ScotchPartners
Building Services Engineering | Sustainability | Acoustics

88 Kingsway

Aprirose

Noise Impact Assessment

Revision 01

02/10/2020

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Project Particulars

Client Name: Aprirose

Project Name: 88 Kingsway

Disclaimer

Revision History

Revision	Date	Prepared By	Checked By
00	14 August 2020	Kial Jackson BSc MIET MIOA	Jason Clouston BEng MSc MIOA
01	02 October 2020	Kial Jackson BSc MIET MIOA	Jason Clouston BEng MSc MIOA

Executive summary

A noise impact assessment for the plant associated with the proposed redevelopment of 88 Kingsway has been undertaken.

An external noise survey has been carried out at the site to establish the prevailing noise climate and the data has been used to assess the plant proposals against the London Borough of Camden's planning requirements.

Rooftop plant is to be installed behind acoustically rated screens and ventilation plant is to be installed with atmosphere side attenuation.

The *rating levels* at the nearest noise sensitive receivers are predicted to range between 11dB and 19dB below the prevailing background sound levels which is compliant with Camden's most onerous design threshold. The proposals are therefore considered compliant with the planning objectives of the *Camden Local Plan 2017*.

It should be noted that this assessment represents a fairly worst-case scenario as it assumes all of the plant operating simultaneously at the quietest time of the day. This is only likely to occur on the hottest and coldest days of the year. Background noise levels can also be expected to increase when lockdown measures associated with Covid-19 are removed.

Contents

1 Introduction

1.1 Works are currently underway to refurbish the commercial office spaces at 88 Kingsway and proposals have been put forward to introduce new ventilation and air conditioning plant.

1.2 It has been recognised that noise from the new equipment has the potential to disturb sensitive neighbours in the area and Scotch Partners have been instructed to undertake an acoustic assessment of the plant against the Local Authority's planning requirements.

1.3 An external noise survey has been carried out on the site to gain an understanding of the prevailing noise climate at the site and the data have been used to inform the assessment of plant noise.

1.4 A description of the external noise survey and the recorded data are provided in Chapter 2 while the assessment of the plant proposals is provided in Chapter 3.

1.5 A selection of the measurement data and definitions of some of the terminology used throughout this report are provided within the appendices. Full measurement data are available in digital format upon request.

2 External noise survey

2.1 Site description

2.1.1 88 Kingsway is an office building situated above Holborn Underground Station on the south eastern corner of the junction between Kingsway and High Holborn.

2.1.2 The building is joined by the Kingsbourne House commercial office building to the east and the walkway and motorcycle parking of Gate Street forms the southern site boundary.

2.1.3 The acoustic climate around the site is fairly typical for a Central London location and is heavily dominated by traffic on the local roads and noise from building service plant serving the surrounding buildings at high level.

2.2 Measurement methodology

2.2.1 Continuous unattended measurements were undertaken at two positions across the site. The first was to the rear of the building, overlooking the courtyard shared with Kingsbourne House, and the second was to the front, directly overlooking Kingsway. The measurement positions are shown on a satellite image of the site in Figure 2-1.

2.2.2 Measurement data from the first position are considered representative of typical ambient and background noise levels at the facades of Kingsbourne House overlooking the shared courtyard. Data from the second position are considered representative of ambient and background noise levels at neighbouring facades which overlook High Holborn and Kingsway.

2.2.3 Measurements were recorded in 15-minute samples with spectral and statistical data captured with the fast time weighting (125ms). Measurements to the rear of the building were undertaken between 13:30 on Wednesday 5th August and 13:45 on Thursday 6th August 2020. Measurements to the front of the building were recorded between 14:30 on Thursday 6th August and 14:30 on Friday 7th August 2020.

2.2.4 The following equipment was used to carry out the survey.

Equipment	Type	Serial №
Class 1 sound level meter	Norsonic 131	1312766
Environmental microphone	Norsonic 1218	12182559
Portable sound calibrator	B&K 4231	34926

Table 2-1 Survey equipment

2.2.5 The calibration of the sound level meter and associated microphone was checked prior to and on completion of the measurement period in accordance with recommended practice. No significant drift in calibration occurred during the measurement period. The accuracy of the calibrator can be traced to National Physical Laboratory Standards.

