of which are expected to occur at night.

The increase in passenger numbers and associated night time ATMs facilitated by the NAO and RD is likely to cause minor negative effects on air quality (specifically for settlements located directly under the flightpaths within 2 km of Dublin Airport); biodiversity (due to more overflying of protected sites and species, though existing research suggests that the birds, cetaceans, and other flora and fauna for which nearby Natura 2000 sites are designated are habituated to overflying); carbon and climate change; noise and vibration; and population and health (due to more frequent noise episodes at night impacting on sleep).

The other specified components of the NAO seek to limit and reduce the long-term adverse effects of aircraft noise on health and quality of life, including through encouraging a switch to quieter and more efficient aircraft, and these are expected to have beneficial effects on each of these environmental aspects. However, though not within ANCA's remit, daa could choose to deliver the expected outcomes of the NAO (i.e. reductions in the number of people adversely affected by noise) by increasing the angle of aircraft ascent to ascend more quickly, and/or changing airspace design to overfly less densely populated areas. Though these latter effects are indirect and

uncertain, they could result in additional adverse impacts on air quality (though emissions from additional burnt fuel would affect a smaller area); biodiversity (through overflying of sites not previously overflown); and carbon emissions and climate change.

In terms of impacts relating specifically to the RD, amending Condition 3(d) to enable use of north runway during the period 23:00-23:59 and 06:00-06:59, with all landings to be from the east, and all take-offs to the west (i.e. runway use pattern P02) is expected to have additional minor negative effects on biodiversity (due to the increase in noise over Malahide Estuary SPA / SAC and Feltrim Hill pNHA), and population and health (due to the increase in noise over settlements including Ridgewood, Kilbrook, The Ward Cross, Coolquay, Mooreside and Rathlittle). Having said that, it should be noted that the alternative runway use patterns simply redistribute spatially the noise associated with the lifting of Condition 5. Runway use pattern P02 therefore, whilst causing an increase in noise for the people and species residing in the aforementioned locations, also causes a decrease in noise over Baldoyle Bay SPA / SAC / pNHA, Ireland's Eye SPA / SAC / pNHA, and settlements such as Ratoath and Dunshaughlin.

Finally, there are a number of interrelationships between the environmental aspects that have been addressed throughout the assessment of the NAO and RD. For example, a deterioration in air quality has the potential to lead to impacts on biodiversity (especially pollution-sensitive habitats associated with SACs) and human health. For the NAO and RD, this is only relevant for locations directly beneath the flight paths within 2 km of the Airport, and thus air pollution is not considered to be an issue for biodiversity or human health in this case. An increase in noise also has the potential to lead to impacts on several of the other environmental aspects, as has been the focus of this assessment. For the NAO and RD, this increase in noise is expected to occur only at night, and so impacts on human health are of greatest concern; impacts on biodiversity have been deemed to be insignificant; whilst impacts on the use of cultural heritage and landscape assets and their settings are considered negligible.

Overall, the assessment of the NAO and RD revealed that there would be no significant adverse environmental effects as a result of implementing the preferred alternatives, i.e. Alternative (1) for the NAO and Alternatives (iv), (vi) and (x) for the RD. ANCA will monitor the effectiveness of these measures with regard to noise through the requirements of the NAO.

9 COST EFFECTIVENESS ANALYSIS

The Act of 2019 requires ANCA to evaluate the cost-effectiveness of noise mitigation measures and any proposed operating restrictions, with a view to determining the most cost-effective measure or combination of measures for achieving the Noise Abatement Objective (NAO). Annex II of the Aircraft Noise Regulation sets out guidance on assessing the cost-effectiveness of operating restrictions.[123]

ANCA, as the Competent Authority, has exclusive competence to determine whether a noise problem has arisen; define, restate or amend the NAO in response; assess the cost-effectiveness of noise mitigation measures and operating restrictions; and determine which measures and/or restrictions should apply.

In June 2020, prior to the Applicant making a formal application, ANCA provided guidance on how it intended to assess cost-effectiveness which is provided in Appendix I[124]. The Applicant has since made a formal application and provided its assessment of its proposals, including a cost-effectiveness analysis. Since commencing the formal process, ANCA has requested further information and clarifications to assist its cost-effectiveness evaluation through the Direction to Provide Information.[125]

In the following section, ANCA presents its cost-effectiveness evaluation. ANCA has developed this evaluation independently but has drawn on the analysis and modelling undertaken by the Applicant in support of the Application.

All of the monetary values in the cost-effectiveness analysis are presented in 2020 prices. The costs of each measure assessed within this cost-effectiveness analysis are presented in cumulative terms over the five-year period from 2022 to 2026. The year 2022 has been selected as the start as it is the when the north runway is expected to become operational; while 2026 has been selected as it is the final year that the operating restrictions are expected to impose a cost. This has allowed ANCA to compare the options on a consistent time basis where the use of a different time horizon for the cost-effectiveness evaluation may lead to differing results.

[123] Regulation (EU) No 598/2014 of the European Parliament and of the Council 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, Available at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014R0598

[124] Aircraft Noise Competent Authority (2020) ANCA interim response to pre-application consultation on cost-effectiveness, 9 June 2020.

[125] Aircraft Noise Competent Authority (2021) Re: Direction 01 by the Competent Authority in relation to planning application F20A/0668 under Section 9(10) of the Aircraft Noise (Dublin Airport) Regulation Act 2019 to provide information and assessments for the purposes of an Assessment of the Noise Situation at Dublin Airport. Available at fingal.ie

To present the effectiveness of the different mitigation measures, ANCA has chosen a single effectiveness year, 2025. This is because 2025 has been identified as the peak year for noise exposure and, therefore, the peak year for health effects from noise exposure, according to the Applicant's noise modelling. As a result, the cost-effectiveness ratios presented in the analysis below are in the format:

Cumulative cost between 2022 and 2026 per person no longer impacted in 2025.

The full methodology and results are presented in Appendix J.

9.1 Effectiveness Metric

To assess the cost-effectiveness of noise mitigation measures, an effectiveness metric (or metrics) needs to be selected that can be used to evaluate how well different mitigation measures perform against the NAO. As the outcomes targeted within the NAO are multi-faceted, ANCA selected two metrics for assessment:

Number of people HSD in 2025. The NAO sets targets for the number of people HA and HSD by 2030, 2035 and 2040. ANCA selected HSD as the relevant metric instead of HA as it relates more directly to night time noise exposure and, is therefore, a more relevant metric when assessing the performance of different measures for mitigating night time noise. ANCA has used 2025 as the assessment year as it is the peak year for noise exposure according to daa's noise modelling and, therefore, the year when health effects from night-noise are highest.

Number of people exposed to a high noise impact in 2025, i.e., noise levels over 55 dB L_{night}. The NAO also sets targets for the number of people exposed to 55 dB L_{night} and 65 dB L_{den}. ANCA selected the 55 dB L_{night} metric over the 65 dB L_{den} metric as it relates more directly to night time noise exposure.

ANCA's approach differs to the approach used by the Applicant in that two metrics have been selected. ANCA has applied these throughout its cost-effectiveness analysis, rather than using different metrics at various stages of the cost-effectiveness analysis. The Applicant also used an additional metric: the number of people significantly adversely affected. This metric represents the number of people exposed to an increase in night noise exposure relative to 2018 as a result of the opening of the new runway. ANCA does not consider it appropriate to use this metric as it does not relate to the NAO. However, the NAO was not available to the Applicant at the time it prepared its own CEA, and accordingly could not be factored into the Applicant's identification of proposed metrics. The significantly adversely affected metric also forms part of the noise problem and, therefore, may be a relevant consideration when deciding between measures. A more detailed discussion on the choice of cost-effectiveness metrics is included in Appendix J.

9.2 Forecast Without New Measures

The Forecast Without New Measures is used as a scenario to test new measures against, i.e. it is the counterfactual against which the costs and impacts of all noise mitigation measures are assessed for compliance with the NAO. It has been created in line with the Draft Cost Effectiveness Guidance issued by ANCA which is in reference to the Aircraft Noise Regulation (Appendix I).

The Forecast Without New Measures (Scenario P06) includes all existing and planned measures to manage aircraft noise, except for Conditions 3(d) and 5 of the North Runway Planning Permission. Conditions 3(d) and 5 are excluded as these are operating restrictions that the Applicant has applied to replace.

The Applicant's estimates of the noise impacts under the Forecast Without New Measures are presented in Table 9.1 below. To develop these estimates, the Applicant has forecast future flight movements and used this to forecast future noise levels around Dublin Airport, making assumptions around the fleet mix. Further details of Applicant's approach are provided in Appendix J.

Table 9.1: Forecast Without New Measures

	2018	2019	2022	2025	2030	2035	2040
ATMs (thousands)	232.3	238.0	175.7	235.9	235.9	235.9	235.9
Passengers (millions)	31.5	32.9	21.0	32.0	32.0	32.0	32.0
Population Highly Sleep Disturbed (% reduction from 2019 levels)	42,260	47,045	26,261 (-44%)	36,592 (-22%)	26,057 (-45%)	17,639 (-63%)	15,095 (-68%)
Population >55 dB L_{night} (% reduction from 2019 levels)	753	1,533	283 (-82%)	407 (-73%)	301 (-80%)	240 (-84%)	215 (-86%)

As can be seen in Table 9.1, noise exposure levels are expected to reduce over time despite aircraft numbers generally recovering to 2019 levels. This is due to the Applicant's assumptions around the evolution of the fleet mix, with newer, quieter aircraft, gradually replacing older, noisier aircraft. Importantly, the Applicant's analysis shows that the NAO targets may be met under certain circumstances in the Forecast Without New Measures (i.e. without conditions 3(d) and 5) being in place. The number of people HSD in the Forecast Without New Measures is

expected to reduce by 45% by 2030 compared with 2019 (against a target of 30%), 63% by 2035 (against a target of 40%), and 68% by 2040 (against a target of 50%).

