CLV CONSULTING

TECHNICAL REPORT

DOUGLAS LRD RESIDENTIAL DEVELOPMENT
NOISE & VIBRATION IMPACT ASSESSMENT
DOUGLAS, CORK

For:

McCutcheon Halley
6 Joyce House
Barrack Square
Co. Cork

Report Prepared By:
Brian S. Johnson MIOA
Our Reference:
24/0997R01B
Date:
20 January 2025

Tel: +353 21 242 8704
Web: www.clvconsulting.ie
Email: info@clvconsulting.ie
Postal Address: The NSC Campus, Mahon, Cork, Ireland.

CONTENTS PAGE

1.0	Introduction	3
2.0	Proposed Development Location & Layout	3
3.0	Noise Monitoring Survey	5
3.1	Measurement Locations	5
3.2	Survey Periods	6
3.3	Personnel & Instrumentation	7
3.4	Procedure	7
3.5	Measurement Parameters	7
3.6	Measurement Results	8
4.0	Outward Noise Impact Assessment	9
4.1	Noise Emissions Criteria	9
4.2	Noise Impact Assessment Strategy Overview	13
4.3	Construction Phase	14
4.4	Operational Phase	16
4.5	Avoidance, Remedial & Reductive Measures	21
4.6	Summary of Resultant Outward Noise Impact	23
5.0	Inward Noise Impact Assessment	24
5.1	Noise Level Design Criteria	24
5.2	Initial Site Noise Risk Assessment (ADS Stage 1)	25
5.3	External Area Acoustic Design Assessment (ADS Stage 2)	27
5.4	Internal Area Acoustic Design Assessment (ADS Stage 2)	30
5.5	Summary of Inward Noise Impact	35
	APPENDIX A: NML #1 - Full Noise Monitoring Results	37
	APPENDIX B: NML #2 - Full Noise Monitoring Results	41
	APPENDIX C: Sound Level Meter Calibration Certificates	45
	APPENDIX D: Sound Level Calibrator Calibration Certificate	46

1.0 INTRODUCTION

McCutcheon Halley (on behalf of Barry's Field Ltd) is applying for planning permission in respect of a large scale residential development proposed to be located in the Douglas area of Cork. The proposed development is to consist of 2 no. apartment blocks consisting of 124 no. units and a commercial ground floor units comprising a 396m^2 area along with associated infrastructure and external amenity areas.

Following consultation with Cork City Council, the Council has requested the following:

> *The neighbouring residential properties, as well as the beer garden and telecommunications complex are noted. As such an inward and outward Noise Assessment would be required to determine noise levels and mitigation if required.*

In order to respond to this request, CLV was engaged to carry out a noise monitoring survey and inward / outward noise impact assessments for the proposed development.

The purpose of the outward noise impact assessment was to consider the potential for the proposed residential development to impact on identified noise sensitive receptors in the vicinity during both the construction and operational stages and either confirm acceptability or recommend necessary noise mitigation measures as required.

The purpose of the inward noise impact assessment was to quantify the external noise environment in the vicinity of the development buildings and determine the noise mitigation measures required to be incorporated into the design of the development in order to ensure that any potential noise impacts on the proposed development are minimised in accordance with the established criteria limits.

The following document details the results of this assessment.

2.0 PROPOSED DEVELOPMENT LOCATION & LAYOUT

As stated in the Introduction section, the proposed development is a 2-block apartment building residential development (with heights of 1 - 5 storeys) proposed to be located on an existing greenfield land area in the centre of Douglas village in Cork. The proposed development site is bordered to the east by both residential apartments buildings and dwelling), to the north by Barry's of Douglas Restaurant & Bar and a single residential dwelling, to the west by a graveyard and to the south by a telecommunications building (with additional graveyard area on the other side).

Each of the nearest noise sensitive receptors are listed along with their nearest approximate distances away from the nearest development buildings as follows:

Apartment Building to East	12m
Residential Dwellings to East	17m
Barry's of Douglas Bar	35m
Residential Dwelling to North	19m
Office Buildings to Southeast	42m
Telecommunications Building to South	12m

See Figure 1 below.



Figure 1 Proposed Development Location & Nearest Noise Sensitive Receptors

A general layout of the proposed development is provided in Figure 2 below.



Figure 2 Proposed Development Layout

3.0 NOISE MONITORING SURVEY

An environmental noise monitoring survey was conducted in order to quantify the ambient external noise environment in the vicinity of the proposed development site. The survey was conducted in general accordance with *ISO 1996-2: 2017: Acoustics - Description, measurement and assessment of environmental noise.*

Specific details are set out in the following sections.

3.1 Measurement Locations

The proposed development site is fairly small and has a limited number of both external noise sources and noise sensitive receptors located in its vicinity. The nearest noise sensitive receptors are the dwellings / apartment buildings located along the Old Carrigaline Road to the east and the dwelling located along Church Street to the north. The only significant external noise sources are the Old Carrigaline Road to the east and Barry's of Douglas Bar to the north.

Given the similar orientation of both the external noise sources and noise sensitive receptors, two measurement locations were deemed to be appropriate in order to obtain a range of the ambient noise level variance across the site in this instance as follows:

NML 1: in the vicinity of the nearest development façade to Barry's of Douglas Bar and the dwelling to the north.

NML 2: in the vicinity of the eastern boundary adjoining the Old Carrigaline Road and the adjacent dwellings / apartment buildings.



Figure 3 Site Layout Showing Approximate Position of Measurement Locations

3.2 Survey Periods

Noise monitoring was conducted over the course of two survey periods as follows:

NML 1: 12:00 hrs on 2 October 2024 - 12:00 hrs on 9 October 2024

NML 2: 13:00 hrs on 25 September 2024 - 13:00 hrs on 1 October 2024

The meteorological conditions that were observed at Cork Airport on the days of the survey period are detailed in Table 1 below.

Survey Period	Period	Wind		Temperature °C	Precipitation?
		Speed	Directional Range		
25 September 2024	Daytime	3 - 6 m/s	NW	8 - 14 °C	≈ 10 mm
	Night Time	5 - 10 m/s	NW to NNW	8 - 9 °C	-
26 September 2024	Daytime	6 - 10 m/s	NW to N	7 - 11 °C	≈ 2 mm
	Night Time	6 - 9 m/s	NNW	8 °C	-
27 September 2024	Daytime	2 - 9 m/s	W to NNW	8 - 12 °C	-
	Night Time	2 - 3 m/s	WNW	7 - 8 °C	-
28 September 2024	Daytime	1 - 5 m/s	SE to WNW	9 - 13 °C	-
	Night Time	8 - 12 m/s	SE	11 - 12 °C	≈ 10 mm
29 September 2024	Daytime	5 - 15 m/s	N to NE	12 - 14 °C	≈ 34 mm
	Night Time	4 - 9 m/s	NW	10 - 11 °C	-
30 September 2024	Daytime	4 - 8 m/s	W to NW	10 - 15 °C	-
	Night Time	3 - 7 m/s	NW to NNW	8 – 9 °C	-
1 October 2024	Daytime	3 - 6 m/s	NNW to N	9 - 15 °C	-
	Night Time	3 - 5 m/s	NNW	7 – 9 °C	-
2 October 2024	Daytime	2 - 8 m/s	NE to E	10 - 15 °C	-
	Night Time	4 - 6 m/s	ESE	12 °C	-
3 October 2024	Daytime	5 - 7 m/s	SE to SSE	13 °C	-
	Night Time	5 - 8 m/s	SSE to S	13 °C	≈ 5 mm
4 October 2024	Daytime	5 - 7 m/s	S to SSW	13 - 14 °C	≈ 7 mm
	Night Time	8 - 11 m/s	SSE	13 - 14 °C	≈ 1 mm
5 October 2024	Daytime	4 - 13 m/s	SE to S	13 - 14 °C	≈ 40 mm
	Night Time	1 - 5 m/s	S to SW	9 - 14 °C	≈ 2 mm
6 October 2024	Daytime	2 - 6 m/s	S	12 - 15 °C	≈ 3 mm
	Night Time	4 - 6 m/s	S	13 °C	-
7 October 2024	Daytime	5 - 8 m/s	ESE to S	12 - 15 °C	-
	Night Time	3 - 5 m/s	NNE to NE	9 - 11 °C	-
8 October 2024	Daytime	2 - 5 m/s	NW to N	9 - 16 °C	< 1 mm
	Night Time	4 - 7 m/s	NW to NNW	10 - 11 °C	-
9 October 2024	Daytime	5 - 7 m/s	NW to NNW	9 - 14 °C	-

Table 1 Meteorological Conditions During the Noise Surveys

3.3 Personnel & Instrumentation

Brian S. Johnson (CLV) managed the noise level monitoring. He is an internationally experienced acoustic consultant who has been working in the fields of architectural / building acoustics and noise control since 1994. He has been based in America, Europe, Asia and Australia and is a member of the Institute of Acoustics. Brian also has extensive knowledge in the field of environmental acoustics and holds a Certificate of Competence in Environmental Noise Measurements from the Institute of Acoustics.

The measurements were conducted using two Larson Davis Type LxTL1 Sound Level Meters (Serial #0004647 & #0007030). The microphones were fitted with a 90mm windshield and the microphone was positioned approximately 2.5m above the ground at each measurement location (in order to be above the existing site boundary perimeter wall). Both measurement systems were check calibrated both before and after the survey using a Larson Davis Type CA250 Acoustic Calibrator (Serial #3252).

The calibration certificates for the sound level meters and calibrator are provided in Appendices C & D respectively of this document.

3.4 Procedure

Measurements were conducted continuously over the full extent of the survey period. The sound level meters were set to average over periods that were 60 minutes in duration. The results were saved to the instrument memory for later download and analysis.

3.5 Measurement Parameters

The statistical noise monitoring results are presented in terms of the following five parameters:

- L_{Aeq} is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period. It is typically used as a descriptor for the ambient noise level.
- L_{Amax} is the instantaneous maximum sound level measured during the sample period.
- L_{Amin} is the instantaneous minimum sound level measured during the sample period.
- L_{A10} is the sound level that is exceeded for 10% of the sample period.
- L_{A90} is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.

The "A" suffix denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing. All sound levels in this report are expressed in terms of decibels (dB) relative to $2x10^{-5}$ Pa. The noise survey results are also considered in respect of the following two aspects:

Tonal Noise: Sounds which cover a range of only a few Hz which contain a clearly audible tone, i.e. distinguishable, discrete or continuous noise (whine, hiss, screech, or hum etc.) are referred to as being 'tonal'.

Impulsive Noise: A noise that is of short duration (typically less than one second), the sound pressure level of which is significantly higher than the background (pressurised air release, gunshot etc.).

3.6 Monitoring Results

The full hourly survey results for all quantities are detailed in Appendix A. However, the daytime (dB $L_{Aeq,16hr}$) and night time (dB $L_{Aeq,8hr}$) noise levels for each of the days surveyed are summarised in Tables 2 & 3 below.

Weekday	Daytime Period dB $L_{Aeq,16hr}$	Night Time Period dB $L_{Aeq,8hr}$
Monday	52.4	47.8
Tuesday	52.0	47.3
Wednesday	54.2	46.5
Thursday	51.8	48.1
Friday	54.2	48.4
Saturday	57.4	47.8
Sunday	53.3	45.9
Average	**54**	**47**

Table 2 Summary of Measured Daytime & Night Time Noise Levels at NML #1

Weekday	Daytime Period dB $L_{Aeq,16hr}$	Night Time Period dB $L_{Aeq,8hr}$
Monday	57.0	49.7
Tuesday	54.7	49.6
Wednesday	55.3	51.4
Thursday	57.9	52.8
Friday	57.4	49.0
Saturday	52.7	54.6
Sunday	60.7	51.0
Average	**57**	**52**

Table 3 Summary of Measured Daytime & Night Time Noise Levels at NML #2

As can be seen from the measurement results above, the ambient noise environment was relatively consistent across the extent of the proposed development site.

Note that it should be considered that the noise levels measured during the weekend at NML 1 was during a period when Cork was under an orange weather warning (wind and rain).

Ambient noise measurements carried out during inclement weather periods typically tend to be elevated due to wind generated noise. However, it is acknowledged that this would tend to deter Barrys of Douglas Bar patrons from occupying the beer garden. Subsequent measurements were therefore carried out at NML 1 during the weekends of Nov 22 - 24, Nov 29 - Dec 1 and Dec 6 - 8.

The average ambient noise level measured during the busiest 18:00 - 01:00hrs during these weekend periods ranged between 54 - 57dB L_{Aeq} which was relatively consistent with the 52 - 56dB L_{Aeq} range average ambient noise level range measured during the October 4 - 6 weekend. Given this consistency, it can therefore be concluded that the measured noise levels would be considered typical of the ambient noise level in the vicinity.

4.0 OUTWARD NOISE IMPACT ASSESSMENT

4.1 Noise Emission Criteria

Construction Phase

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Local authorities normally control construction activities by imposing limits on the hours of operation and may consider noise limits at their discretion.

In the absence of specific noise limits, appropriate criteria relating to permissible construction noise levels for a development of this scale may be found in the British Standard *BS 5228 - 1: 2009+A1: 2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Part 1: Noise*.