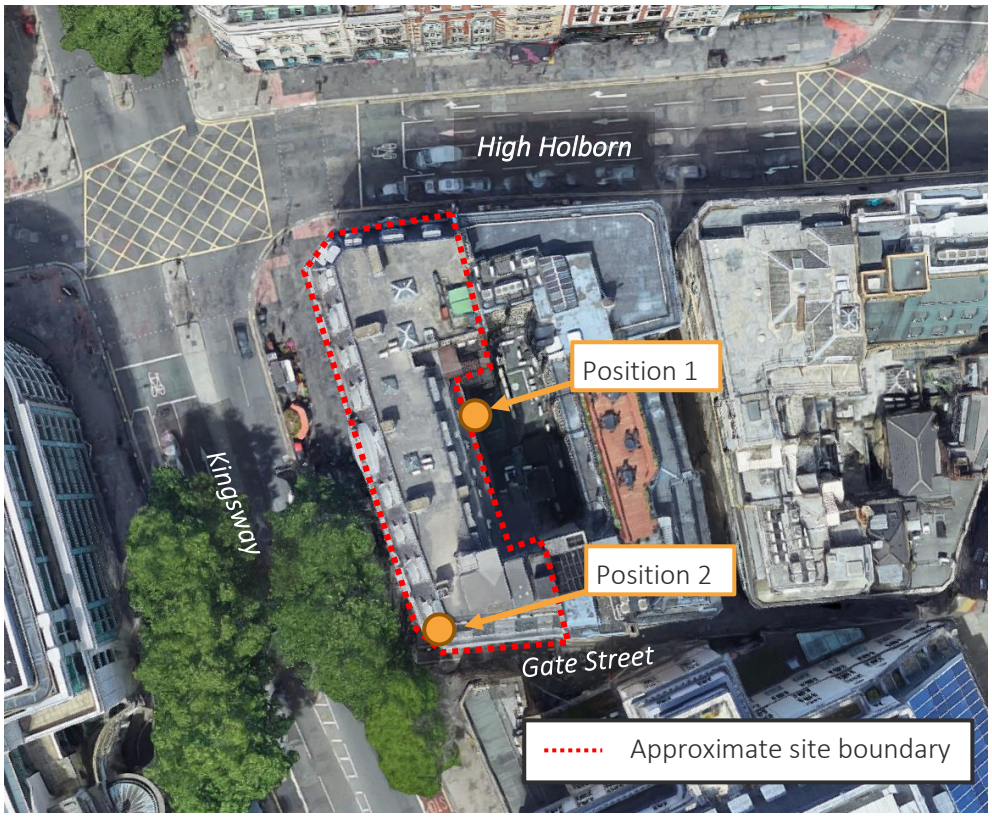

Image courtesy of Google
Figure 2-1 Site overview and measurement positions

2.3 Weather

2.3.1 Weather data during the survey has been taken from a local weather station[1] some 2.3km to the south of the site.

2.3.2 Conditions were generally clear and dry with wind speeds below 5m/s. The measurement data are not considered to have been adversely affected by the weather.

[1] Weather station: ILONDO209, Accessed via: www.wunderground.com

2.4 Data

2.4.1 A selection of the measurement data are provided in Appendix A. Graphs showing the noise level histories at each measurement position are presented below.

