Table 13C-56: Zoned Population Counts, N60 Metric

Metric Value, N60	Scenario and Zoned Population Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 10	12,600	12,600	12,600	12,600	12,600	12,600	12,600
≥ 25	10,800	10,800	10,800	7,200	10,800	10,200	7,200
≥ 50	0	7,200	0	0	0	0	0
≥ 100	0	0	0	0	0	0	0

Table 13C-57: Zoned Population Counts, L_{day} Metric

Metric Value, dB L_{day}	Scenario and Zoned Population Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 45	13,500	13,500	13,500	12,600	13,500	13,500	12,600
≥ 50	12,600	12,600	12,300	9,000	12,000	13,500	9,000
≥ 55	9,300	9,000	5,400	6,000	5,400	10,200	6,000
≥ 60	2,400	2,700	0	0	0	4,500	0
≥ 65	0	0	0	0	0	0	0
≥ 70	0	0	0	0	0	0	0
≥ 75	0	0	0	0	0	0	0

Table 13C-58: Zoned Population Counts, $L_{evening}$ Metric

Metric Value, dB $L_{evening}$	Scenario and Zoned Population Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 45	13,500	13,200	10,500	10,500	10,200	13,500	10,200
≥ 50	12,600	12,600	9,000	9,000	9,000	9,000	9,000
≥ 55	8,100	8,100	5,400	5,100	4,800	9,000	4,800
≥ 60	0	0	0	0	0	3,600	0
≥ 65	0	0	0	0	0	0	0
≥ 70	0	0	0	0	0	0	0
≥ 75	0	0	0	0	0	0	0

Community Building Counts

13C.4.4 For each assessment scenario and metric, the tables below present the number of community buildings within each contour. The following community buildings have been assessed:

- Education Buildings
- Residential Healthcare Facilities
- Religious Buildings

13C.4.5 All of the areas and counts below are cumulative, i.e. the buildings within a 60 dB contour would also be counted as within the corresponding 50 dB contour. Table 13C-59 provides a reference to aid finding a specific result.

Table 13C-59: Community Building Count Table References

Metric	Result Item and Table Reference		
	Education Buildings	Residential Healthcare Facilities	Religious Buildings
L_{den}	Table 13C-60	Table 13C-68	Table 13C-76
L_{night}	Table 13C-61	Table 13C-69	Table 13C-77
$L_{Aeq,16h}$	Table 13C-62	Table 13C-70	Table 13C-78
$L_{Aeq,8h}$	Table 13C-63	Table 13C-71	Table 13C-79
N65	Table 13C-64	Table 13C-72	Table 13C-80
N60	Table 13C-65	Table 13C-73	Table 13C-81
L_{day}	Table 13C-66	Table 13C-74	Table 13C-82
$L_{evening}$	Table 13C-67	Table 13C-75	Table 13C-83

Table 13C-60: Education Building Counts, L_{den} Metric

Metric Value, dB L_{den}	Scenario and Education Building Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 45	336	344	167	184	164	373	176
≥ 50	62	59	30	34	30	77	31
≥ 55	10	9	8	10	8	11	10
≥ 60	2	2	2	2	2	3	2
≥ 65	0	1	0	0	0	1	0
≥ 70	0	0	0	0	0	0	0

≥ 75	0	0	0	0	0	0	0

Table 13C-61: Education Building Counts, L_{night} Metric

Metric Value, dB L_{night}	Scenario and Education Building Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 40	117	133	49	65	48	99	65
≥ 45	15	15	9	11	9	15	11
≥ 50	3	3	2	5	2	3	5
≥ 55	1	1	0	1	0	1	1
≥ 60	0	0	0	0	0	0	0
≥ 65	0	0	0	0	0	0	0
≥ 70	0	0	0	0	0	0	0

Table 13C-62: Education Building Counts, $L_{Aeq,16h}$ Metric

Metric Value, dB $L_{Aeq,16h}$	Scenario and Education Building Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 51	9	16	13	12	11	26	12
≥ 54	8	8	8	8	8	13	8
≥ 57	2	2	2	2	2	8	2
≥ 60	1	1	1	1	1	2	1
≥ 63	1	1	0	0	0	1	0
≥ 66	0	0	0	0	0	0	0
≥ 69	0	0	0	0	0	0	0

Table 13C-63: Education Building Counts, $L_{Aeq,8h}$ Metric

Metric Value, dB $L_{Aeq,8h}$	Scenario and Education Building Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 45	18	20	9	11	9	17	11
≥ 48	11	9	5	7	5	7	7
≥ 51	3	4	2	3	2	3	3
≥ 54	1	2	1	1	1	1	1
≥ 57	0	1	0	0	0	1	0
≥ 60	0	0	0	0	0	0	0
≥ 63	0	0	0	0	0	0	0

Table 13C-64: Education Building Counts, N65 Metric

Metric Value, N65	Scenario and Education Building Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 10	30	31	18	16	18	50	16
≥ 25	21	22	12	12	12	21	12
≥ 50	8	8	9	9	9	12	9
≥ 100	5	5	4	4	5	10	6
≥ 200	2	2	2	2	2	5	2
≥ 500	0	0	0	0	0	0	0

Table 13C-65: Education Building Counts, N60 Metric

Metric Value, N60	Scenario and Education Building Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 10	22	21	9	15	9	21	15
≥ 25	9	9	5	6	5	5	6
≥ 50	0	5	0	0	0	0	0
≥ 100	0	0	0	0	0	0	0

Table 13C-66: Education Building Counts, L_{day} Metric

Metric Value, dB L_{day}	Scenario and Education Building Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 45	149	21	94	77	92	209	75
≥ 50	21	9	14	14	14	45	14
≥ 55	6	5	5	6	6	10	6
≥ 60	1	0	1	1	1	2	1
≥ 65	0	21	0	0	0	0	0
≥ 70	0	9	0	0	0	0	0
≥ 75	0	5	0	0	0	0	0

Table 13C-67: Education Building Counts, $L_{evening}$ Metric

Metric Value, dB $L_{evening}$	Scenario and Education Building Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 45	83	77	53	53	46	126	45
≥ 50	10	9	11	10	10	22	10
≥ 55	2	2	3	3	3	8	3
≥ 60	1	1	0	0	0	1	0
≥ 65	0	0	0	0	0	0	0
≥ 70	0	0	0	0	0	0	0
≥ 75	0	0	0	0	0	0	0

Table 13C-68: Residential Healthcare Facility Counts, L_{den} Metric

Metric Value, dB L_{den}	Scenario and Residential Healthcare Facility Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 45	28	27	11	12	11	37	11
≥ 50	6	7	3	5	3	6	5
≥ 55	2	2	1	1	1	2	1
≥ 60	1	1	1	1	1	1	1
≥ 65	0	0	0	0	0	0	0
≥ 70	0	0	0	0	0	0	0
≥ 75	0	0	0	0	0	0	0

Table 13C-69: Residential Healthcare Facility Counts, L_{night} Metric

Metric Value, dB L_{night}	Scenario and Residential Healthcare Facility Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 40	10	8	4	6	4	7	6
≥ 45	4	2	2	2	2	2	2
≥ 50	1	1	1	1	1	1	1
≥ 55	1	1	0	1	0	1	1
≥ 60	0	0	0	0	0	0	0
≥ 65	0	0	0	0	0	0	0
≥ 70	0	0	0	0	0	0	0

Table 13C-70: Residential Healthcare Facility Counts, $L_{Aeq,16h}$ Metric

Metric Value, dB $L_{Aeq,16h}$	Scenario and Residential Healthcare Facility Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 51	2	2	2	2	2	3	2
≥ 54	2	2	1	1	1	2	1
≥ 57	1	1	1	1	1	1	1
≥ 60	1	1	1	1	1	1	1
≥ 63	0	0	0	0	0	1	0
≥ 66	0	0	0	0	0	0	0
≥ 69	0	0	0	0	0	0	0

Table 13C-71: Residential Healthcare Facility Counts, $L_{Aeq,8h}$ Metric

Metric Value, dB $L_{Aeq,8h}$	Scenario and Residential Healthcare Facility Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 45	3	3	2	2	2	2	2
≥ 48	2	2	1	1	1	2	1
≥ 51	1	1	1	1	1	1	1
≥ 54	1	1	1	1	1	1	1
≥ 57	0	1	0	0	0	0	0
≥ 60	0	0	0	0	0	0	0
≥ 63	0	0	0	0	0	0	0

Table 13C-72: Residential Healthcare Facility Counts, N65 Metric

Metric Value, N65	Scenario and Residential Healthcare Facility Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 10	3	3	3	3	3	4	3
≥ 25	2	2	2	2	2	3	2
≥ 50	1	1	1	1	1	2	1
≥ 100	1	1	1	1	1	1	1
≥ 200	1	1	1	1	1	1	1
≥ 500	0	0	0	0	0	0	0

Table 13C-73: Residential Healthcare Facility Counts, N60 Metric

Metric Value, N60	Scenario and Residential Healthcare Facility Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 10	3	4	2	2	2	3	2
≥ 25	1	1	1	1	1	1	1
≥ 50	0	1	0	0	0	0	0
≥ 100	0	0	0	0	0	0	0

Table 13C-74: Residential Healthcare Facility Counts, L_{day} Metric

Metric Value, dB L_{day}	Scenario and Residential Healthcare Facility Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 45	11	8	8	6	8	11	6
≥ 50	3	3	2	2	2	5	2
≥ 55	2	1	1	1	1	2	1
≥ 60	1	1	1	1	1	1	1
≥ 65	0	0	0	0	0	0	0
≥ 70	0	0	0	0	0	0	0
≥ 75	0	0	0	0	0	0	0