The approach adopted in this instance calls for the designation of a noise sensitive location into a specific category (A, B or C) based on exiting ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded, indicates a significant noise impact is associated with the construction activities.

Table 4 below sets out the values which, when exceeded, indicate a significant effect at the facades of residential receptors as recommended by BS 5228 - 1. Please note that these are cumulative levels, i.e. the sum of both ambient and construction noise levels.

Assessment Category & Threshold Value Period (L_{Aeq})	Threshold Value, Decibels (dB)		
	Category A [A]	Category B [B]	Category C [C]
Night-Time (23:00 to 07:00hrs)	45	50	55
Evenings & Weekends [D]	55	60	65
Daytime (07:00 - 19:00) & Saturdays (07:00 - 13:00)	65	70	75

Table 4 Example Threshold of Significant Effect at Dwellings

A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.

B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.

C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.

D) 19:00 - 23:00 weekdays, 13:00 - 23:00 Saturdays and 07:00 - 23:00 Sundays.

For the appropriate period (e.g. daytime), the ambient noise level is determined and rounded to the nearest 5dB. In this instance, the measured daytime ambient noise levels in the vicinity of the proposed development were measured in the range of 52 - 61dB $L_{Aeq,16hr}$ during daytime periods. The residential dwellings in the vicinity will therefore be considered as Category A receptors.

It should also be considered that the established noise emission criterion detailed above is for residential dwellings. For construction noise impact on the less acoustically sensitive Barry's of Douglas bar, office buildings to the southeast and other commercial units in the vicinity, a 10dB relaxation of the applicable residential criteria is typically applied which would make them Category C receptors. Note that the applicable Category C daytime criterion of 75dB $L_{Aeq,T}$ would be consistent with the criteria that BS 5228-1 recommends for construction noise impact on office / commercial building properties:

- *75 decibels (dBA) in urban areas near main roads.*

The maximum daytime criteria limits summarised in Table 5 below will therefore be applied at the facades of the nearest noise sensitive receptors in respect of construction noise emissions from the proposed development.

Noise Sensitive Receptor	Threshold Value, Decibels (dB $L_{Aeq,T}$)		
	Daytime Periods (07:00 - 19:00) & Saturdays (07:00 - 13:00)	Evening Periods 19:00 - 23:00 Weekdays 13:00 - 23:00 Saturdays & 07:00 - 23:00 Sundays	Night Periods (23:00 to 07:00hrs)
Residential Buildings	65	55	45
Barry's of Douglas Bar / Commercial Units / Office Buildings / Telecom Building	75	65	55

Table 5 Established Threshold / Maximum Construction Noise Criteria Limits for Proposed Development

If the total noise level (i.e. construction noise plus existing ambient noise level) exceeds the appropriate category value (e.g. 65dB $L_{Aeq,T}$ during daytime periods for residential buildings and 75dB $L_{Aeq,T}$ for Barry's of Douglas Bar and the office buildings to the southeast), then a relative noise impact is deemed to have occurred.

Note also that the levels listed in Table 5 are $L_{Aeq,T}$ noise levels (defined in Section 3.5) are typically averaged over hourly periods.

Operational Phase

Due consideration must be given to the nature of the primary noise sources when setting noise emissions criteria. In this instance, there are four primary sources of noise associated with the development once operational. Criteria for noise from each of these sources, will be considered in terms of the $L_{Aeq,T}$ parameter (the equivalent continuous sound level).

There is no Irish Standard containing guidance that is applicable to residential development in this instance. In the absence of such standards, best practice dictates that the potential noise impact of the proposed development is assessed against appropriate British and / or International Standards.

In this instance, appropriate guidance is contained within *BS 8233 (2014): Guidance on Sound Insulation and Noise Reduction for Buildings*. This British Standard sets out recommended noise limits for indoor ambient noise levels in residential buildings as detailed in Table 6 below.

Activity	Room Type	Design Criterion $L_{Aeq,T}$ (dB)	
		Daytime (07:00 - 23:00hrs)	Night Time (23:00 - 07:00hrs)
Resting / Sleeping Conditions	Living Rooms	35dB $L_{Aeq,16hr}$	-
	Bedrooms	35dB $L_{Aeq,16hr}$	30dB $L_{Aeq,8hr}$

Table 6 Recommended Indoor Ambient Noise Levels from *BS 8233 (2014)*

For the purposes of this assessment, it is necessary to derive external limits based on the internal criteria listed in the table above. This is done by factoring in a degree of noise reduction afforded by an open window, which is defined in the standard as being 15dB.

Applying the 15dB factor to the values from the BS 8233 table, the following criteria would apply at the façades of all of the nearby residential buildings:

- *Daytime (07:00 to 23:00 hours)* *50dB $L_{Aeq,16hr}$*
- *Night-time (23:00 to 07:00 hours)* *45dB $L_{Aeq,8hr}$*

In consideration of the adjacent office buildings, Barry's of Douglas Bar and nearby commercial / retail units, there is no specific criteria guidance provided in BS 8233. However, the standard does list 'typical' internal noise level design ranges of 50 - 55dB L_{Aeq} for a department store and 35 - 40dB L_{Aeq} for executive private offices which could be considered applicable as worst case conditions in this instance. We have therefore applied an internal noise emission criterion of 50dB L_{Aeq} to Barry's of Douglas Bar and the adjacent commercial / retail properties and 35dB L_{Aeq} for the nearby office buildings.

Note that the telecommunications building to the south does not appear to be occupied on a regular or even an intermittent basis. However, we understand that there is office space inside the building so have assessed it as being an office receptor as a worst case consideration in case it is reoccupied in the future.

Operable windows aren't located in office buildings so a nominal sound reduction of 25dB was assumed for a worst case standard external glazing construction to obtain an external

noise criterion of 60dB L_{Aeq}. Not all of the commercial / retail properties will have windows but they all will have entry doors that can be left open, so the same 15dB open window correction was also applied to obtain an external noise criterion of 65dB L_{Aeq}.

In summary, the established noise emission criteria at the various noise sensitive receptors in the vicinity of the proposed development is detailed in Table 7 below.

Location	Design Criteria $L_{Aeq,T}$ (dB)	
	Daytime	Night Time
Residential Dwellings	50dB $L_{Aeq,16hr}$	45dB $L_{Aeq,8hr}$
Office Buildings	60dB L_{Aeq}	
Barry's of Douglas Bar / Commercial Units	65dB L_{Aeq}	

Table 7 Summary of Established Noise Emission Criteria, dB $L_{Aeq,T}$

In order to assist with the interpretation of the noise associated with changes in noise level, Table 8 below offers guidance as to the likely impact associated with any particular relative change.

Change in Sound Level (dB L_{Aeq})	Subjective Perception	Impact
< 3	Inaudible	Imperceptible
3 - 5	Perceptible	Slight
6 - 10	Up to a doubling of loudness	Moderate
11 - 15	Over a doubling of loudness	Significant
> 15		Profound

Table 8 Likely Impact Associated with Change in Noise Level

Vibration Criteria

Vibration standards come in two varieties: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. In both instances, it is appropriate to consider the magnitude of vibration in terms of Peak Particle Velocity (PPV).

Guidance relevant to acceptable vibration within buildings is contained in the following documents:

- *British Standard BS 7385-2 (1993): Evaluation and measurement vibration in buildings Part 2: Guide to damage levels from ground borne vibration;*
- *British Standard BS 5228-2 (2009): Code of practice for noise and vibration control on construction and open sites Part 2: Vibration;*

BS 7385 states there should typically be no cosmetic damage if transient vibration does not exceed 15mm/s at low frequencies rising to 20mm/s at 15Hz and 50mm/s at 40Hz and above. These guidelines relate to relatively modern buildings and should be reduced by 50% or less for more critical buildings or structures that are considered to be compromised.

BS 5228 recommends that for soundly constructed residential property, light commercial buildings and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak particle velocity of 15mm/s at 4Hz increasing to 20mm/s at 15Hz and increasing to 50mm/s at 40Hz and above for intermittent vibration.

For reinforced or framed structures or industrial and heavy commercial buildings and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak particle velocity of 50mm/s at 40Hz and above again for intermittent vibration.

In the case of continuous vibration, it states that these figures may need to be reduced by up to 50%. Below these vibration magnitudes minor damage is unlikely, although where there is existing damage, these limits may be reduced by up to 50%.

4.2 Noise Impact Assessment Strategy Overview

In order to assess the potential for noise impacts from the proposed development, the following prediction methodology was adopted in this instance:

- ✓ Noise measurements were conducted in order to quantify the ambient noise level environment in the vicinity of the nearest noise sensitive receptors (refer to Section 3.0).
- ✓ The measured ambient noise levels were used to establish construction maximum noise emission criteria limits (refer to Section 4.1).
- ✓ Construction noise emission levels were calculated in accordance with BS 8233:2014 at each of the nearest noise sensitive receptors based on sound power / pressure levels for expected equipment / processes and estimated utilisation periods along with standard appropriate corrections for attenuation with distance, screening from buildings / perimeter site hoarding and the presence of nearby reflecting surfaces (refer to Section 4.3).
- ✓ Operational noise emission levels were calculated at each of the nearest noise sensitive receptors (in accordance with BS 8233:2014) based on all identified operational noise source sound power / pressure levels along with standard appropriate corrections for attenuation with distance, screening from buildings and the presence of nearby reflecting surfaces (refer to Section 4.4).
- ✓ The cumulative results of these operational calculations were then used to assess the potential for a noise impact based on a comparison with criteria limits at the nearest noise sensitive receptors (refer to Section 4.4).

All noise prediction calculations were conducted in general accordance with ISO 9613: *Acoustics - Attenuation of sound outdoors, Part 2: General method of calculation, 1996.*

4.3 Construction Phase

During the construction phase, a variety of plant items will be in use such as lifting equipment, dumper trucks and general construction plant items. Each of these items will generate significant levels of noise and will need to have noise emissions predictions carried out in respect of same.

The nearest noise sensitive receptors to the proposed development were identified and detailed in Section 2.0 as follows:

Apartment Building to East	12m
Residential Dwellings to East	17m
Barry's of Douglas Bar	35m
Residential Dwelling to North	19m
Office Buildings to Southeast	42m
Telecommunications Building to South	12m

Note that these distances represent the closest distance of the nearest proposed development block facade to each noise sensitive receptor. It must be stated that, for most of the time, plant and equipment will be at a greater distance than these and, consequently, will have a lesser impact. Calculations to the furthest distance of the proposed development façade were also calculated. This allows for both an estimate of the average range as well as the "worst-case" scenario in respect of construction noise emissions.

The following assumptions have been made in the preparation of these construction noise prediction calculations:

- utilisation of all equipment of 66% of the 12-hour working day (i.e. 8 hours)
- the site will be surrounded by a 2.4m high solid hoarding

Table 9 below indicates typical noise levels that would be expected from the proposed construction site during the various phases of the construction project and their predicted level at each of the nearest noise sensitive receptors.

Phase	Plant Item (BS 5228 Ref)	At 10m (dB)[1]	Predicted Noise Level (dB L_{Aeq})					
			Apartment Buildings to the East	Residential Dwellings to the East	Barry's of Douglas Bar	Residential Dwelling to the North	Office Buildings to the Southeast	Telecom Building to the South
Excavation / Site Preparation	Tracked Excavator (C2.22)	72	55 - 70	52 - 67	49 - 59	53 - 66	49 - 59	53 - 70
	Dumper (C3.100)	74						
	Wheeled Loaded Lorry (D3.1)	75						

[1] Sound data from BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration on construction and open sites*.

Phase	Plant Item (BS 5228 Ref)	At 10m (dB)[1]	Predicted Noise Level (dB L_{Aeq})					
			Apartment Buildings to the East	Residential Dwellings to the East	Barry's of Douglas Bar	Residential Dwelling to the North	Office Buildings to the Southeast	Telecom Building to the South
Foundation Laying	Compressor (C6.19)	72	49 - 69	49 - 65	49 - 59	51 - 65	47 - 58	52 - 69
	Poker Vibrator (C6.40)	73						
	Cement Mixers (C6.6)	71						
Steel Erection	Crane (C7.120)	76	49 - 69	49 - 65	49 - 59	51 - 65	47 - 58	52 - 69
	Lorry (C7.121[2])	70						
Bored Piling	Bored Pile (D.24)	76	38 - 68	48 - 64	48 - 58	50 - 64	46 - 57	51 - 68
General Construction	Compressor (C7.70)	70	57 - 77	54 - 74	57 - 67	59 - 73	55 - 66	60 - 77
	Diesel Hoist (C7.97)	73						
	Pneumatic Circular Saw (C.79)	75						
	Generator (C7.51)	72						
	Dumper (C3.100)	74						
Roadworks	Surfacing	73	43 - 65	41 - 50	37 - 42	35 - 39	33 - 44	38 - 55

Table 9 Predicted Noise Emission Levels at Nearest Noise Sensitive Receptors During Construction Phases

[2] Assumes the methods for noise reduction outlined in Table B1 of BS5228: Part 1 are considered when operation is being carried out on site.