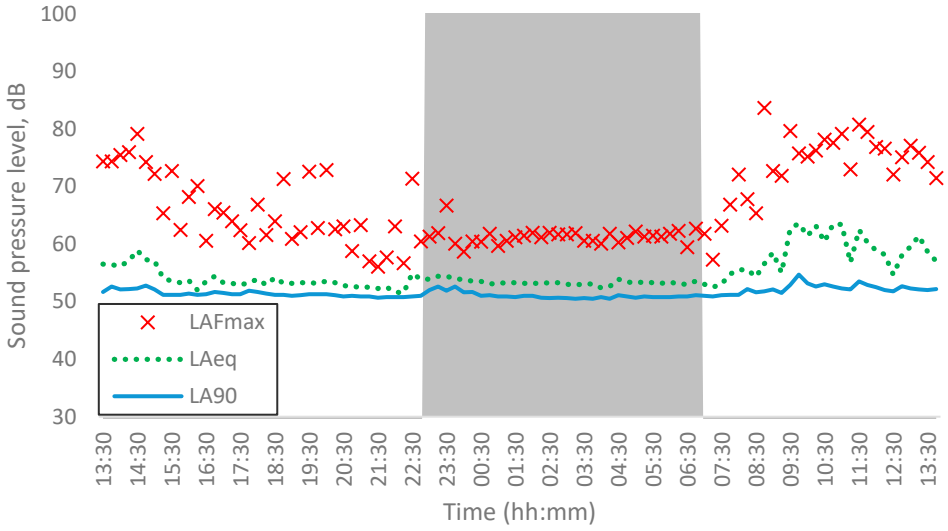

Figure 2-2 Noise level history, Position 1

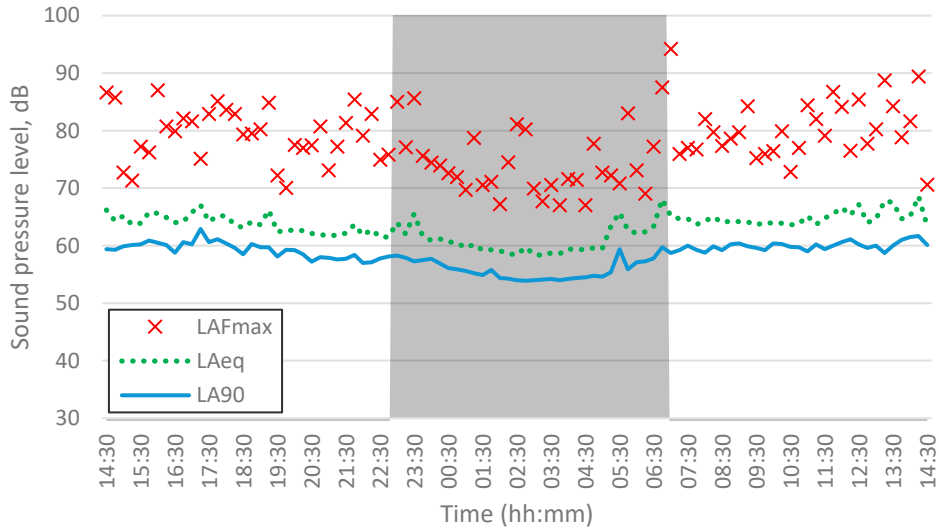

Figure 2-3 Noise level history, Position 2

2.4.2 The lowest measured background noise levels measured at each position during the daytime, evening and night-time are set down in Table 2-2.

Time	Position 1	Position 2
Daytime (07:00-19:00)	51dB $L_{A90,15min}$	59dB $L_{A90,15min}$
Evening (19:00-23:00)	51dB $L_{A90,15min}$	57dB $L_{A90,15min}$
Night (23:00-07:00)	51dB $L_{A90,15min}$	54dB $L_{A90,15min}$

Table 2-2 Lowest measured background noise levels

2.5 Commentary

2.5.1 Noise levels to the rear of the building were predominantly influenced by existing building services plant serving the adjacent buildings. This is reflected in the measurement data which show a fairly consistent background noise level throughout the day and night.

2.5.2 The acoustic climate to the front of the site is heavily dominated by road traffic comprising cars, motorcycles, light and heavy goods vehicles, buses and the occasional emergency vehicles. Kingsway and High Holborn are two major roads through Central London, serving multiple bus routes, and it can be seen from the data that there is little reduction in noise levels during the night.

2.5.3 Construction works within 88 Kingsway were expected to have some influence on the measurement data during normal working hours (08:00-17:00), but while there was an uplift in ambient and maximum noise levels measured to the rear of the building, the background noise level appears to be largely unaffected. Noise levels to the front of the building appear to be unaffected by any construction noise.

2.5.4 It should be appreciated that this survey was undertaken during the Covid-19 pandemic and even though local lockdown measures have been relaxed, it is unlikely that traffic through Central London has returned to pre-lockdown levels. In fact, footfall through the area appeared to be significantly below pre-lockdown levels. This reduction in traffic can only be expected to have reduced noise levels during the survey and this would be expected to result in a more conservative assessment of the new plant.

3 Plant noise assessment

3.1 Criteria

3.1.1 The London Borough of Camden have published their *Camden Local Plan 2017* which sets out a series of planning policies against which planning applications are assessed. Policy A4 addresses the issue of noise and reads:

> *Policy A4: Noise and Vibration*
>
> *The Council will seek to ensure that noise and vibration is controlled and managed.*
>
> *Development should have regard to Camden's Noise and Vibration Thresholds (Appendix 3). We will not grant planning permission for:*
>
> *a. development likely to generate unacceptable noise and vibration impacts; or*
>
> *b. development sensitive to noise in locations which experience high levels of noise, unless appropriate attenuation measures can be provided and will not harm the continued operation of existing uses.*
>
> *We will only grant permission for noise generating development, including any plant and machinery, if it can be operated without causing harm to amenity. We will also seek to minimise the impact on local amenity from deliveries and from the demolition and construction phases of development.*

3.1.2 The design thresholds for noise emission from fixed items of building services draw from guidance provided by the National Planning Policy Framework and are split into three "effect levels". Camden offer the following definitions for each category:

Category	Definition
Green	Lowest Observed Adverse Effect (LOAEL) where noise is considered to be at an acceptable level.
Amber	Lowest to Significant Observed Adverse Effect Level (LOAEL – SOAEL) where noise is observed to have an adverse effect but which may be considered acceptable.
Red	Significant Observed Adverse Effect Level (SOAEL) where noise is observed to have a significant adverse effect.

Table 3-1 London Borough of Camden's noise threshold definitions

3.1.3 Table 3-2 on the next page presents the Borough's objective design limits for each of the thresholds discussed above.

