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Dublin Airport Compliance Report

Report supplement

Aviation Consultants

Dublin Airport Compliance Report

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Report

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Attached: Dublin Airport ICAO aircraft noise chapter assessment, Bickerdike Allen Partners (2021)

1 Introduction

The Aircraft Noise (Dublin Airport) Regulation Act 2019, Part 4, section 19 states that the airport shall on or before each anniversary of the date of commencement of this section, prepare and adopt a report in writing in the specified form (in this section referred to as a "compliance report") on the compliance of airport users with noise mitigation measures and operating restrictions.

The daa has requested To70 to draft a compliance report in accordance with the Act. The compliance report was finalised in August 2020 as Dublin Airport Noise Compliance Report 2019. The Aircraft Noise Competent Authority (ANCA) has reviewed the compliance report. This review by ANCA produced several points on which additional information was requested.

This report acts as a supplement to the 2019 compliance report, providing additional information to the compliance report.

1.1 Report structure

Section 2 of this supplement provides a complete overview of all noise mitigation measures in place at Dublin Airport. The following chapter (**section 3**) presents a series of maps, presenting the usage of departure routes, the actual flown tracks and the calculated noise contours. **Section 4** provides a detailed overview of the fleet mix. Finally, **Section 5** will go into details on compliance with the environmental corridors.

Appendix A of this supplement provides a glossary of all acronyms and technical terms used in the compliance report and this supplement.

2 Noise mitigation measures

Aircraft operators are instructed to ensure that, at all times, aircraft are operated in such a way as to cause the least disturbance practicable in areas surrounding the airport. The supplementary compliance report refers to several noise mitigation measures and goes into more details specifically on the environmental corridors.

The table on the next page provides a complete overview of all noise mitigation measures in place at Dublin Airport. Information is provided on the current monitoring system, enforcement, compliance and the introduction of monitoring systems. Besides daa, Dublin ATC ensures compliance with noise mitigation measures. ATC ensures that clearances to aircraft do not breach the environmental corridors (except for traffic or weather deviations requested by the pilot). NADP and reverse thrust are flight operations issues which are transparent to ATC.

2.1 Advanced Noise & Track Monitoring System (ANOMS)

For several noise mitigation measures, there is currently no live monitoring system available. To increase monitoring capabilities daa is in the process of sourcing a more Advanced Noise & Track Monitoring System (ANOMS). This system will strengthen the monitoring capabilities of the daa, which will help in gathering more detailed statistics on compliance and with enforcement.

ANOMS will provide accurate and reliable information on which compliance reports, noise impact reduction strategies and community engagement can be built. The system is modular and accommodates multiple data sources, including the existing Noise Monitoring Terminals (NMTs) around Dublin Airport which collect noise and weather data. The implementation process of ANOMS will also include an analysis of additional NMTs at appropriate locations.

Besides the NMTs, ANOMS can make use of a wide variety of data sources, including radar and flight plan systems, to give a complete overview of operating conditions at the airport and support in determining the source of any environmental disturbances. ANOMS assist airports with monitoring and reporting on noise mitigation measures using a range of airport standard rules which are applied to the gathered data. The system also allows the airport to specify more advanced violation rules, which monitor airport specific measures. This will provide the daa with improved reporting capabilities on, among others, Reverse Thrust, Continuous Climb and Continuous Descent Operations.

ANOMS delivers information in a user-friendly manner, so anyone, even those untrained in acoustics or noise management terminology, can benefit from its impartiality and independence. Especially the Webtrak Replay module of ANOMS can be used externally for community engagement programs. The online system's interactive and user-friendly display shows flights, weather, noise monitoring locations, noise level graphs and point of closest approach in relation to a person's location. With this information, WebTrak enables people to investigate noise disturbances in near real time. Besides providing people to conduct their own investigations, Webtrak streamlines complaints handling by integrating relevant flight data with an automated form sent from a PC, tablet or smartphone.

Noise mitigation measures

SID compliance

At Dublin Airport strict compliance with Standard Instrument Departures (SIDs) are mandatory. Tracks are monitored in Noise Desk. The new ANOMS / Webtrak systems will allow for monitoring capabilities on this measure.

Monitoring system	Enforcement	Compliance 2018	Compliance 2019	System Introduction
Noise Desk	NIL	Not available	Not available	ANOMS / Webtrak

Preferential Runway Program

Runway 10 or Runway 28 are the required runways between 0600 and 2300 local time when the crosswind component is 20 knots or less. Runway 28 will be the preferential runway when the tailwind component is 10 knots or less and braking action is assessed as good. Aircraft will be required to use these runways except when operational reasons dictate otherwise. If the crosswind component on Runway 10 or Runway 28 is greater than 20 knots, Runway 16 or Runway 34 may become the active runway. If the forecast crosswind component on Runway 10 or 28 is greater than 20 knots, Runway 16 or 34 may become the active runway. The use of Runway 16-34 is kept to an absolute minimum subject to operational conditions.

Runways will be prioritized for noise abatement purposes between 2300 and 0600 local time, subject to the same wind calculation method and values as used between 0600 and 2300 local time. When weather conditions and flight operations permit, runway usage will be prioritized as follows: Arrivals: Priority 1 (Runway 10), Priority 2 (Runway 16), Priority 3 (Runway 28), Priority 4 (Runway 34); Departures: Priority 1 (Runway 28), Priority 2 (Runway 34), Priority 3 (Runway 10), Priority 4 (Runway 16).

Runway usage is monitored and reported on monthly and annually. The prioritization of runways is laid down in procedures for ATC. The preferential 10/28 runway was used by 98% of movements in 2019, against 95% the previous year. Runway performance will also be included in the ANOMS system.

Monitoring system	Enforcement	Compliance 2018	Compliance 2019	System Introduction
Runway performance	Procedural	95% usage RWY 10/28	98% usage RWY 10/28	ANOMS

Environmental Corridors / Noise Preferential Routes (NPRs) and Track Keeping

The intent is to minimize disruption by routing aircraft away from built-up areas, where possible. Unless directed otherwise by ATC, all category C/D aircraft taking off from Dublin Airport are required to follow specific NPRs. To minimize impact, NPRs are designed to avoid overflight of built-up areas, where possible. An NPR is a path or corridor (1.8 kilometers at its widest point) that category C/D aircraft must follow from take-off until being directed by ATC onto their designated air traffic routes, typically at 3,000 feet altitude above mean sea level.

Aircraft flying inside the environmental / NPR corridor are considered to be flying on-track. Departures from all runways (except easterly departures from Runway 10) must maintain course straight out for 5 nautical miles after take-off before commencing a turn, unless otherwise cleared by ATC. Easterly departures on Runway 10 must maintain course straight out for 5 nautical miles before commencing a turn to the north, or to 6 nautical miles before commencing turn to the south. There is no upper limit on this corridor. Once an aircraft departing on Runway 28, 16 or 34 reaches the end of the NPR, or an altitude of 3,000 feet, ATC may turn it onto a more direct heading to its destination. ATC can turn aircraft off NPRs below 3,000 feet for safety reasons, for example to avoid storms.