Additionally, the figures in the table do not account for homes that the Applicant expects will have been insulated by 2025 under existing noise insulation schemes.

The Applicant anticipates that by 2025, all eligible homes under both the RNIS and HSIP will have been fully insulated. The assumption made by the Applicant is that insulation implies a 5 dB reduction in noise exposure levels. As a result, when we account for homes that will have been insulated by 2025, the number of people HSD in 2025 reduces further to 36,564 and the number of people exposed to a high noise impact in 2025 reduces to 16.

ANCA developed its cost-effectiveness analysis below to understand whether further measures can be cost-effectively introduced as a replacement for the operating restrictions contained within Conditions 3(d) and 5, and to understand the impact of the Applicant's proposed mitigation measures.

As part of this cost-effectiveness analysis, the impact of a Noise Quota Scheme to provide communities with certainty that the forecast noise reductions assumed within the Forecast Without New Measures materialise. This is considered in detail alongside the cost-effectiveness of operating restrictions.

9.3 Assessment of Noise Mitigation Measures

The Aircraft Noise Regulation requires that the Balanced Approach is adopted to manage aircraft noise, with operating restrictions only introduced once other measures have been fully considered. The four principal elements to aircraft noise management considered under the Balanced Approach are:

Reduction of noise at source. Refers to the setting of noise limits for aircraft in the form of aircraft noise standards and recommended practices for operating aircraft. The aim is for noise reducing technology to be incorporated into aircraft to reduce noise levels around airports.

Noise abatement operational procedures. These aim to reduce noise pollution around airports by optimising how aircraft use the facilities, including preferential runways and routes. They depend on the physical layout of an Airport and its surroundings.

Land use planning and management. This relates to how the land near to an Airport is used and encompasses zoning laws, building regulations, land purchasing and noise control schemes such as insulation programmes.

Operating restrictions. This includes restrictions on use of certain types of aircraft or establishing periods of time when the number of flights is restricted.

The Applicant has a mix of existing and planned measures designed to manage aircraft noise at Dublin Airport. Many of these measures are already in place, with others planned to be introduced by 2025. The Applicant has also identified several additional measures for managing aircraft noise, including a series of preferential runway patterns (which fall into the category of noise abatement operational procedures), and a new residential noise insulation scheme (which falls into the category of land use planning and management), which the Applicant evaluated as part of its cost-effectiveness analysis.

In the following sections, ANCA has considered each of the principal approaches to noise management. No additional measures were identified by either the Applicant or ANCA beyond those which are planned. ANCA undertook the cost-effectiveness of both additional measures (over and above the existing and planned mix) identified by daa, and additional measures identified by ANCA. A comparison is then made of the cost-effectiveness of these measures relative to the cost-effectiveness of the existing operating restrictions contained within Conditions 3(d) and 5.

9.3.1 Night time Preferential Runway Use and Runway Restriction Measures

These scenarios consider the combined effect of taking the relevant action in respect of both Conditions 3(d) and 5

9.3.1.1 Cost of Measures

The different runway usage and runway restrictions do not themselves impose any direct financial cost on the Applicant or the aviation industry. However, the Applicant in its cost-effectiveness analysis identified two other impacts:

- Cost-savings. The Applicant has estimated the potential for cost savings from operating mostly a single runway for parts of the night period rather than two runways. The main saving was from needing one fewer air traffic controller.

- Indirect costs associated with delays. The Applicant also considered the potential for delays from managing air traffic movements over a single runway rather than two runways, but considered the impact to be negligible relative to the Forecast Without New Measures (Scenario P06).

In Table 9.2 below, ANCA has presented its estimate of the cost savings that operating each of the different runway use and runway restriction scenarios could offer. The scenarios that involve only using a single runway for parts of the night provide a cost saving, whereas the other runway patterns impose no cost.

Table 9.2: Cost savings under the different runway patterns over the period 2022-2026 (€ million, 2020 prices)

Runway Use and Restriction Scenario	Cumulative Costs (2022-2026)
P02	-1.7
P03	-
P04	-
P05	-
P07	-
P08	-
P09	-1.7
P10	-1.7
P12	-2.0
P13	-1.6

The estimates presented in the table above differ from those presented in the Applicant's cost-effectiveness analysis. There are three reasons for this:

- The Applicant only assessed the costs of its preferred runway pattern (Scenario P02), under which the north runway is not used between 00:00-05:59. ANCA's analysis extends this to all runway use and runway restriction scenarios.
- ANCA has assessed the cumulative costs over the period 2022 to 2026, whereas the Applicant has assessed the cumulative costs over the period 2022-2025.
- ANCA also considers the Applicant's estimate of the wage savings from needing fewer air traffic controllers to be an over-estimate. A different approach has therefore been taken to estimate these savings.

Further details on the method used to estimate savings are presented in Appendix J.

9.3.1.2 Effectiveness of Metrics

In Table 9.3 below, an analysis of the number of people HSD and exposed to the night time priority under the different runway patterns is presented. Scenario P09 is the most effective at minimising the number of people HSD in 2025, but (in absolute terms) none of the runway patterns are as effective as the Forecast Without New Measures at minimising the number of people exposed to the priority of 55 dB L_{night}. However, the table also shows that the difference, in effectiveness terms, between the runway patterns is small in comparison to the number of people HSD.

Based on the Applicant's modelling, and as outlined in Table 9.3, the NAO continues to be met under each of the runway use and restriction scenarios assessed[126].

Table 9.3: Effectiveness of different runway use and restriction scenarios in 2025 (before accounting for existing noise Insulation schemes)

	Noise Impacts		Change relative to the Forecast Without New Measures (FWNM) (P06)	
	Population HSD	Population > 55 dB L_{night}	Population HSD	Population > 55 dB L_{night}
FWNM (P06)	36,592	407	-	-
Runway Use and Restriction Scenario (Forecast with new measures)				
P02	37,080	1,059	487	652
P03	35,757	1,055	-835	648
P04	35,260	737	-1,332	330
P05	36,363	412	-230	6
P07	36,699	989	106	582
P08	35,784	422	-808	15
P09	34,896	528	-1,696	121
P10	36,463	426	-129	19
P12	37,159	1,119	567	712
P13	36,275	1,055	-318	648

[126] P11 was not considered in this analysis, as it was found to not meet the objectives of the NAO.

The Applicant has also compared the performance of the different runway patterns against its significantly adversely affected metric, which has been included below for reference. The Applicant's preferred measure (Scenario P02) is the most effective at minimising the number of people significantly adversely affected, i.e. it is the most effective at minimising the number of people newly affected by noise.

Table 9.4: Number of people significantly adversely affected in 2025[127]

Runway Use and Restriction Scenario (Forecast with new measures)	Total	Compared to Forecast Without New Measures (P06)
P02	1,879	-15,171
P03	3,677	-13,373
P04	23,414	6,364
P05	17,547	497
P07	4,629	-12,421
P08	14,984	-2,066
P09	22,379	5,329
P10	15,044	-2,006
P12	-	-
P13	-	-

The results in Table 9.4 above show that no single runway usage or runway restriction scenario is definitively the most effective at achieving the noise outcomes prioritised within the NAO. Performance between measures is similar and all scenarios meet the NAO outcomes of an improvement over the 2019 situation.

[127] Source: daa, A11267_19_CA437_2.0 Summary of Results Including Mitigation Excel Sheet

Note: The Applicant's analysis for number of people significantly adversely affected was not extended to Scenarios P12 and P13. However, ANCA would expect both of these measures to have substantially fewer people significantly adversely affected than the Forecast Without New Measures, with Scenario P12 more effective than Scenario P02 and Scenario P12 slightly less effective than Scenario P02.

When comparing Table 9.3 and Table 9.4, the results illustrate the trade-off between minimising the overall health effects of aircraft noise (as demonstrated by the HSD and high noise impact metrics) and minimising the number of people who may experience significant change in night time noise (as demonstrated by the significantly adversely affected metrics). The measures that perform strongly under the HSD metric do not perform as strongly under the significantly adversely affected metric, and vice versa.

The Applicant's preferred measure minimises the number of people significantly adversely affected, which is not a prioritised outcome within the NAO but is a clear aspect of the noise problem. Several other measures also perform strongly under this metric, including Scenarios P03, P07, P12 and P13[126].

9.3.1.3 Cost Effectiveness of Measures

Table 9.5 shows the cost-effectiveness, in monetary terms, of the runway use and runway restriction scenarios firstly in terms of reducing the number of people HSD in 2025, and secondly in terms of reducing the number of people exposed to high levels of night noise (i.e. greater than 55 dB L_{night}). The table shows that from a purely cost-effectiveness perspective, some of the scenarios (P02, P07 and P12) perform worse than the Forecast Without New Measures (Scenario P06) under both metrics. Under the HSD metric, Scenarios P09, P10 and P13 are all cost-effective with several other scenarios being cost-neutral, though all scenarios perform worse than the Forecast Without New Measures with respect to the night time priority.