Assessment location	Design period	LOAEL	LOAEL to SOAEL	SOAL
Garden used for main amenity (free field) and outside living or dining or bedroom window. (façade)	Day (07:00-23:00)	*Rating level* 10dB* below background	*Rating level* between 9dB below and 5dB above background	*Rating level* greater than 5dB above background
Outside bedroom window (façade)	Night (23:00-07:00)	*Rating level* 10dB* below background and no events exceeding 57dB L_{Amax}	*Rating level* between 9dB below and 5dB above background or noise evens between 57dB and 88dB L_{Amax}	*Rating level* greater than 5dB above background and/or events exceeding 88dB L_{Amax}

*10dB should be increased to 15dB if the noise contains audible tonal elements.

**levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises.

Table 3-2 The London Borough of Camden's noise thresholds for fixed building services plant

3.1.4 The accompanying note within the Local Plan clarifies that the design criteria above are specific to dwellings and that alternative criteria may be adopted for alternative building types. However, no objective guidance is offered as to what alternative criteria would be considered acceptable.

3.1.5 It is reasonable to assume that commercial offices are less sensitive than dwellings, but a conservative approach has been taken within this assessment and the dwelling criteria have also been applied to office uses.

3.1.6 The Borough also specify that the plant *rating level* should be established in accordance with the methodology set out in British Standard 4142: 2014 *Methods for rating and assessing industrial and commercial sound.*

3.1.7 The *rating level* is derived by applying penalty corrections to the noise output from the equipment, the *specific sound level*, to account for any acoustic characteristics which may stand out against the prevailing noise climate. BS 4142 allows for the following corrections:

- Up to +6dB for any tonal components which may be perceptible by the receiver
- Up to +9dB for any impulsive elements which may be perceptible by the receiver
- +3dB if the noise source is considered intermittent
- +3dB for any other characteristics which may be readily identifiable and have not already been accounted for.

3.2 Plant proposals

3.2.1 The plant associated with the refurbishment works is to comprise 1 extract fan, 2 air handling units and 12 air source heat pumps installed within a screened enclosure at roof level. An annotated drawing of the roof layout is provided in Figure 3-1.

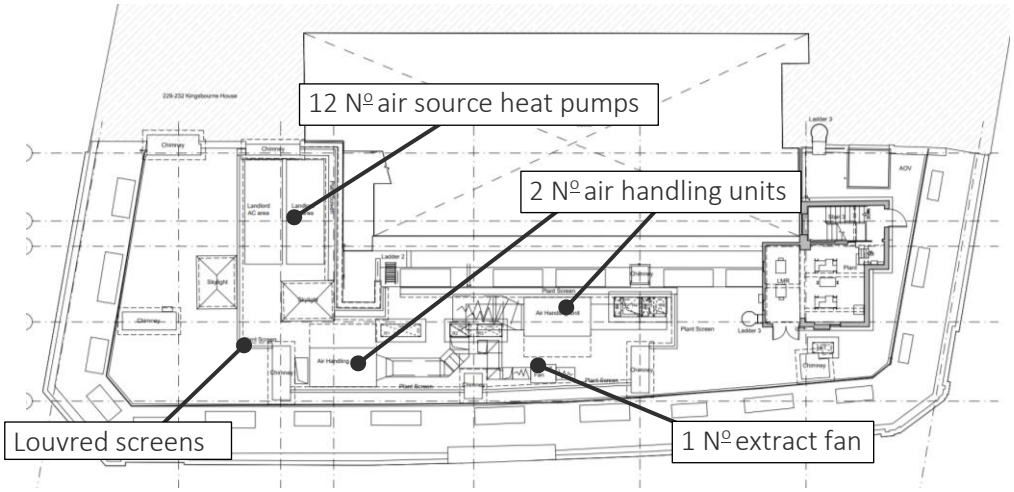

Figure 3-1 Proposed plant layout

3.2.2 At this early stage in the design, plant selections are still to be finalised but indicative noise data for the equipment, based on preliminary selections made by the MEP consultant, are set down in Table 3-3.

Equipment	Nº	Noise output
Extract fan	1	Exhaust: 79dB L_{wA} Casing breakout: 66dB L_{wA}
Air handling unit	2	Intake: 66dB L_{wA} Exhaust: 80dB L_{wA} Casing breakout: 57dB L_{wA}
Air source heat pumps	12	60dB L_{pA} at 1 metre

Table 3-3 Indicative noise data for rooftop plant

3.2.3 The exhausts of the extract fan and the southernmost air handling unit are to be installed with inline attenuation to limit their noise output to 60dB L_{pA} at 1 metre and 55dB L_{pA} at 1 metre respectively.

3.2.4 Louvred screens around the plant will terminate above the installed height of the plant and will be acoustically rated. Outward facing screens to the north, west and south should achieve a minimum performance of 8dB R_w whereas inward facing screens to the east should be rated ≥18dB R_w. The lesser performance could be achieved with a 120mm deep louvre unit and the higher performance with a 300mm deep unit.