Table 13C-75: Residential Healthcare Facility Counts, $L_{evening}$ Metric

Metric Value, dB $L_{evening}$	Scenario and Residential Healthcare Facility Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 45	7	7	6	6	6	9	5
≥ 50	2	2	2	2	2	2	2
≥ 55	1	1	1	1	1	1	1
≥ 60	0	0	0	0	0	1	0
≥ 65	0	0	0	0	0	0	0
≥ 70	0	0	0	0	0	0	0
≥ 75	0	0	0	0	0	0	0

Table 13C-76: Religious Building Counts, L_{den} Metric

Metric Value, dB L_{den}	Scenario and Religious Building Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 45	116	123	65	72	64	145	71
≥ 50	25	26	15	16	15	31	15
≥ 55	6	6	5	5	5	6	5
≥ 60	3	3	2	2	2	2	2
≥ 65	1	1	0	1	0	2	1
≥ 70	0	0	0	0	0	0	0
≥ 75	0	0	0	0	0	0	0

Table 13C-77: Religious Building Counts, L_{night} Metric

Metric Value, dB L_{night}	Scenario and Religious Building Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 40	46	49	17	29	17	37	30
≥ 45	10	7	6	6	6	8	6
≥ 50	3	3	3	2	3	3	2
≥ 55	2	2	1	2	1	2	2
≥ 60	0	0	0	0	0	0	0
≥ 65	0	0	0	0	0	0	0
≥ 70	0	0	0	0	0	0	0

Table 13C-78: Religious Building Counts, $L_{Aeq,16h}$ Metric

Metric Value, dB $L_{Aeq,16h}$	Scenario and Religious Building Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 51	6	6	7	6	7	13	6
≥ 54	5	5	3	3	3	7	3
≥ 57	3	3	2	2	2	4	2
≥ 60	2	2	2	2	2	2	2
≥ 63	0	0	0	0	0	2	0
≥ 66	0	0	0	0	0	0	0
≥ 69	0	0	0	0	0	0	0

Table 13C-79: Religious Building Counts, $L_{Aeq,8h}$ Metric

Metric Value, dB $L_{Aeq,8h}$	Scenario and Religious Building Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 45	9	10	6	7	6	8	7
≥ 48	6	6	4	5	4	5	5
≥ 51	3	3	2	2	2	3	2
≥ 54	2	2	1	2	1	2	2
≥ 57	1	1	0	1	0	1	1
≥ 60	0	0	0	0	0	0	0
≥ 63	0	0	0	0	0	0	0

Table 13C-80: Religious Building Counts, N65 Metric

Metric Value, N65	Scenario and Religious Building Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 10	12	12	10	8	10	23	8
≥ 25	8	8	6	6	6	11	6
≥ 50	5	5	6	6	6	7	6
≥ 100	4	4	2	2	2	5	2
≥ 200	3	3	2	2	2	3	2
≥ 500	0	0	0	0	0	0	0

Table 13C-81: Religious Building Counts, N60 Metric

Metric Value, N60	Scenario and Religious Building Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 10	9	9	6	7	6	12	7
≥ 25	5	5	3	3	3	3	3
≥ 50	0	2	0	0	0	0	0
≥ 100	0	0	0	0	0	0	0

Table 13C-82: Religious Building Counts, L_{day} Metric

Metric Value, dB L_{day}	Scenario and Religious Building Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 45	52	47	41	34	41	85	35
≥ 50	10	9	8	7	8	21	7
≥ 55	3	3	2	2	2	6	2
≥ 60	2	2	2	2	2	2	2
≥ 65	0	0	0	0	0	1	0
≥ 70	0	0	0	0	0	0	0
≥ 75	0	0	0	0	0	0	0

Table 13C-83: Religious Building Counts, $L_{evening}$ Metric

Metric Value, dB $L_{evening}$	Scenario and Religious Building Count						
	2018 Baseline	2019 Baseline	2022 Baseline	2022 Relevant Action	2025 Baseline	2025 Consented	2025 Relevant Action
≥ 45	31	29	28	26	24	50	23
≥ 50	7	6	6	6	5	12	5
≥ 55	3	3	2	2	2	4	2
≥ 60	1	2	1	1	1	2	1
≥ 65	0	0	0	0	0	0	0
≥ 70	0	0	0	0	0	0	0
≥ 75	0	0	0	0	0	0	0

13D. Air noise baseline survey

13D.1 Introduction

13D.1.1 This appendix of the Environmental Impact Assessment Report (EIAR), prepared by Bickerdike Allen Partners LLP (BAP), describes the survey work undertaken to measure the baseline noise conditions in the vicinity of Dublin Airport, where the surrounding noise environment is affected primarily by transport noise from the local road network and from airport operations.

13D.1.2 Due to the ongoing COVID-19 pandemic and its impact on the transport network, the noise conditions at the present time are likely to be unrepresentative of the normal baseline noise conditions. This effect is expected to be temporary, although the precise timescale is uncertain. Because of this, survey work undertaken by BAP in 2016 has been used and supplemented by more recent results from the Dublin Airport noise monitoring system.

13D.1.3 The baseline noise surveys comprised a combination of attended and unattended noise monitoring. Attended noise monitoring was undertaken at various locations during periods in August, September and October 2016. Unattended monitoring was carried out during similar periods to the attended monitoring.

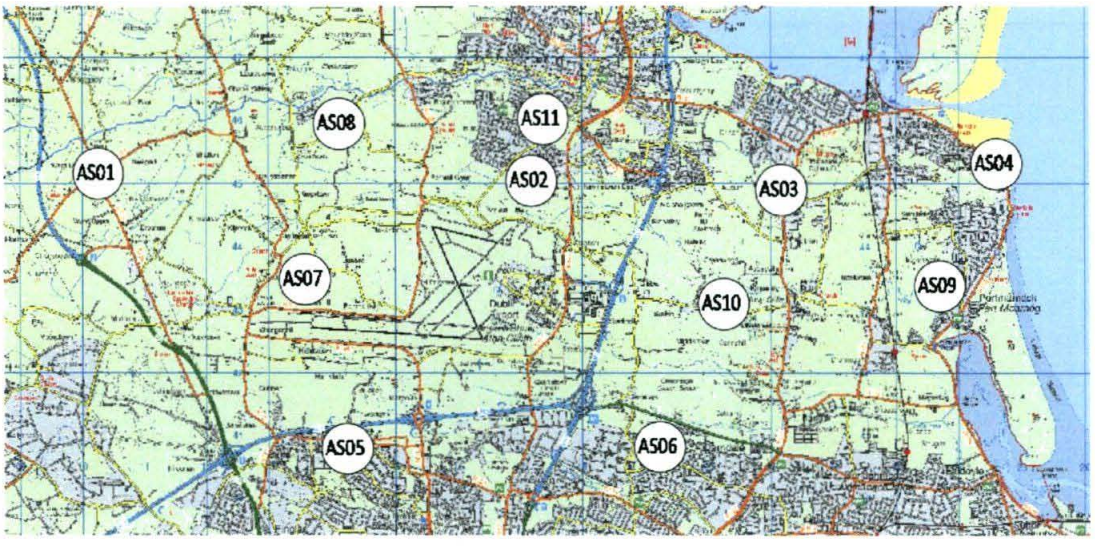
13D.1.4 In addition, the long-term monitoring data measured by Dublin Airport's Noise Monitoring Terminals (NMTs) has been utilised for the calendar year of 2018. A comparison of the NMT data for 2016 and 2018 has also been carried out to check if the conditions in 2016 were significantly different to those in 2018.

13D.2 Methodology

Measurement Locations

13D.2.1 The locations of the attended and unattended monitoring are shown in Figure 13D-1.

Figure 13D-1: Baseline Noise Measurement Locations



Attended Survey Measurements (Locations AS01 to AS06)

13D.2.2 All attended noise monitoring measurements were undertaken in general accordance with the British Standard BS 7445 Description and measurement of environmental noise. This comprised locations with free field conditions and a series of 5 minute measurement samples taken at a specified locations for typically at least 30 minutes. Repeat measurements were made at each location on a given day or night. The microphone of the noise monitor was located approximately 1.5 m above ground level with the monitor mounted on a tripod and away from any reflective surfaces. Observations were made of the noise climate prevailing at the time. These attended measurements include the noise contribution of aircraft activity as well as non-aircraft related activities. This procedure is commonly used to obtain attended environmental noise information, supplemented where possible with unattended noise measurement data. Details of the sound level meters used for each survey, including calibration certificates, are available on request.

Unattended Survey Measurements (Locations AS07 to AS11)

13D.2.3 During the unattended surveys noise measurements were obtained over a period of around three weeks at each location used. At locations AS07, AS08 and AS09 noise measurements were obtained under free field conditions. At locations AS10 and AS11 measurements were made approximately 1 m from a reflective surface and therefore a reflection effect was included in the measurements. Unattended measurements comprised a series of consecutive 15 minute measurement samples over the full survey period. The noise monitors were located in environmental cases with the microphones connected via extension cables. The microphones were fitted with windshields and attached to tripods so they were positioned approximately 1.5 m above local ground level with the exception of location AS09, Portmarnock Community School, where the tripod was on a first floor flat roof.

13D.3 Results

Attended Noise Monitoring

13D.3.1 A summary of the average measured noise levels at each attended survey location is given in Table 13D-1.

