Noise monitoring report

Contents

Executive summary

This noise monitoring report is drafted for the period July - December 2017. This report consists of three parts: introduction to this report, general statistics related to the operations at Dublin Airport, and noise monitoring statistics per noise terminal. This executive summary lists brief numbers related to the noise performance of Dublin Airport, these can be found in Table 1 and Table 2. In Table 1 the number of events of noise monitoring terminals (NMTs) which are directly overflown, correlated to aircraft movements, is listed. Table 2 shows in summary the average measured noise levels for the second half year period of 2017 for all operational NMTs. As one may expect, NMTs directly overflown (NMTs 1, 2, 5, 6, and 20) have higher measured noise levels that can be identified as relating to aircraft noise. While at other NMTs other noise sources are more prevalent.
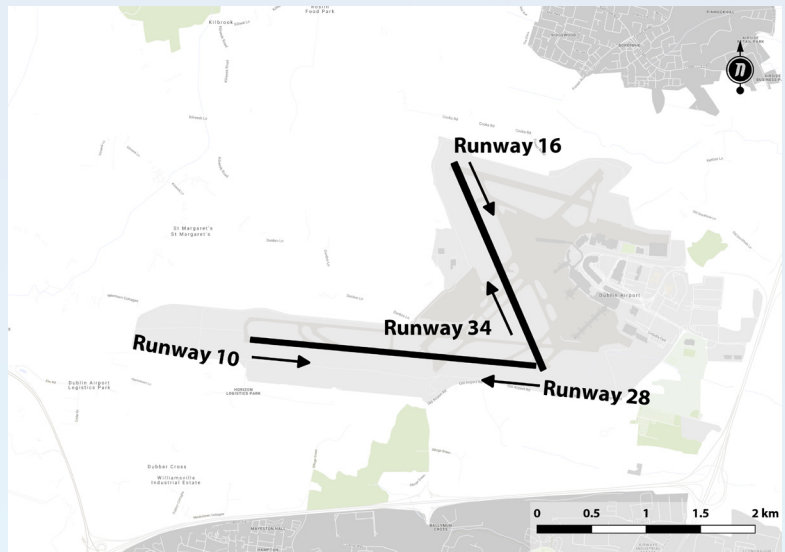

Figure 1: Runway layout Dublin Airport

Table 1: Correlated aircraft noise events

NMT	Number of correlated aircraft noise events			
	Description	Arrivals	Departures	Total
1	Arrivals Runway 10, Departures Runway 28	5 441	40 244	45 685
2	Arrivals Runway 28, Departures Runway 10	42 534	5 032	47 566
5	Arrivals Runway 16, Departures Runway 34	3 567	1 396	4 963
6	Arrivals Runway 34, Departures Runway 16	1 409	472	1 881
20	Arrivals Runway 28, Departures Runway 10	41 178	4 668	45 846

Table 2: Average measured noise levels

NMT	Daytime noise level, $L_{Aeq, 16 h}$ [dB]		Nighttime noise level, $L_{Aeq, 8 h}$ [dB]	
	Total	Aircraft	Total	Aircraft
1	63.5	62.5	57.5	56.0
2	59.9	59.0	53.4	52.3
4	55.4	44.3	53.0	35.6
5	53.4	48.5	55.8	54.4
6	67.1	46.0	63.5	51.8
20	62.6	58.8	56.6	52.0
21	59.9	53.1	57.4	48.3

Introduction

This half yearly report, commissioned by Dublin Airport, presents a summary of the noise performance near Dublin Airport, for the period from July 1st to December 31st 2017.

To monitor aircraft noise levels and flight tracks near Dublin Airport, a Noise and Flight Track Monitoring System (NFTMS) is in place. This system, by Brüel & Kjær, is composed of a series of Noise Monitoring Terminals (NMTs) which are installed in the area around the airport. In total, eight NMTs are in place and one mobile unit available:

- Bay Lane (NMT 1 : monitoring runway 28 departures and runway 10 arrivals);
- St. Doolaghs (NMT 2 : monitoring runway 10 departures and runway 28 arrivals);
- Bishopswood (NMT 3 : monitoring local area);
- Feltrim (NMT 4 : monitoring local area);
- Balcultry (NMT 5 : monitoring runway 34 departures and runway 16 arrivals);
- Artane (NMT 6 : monitoring runway 16 departures and runway 34 arrivals);
- Coast Road (NMT 20 : monitoring runway 10 departures and runway 28 arrivals);
- Airport (NMT 21 : monitoring aircraft noise at the airport);
- Mobile NMT (NMT 22: mobile monitoring terminal, its location varies around the airport).

This report presents the results of the measurements in the period from the start of July to the end of December 2017 for all NMT locations, with the exception of NMT 3 and NMT 22. The report does not include NMT 3 as at the time of writing, a review of this NMT location was ongoing. NMT 22 is not within this report as its location varies. The other NMT locations are shown in Figure 2. General statistics of flight operations of Dublin Airport in the second half of 2017 are provided in the General Statistics section. Results specific to the measurements obtained at the various monitoring stations are presented in the Noise Monitoring Statistics section.

Figure 2: Noise Monitoring Terminal locations

General Statistics

Traffic

In the second half of 2017, Dublin Airport handled a total of 115,729 flights and 15.8 million passengers. This is an increase of 3.1% in traffic and 5.6% in passenger numbers compared to the same period in 2016. Note that the number of movements includes both departures and arrivals. Figure 3, gives an hourly distribution of the movements for the last six months of 2017, compared to the hourly distribution of the same period in 2016.
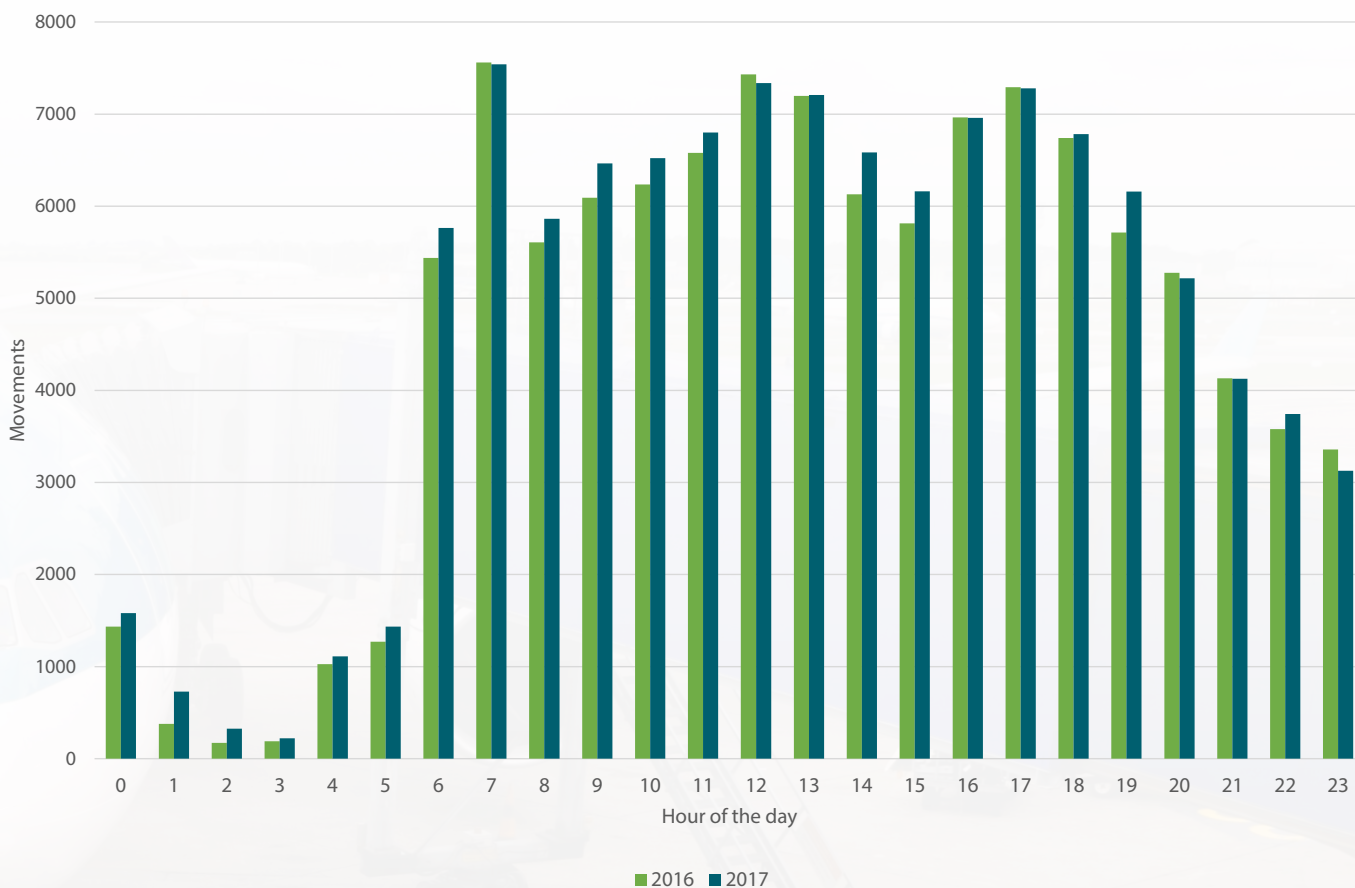
Figure 3: Hourly distribution of movements from July – December 2016 vs. 2017

Dublin Airport hosts a wide variety of aircraft, ranging from turboprop aircraft such as the ATR and Dash-8 to wide body jets like the Boeing 777. However, the majority of movements were performed using medium sized jets, with the Boeing 737 and Airbus A320 series aircraft accounting for more than 67% of the total. Figure 4 provides a more detailed overview of aircraft types. The aircraft types are divided into the categories: A/B and C/D. Table 3 on the next page list typical aircraft types belonging to these categories.
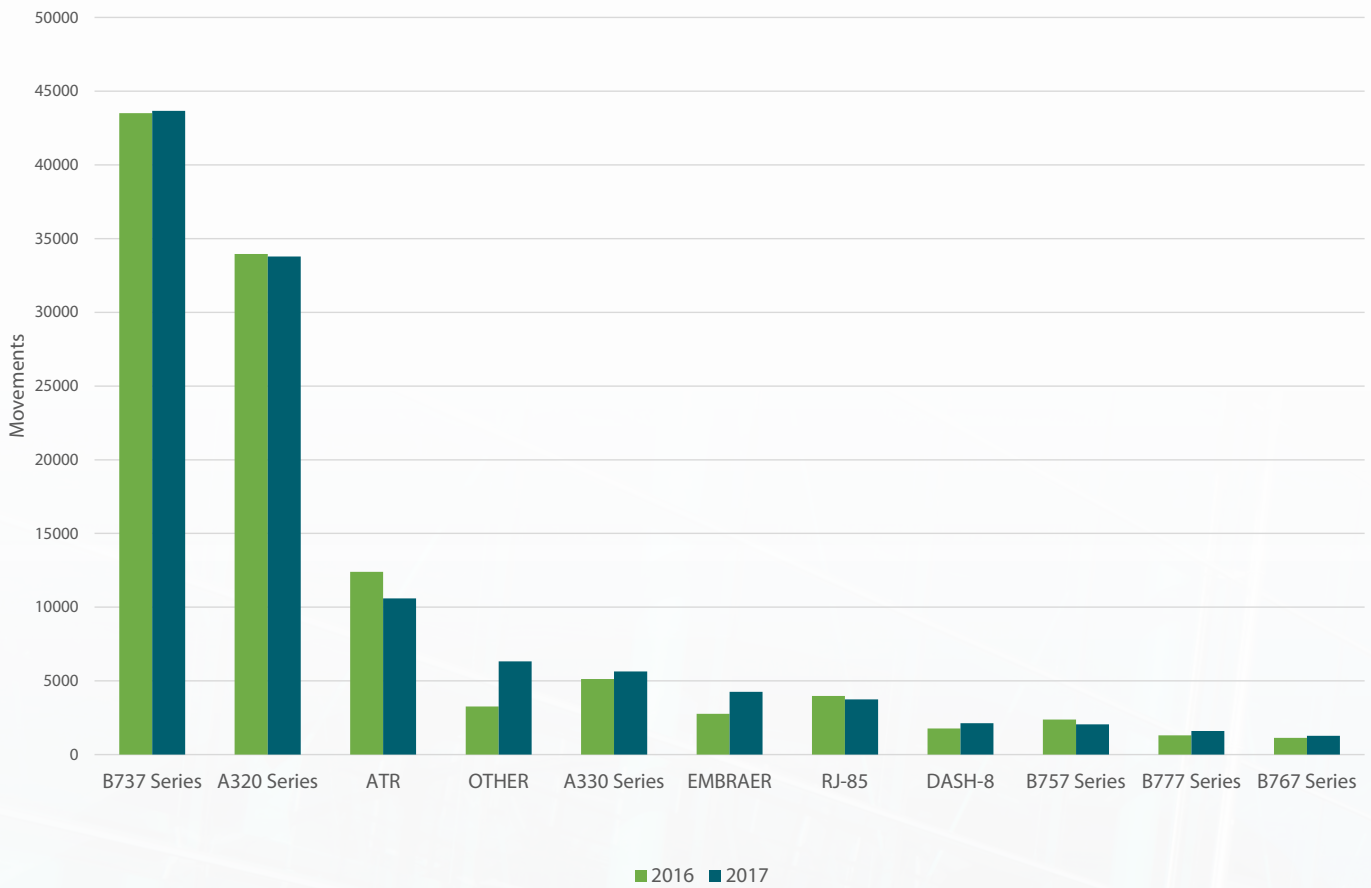
Figure 4: Aircraft type distribution July - December 2016 vs. 2017

Table 3: Aircraft type classification

Aircraft category	Aircraft type:
A/B	Propellor aircraft
	Turboprop aircraft
	Whisperjets (aircraft like BAe-146 and Avro-Jet)
	Mostly small general aviation aircraft powered by piston engines
C/D	Airbus
	Boeing
	Bombardier Canadair Regional Jet (CRJ) - Series
	Business jets
	Embraer

Track adherance

There are four environmental corridors at Dublin airport, one for every runway direction. For both the second half of 2016 and 2017, 99.5% of the aircraft stayed within these corridors.

Runway use and weather

Figure 5 shows that Runway 28, the runway for aircraft landing and departing in the westerly direction, handled more than 80% of all movements in 2017 versus 76% in 2016. Runway 10, the runway for aircraft landing and departing in the easterly direction, was used for more than 10% of the movements in 2017 versus 20% in 2016. The remaining percentage of the movements in 2017 and 2016 took place on the cross runway 16/34 and the helicopter platform (H).
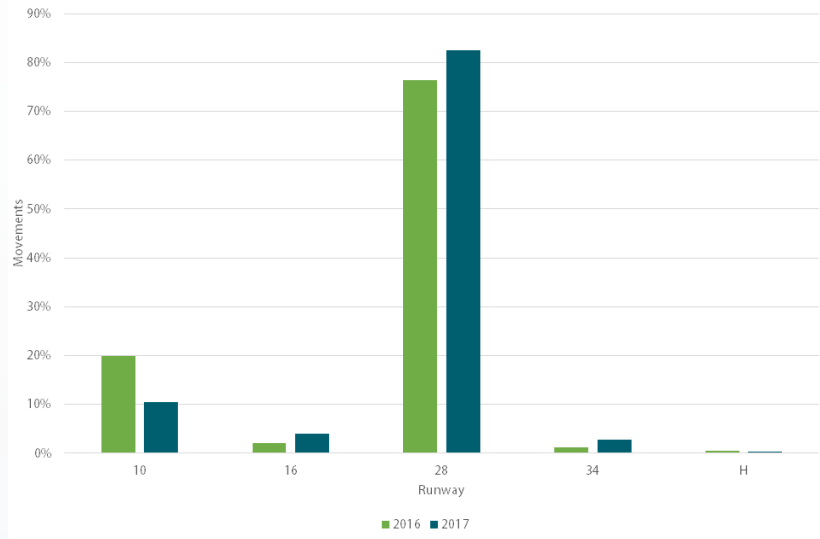

Figure 5: Runway usage, July - December 2017 vs. 2016

Overflying height analysis

The measured sound levels depends on the height at which the NMT is overflown. Generally, higher overflying altitudes result in lower recorded sound levels. For NMT's, which are directly overflown, the average overflying height is shown in Table 4 below for 2016 and 2017. In which A and D stands for arrivals and departures respectively.