The biggest noise impacts from the construction phase are expected to occur at the residential dwelling to the north and the residential dwellings / apartment building overlooking the site to the east. Noise emissions at the facades of these residential buildings are predicted to be as high as 65 - 77 dB $L_{Aeq,T}$ during most construction phases when construction activities are occurring at the nearest development building. Noise emission levels of this order would be above the 65dB L_{Aeq} criteria and therefore would be expected to impart a slight to significant noise impacts on these receptors. However, it should be considered that noise levels of this order will only occur during periods when activities are occurring in respect of the nearest proposed development building location. This is typical in instances where buildings are constructed in close proximity to noise sensitive receptors and cannot be avoided (especially when all practical mitigation measures are already being provided). However, it is apparent from a review of the predicted noise level ranges that construction noise emissions will be below the recommended thresholds for activities occurring across the majority of construction areas. In addition, once the buildings in these areas are constructed, construction noise emission levels will decrease significantly even below those predicted due to shielding from the constructed buildings and increased distances away from the noise sensitive receptors.

Construction noise emission levels predicted at Barry's of Douglas Bar and the office buildings to the southeast range between 35 - 73dB L_{Aeq} and 33 - 66dB L_{Aeq} respectively; all of which would therefore be below the 75dB L_{Aeq} criterion. However, some minor noise impact could be experienced by occupants of the bar's exterior beer garden during some periods.

All supplemental source / path noise control mitigation measures that can be provided are being provided in this instance (refer to both Section 6.1 and the CEMP). Unfortunately, construction activities that occur in close vicinities to noise sensitive receptors will always be expected to cause noise impacts. The necessity for these activities to be managed / coordinated with local residents (in conjunction with the other best practice noise reduction measures detailed in Section 5.5) therefore becomes critical for minimising these impacts.

In respect of vibration, the potential for impact at neighbouring sensitive locations during construction will be limited to excavation works and lorry movements on uneven road surfaces. However, lorry movements will be mostly on existing roads which are free of significantly sized speed bumps and other similar impediments so any potential vibration impact will therefore be minimised.

4.4 Operational Phase

There are typically three principal sources of noise that typically arise from residential apartment developments during the operational phase of the proposed development. These are as follows:

- Building Services Plant
- Café Noise Emissions
- Car Parking
- Additional Vehicular Traffic on Public Roads

Each one of these potential sources of noise is considered in turn in the following sections.

Building Services Plant

As part of the design of the proposed development, there will be a limited number of electrical / mechanical plant operating to service it; most of it will be capable of generating noise to some degree. Although the MEP design isn't advanced at this stage, it is understood that the noise producing element of the development building services strategy will consist of outdoor heat pumps on the roof of the building that will serve indoor units within each apartment along with small (CMEV) ventilation / extract fans for apartment wet room / kitchen areas.

Most residential heat pumps vary in noise level between manufacturers but typically have sound power levels that range between 54dB(A) (Daikan Altrherma 3) and 63dB(A) (LG Terma V). For the sake of this assessment, we will assume that the units will be selected to have a maximum sound power of 60dB(A).

Noise levels from ventilation / extract fans are harder to estimate without knowing the specific selections being provided. In this instance, we would recommend that rooftop plant be selected so that a contributory noise level of ≤ 35dB L_{Aeq} is achieved at a distance of 1m from any of the development building façades. This is a reasonable level to expect for CMEV fans and has therefore been considered as such for this assessment.

It has also been assumed for this assessment that the heat pumps are either set back on the roof a sufficient distance to be visually screened from the nearest noise sensitive receptors or that visual screening walls will be provided around the heat pump area accordingly.

In order to consider building services for the café, it has been assumed for the sake of this assessment that heating will be provided by a similar heat pump design and that all ventilation kitchen / toilet exhaust fans are selected to have maximum sound pressure levels of 45dB L_{Aeq} at a distance of 1m from their external exhaust points (or have mitigation measures incorporated to achieve same).

Taking into consideration these noise levels along with appropriate corrections for distance, screening and the presence of nearby reflecting surfaces and assuming that all heat pumps and CMEV fans are operating simultaneously, the resultant noise levels at the nearest noise-sensitive receptors for each strategy have been calculated and are predicted to be as follows:

- Apartment Buildings to East — 39 dB L_{Aeq}
- Residential Dwelling to East — 37 dB L_{Aeq}
- Residential Dwelling to North — 37 dB L_{Aeq}
- Barry's of Douglas Bar — 32 dB L_{Aeq}
- Office Buildings to Southeast — 31 dB L_{Aeq}
- Telecom Building to South — 39 dB L_{Aeq}

The predicted noise levels at the nearest residential receptors are in the range of 37 - 39 dB L_{Aeq} which is lower than the established criteria of 50dB $L_{Aeq,16hr}$ and 45dB $L_{Aeq,8hr}$ for both daytime and night time periods respectively. They are also lower than the ambient noise levels measured in the vicinity of each.

The noise levels predicted at the office buildings to the south and southeast are in the range of 31 - 39dB L_{Aeq} which would also comply with the established 60dB L_{Aeq} criterion during both daytime and night time periods.

The noise level predicted at Barry's of Douglas Bar is 32dB L_{Aeq} which would also comply with the established 65dB L_{Aeq} criterion during both daytime and night time periods.

In respect of tonal noise emission elements, it is not typically possible to carry out a tonal analysis of building services plant during the planning stage given that actual unit selections (and often actual unit types) are not made until the detailed design stage of a project. Whilst it is not expected that low level building services plant of this nature will contain significant enough tonal elements that would be manifest above the background noise levels in the vicinity, it is nonetheless recommended that a noise emission survey be conducted once the development is occupied to confirm same.

No impulsive elements are expected from building services plant.

The mitigation measures that are therefore be required in this instance in respect of building services plant are the following:

- ✓ heat pumps are selected to have sound power levels that are no louder than 60dB L_{Aeq};
- ✓ heat pumps are visually screened from all nearby noise sensitive receptors;
- ✓ CMEV system fans and café kitchen / exhaust fans are selected to have sound pressure levels that are no louder than 35 & 45dB L_{Aeq} at a distance of 1m from any of their ventilation openings respectively (or have mitigation measures incorporated to achieve same).
- ✓ a noise emission survey should be carried out by a suitably qualified acoustic consultant once the development is occupied to confirm compliance with the established criteria limits and that there are no tonal elements present.

Café Noise Emissions

The café is to be located on the ground floor of the easternmost development building. It will have a frontage and a main entrance onto the Old Carrigaline Road to the east. The café could have a number of moderate noise level sources associated with its operation such as coffee bean grinders and background music in addition to general patron noise.

Noise levels measured in similar street cafés in Cork were of the order of 75 - 78dB L_{Aeq} during busy periods. Note that the building services noise emissions were considered separately in the preceding section.

Assuming a worst-case noise reduction of 30dB R_w through the external glazing, the predicted noise level emissions from the café at the various noise sensitive receptors are summarised as follows:

- ➢ Apartment Buildings to East — 19 dB L_{Aeq}
- ➢ Residential Dwelling to East — 17 dB L_{Aeq}
- ➢ Residential Dwelling to North — 14 dB L_{Aeq}
- ➢ Barry's of Douglas Bar — ≤ 10 dB L_{Aeq}
- ➢ Office Buildings to Southeast — 13 dB L_{Aeq}
- ➢ Telecom Building To South — < 10 dB L_{Aeq}

All of these absolute predicted levels are well within the daytime criteria at all adjacent noise sensitive receptors. The café is not expected to be in operation during night time hours but it is worth noting that these levels would be within the established night time criteria as well.

No significant impulsive or tonal elements are expected from café noise emissions.

No further mitigation measures would therefore be required in respect of external noise emissions from the proposed development café.

Car Parking

In this instance, there are 26 no. car spaces for all 124 no. units in the proposed development. Given this extremely low number of vehicles, any noise contributions from development car parking activity in the vicinity of the proposed development would therefore be considered insignificant when compared with noise emissions from traffic on the adjoining roads.

No significant impulsive or tonal elements are expected from car parking activities.

No mitigation measures are therefore required in respect of the proposed development car parking noise emissions.

Additional Vehicular Traffic on Public Roads

As discussed in the previous section, the proposed development is only expected to add a very limited number of additional vehicles (26 maximum) onto public roads in the locality of the site. Given the significant traffic flow levels along the roads in the vicinity of Douglas village, even an additional 26 vehicles would be considered a negligible increase.

It can therefore be concluded that noise emissions from 26 additional vehicles as a worst case consideration would be considered imperceptible and the associated noise impact would not be significant.

No significant impulsive or tonal elements are expected from additional vehicular traffic on public roads.

No mitigation measures are therefore required in respect of additional vehicular traffic on public roads.

Cumulative Operational Noise Levels

The total level of combined noise emissions from the proposed development noise sources can be determined by summing together all their individual contributions. The total levels of each are summarised and totalled in Table 10 on the following page.

Noise Source	Noise Level Emissions (dB L_{Aeq})					
	Apartment Bldgs to the East	Dwellings to the East	Barry's of Douglas Bar	Dwelling to the North	Office Bldgs to Southeast	Telecom Bldg to South
Building Services Plant	39	37	32	37	31	39
Café Noise Emissions	19	17	14	≤ 10	13	< 10
Car Parking on Site	Negligible					
Additional Vehicular Traffic	Negligible					
Cumulative Noise Level	**39**	**37**	**32**	**37**	**31**	**39**

Table 10 Proposed Development Cumulative Noise Levels Summary

These cumulative noise levels are compared with the established project noise emission criteria in Table 11 below.

Location	Predicted Noise Level Range	Noise Emission Criteria	Compliant?
Apartment Bldgs to the East	39 dB L_{Aeq}	**50dB $L_{Aeq,16hr}$ / 45dB $L_{Aeq,8hr}$**	✓
Dwellings to the East	37 dB L_{Aeq}		✓
Dwelling to the North	37 dB L_{Aeq}		✓
Barry's of Douglas Bar	32 dB L_{Aeq}	**60dB L_{Aeq}**	✓
Office Bldgs to the Southeast	31 dB L_{Aeq}	**65dB L_{Aeq}**	✓
Telcom Bldg to South	39 dB L_{Aeq}		✓

Table 11 Proposed Development Cumulative Noise Emission Level Comparison with Criteria

As can be seen in Table 11, the expected levels of noise emissions from the proposed development are within the established criteria at all adjacent noise sensitive receptors during all time periods.

The predicted cumulative noise levels for each of the residential receptors have also been compared with the measured ambient noise levels measured in their vicinity in Tables 12 & 13 on the following page.

Location	Period	Predicted Noise Level	Measured Ambient Noise Level Range	Noise Level Above or Below Ambient?
Apartment Bldgs to the East	Daytime	39 dB $L_{Aeq,16hr}$	53 - 61 dB $L_{Aeq,16hr}$	Below
Dwellings to the East		37 dB $L_{Aeq,16hr}$	53 - 61 dB $L_{Aeq,16hr}$	Below
Dwelling to the North		37 dB $L_{Aeq,16hr}$	52 - 57 dB $L_{Aeq,16hr}$	Below

Table 12 Noise Emission Level Comparison with Daytime Period Ambient Noise Levels

Location	Period	Predicted Noise Level	Measured Ambient Noise Level Range	Noise Level Above or Below Ambient?
Apartment Bldgs to the East	Night Time	39 dB $L_{Aeq,8hr}$	49 - 55 dB $L_{Aeq,8hr}$	Below
Dwellings to the East		37 dB $L_{Aeq,8hr}$	49 - 55 dB $L_{Aeq,8hr}$	Below
Dwelling to the North		37 dB $L_{Aeq,8hr}$	46 - 48 dB $L_{Aeq,8hr}$	Below

Table 13 Noise Emission Level Comparison with Night Time Period Ambient Noise Levels

As can be seen in the preceding tables, the predicted levels of noise emissions from the proposed development are well below the existing ambient noise levels at the nearest noise sensitive receptors in the vicinity and would therefore be expected to be nominally inaudible for the vast majority of the time.

It should also be highlighted that the noise level conditions that were assessed would be considered worst case.

There are therefore no significant operational noise impacts that are expected from the proposed development on any of the identified adjacent noise sensitive receptors.

4.5 Avoidance, Remedial & Reductive Measures

The following measures are recommended to minimise the potential for disturbance due to noise emissions from the proposed development. Proper application of these measures should reduce noise emissions less than those predicted in this report.

Construction Phase

With regard to construction activities, reference will be made to *BS 5228: Noise control on construction and open sites*. This document provides detailed guidance on the control of noise from demolition and construction activities.

In particular, it is proposed that various practices be adopted during general construction activities including:

- ✓ Establishing channels of communication between the contractor / developer, Local Authority and residents.
- ✓ Appointment of a site representative responsible for matters relating to noise.

Furthermore, it is envisaged that a variety of practicable noise control measures will be employed. These should include:

- ✓ Provision of 2.4m high perimeter hoarding around the site boundary.
- ✓ Selection of plant with low inherent potential for generation of noise.
- ✓ Erection of barriers as necessary around items such as generators or high duty compressors.
- ✓ Placement of noisy plant as far away from sensitive properties as permitted by site constraints.
- ✓ Avoiding unnecessary revving of engines and switch off idling engines / equipment when not in use.
- ✓ Restricting construction activities to daytime periods only.