3.2.5 It is expected that any lifesaving/emergency plant will be subject to a relaxed noise limit as it is only expected to operate under emergency conditions. A limit at the nearest noise sensitive receivers some 10dB above the prevailing background noise is a commonly adopted standard for emergency plant throughout London.

3.3 Nearest noise sensitive receivers

3.3.1 The nearest noise sensitive receivers to the site have been identified as the commercial units on High Holborn to the north, the offices of Kingsbourne House to the east, the offices of Africa House to the south and the We Work offices at 138 Holborn to the west.

3.3.2 The location of these receivers in relation to the site are shown on the satellite image of the area below.

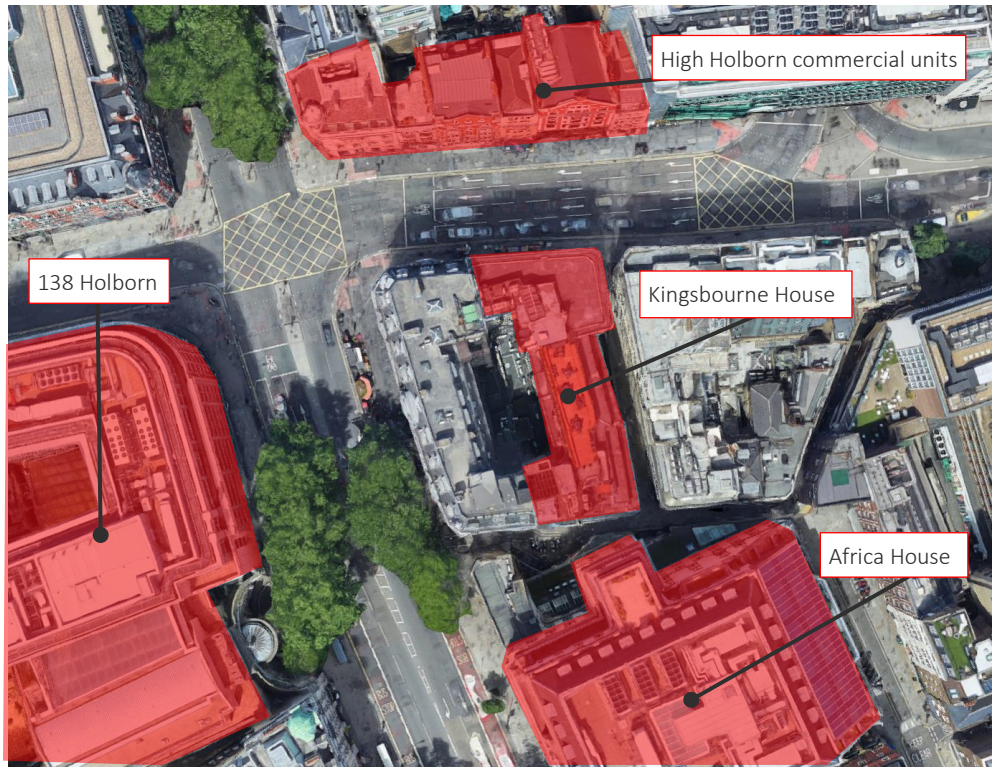

Image courtesy of Google
Figure 3-2 Location of nearest noise-sensitive receivers

3.4 Background sound levels

3.4.1 When establishing the background sound level at each receiver, a conservative approach has been taken and the lowest measured background noise levels presented in Table 2-2 have been adopted. Consideration has been given to which measurement position best represents each receiver.

3.4.2 The assumed background sound level at each receiver are presented in Table 3-4 and are based on the levels measured during the external noise survey.

Receiver	Assumed background sound level
High Holborn commercial units	54dB $L_{A90,15min}$
Kingsbourne House	51dB $L_{A90,15mins}$
Africa House	54dB $L_{A90,15min}$
138 Holborn	54dB $L_{A90,15min}$

Table 3-4 Assumed background sound levels

3.5 Predicted noise levels

3.5.1 Based on the plant layout shown in Figure 3-1 and the indicative noise data in Table 3-3, the following *specific sound levels* are predicted at each of the sensitive receivers identified in Figure 3-2.

Receiver	Predicted specific sound level
High Holborn commercial units	36dB L_{pA}
Kingsbourne House	38dB L_{pA}
Africa House	43dB L_{pA}
138 Holborn	35dB L_{pA}

Table 3-5 Predicted specific sound levels

3.5.2 As discussed in paragraph 3.1.6, Camden's design limits apply to the plant *rating level* and consideration must be given to any readily identifiable acoustic characteristics which may be associated the equipment.

3.5.3 The ventilation equipment (air handling unit and extract fan) are expected to operate continuously throughout the day without any obvious tonal or impulsive qualities and therefore, no corrections have been applied to these items.