Category A/B traffic may operate outside the environmental corridors (NPRs) as long as they achieve an altitude of 750ft (on a SID) or 2000ft (on ATC climb-out) above mean sea level before commencing a turn. Category A/B jet traffic (BAE146 type aircraft) may also operate outside the environmental corridors as long as they achieve an altitude of 750ft above mean sea level and pass the end of the runway before commencing a turn.

Noise mitigation measures				
The SIDs are designed to comply with the environmental corridors. ATC give SID instructions to pilots to remain within the corridor. Dublin Airport monitors breaches of the environmental corridor in their Noise & Flight Track Monitoring Service (NFTMS / Noise desk). In both 2018 and 2019 over 99% of all category C/D movements complied with the environmental corridor. With the introduction of the ANOMS and Webtrak systems, track adherence monitoring will be conducted with these systems.				
Monitoring system	Enforcement	Compliance 2018	Compliance 2019	System Introduction
Noise desk	SID design and ATC Staff instructing pilots	99.3% track keeping	99.2% track keeping	ANOMS / Webtrak
Noise Abatement Departure Procedures (NADP) Climb Profile Dublin Airport's departure procedure is based on noise-abatement departure climb guidance contained in ICAO's Procedures for Air Navigation Services Aircraft Operations Document 8168 Volume 1, Flight Procedures Appendix to Chapter 3 – NADP2. It is currently not possible to monitor NADP profiles. daa is researching the possibility of developing and implementing this with Envirosuit in the future.				
Monitoring system	Enforcement	Compliance 2018	Compliance 2019	System Introduction
NIL	NIL	Not available	Not available	Under development
Visual Approach Jet aircraft (Cat C/D) on visual approach to Runways 28, 10, 16, and 34 must join final approach no closer than 6 nautical miles from touchdown. Aircraft must follow a descent path that is no lower than the ILS glide path. All approaches are monitored but it is unknown if they are visual or not.				
Monitoring system	Enforcement	Compliance 2018	Compliance 2019	System Introduction
Noise desk	NIL	Not available	Not available	ANOMS
Reverse Thrust Reverse thrust is used to aid the deceleration of aircraft on landing through the use of the aircraft's engines. This should not be used at night, unless required for safety reasons. Reverse thrust is currently not monitored and enforced. The new ANOMS system will allow for monitoring capabilities on this measure.				
Monitoring system	Enforcement	Compliance 2018	Compliance 2019	System Introduction
NIL	NIL	Not Available	Not Available	ANOMS
Engine Ground Running Engine test runs are not permitted between 2000 and 0700. All aircraft types may undertake testing between 0900 and 2000HRs, and only aircraft up to Code C may undertake engine testing between 0700 and 0900.				

Noise mitigation measures				
Engine test runs are currently monitored by airside operations. Airside ops. also enforces the time, length and positioning of the engine test runs. The new ANOMS system will allow for more monitoring capabilities on this function.				
Monitoring system	Enforcement	Compliance 2018	Compliance 2019	System Introduction
Airside Ops	Airside Ops	Not Available	Not Available	ANOMS
Continuous Decent Operations (CDO) At Dublin Airport Continuous Decent Operations should be applied as much as possible. Data on the percentage of flights conducted with a CDO is collected by Eurocontrol. ATC and daa have access to this data, but currently don't regularly report on this metric. The IAA ANSP is currently engaging with EUROCONTROL regarding the validity of metrics for CDO's. daa plans to use Eurocontrol data combined with information from ANOMS for reporting when ANOMS is introduced.				
Monitoring system	Enforcement	Compliance 2018	Compliance 2019	System Introduction
Eurocontrol	NIL	Figure 1	Figure 1	ANOMS
Continuous Climb Operations (CCO) At Dublin Airport Continuous Climb Operations should be applied as much as possible. Data on the percentage of flights conducted with a CCO is collected by Eurocontrol. ATC and daa have access to this data, but currently don't regularly report on this metric. daa plans to use Eurocontrol data combined with information from ANOMS for reporting when ANOMS is introduced.				
Monitoring system	Enforcement	Compliance 2018	Compliance 2019	System Introduction
Eurocontrol	NIL	Figure 1	Figure 1	ANOMS

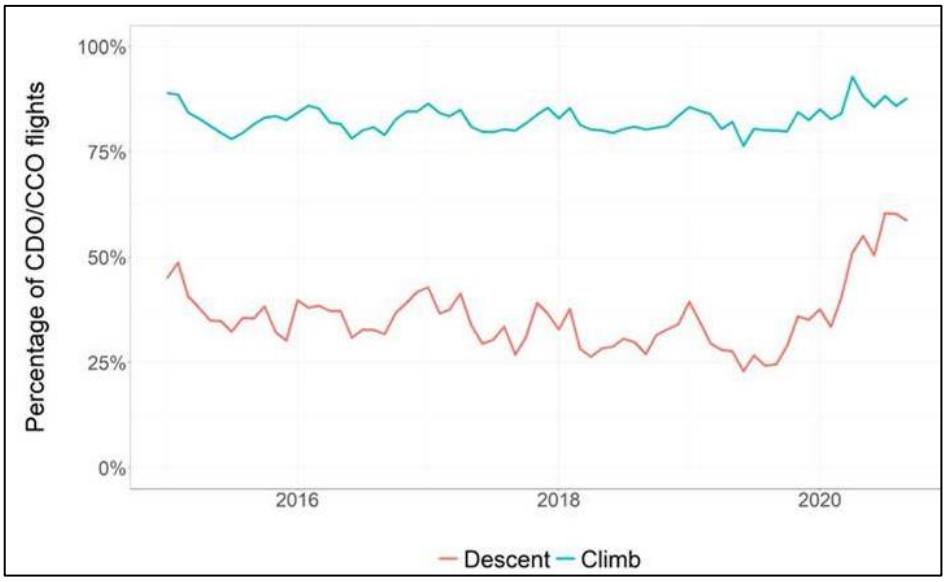

Figure 1: CDO and CCO flights Dublin Airport

3 Route usage, tracks and noise contours

As mentioned in the compliance report, Runway 10/28 is operated as the primary runway with 72% of all movements using the runway in westerly operation and 26% in easterly operation. Figure 2 provides an overview of the route usage for departing aircraft on the primary runway. The majority of large aircraft (cat. C/D) departing in westerly direction make a left or a right turn after clearing the environmental corridor. Aircraft departing in easterly direction turn in different directions over the sea. Category A/B traffic may operate outside the environmental corridors and therefore turns earlier towards different directions.