Operational Phase

Building Services Plant

The predicted noise levels from proposed development building services plant are within the adopted criteria for both the daytime and night-time periods. The only mitigation considerations that would be deemed as being required in this instance are as follows:

- ➢ All development heat pumps shall be selected to have sound power levels that are no louder than 60dB L_{Aeq}.
- ➢ Heat pumps are either set back or provided with perimeter screening walls so that they are visually screened from all nearby noise sensitive receptors
- ➢ All CMEV system fans shall be selected to have a maximum sound pressure levels of 35dB L_{Aeq} at a distance of 1m from any ventilation opening.
- ➢ All café kitchen / toilet ventilation fans shall be selected to have a maximum sound pressure levels of 45dB L_{Aeq} at a distance of 1m from any ventilation opening.
- ➢ a noise emission survey should be carried out by a suitably qualified acoustic consultant once the development is occupied to confirm compliance with the established criteria limits and that there are no tonal elements present.

Café Noise Emissions

The noise impact assessment has demonstrated that ameliorative measures are not required in respect of café noise emissions.

Car Parking

The noise impact assessment has demonstrated that ameliorative measures are not required in respect of car parking noise.

Additional Vehicular Traffic on Public Roads

The noise impact assessment has demonstrated that ameliorative measures are not required in respect of additional vehicular traffic on public roads.

4.6 Summary of Resultant Outward Noise Impact

This section summarises the likely residual noise impact associated with the proposed development, taking into account the ameliorative measures described in Section 5.5.

Construction Phase

During the construction phase of the project, there is expected to be slight to significant noise impacts on the adjacent residential noise sensitive receptors.

As stated in Section 5.2, construction activities are typically expected to impact significant impacts on noise sensitive receptors when carried out in close proximities with the receptors immediately adjacent to the proposed development. In this instance, it is worth noting that these significant noise levels will only occur when construction works are being carried out on building elements in close proximity to each of these nearest receptors. Construction activities carried out across most of the site will be within the recommended thresholds and once the portions of the development nearest to each receptor are constructed, noise emissions from the remaining construction activities will be significantly attenuated through shielding by these elements and the increased distances. However, the necessity for these activities to be managed / coordinated with local residents will be critical for minimising their noise impact.

Limiting the hours of noisy operations and continuous noise monitoring along with implementation of appropriate noise control measures detailed in this report will also serve to minimise noise impact as far as practicable in this instance.

Operational Phase

Building Services Plant

The predicted noise levels associated with building services are within the criteria of 45 / 50dB $L_{Aeq,T}$ at the nearby residential receptors, 60dB $L_{Aeq,T}$ at the office buildings to the southeast and 65dB $L_{Aeq,T}$ Barry's of Douglas Bar respectively and will be below the ambient noise levels in the vicinity.

Café Noise Emissions

The predicted noise levels associated with the proposed development café are negligible.

Car Parking

The predicted noise levels associated with car parking are negligible.

Additional Vehicular Traffic on Public Roads

The predicted noise levels associated with additional vehicular traffic on roads are negligible.

5.0 INWARD NOISE IMPACT ASSESSMENT

5.1 Noise Level Design Criteria

External Noise Level Criteria

Guideline criteria for external noise levels in the proposed development's porch / balcony / external amenity areas can be found in both the *BS 8233 Guidance on Sound Insulation and Noise Reduction for Buildings* and *ProPG: Planning & Noise (Professional Guidance on Planning & Noise For New Residential Developments)* guidance documents. Both documents state that ambient noise levels in external residential areas should ideally not be above 50 - 55dB $L_{Aeq,16hr}$.

This criteria range is reiterated in *ProPG 2017* in 3(ii):

> *The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 - 55 dB $L_{Aeq,16hr}$.*

Although exceedances of this criteria are naturally not desirable, both the *BS 8233* and *ProPG guidance documents* recognize that their stated guideline values are not achievable in all instances and that external noise levels in excess of this criteria would not be prohibitive provided additional considerations are made in relation to the development.

From *BS 8233*:

> *It is recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.*
>
> *In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space.*

From *ProPG* documents:

> *These guideline values may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels in these external amenity spaces.*
>
> *Where, despite following a good acoustic design process, significant adverse noise impacts remain on any private external amenity space (e.g. garden or balcony) then that impact may be partially off-set if the residents are provided, through the design of the development or the planning process, with access to:*
>
> - *A relatively quiet facade (containing openable windows to habitable rooms) or a relatively quiet externally ventilated space (i.e. an enclosed balcony) as part of their dwelling; and/or*

- *A relatively quiet alternative or additional external amenity space for sole use by a household, (e.g. a garden, roof garden or large open balcony in a different, protected, location); and/or*
- *A relatively quiet, protected, nearby, external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings; and/or*
- *A relatively quiet, protected, publicly accessible, external amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance).*

Given the above guidance, the following general approach was developed as the development's external noise level strategy in order to provide an acceptable external ambient noise environment:

- ✓ The 50 - 55dB(A) $L_{Aeq,16hr}$ criteria will be designed for in all development porch / balcony / public amenity areas where it is practically possible to be achieved.
- ✓ Relatively quiet external amenity spaces will be incorporated into the development.
- ✓ The façade design of the development buildings will incorporate superior sound insulation glazing / façade elements to achieve a quiet internal acoustic environment that will comply with criteria applicable to low level residential bedroom environments.

Internal Noise Level Criteria

In setting appropriate target internal noise levels, the *ProPG 2017* again refers to *BS 8233*. The *BS 8233* recommended noise limits for indoor ambient noise levels in residential dwellings are summarised in Table 14 below.

Activity	Room Type	Design Criterion $L_{Aeq,T}$ (dB)	
		Daytime (07:00 - 23:00hrs)	Night Time (23:00 - 07:00hrs)
Resting / Sleeping Conditions	Living / Dining Rooms	35dB $L_{Aeq,16hr}$	-
	Bedrooms	35dB $L_{Aeq,16hr}$	30dB $L_{Aeq,8hr}$ (45dB L_{Amax})

Table 14 Recommended Indoor Ambient Noise Levels from *BS 8233 (2014)*

In order to demonstrate ADS compliance with the *ProPG 2017* and *BS 8233* internal noise level criteria, the glazing and external façade elements of the proposed apartment blocks must be designed to ensure that the maximum levels in the above table are achieved throughout.

5.2 Initial Site Noise Risk Assessment (ADS Stage 1)

In order to provide a preliminary indication of the likely risk of adverse effects from external noise prior to consideration for provision of noise mitigation, a comparison is carried out between the average noise levels measured during the daytime and night time periods against noise risk assessment indicators detailed in the *ProPG 2017*. The results of this comparison (refer to Section 3.6) are detailed in Figure 4 on the following page.

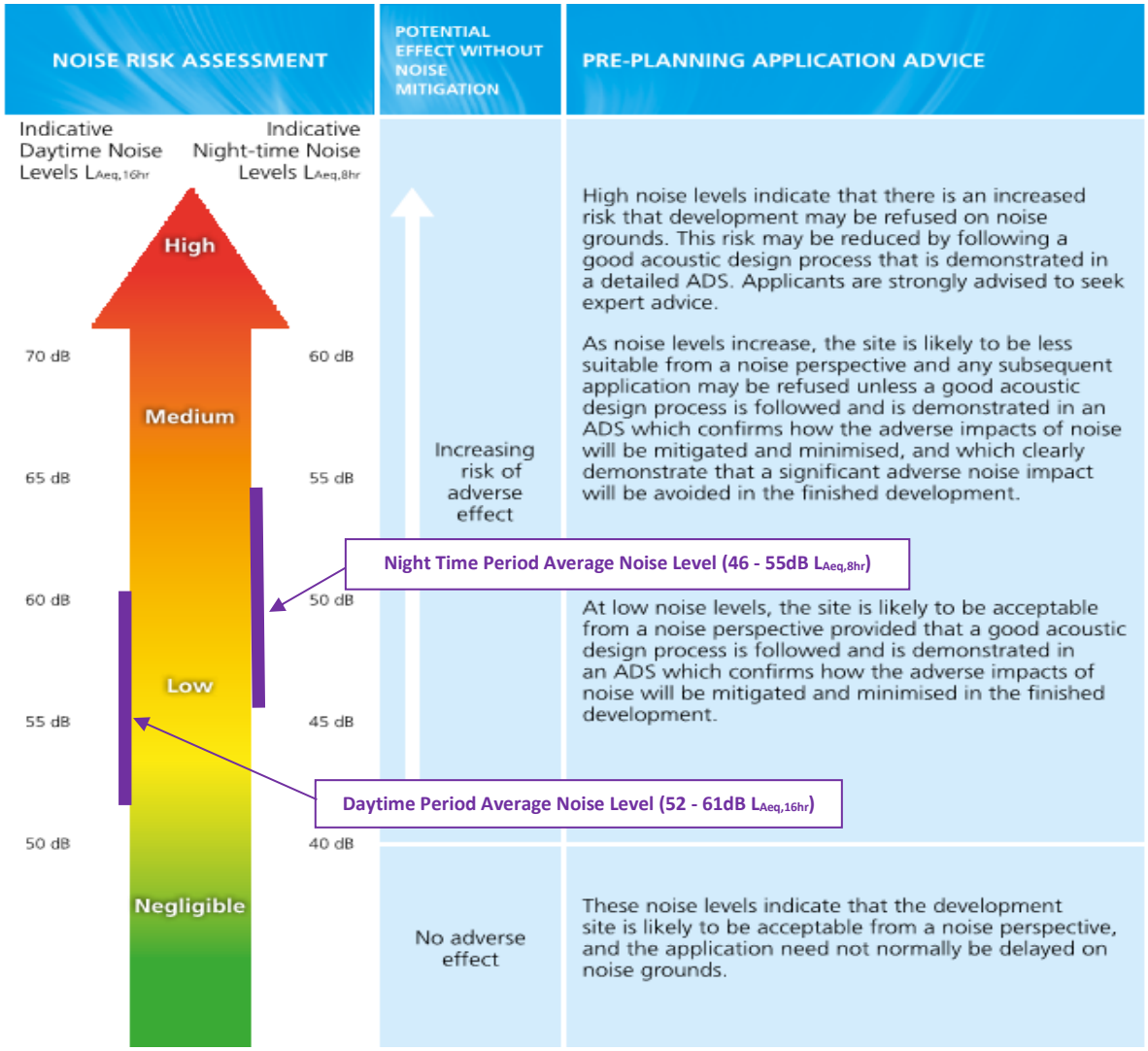


Figure 4 ProPG 2017 - Stage 1 Initial Noise Risk Assessment for Proposed Development

Overall, the noise level averages of 52 - 61 dB $L_{Aeq,16hr}$ for daytime periods that were measured on the development site would all fall within the 'Low' magnitude range and the 46 - 55 dB $L_{Aeq,8hr}$ for night time periods would also fall predominately within the 'Low' magnitude range but did extend slightly into the 'Medium' magnitude on one day.

Ambient noise levels in this range indicate that the site is 'likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and demonstrated' but that the elements of this process should be clearly demonstrated in an ADS. Given that the noise level environment is controlled primarily by traffic along the Old Carrigaline Road and urban hum which is fairly constant and at a reasonable level across all time periods, only a nominal degree of mitigation measures will be required in order to confirm an acceptable level of both internal and external noise levels across the entire development.

The predicted residual internal / external noise levels for the development and the mitigation measures that were deemed as being required are discussed in the following sections.

5.3 External Area Acoustic Design Assessment (ADS Stage 2)

Private Communal Space

There is one private external communal space amenity area planned for the proposed development. it is located in the central courtyard area formed by the two residential blocks.

See Figure 5 below.



Figure 5 Private Communal Space Amenity Area for Proposed Development

The daytime noise levels for this amenity area can be considered in respect of the existing ambient noise levels measured during the survey which ranged between 52 - 61dB $L_{Aeq,16hr}$ at both measurement locations. These levels would be typical of those on the 'outside' of the development buildings, the presence of which will provide a significant degree of acoustic shielding for the internally located private communal space which they fully enclose. Even if a nominal noise reduction of 10dB is applied to the levels measured at the development perimeter for the proposed development buildings, the expected ambient noise level range in the private communal space would be in the range of 42 - 51dB $L_{Aeq,16hr}$.

Ambient noise levels of this order are consistent with or below the ProPG 2017 recommended criteria requirement range of 50 - 55dB(A) dB $L_{Aeq,16hr}$ and would therefore be considered acceptable.

No further mitigation measures would therefore be required in respect of the proposed development's communal open areas.

Public Open Space

In addition to the proposed development's central communal space, there is also a public open space amenity area proposed. It is located along the northern boundary of the development between both Barry's of Douglas Bar and the Church St. residential dwelling and the proposed development apartment blocks.

See Figure 6 below.