3.5.4 The air source heat pumps are expected to operate with a soft start up mode which should mask any intermittent characteristics and while noise associated with the compressors could be considered slightly impulsive, this is expected to be masked by the numerous air source heat pumps serving the surrounding buildings. It has therefore been considered appropriate to apply no corrections to these items either and the specific sound levels in Table 3-5 can be taken as the *rating levels.*

3.6 Assessment of plant noise

3.6.1 The *rating levels* at the nearest noise-sensitive receivers are expected to range between 11dB and 19dB below the prevailing background noise levels. This is compliant with Camden's most onerous LOAEL design threshold "*where noise is considered to be at an acceptable level.*"

3.6.2 The proposals are therefore considered compliant with Camden's planning requirements.

3.6.3 It should be noted that this assessment represents a fairly worst-case scenario as it assumes all of the plant operating simultaneously at the quietest time of the day. This is only likely to occur on the hottest and coldest days of the year. Background noise levels can also be expected to increase when lockdown measures associated with Covid-19 are removed.

Appendix A – Noise level data

A selection of the measured noise level data over a representative 24-hour period are presented in the tables in this appendix. The full set of data are available in electronic form on request.

All values are sound pressure levels in dB re $2x10^{-5}$ Pa.

Time	L_{Aeq}	L_{AFmax}	L_{AFmin}	L_{A90}
13:30	56.5	74.4	50.5	51.7
13:45	56.4	74.4	50.9	52.6
14:00	56.2	75.5	50.5	52.1
14:15	57.1	76.0	50.5	52.2
14:30	58.9	79.2	50.7	52.3
14:45	57.3	74.3	50.6	52.8
15:00	57.1	72.2	50.7	52.1
15:15	54.1	65.4	50.4	51.2
15:30	53.6	72.7	50.2	51.2
15:45	53.3	62.5	50.3	51.2
16:00	53.7	68.2	50.4	51.4
16:15	52.0	70.1	50.5	51.2
16:30	53.5	60.6	50.4	51.3
16:45	54.4	66.1	50.4	51.7
17:00	53.3	65.5	50.6	51.5
17:15	53.2	64.0	50.5	51.3
17:30	52.9	62.4	50.2	51.3
17:45	53.3	60.2	50.9	51.9
18:00	53.9	66.9	50.6	51.7
18:15	52.9	61.6	50.3	51.4
18:30	54.2	64.0	50.1	51.2
18:45	53.2	71.3	50.0	51.2
19:00	53.2	60.9	49.9	51.0
19:15	53.3	62.1	50.0	51.1
19:30	53.3	72.6	50.2	51.3
19:45	53.2	62.8	50.4	51.3
20:00	53.6	72.9	50.4	51.3
20:15	53.3	62.6	49.9	51.1
20:30	52.8	63.1	50.0	50.9
20:45	52.6	58.8	50.2	51.0
21:00	52.5	63.3	49.8	50.9
21:15	52.5	57.0	50.1	50.9
21:30	52.3	56.1	49.8	50.7
21:45	52.5	57.7	49.7	50.8
22:00	51.7	63.1	49.8	50.8
22:15	51.5	56.7	49.9	50.8
22:30	54.9	71.4	49.9	50.9
22:45	53.9	60.5	49.7	51.0
23:00	53.9	61.3	50.2	52.0
23:15	54.4	61.9	51.7	52.6
23:30	54.4	66.7	50.7	51.9
23:45	54.0	60.1	50.9	52.6
00:00	53.8	58.7	50.5	51.6
00:15	53.6	60.5	49.6	51.7
00:30	53.5	60.4	49.8	51.0
00:45	53.1	61.8	49.9	51.1
01:00	53.2	59.7	49.6	50.9
01:15	53.3	60.6	50.0	50.9
01:30	53.3	61.2	49.7	50.8