Table 4: Average overflying height

	Height [ft]									
	NMT1		NMT2		NMT5		NMT6		NMT20	
	A	D	A	D	A	D	A	D	A	D
2016	1,000	2,400	1,000	2,400	1,100	2,500	1,100	2,600	1,600	2,800
2017	900	2,500	1,000	2,400	1,100	2,700	1,100	2,600	1,600	2,800

Temporary change in operations

From the beginning of November 2016 runway 10/28 is undergoing a major overlay. This construction work is taking place overnight for a period of 15-18 months and is due to finish in mid September 2018. While the night-time works are ongoing, the airport is making use of its secondary runway, runway 16/34, to facilitate landings and takeoffs during this time and therefore the usage pattern for this runway is more intensive than is normally the case. The preferred runway direction is runway 16, which brings aircraft over rural areas of North Dublin as they approach Dublin Airport. Runway 34 will only be used when wind direction and safety requires it.

Noise Monitoring Statistics

Reading guide

The noise values presented in this report are values based on measurements, these values will differ from noise contours produced by computer modelling and are not directly comparable. Noise contours produced by computer modelling are typically based on an average summer or annual day and include all aircraft movements rather than just those which produce a correlated noise event.

The measured noise values are obtained from Noise Monitoring Terminals (NMTs). A new Noise and Flight Track Monitoring System (NFTMS) with all new NMTs, provided by Brüel & Kjær, has been commissioned by daa as of 2017 to monitor the noise performance of Dublin Airport.

These NMTs are set to record continuously and to trigger a noise event when two conditions are met. The first condition is the threshold level. The threshold level needs to be exceeded before recording is initiated. The threshold levels are continuously adjusted by Brüel & Kjær to ensure maximum correlation between noise and individual operations. The second condition is the length of the recorded noise event. The recorded noise event should last for at least 10 seconds. Due to its proximity to agricultural, roads, and/or urban areas, NMTs can be triggered not just by aviation noise. It is for this reason the system is designed to correlate a noise event with an aircraft departing or landing. Similarly, the system can detect when the noise originates from a weather event, such as thunder or other stormy conditions.

Noise measurements are classified in three categories: aircraft, community, and weather. The community category, or normal human activity, includes all noise events that are not categorised as aircraft or weather. Therefore, when total noise is mentioned, this includes all three noise categories.

Noise levels calculation methodology

The noise monitoring system logs, per correlated aircraft event, the duration and measures the noise level of the event, which is later converted to $L_{Aeq, 1h}$. This is the sound level, in decibels, equivalent to the total A-weighted sound energy of one hour. Average noise levels, for a reference duration, are derived from $L_{Aeq, 1h}$. The four noise levels are used in this report are:

- $L_{Aeq, 16h}$, average daytime noise levels:

  The $L_{Aeq, 16h}$ is determined by averaging the aircraft noise levels per month between 07:00 and 23:00, hence 16 hour;

- $L_{Aeq, 8h}$, average nighttime noise levels:

  The $L_{Aeq, 8h}$ is determined by averaging the aircraft noise levels per month between 23:00 and 07:00, hence 8 hour equivalent;

- L_{Aeq}, average hourly noise levels:

  Same methodology applies for L_{Aeq}, compared to $L_{Aeq, 16h}$ and $L_{Aeq, 8h}$, instead an average is taken per hour over a half year period instead of per month;

- $L_{A,MAX}$:

  $L_{A,MAX}$ indicates the maximum recorded noise level per correlated aircraft-noise event, while the average noise levels indicates the average noise levels for a reference duration;

- $L_{A,MAX}$ distribution:

  This distribution is determined by determining the number of occurrences per 3 dB bracket, since every 3 dB increase is doubling in sound level.

NMT 1: Bay Lane

Noise Monitoring Terminal 1 ('Bay Lane') is located west of Dublin Airport, see Figure 6 below, under the extended runway centerline of runway 28. Its purpose is to monitor runway 28 departures and runway 10 arrivals. The resulting data for NMT 1 measurements in the period from July 1st up to and including December 31st 2017 are presented in this section.

Figure 6: Noise Monitoring Terminal Bay Lane Location

Noise Events

The results are presented in Figure 7: 45,761 registered noise events were attributable to aircraft noise (84.9%).

Aircraft 84.9%
8.9%
6.0%

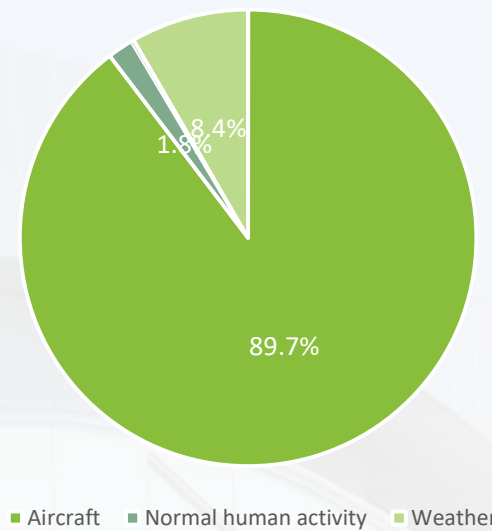■ Aircraft   ■ Normal human activity   ■ Weather
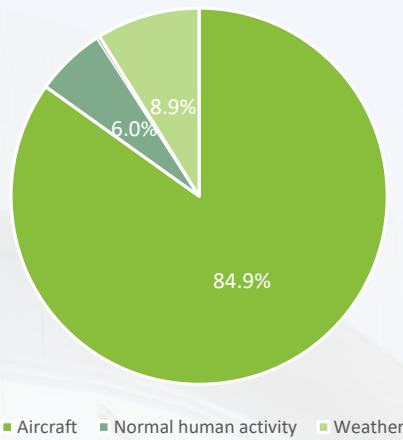
Figure 7: NMT 1 Noise Event Types

NMT Operational Status

To ensure that Noise Monitoring Terminals keep working within specific limits, internal calibration checks are completed every 6 hours. During this period, some of the NMTs are out of operation for maintenance purposes and do not record noise events. The operational status of NMT 1: Bay Lane is presented in Figure 8.

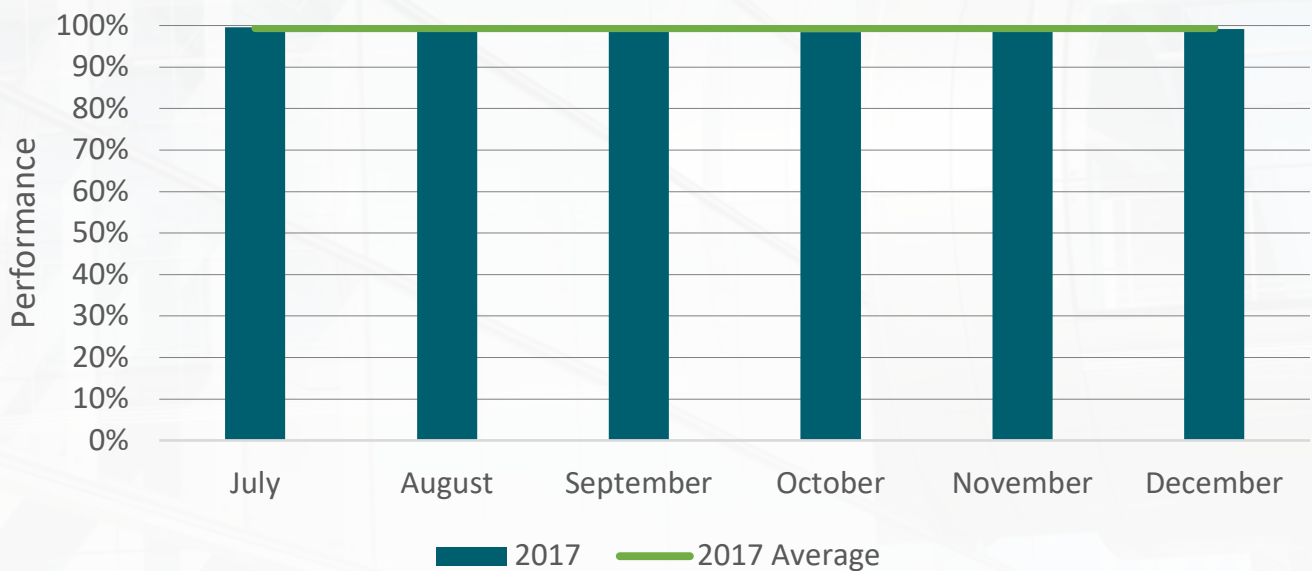
■ 2017   — 2017 Average
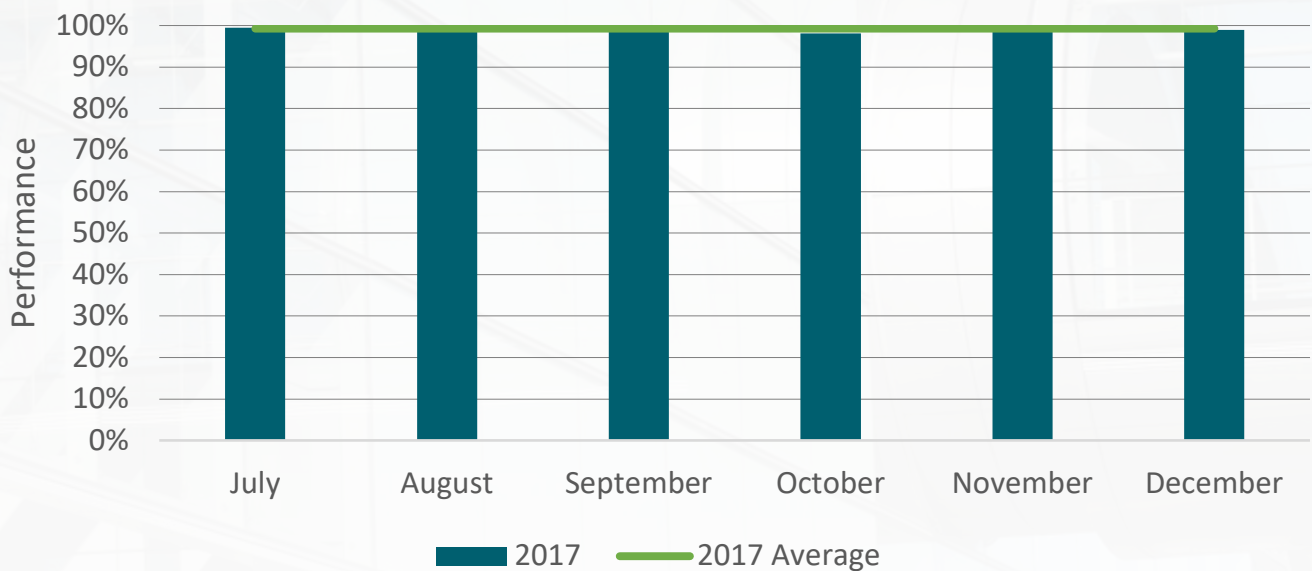
Figure 8: Operational status of NMT 1

Noise Levels

Figure 9 presents the average noise levels measured at NMT 1 during daytime periods, which are defined to be from 07:00 in the morning to 22:59 in the evening. Recorded noise levels during these time segments are therefore averaged over a 16-hour window.

This procedure is followed both for all noise events, and for those events that were correlated to aircraft movements. The results shown are presented monthly.
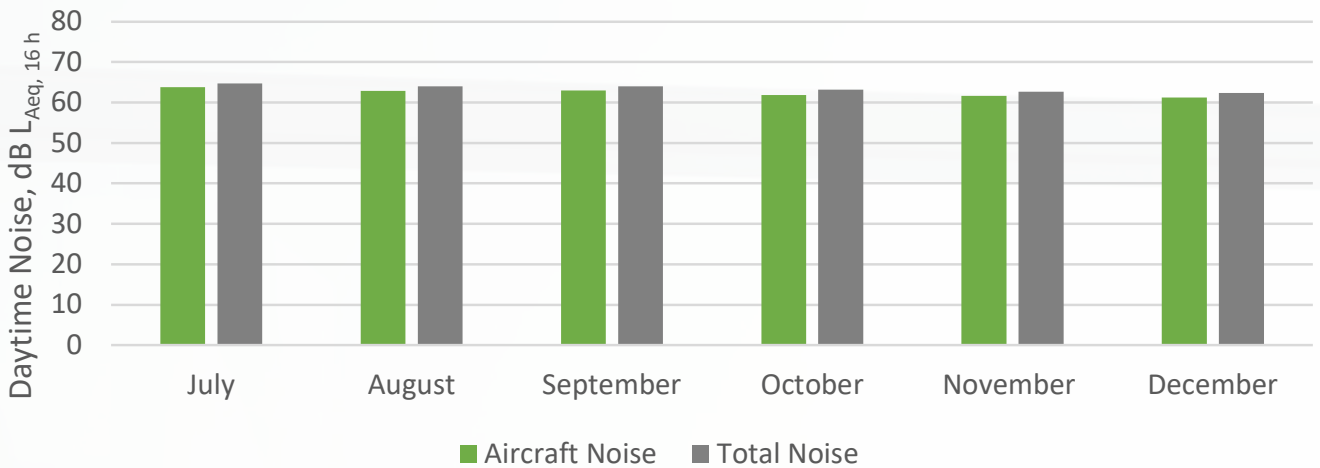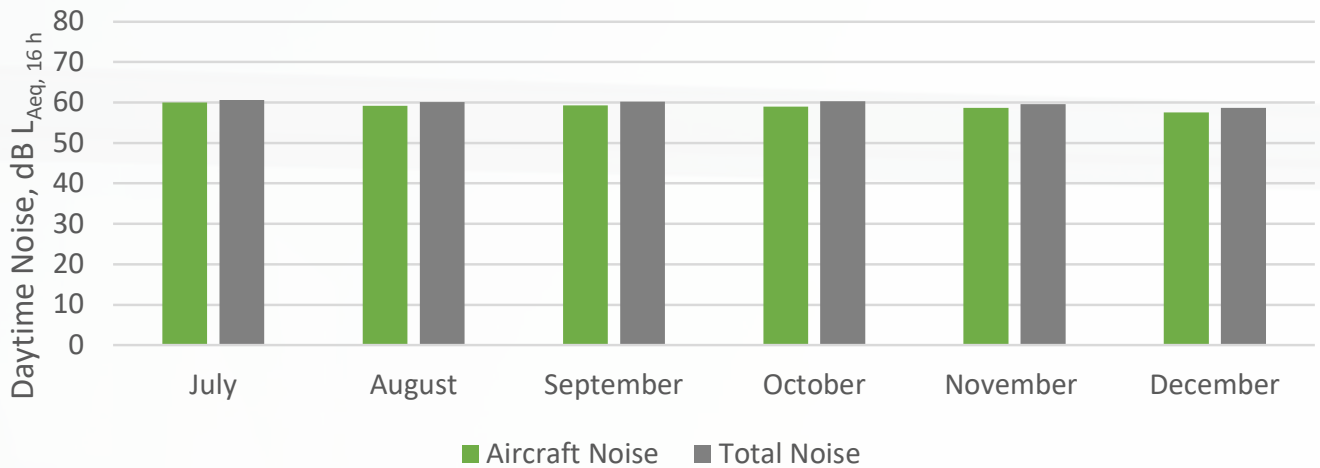