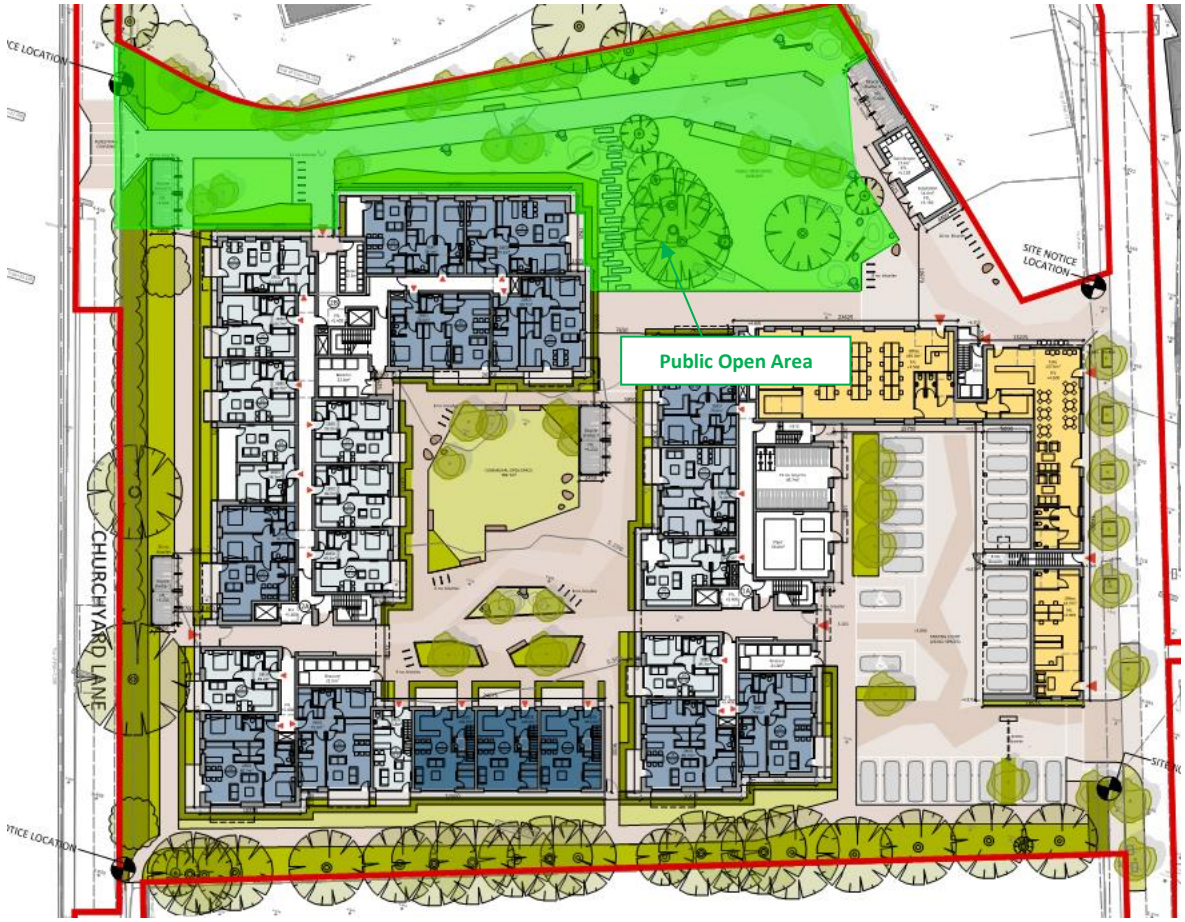


Figure 6 Public Amenity Open Area for Proposed Development

The ambient noise levels in this location will be similar to the existing ambient noise levels measured during the survey at NML 1 which ranged between 52 - 57dB $L_{Aeq,16hr}$. Levels of this order are relatively consistent with the ProPG 2017 recommended criteria requirement range of 50 - 55dB(A) dB $L_{Aeq,16hr}$ even before any additional reductions are estimated for the buildings shielding the area from portions of the Old Carrigaline Road and would therefore be considered acceptable.

No further mitigation measures would therefore be required in respect of the proposed development's public amenity open area.

Apartment Block Balconies / Porches

The proposed apartment balconies / porches are located all sides of both proposed development blocks. The balconies will protrude from the facades in most instances but will be recessed into the apartment block façade in areas that directly overlook the Old Carrigaline Road. There are five balconies / porches with a direct or oblique view to Barry's of Douglas Bar.

See Figures 7 & 8 below.

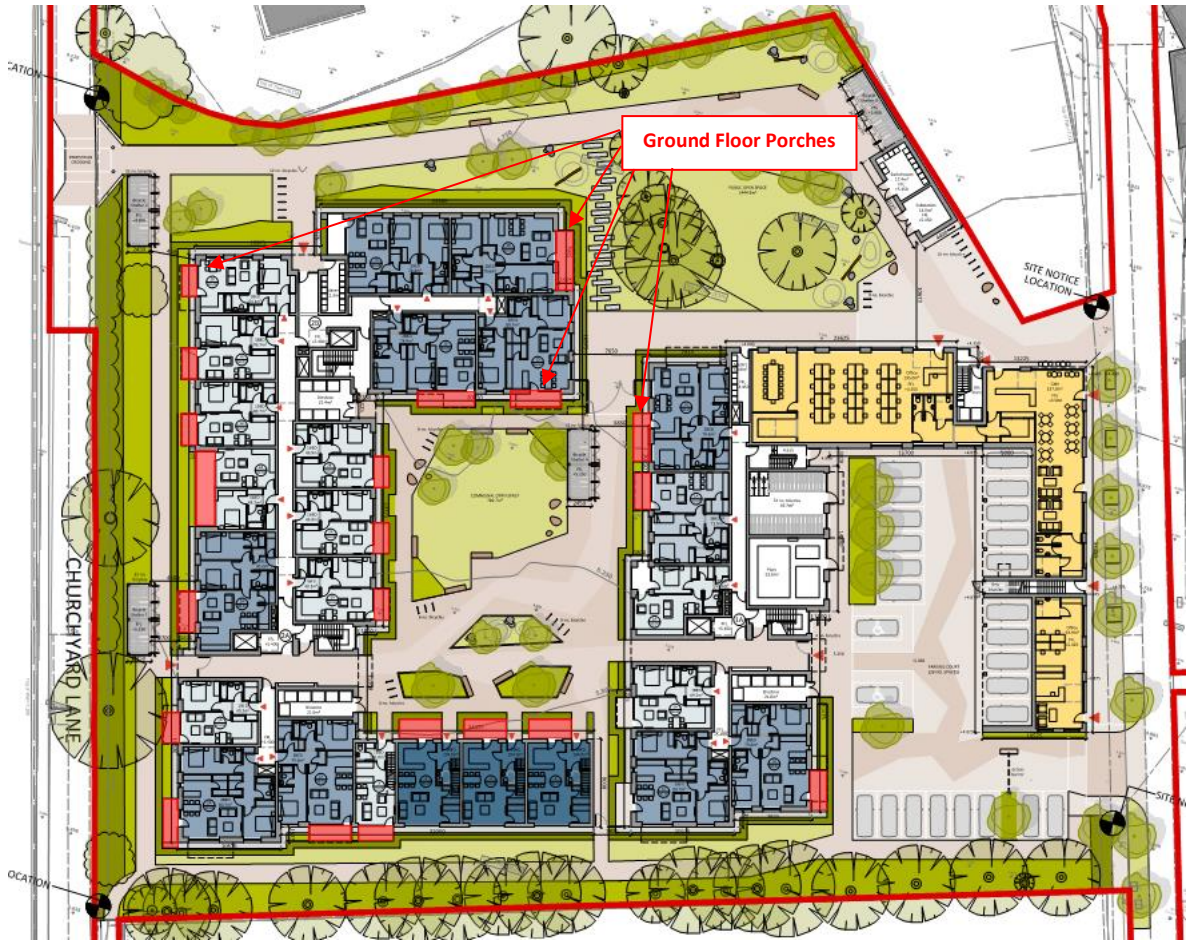


Figure 7 Ground Level Porch Locations



Figure 8 Upper Floor Apartment Block Balcony Locations

Given the location of the apartment building, the ambient noise levels on all balconies will be controlled by urban hum which consists of traffic noise, building services emissions from adjacent buildings, pedestrian activities and beer garden patron noise from bars in the vicinity.

The daytime noise levels for the balconies / porches can be considered in respect of the existing ambient noise levels measured during the survey which ranged between 52 - 61dB $L_{Aeq,16hr}$ at both measurement locations. Acoustic shielding provide by the easternmost development building will provide a minimum 5dB(A) reduction in noise levels from traffic along the Old Carrigaline Road and should therefore reduce external ambient noise levels in almost all proposed development porch / balcony areas to levels consistent with the ProPG 2017 recommended criteria requirement range of 50 - 55dB(A) dB $L_{Aeq,16hr}$.

The only balconies that will likely exceed this recommended criteria range for a limited number of time periods are the three balconies on each floor in the easternmost block due to their close proximity to the Old Carrigaline Road and view of central Douglas village. However, these balconies are recessed into the line of the building faced which will help to mitigate external noise ingress to these balcony areas.

In addition to the above, it is also recommended that the balcony balustrades for these apartments are imperforate so that an additional measure of acoustic shielding will be provided for occupants in seated positions.

Acoustic calculation predictions for a seated occupant with a head height of approximately 1.3m on external balconies with solid, imperforate balcony balustrades provided confirms that noise levels experienced for occupants of these balconies would be expected to be ≤ 55dB(A) for all time periods.

External Area Noise Recommended Mitigation Measures

Based on our assessment, the only additional noise mitigation measure that is recommended for external areas in this instance is as follows:

- ✓ Balcony balustrades on the three upper floor balconies on the easternmost building should be solid and imperforate with no gaps.

The remainder of the development blocks are located in a relatively quiet and consistent ambient noise level area with sufficient acoustic shielding from the development buildings.

No additional mitigation measures were therefore required in this instance.

5.4 Internal Area Acoustic Design Assessment (ADS Stage 2)

The following sections detail the requirements for the various external façade elements based on the noise monitoring results. The various specifications are therefore based on ambient noise levels measured at ground level which would be considered worst case for incident noise on the various building facades. Although this incident noise will reduce slightly with floor height (due to increasing distance from the various ground level sources), this reduction is only predicted as being ≤ 3dB in all instances. Given this minimal difference, the specifications developed for the various facades at ground level were therefore applied uniformly to all development building floor heights as both a straightforward and worst case approach.

External Façade / Roof Constructions

As directly confirmed by our noise monitoring survey, external ambient noise levels at the outward facing façades of the proposed development buildings ranged between 52 - 61dB $L_{Aeq,16hr}$ (daytime) and 46 - 55dB $L_{Aeq,8hr}$ (night time).

Based on these noise levels, the following minimum sound insulation performances were determined for the development's dwelling external wall and roof constructions:

- Provision of minimum ≥ 45dB R_w external walls.
- Provision of minimum ≥ 40dB R_w roof constructions.

We understand that the following building constructions are being provided:

External Wall Construction

102.5mm brick - 50mm air gap - 100mm rockwool insulation - 200mm precast / in-situ concrete inner leaf - 100mm rockwool insulation - 25mm void - 15mm plasterboard

Roof Construction

Paralon or similar membrane - 150mm PIR insulation - 250mm concrete slab - 150mm service void - 12.5mm plasterboard ceiling

The sound insulation performances of these constructions are estimated and compared against the established design criteria in Table 15 on the following page.

Construction Element	Minimum Sound Insulation Performance	Estimated Sound Insulation Performance	Acceptable?
External Walls	≥ 45dB R_w	**≈ 67 dB R_w**	✓
Roof	≥ 40dB R_w	**≈ 59 dB R_w**	✓

Table 15 Proposed External Wall & Roof Construction Estimated Sound Insulation Performance Summary

As can be seen in Table 13, the proposed external wall and roof constructions would comply with the established design criteria and therefore are acceptable as specified.

External Glazing Constructions

Given the relative uniformity of the ambient noise level environment, only two minimum glazing specifications were deemed as being required in this instance.

This specification is summarised in Table 16 below.

Glazing Spec	Octave Band Centre Frequency (Hz)						dB Rw	Indicative Glazing Configuration
	125	250	500	1k	2k	4k		
A	19	20	29	33	33	35	33	6mm glass - 12mm air space - 6mm glass
B	26	27	34	38	38	40	37	6mm glass - 12mm air space - 10mm glass

Table 16 Development Buildings External Glazing Sound Insulation Performance Requirement, SRI (dB)

The acoustic glazing drawings in Figures 9 & 10 as follows detail the locations where these glazing specifications should be applied for the various development building facades.