Time	L_{Aeq}	L_{AFmax}	L_{AFmin}	L_{A90}
01:45	53.2	61.5	50.0	51.0
02:00	53.2	62.0	50.1	51.0
02:15	53.2	61.2	49.7	50.7
02:30	53.3	62.0	49.7	50.6
02:45	53.3	61.7	49.4	50.7
03:00	53.0	61.7	49.6	50.6
03:15	52.9	61.9	49.6	50.5
03:30	53.1	60.6	49.5	50.6
03:45	53.1	60.6	49.3	50.5
04:00	52.4	60.1	49.5	50.8
04:15	52.6	61.8	49.6	50.5
04:30	53.9	60.3	50.0	51.1
04:45	53.4	61.1	49.8	50.9
05:00	53.3	62.2	49.7	50.7
05:15	53.4	61.3	49.8	50.9
05:30	53.3	61.5	49.9	50.8
05:45	53.2	61.3	49.8	50.8
06:00	53.4	61.8	49.8	50.8
06:15	53.1	62.3	50.0	50.9
06:30	53.0	59.5	50.0	50.9
06:45	53.6	62.7	50.0	51.1
07:00	53.0	61.8	50.0	51.0
07:15	52.5	57.3	49.8	50.9
07:30	53.0	63.2	50.2	51.1
07:45	54.8	66.9	50.2	51.2
08:00	55.5	72.1	50.2	51.2
08:15	55.6	67.8	51.2	52.2
08:30	54.3	65.4	50.4	51.6
08:45	56.6	83.7	50.3	51.8
09:00	58.5	72.7	50.5	52.1
09:15	55.0	71.9	50.5	51.5
09:30	62.7	79.7	51.0	52.9
09:45	63.6	75.8	51.8	54.7
10:00	61.4	75.2	51.4	53.2
10:15	63.2	76.3	51.1	52.6
10:30	60.4	78.2	51.0	53.0
10:45	63.5	77.6	50.9	52.6
11:00	63.4	79.2	51.1	52.3
11:15	56.8	73.0	51.0	52.1
11:30	62.5	80.8	51.6	53.5
11:45	60.3	79.5	51.0	52.9
12:00	58.9	76.9	50.9	52.5
12:15	58.2	76.6	50.8	52.0
12:30	54.7	72.1	50.7	51.8
12:45	58.1	75.1	51.1	52.7
13:00	59.6	77.1	51.2	52.3
13:15	61.4	75.9	50.8	52.1
13:30	58.7	74.3	50.7	52.0
13:45				

Table A1 Statistical noise level data, Position 1

Time	L_{Aeq}	L_{AFmax}	L_{AFmin}	L_{A90}
14:30	66.2	86.6	57.1	59.4
14:45	64.3	85.7	56.1	59.3
15:00	65.2	72.7	57.0	59.9
15:15	63.7	71.3	57.3	60.1
15:30	63.9	77.2	56.1	60.2
15:45	65.8	76.2	58.4	60.9
16:00	65.6	87.0	56.0	60.5
16:15	64.9	80.7	57.3	60.1
16:30	64.0	79.9	55.3	58.8
16:45	64.2	82.1	55.9	60.6
17:00	65.8	81.6	56.5	60.2
17:15	67.1	75.1	58.5	62.9
17:30	64.2	82.9	58.9	60.6
17:45	65.2	85.1	57.9	61.1
18:00	65.2	83.6	57.8	60.4
18:15	63.6	82.9	56.0	59.6
18:30	63.1	79.3	55.8	58.5
18:45	64.2	79.5	57.0	60.3
19:00	63.6	80.2	57.1	59.7
19:15	66.2	84.8	57.6	59.7
19:30	62.4	72.2	55.4	58.1
19:45	62.7	70.0	56.4	59.3
20:00	62.7	77.5	55.3	59.2
20:15	62.6	77.0	56.1	58.5
20:30	62.1	77.4	54.6	57.2
20:45	61.9	80.7	54.6	58.0
21:00	61.8	73.1	54.7	57.9
21:15	61.8	77.2	54.6	57.6
21:30	62.2	81.3	54.9	57.7
21:45	63.7	85.4	54.6	58.4
22:00	61.8	79.1	54.6	57.0
22:15	62.8	82.9	54.5	57.1
22:30	61.5	74.9	54.5	57.8
22:45	61.5	75.8	55.0	58.1
23:00	64.0	85.0	55.6	58.3
23:15	62.0	77.1	54.5	57.9
23:30	65.5	85.6	54.3	57.3
23:45	61.7	75.6	55.0	57.5
00:00	60.9	74.4	54.8	57.7
00:15	61.2	73.9	53.7	56.9
00:30	60.7	72.6	53.6	56.1
00:45	60.5	71.9	53.7	55.9
01:00	59.6	69.7	53.4	55.6
01:15	60.2	78.7	53.4	55.2
01:30	59.2	70.5	53.3	54.9
01:45	59.3	71.1	53.9	55.8
02:00	59.1	67.2	52.9	54.4
02:15	58.6	74.5	52.6	54.3
02:30	58.4	81.1	52.5	54.0
02:45	59.7	80.2	52.4	53.9
03:00	58.5	69.9	52.3	54.0
03:15	58.3	67.7	52.3	54.1
03:30	58.7	70.5	52.1	54.2
03:45	58.6	67.0	52.3	54.0
04:00	59.4	71.6	52.6	54.2
04:15	59.4	71.4	52.7	54.4
04:30	59.3	67.0	53.0	54.5
04:45	59.6	77.7	52.6	54.8
05:00	59.5	72.7	52.8	54.6
05:15	63.4	72.2	52.8	55.4
05:30	65.8	70.8	55.8	59.4
05:45	62.7	83.0	53.7	55.9
06:00	62.2	73.1	53.8	57.1
06:15	62.4	69.0	54.3	57.3
06:30	63.3	77.2	53.7	57.8
06:45	68.1	87.5	56.7	59.7
07:00	65.1	94.2	56.1	58.7
07:15	64.7	75.9	56.5	59.2
07:30	64.7	77.0	57.5	60.0
07:45	63.7	76.7	55.5	59.3
08:00	64.3	82.0	56.3	58.8
08:15	65.0	79.7	57.2	59.9
08:30	64.0	77.3	56.4	59.2
08:45	64.3	78.6	57.6	60.2
09:00	64.2	79.7	57.0	60.4
09:15	64.1	84.2	57.4	59.9
09:30	63.6	75.2	57.0	59.6
09:45	64.0	75.9	56.4	59.2
10:00	63.9	76.4	56.0	60.4
10:15	63.9	79.9	57.1	60.3
10:30	63.6	72.8	58.0	59.8
10:45	63.8	77.0	57.3	59.7
11:00	65.2	84.4	56.1	59.0
11:15	63.7	82.0	58.2	60.2
11:30	64.8	79.1	56.5	59.4
11:45	65.5	86.7	57.6	60.0
12:00	66.6	84.1	57.3	60.6
12:15	65.3	76.5	57.4	61.1
12:30	67.2	85.4	58.6	60.2
12:45	64.0	77.7	57.6	59.6
13:00	64.6	80.2	57.9	60.0
13:15	67.8	88.7	54.9	58.7
13:30	67.5	84.2	56.1	60.0
13:45	64.7	78.8	58.6	61.0
14:00	65.1	81.6	59.3	61.5
14:15	68.6	89.4	59.9	61.7
14:30	63.4	70.6	57.9	60.1