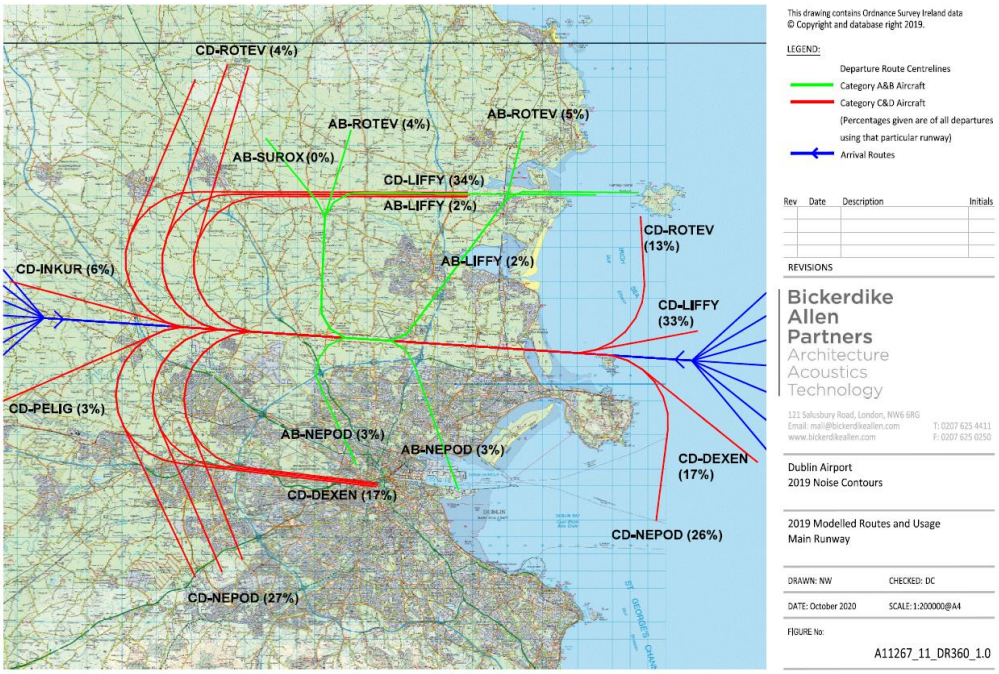

Figure 2: Overview of route usage 2019

Figures 3 to 6 provide radar tracks of flights perfomed on the 11th of August, 2019. The figures provide tracks for aircraft categories C/D and A/B seperately for both departures and arrivals. The figures also show the enviromental corridors for each runway. This day was chosen since it falls within the busiest period of the year at Dublin Airport. On this day the primary runway was opperated in westerly direction (runway 28), a small minority off flights operated on other runways / in other directions.

Figures 7 and 8 provide the calculated Lden and Lnight contours for 2019. Lden is the weighted average of the yearly individual noise level during day, evening and night. Lnight is the weighted average of the yearly individual noise level specifically during the night (23:00 – 07:00). The contours show that higher noise levels concentrate around the airport and in the extension of the primary runway. Lower noise level contours to the west of the airport follow the turns made by departing aircraft after they clear the enviromental noise corridors. Noise contours in the extent of runway 16/34 are considerably smaller, due to the low traffic volumes on this runway.