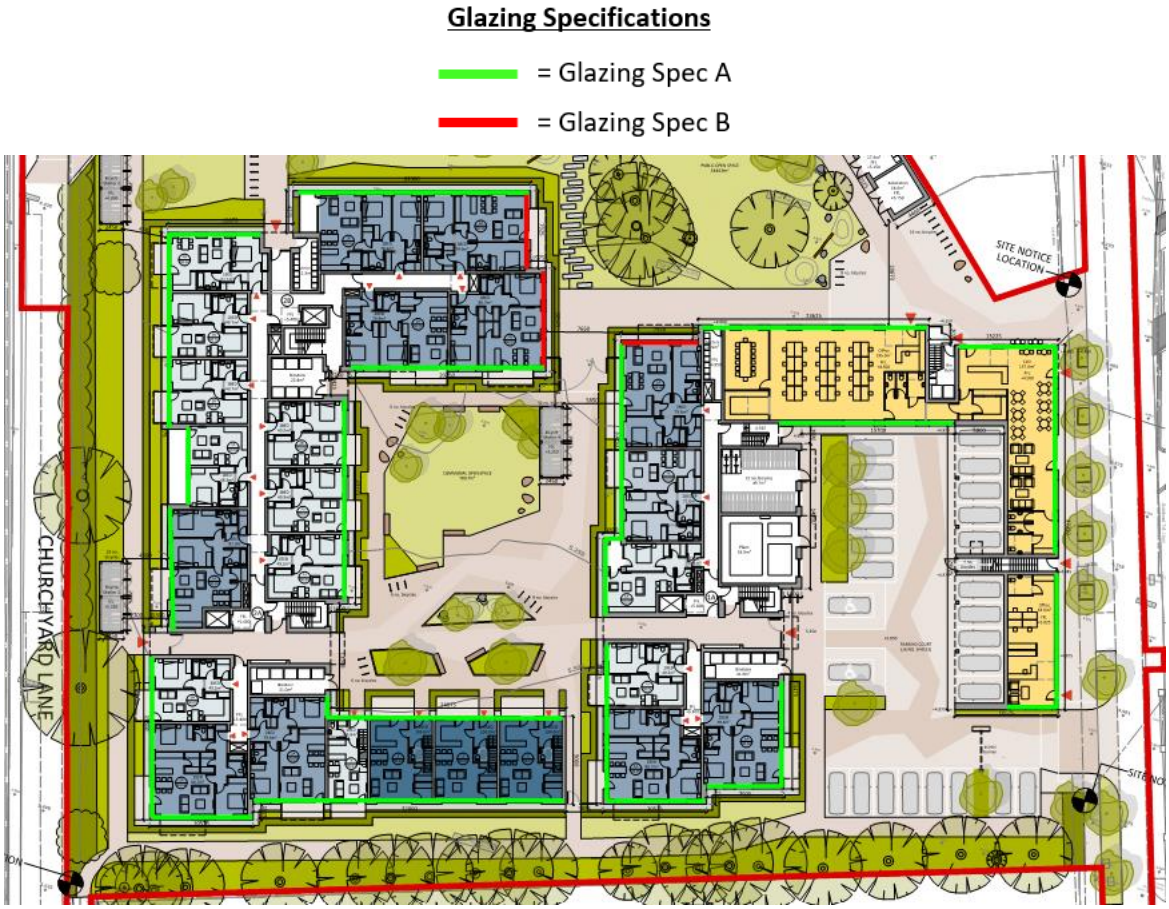


Figure 9 Ground Floor External Glazing Minimum Sound Insulation Specifications



Figure 10 Upper Floor External Glazing Minimum Sound Insulation Specifications

It should be noted that the octave band performance values detailed in Table 16 are the basis of the assessment and that the configuration detailed is merely a typical example which can be expected to afford these values. Alternative products with an equivalent or better performance would also provide sufficient sound insulation; however, glazing thicknesses of individual panes should not be similar to each other for Glazing Specification B in order to avoid unwanted resonance dips in the presence of traffic noise.

For operable windows, the proposed framing design will need to be acoustically reviewed during the design stage and acoustic treatment may be required. At a minimum, operable windows would need to incorporate compressible gasket seals to the full perimeter of the frame and any sliding windows will need to be installed in a rebated frame and sealed so that no gaps exist around the perimeter when closed.

Acoustic test data should be obtained from the façade supplier to confirm that all primary window constructions to be supplied perform to the required acoustic specification as given above. If acoustic performance data is not available for any of the specific systems, then it must be provided in accordance with the following details:

- The performance requirements shall be obtained from laboratory measurements obtained in accordance with *ISO 140-3: 1995 "Measurement of sound insulation in buildings and of building elements*" and weighted in accordance with *ISO 717-1: 1997 "Acoustics - Rating of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation"*.
- Laboratory measurements shall be obtained from an independent acoustic test laboratory accredited by a recognized body and shall be a fully representative part of the system including associated framing / support systems / seals.
- Ratings / measurements obtained in accordance with other equivalent standards may be permitted but should be submitted to the client representative for approval.
- The Trade Contractor shall provide Tender test certificates demonstrating compliance with the specified acoustic performance for the products offered. Failing this, the Trade Contractor shall allow for the expense of such necessary testing as demonstrating compliance with the specification. The tests shall be carried out at an independent acoustic test laboratory approved by a recognized acoustic institution.

Trickle Vents (if provided)

It is also important that the sound insulation performance of trickle vents (if provided) do not significantly compromise the integrity of the window performance. Provision should be made for provision of acoustic trickle vents in building façades achieve the minimum sound reduction values listed in Table 17 below.

Glazing Specification	Minimum Trickle Vent Sound Insulation Performance (dB $D_{n,e,w}$)
A	27
B	35

Table 17 Trickle Vent Minimum Sound Reduction Performance Specifications

External Doors

The other design element consideration is in relation to the external facade balcony entry doors. All balcony entry doors should be selected with a minimum sound insulation performance of 30dB R_w.

Acoustic test data should be obtained from the façade supplier to confirm that all external door constructions supplied perform to this specification. If acoustical performance data is not available, then it must be provided in accordance with the details outlined in the External Glazing section above.

Considerations for Internal Development Area Adjacencies

Note that there will need to be consideration for internal development area adjacencies for the development apartments located in close proximity to bin stores, plant rooms and other communal areas. However, the acoustic assessment of these adjacencies is typically carried out during the design stage when the specific internal slab / ceiling / partition constructions and plant room equipment are known and the need for independent partitions or sound barrier ceilings can be better determined and their specifications definitively confirmed.

From a planning perspective, whilst it is likely that sound barrier ceilings will be recommended for the bin store, plant room and possibly the café, there are no unusual or atypical noise producing / sensitive adjacencies identified in the current architectural design that cannot be mitigated with conventional constructions at the design stage. The only consideration at this stage is the recommendation that a suitably qualified acoustic consultant is engaged at the design stage to ensure that the building is designed to both TGD Part E and acoustic best practice requirements.

Considerations for Noise Emissions from Barry's of Douglas Bar

Although it was not specifically stated in the previous sections, noise emissions from Barry's of Douglas Bar were considered in the assessment. As discussed in Section 3.6, additional measurements were therefore out at NML 1 during the weekends of Nov 22 - 24, Nov 29 - Dec 1 and Dec 6 - 8. The average ambient noise level measured during the busiest 18:00 - 01:00hrs during these weekend periods ranged between 54 - 57dB L_{Aeq} which was relatively consistent with the 52 - 56dB L_{Aeq} range average ambient noise level range measured during the initial October 4 - 6 weekend. Given this consistency, it can therefore be concluded that the measured noise levels would be considered typical of the ambient noise level in the vicinity.

The maximum noise levels (L_{Amax}) measured during the weekend evening / night time periods (e.g. 18:00 - 01:00hrs) only show very slight increases when compared with results obtained on either side of these time periods and were generally ≤ 70dB L_{Amax}.

Notwithstanding the results of the survey, there is always the potential for noise emissions from a bar or public house to cause periods of noise impact. In order to mitigate the potential for the occurrence of these periods to cause an impact, the external glazing and trickle vent minimum specifications were upgraded on the proposed development building northern facades.

Maximum noise levels of 70dB L_{Amax} would be attenuated to ≤ 30dB in internal development apartments by these upgraded glazing / façade element specifications in conjunction with the other recommended external glazing / façade element recommendations provided in this report and would therefore be with the BS 8233 criteria thresholds. The ambient level of urban hum in the vicinity of the development should also provide sufficient masking to further minimise potential periods of disturbance.

5.5 Summary of Inward Noise Impact

External Areas

In accordance with the *ProPG 2017* and *BS 8233* guidance documents, a suitable approach was adopted in order to ensure an acceptable external ambient noise environment could be achieved.

This approach is summarised as follows:

- ✓ The 50 - 55dB(A) $L_{Aeq,16hr}$ criteria will be designed for in all back garden / public amenity areas where it is practically possible to be achieved.
- ✓ Relatively quiet external amenity spaces will be incorporated into the development.
- ✓ The façade design of the development buildings will incorporate superior sound insulation glazing / façade elements to achieve a quiet internal acoustic environment that will comply with criteria applicable to low level residential bedroom environments.

Following an ambient noise measurement and subsequent noise prediction assessment, it was determined that background noise levels in the vicinity of the proposed development are sufficiently low and that the development's external areas are adequately shielded (both through the architectural design and natural shielding provided by surrounding buildings) to ensure that all proposed development external areas will be fully compliant with the requirements of the *ProPG 2017* and *BS 8233* guidance documents.

Internal Areas

Appropriate guidance for internal noise levels within residential spaces was taken from *BS 8233 (2014): Guidance on Sound Insulation and Noise Reduction for Buildings* as summarised in the table at the top of the following page.

Activity	Room Type	Design Criterion $L_{Aeq,T}$ (dB)	
		Daytime (07:00 - 23:00hrs)	Night Time (23:00 - 07:00hrs)
Resting / Sleeping Conditions	Living / Dining Rooms	35dB $L_{Aeq,16hr}$	-
	Bedrooms	35dB $L_{Aeq,16hr}$	30dB $L_{Aeq,8hr}$ (45dB L_{Amax})

Given the requirements in the above table together with the predicted external noise levels with the development in place, the following mitigation measures were developed for development apartment blocks:

- Provision of minimum 67 dB R_w performance external walls.
- Provision of minimum 59 dB R_w performance roof constructions.
- Provision of acoustic trickle vents (if provided) with minimum sound reduction values similar to those detailed in Table 9 (in the opened position).
- Provision of glazing with minimum acoustic performance specification as detailed in Table 15.
- Provision of acoustic external entry doors with a minimum sound insulation performance of 30dB R_w.

Assuming the above developed mitigation measures are appropriately incorporated into the development design, the development should be fully compliant with the internal area noise requirements contained within the *ProPG 2017* and *BS 8233* guidance documents and the magnitude of the inward noise impact on development internal areas would therefore be considered negligible.

APPENDIX A

NML #1 - FULL NOISE MONITORING RESULTS

Date	Time Period		Measured Sound Pressure Levels (dB)				
	Start	Finish	$L_{Aeq,1hr}$	L_{AFmax}	L_{AFmin}	L_{AF10}	L_{AF90}
2024-10-02	12:00	13:00	55.1	63.6	50.5	56.6	53.1
2024-10-02	13:00	14:00	54.3	67.4	49.9	55.7	52.2
2024-10-02	14:00	15:00	54.6	62.7	50.5	56.0	52.8
2024-10-02	15:00	16:00	55.1	71.8	51.5	56.4	53.3
2024-10-02	16:00	17:00	53.8	71.7	50.0	55.1	52.0
2024-10-02	17:00	18:00	52.8	66.7	49.0	54.1	50.8
2024-10-02	18:00	19:00	52.6	66.6	49.2	53.7	51.2
2024-10-02	19:00	20:00	53.1	70.2	49.5	54.3	51.6
2024-10-02	20:00	21:00	51.7	63.8	48.5	53.0	50.2
2024-10-02	21:00	22:00	51.2	66.8	46.8	52.7	49.3
2024-10-02	22:00	23:00	49.9	67.5	44.2	51.7	47.3
2024-10-02	23:00	00:00	48.1	79.5	36.4	50.6	41.8
2024-10-03	00:00	01:00	47.9	82.1	32.7	53.0	36.7
2024-10-03	01:00	02:00	41.0	54.2	31.5	43.9	36.1
2024-10-03	02:00	03:00	40.8	58.3	31.8	43.5	35.4
2024-10-03	03:00	04:00	41.2	59.9	32.8	43.7	36.6
2024-10-03	04:00	05:00	43.4	56.0	34.8	45.8	39.1
2024-10-03	05:00	06:00	47.0	67.1	38.5	49.4	42.9
2024-10-03	06:00	07:00	50.8	63.8	44.4	52.8	47.7
2024-10-03	07:00	08:00	53.2	74.6	48.9	54.4	51.2
2024-10-03	08:00	09:00	52.1	71.2	47.7	53.3	49.8
2024-10-03	09:00	10:00	51.9	66.8	47.5	53.4	49.7
2024-10-03	10:00	11:00	52.0	66.3	47.8	53.2	50.2
2024-10-03	11:00	12:00	51.4	66.9	47.7	52.5	49.7
2024-10-03	12:00	13:00	51.9	68.1	48.2	53.0	50.3
2024-10-03	13:00	14:00	51.9	65.0	47.6	53.1	50.1
2024-10-03	14:00	15:00	53.0	70.3	49.5	53.9	51.1
2024-10-03	15:00	16:00	52.3	64.9	48.9	53.4	50.8
2024-10-03	16:00	17:00	52.0	66.5	48.2	53.2	50.5
2024-10-03	17:00	18:00	51.7	62.3	48.7	52.8	50.3
2024-10-03	18:00	19:00	51.7	63.1	49.0	52.7	50.6
2024-10-03	19:00	20:00	51.6	65.1	48.6	52.6	50.2
2024-10-03	20:00	21:00	50.7	57.1	47.3	51.7	49.5
2024-10-03	21:00	22:00	50.4	74.9	46.9	51.3	48.7
2024-10-03	22:00	23:00	49.1	62.9	44.9	50.6	47.4
2024-10-03	23:00	00:00	47.4	75.9	40.2	49.0	43.5
2024-10-04	00:00	01:00	45.7	62.0	37.6	48.2	41.4
2024-10-04	01:00	02:00	43.2	56.1	35.6	45.7	39.4
2024-10-04	02:00	03:00	42.3	55.0	34.3	45.1	37.8
2024-10-04	03:00	04:00	43.9	64.8	34.6	45.9	37.9
2024-10-04	04:00	05:00	47.7	61.6	39.5	50.3	43.1
2024-10-04	05:00	06:00	50.1	65.5	41.3	52.3	45.5
2024-10-04	06:00	07:00	52.9	63.5	47.0	55.2	49.8
2024-10-04	07:00	08:00	54.6	67.6	50.2	56.2	52.8