Table 13D-1: Baseline Noise Measurements – Attended – Dublin Airport

Reference	Location	Daytime (07:00-23:00)		Night-time (23:00-07:00)		Location Description and Observations	Survey dates
		$L_{Aeq,T}$ dB	$L_{A90,T}$ dB	$L_{Aeq,T}$ dB	$L_{A90,T}$ dB		
AS01	The Ward Cross	61	52	59	44	Measurement location approximately 60 metres from R135	9th and 11th August 2016
AS02	Ridgewood	61	47	57	39	Residential area with infrequent local road traffic	9th and 11th August 2016
AS03	South Malahide	50	40	47	32	Residential area, measurement location approximately 90 metres from Swords Road	16th to 18th August 2016
AS04	Malahide	69	54	55	40	Coastal area, adjacent to the sea and R106	17th and 18th August 2016
AS05	Belcamp Park	57	53	52	46	Residential area with infrequent local road traffic	9th to 11th August 2016
AS06	Hampton Wood	59	56	48	44	Residential area with infrequent local road traffic	10th and 11th August 2016

Noise Environment Description

13D.3.2 This section describes the general noise environment in the vicinity of the attended monitoring locations based on observations made on site and the results presented in Table 13D-1. Reference is made below to ambient noise levels, depicted by the $L_{Aeq,T}$ index, and background noise levels, depicted by the $L_{A90,T}$ index.

North west (Location AS01)

13D.3.3 North west of the airport approximately 4km away contains further rural areas. The R135 and R121 roads are dominant noise sources. Ambient and background noise levels of 61 dB $L_{Aeq,T}$ and 52 dB $L_{A90,T}$ respectively were measured. The night-time ambient and background noise levels measured were 59 dB and 44 dB respectively. Aircraft noise was not considered dominant.

North (Location AS02)

13D.3.4 Ridgewood is a residential area located just under 2 km north of the airport. The R132 and M1 are located approximately 1km and 2.5km from measurement location AS02. Daytime ambient and background noise levels ranged between 56 dB – 61 dB $L_{Aeq,T}$ and 45 dB – 47 dB $L_{A90,T}$ respectively. Night-time ambient noise levels ranged between 45 – 57 dB and background noise levels were around 39 dB at both locations. Local road traffic was generally the dominant noise source, however between 6:30 and 07:00 frequent plane activity was the dominant noise source.

North east (Locations AS03 & AS04)

13D.3.5 Malahide is located near the coast, north east of the airport. The R106 was a dominant noise source in the area during the daytime. Location AS04 was located next to the R106 approximately 7km away from Dublin airport with ambient and background noise levels of around 69 dB $L_{Aeq,T}$ and 54 dB $L_{A90,T}$. At night-time ambient and background noise levels at this location were around 55 dB and 40 dB respectively. Location AS03 was located approximately 4km away from Dublin airport in a quieter residential area located away from busy main roads. The daytime ambient and background noise levels were 50 dB and 40 dB respectively. The night-time levels were 47 dB $L_{Aeq,T}$ and 32 dB $L_{A90,T}$. Aircraft noise at these locations was considered negligible.

South (Location AS05)

13D.3.6 The M50 and the Hampton Wood residential area are located south of the airport. The measurement location was approximately 500 metres from the M50 and 2km from Dublin airport. The daytime ambient and background noise levels were 59 dB $L_{Aeq,T}$ and 56 dB $L_{A90,T}$ respectively. The night-time ambient and background noise levels measured were 48 dB and 44 dB respectively.

South east (Location AS06)

13D.3.7 Clonshaugh's business and technology park and Belcamp Park are located approximately 3 km to the south east of the airport. The M1, M50 and R139 are dominant noise sources in the area. The daytime ambient and background noise levels measured were 57 dB $L_{Aeq,T}$ and 53 dB $L_{A90,T}$ respectively. The night-time ambient and background noise levels measured were 52 dB and 46 dB respectively. Aircraft noise was occasionally dominant.

Unattended Noise Monitoring

A summary of the average measured noise levels at each unattended survey location is given in Table 13D-2. Further details of the unattended monitoring results are provided in

Table 13D-3

13D.3.8 Table 13D-3 to **Error! Reference source not found.** alongside time history graphs in

Figure 13D-2 to

13D.3.9 Figure 13D-7.

Table 13D-2: Baseline Noise Measurements – Unattended – Dublin Airport

Reference	Location	Daytime (07:00-23:00)		Night-time (23:00-07:00)		Location Description and Observations	Survey dates
		$L_{Aeq,T}$ dB	$L_{A90,T}$ dB	$L_{Aeq,T}$ dB	$L_{A90,T}$ dB		
AS07	St Margaret's Dunsoghly	64	45	59	39	Small village in rural area. Aircraft activity the dominant noise source	11th to 29th August 2016
		64	47	57	42		15th to 26th September 2016
AS08	Kilbrook	50	40	44	33	Quiet residential area. No obvious dominant noise source	11th to 29th August 2016
AS09	Portmarnock Community School	51	40	44	33	Measurement location within the school grounds. No obvious dominant noise source	19th August to 5th September 2016
AS10	The Baskins	58	43	52	37	Residential area Aircraft activity occasionally the dominant noise source	11th to 29th August 2016
AS11	River Valley	56	45	45	39	Measurement location within the school grounds	10th to 30th October 2016

Table 13D-3: Location AS07, long-term noise monitoring results, August 2016

Date	$L_{Aeq,16h}$ (dB)	$L_{AF90,day}$ (dB)	$L_{Aeq,8h}$ (dB)	$L_{AF90,night}$ (dB)
2016/08/10	64	47	59	43
2016/08/11	68	49	59	42
2016/08/12	65	49	58	40
2016/08/13	65	43	60	35
2016/08/14	66	39	61	38
2016/08/15	60	46	52	40
2016/08/16	62	51	53	41
2016/08/17	58	45	61	36
2016/08/18	62	42	53	41
2016/08/19	60	49	60	41
2016/08/20	64	49	56	38
2016/08/21	63	42	57	40
2016/08/22	65	45	50	38
2016/08/23	66	45	60	39
2016/08/24	64	43	60	38
2016/08/25	65	44	60	41
2016/08/26	65	46	60	38
2016/08/27	60	42	60	33
2016/08/28	66	37	60	38
2016/08/29	65	45	60	39
2016/08/30	66	49	-	-
Average	64	45	59	39
Range	58 - 68	37 - 51	50 - 61	33 - 43

Figure 13D-2: Location AS07, long-term noise monitoring time history

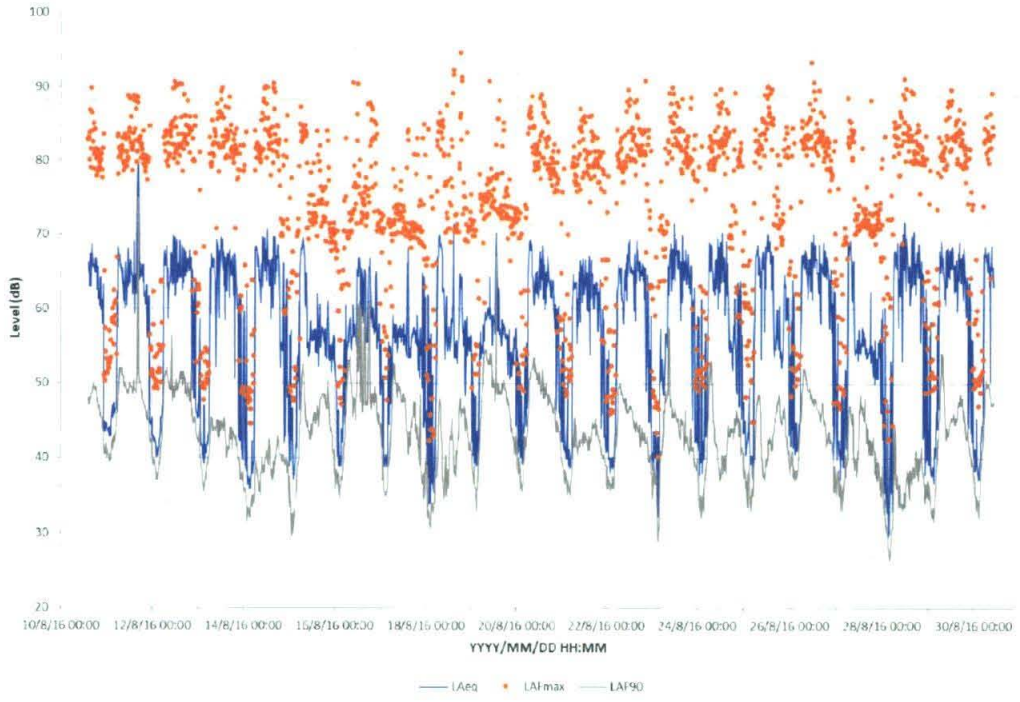


Table 13D-4: Location AS07, long-term noise monitoring results, September 2016

Date	$L_{Aeq,16h}$ (dB)	$L_{AF90,day}$ (dB)	$L_{Aeq,8h}$ (dB)	$L_{AF90,night}$ (dB)
2016/09/14	59	42	57	41
2016/09/15	64	46	56	41
2016/09/16	63	47	56	40
2016/09/17	63	44	58	40
2016/09/18	64	45	57	39
2016/09/19	64	44	57	39
2016/09/20	62	44	58	42
2016/09/21	64	48	58	44
2016/09/22	64	50	56	44
2016/09/23	65	51	59	50
2016/09/24	62	50	58	43
2016/09/25	64	48	58	43
2016/09/26	64	46	58	42
2016/09/27	63	50	48	45
Average	63	47	57	42
Range	59 - 65	42 - 51	48 - 59	39 - 50

Figure 13D-3: Location AS07, long-term noise monitoring time history, September 2016