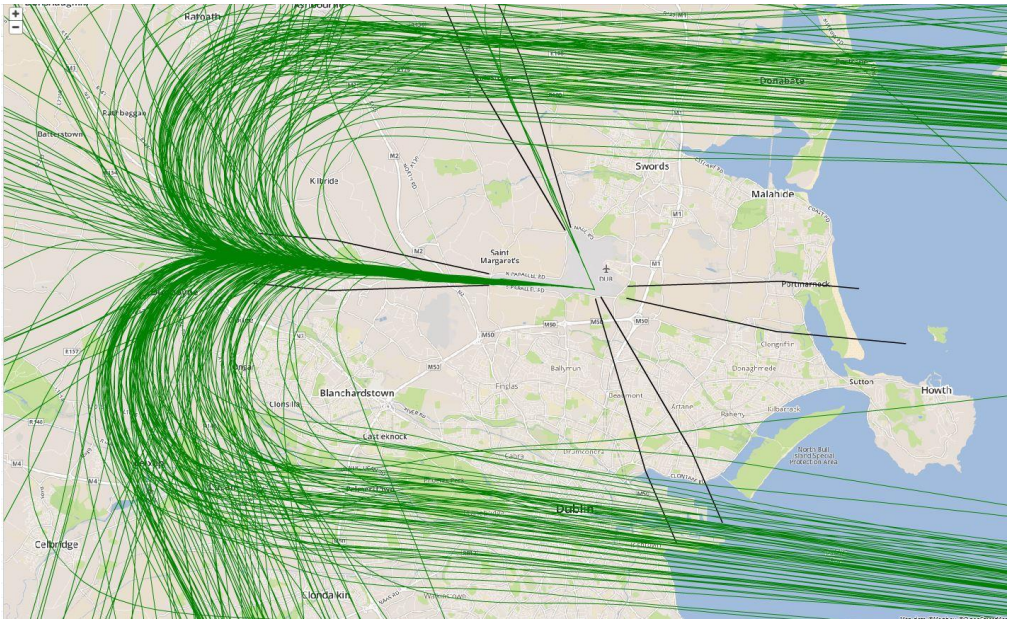

Figure 3: Tracks of category C/D departures on the 11-08-2019

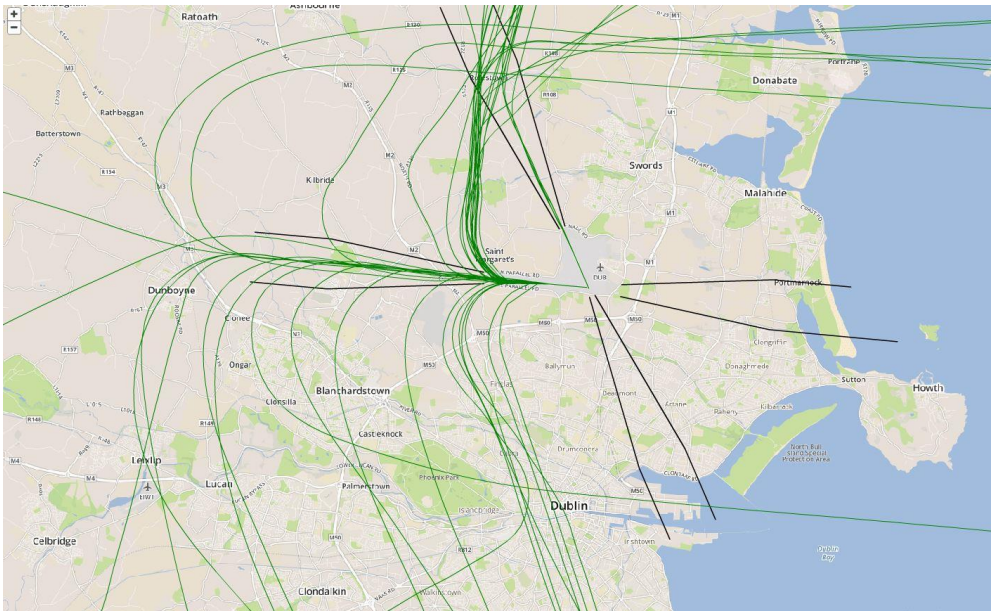

Figure 4: Tracks of category A/B departures on the 11-08-2019

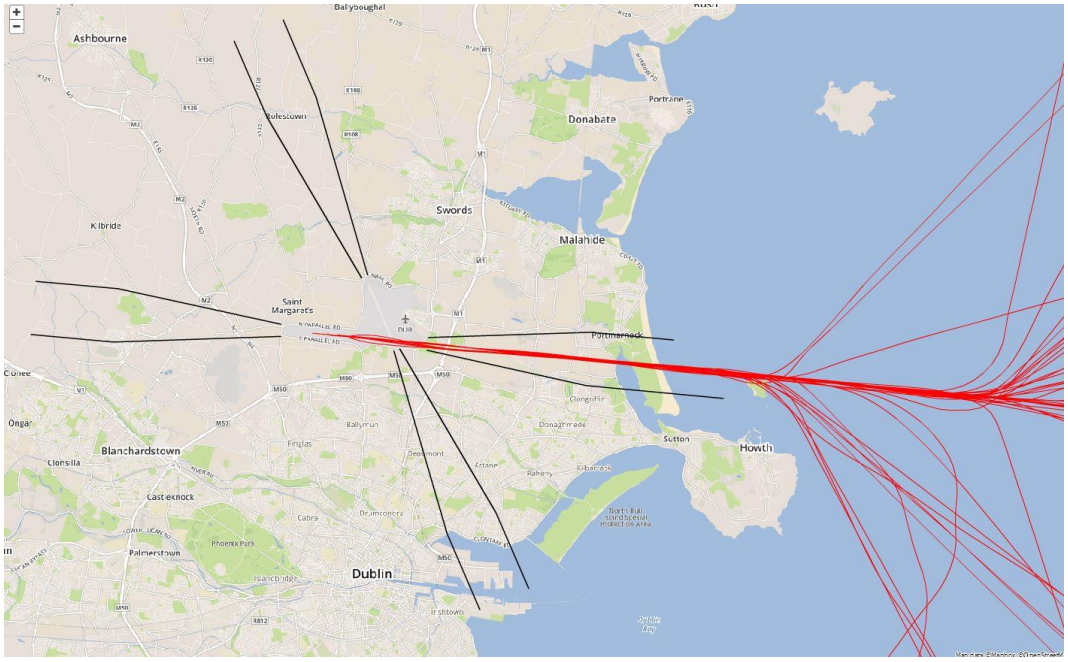

Figure 5: Tracks of category A/B arrivals on the 11-08-2019

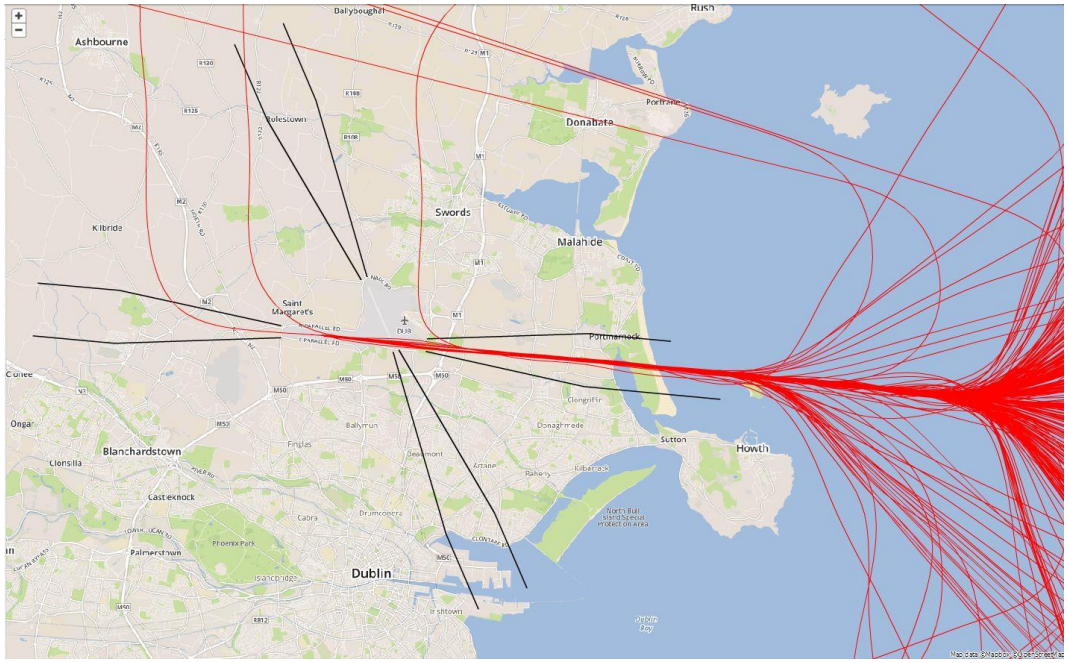

Figure 6: Tracks of category C/D arrivals on the 11-08-2019

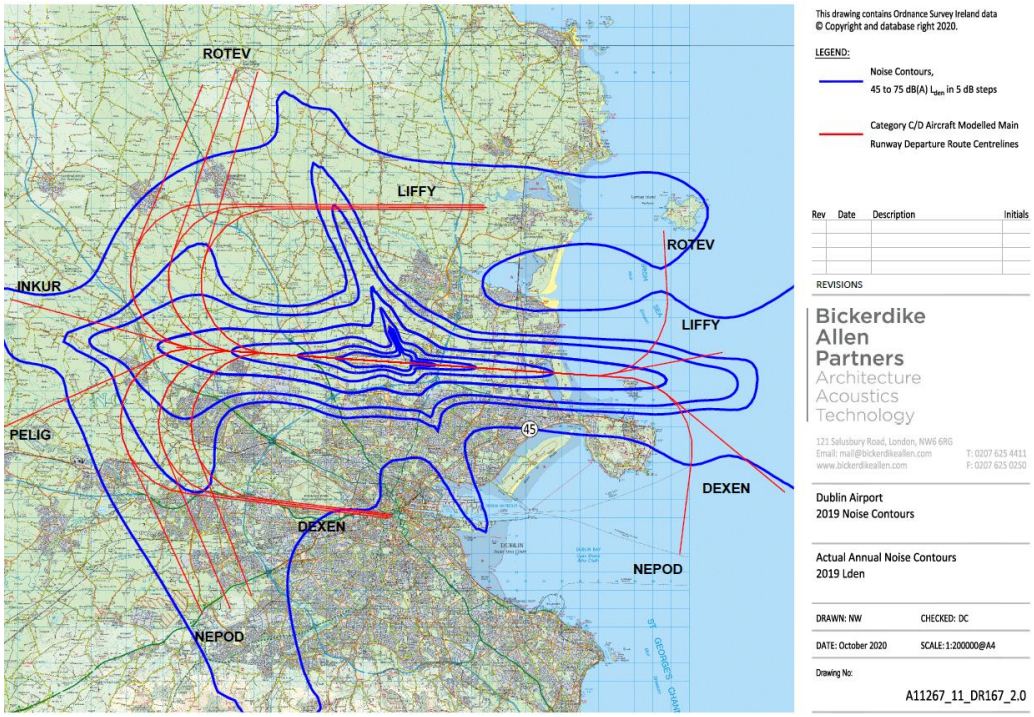

Figure 7: Calculated Lden noise contours for 2019

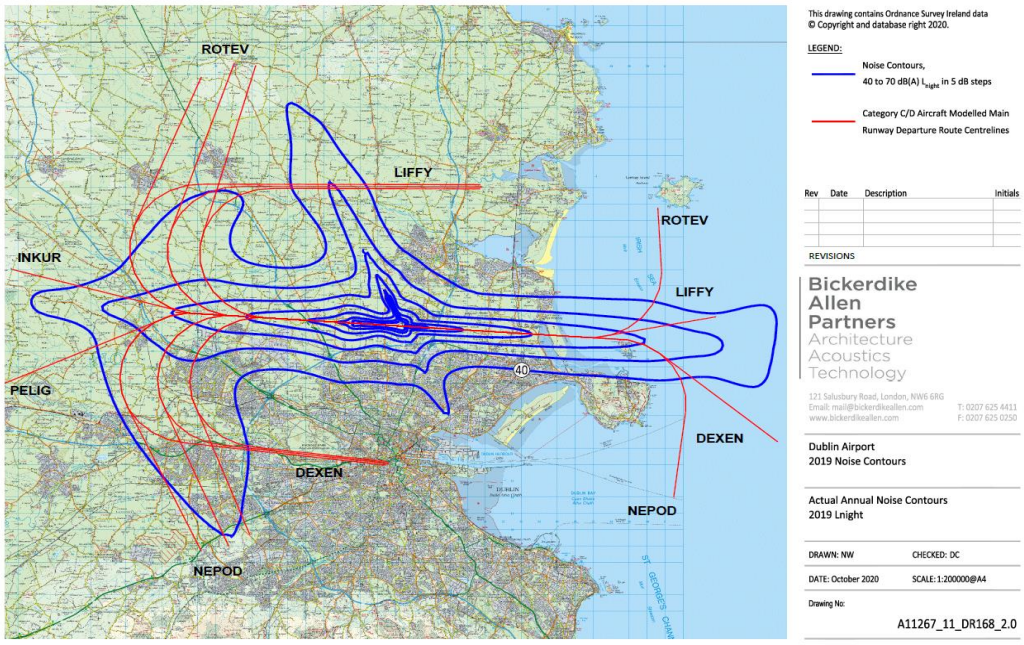

Figure 8: Calculated Lnight noise contours for 2019

4 Fleet mix

In the compliance report, a figure with the distribution of aircraft type groups in 2019 was included, such as 737-Series and A320-Series. A more detailed overview of movements per aircraft type and a comparison with the preceding year has been added to provide more insight, see Figure 9. Only