Figure 9: Averaged daytime noise levels for NMT 1, July – December 2017

Noise levels during the night are determined using a similar method. The night period is defined as a period between 23:00 in the evening to 06:59 in the morning. Noise levels are therefore averaged over an 8-hour window. Figure 10 presents these results monthly.
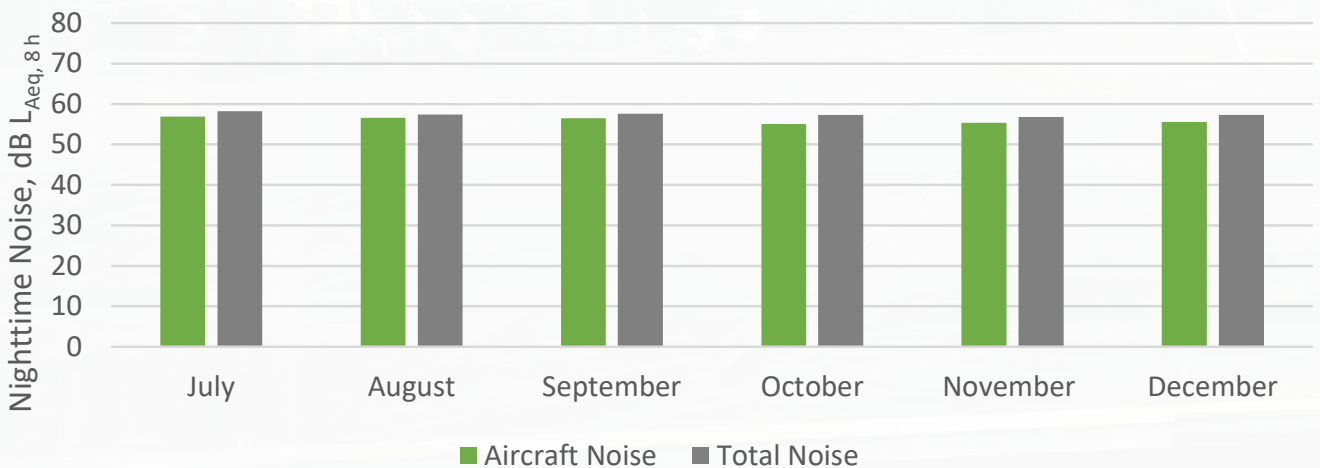
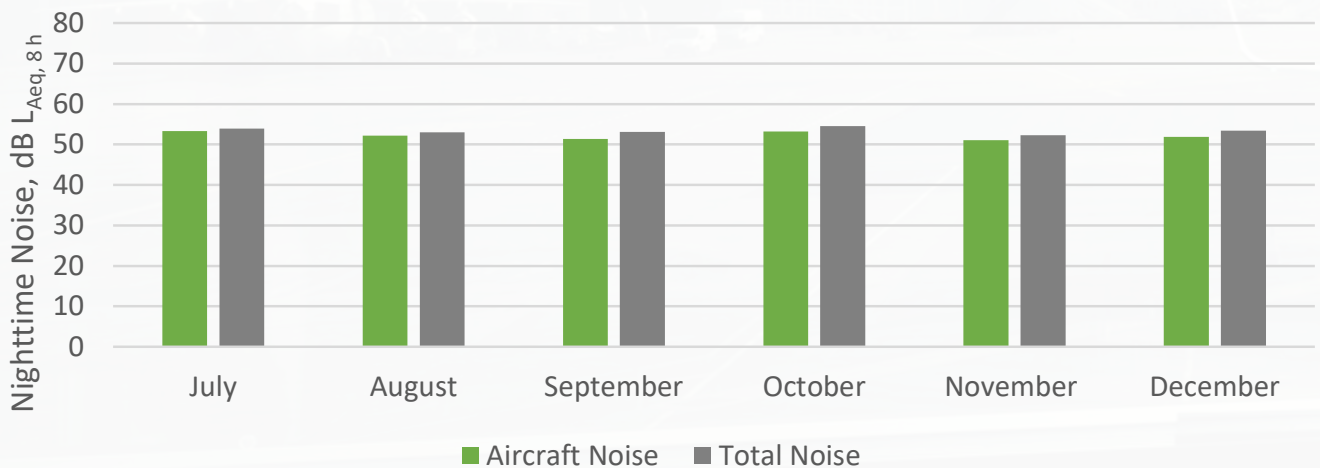**Figure 10: Averaged nighttime noise levels for NMT 1, July - December 2017**

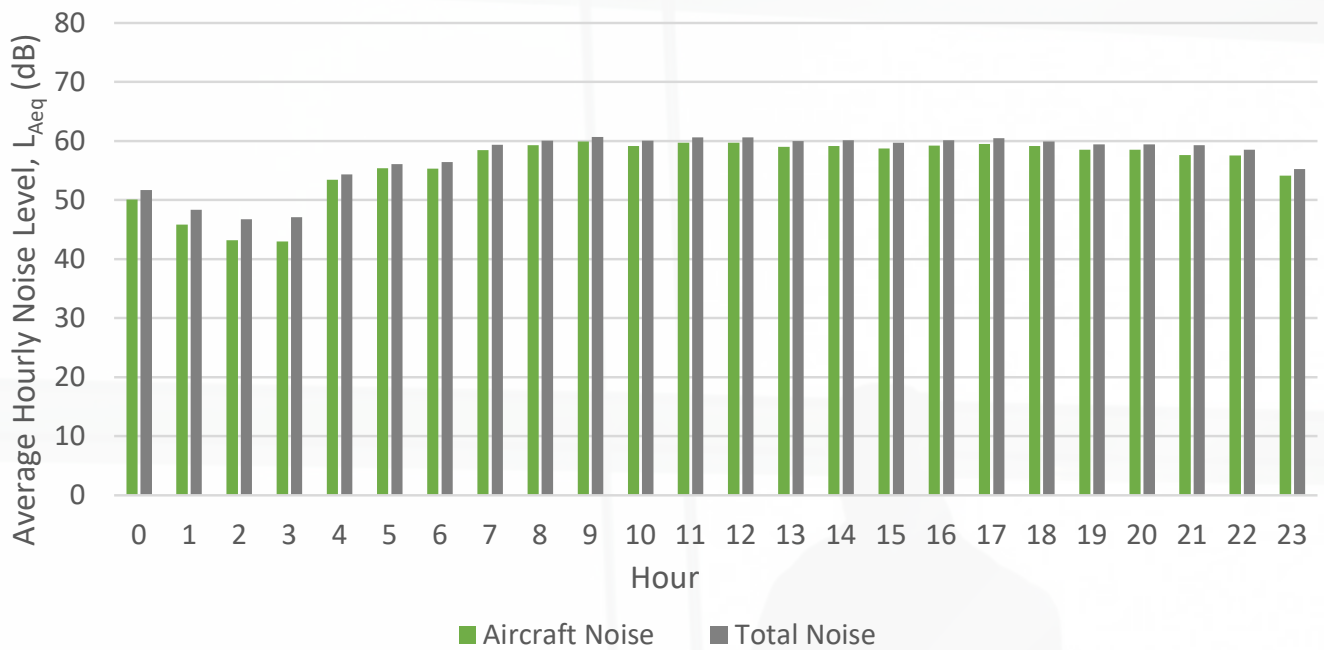The hourly noise distribution at NMT 1 as shown in Figure 11.
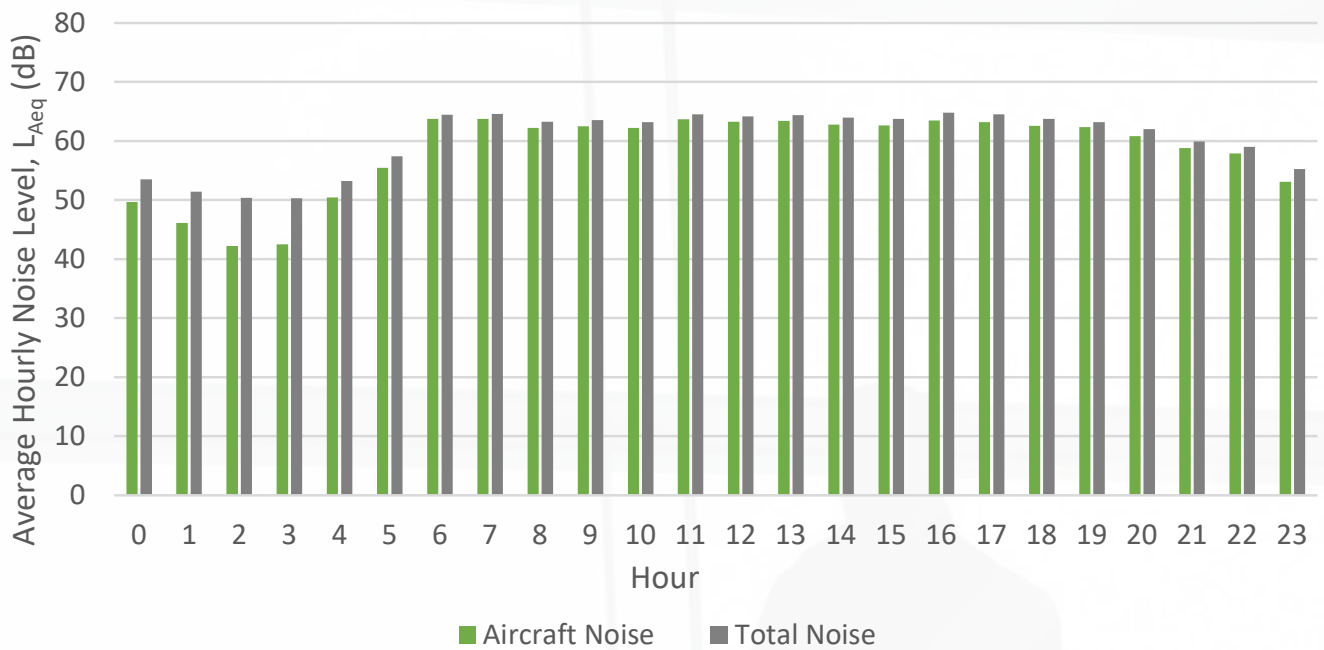
Figure 11: Averaged hourly noise levels for NMT 1, July - December 2017

Figure 12 shows the $L_{A,MAX}$ distribution, for aircraft noise, for the second half year of 2017 for NMT 1.
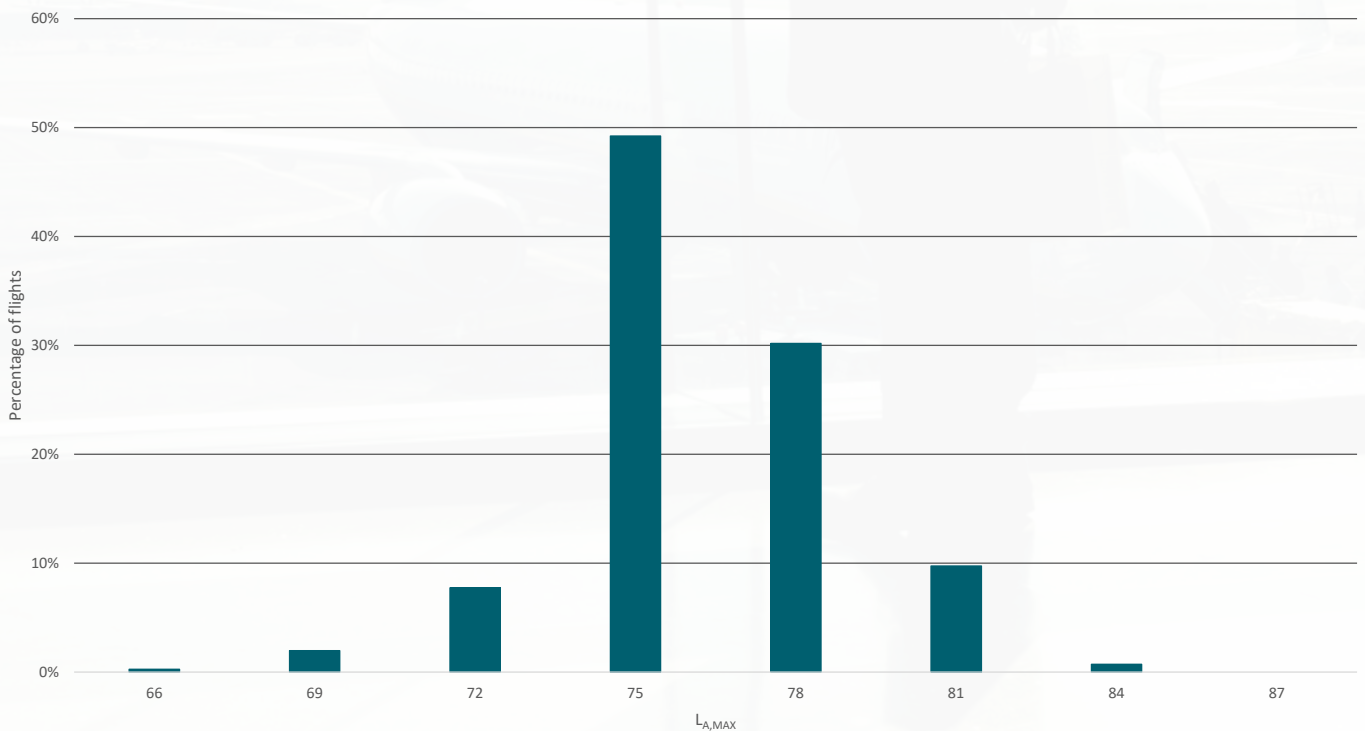
Figure 12: $L_{A,MAX}$ levels distribution for NMT 1, July - December 2017

NMT 2: St. Doolaghs

Noise Monitoring Terminal 2 ('St. Doolaghs') is located east of Dublin Airport, see Figure 13 below, under the extended runway centerline of runway 10. Its purpose is to monitor runway 10 departures and runway 28 arrivals. The resulting data for NMT 2 measurements in the period from July 1st up to and including December 31st 2017 are presented in this section.

Figure 13: Noise Monitoring Terminal St. Doolaghs Location

Noise Events

The results are presented in Figure 14. 47,690 registered noise events were attributable to aircraft noise (89.7%).

8.4%

1.8%

89.7%

■ Aircraft   ■ Normal human activity   ■ Weather

Figure 14: NMT 2 Noise Event Types
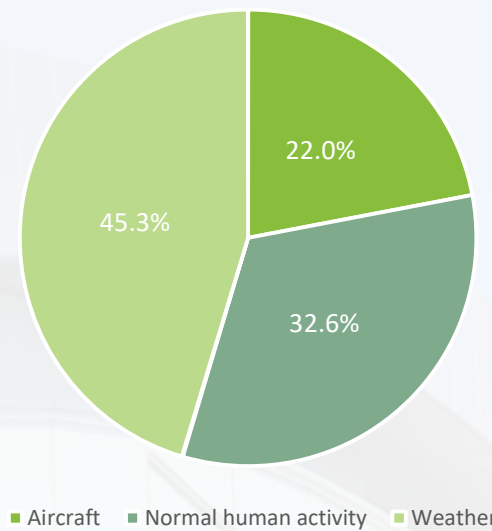
NMT Operational Status

To ensure that Noise Monitoring Terminals keep working within specific limits, internal calibration checks are completed every 6 hours. During this period, some of the NMTs are out of operation for maintenance purposes and do not record noise events. The operational status of NMT 2: St. Doolaghs is presented in Figure 15.
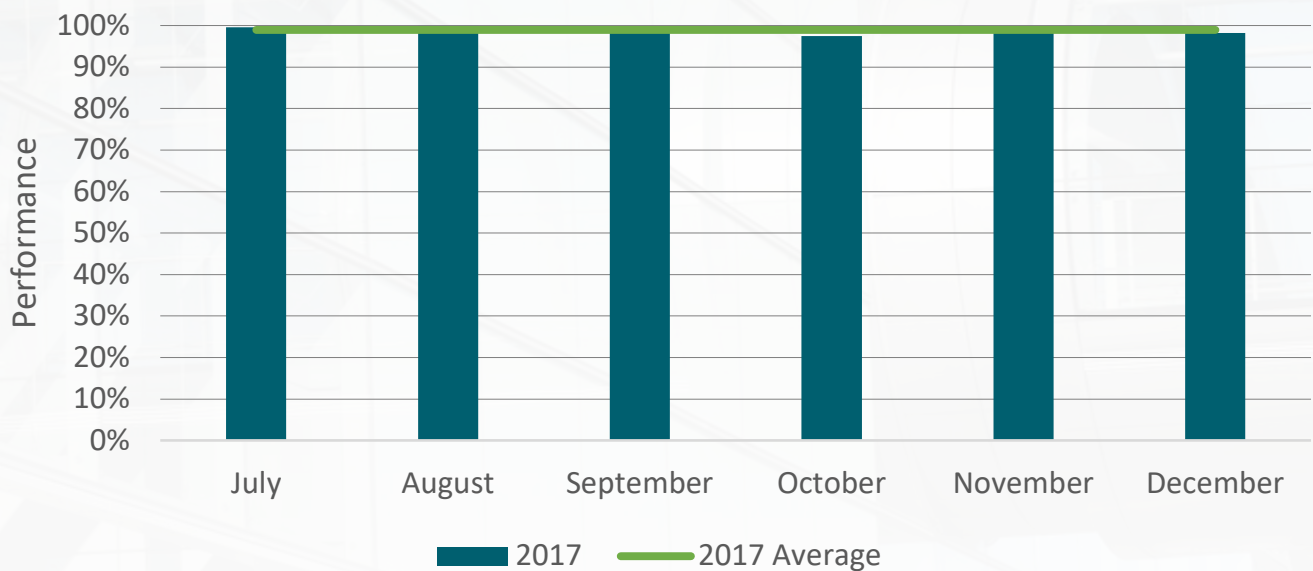

Figure 15: Operational status of NMT 2

Noise Levels

Figure 16 presents the average noise levels measured at NMT 2 during daytime periods, which are defined to be from 07:00 in the morning to 22:59 in the evening. Recorded noise levels during these time segments are therefore averaged over a 16-hour window.