Table A2 Statistical noise level data, Position 2

Appendix B – Terminology

This appendix provides an explanation of some of the acoustics terms used in this report.

A-weighting L_A or L_{pA}, L_{WA},	The human ear does not sense all frequencies of sound equally. Our sensitivity is at a maximum at around 2 kHz and steadily decreases above and below. Below 20 Hz and above about 20 kHz we can't hear at all. Within its operating limits a precision measurement microphone measures all frequencies the same so the output it produces does not reflect what we would actually hear. The A-weighting is an electronic filter that matches the response of a sound level meter to that of the human ear. When A-weighted the Sound Pressure Level L_p becomes L_{pA} (or L_A) and the Sound Power Level L_W becomes L_{WA}.
L_p	*The instantaneous sound pressure level* (L_p)
L_{pA} (or L_A)	*The A-weighted instantaneous sound pressure level* (L_{pA} or L_A) This is the root mean square size of the pressure fluctuations in the air. This level can fluctuate wildly even for seemingly steady sounds. To make sound level meters easier to read the values on the display are smoothed or damped out. This is effectively done by taking a rolling average of the previous 0.125 s (FAST time constant) or the previous 1 s (SLOW time constant).
L_{AF}, L_{AS}	The letters F or S are added to the subscripts in the notation to indicate when the FAST or SLOW time constant has been used. These are often omitted but it is good practice to include them.
L_{max}	*The maximum instantaneous sound pressure level* (L_{max}),
L_{Amax}	*The A-weighted maximum instantaneous sound pressure level* (L_{Amax})
L_{AFmax}	*The A-weighted maximum instantaneous sound pressure level with a FAST time constant* (L_{AFmax}).
$L_{N,T}$	*The percentage exceedance sound pressure level* ($L_{N,T}$),
$L_{AN,T}$ $L_{AFN,T}$ N = %age value, 0-100 T = measurement time eg. L_{A90}, L_{A10}, $L_{AF90,\ 5\ min}$	*The A-weighted percentage exceedance sound pressure level* ($L_{AN,T}$), *the A-weighted percentage exceedance sound pressure level with a FAST time constant* ($L_{AFN,T}$). This is the sound pressure level exceeded for N% of time period T. eg. If an A-weighted level of x dB is exceeded for a total of 6 minutes within one hour, the level will have been above x dB for 10% of the measurement period. This is written as $L_{A10,1hr}$ = x dB. L_{A0} (the level exceeded for 0 % of the time) is equivalent to the L_{Amax} and L_{A100} (the level exceeded for 100 % of the time) is equivalent to the L_{Amin}. It is good practice to include the letter which identifies the time constant used as this can make a significant difference to the value.
$L_{eq,T}$	The *equivalent continuous sound pressure level over period T* ($L_{eq,T}$), *The A-weighted equivalent continuous sound pressure level over period T* ($L_{Aeq,T}$).
$L_{Aeq,T}$ T = measurement time eg. $L_{Aeq,5min}$	This is effectively the average sound pressure level over a given period. As the decibel is a logarithmic quantity the L_{eq} is not a simple arithmetic mean value. The L_{eq} is calculated from the raw sound pressure data. It is not appropriate to include a reference to the FAST and SLOW time constants in the notation

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