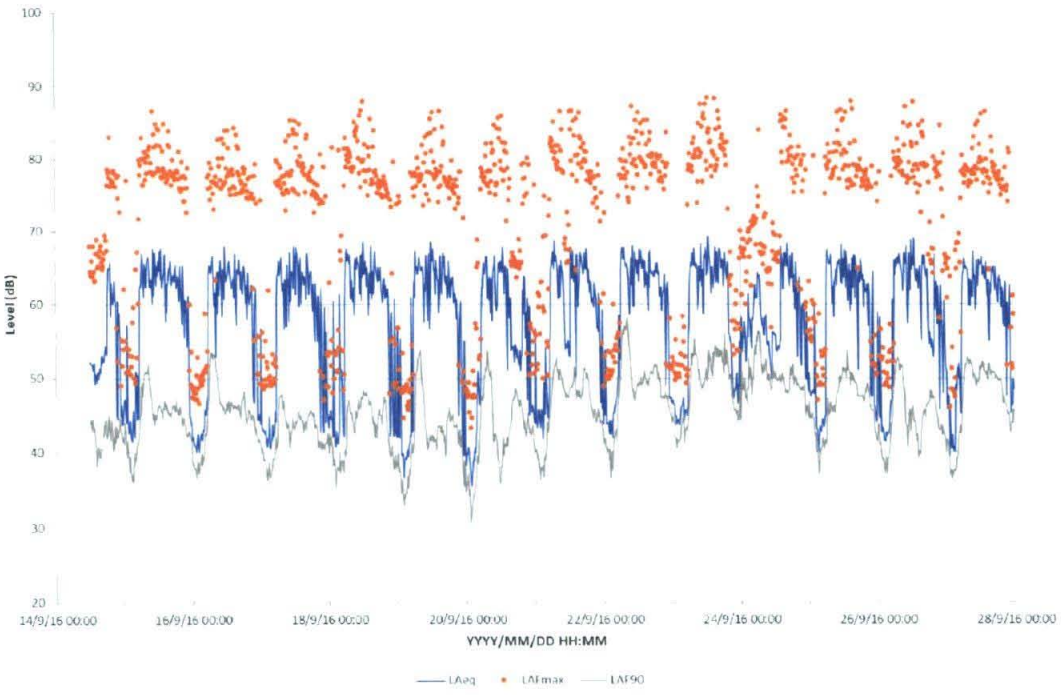


Table 13D-5: Location AS08, long-term noise monitoring results

Date	$L_{Aeq,16h}$ (dB)	$L_{AF90,day}$ (dB)	$L_{Aeq,8h}$ (dB)	$L_{AF90,night}$ (dB)
2016/08/10	49	40	46	38
2016/08/11	51	43	44	35
2016/08/12	51	44	43	34
2016/08/13	49	37	45	27
2016/08/14	54	34	45	31
2016/08/15	48	41	44	35
2016/08/16	49	42	45	36
2016/08/17	49	41	41	31
2016/08/18	46	37	47	37
2016/08/19	52	45	47	38
2016/08/20	53	45	42	33
2016/08/21	48	39	45	37
2016/08/22	48	39	42	34
2016/08/23	48	38	46	29
2016/08/24	48	37	45	32
2016/08/25	49	39	43	33
2016/08/26	49	40	45	31
2016/08/27	51	37	41	28
2016/08/28	46	33	45	28
2016/08/29	50	40	42	31
2016/08/30	50	43	-	-
Average	50	40	44	33
Range	46 - 54	33 - 45	41 - 47	27 - 38

Figure 13D-4: Location AS08, long-term noise monitoring time history

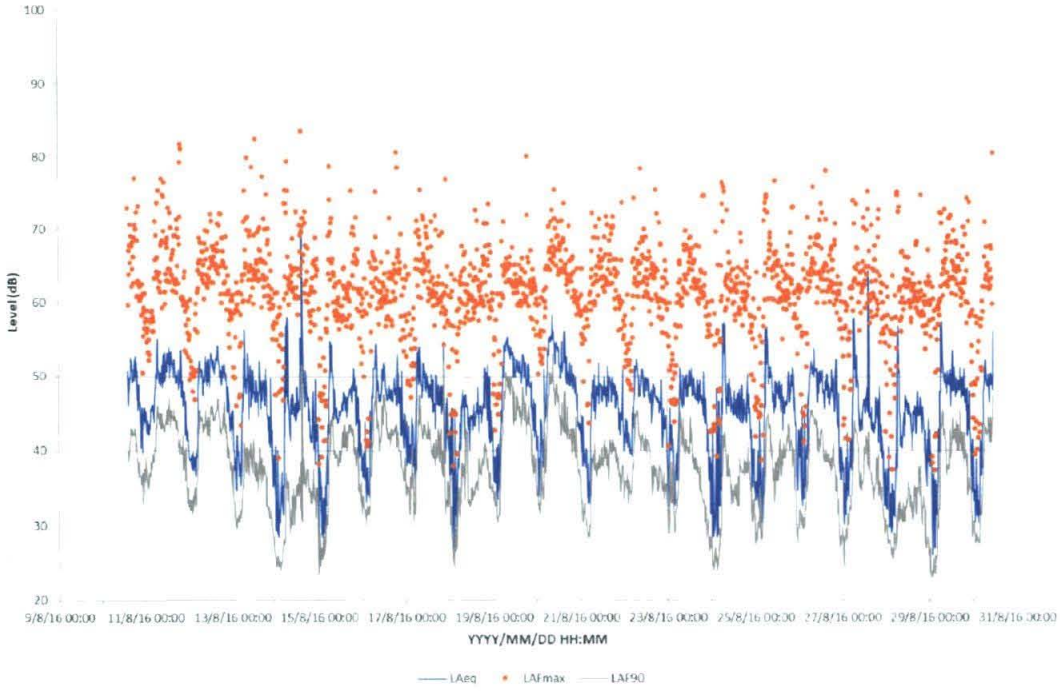


Table 13D-6: Location AS09, long-term noise monitoring results

Date	$L_{Aeq,16h}$ (dB)	$L_{AF90,day}$ (dB)	$L_{Aeq,8h}$ (dB)	$L_{AF90,night}$ (dB)
2016/08/18	56	38	49	35
2016/08/19	57	47	46	40
2016/08/20	53	45	43	35
2016/08/21	46	39	43	35
2016/08/22	53	39	45	29
2016/08/23	47	38	42	30
2016/08/24	49	37	41	30
2016/08/25	54	38	42	32
2016/08/26	47	39	39	30
2016/08/27	52	37	41	32
2016/08/28	44	34	41	29
2016/08/29	47	40	41	30
2016/08/30	49	41	42	34
2016/08/31	55	41	42	31
2016/09/01	50	42	42	33
2016/09/02	50	41	42	33
2016/09/03	51	41	42	33
2016/09/04	48	37	50	41
2016/09/05	49	41	43	35
2016/09/06	58	44	-	-
Average	52	40	44	33
Range	44 - 58	34 - 47	39 - 50	29 - 41

Figure 13D-5: Location AS09, long-term noise monitoring time history

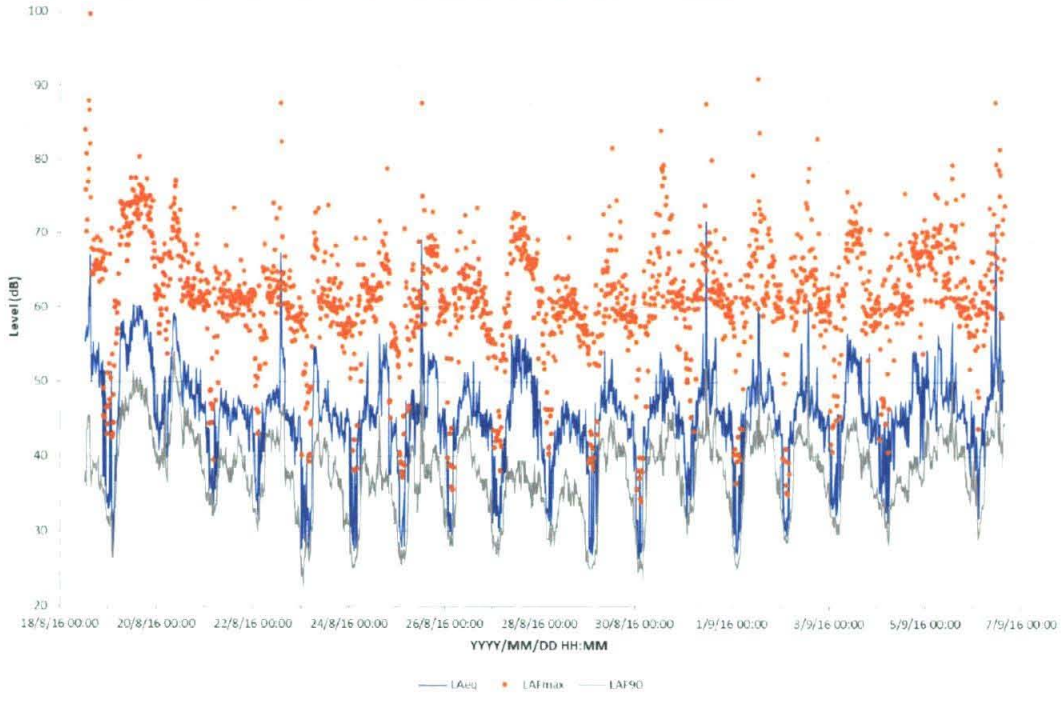


Table 13D-7: Location AS10, long-term noise monitoring results

Date	$L_{Aeq,16h}$ (dB)	$L_{AF90,day}$ (dB)	$L_{Aeq,8h}$ (dB)	$L_{AF90,night}$ (dB)
2016/08/10	54	46	49	43
2016/08/11	55	47	48	41
2016/08/12	55	46	50	40
2016/08/13	53	43	50	37
2016/08/14	55	38	47	32
2016/08/15	61	43	56	36
2016/08/16	61	44	56	36
2016/08/17	62	42	49	37
2016/08/18	60	39	56	37
2016/08/19	62	47	49	39
2016/08/20	56	48	51	41
2016/08/21	54	44	50	40
2016/08/22	55	43	56	30
2016/08/23	56	43	50	41
2016/08/24	57	40	48	34
2016/08/25	58	41	51	42
2016/08/26	54	44	48	33
2016/08/27	61	38	48	32
2016/08/28	53	38	49	39
2016/08/29	54	43	49	38
2016/08/30	54	46	-	-
Average	58	43	52	37
Range	53 - 62	38 - 48	47 - 56	30 - 43