This procedure is followed both for all noise events, and for those events that were correlated to aircraft movements. The results shown are presented monthly.

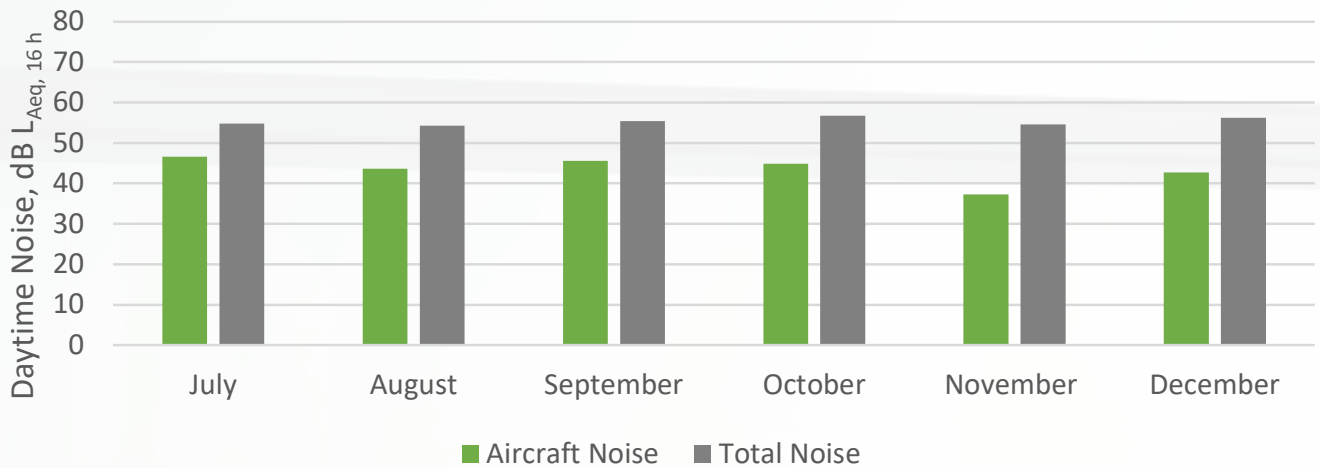**Figure 16: Averaged daytime noise levels for NMT 2, July - December 2017**

Noise levels during the night are determined using a similar method. The night period is defined as a period between 23:00 in the evening to 06:59 in the morning. Noise levels are therefore averaged over an 8-hour window. Figure 17 presents these results monthly.

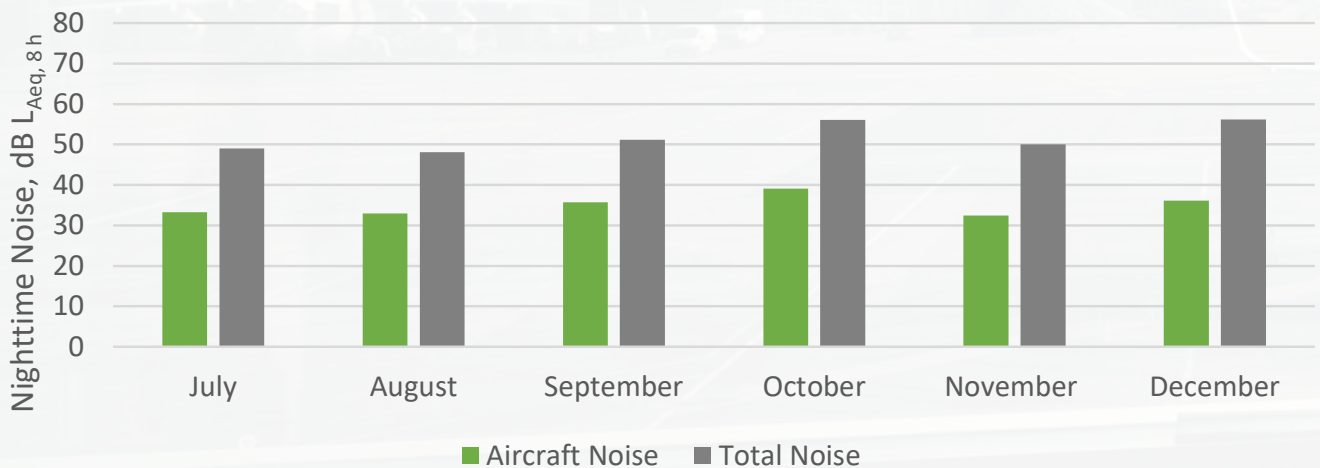**Figure 17: Averaged nighttime noise levels for NMT 2, July - December 2017**

The hourly noise distribution at NMT 2 as shown in Figure 18.

Figure 18: Averaged hourly noise levels for NMT 2, July - December 2017

Figure 19 shows the $L_{A,MAX}$ distribution, for aircraft noise, for the second half year of 2017 for NMT 2.
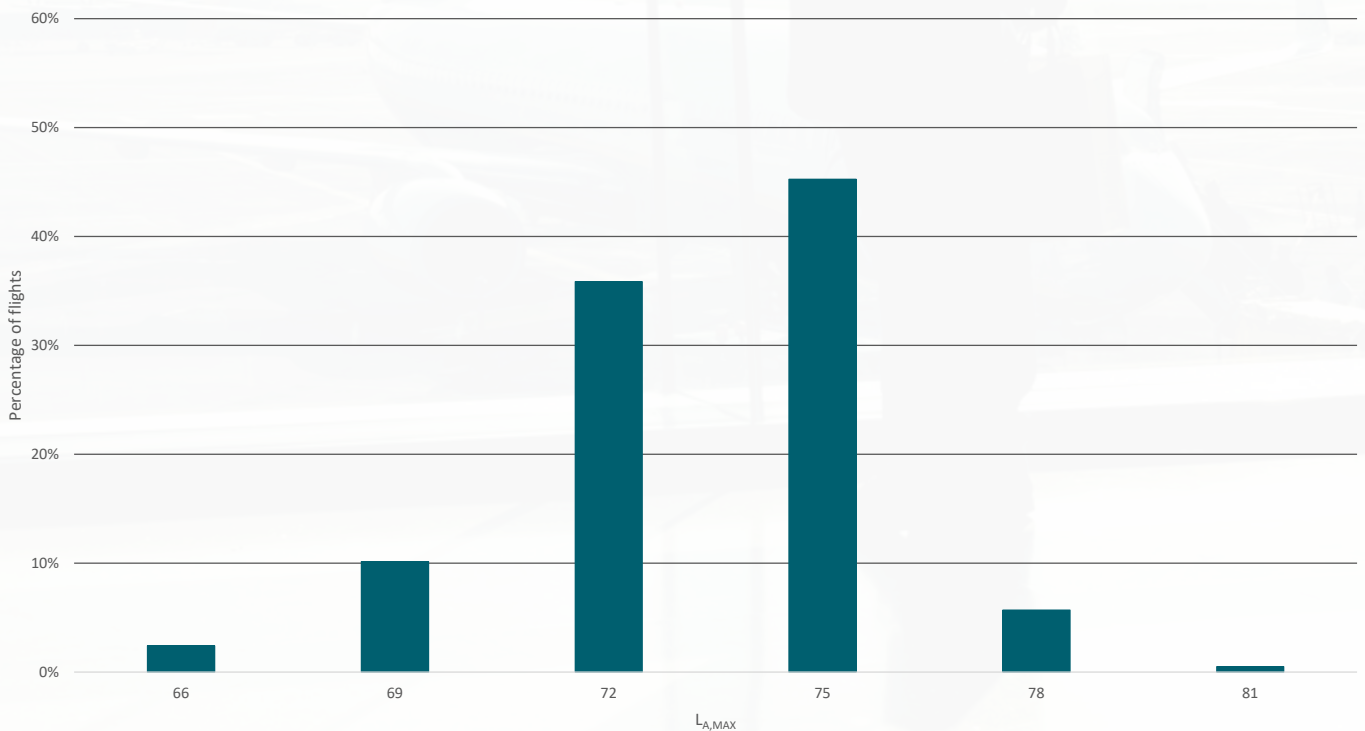
Figure 19: $L_{A,MAX}$ levels distribution for NMT 2, July - December 2017

NMT 4: Feltrim

Noise Monitoring Terminal 4 ('Feltrim') is located east of Dublin Airport and north of the flight path of runway 10/28, see Figure 20 below, and monitors the local area. The resulting data for NMT 4 measurements in the period from July 1st up to and including December 31st 2017 are presented in this section.

Figure 20: Noise Monitoring Terminal Feltrim Location

Noise Events

The results are presented in Figure 21. 3,539 registered noise events were attributable to aircraft noise (22.0%).

Figure 21: NMT 4 Noise Event Types

NMT Operational Status

To ensure that Noise Monitoring Terminals keep working within specific limits, internal calibration checks are completed every 6 hours. During this period, some of the NMTs are out of operation for maintenance purposes and do not record noise events. The operational status of NMT 4: Feltrim is presented in Figure 22.

Figure 22: Operational status of NMT 4

Noise Levels

Figure 23 presents the average noise levels measured at NMT 4 during daytime periods, which are defined to be from 07:00 in the morning to 22:59 in the evening. Recorded noise levels during these time segments are therefore averaged over a 16-hour window.

This procedure is followed both for all noise events, and for those events that were correlated to aircraft movements. The results shown are presented monthly.

Figure 23: Averaged daytime noise levels for NMT 4, July - December 2017

Noise levels during the night are determined using a similar method. The night period is defined as a period between 23:00 in the evening to 06:59 in the morning. Noise levels are therefore averaged over an 8-hour window. Figure 24 presents these results monthly.

Figure 24: Averaged nighttime noise levels for NMT 4, July - December 2017

The hourly noise distribution at NMT 4 as shown in Figure 25.
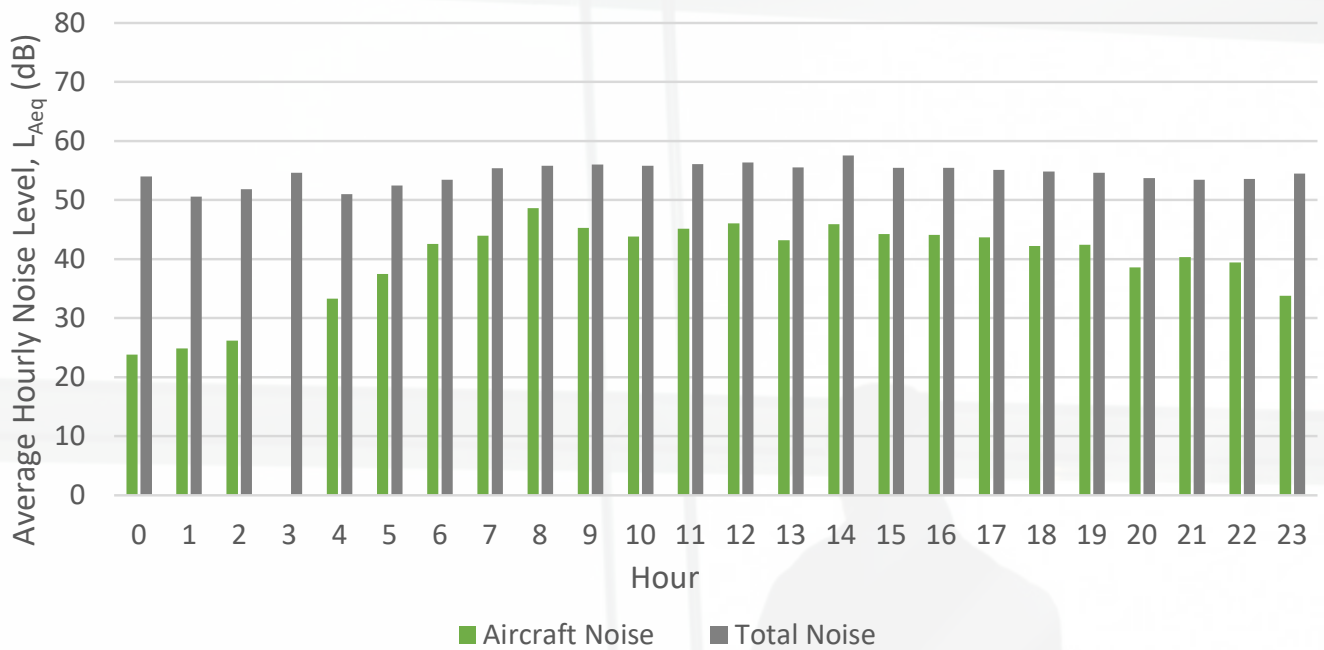
Figure 25: Averaged hourly noise levels for NMT 4, July - December 2017

Figure 26 shows the $L_{A,MAX}$ distribution, for aircraft noise, for the second half year of 2017 for NMT 4.
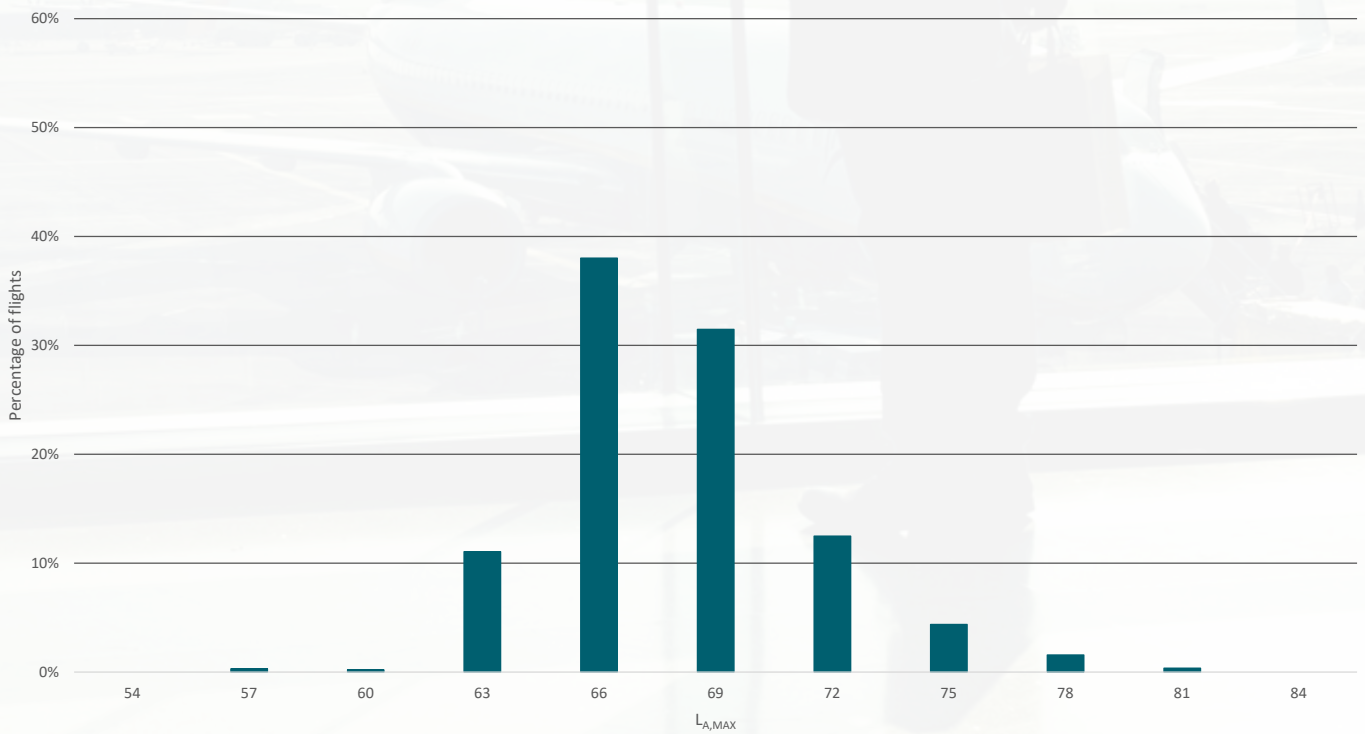
Figure 26: $L_{A,MAX}$ levels distribution for NMT 4, July - December 2017