aircraft types with more than 200 movements are shown to improve readability. As can be seen, in both years the B737-800 (B738) and A320 aircraft types were used the most. Most of the aircraft configurations (engine types and take-off weights) of these two types are compliant with chapter 4 limits. Further details on ICAO chapter compliance is provided in the report by BAP (2021), which is attached to this report.

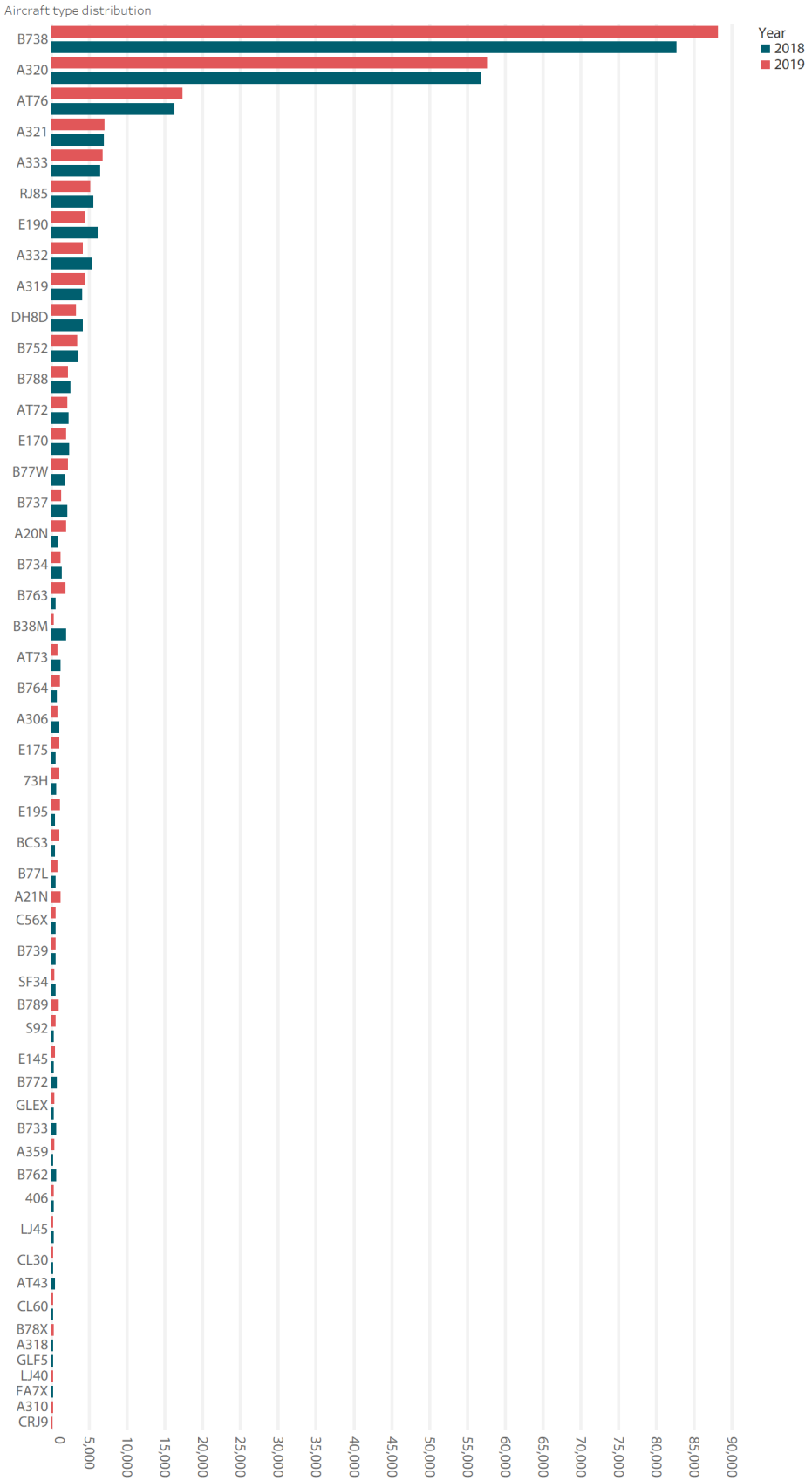

Figure 9: Movements per aircraft type in 2018 and 2019

5 Compliance with environmental corridors

As mentioned in the compliance report, there were 1,594 breaches of the Environmental Corridors (NPRs) in 2019. This means over 99% of all category C/D movements (200,931 in 2019) complied with the environmental corridor. Focusing on departures (110,234 in 2019), 98.5% of departing category C/D movements stayed within the Environmental Corridors.