Figure 13D-6: Location AS10, long-term noise monitoring time history

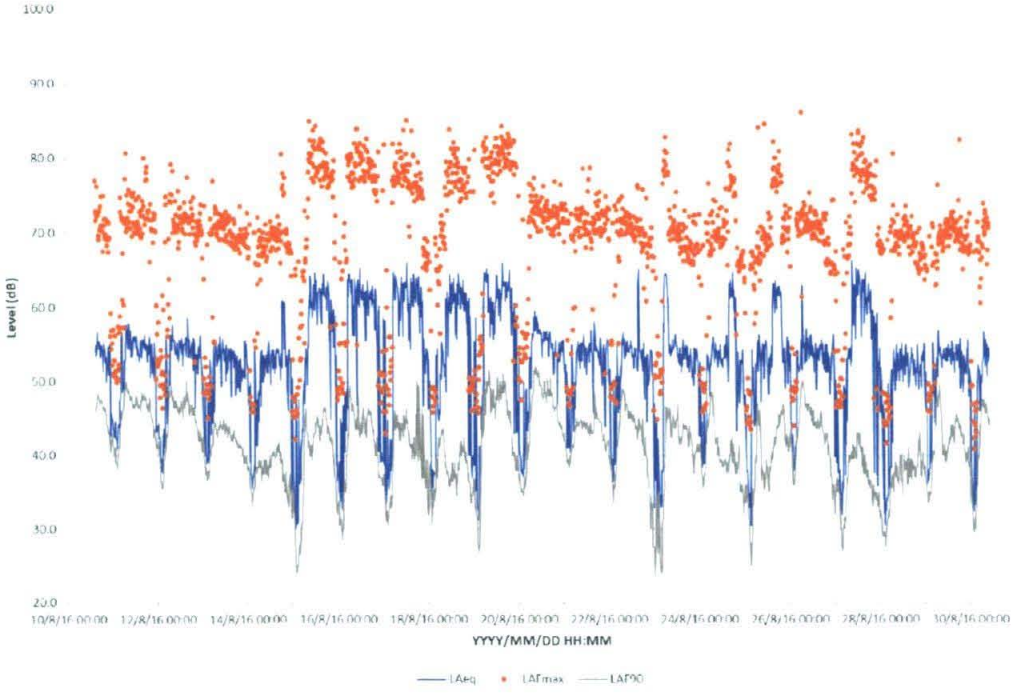
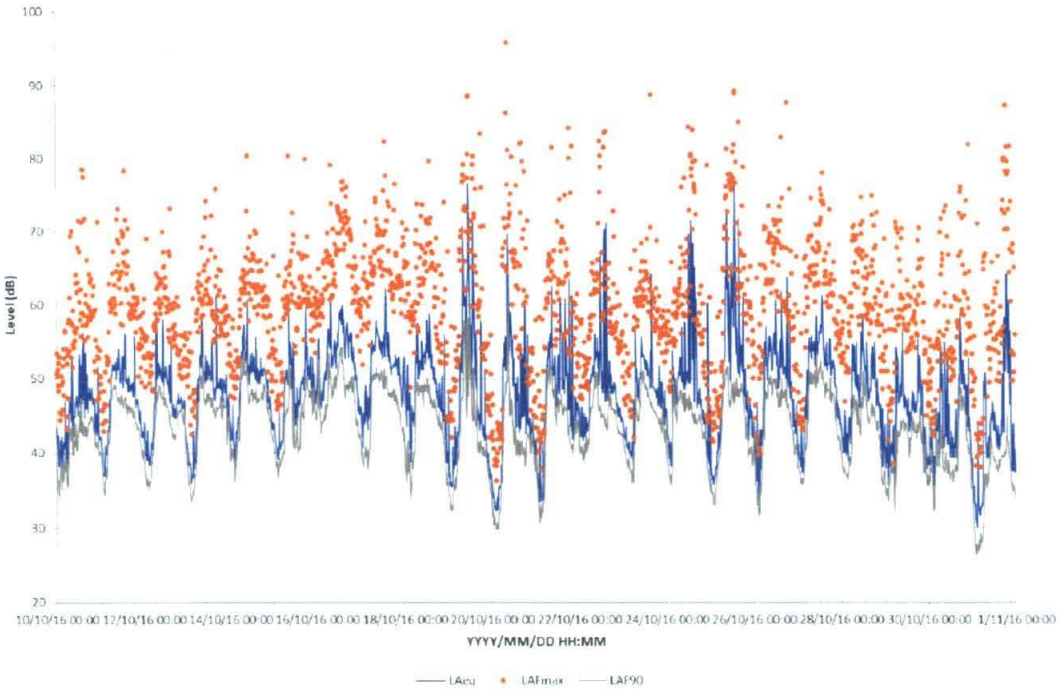


Table 13D-8: Location AS11, long-term noise monitoring results

Date	$L_{Aeq,16h}$ (dB)	$L_{AF90,day}$ (dB)	$L_{Aeq,8h}$ (dB)	$L_{AF90,night}$ (dB)
2016/08/12	48	43	44	40
2016/08/13	51	46	43	39
2016/08/14	50	45	43	38
2016/08/15	51	47	47	42
2016/08/16	52	48	44	40
2016/08/17	52	46	51	46
2016/08/18	56	49	48	41
2016/08/19	55	49	48	40
2016/08/20	52	46	43	36
2016/08/21	63	45	40	33
2016/08/22	57	43	44	37
2016/08/23	55	46	45	41
2016/08/24	58	46	43	39
2016/08/25	52	46	47	42
2016/08/26	61	45	47	37
2016/08/27	63	47	46	38
2016/08/28	54	47	47	40
2016/08/29	54	48	45	39
2016/08/30	51	45	44	36
2016/08/31	48	42	44	38
2016/09/01	49	41	40	30
2016/09/02	53	39	39	35
Average	51	45	45	38
Range	48 - 63	39 - 49	39 - 51	30 - 46

Figure 13D-7: Location AS11, long-term noise monitoring time history



Noise Environment Description

13D.3.10 This section describes the general noise environment in the vicinity of the unattended monitoring locations based on observations made on site and the results presented in Table 13D-2. Reference is made below to ambient noise levels, depicted by the $L_{Aeq,T}$ index, and background noise levels, depicted by the $L_{A90,T}$ index.

West (Location AS07)

13D.3.11 The area west of the airport contains further rural areas with smaller residential neighbourhoods. Aircraft noise dominated St Margaret's with daytime ambient noise levels of 64 dB and background noise levels ranging from 45 dB – 47 dB. The night-time ambient noise levels ranged between 57 dB – 59 dB and background noise levels ranged between 39 dB – 42 dB. The surrounding road network consisting of N2 and R135 were also audible. Aircraft noise was measured under both easterly and westerly modes of operation at the airport.

North West (Location AS08)

13D.3.12 The area north west of the airport contains further rural areas with smaller residential neighbourhoods. The area is generally quieter than other locations around the airport with the daytime ambient and background noise levels, measured at 50 dB $L_{Aeq,T}$ and 40 dB $L_{A90,T}$. The night-time ambient and background noise levels were around 44 dB and 33 dB. The surrounding road network consisting of N2 and R135 were also audible. Aircraft noise at this location was not considered dominant.

East (Locations AS09 & AS10)

13D.3.13 The area east of the Dublin airport, at a distance of approximately 2.5 km contains rural areas with smaller residential neighbourhoods located away from busy roads. The area is generally quieter than other locations around the airport with the daytime ambient and background noise levels, measured at location As10, of around 58 dB $L_{Aeq,T}$ and 43 dB $L_{A90,T}$. The night-time ambient and background noise levels were around 52 dB and 37 dB. Aircraft noise was occasionally dominant. For Portmarnock Community School (AS09), approximately 6.5km away from Dublin airport, which was closed for the summer holidays during the survey, a similar result was evident with daytime ambient and background noise levels of around 52 dB $L_{Aeq,T}$ and 40 dB $L_{A90,T}$. At night, the ambient and background levels were around 44 dB and 33 dB. Aircraft noise at this location was not considered dominant.

North (Location AS11)

13D.3.14 River Valley is a residential area located just under 2 km north of the airport. The R132 and M1 are located approximately 1km and 2.5km from measurement location M. Daytime ambient and background noise levels ranged between 48 dB – 63 dB $L_{Aeq,T}$ and 39 dB – 49 dB $L_{A90,T}$ respectively. Night-time ambient noise levels ranged between 39 – 51 dB and background noise levels ranged between 30 – 46 dB. Local road traffic was generally the dominant noise source.

daa Permanent Noise Monitoring Terminal Results

13D.3.15 This section describes the locations of the permanent noise monitors in place and operating in the vicinity of Dublin Airport. Results are presented for each noise monitor over the period commencing January 2016 to the end of December 2016, describing the noise environment with and without aircraft activity. The corresponding information for the period commencing January 2018 to the end of December 2018 is also presented to highlight any trends.