Table 9.5: Cost effectiveness of different runway patterns relative to the Forecast Without New Measures (FWNM) (€ per person, 2020 prices)[128]

Runway Use and Restriction Scenario (Forecast with new measures)	Population HSD	Population > 55 dB L_{night}
P02	Performs worse than FWNM	Performs worse than FWNM
P03	0	Performs worse than FWNM
P04	0	Performs worse than FWNM
P05	0	Performs worse than FWNM

[128] **Source: daa. Note: daa's analysis for number of people significantly adversely affected was not extended to Scenarios P12 and P13. However, we expect both of these measures to have substantially fewer people SAA than the FWNM, with Scenario P12 more effective than Scenario P02 and Scenario P12 slightly less effective than Scenario P02.**

P07	Performs worse than FWNM	Performs worse than FWNM
P08	0	Performs worse than FWNM
P09	Leads to cost savings	Performs worse than FWNM
P10	Leads to cost savings	Performs worse than FWNM
P12	Performs worse than FWNM	Performs worse than FWNM
P13	Leads to cost savings	Performs worse than FWNM

However, all of the runway patterns continue to meet the 2030, 2035 and 2040 targets as set out in the NAO with the Airport operating at its 32 mppa passenger cap. As such, ANCA considers that all scenarios can proceed to the next stage of the analysis. In this respect, ANCA's approach differs from that taken by the Applicant, which assessed only Scenario P02 on the basis that it performed most strongly when considering the number of people experiencing significant effects with respect to changes in night time noise exposure.

As highlighted earlier this metric is not part of the NAO but it does relate to the third aspect of the noise problem identified with the Application. The evidence from the Applicant is that Scenario P02 would be the best at reducing this aspect of the noise problem, albeit with a higher number of people being exposed to aircraft noise above the night time priority set out in the NAO.

9.3.2 Residential Sound Insulation Grant Scheme (RSIGS)

Land-use planning and management refers to a range of possible measures that seek to ensure that the activities that take place around an airport, are compatible with aviation. This includes:

- Locating new airports away from noise-sensitive areas, such as densely populated areas; and
- Introducing land-use zoning around airports to minimise the number of houses and other noise-sensitive premises built in close proximity.

The Applicant has proposed a new Residential Sound Insulation Grant Scheme (RSIGS) for dwellings which fall within eligible noise contours. As proposed the RSIGS will provide a €20,000 grant for noise insulation to residential dwellings exposed to noise levels exceeding 55 dB L_{night} in 2025 and is aimed at mitigating noise from the operation of the north runway at night but would potentially help some dwellings already affected by night time noise from south runway operations.

Based on ANCA's review of the proposed scheme, there are additional ways in which eligibility to the proposed scheme could be determined having regard to the forecast and historic years. Table 9.6 presents the list of options assessed in this cost-effectiveness analysis.

Table 9.6: Noise insulation measures based on different RSIGS eligibility criteria

Measure	RSIGS Eligibility Criterion The Applicant's Proposed Eligibility Criterion
RSIGS B	A €20,000 grant for noise insulation given to dwellings exposed to noise levels exceeding 55 dB L_{night} in 2025 and not eligible under existing noise insulation schemes
Additional Measures assessed by ANCA	
RSIGS A	€20,000 grant for dwellings exposed to noise levels exceeding 55 dB L_{night} in 2022 and not eligible under existing noise insulation schemes
RSIGS C1	€20,000 grant for dwellings exposed to noise levels that, in 2022, either a) exceed 55 dB, or b) exceed 50 dB and are 9 dB higher than in 2018, provided they are not eligible under existing noise insulation schemes
RSIGS C2	€20,000 grant for dwellings exposed to noise levels that, in 2025, either a) exceed 55 dB, or b) exceed 50 dB and are 9 dB higher than in 2018, provided they are not eligible under existing noise insulation schemes
RSIGS C3	€20,000 grant for dwellings exposed to noise levels that, in 2022, either a) exceed 55 dB, or b) exceed 50 dB and are 9 dB higher than in 2019, provided they are not eligible under existing noise insulation schemes
RSIGS C4	€20,000 grant for dwellings exposed to noise levels that, in 2025, either a) exceed 55 dB, or b) exceed 50 dB and are 9 dB higher than in 2019, provided they are not eligible under existing noise insulation schemes
RSIGS C5	€20,000 grant for dwellings exposed to noise levels that, in 2022, either a) exceed 55 dB, or b) exceed 50 dB and are 9 dB higher than in a scenario with the operating restrictions, provided they are not eligible under existing noise insulation schemes
RSIGS C6	€20,000 grant for dwellings exposed to noise levels that, in 2025, either a) exceed 55 dB, or b) exceed 50 dB and are 9 dB higher than in a scenario with the operating restrictions, provided they are not eligible under existing noise insulation schemes

9.3.2.1 Cost of Measures

The Applicant states that the proposed RSIGS scheme will operate between 2022 and 2024, with set-up costs of €300,000 and annual administrative costs of €100,000 per year. The grant itself is €20,000 per eligible dwelling.

Based on these cost estimates, and assuming there is 100% uptake of the grant[129], ANCA has estimated the cumulative costs of the eligibility options for the insulation scheme as outlined in Table 9.6. As the eligibility of the noise insulation scheme is based on noise exposure, it is assumed that the number of households eligible for noise insulation, and therefore the cost, will vary depending on the runway pattern.

In Table 9.7 the cumulative costs of the noise insulation schemes are presented assuming Scenario P06 (i.e. the Forecast Without New Measures), and the range of costs under the other runway usage and runway restriction scenarios.

Table 9.7: Total costs associated with RSIGS scheme under different eligibility criteria, 2022-26 (€ million, 2020 prices)

RSIGS Eligibility Option	Eligibility set based on 2022 or 2025 noise exposure?	Insulation costs under Scenario P06 (FWNM)	Full range of insulation costs
RSIGS A	2022	0.6	0.6 to 1.0
RSIGS B	2025	0.6	0.7 to 7.2
RSIGS C1	2022	4.1	0.9 to 4.1
RSIGS C2	2025	16.7	4.5 to 41.5
RSIGS C3	2022	3.9	0.6 to 3.9
RSIGS C4	2025	14.3	4.0 to 40.8
RSIGS C5	2022	13.6	1.1 to 13.6
RSIGS C6	2025	24.6	5.8 to 50.6

The eligibility criteria which are based on exposure levels in 2025 lead to the highest noise insulation costs. This is unsurprising as 2025 is the peak year for noise exposure. Therefore, more dwellings will be eligible for the insulation scheme, and the costs of the scheme will also be higher. This effect is most notable for noise insulation measure C6, where eligibility is extended to

[129] This is a simplifying assumption, but is supported by the high uptake of daa's existing sound insulation schemes

households that will experience materially higher noise levels in 2025 than they would experience if the operating restrictions were retained.

9.3.2.2 Effectiveness of Measures

In Table 9.8 the change in the number of people HSD and exposed to the night time priority are presented for the different noise insulation options. These impacts are presented assuming Scenario P06 (i.e. the forecast without new measures) with the full range of impacts under the other scenarios also presented. As can be seen, the range of impacts varies substantially across the runway use and runway restriction scenarios, due to differences in the noise exposure levels (which determine eligibility).

Table 9.8: Change in people highly sleep disturbed or exposed to high noise impact following insulation, 2025[130]

RSIGS Eligibility Option	Effectiveness under Scenario P06 (FWNM)		Full Effectiveness Range	
	Population HSD	Population > 55 dB L_{night}	Population HSD	Population > 55 dB L_{night}
RSIGS A	-1	-14	-1 to -5	-14 to -80
RSIGS B	-1	-16	-1 to -59	-16 to -906
RSIGS C1	-27	-14	-4 to -27	-14 to -80
RSIGS C2	-123	-16	-31 to -329	-16 to -906
RSIGS C3	-26	-14	-1 to -26	-14 to -80
RSIGS C4	-105	-16	-27 to -324	-16 to -906
RSIGS C5	-97	-14	-5 to -97	-14 to -80
RSIGS C6	-181	-16	-46 to -396	-16 to -906

Where the eligibility is set based on exposure in 2025 (B, C2, C4 and C6) this is most effective in terms of total reduction in number of people HSD or exposed to the night time priority, as they result in more households being insulated.

However, it is important to put the change in the number of people HSD into context – the reduction in the number of HSD people as a result of insulation is modest compared to how many people remain HSD, regardless of how the eligibility of the insulation scheme is set. However, the

[130] *Source: CEPA analysis of the Applicant's data and assumptions*

noise insulation scheme is effective at reducing the number of people exposed to aircraft noise levels above the night time priority set in the NAO to zero.

Table 9.9 below shows the number of people that remain HSD or exposed to high noise impacts after accounting for existing insulation schemes (RNIS and HSIP) and the proposed noise insulation scheme (RSIGS). The table also shows which combination of runway pattern and noise insulation scheme minimises the number of people HSD or exposed to high noise impacts.