NMT 5: Balcultry

Noise Monitoring Terminal 5 ('Balcultry') is located northwest of Dublin Airport, see Figure 27 below, under the extended runway centerline of runway 34. Its purpose is to monitor runway 34 departures and runway 16 arrivals. The resulting data for NMT 5 measurements in the period from July1st up to and including December 31st 2017 are presented in this section.
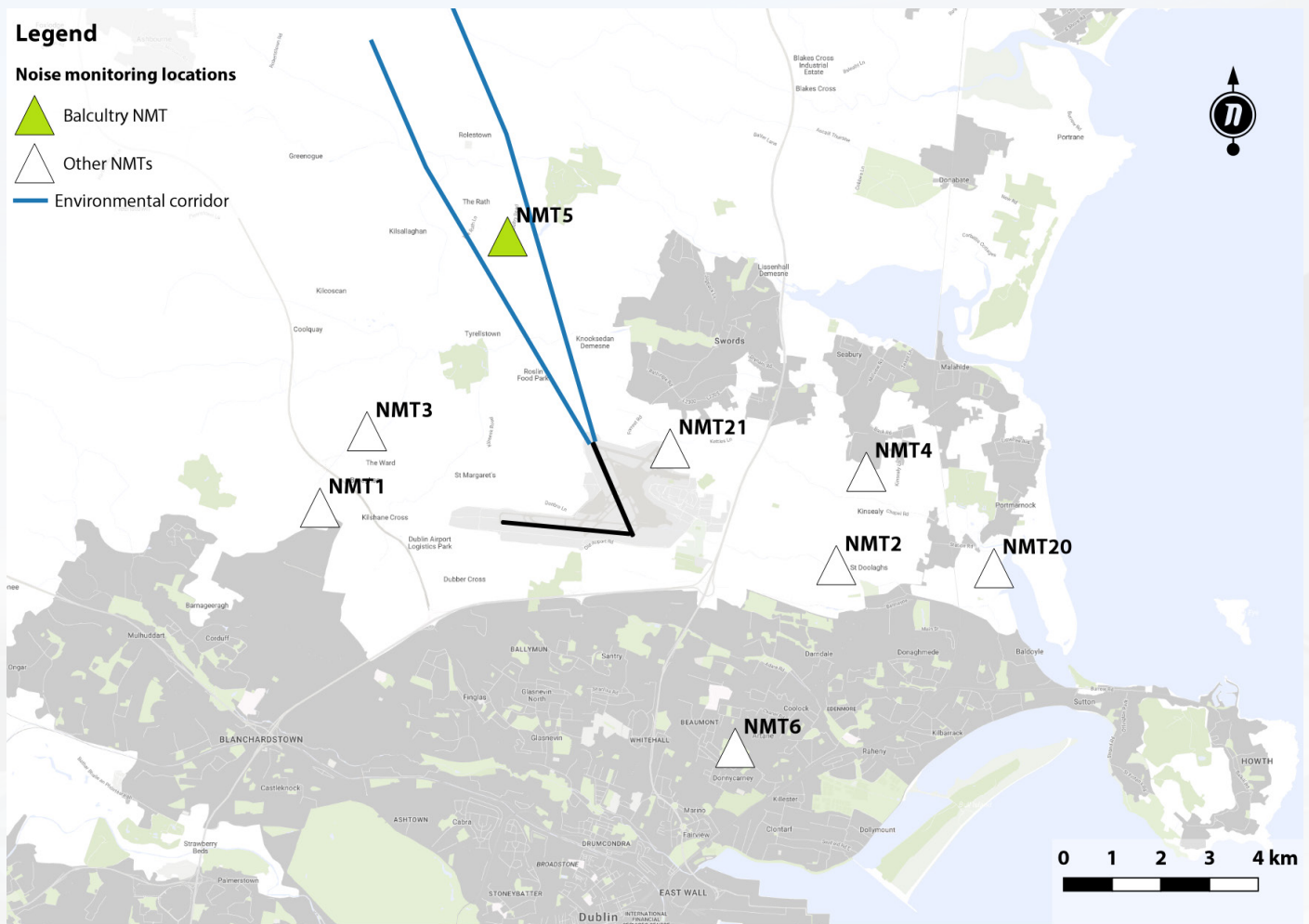
Figure 27: Noise Monitoring Terminal Balcultry Location

Noise Events

The results are presented in Figure 28. 5,493 registered noise events were attributable to aircraft noise (57.5%).
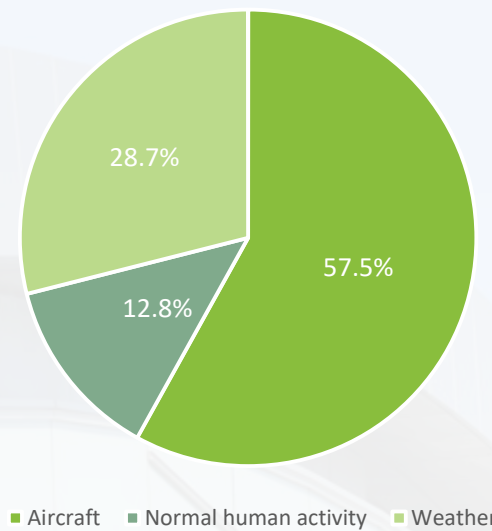
Figure 28: NMT 5 Noise Event Types

NMT Operational Status

To ensure that Noise Monitoring Terminals keep working within specific limits, internal calibration checks are completed every 6 hours. During this period, some of the NMTs are out of operation for maintenance purposes and do not record noise events. The operational status of NMT 5: Balcultry is presented in Figure 29.
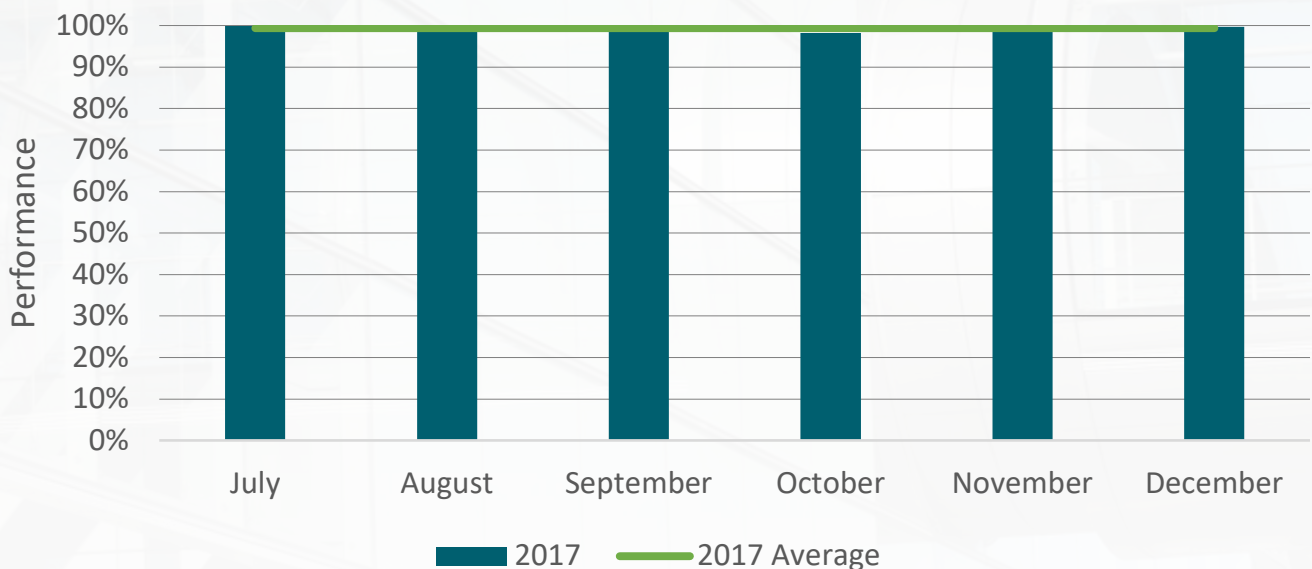
Figure 29: Operational status of NMT 5

Noise Levels

Figure 30 presents the average noise levels measured at NMT 5 during daytime periods, which are defined to be from 07:00 in the morning to 22:59 in the evening. Recorded noise levels during these time segments are therefore averaged over a 16-hour window.

This procedure is followed both for all noise events, and for those events that were correlated to aircraft movements. The results shown are presented monthly.
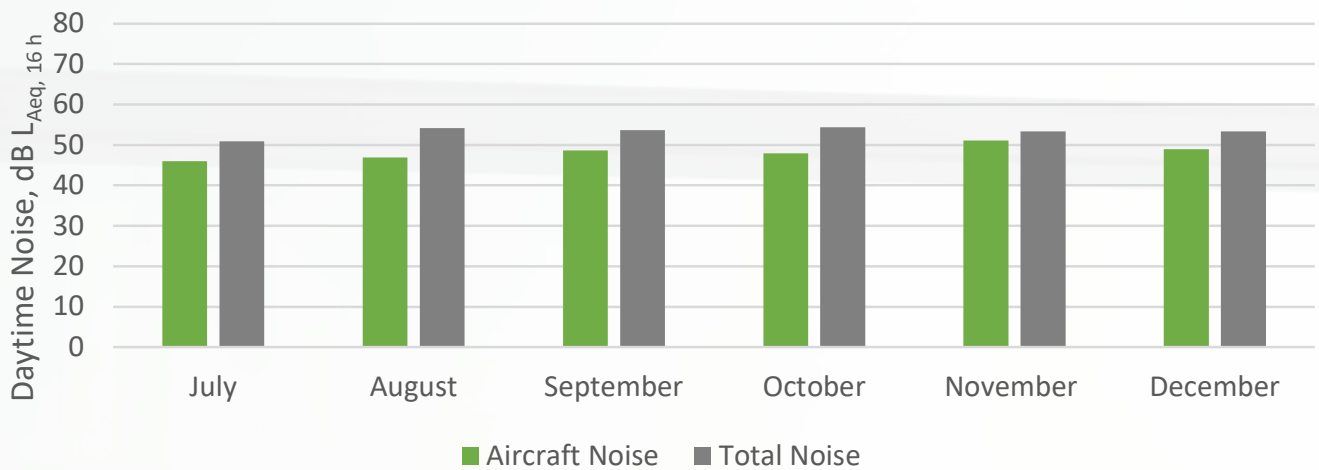
Figure 30: Averaged daytime noise levels for NMT 5, July - December 2017

Noise levels during the night are determined using a similar method. The night period is defined as a period between 23:00 in the evening to 06:59 in the morning. Noise levels are therefore averaged over an 8-hour window. Figure 31 presents these results monthly.
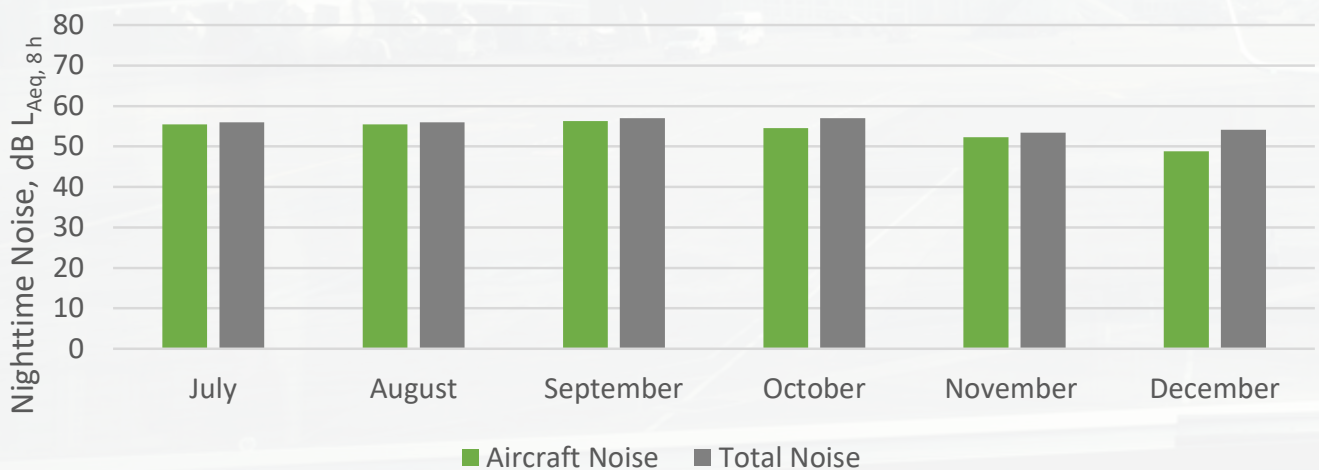
Figure 31: Averaged nighttime noise levels for NMT 5, July - December 2017

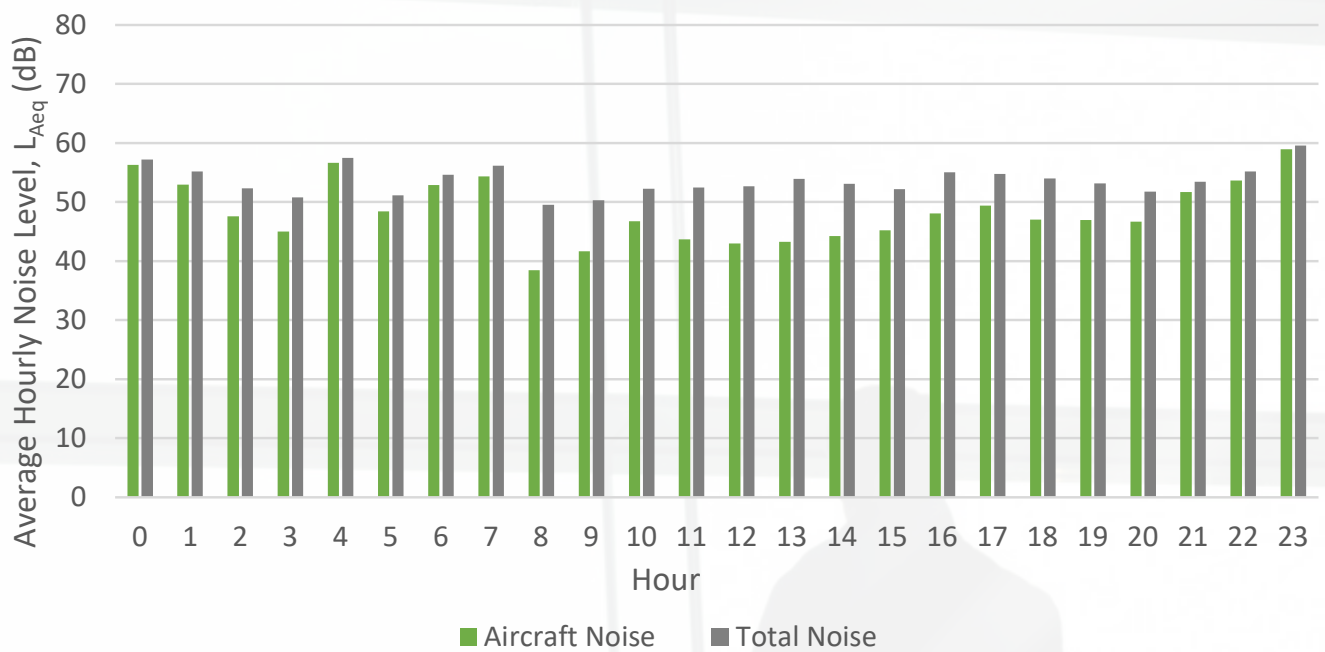The hourly noise distribution at NMT 5 as shown in Figure 32.