Date	Time Period		Measured Sound Pressure Levels (dB)				
	Start	Finish	$L_{Aeq,1hr}$	L_{AFmax}	L_{AFmin}	L_{AF10}	L_{AF90}
2024-10-04	08:00	09:00	54.6	71.6	50.5	56.1	52.3
2024-10-04	09:00	10:00	54.4	66.1	50.0	55.8	52.3
2024-10-04	10:00	11:00	54.3	64.2	50.5	55.8	52.5
2024-10-04	11:00	12:00	55.0	73.8	50.0	56.4	52.5
2024-10-04	12:00	13:00	54.8	72.8	51.2	56.2	53.0
2024-10-04	13:00	14:00	55.2	66.9	51.0	56.5	53.3
2024-10-04	14:00	15:00	55.4	67.1	51.3	56.7	53.6
2024-10-04	15:00	16:00	52.9	68.6	48.6	54.4	50.9
2024-10-04	16:00	17:00	53.1	61.6	49.8	54.5	51.5
2024-10-04	17:00	18:00	54.0	75.4	50.4	55.0	52.2
2024-10-04	18:00	19:00	53.4	62.9	50.4	54.6	52.0
2024-10-04	19:00	20:00	54.6	66.3	51.5	55.9	53.1
2024-10-04	20:00	21:00	54.0	70.5	49.8	55.3	51.8
2024-10-04	21:00	22:00	53.1	68.7	49.0	54.7	51.1
2024-10-04	22:00	23:00	52.7	64.7	47.6	54.4	50.2
2024-10-04	23:00	00:00	51.6	71.9	46.2	53.5	48.7
2024-10-05	00:00	01:00	50.0	66.1	43.5	51.9	46.4
2024-10-05	01:00	02:00	47.5	65.1	39.6	50.0	43.3
2024-10-05	02:00	03:00	45.6	62.1	37.3	48.5	40.8
2024-10-05	03:00	04:00	45.1	61.4	39.4	47.3	41.4
2024-10-05	04:00	05:00	46.0	60.0	38.5	48.3	41.7
2024-10-05	05:00	06:00	48.2	65.2	40.3	50.6	43.5
2024-10-05	06:00	07:00	49.3	61.1	43.1	51.6	45.8
2024-10-05	07:00	08:00	51.6	67.2	45.0	53.5	48.1
2024-10-05	08:00	09:00	51.7	68.6	46.4	53.4	48.9
2024-10-05	09:00	10:00	52.9	67.4	48.8	54.4	50.9
2024-10-05	10:00	11:00	53.5	75.6	49.7	54.7	51.8
2024-10-05	11:00	12:00	54.0	65.6	50.5	55.2	52.5
2024-10-05	12:00	13:00	56.6	66.9	51.1	58.9	53.4
2024-10-05	13:00	14:00	60.2	66.3	55.7	61.7	58.4
2024-10-05	14:00	15:00	61.7	68.0	58.3	63.4	59.9
2024-10-05	15:00	16:00	60.4	69.4	55.4	62.0	57.8
2024-10-05	16:00	17:00	56.5	68.0	52.6	57.9	54.6
2024-10-05	17:00	18:00	59.6	69.7	53.4	62.6	55.3
2024-10-05	18:00	19:00	60.8	72.9	53.8	64.1	55.9
2024-10-05	19:00	20:00	57.5	82.6	52.0	58.9	54.5
2024-10-05	20:00	21:00	54.9	69.9	50.1	56.6	52.6
2024-10-05	21:00	22:00	53.3	63.6	48.7	55.6	50.7
2024-10-05	22:00	23:00	51.1	61.5	46.3	52.7	49.1
2024-10-05	23:00	00:00	48.5	77.7	42.7	50.2	45.4
2024-10-06	00:00	01:00	50.6	61.0	41.9	53.5	45.5
2024-10-06	01:00	02:00	50.6	61.8	39.9	53.6	44.4
2024-10-06	02:00	03:00	47.2	63.1	37.1	50.0	42.1
2024-10-06	03:00	04:00	44.6	59.3	35.4	47.4	39.6
2024-10-06	04:00	05:00	43.9	60.8	34.9	46.0	40.2
2024-10-06	05:00	06:00	44.1	56.9	37.0	46.6	39.8
2024-10-06	06:00	07:00	46.9	64.1	38.6	48.6	44.0
2024-10-06	07:00	08:00	51.9	70.0	43.1	54.6	46.9
2024-10-06	08:00	09:00	51.1	64.8	44.7	53.0	48.2
2024-10-06	09:00	10:00	50.9	70.7	44.2	53.0	47.1
2024-10-06	10:00	11:00	54.6	78.1	45.0	52.9	48.1
2024-10-06	11:00	12:00	52.5	72.3	46.3	54.1	49.1
2024-10-06	12:00	13:00	53.3	69.8	48.1	54.4	50.4

Date	Time Period		Measured Sound Pressure Levels (dB)				
	Start	Finish	$L_{Aeq,1hr}$	L_{AFmax}	L_{AFmin}	L_{AF10}	L_{AF90}
2024-10-06	13:00	14:00	53.2	70.9	49.0	54.3	51.0
2024-10-06	14:00	15:00	53.6	69.1	50.3	54.7	51.9
2024-10-06	15:00	16:00	54.0	71.2	50.4	55.0	52.2
2024-10-06	16:00	17:00	54.8	71.2	51.0	56.1	52.9
2024-10-06	17:00	18:00	54.3	66.9	50.8	55.4	52.7
2024-10-06	18:00	19:00	55.0	72.3	50.7	56.8	52.4
2024-10-06	19:00	20:00	54.9	66.4	51.0	56.4	52.8
2024-10-06	20:00	21:00	52.7	67.5	49.5	54.1	51.0
2024-10-06	21:00	22:00	52.0	61.0	49.1	53.1	50.7
2024-10-06	22:00	23:00	50.0	62.6	46.3	51.5	48.2
2024-10-06	23:00	00:00	48.6	57.4	45.5	50.0	47.1
2024-10-07	00:00	01:00	46.5	59.0	36.6	48.9	41.4
2024-10-07	01:00	02:00	42.9	57.7	34.9	45.8	38.2
2024-10-07	02:00	03:00	42.3	62.4	33.2	44.9	37.5
2024-10-07	03:00	04:00	39.8	54.2	32.9	41.8	36.0
2024-10-07	04:00	05:00	42.3	61.3	33.9	44.5	37.6
2024-10-07	05:00	06:00	45.2	63.8	35.8	48.1	40.3
2024-10-07	06:00	07:00	49.7	58.4	43.4	51.8	46.7
2024-10-07	07:00	08:00	53.5	71.0	48.3	54.9	50.7
2024-10-07	08:00	09:00	54.7	74.7	49.2	55.0	51.3
2024-10-07	09:00	10:00	53.7	71.0	48.0	55.2	50.4
2024-10-07	10:00	11:00	52.5	72.0	47.4	53.5	49.5
2024-10-07	11:00	12:00	52.3	70.0	47.1	53.5	49.7
2024-10-07	12:00	13:00	52.0	70.3	47.8	53.5	50.0
2024-10-07	13:00	14:00	52.8	66.3	48.2	54.1	50.6
2024-10-07	14:00	15:00	52.4	68.5	48.7	53.5	50.7
2024-10-07	15:00	16:00	52.2	66.9	48.1	53.4	50.5
2024-10-07	16:00	17:00	52.5	67.8	48.3	53.7	50.5
2024-10-07	17:00	18:00	53.4	67.2	49.0	54.9	51.2
2024-10-07	18:00	19:00	52.5	67.4	48.8	53.9	50.6
2024-10-07	19:00	20:00	51.7	68.1	48.1	52.7	50.0
2024-10-07	20:00	21:00	50.5	64.9	47.3	51.7	49.0
2024-10-07	21:00	22:00	49.7	66.1	46.2	51.0	48.1
2024-10-07	22:00	23:00	49.4	64.8	45.6	50.9	47.5
2024-10-07	23:00	00:00	49.6	61.9	39.3	52.0	43.4
2024-10-08	00:00	01:00	44.7	57.5	36.3	47.2	40.7
2024-10-08	01:00	02:00	44.0	59.2	34.3	46.5	39.8
2024-10-08	02:00	03:00	42.0	64.2	33.3	44.8	36.7
2024-10-08	03:00	04:00	42.6	57.4	32.6	45.4	37.9
2024-10-08	04:00	05:00	45.8	61.7	36.6	48.8	40.6
2024-10-08	05:00	06:00	49.4	63.1	40.4	52.0	45.0
2024-10-08	06:00	07:00	52.5	64.5	46.7	54.3	49.8
2024-10-08	07:00	08:00	56.4	74.5	50.7	57.4	53.7
2024-10-08	08:00	09:00	54.7	65.9	50.3	56.3	52.5
2024-10-08	09:00	10:00	52.6	67.4	46.7	54.4	49.3
2024-10-08	10:00	11:00	52.1	71.3	45.2	54.2	48.7
2024-10-08	11:00	12:00	53.0	70.4	47.8	54.3	50.4
2024-10-08	12:00	13:00	51.6	65.2	46.4	53.0	49.2
2024-10-08	13:00	14:00	50.3	63.4	44.9	51.9	47.9
2024-10-08	14:00	15:00	51.2	66.8	45.6	52.9	48.9
2024-10-08	15:00	16:00	52.1	70.6	46.6	53.8	49.6
2024-10-08	16:00	17:00	51.6	72.3	44.8	52.5	48.3
2024-10-08	17:00	18:00	51.1	75.5	45.6	52.6	47.8

Date	Time Period		Measured Sound Pressure Levels (dB)				
	Start	Finish	$L_{Aeq,1hr}$	L_{AFmax}	L_{AFmin}	L_{AF10}	L_{AF90}
2024-10-08	18:00	19:00	52.2	71.9	46.2	53.7	49.6
2024-10-08	19:00	20:00	51.6	72.9	45.6	53.6	48.1
2024-10-08	20:00	21:00	48.1	60.0	43.5	49.8	45.9
2024-10-08	21:00	22:00	46.8	67.2	41.7	48.4	43.6
2024-10-08	22:00	23:00	45.7	61.7	39.1	47.9	42.6
2024-10-08	23:00	00:00	44.6	58.1	35.3	47.2	39.5
2024-10-09	00:00	01:00	42.4	55.7	35.6	45.2	38.1
2024-10-09	01:00	02:00	41.4	60.0	33.4	44.3	35.9
2024-10-09	02:00	03:00	40.1	55.4	31.8	43.4	34.7
2024-10-09	03:00	04:00	40.7	52.9	32.7	43.9	35.1
2024-10-09	04:00	05:00	43.8	64.8	36.7	46.1	39.6
2024-10-09	05:00	06:00	48.0	62.3	36.8	50.7	42.9
2024-10-09	06:00	07:00	54.2	67.7	45.8	56.6	49.7
2024-10-09	07:00	08:00	56.1	77.0	50.9	57.4	54.0
2024-10-09	08:00	09:00	55.9	67.5	52.0	57.1	54.4
2024-10-09	09:00	10:00	56.0	68.8	51.0	57.5	54.0
2024-10-09	10:00	11:00	54.7	71.5	49.6	56.3	52.4
2024-10-09	11:00	12:00	55.5	65.6	50.8	57.2	53.2
2024-10-09	12:00	13:00	56.4	69.3	50.9	58.3	53.8