Table 9.9: Number of highly sleep disturbed or exposed to high noise impact following insulation under RSIGS, RNIS and HSIP, 2025

RSIGS Eligibility Option	Under Scenario P06 (Forecast Without New Measures)		Scenario with the lowest number of People Affected	
	Population HSD	Population > 55 dB L_{night}	Population HSD	Population > 55 dB L_{night}
RSIGS A	36,563	0	35,722 (P03)	0 (All except P04)
RSIGS B	36,563	0	34,860 (P09)	0 (All except P04)
RSIGS C1	36,537	0	35,715 (P03)	0 (All except P04)
RSIGS C2	36,441	0	35,640 (P08)	0 (All except P04)
RSIGS C3	36,537	0	35,717 (P03)	0 (All except P04)
RSIGS C4	36,459	0	35,662 (P08)	0 (All except P04)
RSIGS C5	36,467	0	35,666 (P08)	0 (All except P04)
RSIGS C6	36,382	0	34,542 (P09)	0 (All except P04)

The table demonstrates how the eligibility can collectively reduce the number of people exposed to aircraft noise exposure above the night time priority to zero.

9.3.2.3 Cost Effectiveness of Measures

Table 9.2: Cost savings under the different runway patterns over the period 2022-2026 (€ million, 2020 prices) shows the cost-effectiveness of the different noise insulation eligibility options in terms of reducing the number of people HSD or exposed to noise above the night time priority, in 2025. The cost-effectiveness ratio is the cost (in €) per person no longer impacted, under the HSD metric or high noise impact metric, after being insulated. Therefore, the measure with the lowest cost-effectiveness ratios is the most cost-effective.

As with the previous tables, we present the cost-effectiveness ratio under Scenario P06 (Forecast Without New Measures) and the full range of cost-effectiveness ratios under the other runway patterns.

Table 9.10: Cost effectiveness of insulation scheme (Residential Noise Insulation Grant Scheme) (€ per person no longer impacted)[131]

RSIGS Eligibility Option	Under Scenario P06 (Forecast Without New Measures)		Scenario with the lowest number of People Affected	
	Population HSD	Population > 55 dB L_{night}	Population HSD	Population > 55 dB L_{night}
RSIGS A	663,000	44,000	220k to 663k	13k to 44k
RSIGS B	555,000	38,000	123k to 555k	7k to 38k
RSIGS C1	149,000	296,000	149k to 264k	21k to 296k
RSIGS C2	136,000	1,035,000	123k to 147k	7k to 1,035k
RSIGS C3	150,000	287,000	150k to 524k	20k to 287k
RSIGS C4	137,000	886,000	123k to 149k	7k to 886k
RSIGS C5	140,000	988,000	140k to 224k	33k to 988k
RSIGS C6	136,000	1,520,000	123k to 140k	7k to 1,520k

The results show that insulation can be a relatively expensive noise mitigation measure, particularly if the eligibility is poorly targeted against the chosen noise outcomes. For example, noise insulation variants A and B are most cost-effective at reducing the number of people

[131] *Source: CEPA analysis of daa data and assumptions. Note: Cost-effectiveness ratios are rounded to nearest thousand*

exposed above the night time priority. This is because only households that are exposed to those impacts are eligible for insulation under these eligibility options.

The results also show that insulation schemes that are based on 2025 exposure levels are generally more cost effective than those that are based on 2022 exposure levels. There are two reasons for this:

- More households are eligible under these schemes, which spreads the overheads, therefore reducing the overall percentage of fixed costs, thus lowering the cost per person no longer impacted.
- Setting eligibility based on 2022 noise exposure results in the insulation of some households who would have benefitted from reduced noise exposure regardless (due to the background reduction in aircraft noisiness over time).

As a result, ANCA has not considered proceeding with eligibility options that are based on 2022 noise exposure levels preferring instead to focus on setting eligibility based on the forecasts provided with the Application for 2025.

9.3.2.4 Overall Cost Effectiveness

ANCA now considers the combined effect of changing the runway pattern scenario and implementing a noise insulation scheme. Here, consideration has been given to the impact of changing the runway pattern on existing noise insulation schemes as changing the runway pattern changes the numbers of households that are eligible for noise insulation under the existing schemes, which can increase insulation costs for the Applicant but also reduce the noise impact on households.

Table 9.11: Change in number of people HSD in 2025 compared against the Forecast Without New Measures, after accounting for the impact of changing the runway pattern and of insulating homes under RNIS, HSIP and RSIGS[132]

Scenario	Highly Sleep Disturbed			
	B	C2	C4	C6
Scenario P06 (FWNM)	-1	-123	-105	-181
Scenario P02	442	442	442	439

[132] *Source: CEPA analysis of daa data and assumptions*

Scenario P03	-881	-885	-884	-922
Scenario P04	-1,367	-1,656	-1,651	-1,723
Scenario P05	-231	-352	-335	-425
Scenario P7	65	62	62	35
Scenario P08	-810	-924	-902	-993
Scenario P09	-1,704	-1,909	-1,898	-2,022
Scenario P10	-131	-161	-157	-219
Scenario P12	506	506	506	505
Scenario P13	-364	-366	-365	-393

Under the HSD metric, the most effective combination of measures is Scenario P09 with noise insulation variant C6, which results in just over 2,000 people no longer being HSD. For context, 34,542 people remain HSD in 2025. However, with reference to the priority almost all of the measures are fully effective at reducing the number of people exposed to noise levels over 55 dB L_{night} to 0, as shown in Table 9.12.

Table 9.12: Change in number of people exposed to the night time priority of 55 dB L_{night} in 2025 compared against the Forecast Without New Measures after accounting for the impact of changing the runway pattern and of insulating homes under RNIS, HSIP and RSIGS[133]

Scenario	> 55 dB L_{night}			
	B	C2	C4	C6
Scenario P06 (FWNM)	-16	-16	-16	-16
Scenario P02	-16	-16	-16	-16
Scenario P03	-16	-16	-16	-16
Scenario P04	-14	-14	-14	-14
Scenario P05	-16	-16	-16	-16
Scenario P7	-16	-16	-16	-16
Scenario P08	-16	-16	-16	-16
Scenario P09	-16	-16	-16	-16

[133] *Source: CEPA analysis of daa data and assumptions*

Scenario P10	-16	-16	-16	-16
Scenario P12	-16	-16	-16	-16
Scenario P13	-16	-16	-16	-16

In Table 9.13 and Table 9.14 below, the cost effectiveness of the combined measures in terms of reducing the number of people HSD and exposed to the night time priority is presented. Here, the additional cost of insulating homes that become eligible under existing schemes is also accounted, which would not otherwise be eligible in the Forecast Without New Measures. Items highlighted in red are measures that do not have a cost-effectiveness ratio as they perform worse than the Forecast Without New Measures. Items highlighted in green are measures that do not have a cost-effectiveness ratio as they lead to cost savings.

Table 9.13: Cost-effectiveness per person no longer HSD in 2025, (€ per person, 2020 prices)[134]

Scenario	Insulation Eligibility Option			
	RSIGS B	RSIGS C2	RSIGS C4	RSIGS C6
Scenario P06 (FWNM)	520,000	136,000	137,000	136,000
Scenario P02	Worse than FWNM	Worse than FWNM	Worse than FWNM	Worse than FWNM
Scenario P03	6,000	7,000	7,000	13,000
Scenario P04	4,000	25,000	25,000	29,000
Scenario P05	3,000	47,000	43,000	63,000
Scenario P7	Worse than FWNM	Worse than FWNM	Worse than FWNM	Worse than FWNM
Scenario P08	1,000	17,000	14,000	25,000
Scenario P09	0	14,000	13,000	21,000
Scenario P10	Cost Savings	18,000	15,000	50,000
Scenario P12	Worse than FWNM	Worse than FWNM	Worse than FWNM	Worse than FWNM
Scenario P13	11,000	12,000	12,000	21,000

[134] *Source: CEPA analysis of daa data and assumptions provided in reporting template*
Note: Items highlighted in red are measures that perform worse than the Forecast Without New Measures. Items highlighted in green are measures that lead to cost savings.

Table 9.14: Cost-effectiveness per person no longer exposed to night time priority of > 55 dB L_{night} in 2025, (€ per person, 2020 prices)[135]

Scenario	Insulation Eligibility Option			
	RSIGS B	RSIGS C2	RSIGS C4	RSIGS C6
Scenario P06 (FWNM)	36,000	1,035,000	886,000	1,530,000
Scenario P02	242,000	245,000	242,000	277,000
Scenario P03	354,000	385,000	377,000	708,000
Scenario P04	363,000	2,987,000	2,942,000	3,644,000
Scenario P05	38,000	1,033,000	889,000	1,653,000
Scenario P7	325,000	350,000	346,000	580,000
Scenario P08	43,000	976,000	797,000	1,562,000
Scenario P09	Cost Savings	1,640,000	1,553,000	2,575,000
Scenario P10	Cost Savings	178,000	148,000	680,000
Scenario P12	333,000	333,000	333,000	346,000
Scenario P13	251,000	277,000	260,000	511,000

Looking at the differences between the scenarios in more detail, the noise insulation variant B is more cost effective than the alternatives, but is less effective overall. In other words, it has less of an effect in terms of reducing the number of people HSD than the other noise insulation schemes.