Figure 32: Averaged hourly noise levels for NMT 5, July - December 2017

Figure 33 shows the $L_{A,MAX}$ distribution, for aircraft noise, for the second half year of 2017 for NMT 5.
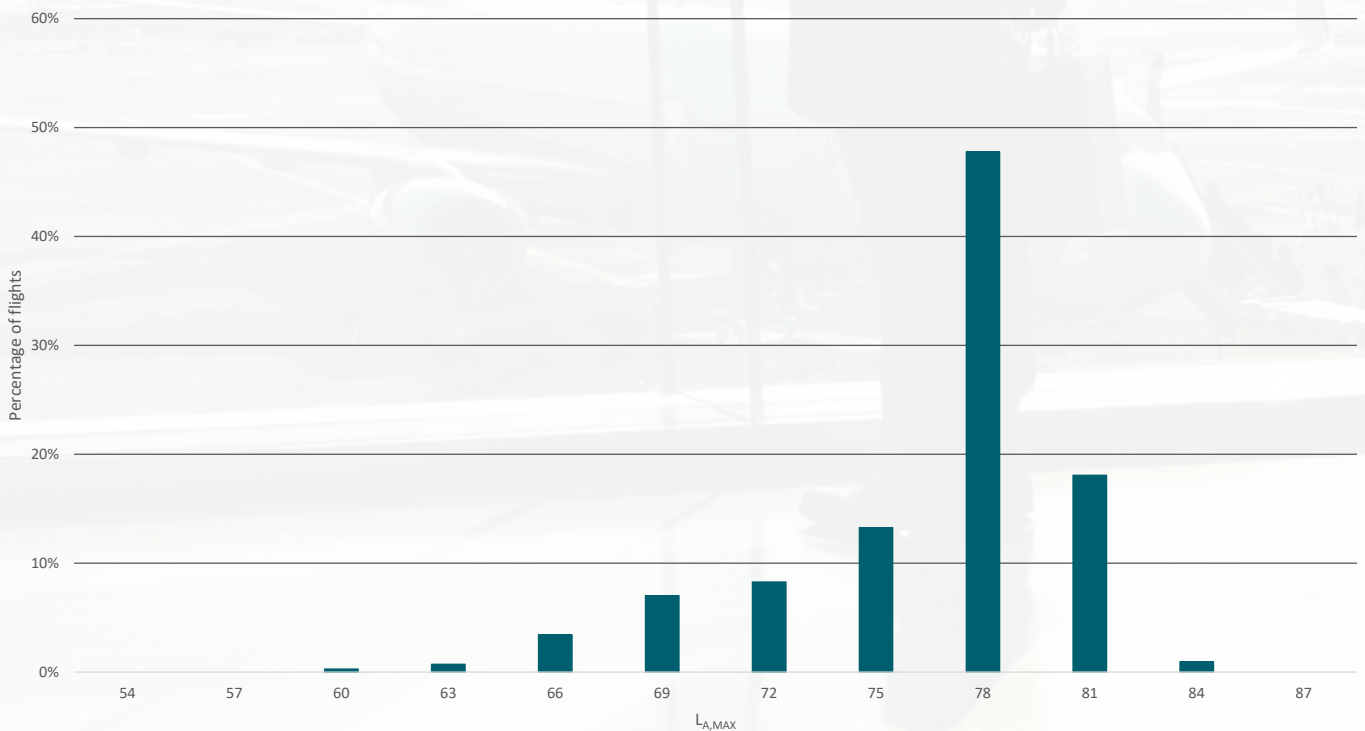

Figure 33: $L_{A,MAX}$ levels distribution for NMT 5, July - December 2017

NMT 6: Artane

Noise Monitoring Terminal 6 ('Artane') is located southeast of Dublin Airport on the roof a school building, see Figure 34 below, under the extended runway centerline of runway 16. Its purpose is to monitor runway 16 departures and runway 34 arrivals. The resulting data for NMT 6 measurements in the period from July 1st up to and including December 31st 2017 are presented in this section.

Figure 34: Noise Monitoring Terminal Artane Location

Noise Events

The results are presented in Figure 35. 2,013 registered noise events were attributable to aircraft noise (5.3%).
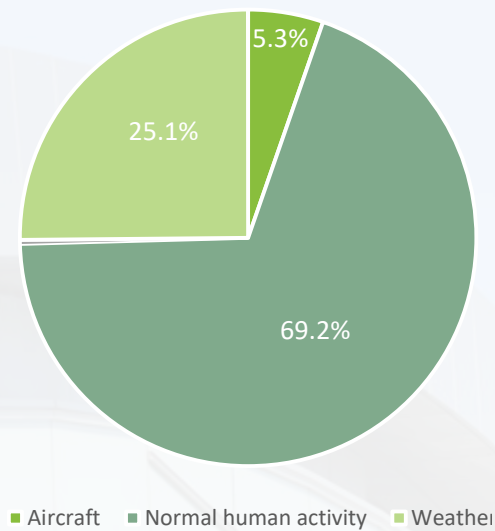
Figure 35: NMT 6 Noise Event Types

NMT Operational Status

To ensure that Noise Monitoring Terminals keep working within specific limits, internal calibration checks are completed every 6 hours. During this period, some of the NMTs are out of operation for maintenance purposes and do not record noise events. The operational status of NMT 6: Artane is presented in Figure 36.
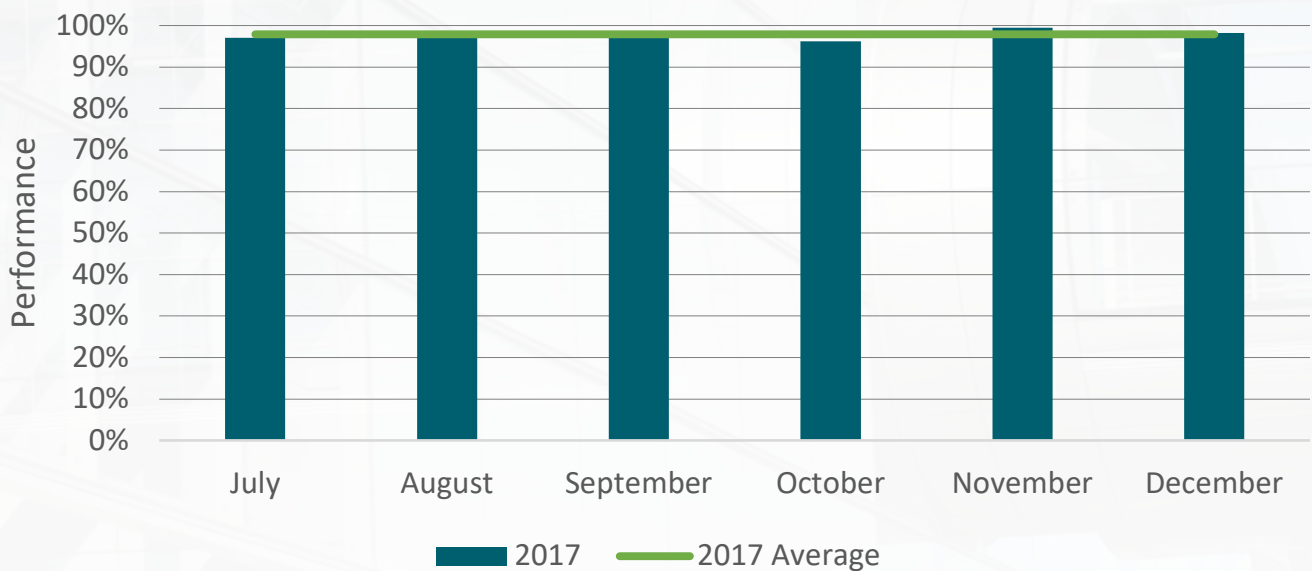

Figure 36: Operational status of NMT 6

Noise Levels

Figure 37 presents the average noise levels measured at NMT 6 during daytime periods, which are defined to be from 07:00 in the morning to 22:59 in the evening. Recorded noise levels during these time segments are therefore averaged over a 16-hour window.

This procedure is followed both for all noise events, and for those events that were correlated to aircraft movements. The results shown are presented monthly.
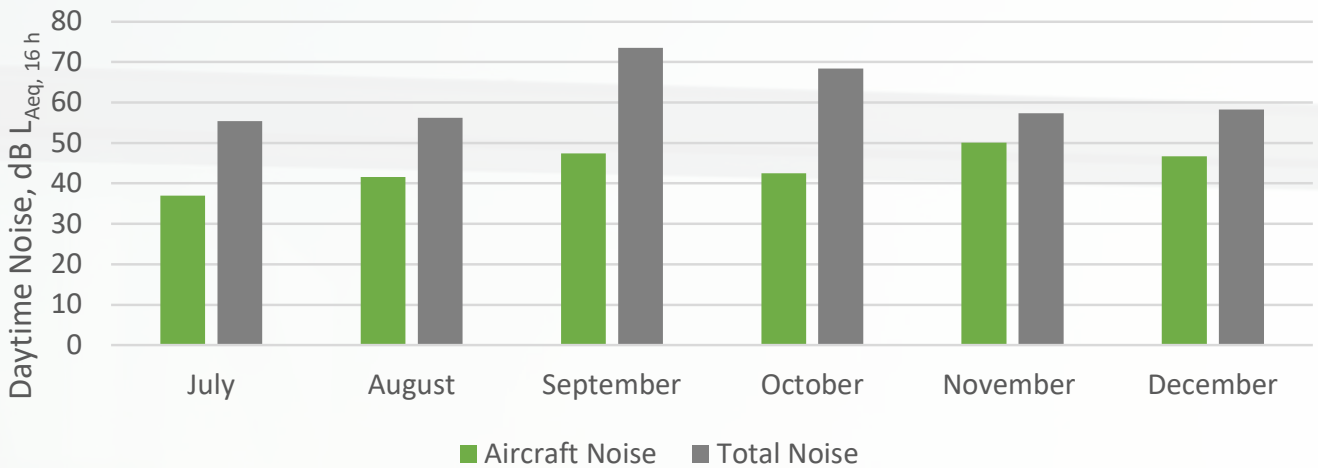

Figure 37: Averaged daytime noise levels for NMT 6, July - December 2017

Noise levels during the night are determined using a similar method. The night period is defined as a period between 23:00 in the evening to 06:59 in the morning. Noise levels are therefore averaged over an 8-hour window. Figure 38 presents these results monthly.
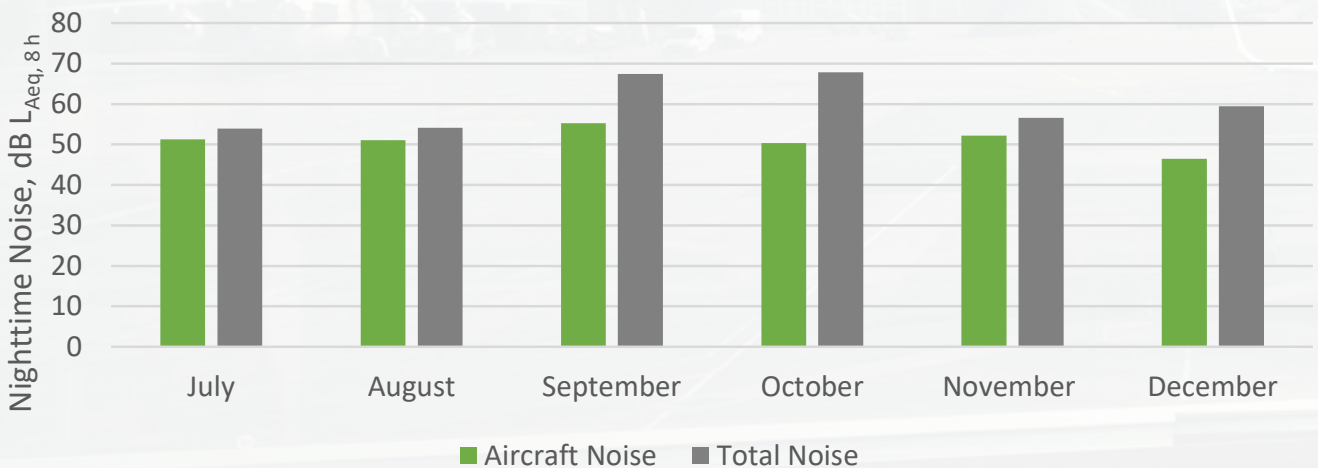

Figure 38: Averaged nighttime noise levels for NMT 6, July - December 2017

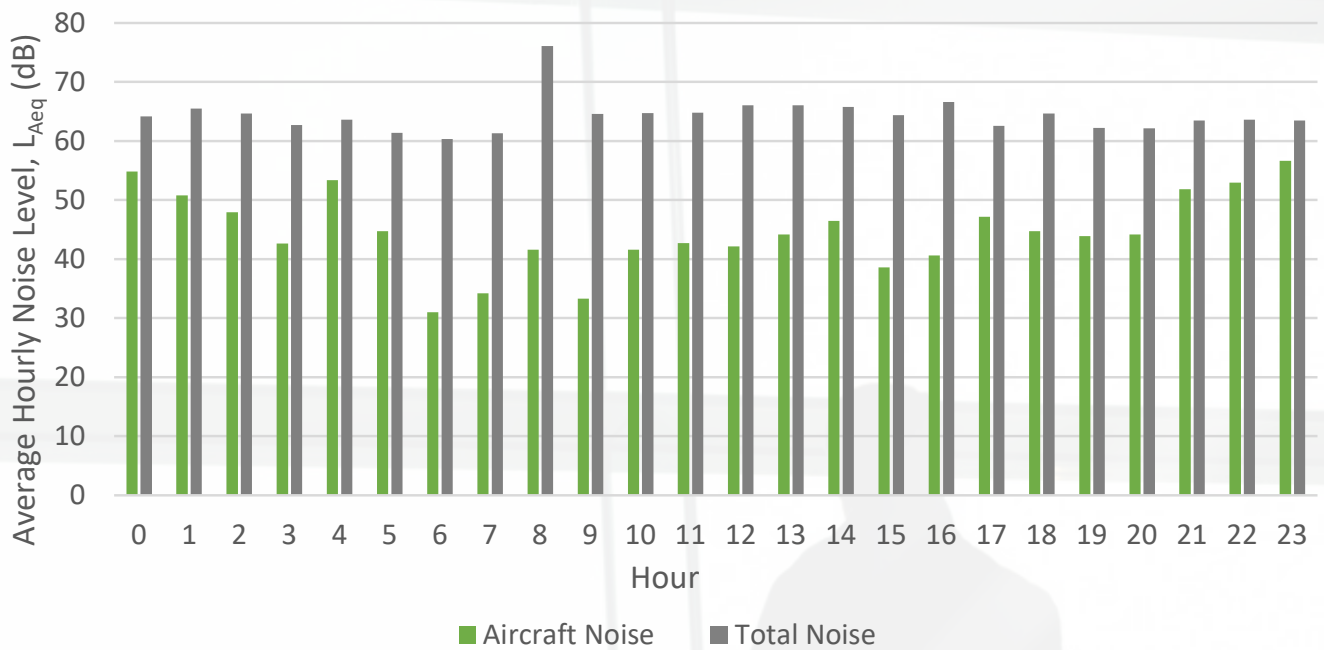The hourly noise distribution at NMT 6 as shown in Figure 39.