Of the 1,594 breaches of the Environmental Corridors (NPRs), 56 aircraft were the subjects of complaints from the public. The IAA ANSP (ATC) only investigates a query if an aircraft is the subject of a complaint from a member of the public. Other breaches are not sent to the IAA but are reported on in the bi-annual noise reports (as a track keeping percentage) and in the annual compliance report.

A Glossary

A/B category aircraft	Category of smaller aircraft, containing propeller aircraft, turboprop aircraft, Whisperjets (like Bae-146 and Avro-Jet) and other small general aviation aircraft powered by jets engines.
ANSP	Air Traffic Service Provider
ANOMS	Advanced Noise & Track Monitoring System
ATSU	Air Traffic Service Unit
ATC	Air Traffic Control
C/D category aircraft	Large aircraft, such as Airbus and Boeing aircraft, Bombardier Canadair Regional Jet series, business jets and Embraer aircraft.
Clearway	End part of the runway
daa	Dublin airport authority
NMP	Noise Management Plan
dB	Decibels, a unit of sound pressure
FCC NAP	Fingal County Council Noise Action Plan
HR	Hour
IAA	Irish Aviation Authority
ILS	Instrument Landing System
ICAO	International Civil Aviation Organisation
KT	knots
LAEq	Equivalent average sound level
LAP	Local Area Plan
Lden	Lden is the weighted average of the yearly individual noise level during day, evening and night.
Lnight	Lnight is the weighted average of the yearly individual noise level specifically during the night (23:00 – 07:00).
Reverse thrust	Using the engine of the aircraft for braking after landing on the runway
SID	Standard Instrument Departure

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DUBLIN AIRPORT

ICAO AIRCRAFT NOISE CHAPTER ASSESSMENT

Report to

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Acoustic Consultants: Expertise in planning and noise, the control of noise and vibration and the sound insulation and acoustic treatment of buildings.

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REVISION HISTORY

Revision	Details
1.0	Draft issued for client comment.
2.0	Final

Contents

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1.0 INTRODUCTION

Before a newly developed aircraft model may enter into operation, it must obtain a type certificate from the responsible aviation regulatory authority, such as the European Union Aviation Safety Agency (EASA) or the Federal Aviation Administration (FAA). One element assessed as part of the certification process is the noise produced by an aircraft type. Noise levels are established in compliance with the applicable noise standards as defined in International Civil Aviation Organisation (ICAO) Annex 16[1]. If satisfactory this leads to the declaration that the aircraft type in question meets the requirements of a given Chapter of ICAO Annex 16, Volume I, for example Chapter 4.

EU regulation 598/2014[2] contains the related definition of a 'marginally compliant aircraft'. This is an aircraft type that meets the Chapter 3 requirements but by a limited amount. Consequently, the type falls between the requirements of Chapter 3 and those of the more stringent Chapter 4.

The ICAO Chapters provide a means of assessing the relative noise of the fleet operating at an airport. Specifically, by determining the proportion of operations that meet the requirements of the various chapters. This has been previously assessed and reported for Dublin Airport, see below.

[1] ICAO Annex 16 - Environmental Protection - Volume I - Aircraft Noise
[2] REGULATION (EU) No 598/2014 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Union airports within a Balanced Approach and repealing Directive 2002/30/EC https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0598&from=EN

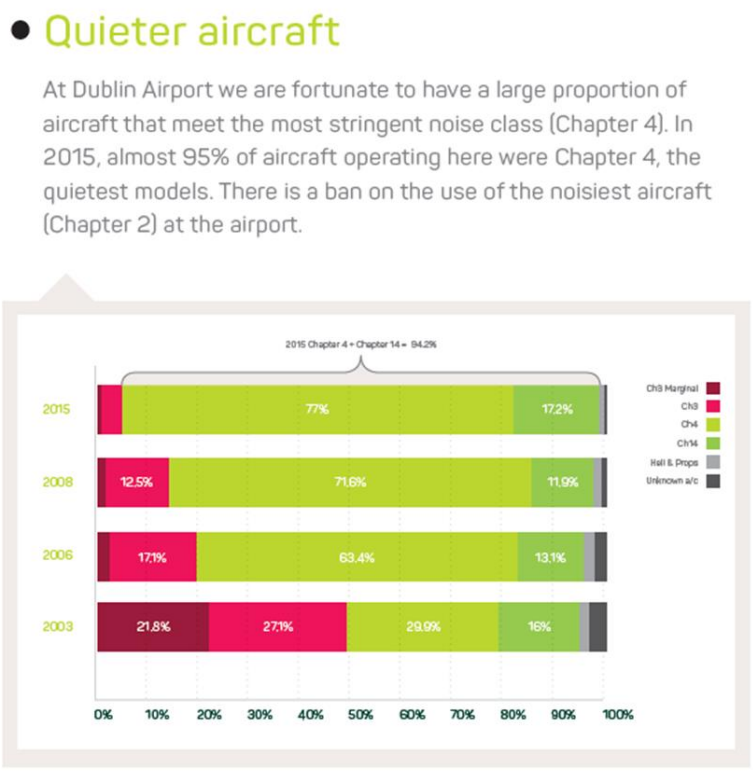


Figure 1: Previous ICAO Noise Chapter Assessment Results

This report details an update of the earlier exercise and considers the activity in 2018 and 2019. Section 2.0 details the noise chapters, and section 3.0 details the latest assessment of the Dublin Airport operations against them.

A glossary of acoustic terminology is contained in Appendix 1.

2.0 NOISE CHAPTERS

2.1 ICAO

ICAO Annex 16 contains the standards and recommended practices for aircraft noise certification. It also covers international specifications relating to aircraft noise measurement and evaluation methods.

The document is split into a series of chapters which relate to specific aircraft categories from supersonic aircraft to helicopters. Of most relevance to Dublin Airport are Chapters 2, 3, 4 and 14 which relate to subsonic jet aircraft and large propeller aircraft (over 8,618 kg). Aircraft of these general types undertake most of the operations at Dublin Airport.

The most recent standard for these aircraft types is given in ICAO 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 less than 55 tonnes in mass. The previous equivalent standards were contained in ICAO Chapter 4 (applicable from 2006), ICAO Chapter 3 (applicable from 1978), and ICAO Chapter 2 (applicable from 1972).