When looking at the different runway use or runway restriction scenarios, there is variation in cost-effectiveness, but there is no single measure that consistently performs better than the others:

- The Applicant's preferred runway preference and restriction scenario is Scenario P02 with a noise insulation eligibility variant B. This results in an increase in the number of people HSD compared to the Forecast Without New Measures but is relatively cost effective at minimising the number of people exposed to the night time priority. As mentioned

[135] *Source: CEPA analysis of daa data and assumptions provided in reporting template*
Note: Items highlighted in red are measures that perform worse than the FWNM. Items highlighted in green are measures that lead to cost savings.

previously, it also performs well at minimising the number of people forecast to experience significant adverse changes in night time noise exposure.

- Overall, it could be considered that the most cost-effective combination of measures occurs with Scenario P10 with noise insulation eligibility variant B. This combination of measures leads to cost savings while reducing the population HSD and exposed to the night time priority. However, Scenario P10 performs less effectively when it comes to minimising the number of people significantly adversely affected and is worse in this respect to the Applicant's preferred scenario. It is also one of the least effective measures, in that it does not have a very large effect in terms of reducing the number of people HSD.
- Scenario P09 is relatively cost-effective when targeting the number of people highly sleep disturbed but less so when targeting the number of people exposed to noise levels exceeding the night time priority. It also generally has the highest levels of effectiveness under the HSD and night time priority metrics, but leads to more people significantly adversely affected (i.e. it leads to more people experiencing an increase in noise relative to historic levels).
- Scenario P13 is also generally cost-effective under both the HSD and night time noise priority metrics, though this depends somewhat on the noise insulation option assumed. It also delivers reductions in the number of people HSD and exposed to noise levels exceeding the night time noise priority, and it is likely to perform well at minimising the number of people significantly adversely affected.

Generally, we consider that all scenarios assessed can be considered suitable, as they all continue to meet the targets set out in the NAO in the context of the Application and none of them consistently underperforms the others when having regard for all metrics considered. However, in the following section, we test only a subset of these against the operating restrictions to make it easier to compare them. These are as follows:

Most effective combination of measures under the HSD metric. This is the combination of runway pattern and noise insulation variant that results in the greatest reduction in number of people HSD. Based on our analysis, the most effective measure under the HSD metric is Scenario P09 with noise insulation eligibility variant C6.

Most cost-effective combination of measures. This is the combination of runway pattern and noise insulation variant that results in the most cost-effective outcome under the given metric. We consider this to be Scenario P10 with noise insulation variant B under both metrics, based on the analysis presented in this document.

The Applicant's preferred measures, which is Scenario P02 with noise insulation eligibility variant B.

A more effective variant of the Applicant's preferred measure. The Applicant's preferred measure performs worse than the Forecast Without New Measures in terms of reducing the number of people HSD. We therefore consider a variant of this measure that performs better in terms of reducing the number of people HSD – Scenario P13 with noise insulation variant C6.

9.3.3 Operating Restrictions

Operating restrictions include measures such as restrictions on certain types of aircraft or periods of time when the number of flights is restricted. In our analysis, we assess two types of operating restrictions, as presented in Table 9.15 below.

Table 9.15: Operating Restrictions

Measure	Description
The Applicant's Assessed Options	
Permitted Operations	Retain existing restrictions currently due to be introduced on the opening of the new north runway: Condition 3(d) – Runway 10L-28R shall not be used for take-off or landing between 23:00-07:00 Condition 5 – The average number of night time aircraft movements at Dublin Airport shall not exceed 65 per night (between 23:00-07:00) when measured over the 92-day modelling period.
The Applicant's Proposed Noise Quota Scheme	Annual noise quota limit of 7,990 between the hours of 23:00-05:59, with noise related limits on aircraft permitted to operate at night.
Additional Measures Assessed by ANCA	

Alternative Noise Quota Scheme	Annual noise quota limit of 16,260 between the hours of 23:00-06:59, with noise related limits on aircraft permitted to operate at night.
Scenario P11	Retain Condition 3(d) only – Runway 10L-28R shall not be used for take-off or landing between 23:00-07:00

The Permitted Operations scenario are the operating restrictions currently due to be introduced in 2022 when operations commence on the new north runway as set out in Conditions 3(d) and Condition 5 of the North Runway Planning Permission. As such, it is necessary to compare the cost-effectiveness of this scenario against alternatives.

Scenario P11, which involves retaining Condition 3(d) but not Condition 5, has been ruled out at an earlier stage of the analysis as it is expected to lead to an increase in the number of people exposed to noise levels exceeding 55 dB L_{night}, relative to 2019.

ANCA has also considered the cost-effectiveness of a Noise Quota Scheme as it has been proposed by the Applicant as a replacement to the operating restrictions contained within the Permitted Operations scenario.

The Noise Quota Scheme creates an annual limit on the volume of noise generated by aircraft during the night period, using the Quota Count (QC) system. Each aircraft type is given a QC rating depending on how much noise it generates. If there is a risk that the total QC rating of all the night flights flown in a year will breach the quota limit, it will impose an operating restriction. Airlines will either be required to fly a quieter aircraft with a lower QC, or not operate at all.

The Applicant proposed a Noise Quota Scheme that would create an annual noise quota limit for 6.5 hours of the night period. The limit was set such that it would not impose any operating restrictions based on the Applicant's forecasts in terms of ATMs and the corresponding fleet mix. ANCA has assessed an additional measure that extends the Noise Quota Scheme to cover the full night period and introduces restrictions on certain aircraft types based on their QC from 2025.

9.3.3.1 Cost of Measures – Permitted Operations

The Applicant assessed the cost of the permitted operations scenario to be €1,396 m over the period 2022-25, based on the Applicant's consultant's assessment of the economic impact of the operating restrictions. The Applicant used an economic impact methodology, that seeks to value lost economic output as a result of the operating restrictions, estimating:

- The 'direct' loss in economic activity within the aviation sector from fewer flights and fewer passengers.
- 'Indirect' losses in economic activity incurred by the wider supply chain.
- 'Catalytic' losses in economic activity based on the wider relationship between aviation and economic growth.

ANCA has taken a more stringent approach that accounted for displacement effects – the concept that less spending on aviation would lead to more spending elsewhere in the economy. Without accounting for these effects, the Applicant's estimates of the direct and indirect losses are likely to be significantly overstated. Additionally, the Applicant's approach for assessing the costs of operating restrictions is inconsistent with the treatment of costs elsewhere in the Applicant's CEA. Needing fewer air traffic controllers due to runway closures is treated as cost saving, whereas needing fewer airport and airline staff as a result of operating restrictions is treated as a cost due to lower economic output.

As a result of these deficiencies, which are somewhat inherent in economic impact methodologies, this approach is not commonly used for economic appraisal in Ireland (or globally). ANCA has therefore used a different approach, although the Applicant's estimate of catalytic losses has been retained for the ANCA CEA upper estimate. The ANCA CEA approach identifies four key impacts:

Loss in value to passengers no longer able to travel – ANCA has estimated this by proxy by considering how much ticket prices would have to rise to reduce demand by enough to meet the capacity constraints introduced by the operating restrictions

Wider losses to the economy from having less connectivity – There is evidence to suggest that improved air connectivity leads to higher economic growth. However, the precise relationship is highly uncertain. As ANCA does not have detailed flight schedules from the Applicant as these are commercially sensitive, it is not possible to separately estimate this effect, but the Applicant's estimate for the 'catalytic' impacts of the operating restrictions as our upper bound estimate can be used.

Air traffic controller savings from only operating a single runway during the night period – This was not assessed by the Applicant for the operating restrictions measures, but was assessed for the other measures.

Lower profits for airlines from higher airport charges – As most of Dublin Airport's other costs are fixed, it will have to spread those costs over a smaller passenger base meaning higher charges for everybody else. This will lead to lower profits for airlines.

The detailed methodology used for these calculations is set out in Appendix J. Using this methodology ANCA assess that the costs of the permitted operations scenario to range from €88 million to €1,023 million over the period 2022-26.

9.3.3.2 Noise Quota Schemes

Whether the Noise Quota Scheme will impose a cost will depend on how tight the restriction is and the state of technology available to airlines.

- If there is no risk of the quota limit being breached or the QC restriction acting as a constraint on airline operating plans, there would be no cost to airlines.
- If there is a risk of the quota limit being breached or the QC restriction acting as a constraint, airlines may choose to "shuffle" their fleet so that their quietest aircraft are in use during the night period, with noisier aircraft in use during the day period or at other airports. This may impose a cost on airlines in terms of reduced operational efficiency. However, fleet shuffling is less likely to be an option for airlines at Dublin Airport as many are based at the airport and, therefore, have less scope for shuffling their fleet.
- If airlines are unable to shuffle their fleet in order to meet the restrictions, their next option would be to bring forward investment in quieter aircraft. This would present an opportunity cost to airlines.
- If the technology does not exist for airlines to replace their existing fleet, their final option would be to schedule a smaller aircraft, which is typically quieter, or opt not to schedule a flight at that time.

The Applicant's modelling shows that the annual night quota count (i.e. over the period 23:00 to 06:59) will be highest in 2025, at 15,892. This suggests that the noise quota limit of 16,260 suggested by ANCA can be met without imposing any restrictions on how an airline may wish to operate from the airport.