Figure 39: Averaged hourly noise levels for NMT 6, July - December 2017

Figure 40 shows the $L_{A,MAX}$ distribution, for aircraft noise, for the second half year of 2017 for NMT 6.
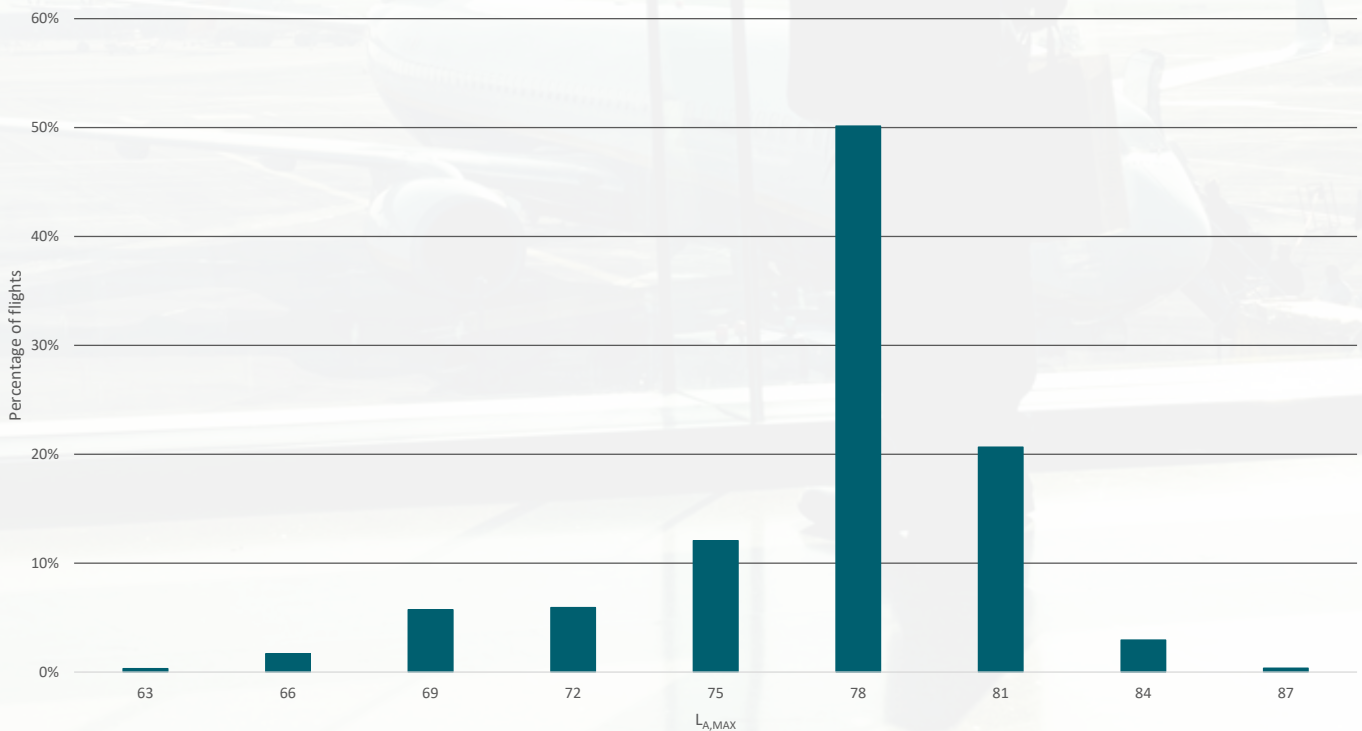

Figure 40: $L_{A,MAX}$ levels distribution for NMT 6, July - December 2017

NMT 20: Coast Road

Noise Monitoring Terminal 20 ('Coast Road') is located east of Dublin Airport, see Figure 41 below, under the extended runway centerline of runway 10. Its purpose is to monitor runway 10 departures and runway 28 arrivals. The resulting data for NMT 20 measurements in the period from July 1st up to and including December 31st 2017 are presented in this section.

Figure 41: Noise Monitoring Terminal Coast Road Location

Noise Events

The results are presented in Figure 42. 45,976 registered noise events were attributable to aircraft noise (87.4%).

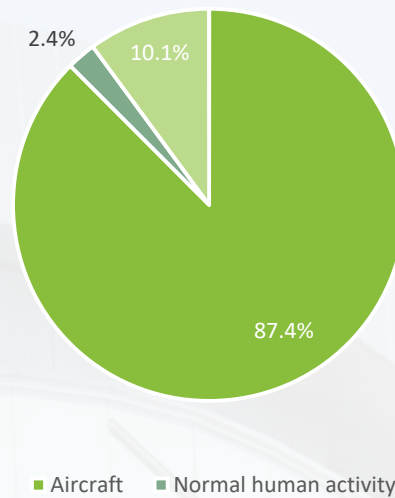2.4%   10.1%

87.4%

■ Aircraft   ■ Normal human activity

Figure 42: NMT 20 Noise Event Types

NMT Operational Status

To ensure that Noise Monitoring Terminals keep working within specific limits, internal calibration checks are completed every 6 hours. During this period, some of the NMTs are out of operation for maintenance purposes and do not record noise events. The operational status of NMT 20: Coast Road is presented in Figure 43.
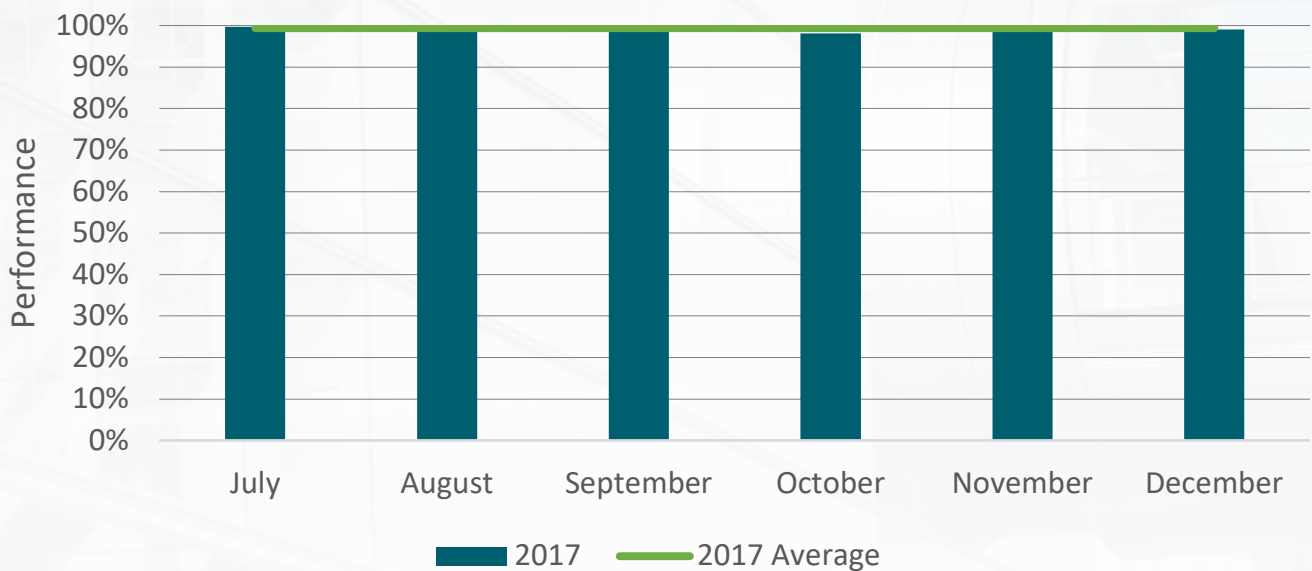

Figure 43: Operational status of NMT 20

Noise Levels

Figure 44 presents the average noise levels measured at NMT 20 during daytime periods, which are defined to be from 07:00 in the morning to 22:59 in the evening. Recorded noise levels during these time segments are therefore averaged over a 16-hour window.

This procedure is followed both for all noise events, and for those events that were correlated to aircraft movements. The results shown are presented monthly.
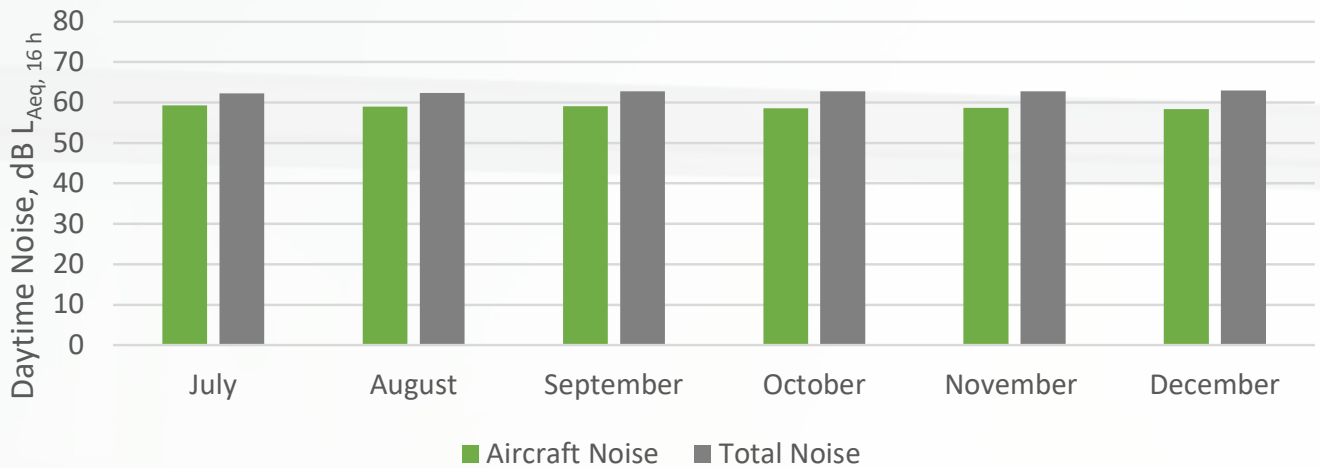

Figure 44: Averaged daytime noise levels for NMT 20, July - December 2017

Noise levels during the night are determined using a similar method. The night period is defined as a period between 23:00 in the evening to 06:59 in the morning. Noise levels are therefore averaged over an 8-hour window. Figure 45 presents these results monthly.
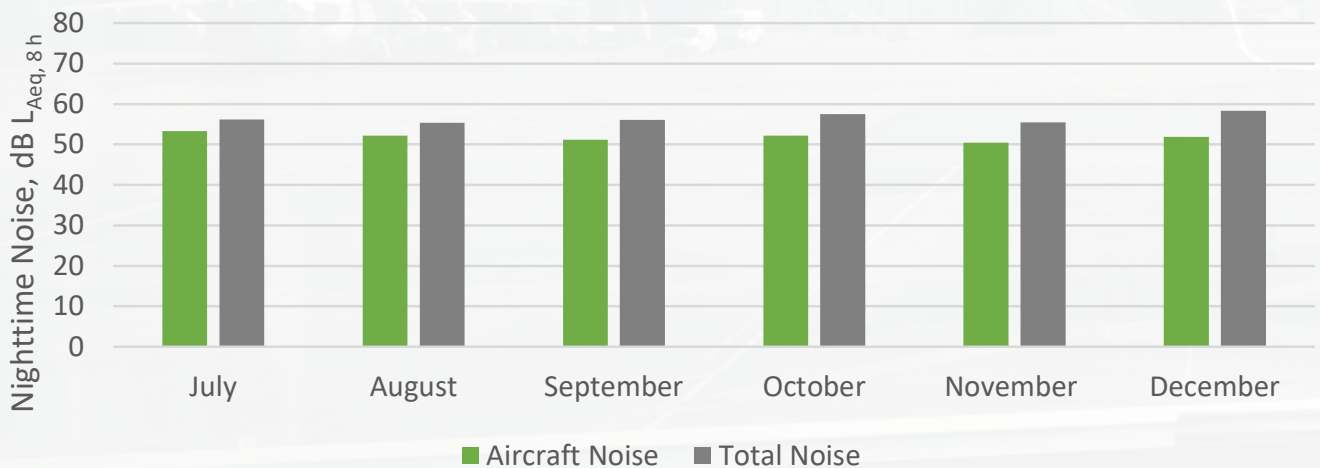

Figure 45: Averaged nighttime noise levels for NMT 20, July - December 2017

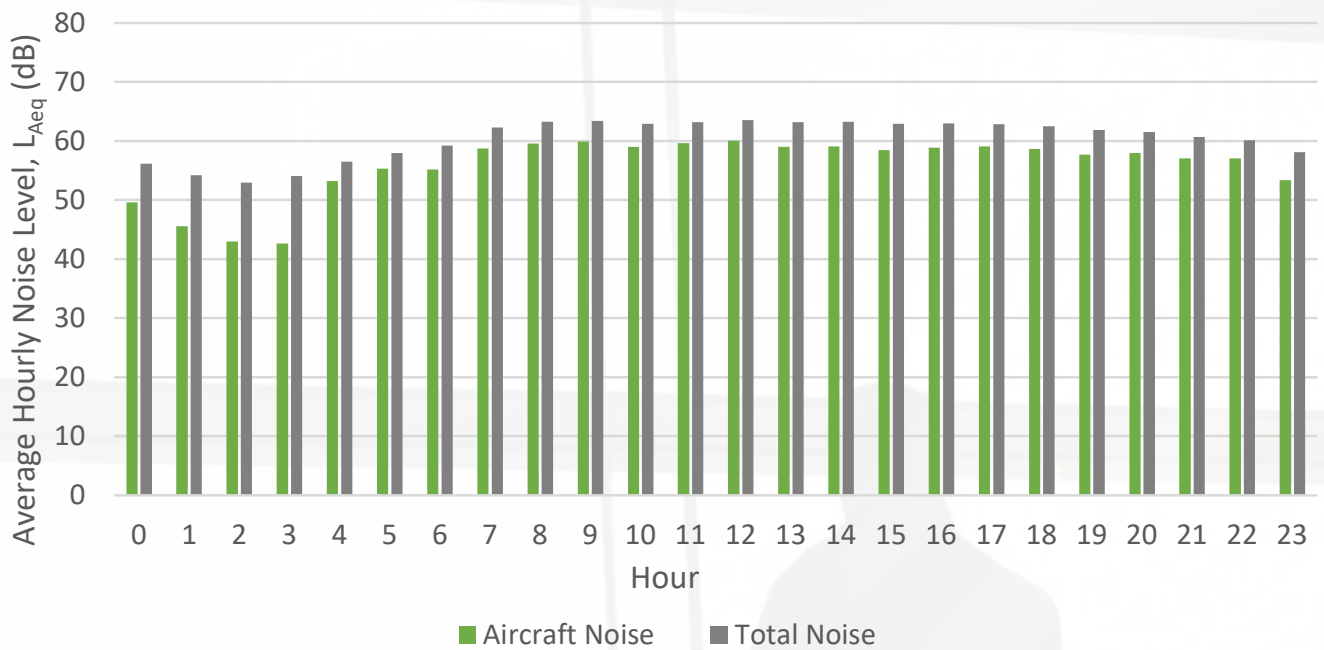The hourly noise distribution at NMT 20 as shown in Figure 46.

Figure 46: Averaged hourly noise levels for NMT 20, July - December 2017

Figure 47 shows the $L_{A,MAX}$ distribution, for aircraft noise, for the second half year of 2017 for NMT 20.
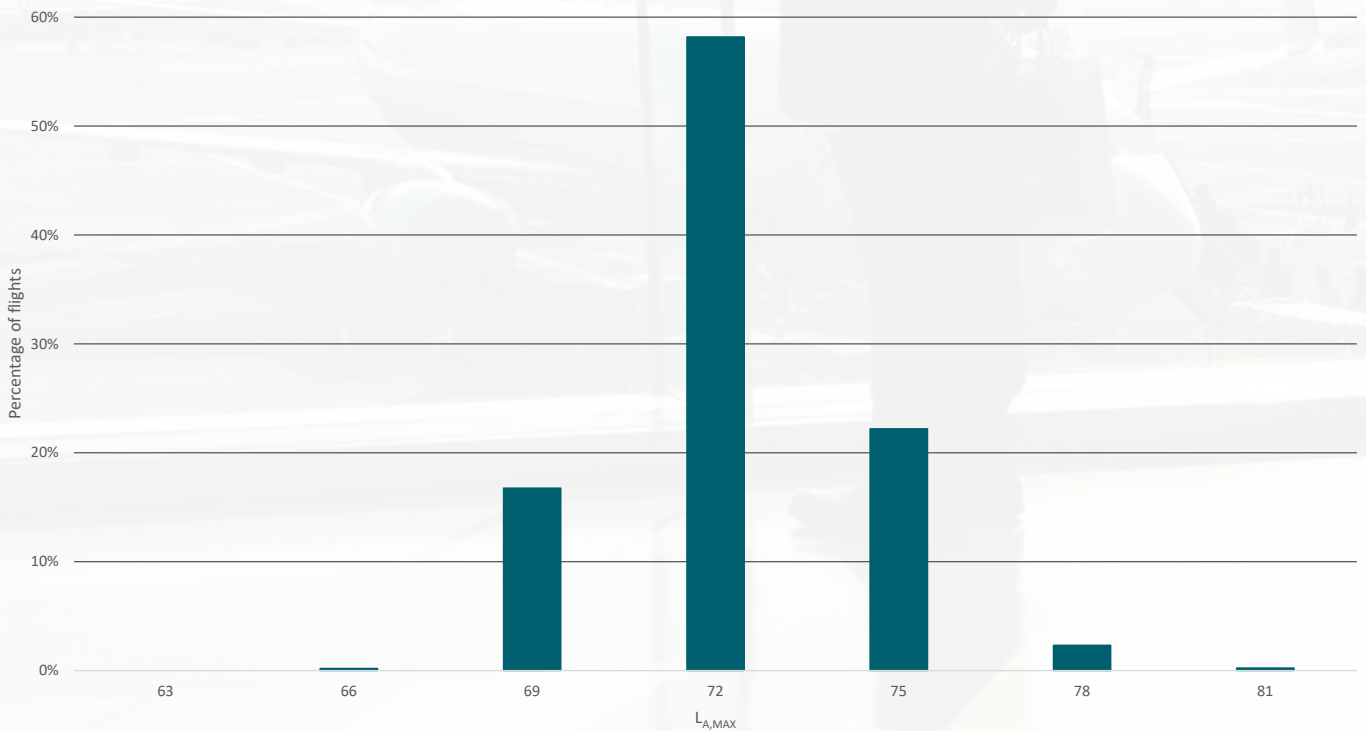

Figure 47: $L_{A,MAX}$ levels distribution for NMT 20, July - December 2017

NMT 21: Airport

Noise Monitoring Terminal 21 ('Airport') is located north east side of Dublin Airport campus, see Figure 48 below, and monitors the local area. The resulting data for NMT 21 measurements in the period from July 1st up to and including December 31st 2017 are presented in this section.