13D.3.16 The location of each noise monitoring terminal (NMT) is shown in Figure 13D-8. There are currently eight permanent NMTs in the vicinity of Dublin Airport. These are located as follows:

- Bay Lane (NMT1), monitoring Runway 28 Departures & Runway 10 Arrivals
- St. Doolaghs (NMT2), monitoring Runway 10 Departures & Runway 28 Arrivals
- Bishopswood (NMT3), monitoring the local area
- Feltrim (NMT4), monitoring the local area
- Balcultry (NMT5), monitoring Runway 34 Departures & Runway 16 Arrivals
- Artane (NMT6), monitoring Runway 16 Departures & Runway 34 Arrivals
- Coast Road (NMT20), monitoring Runway 10 Departures & Runway 28 Arrivals
- North-east of the airport off the Naul Road (NMT21), monitoring noise produced by aircraft on the ground at a location close to the airport.

13D.3.17 NMT22 is a mobile NMT, currently located within the airport site, located close to the West Apron in the vicinity of the mid-western boundary of the airport. NMTs 3 and 4 have been installed in preparation for the opening of the North Runway. daa publish half yearly reports on the outputs of these NMTs, providing a summary of the aircraft noise measurements from the system. The most recent of these reports are available from the Dublin Airport website[1].

[1] https://www.dublinairport.com/corporate/community-and-sustainability/noise/airport-noise-noise-reports

Figure 13D-8: Permanent Noise Monitoring Terminals at Dublin Airport

13D.3.18

13D.3.19 Table 13D-9 presents the average measured noise level over the six-month periods from January to June and July to December 2016 inclusive at each monitor, split into daytime (07:00 to 23:00) and night time (23:00 to 07:00) periods. Also presented is the noise level produced by aircraft, i.e. the correlated aircraft noise events. Where the "total" noise level at a given monitor is close in value to the "aircraft" noise level, this indicates that the total noise is dominated by aircraft noise. Where there is a 3 dB or more difference, this indicates that some other noise source(s) dominates the noise environment at the NMT. It can be seen that only at NMTs 1 and 2 does aircraft noise dominate the total noise environment. This is to be expected given the locations of these two monitors within 4 km directly to the east and west respectively of the airport's existing main runway.

13D.3.20 These averages are not directly comparable to noise contours produced by computer modelling as noise contours are typically based on an average summer or annual day, and also include all aircraft movements rather than just those which produce a correlated noise event. Noise contours also include no other noise than that produced by aircraft.

13D.3.21 Table 13D-10 presents the average measured noise level over the six-month periods from January to June and July to December 2018 inclusive at each monitor, split into daytime (07:00 to 23:00) and night time (23:00 to 07:00) periods.

Table 13D-9: Average Measured Noise Levels (2016)

NMT	Daytime Noise Level, dB $L_{Aeq\ 16hr}$				Night Time Noise Level, dB $L_{Aeq\ 8hr}$			
	Jan-Jun 2016		Jul-Dec 2016		Jan-Jun 2016		Jul-Dec 2016	
	Total	Aircraft	Total	Aircraft	Total	Aircraft	Total	Aircraft
1	63.8	62.5	63.7	62.4	58.4	57.1	58.1	57.0
2	62.4	60.7	61.8	60.3	56.8	55.4	56.8	55.6
3	62.9	49.6	-	-	54.9	47.0	-	-
4	56.6	41.5	56.8	41.2	52.1	38.3	49.7	39.4
5	54.9	49.2	55.3	48.6	57.3	48.1	51.3	49.7
6	61.6	46.7	58.1	44.2	56.5	45.5	51.6	43.4
20	63.7	57.2	62.4	54.9	57.6	52.2	56.3	50.2

Table 13D-10: Average Measured Noise Levels (2018)

NMT	Daytime Noise Level, dB $L_{Aeq\ 16hr}$				Night Time Noise Level, dB $L_{Aeq\ 8hr}$			
	Jan-Jun 2018		Jul-Dec 2018		Jan-Jun 2018		Jul-Dec 2018	
	Total	Aircraft	Total	Aircraft	Total	Aircraft	Total	Aircraft
1	63.9	62.8	64.0	62.9	58.9	57.2	58.1	56.6
2	61.1	60.5	61.9	61.1	56.5	54.9	57.5	56.5
4	57.2	46.9	55.3	43.8	54.2	36.7	51.0	33.7
5	58.3	49.5	54.8	48.5	55.1	50.2	54.3	50.4
6	57.7	45.8	60.9	48.9	58.0	45.1	59.2	47.0
20	64.3	58.7	63.4	59.6	58.6	47.7	58.9	54.8

13D.3.22 Taking the NMTs where the highest noise levels were measured these are generally consistent between the two years, and are especially for NMT1 where the differences are not more than 0.5 dB, At some of the other locations the variations are greater, for example at NMT6 where the aircraft activity is due to use of the cross runway, the amount of which is weather dependent. Despite this the overall picture presented by the results is similar with regards to where the highest noise levels occur and where aircraft noise contributes the most.

13E. Air Noise Glossary

13E.1 Acoustic Terms

Sound

13E.1.1 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.

Decibel

13E.1.2 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.

13E.1.3 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).

13E.1.4 The sound energy radiated by a source can also be expressed in decibels. The sound power is a measure of the total sound energy radiated by a source per second, in Watts (W). The sound power level L_w is expressed in decibels, referenced to 10^{-12} Watts.

Frequency

13E.1.5 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).

13E.1.6 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.

A-Weighting

13E.1.7 The sensitivity of the human ear is frequency dependent. Mid-frequency sound tends to be perceived as louder than very low- or high-frequency sound even when the decibel values are equal. Sound levels are therefore often frequency weighted to give an overall single figure value in dB(A) that accounts for the response of the human ear at different frequencies.

Ambient Noise

13E.1.8 Ambient noise, usually expressed using the $L_{Aeq,T}$ metric, is commonly understood to include all sound at any particular site over a defined period of time, regardless of whether the sound is actually defined as noise.

Background Noise

13E.1.9 Background noise, usually expressed using the $L_{A90,T}$ metric, is the steady sound attributable to less prominent and mostly distant sound sources above which clearly identifiable specific noise sources intrude.

Sound Transmission in the Open Air

13E.1.10 Most sources of sound can be characterised as a single point in space. Sound energy is radiated out in all directions and spreads over the surface area of a sphere centred on the point. The area of a sphere is proportional to the square of the radius, so the sound energy is inversely proportional to the square of the radius. This is the inverse square law. In decibel terms, for each doubling of distance from a point source the sound pressure level is reduced by 6 dB.

13E.1.11 Road traffic noise is a notable exception to this rule, as it approximates to a line source. The sound energy radiated is inversely proportional to the area of a cylinder centred on the line. In decibel terms, every time the distance from a line source is doubled, the sound pressure level is reduced by 3 dB.

Factors Affecting Sound Transmission in the Open Air

Reflection

13E.1.12 When sound waves encounter a hard surface, such as concrete, brickwork, glass, timber, or plasterboard, they are reflected from it. As a result, the sound pressure level measured immediately in front of a building façade is approximately 3 dB higher than it would be in the absence of the façade.

Screening

13E.1.13 If a solid screen is introduced between a source and receiver, interrupting the sound path, a reduction in sound level is experienced. Although this reduction is limited by diffraction of the sound around the edges of the screen, it can still provide valuable noise attenuation. For example, a timber boarded fence built next to a motorway can reduce noise levels on the land immediately beyond by around 10 dB. The best results are obtained when a screen is situated close to the source or close to the receiver.

Meteorological Effects

13E.1.14 Temperature and wind gradients affect noise transmission, especially over large distances. The wind effects range from increasing the level by typically 2 dB downwind, to reducing it by typically 10 dB upwind – or even more in extreme conditions. Temperature and wind gradients are variable and difficult to predict.

Noise Metrics

13E.1.15 Where noise levels vary with time, it is necessary to express the sound level over a period of time in statistical terms. Some commonly used descriptors follow.

$L_{Aeq,T}$

13E.1.16 $L_{Aeq,T}$, or the equivalent continuous A-weighted sound pressure level, is the most widely used noise metric. It is an energy average and is defined as the level of a notional sound which would deliver the same A-weighted sound energy as the actual variable sound over a defined period of time, T.

13E.1.17 $L_{Aeq,16h}$ and $L_{Aeq,8h}$ are commonly used to describe the daytime period (07:00 to 23:00) and night-time period (23:00 to 07:00) respectively. In the context of aircraft noise, these are typically averaged over the summer period (92 days from June 16th to September 15th inclusive) and are referred to as the summer day and summer night values.

L_{den}

13E.1.18 L_{den}, or the day-evening-night noise indicator, is a long-term average (usually annual in the context of aircraft noise) 24 hour $L_{Aeq,T}$ value where a 10 dB penalty is applied to noise at night and a 5 dB penalty is applied to noise in the evening. It is defined by the following formula:

$$L_{den} = 10 \times Log\left(\frac{12}{24} \times 10^{\left(\frac{L_{day}}{10}\right)} + \frac{4}{24} \times 10^{\left(\frac{L_{eve}+5}{10}\right)} + \frac{8}{24} \times 10^{\left(\frac{L_{night}+10}{10}\right)}\right)$$

13E.1.19 Where:

L_{day} is the A-weighted long-term average sound level for the 12 hour daytime period (07:00 to 19:00),

L_{eve} is the A-weighted long-term average sound level for the 4 hour evening period (19:00 to 23:00), and

L_{night} is the A-weighted long-term average sound level for the 8 hour night-time period (23:00 to 07:00).

$L_{A90,T}$

13E.1.20 $L_{A90,T}$ is the A-weighted sound pressure level exceeded for 90% of the time over a defined period, T, and is normally used to describe background noise.

$L_{Amax,T}$

13E.1.21 $L_{Amax,T}$ is the maximum A-weighted sound pressure level measured in a defined period, T. Normally associated with a time weighting, F (fast, $L_{AFmax,T}$) or S (slow, $L_{ASmax,T}$), which is related to the sampling speed of the measurement instrument. It is sometimes used independently of a time period, for example when describing the maximum value of a single aircraft flyover.