The Applicant's forecasts also shows that the quota limit on individual aircraft does not restrict operations up to 2030 as there are no aircraft forecast which have a QC rating of 4.0 of more on take-off or 2.0 or more on landing. From 2030, when aircraft with a QC rating of 2.0 or more are

restricted from taking off during the night period, and aircraft with a QC rating of 1.0 or more are restricted from arriving during the night period, there may be an impact on airline operations. The Applicant's modelling suggests that approximately 12% of the aircraft forecast in the night period in 2030 would be restricted under the proposed QC restrictions. This may result in a cost to certain operators but would also likely improve the noise forecasts. As ANCA's appraisal only considers costs over the five-year period covering 2022-26, the cost of the scheme is estimated to be zero. ANCA recognise that there may be a cost (and an improvement in noise impacts) when considering a longer time horizon.

It is also possible that ATM growth increases more quickly than forecast by the Applicant, and/or the Applicant's assumptions around fleet replacement are optimistic. Under such a scenario, there would be a cost to the Noise Quota Scheme over the period 2022-26. The Noise Quota Scheme effectively guards against the Applicant's forecasts being optimistic.

9.3.3.3 Effectiveness of Measures

As the Balanced Approach requires ANCA to consider operating restrictions only after other alternatives have been fully considered, it is necessary for us to compare the performance of operating restrictions against alternative measures.

Below, the operating restrictions measures are compared to four other measures that do not include operating restrictions:[136]

Table 9.16 compares the effectiveness of the measures compared with the Forecast Without New Measures, and shows the number of people that remain HSD or exposed to high noise impact following the implementation of the measures.

[136] Note that it was not possible to derive effectiveness measure Permitted Operations Scenario for Significantly Adversely Affected people due to data not being available.

Table 9.16: Reduction in people impacted in 2025 under different measures[137]

Measure	Number of people no longer impacted compared with Forecast Without New Measures		Number of people impacted following measure	
	Population HSD	Population > 55 dB L_{night}	Population HSD	Population > 55 dB L_{night}
Permitted Operations	-14,083	-16	22,481	0
Applicant's Noise Quota Scheme	0	0	36,564	16
Alternative Noise Quota Scheme	0	0	36,564	16
Most effective measure under HSD metric	-2,022	-16	34,542	0
Most cost-effective measure	-219	-16	36,345	0

This table shows that the operating restrictions within the Permitted Operations scenario are by far the most effective at reducing the number of people HSD. However, as discussed previously, these restrictions are not necessary to achieve the targets set out in the NAO. The other measures do vary in their effectiveness, but the differences between them are relatively small. This analysis underlines the analysis covered previously in the report which demonstrates that the biggest impact of the relevant action as applied is to replace Condition 5 of the North Runway Planning Permission.

9.3.3.4 Cost Effectiveness of Measures

Table 9.17 presents the cost-effectiveness of the different measures against the two metrics set by the NAO for night time noise. Given the uncertainty around the costs imposed by the Permitted Operations scenario, the cost-effectiveness is presented as a range.

[137] Source: CEPA analysis of daa data and assumptions provided in reporting template

Table 9.17: Cost effectiveness of different measures relative to the Forecast Without New Measures (FWNM) (€ per person, 2020 prices)[138]

Measure	HSD	Population > 55 dB L_{night}
Permitted Operations	6,000 to 73,000	694,000 to 8,032,000
Applicant's Noise Quota Scheme	0	0
ANCA Noise Quota Scheme	0	0
Most effective measure under HSD metric	21,000	2,575,000
Most cost-effective measure	Cost savings	Cost savings
The Applicant's Preferred Option	Performs worse than FWNM	242,000

From a purely cost-effectiveness perspective, alternating between using the north runway and south runway over the period 00:00-05:59 with noise insulation variant B (insulating homes exposed to noise greater than 55 dB L_{night}) is the most cost-effective under both metrics. However, as discussed previously, it does not perform as well in minimising the number of people experiencing significant adverse noise changes and has limited effectiveness.

The table also shows that when looking at the outcomes targeted by the NAO, particularly the HSD metric, the measure preferred by the Applicant (Scenario P02 with noise insulation variant B) does not perform well. However, it does perform well against minimising the number of people experiencing significant noise changes (i.e. significantly adversely affected), which is an important part of the noise problem.

Scenario P13, in isolation, is one of the most cost-effective runway use and restriction scenarios. When combined with insulation option C6, the combination of measures is not necessarily the most cost effective under the outcomes targeted by the NAO. However, it does achieve an improvement under both outcomes targeted by the NAO, and under the significantly adversely affected metric.

[138] Cells which are red do not result in an improvement in the noise situation. Cells with a number provide a noise reduction benefit and the € value is the cost per person required to deliver that benefit. Cells which are green provide a noise reduction benefit and deliver a cost saving at the same time. Therefore, when a noise benefit is delivered, large values achieve it at the highest cost, small values achieve it a lower cost, and green cells achieve it with no cost, indeed they deliver a cost saving.

The lower bound estimate of the cost-effectiveness of the Permitted Operations scenario, suggests it is possible that the restrictions could be more cost-effective than some of the alternatives. However, that is assuming the most optimistic outcome in terms of costs.

9.3.4 Summary of ANCAs Analysis

The analysis presented by ANCA can be summarised as follows:

For Dublin Airport to meet its forecasts in 2025 with Condition 5 either revoked or replaced, noise impacts will need to increase above those forecast in 2025 without relevant action i.e. the noise situation. However, these impacts in overall terms will be lower than what occurred in 2019 and in this respect the relevant action can meet the NAO.

The permitted operations whilst being extremely effective in reducing noise impacts in terms of population HSD and the night time priority are costly. The analysis shows that the existing restrictions are not cost-effective when compared to the alternatives considered.

Replacing Condition 5 with a noise quota scheme is a much more cost-effective means of managing and limiting aircraft noise impacts. Such schemes provide security of meeting outcomes whereas revoking Condition 5 altogether would not. This is particularly the case over the period to 2030 before the first reduction outcome set by the NAO needs to be achieved.

By retaining Condition 3(d) and allowing only aircraft to use the south runway at night will lead to increases in the number of people exposed to aircraft noise above the night time priority. In this respect, single south runway operations (Scenario P11), would fail to meet the NAO.

The analysis shows that all other runway use and restriction scenarios considered have various strengths and weaknesses. For example, a scenario which may perform well with respect to reducing population HSD may perform badly in terms of introducing significant adverse changes in aircraft noise exposure. The selection of a runway use restriction, which can be informed by the analysis presented earlier in this report, is therefore a matter of judgement.

Noise insulation is a relatively costly measure. Based on the insulation eligibility options explored, these will not reduce the population HSD more than what can be achieved through

a certain runway use or restriction. However, insulation is particularly effective at reducing the number of people exposed above the night time priority.

The main finding from the cost-effectiveness analysis respect to insulation is that eligibility should be based on 2025 exposure forecasts.

9.4 Summary of Data Explained

The analysis presented in this report has had regard for the material submitted by the Applicant as presented in Appendix A. This has taken forecast, noise exposure information and digital noise contours and noise exposure grids as reported in the following Excel documents that are available on the ANCA website: https://www.fingal.ie/aircraftnoiseca/documents-f20a0668.

- a11267_19_ca437_2.0-summary-of-results-including-mitigation.xlsx
- 20210618-reporting-template-update.xlsxCA434_5.0

10 DRAFT REGULATORY DECISION AND REASONS FOR SELECTION OF PREFERRED OPTIONS

Based on the analysis presented in Chapter 6, ANCA has made a draft regulatory decision (DRD). This chapter sets out the conditions attached to the draft decision along with the reasons for them.

10.1 Noise Quota Scheme

The Applicant has proposed an annual noise quota scheme effective over a period of six-and-a-half-hours from 23:30-05:59 (local time). Following ANCA's review of the measures available, an alternative scheme, where an annual noise quota is proposed for an eight-hour period from 23:00-07:00 (local time) with restrictions on certain aircraft types based on their quota count, was also considered. Both noise quota schemes would allow Dublin Airport to meet its forecasts although in the case of the alternative restrictions on aircraft types would require some change to the forecasted fleet mix from 2030 onwards. In the Forecast Without New Measures, a scenario is presented whereby there are no restrictions on the number and type of aircraft operating at night.

ANCA's analysis shows that each of these alternatives to Condition 5 of the North Runway Planning Permission will increase noise exposure compared to the situation that would pertain without any changes. However, noise exposure and health outcomes in 2025 and beyond would be better than those which occurred in 2019. This is a key component of the NAO.

Whilst the Forecast Without New Measures is also capable of meeting the NAO, this does not provide any limits on night-time noise beyond the NAO itself. ANCA determined that a restriction is necessary in the form of a limit to ensure that the Applicant's forecasts will be met. This is particularly important over the period to 2030 in anticipation of the 30% noise reduction target being required under the NAO. For this reason, ANCA considers that revoking Condition 5 would not be in line with the broader policy of setting limits as defined by the NAO.

The Cost-Effectiveness Analysis (CEA) presented in this report has had regard to the cost-effectiveness of the permitted operation i.e. Condition 5 alongside the noise quota schemes. This CEA demonstrates that whilst the existing consent is an effective way of managing aircraft noise, i.e. it performs best in reducing the number of people HSD, it is not cost-effective and will result in economic impacts. This is a clear conclusion from the CEA and is in line with the Applicant's own assessment. The analysis presented throughout this report has highlighted that Dublin Airport was operating above the movement restriction of 65/night in 2016 and 2019. It also shows that if Condition 5 is to be replaced to facilitate aircraft movements above the 65/night restriction set by

Condition 5 then noise outcomes in terms of population HA and HSD would be better than 2019 and would continue to improve over time. This is mainly due to fleet modernisation.