Figure 48: Noise Monitoring Terminal Airport Location

Noise Events

The results are presented in Figure 49. 17,555 registered noise events were attributable to aircraft noise (34.9%).
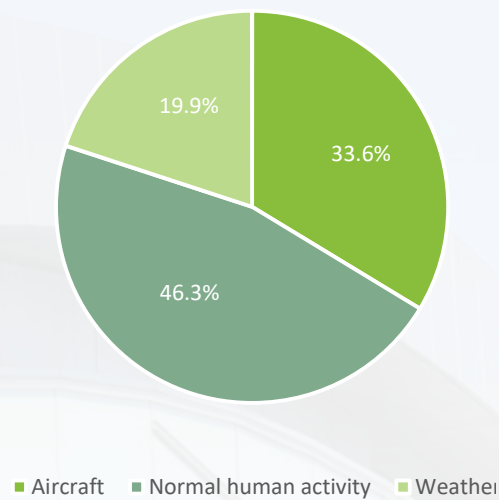

Figure 49: NMT 21 Noise Event Types

NMT Operational Status

To ensure that Noise Monitoring Terminals keep working within specific limits, internal calibration checks are completed every 6 hours. During this period, some of the NMTs are out of operation for maintenance purposes and do not record noise events. The operational status of NMT 21: Airport is presented in Figure 50.
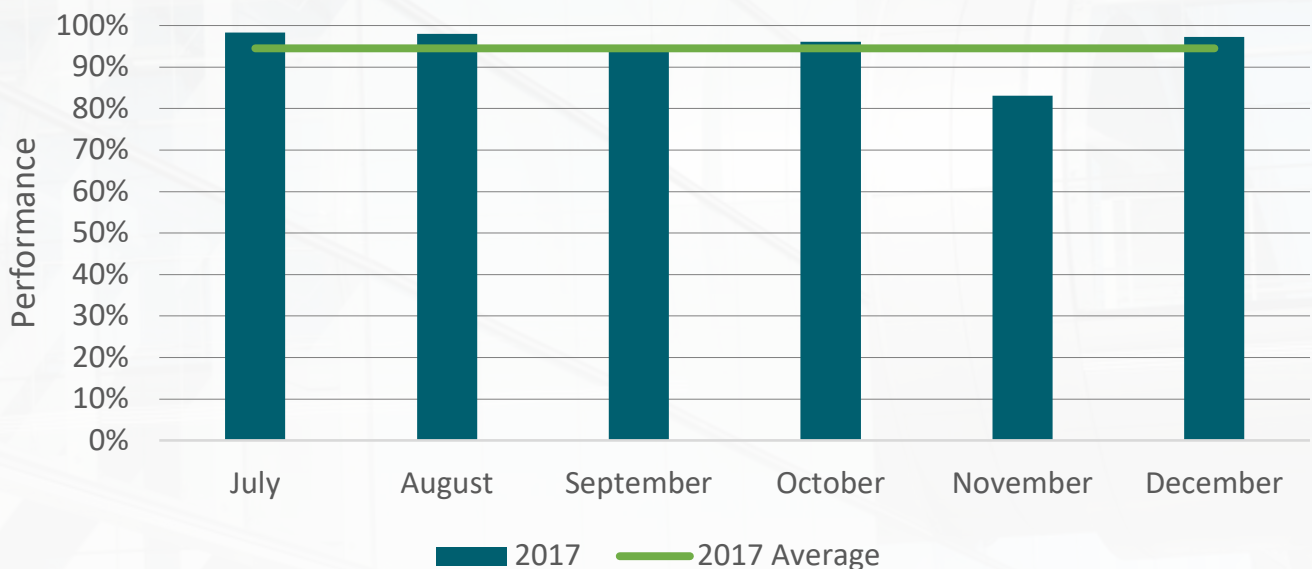

Figure 50: Operational status of NMT 21

Noise Levels

Figure 51 presents the average noise levels measured at NMT 21 during daytime periods, which are defined to be from 07:00 in the morning to 22:59 in the evening. Recorded noise levels during these time segments are therefore averaged over a 16-hour window.

This procedure is followed both for all noise events, and for those events that were correlated to aircraft movements. The results shown are presented monthly.
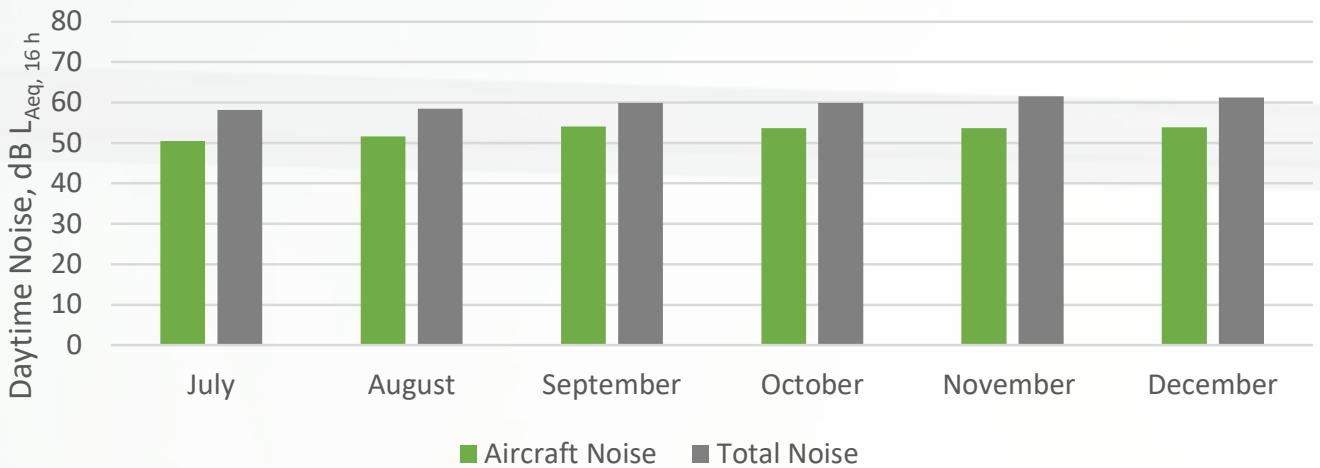

Figure 51: Averaged daytime noise levels for NMT 21, July - December 2017

Noise levels during the night are determined using a similar method. The night period is defined as a period between 23:00 in the evening to 06:59 in the morning. Noise levels are therefore averaged over an 8-hour window. Figure 52 presents these results monthly.
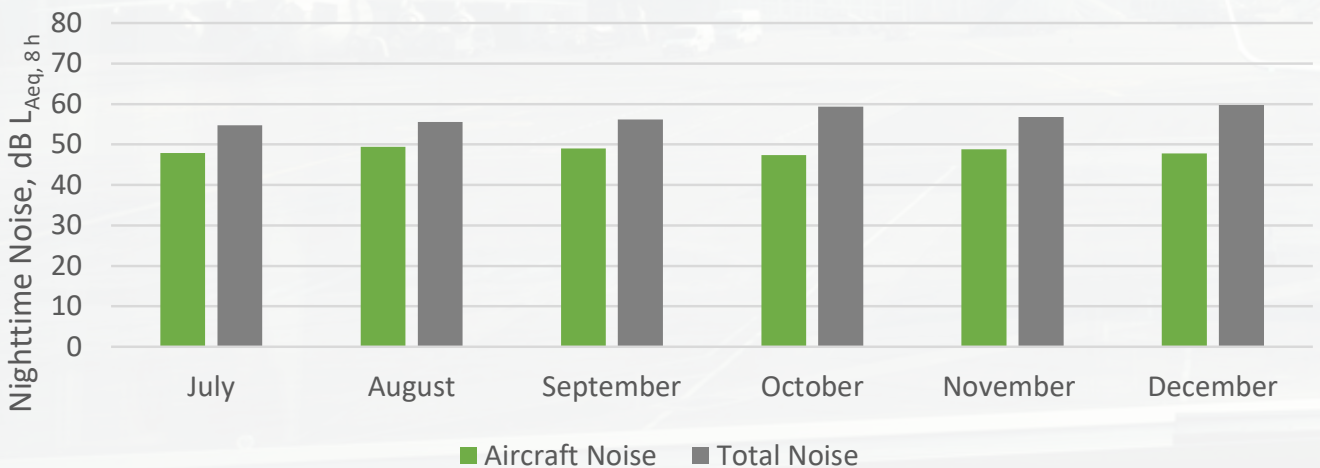

Figure 52: Averaged nighttime noise levels for NMT 21, July - December 2017

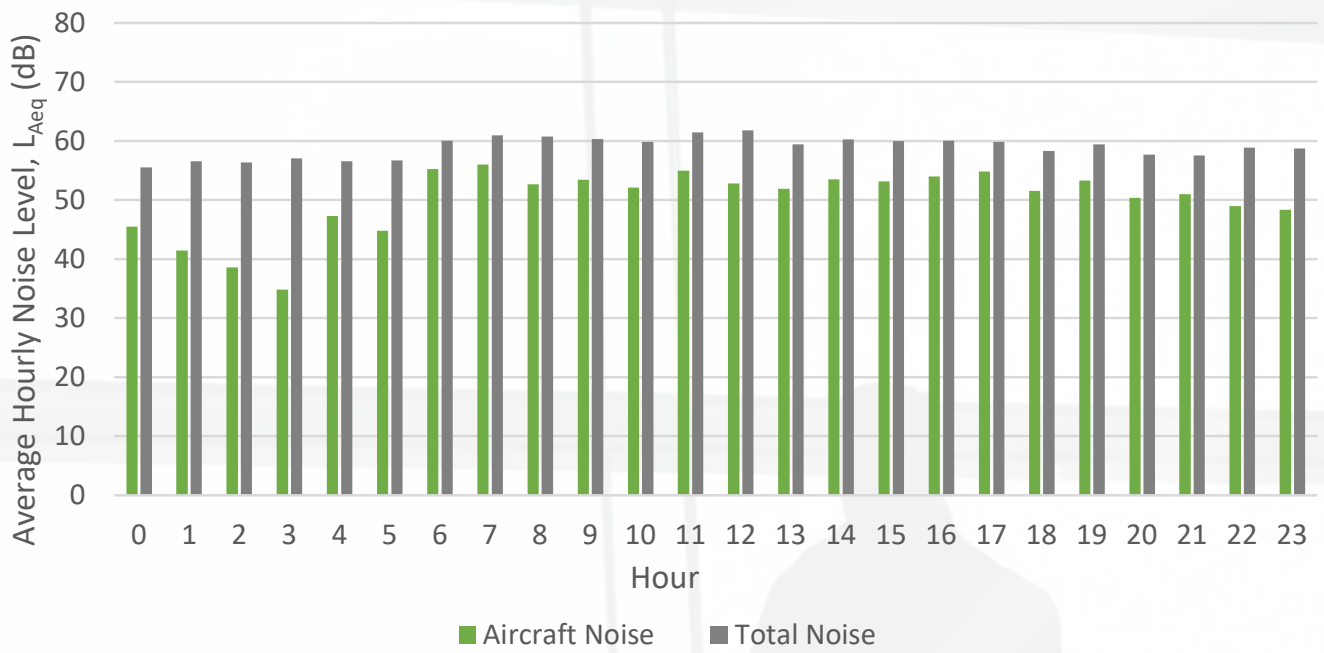The hourly noise distribution at NMT 21 as shown in Figure 53.

Figure 53: Averaged hourly noise levels for NMT 21, July - December 2017

Figure 54 shows the $L_{A,MAX}$ distribution, for aircraft noise, for the second half year of 2017 for NMT 21.
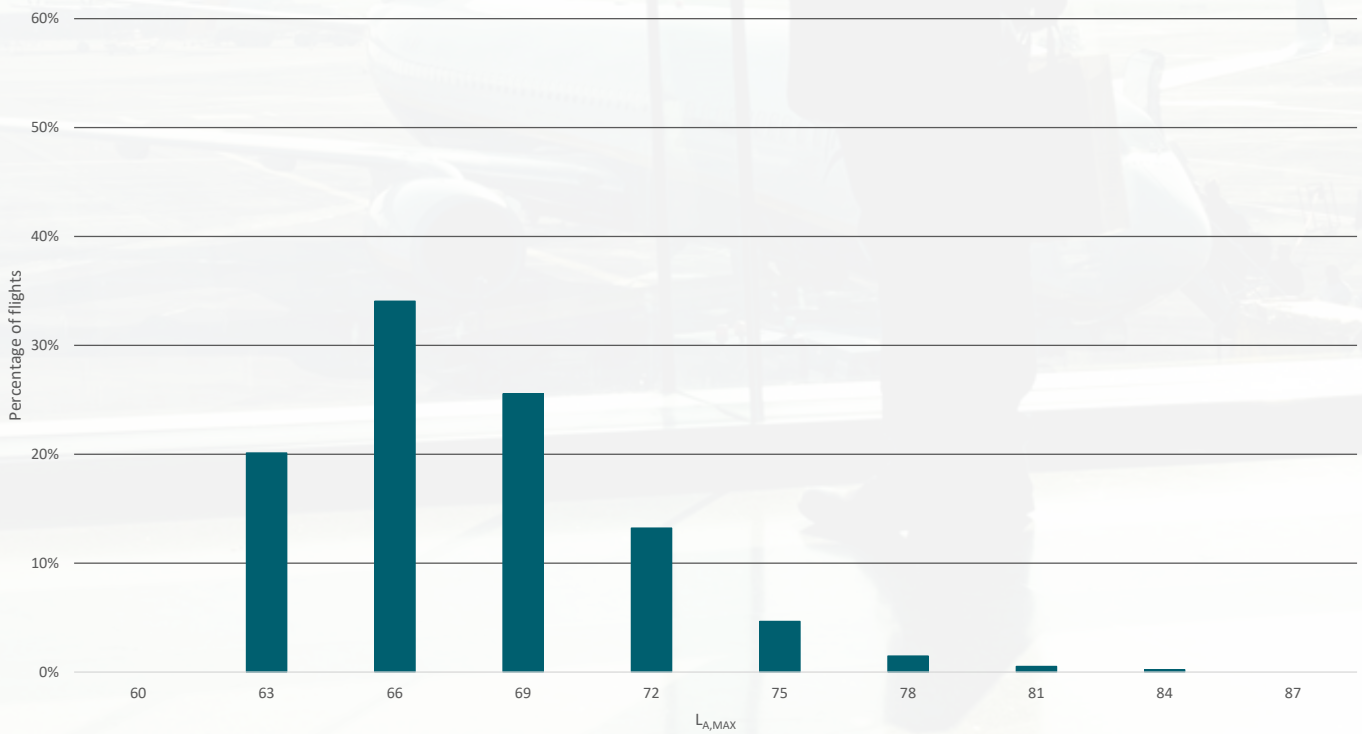

Figure 54: $L_{A,MAX}$ levels distribution for NMT 21, July - December 2017

Glossary

Symbol	Description	Unit
L_{Aeq}	A-weighted, equivalent noise level, averaged per hour over a half year period.	[dB]
$L_{Aeq, 8h}$	A-weighted, equivalent noise level, averaged over eight hours per month between 23:00 and 07:00 (nighttime), hence 8 hour equivalent.	[dB]
$L_{Aeq, 16h}$	A-weighted, equivalent noise level, averaged over 16 hours per month between 07:00 and 23:00 (daytime), hence 16 hour equivalent.	[dB]
$L_{A,MAX}$	A-weighted, maximum recorded noise level per correlated aircraft-noise event, instead of indicating the average noise levels for a reference duration.	[dB]

Report inquiries

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This report is drafted by To70 Aviation Consultants on behalf of Dublin Airport.