SEL

13E.1.22 SEL is the sound exposure level which is a measure of the total sound energy from an event such as an aircraft movement. The SEL value is the notional constant sound level that has the same amount of energy in 1 second as the original noise event has in total. This is equal to $L_{Aeq,T}$ + 10Log(T).

Nx Contours

13E.1.23 Nx contours define the area exposed to a minimum number of events with a specified maximum noise level x in a given period. For example, an N60,100 contour shows the area exposed to at least 100 noise events, each of which has a maximum noise level of at least 60 dB L_{ASmax}.

13E.2 Aviation Terms

ANCA

13E.2.1 ANCA, the Aircraft Noise Competent Authority, is the body responsible for ensuring that noise generated by aircraft activity at Dublin Airport is assessed in accordance with EU and Irish legislation.

FAA

13E.2.2 The Federal Aviation Administration (FAA) is the regulatory body for civil aviation in the United States. The FAA produces AEDT, the industry standard modelling software for aircraft noise.

AEDT

13E.2.3 The Aviation Environmental Design Tool (AEDT) is the industry standard software for the evaluation of aircraft noise in the vicinity of airports based on aircraft type, operation, route, flight profile and terrain.

NMT

13E.2.4 A noise monitoring terminal (NMT) is a fixed or mobile station with the appropriate instrumentation to measure aircraft noise in the vicinity of an airport on a long-term basis.

NFTMS

13E.2.5 A noise and flight track monitoring system (NFTMS) comprises a network of NMTs that record and correlate noise data with individual flights by use of other airport logged flight telemetry, such as radar data.

Start of roll

13E.2.6 The position on a runway where aircraft commence their take-off procedure.

Runway arrival threshold

13E.2.7 The beginning of the portion of the runway usable for landing.

Appendices: 14A-E

Ground Noise and Vibration

14A. Legislation, policy, technical guidelines and assessment criteria relevant to ground noise

14A.1 Introduction

14A.1.1 This appendix of the Environmental Impact Assessment Report (EIAR), prepared by Bickerdike Allen Partners LLP, sets out details of the legislation and planning policy considered relevant to the assessment.

14A.1.2 Chapter 6 of the EIAR contains details of the strategic planning context, national planning policy, and local planning policy. Further details of the strategic planning context are given in Section 14A.2. Relevant UK policy, standards and guidance are considered in Section 14A.3, and other international policy, standards and guidance in Section 14A.4.

14A.1.3 There are various noise metrics available for the assessment of the impacts of ground noise. These are described in detail in Section 14A.5.

14A.1.4 The derivation of the effect scales used in the ground noise assessment are discussed in Section 14A.6.

14A.2 Strategic Planning Context

S.I. No. 549/2018– Environmental Noise Regulations 2018

14A.2.1 This Statutory Instrument gives effect to Directive (EC) 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise, as amended by Commission Directive (EU) 2015/996 of 19 May 2015 establishing common noise assessment methods.

14A.2.2 The regulations are to be known as the European Communities (Environmental Noise) Regulations 2018 and came into operation on the 31 December 2018. They require the production of strategic noise maps for set agglomerations, major roads, major railways, and major airports. They also require the production of subsequent action plans.

EU Regulation 598/2014

14A.2.3 The European Commission introduced EU Regulation 598/2014[1] in 2016 to account for developments in the aviation world. This repeals 2002/30/EC[2] which set out procedures and rules for the introduction of noise related operating restrictions to the busiest of the European airports. This previous regime for managing airport noise placed the responsibility with the airport operator. The entry into force in 2016 of EU Regulation 598/2014 represents a shift in responsibility from the airport operator to a separate, independent statutory entity or competent authority to oversee the delivery of the new, more prescriptive approach to airport noise management.

14A.2.4 There are seven key elements of the new regulatory regime which are:

- Designation of a separate, independent statutory entity as the Competent Authority;

[1] European Commission (2014). 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, [online]. Available at: https://publications.europa.eu/en/publication-detail/-/publication/b6947ca7-f1f6-11e3-8cd4-01aa75ed71a1/language-en [Checked 21/08/2018].

[2] European Commission (2002), Directive 2002/30/EC Directive of the European Parliament and the Council of 26th March 2002 on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Community airports [online]. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32002L0030&from=EN [Checked 21/11/2018].

- Appropriate collaborative working arrangements;
- Robust consultation requirements;
- Adhere to the ICAO Balanced Approach;
- Compliance with Environmental Impact Assessment (EIA), Habitats & Birds, and the Environmental Noise Directives;
- Establishment of an appropriate, robust appeal mechanism, and
- Ongoing monitoring and enforcement activities.

14A.2.5 Regulation (EU) No 598/2014 under Article 5 requires that member states shall ensure that the Balanced Approach is adopted in respect of aircraft noise management at those airports where a noise problem has been identified. To that end, they shall ensure that the Noise Abatement Objective (NAO) for that airport is defined. This then allows the measures available to reduce the noise impact to be identified, and the likely cost-effectiveness of the noise mitigation measures to be thoroughly evaluated.

Aircraft Noise (Dublin Airport) Regulation Act, 2019

14A.2.6 The Aircraft Noise (Dublin Airport) Regulation Act 2019 (The Aircraft Noise Act) implements EU Regulation 598/2014 on the establishment of rules and procedures with regard to the introduction of noise related operating restrictions at European Union Airports within the Balanced Approach.

14A.2.7 The Aircraft Noise Act amends the Planning and Development Act 2000 as amended, to cater for the situation where development at Dublin Airport may give rise to an aircraft noise problem and where an airport wishes to apply to revoke, amend or replace operating restrictions at the airport.

14A.2.8 The Aircraft Noise Act was enacted on 22nd May 2019. It was subsequently amended on 1st September 2019, following the removal of Airport infrastructure from the Seventh Schedule of the PDA and thus the strategic infrastructure development planning process is no longer applicable to it.

14A.2.9 Fingal County Council has been designated as the competent authority for the purposes of aircraft noise regulation at Dublin Airport by section 3(1) of the Aircraft Noise (Dublin Airport) Regulation Act 2019.

14A.2.10 The Aircraft Noise Act amends the PDA by inserting a number of new sections in Part 3 of the PDA, which deals with control of development. These sections introduce a number of new measures for planning applications at Dublin Airport that may necessitate noise-related actions or that may require a new operating restriction.

14A.2.11 Section 34C of the PDA permits an applicant who is currently subject to a planning permission for development at the airport, that includes an operating restriction, to make an application under Section 34 of the PDA to revoke, amend, replace or take other action in respect of the operating restriction. Pursuant to Section 34C (23) of the PDA this is defined as a proposed 'Relevant Action'. In this regard, daa is enabled to make this application for a proposed relevant action as it seeks to make changes to the operating restrictions imposed by the North Runway Permission.

ICAO Balanced Approach

14A.2.12 The International Civil Aviation Organisation (ICAO) is the inter-governmental body that oversees the worldwide civil aviation industry. ICAO has adopted a set of principles and guidance, constituting the 'balanced approach' to aircraft noise management, which encourages ICAO member states to address the following points:

14A.2.13 Mitigate aviation noise through selection at a local level of the optimum combination of four key measures;

- Reducing noise at source (from use of quieter aircraft);
- Making best use of land (plan and manage the land surrounding airports);

- Introducing operational noise abatement procedures (by using specific runways, routes or procedures);
- Imposing noise-related operating restrictions (such as a night time operating ban or phasing out of noisier aircraft);

14A.2.14 Select the most cost-effective range of measures; and

14A.2.15 Not introduce noise-related operating restrictions unless the authority is in a position, on the basis of studies and consultations, to determine whether a noise problem exists and having determined that an operating restriction is a cost-effective way of dealing with the problem.

14A.2.16 As detailed in the ANCA report titled Aircraft Noise Mitigation at Dublin Airport, the Balanced Approach to aircraft noise management is an internationally agreed approach to managing noise at large airports. Noise reduction is explored through four principal elements with the objective to address noise problems in the most cost-effective manner, and only apply operating restrictions as a last resort measure.

14A.3 Relevant UK Policy, Standards and Guidance

National Planning Policy Framework

14A.3.1 The National Planning Policy Framework (NPPF)[3] originally published 27th March 2012 and updated in July 2018 and February 2019, sets out the UK Government's planning policies for England and how these are expected to be applied. It is designed to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth.

14A.3.2 Government's current planning policy concerning noise is embodied in the NPPF (and more specifically the Noise Policy Statement for England or NPSE). The aim of planning policies and decisions with respect to noise is addressed in paragraph 180 of the NPPF:

14A.3.3 "Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) Mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise from giving rise to significant adverse impacts on health and the quality of life;

b) *Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason;"*

14A.3.4 The above policy refers to "significant adverse impacts" and "other adverse impacts" which are not defined numerically although reference is made to further research being underway in this regard in NPSE. That research has not yet resulted in clarification on numerical levels.

Noise Policy Statement for England (2010)

14A.3.5 The Noise Policy Statement for England (NPSE)[4] provides the framework for noise management decisions to be made that ensure noise levels do not place an unacceptable burden on society. The stated aims of the Noise Policy Statement for England are to:

14A.3.6 Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development;

[3] Ministry of Housing, Communities and Local Government (2018). National Planning Policy Framework, [online]. Available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2 [Checked 21/11/2018].
[4] Defra (2010). Noise Policy Statement for England, [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69533/pb13750-noise-policy.pdf [Checked 10/04/2018].