ANCA has considered the two noise quota schemes and proposes the following condition:

Condition 1:
The existing operating restriction, Condition 5, of the North Runway Planning Permission (FCC Reg. Ref: F04A/1755; ABP Ref: PL06F.217429) reading as:

On completion of construction of the runway hereby permitted, the average number of night time aircraft movements at the airport shall not exceed 65/night (between 2300 hours and 0700 hours) when measured over the 92 day modelling period as set out in the reply to the further information request received by An Bord Pleanála on the 5th day of March, 2007.
shall be revoked and replaced with an annual noise quota scheme operating restriction as follows:

The airport shall be subject to a Noise Quota Scheme (NQS) with an annual limit of 16,260 between the night time hours of 23:00 and 06:59 (inclusive, local time) with noise-related limits on the aircraft permitted to operate at night. The annual noise scheme shall be applied as detailed in Schedule A.

REASON:
To limit the impact of the aircraft noise at Dublin Airport on sleep disturbance in the interest of residential amenity and to ensure the effective implementation of the Noise Abatement Objective for the Dublin Airport by means of a noise-related limit on aircraft operations.

Schedule A, of the DRD which sets out the mechanics of the proposed NQS is attached to this report.

Whilst this is different to the NQS proposal brought forward by the Applicant, ANCA is of the view that night-time noise is better managed through restrictions which cover the whole night period. The CEA presented in this report shows that this scheme will lead to the same outcomes as the Applicant's proposed scheme over the assessment period of 2022-2026.

Although the Application proposes a night time NQS effective over a period of six-and-a-half-hours from 23:30-05:59 (local time), this does not cover the same night time period as defined in European Union noise policy and against which the NAO has been set. The Application identifies

demand for night flights in the context of eight-hour night time movements rather than during discrete periods of the night, although it is accepted that demand is greatest during 06:00-06:59. Under the NQS set by ANCA, the eight-hour night time restriction on aircraft movements set out under Condition 5 of the North Runway Planning Permission is replaced with an eight-hour noise-related limit.

The Applicant did not propose any specific restrictions on aircraft types which can operate during the night time period. However, such restrictions are a common features of noise quota schemes in other jurisdictions. ANCA has therefore decided that such restrictions are warranted to set limits on individual aircraft noise events at night and to further deliver the noise limiting aspects of the NAO. The aircraft type restrictions that shall accompany the NQS as it becomes effective are aircraft with a Quota Count (QC) of 4.0 on take-off and 2.0 on landing. ANCA also requires that no aircraft with a QC of 2.0 or more on take-off and 1.0 or more landing shall operate during the night-time from 1 January 2030. This allows the Applicant to plan for this restriction to be implemented, with the aim of phasing out marginally compliant aircraft during the night.

10.2 North Runway Operating Restriction

The Applicant proposed an amendment to Condition 3(d) of the North Runway Planning Permission to allow scheduled use of the north runway between 00:00-05:59.

The analysis presented in this report has considered the relative performance of different runway use and runway restriction scenarios. These scenarios entail different forms of night-time runway use as well as runway restrictions. This has shown that the different scenarios have different strengths and weaknesses when considering metrics such as the population HSD and population exposed to levels above the night time priority of 55 dB L_{night} as defined by the NAO.

In reviewing the documentation submitted in support of the Application, ANCA may impose, revoke, revoke and replace, or amend the terms of an operating restriction.

Restating Condition 3(d) as an operating restriction but allowing additional aircraft noise at night compared to the forecast situation through the introduction of an NQS would result in more people being exposed to the night-time priority of 55 dB L_{night} than occurred in 2019. This situation would fail to meet the outcome required by the NAO and therefore ANCA determined that the use of both runways at night should be preferred over single runway use.

All remaining scenarios considered can achieve the requirements of the NAO in the forecast year of 2025 by having noise exposure outcomes which are better than 2019. In the context of the airport operating at 32 mppa and accounting for population growth, all of the scenarios considered are capable of meeting the NAO in 2030, 2035 and 2040. This also includes the

Forecast Without New Measures which would allow Dublin Airport to operate without any defined restriction on how it uses its runways at night. Whilst this situation may provide the Airport a great deal of flexibility and this could meet the NAO, it is not consistent with the existing arrangements for the North Runway as set out in Conditions 3(a)-(c) of the North Runway Planning Permission and does not reflect the Application.

The analysis presented in this report shows that different runway use and restriction scenarios perform better or worse depending upon how they are assessed and the metrics used to evaluate them. When considered alongside the implications these each have on different eligibility criteria for sound insulation, some differentiation can be seen in the cost-effectiveness assessment.

The Applicant's proposal constitutes a shortening by two hours of the current restriction imposed by Condition 3(d). This would result in Dublin Airport implementing the form of operation as described in Condition 3(a)-(c) of the North Runway Planning Permission at 00:00 and recommencing this pattern at 06:00 (local time). ANCA's DRD strikes a balance between the number of people forecast to be exposed to night time aircraft noise, including the number of people exposed above the priority value of 55 dB L_{night}, and those who may experience significant adverse changes in night time noise exposure. ANCA's three proposed conditions address the identified noise problem.

In general, the differences between each runway use and restriction scenario considered in health terms is relatively small compared to the overall number of people forecast to be HSD with the key differentiator being the number of people exposed above the night-time priority value of 55 dB L_{night}. The Applicant has however proposed that those experiencing aircraft noise above 55 dB L_{night} would be eligible for noise insulation under a new night time noise insulation grant scheme. ANCA agrees with this approach and has considered sound insulation eligibility options which incorporate this level of exposure which is also the night time priority set by the NAO. In this respect, any form of night-time runway use or runway restriction selected by ANCA will result in those most affected by aircraft noise being eligible for sound insulation.

Overall, based on the evidence provided in the Application and ANCA's own analysis, taking into account the noise insulation proposals which are discussed in the following paragraphs, ANCA is proposing the following condition:

Condition 2:

The existing operating restriction imposed by Condition 3(d) and the exceptions at the end of Condition 3 of the North Parallel Runway Planning Permission (FCC Reg. Ref: F04A/1755; ABP Ref: PL06F.217429) reading:
'3(d). Runway 10L-28R shall not be used for take-off or landing between 2300 hours and 0700 hours. except in cases of safety, maintenance considerations, exceptional air traffic conditions, adverse weather, technical faults in air traffic control systems or declared emergencies at other airports.'
shall be amended as follows:

Runway 10L/28R shall not be used for take-off or landing between 00:00 and 05:59 (inclusive, local time) except in cases of safety, maintenance considerations, exceptional air traffic conditions, adverse weather, technical faults in air traffic control systems or declared emergencies at other airports or where Runway 10L/28R length is required for a specific aircraft type.

REASON:
To permit the operation of the runways in a manner which reduces the impacts on those newly affected by aircraft night time noise, whilst providing certainty to communities as to how they will be affected by night time operations from the north runway, while also providing continuity with the day-time operating pattern set down by Conditions 3(a)-(c) of the North Runway Planning Permission.

10.3 Residential Sound Insulation Grant Scheme (RSIGS)

The NAO has set a priority of 55 dB L_{night} to reflect levels of noise exposure which presents a clear risk to human health. ANCA agrees with the Applicant's proposal to provide a noise insulation scheme for eligible dwellings found to be exposed to aircraft noise at or above this threshold. This threshold is evidence based and reflects the observations made in determining the second aspect of the noise problem.

Exposure to aircraft noise above this threshold occurs due to operations from Dublin Airport's runways and not just the north runway arising from proposed Condition 2 (above). As such, a noise insulation scheme set around the priority value of 55 dB L_{night} will help to mitigate the effects

on those who become newly exposed to potentially harmful levels of aircraft noise, as well as those who have already been exposed to noise above this value and would continue to do so in the future.

The Application proposed a second criterion for eligibility to the proposed scheme. This criterion proposes to provide noise insulation grants for those who experience a 'very significant' effect as a result of the Application. This occurs where a dwelling is forecast to experience noise exposure of at least 50 dB L_{night} and an increase in noise exposure of at least 9 dB when compared to the current permitted operation. The Application has proposed that subsequent eligibility will be on forecasts for the first year of the Relevant Action and would be a 'one-off' in terms of the area of eligibility and would therefore not be subject to any annual review. ANCA recognises that a scheme of this nature would help mitigate the effect of those who become newly exposed to night-time aircraft noise below the priority value.