The differences between the noise certification standards are illustrated in the following figure reproduced from the European Aviation Environmental Report 2019[3]. This shows noise contours for four hypothetical 75-tonne jet aircraft that just meet the various Chapter limits. The contours represent areas that are exposed to noise levels greater than 80 dB during one landing and take-off, and can be seen to reduce over time from the first Chapter 2 standard applicable before 1977 to the latest Chapter 14 standard applicable from 2018.

Figure 2.1 Single landing and take-off 80 dB noise contours for four hypothetical aircraft that just meet the noise limits of the various ICAO Annex 16 Volume I Chapters

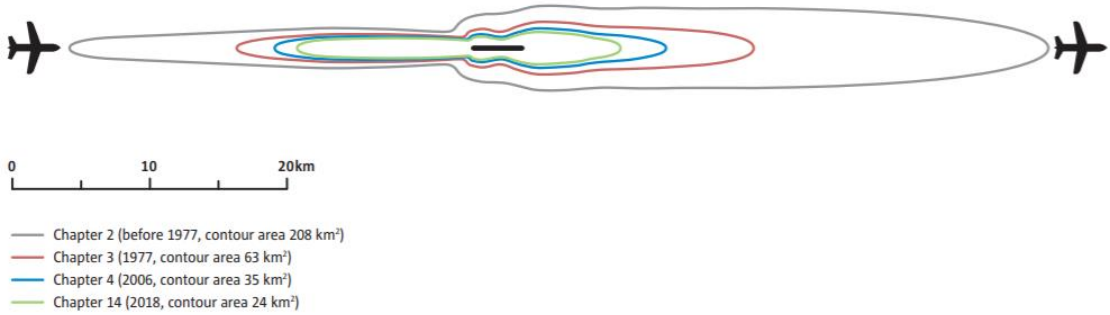


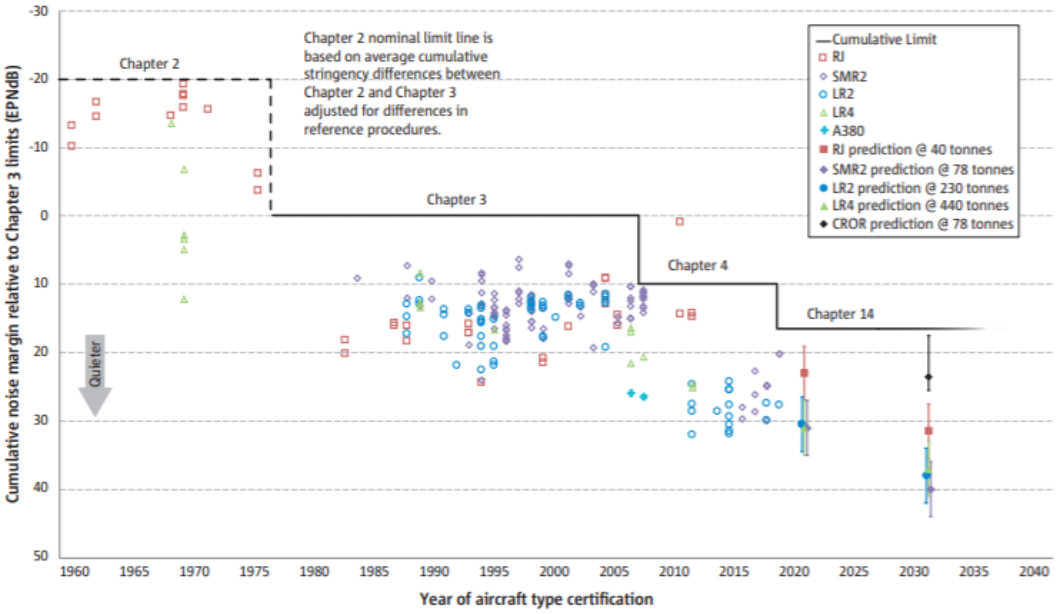
Figure 2: Comparison of aircraft just meeting requirements of different chapters

The European Aviation Environmental Report 2019 also presents an overview of the improvement in aircraft noise technology-design performance over time in terms of the cumulative margin to the Chapter 3 limits. While recognising that aircraft are often sold in various configurations, the Figure 2.2, which is reproduced below, only contains data for the heaviest weights and maximum engine thrust ratings. As the associated noise limits are higher for larger, heavier aircraft, this figure permits a comparison between the relative performance across a range of different aircraft types.

[3] EASA, EEA, EUROCONTROL, European Aviation Environmental Report 2019
https://ec.europa.eu/transport/sites/transport/files/2019-aviation-environmental-report.pdf

A view on future development goals that illustrate what the best technology could potentially achieve in 2020 and 2030, along with uncertainty bands, is also included. These are based on a review of noise technology by independent experts for the ICAO Committee on Aviation Environmental Protection that was performed between 2010 and 2013.

Figure 2.2 Improvement in aircraft noise performance has occurred over time



Aircraft categories as defined by ICAO/CAEP independent experts (IE)

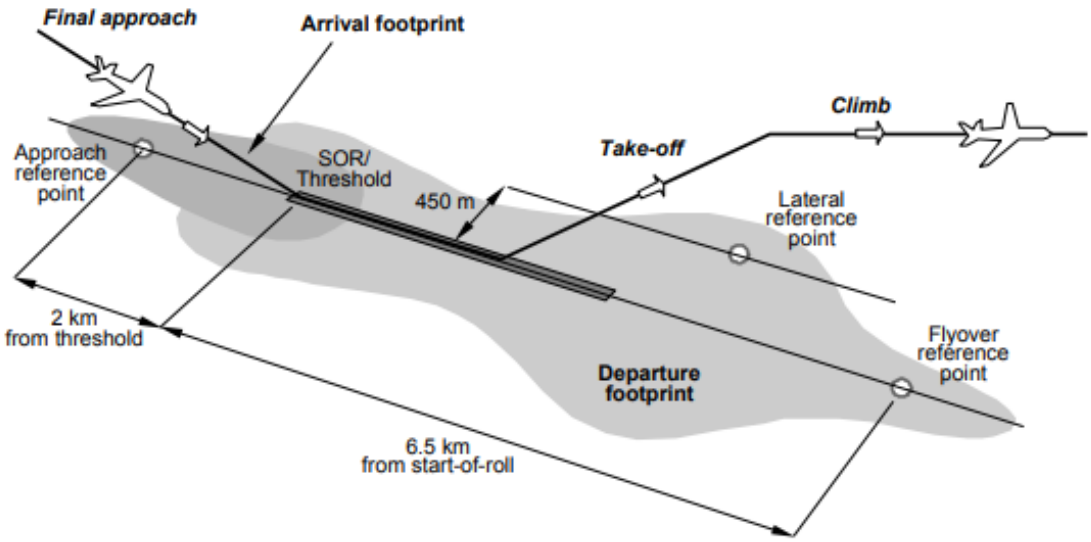
	Description	MTOW (tonnes)
RJ	Regional Jet	30 - 50
SMR2	Short/Medium Range 2-engine	58 - 98
CROR	Counter-Rotating Open Rotor	58 - 91
LR2	Long Range 2-engine	170 - 290
LR4	Long Range 4-engine	330 - 550

Airbus A380 plotted for information as outside weight range for LR4 (575 tonnes)

The certification process involves an example of the aircraft type being operated in a prescribed manner when weather conditions fall within a set range to aid comparability. As a result, the process is often undertaken at airfields in warmer and drier climates, where there is limited other activity. The certification results are not based on measurements from operations at Dublin Airport.