14A.3.7 Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development, and

14A.3.8 *Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.*

14A.3.9 The NPSE introduces the concepts of NOEL (No Observed Effect Level), LOAEL (Lowest Observed Adverse Effect Level) and SOAEL (Significant Observed Adverse Effect Level). The definition of these is as follows:

14A.3.10 NOEL – No observed effect level. This is the level below which no effect can be detected;

14A.3.11 LOAEL – Lowest observed adverse effect level. This is the level above which adverse effects on health and quality of life can be detected, and

14A.3.12 SOAEL – Significant observed adverse effect level. This is the level above which significant adverse effects on health and quality of life occur.

14A.3.13 Further guidance on how planning authorities should take account of the acoustic environment and the mitigation strategies which should be applied in relation to the above terms is provided in the National Planning Practice Guidance which was published in March 2014[5].The advice is that noise above the SOAEL should be avoided using appropriate mitigation while taking into account the guiding principles of sustainable development.

14A.3.14 Where noise is between LOAEL and SOAEL, the advice is to take all reasonable steps to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. Noise in this category is described as an observed adverse effect which is noticeable and intrusive.

14A.3.15 NPSE states that it is not possible to give a single objective noise-based measure that defines a SOAEL that is applicable to all sources of noise for all situations. It acknowledges that the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It also acknowledges that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, it states that not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.

14A.3.16 Where any adverse noise effects are predicted, these are identified and if these cannot be avoided, mitigation measures are recommended to ensure no significant residual effects on health and quality of life arise. This approach is considered consistent with the principal aims of the NPSE. It is important to note that findings against the LOAEL and SOAEL are measures of the effect of noise on health and quality of life, and not environmental impact assessment findings.

14A.3.17 As well as assisting with the interpretation of the NPSE, the Planning Practice Guidance provides a web-based resource in support of the NPPF. The Planning Practice Guidance states (Noise, paragraph 3) that local planning authorities should take account of the acoustic environment and in doing so consider *"whether or not a significant adverse effect is occurring or likely to occur, whether or not an adverse effect is occurring or likely to occur, and whether or not a good standard of amenity can be achieved."*

14A.3.18 The guidance advises on how planning can manage potential noise impacts in new development and provides a series of guidelines that are in line with the NPPF and the Noise Policy Statement for England. Paragraph 5 provides guidance on how to recognise when noise could be a concern. It advises that as noise increases beyond the lowest observed level noise it can start to cause small changes in behaviour and attitude, for example, having to turn up the volume on the television or needing to speak more loudly to be heard. It states that where noise could have an adverse effect consideration needs to be given to mitigating and minimising those effects (taking account of the economic and social benefits being derived from the activity causing the noise).

[5] Defra (2014). National Planning Policy Guidance, Planning Practice Guidance, Noise, [online] Available at: https://www.gov.uk/guidance/noise--2 [Checked 21/08/2018].

14A.3.19 The guidance includes a table that summarises the noise exposure hierarchy based on the likely average response. This is reproduced in Table 14A-1.

Table 14A-1: Noise exposure hierarchy based on the likely average response

Perception	*Examples of Outcomes*	*Increasing Effect Level*	*Action*
Not present	*No Effect*	***No Observed Effect***	***No specific measures required***
	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
	Lowest Observed Adverse Effect Level		
Present and Intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
	Significant Observed Adverse Effect Level		
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

14A.3.20 The guidance advises that above the significant observed adverse effect level boundary, the planning process should be used to avoid this effect occurring, by use of appropriate mitigation such as by altering the design and layout. Such decisions must be made taking account of the economic and social benefit of the activity causing the noise, but it is undesirable for such exposure to be caused.

14A.3.21 At the highest extreme, noise exposure would cause extensive and sustained changes in behaviour without an ability to mitigate the effect of noise. The impacts on health and quality of life are such that regardless of the benefits of the activity causing the noise, this situation should be prevented from occurring.

National Planning Practice Guidance

14A.3.22 The National Planning Practice Guidance is a web based resource which supports the National Planning Policy Framework (NPPF). Further details are given above under the Noise Policy Statement for England (2010).

UK Aviation Policy Framework (2013)

14A.3.23 The Aviation Policy Framework (APF) was published in March 2013[6] by the Department for Transport (DfT). The APF defines the Government's objectives and policies on the impacts of aviation in the UK.

[6] Department for Transport (2013). Aviation Policy Framework. [online]. Available at: https://www.gov.uk/government/publications/aviation-policy-framework [Checked 19/03/2018].

14A.3.24 On managing aviation's environmental impacts, and specifically noise, it states in paragraph 3.12 that the Government's overall objective on noise is to *"Limit and where possible reduce the number of people in the UK significantly affected by aircraft noise"*.

14A.3.25 It goes on in paragraph 3.13 to state that *"This is consistent with the Government's Noise Policy, as set out in the Noise Policy Statement for England (NPSE) which aims to avoid significant adverse impact on health and quality of life."*

14A.3.26 Guidance is provided on the noise metric used to rate airborne noise in paragraph 3.13 where it states *"To provide historic continuity, the Government will continue to ensure that noise exposure maps are produced for the noise-designated airports on an annual basis providing results down to a level of 57 dB LAeq,16hour"*.

14A.3.27 The noise index is described in a footnote as *"the A-weighted average sound level over the 16 hour period of 07:00-23:00. This is based on an average summer day when producing noise contour maps at the designated airports."*

14A.3.28 In paragraph 3.17 the interpretation of the contour is given as *"We will continue to treat the 57 dB LAeq,16h contour as an average level of day time aircraft noise marking the approximate onset of significant community annoyance. However, this does not mean that all people within this contour will experience significant adverse effects from aircraft noise. Nor does it mean that no-one outside of this contour will consider themselves annoyed by aircraft noise."*

14A.3.29 Under the heading "Noise insulation and compensation" the APF states that:

14A.3.30 "The Government continues to expect airport operators to offer households exposed to levels of noise of 69 dB LAeq,16h or more, assistance with the cost of moving.

14A.3.31 *The Government also expects airport operators to offer acoustic insulation to noise sensitive buildings, such as schools and hospitals, exposed to levels of noise of 63 dB LAeq,16h or more. Where acoustic insulation cannot provide an appropriate or cost-effective solution, alternative mitigation measures should be offered."*

BS 8233:2014 Sound insulation and noise reduction in buildings – code of practice

14A.3.32 The British Standard BS8233:2014 Sound insulation and noise reduction for buildings – Code of practice[7] provides guidance on the control of external noise. The standard presents a number of design ranges for indoor noise levels for different types of space.

14A.3.33 The internal ambient noise guideline levels for dwellings are given in Table 14A-2.

Table 14A-2: Dwelling noise exposure hierarchy based on the likely average response

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16h}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16h}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16h}$	30 dB $L_{Aeq,8h}$

14A.3.34 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or L_{AFmax}, depending on the character and number of events per night. Sporadic noise events could require separate values.

14A.3.35 These guideline noise levels can be used for rooms for residential purposes including hotels, hostels, halls of residence, school boarding houses, hospices and residential care homes.

[7] British Standards Institution (2014). BS 8233:2014 Sound insulation and noise reduction for buildings – Code of practice. [Online]. Available at: https://shop.bsigroup.com/ProductDetail/?pid=000000000302415 79&_ga=2.85437209.1462736480.1535108011-979344642.1535108011 [Checked: 24 /08/2018].

14A.3.36 BS8233:2014 also gives guideline ambient noise levels in non-domestic buildings. These are given in Table 14A-3.

Table 14A-3: Non=domestic noise exposure hierarchy based on the likely average response

Activity	Location	Design range $L_{Aeq,T}$ (dB)
Speech or telephone communications	Department store, cafeteria, canteen, kitchen	50 to 55
	Concourse, corridor, circulation space	45 to 55
Study and work requiring concentration	Library, gallery, museum	40 to 50
	Staff/meeting room, training room	35 to 45
	Executive office	35 to 40
Listening	Place of worship, counselling, meditation, relaxation	30 to 35

Department of Education - Acoustic design of schools: performance standards BB93 (2015)

14A.3.37 The Department of Education's BB93[8] gives upper limits for indoor ambient noise level in terms of $L_{Aeq,30min}$ for new and refurbished schools, and schools formed by a material change of use, are as follows:

- Classroom and general teaching area - 35 dB $L_{Aeq,30min}$; and
- Teaching space (special communication needs) - 30 dB $L_{Aeq,30min}$.

14A.3.38 For classrooms and teaching spaces with natural ventilation, these levels can be achieved if the external noise level does not exceed 55 dB $L_{Aeq,30min}$.

14A.3.39 These standards, while not required by legislation to be achieved within those existing schools built prior to their introduction, provide a guide to determine potential impacts on existing schools.

Department of Health - Specialist Services, Health Technical Memorandum 08-01: Acoustics (2013)

14A.3.40 Guidance on recommended internal noise levels for healthcare facilities is given in the Department of Health's HTM 08-01[9]. This recommends internal noise levels for healthcare facilities as follows:

- Hospital wards, daytime - 40 dB $L_{Aeq,1h}$;
- Hospital wards, night - 35 dB $L_{Aeq,1h}$;
- Hospital wards, night - 45 dB $L_{Amax,F}$;
- Operating theatres, night - 40 dB $L_{Aeq,1h}$; and
- Operating theatres, night - 50 dB $L_{Amax,F}$.

14A.3.41 The L_{Amax} limit is applicable to events that occur several times during the night (for example passing trains) rather than sporadic events.

14A.3.42 These criteria would be relaxed for emergency situations and sporadic events subject to agreement by the local authority or other relevant body.

[8] Department of Education (2015). Acoustic design of schools: performance standards Building bulletin 93, [Online]. Available at: https://www.gov.uk/government/publications/bb93-acoustic-design-of-schools-performance-standards [Checked 24/08/2018]

[9] Department of Health (2013). Specialist Services, Health Technical Memorandum 08-01: Acoustics, [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/144248/HTM_08-01.pdf [Checked 24/08/2018].