The analysis presented in this report has considered a range of different approaches to setting eligibility alongside the runway use and restriction scenarios. Having accepted the Applicant's proposals with respect to amending Condition 3(d), a key finding from the CEA is that insulation schemes which are set against forecast year of 2025 are more effective. This is because in this year noise exposure is forecast to be at its peak. Having regard for this and the Applicant's second criteria which seeks to mitigate those who experience a 'very significant' effect the following condition is proposed by ANCA:

Condition 3:

A voluntary residential sound insulation grant scheme (RSIGS) for residential dwellings shall be provided as detailed in Schedule B, for all homes forecast in 2025 to be exposed to aircraft noise at or above 55dB L_{night} contour or experience a 'very significant' effect i.e. exposure to aircraft noise at or above the 50dB L_{night} contour together with an increase in noise exposure of at least 9 dB compared to the forecast noise situation in 2025 (had the relevant action not been taken) as shown on the Initial Eligibility Area Contour. Dwellings exposed to levels at or above 55 dB L_{night} shall be reviewed every two years commencing in 2027 and if applicable be made eligible for the scheme. This scheme shall not apply to properties where works were undertaken under the existing Residential Noise Insulation Scheme (RNIS) or Home Sound Insulation Programme (HSIP) or to properties where a planning application was lodged after 09 December 2019, the date being the adoption of

Variation No. 1 to the Fingal Development Plan 2017 – 2023 incorporating policies relating to development within Aircraft Noise Zones.

REASON:
To mitigate the impact of aircraft night time noise as a result of the use of the Airport's runways, in the interest of residential amenity and the proper planning and sustainable development of the area.

The proposed RSIGS is set out in Schedule B of the DRD.

Schedule B seeks to ensure that the proposed RSIGS scheme operates in a consistent manner with the existing RNIS scheme. ANCA has determined that this is particularly important with regards to the setting of a 'statement of need' i.e. a schedule of the insulation works for each eligible dwelling.

The DRD contains the noise mitigation measures and operating restrictions that ANCA proposes to direct the planning authority to include as conditions of the planning authority's decision. The DRD is comprised of the conditions 1 – 3 and schedules A and B. The DRD is attached in Appendix K.

11 NOTICE OF PROPOSED MEASURES TO THE APPLICANT

Section 34C(8) of the Act of 2000 requires ANCA to issue notice to the Applicant detailing the noise mitigation measures or operating restrictions proposed to be required in a decision of the planning authority and its reasons for so proposing. The notice must provide for the applicant to make submissions, observations or counter proposals on the proposed measures during the specified notice period of not less than 4 weeks.

On 17 September 2021, ANCA issued notice to the Applicant pursuant to 34C(8) of the Act of 2000. Although no counter proposals were made by the Applicant during the period specified in the Notice (17 September 2021 to 19 October 2021), the Applicant made a number of observations and submissions that included requests for clarification.

ANCA proceeded to make a DRD, having regard to the submissions and observations contained within the response of the applicant.

The 34C(8) Notice and the response of the Applicant dated 12 October 2021 is attached in Appendix K.

12 CONSULTATION WITH OTHER AUTHORITIES

Having complied with the provisions of Section 34C(8) of the Act of 2000 in respect of the issue of notice of proposed measures to the applicant, ANCA also consulted with the following authorities pursuant to Section 34C(10) of the Act of 2000:

- Irish Aviation Authority
- Commission for Aviation Regulation

The correspondence issued and response(s) received are attached in Appendix L.

13 PUBLIC PARTICIPATION PROCESS

This section describes the methods by which interested stakeholders can participate in the aircraft noise regulation process.

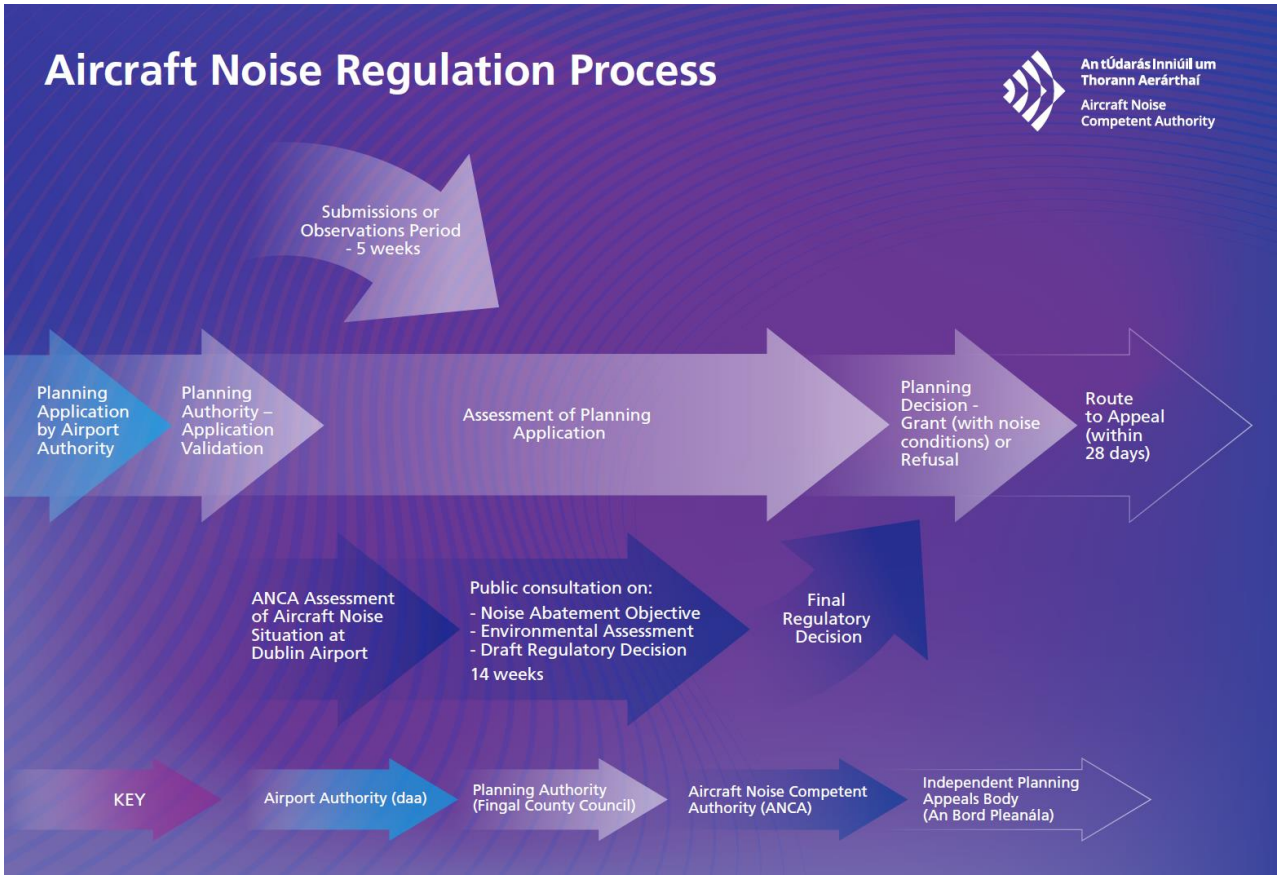

Figure 13.1: The Aircraft Noise Regulation Process

13.1 Statutory Consultation

Having completed and presented the findings of its aircraft noise assessment at Dublin Airport, ANCA is now providing the opportunity for all interested individuals, groups, businesses or organisations to have a say in influencing the final regulatory decision.

The legislation provides for 14-weeks of public consultation so that everyone can consider the implications of our draft proposals and make suggestions as to how aircraft noise can be managed

at Dublin Airport in a sustainable way that achieves the best balance between airport development and protection of the environment, including human health.

13.1.1 Component Parts of the Consultation

- Noise Abatement Objective
- Draft Regulatory Decision and related report
- Environmental Report for the purposes of Strategic Environmental Assessment
- Natura Impact Statement for the purposes of Appropriate Assessment

ANCA will consider all submissions/observations made in writing during this consultation prior to making a regulatory decision. We will send a copy of our regulatory decision to everyone that made a submission during this consultation.

These documents may be viewed on the ANCA website:

www.fingal.ie/aircraftnoiseca/documents-f20a0668

13.2 How to have your say

Information on how to make a submission or observation is available at https://consult.fingal.ie/en/browse.

You can make a submission or observation:

- Online at https://consult.fingal.ie/en/browse.
- By e-mail to aircraftnoiseconsultation@fingal.ie
- In writing to Director of Services, Aircraft Noise Competent Authority, County Hall, Main Street, Swords, Co Dublin K67 X8Y2

Submissions should be in ONE medium only. Submissions should include the full name and address of the person making the submission, details of organisation, community group or company represented where relevant.

Submissions or observations may be made between 11 November 2021 and 28 February 2022. Late submissions will not be accepted.

A submissions policy is available at https://consult.fingal.ie/en/consultation/aircraft-noise-consultation setting out the requirements for making a submission and how your personal information will be managed.

13.3 The Subsequent Role of the Planning Authority

Once a regulatory decision is made, it will be forwarded by ANCA to the planning authority. The planning authority will make a decision on whether to grant or refuse the planning permission. The planning authority will include any noise mitigation measures or operating restrictions provided for in the Regulatory Decision as conditions of the planning decision.

13.4 Route to Appeal

An Bord Pleanála is the appeals body in relation to a decision of the planning authority containing the Regulatory Decision.

For the purposes of an appeal to An Bord Pleanála any person who made submissions or observations in writing in relation to the draft regulatory decision, may on payment of the appropriate fee, may, at any time before the expiration of the appropriate period, appeal to the Board against the decision of the planning authority on the planning application containing the Regulatory Decision.

An acknowledgement of a submission / observation made in writing during this consultation prior to making a regulatory decision.

An tÚdarás Inniúil um Thorann Aerárthaí

Aircraft Noise Competent Authority

Comhairle Contae Fhine Gall
Fingal County Council