There are three Reference Points, approach, lateral and flyover, which are used for the noise measurements. These are shown in the figure below, which is reproduced from CAP 1869[4].

Figure 1 Aircraft noise reference points (in relation to illustrative noise footprints)



To determine whether an aircraft type meets the requirements of a particular ICAO Chapter, the noise levels from the three reference points are used. These are compared with limit values for the aircraft type which are determined from the weight of the aircraft on departure, and the number of engines it has, using the formula given in Annex 16.

Compliance with the requirements of a Chapter requires the measured noise levels to be within a specified margin of the limit values at each reference point, and for the overall margin across the three points to be at least a specified amount. In the case of Chapter 4 the requirement is that the measured noise levels must be no greater than the limit value at any of the reference points, the measured noise levels at any pair of reference points must be cumulatively at least 2 EPNdB less than the limit values, and the measured noise levels at all three reference points must be cumulatively at least 10 EPNdB less than the limit values.

[4] Civil Aviation Authority, Environmental Research and Consultancy Department, Quota Count validation study at Heathrow Airport CAP 1869, 2020
http://publicapps.caa.co.uk/docs/33/CAP1869QuotaCountvalidationstudy31Jan2020.pdf

2.2 Marginally Compliant Aircraft

The definition of a marginally complaint aircraft was introduced in an EU directive[5] in 2002. It was:

> *"civil subsonic jet aeroplanes, that meet the certification limits laid down in Volume 1, Part II, Chapter 3 of Annex 16 to the Convention on International Civil Aviation by a cumulative margin of not more than 5 EPNdB*."

The directive was repealed and by a subsequent regulation[6]. This revised the marginally compliant definition to mean:

> "*aircraft which are certified in accordance with limits laid down in Volume 1, Part II, Chapter 3 of Annex 16 to the Convention on International Civil Aviation signed on 7 December 1944 (the Chicago Convention) by a cumulative margin of less than 8 EPNdB (Effective Perceived Noise in Decibels) during a transitional period ending on 14 June 2020, and by a cumulative margin of less than 10 EPNdB following the end of that transitional period, whereby the cumulative margin is the figure expressed in EPNdB obtained by adding the individual margins (i.e. the differences between the certificated noise level and the maximum permitted noise level) at each of the three reference noise measurement points defined in Volume 1, Part II, Chapter 3 of Annex 16 to the Chicago Convention*."

This change has broadened the definition of marginally complaint aircraft such that to avoid being classed as marginally compliant to Chapter 3 an aircraft almost has to meet the Chapter 4 standards.

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[5] DIRECTIVE 2002/30/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 March 2002 on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Community airports https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32002L0030&from=EN

[6] REGULATION (EU) No 598/2014 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Union airports within a Balanced Approach and repealing Directive 2002/30/EC https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0598&from=en

3.0 CHAPTER ASSESSMENT OF DUBLIN OPERATIONS

daa have provided a schedule of the operations in 2018 and 2019. This lists movements individually with aircraft types and registrations. The schedule also includes the aircraft noise certification data and maximum departure weight when the type was certificated. These are taken from the Fleet Declaration Forms provided to daa by the airlines.

Using the formula in ICAO Annex 16 the limit values at the reference points have been computed and compared to the certification noise levels for each aircraft. This has enabled the determination of the most stringent Chapter that the aircraft complies with the requirements of, including whether it is marginally compliant (applicable to Chapter 3 only).

In some cases, this results in the aircraft having a different classification to that shown on its noise certificate. This arises because when an aircraft is certificated it is compared against the then current Chapter. So, an aircraft being certificated in 2000 would be compared against Chapter 3 standards, even if also met the more stringent Chapter 4 standards, as these were not applicable until 2006.

The assessment therefore more accurately reflects the actual noise performance of the operations against the Chapters, as the date an aircraft type was certificated does not affect the classification of the noise it produced.

The results of the assessment have been used to update the earlier chart, see Figure 3.

Figure 3: Latest ICAO Noise Chapter Assessment Results

The results show that the large majority of the operations, over 96% in both 2018 and 2019, were by aircraft types that meet the Chapter 4 standard. Of these, over 40% also meet the more stringent Chapter 14 standard.

Very few of the operations in 2018 or 2019 were by aircraft types which only meet the Chapter 3 requirement or are classified as marginally complaint with regard to Chapter 3.

Similarly, very few operations in 2018 or 2019 were by helicopters or light propeller aircraft. Requirements for these aircraft are given in different ICAO chapters which are not directly comparable.

A small proportion of the operations in 2018 and 2019 did not have complete data and it was therefore not possible to assess these aircraft. This generally related to movements by business jets which are typically smaller and quieter than the main passenger flights.

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APPENDIX 1
GLOSSARY OF ACOUSTIC TERMS

Sound

Sound is a form of energy that is transmitted away from its source through a medium such as air by longitudinal pressure waves. The human ear can detect the small changes in pressure associated with sound and this manifests as the sense of hearing.

The Decibel, dB

The decibel (dB) is the unit used to describe the magnitude of sound. It is a logarithmic ratio between a measured level and a reference level, typically sound pressure level against a reference pressure level of 20 µPa.

The decibel scale effectively compresses a wide range of values to a more manageable range of numbers; the threshold of hearing occurs at approximately 0 dB (corresponding to the reference value of 20 µPa) and the threshold of pain is around 120 dB (corresponding to a value of 20 Pa).

Frequency, Hz

Frequency is equivalent to musical pitch. It is the rate of vibration of the air molecules that transmit the sound and is measured as the number of cycles per second or Hertz (Hz).

The human ear is sensitive to sound in the range 20 Hz to 20 kHz. This frequency range is normally divided up into discrete bands for engineering use. The most common are octave bands, in which the upper limiting frequency for any band is twice the lower limiting frequency, and one-third octave bands, in which each octave band is further divided into three. The bands are named by their centre frequency value.

Certificated noise levels

The ICAO aircraft noise certification procedure for subsonic jet aeroplanes and propeller-driven aeroplanes over 8,618 kg requires three separate noise measurements to be made at approach, lateral and flyover locations. The three certificated noise levels (measured in EPNdB) are determined within tight tolerances and normalised to standard atmospheric conditions.

EPNdB

Effective Perceived Noise decibels. The measurement unit for EPNL.

EPNL

Effective Perceived Noise Level (measured in EPNdB). Its measurement involves analysis of the frequency spectra of noise events as well as the duration of the sound.