APPENDIX B

NML #2 - FULL NOISE MONITORING RESULTS

Date	Time Period		Measured Sound Pressure Levels (dB)				
	Start	Finish	$L_{Aeq,1hr}$	L_{AFmax}	L_{AFmin}	L_{AF10}	L_{AF90}
2024-09-25	13:00	14:00	57.3	66.4	50.8	60.1	53.8
2024-09-25	14:00	15:00	55.4	66.2	48.0	58.7	51.2
2024-09-25	15:00	16:00	54.2	65.2	46.6	57.5	49.6
2024-09-25	16:00	17:00	55.7	79.5	48.9	58.5	51.5
2024-09-25	17:00	18:00	55.1	71.2	49.1	57.8	51.4
2024-09-25	18:00	19:00	55.9	70.2	50.4	58.0	53.4
2024-09-25	19:00	20:00	55.2	69.3	49.9	57.4	52.4
2024-09-25	20:00	21:00	53.8	65.4	48.3	56.2	50.9
2024-09-25	21:00	22:00	51.9	64.9	46.0	54.2	48.7
2024-09-25	22:00	23:00	50.3	63.9	43.6	52.4	46.6
2024-09-25	23:00	00:00	49.0	68.4	38.6	51.1	43.3
2024-09-26	00:00	01:00	46.6	66.8	36.0	48.1	40.6
2024-09-26	01:00	02:00	45.7	62.2	35.3	47.9	39.5
2024-09-26	02:00	03:00	45.0	62.9	34.0	47.3	37.6
2024-09-26	03:00	04:00	45.1	65.1	34.0	47.9	38.3
2024-09-26	04:00	05:00	49.9	64.9	38.8	52.6	44.0
2024-09-26	05:00	06:00	53.7	71.7	41.1	55.9	48.2
2024-09-26	06:00	07:00	57.3	68.0	47.9	59.6	53.0
2024-09-26	07:00	08:00	59.4	78.0	54.4	61.3	56.6
2024-09-26	08:00	09:00	58.0	71.6	53.4	59.8	55.9
2024-09-26	09:00	10:00	58.6	69.5	54.0	60.4	56.3
2024-09-26	10:00	11:00	58.1	70.3	52.9	59.8	55.8
2024-09-26	11:00	12:00	58.0	69.6	52.6	59.8	55.7
2024-09-26	12:00	13:00	58.1	67.3	52.6	60.0	55.8
2024-09-26	13:00	14:00	58.5	65.9	52.7	60.2	56.3
2024-09-26	14:00	15:00	58.3	68.7	53.6	60.0	56.3
2024-09-26	15:00	16:00	58.1	65.8	53.6	59.8	56.0
2024-09-26	16:00	17:00	57.6	71.2	51.5	59.4	55.1
2024-09-26	17:00	18:00	55.6	71.2	50.0	57.4	52.6
2024-09-26	18:00	19:00	57.4	76.3	52.5	58.7	54.8
2024-09-26	19:00	20:00	57.7	71.0	53.7	59.3	55.8
2024-09-26	20:00	21:00	57.7	68.0	52.7	59.5	55.3
2024-09-26	21:00	22:00	56.7	73.7	50.8	58.4	54.2
2024-09-26	22:00	23:00	57.9	74.1	49.4	60.1	53.6
2024-09-26	23:00	00:00	53.5	71.0	44.7	56.2	48.6
2024-09-27	00:00	01:00	51.3	64.5	41.5	53.8	46.3
2024-09-27	01:00	02:00	50.8	76.7	39.6	53.3	45.1
2024-09-27	02:00	03:00	49.2	64.5	37.8	51.3	43.1
2024-09-27	03:00	04:00	48.1	60.5	38.1	50.7	42.8
2024-09-27	04:00	05:00	50.3	65.8	40.6	52.6	45.9
2024-09-27	05:00	06:00	54.2	71.2	45.1	56.2	49.6
2024-09-27	06:00	07:00	57.1	70.7	49.0	59.1	53.5
2024-09-27	07:00	08:00	59.8	76.8	54.5	61.9	57.1
2024-09-27	08:00	09:00	58.3	67.6	52.6	60.5	55.8

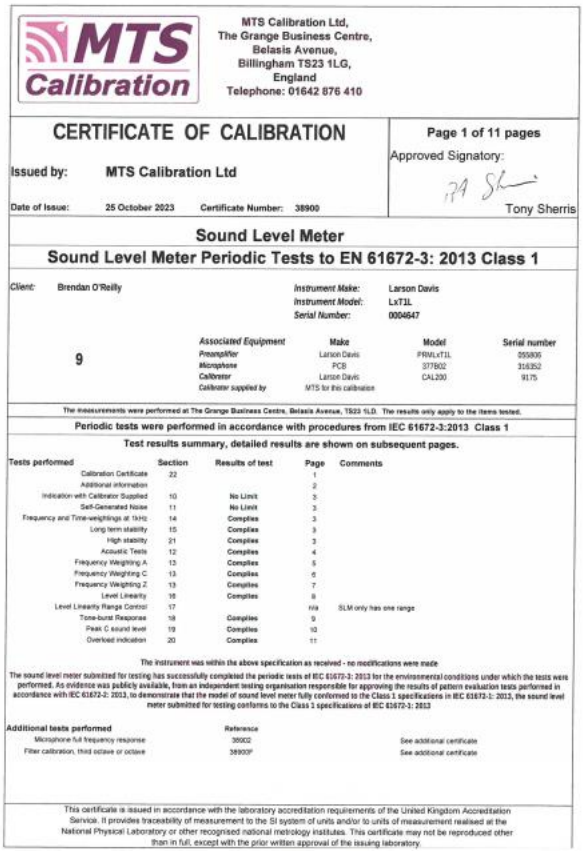
Date	Time Period		Measured Sound Pressure Levels (dB)				
	Start	Finish	$L_{Aeq,1hr}$	L_{AFmax}	L_{AFmin}	L_{AF10}	L_{AF90}
2024-09-27	09:00	10:00	59.2	72.1	53.6	61.1	56.6
2024-09-27	10:00	11:00	58.2	66.1	52.5	60.1	55.7
2024-09-27	11:00	12:00	59.3	72.4	52.6	61.1	57.0
2024-09-27	12:00	13:00	58.9	68.8	53.5	60.6	56.7
2024-09-27	13:00	14:00	58.4	68.8	52.7	60.1	56.2
2024-09-27	14:00	15:00	57.9	67.4	52.2	60.0	55.0
2024-09-27	15:00	16:00	55.5	63.9	51.5	57.0	53.5
2024-09-27	16:00	17:00	56.2	73.1	51.4	57.6	53.4
2024-09-27	17:00	18:00	56.0	64.6	50.7	57.8	53.6
2024-09-27	18:00	19:00	56.6	69.1	50.7	58.8	53.6
2024-09-27	19:00	20:00	55.1	73.6	49.5	56.9	52.6
2024-09-27	20:00	21:00	55.2	77.8	49.5	57.0	52.5
2024-09-27	21:00	22:00	53.6	65.5	47.8	55.8	50.8
2024-09-27	22:00	23:00	52.5	67.1	45.7	55.1	48.8
2024-09-27	23:00	00:00	50.8	69.2	42.5	53.3	46.6
2024-09-28	00:00	01:00	50.7	73.4	38.5	53.3	45.1
2024-09-28	01:00	02:00	49.3	64.2	37.8	52.8	42.2
2024-09-28	02:00	03:00	47.0	63.4	35.7	48.7	40.7
2024-09-28	03:00	04:00	47.0	65.9	37.7	47.4	40.9
2024-09-28	04:00	05:00	44.8	63.4	35.9	46.1	39.4
2024-09-28	05:00	06:00	47.0	65.9	37.1	47.7	40.5
2024-09-28	06:00	07:00	51.1	64.5	41.5	53.2	45.9
2024-09-28	07:00	08:00	55.6	81.9	47.0	57.7	49.8
2024-09-28	08:00	09:00	53.1	67.1	46.0	56.9	48.4
2024-09-28	09:00	10:00	53.3	70.3	45.2	57.3	47.8
2024-09-28	10:00	11:00	54.1	72.3	46.3	57.5	49.1
2024-09-28	11:00	12:00	52.6	67.6	45.7	55.6	48.2
2024-09-28	12:00	13:00	53.4	66.6	46.4	56.3	49.6
2024-09-28	13:00	14:00	53.3	73.9	46.0	56.4	49.0
2024-09-28	14:00	15:00	52.3	62.0	45.3	55.3	48.5
2024-09-28	15:00	16:00	52.8	66.6	46.4	56.0	49.0
2024-09-28	16:00	17:00	53.1	71.1	46.1	56.3	48.7
2024-09-28	17:00	18:00	52.3	72.1	45.3	55.4	47.4
2024-09-28	18:00	19:00	51.6	68.8	45.2	54.6	47.1
2024-09-28	19:00	20:00	51.1	75.0	44.8	54.0	46.7
2024-09-28	20:00	21:00	50.1	63.3	44.4	53.1	46.4
2024-09-28	21:00	22:00	49.7	66.6	43.9	52.7	45.7
2024-09-28	22:00	23:00	49.4	70.1	41.9	52.4	45.2
2024-09-28	23:00	00:00	49.8	67.2	41.1	53.2	44.5
2024-09-29	00:00	01:00	49.4	63.4	39.1	52.8	42.7
2024-09-29	01:00	02:00	51.0	70.6	39.8	54.9	43.5
2024-09-29	02:00	03:00	51.9	66.6	37.8	56.4	42.8
2024-09-29	03:00	04:00	54.2	69.5	39.6	58.7	43.8
2024-09-29	04:00	05:00	55.4	68.4	40.1	59.8	45.1
2024-09-29	05:00	06:00	57.3	68.6	40.4	62.1	45.5
2024-09-29	06:00	07:00	58.5	72.8	47.4	62.5	50.8
2024-09-29	07:00	08:00	60.2	70.5	47.8	63.1	54.2
2024-09-29	08:00	09:00	61.8	80.2	53.8	64.3	57.7
2024-09-29	09:00	10:00	63.6	76.4	55.1	66.1	59.3
2024-09-29	10:00	11:00	62.8	73.2	53.3	65.9	57.3
2024-09-29	11:00	12:00	63.3	77.7	55.4	66.1	58.5
2024-09-29	12:00	13:00	63.3	74.1	54.5	66.2	58.1
2024-09-29	13:00	14:00	62.2	72.5	53.4	65.1	57.5

Date	Time Period		Measured Sound Pressure Levels (dB)				
	Start	Finish	$L_{Aeq,1hr}$	L_{AFmax}	L_{AFmin}	L_{AF10}	L_{AF90}
2024-09-29	14:00	15:00	60.3	71.4	53.3	63.1	55.9
2024-09-29	15:00	16:00	61.9	73.8	53.4	65.0	56.6
2024-09-29	16:00	17:00	58.0	73.0	52.2	60.2	54.8
2024-09-29	17:00	18:00	58.6	66.1	52.1	60.7	55.3
2024-09-29	18:00	19:00	58.7	75.3	53.3	60.4	56.3
2024-09-29	19:00	20:00	57.7	65.7	51.6	59.8	55.1
2024-09-29	20:00	21:00	55.8	66.5	50.0	57.9	52.8
2024-09-29	21:00	22:00	53.5	69.0	46.5	55.7	49.9
2024-09-29	22:00	23:00	49.9	68.7	42.1	52.0	45.4
2024-09-29	23:00	00:00	50.1	64.6	40.2	52.3	45.1
2024-09-30	00:00	01:00	48.6	62.2	37.1	51.0	42.5
2024-09-30	01:00	02:00	45.7	61.8	34.4	48.4	38.5
2024-09-30	02:00	03:00	47.3	63.6	36.0	50.2	40.6
2024-09-30	03:00	04:00	47.7	63.0	35.9	50.3	41.8
2024-09-30	04:00	05:00	48.8	64.7	38.8	51.1	43.4
2024-09-30	05:00	06:00	51.1	65.1	39.2	53.4	45.6
2024-09-30	06:00	07:00	56.7	71.5	46.6	59.1	52.6
2024-09-30	07:00	08:00	58.7	78.8	52.3	60.5	55.4
2024-09-30	08:00	09:00	57.3	69.3	51.9	59.8	54.3
2024-09-30	09:00	10:00	57.1	70.3	51.8	59.3	54.4
2024-09-30	10:00	11:00	56.8	69.6	51.7	58.8	54.4
2024-09-30	11:00	12:00	57.9	71.5	51.5	59.8	55.2
2024-09-30	12:00	13:00	57.3	70.4	51.6	59.3	54.7
2024-09-30	13:00	14:00	57.8	71.6	52.8	59.6	55.5
2024-09-30	14:00	15:00	58.1	66.1	52.5	60.1	55.8
2024-09-30	15:00	16:00	58.4	69.7	53.2	60.2	56.2
2024-09-30	16:00	17:00	58.2	70.7	53.6	59.9	55.9
2024-09-30	17:00	18:00	57.4	72.8	52.2	59.2	55.1
2024-09-30	18:00	19:00	56.3	68.2	51.7	58.3	54.0
2024-09-30	19:00	20:00	56.0	79.6	50.3	58.0	53.3
2024-09-30	20:00	21:00	54.3	63.6	48.3	56.7	51.0
2024-09-30	21:00	22:00	52.0	68.1	46.1	54.5	48.7
2024-09-30	22:00	23:00	50.3	67.8	41.2	52.2	46.8
2024-09-30	23:00	00:00	48.7	62.2	38.1	50.9	43.1
2024-10-01	00:00	01:00	47.1	65.3	32.5	49.2	39.5
2024-10-01	01:00	02:00	45.0	60.7	33.6	47.5	37.3
2024-10-01	02:00	03:00	42.8	61.7	31.0	45.6	34.8
2024-10-01	03:00	04:00	43.1	61.6	31.0	46.4	34.7
2024-10-01	04:00	05:00	46.8	66.6	34.6	49.0	40.3
2024-10-01	05:00	06:00	51.3	66.2	37.9	53.7	44.7
2024-10-01	06:00	07:00	55.7	69.8	47.7	58.2	51.7
2024-10-01	07:00	08:00	57.9	78.5	52.1	60.3	54.0
2024-10-01	08:00	09:00	57.5	84.7	50.9	58.8	53.0
2024-10-01	09:00	10:00	54.7	79.4	46.2	57.6	50.1
2024-10-01	10:00	11:00	54.3	69.7	47.5	56.9	50.5
2024-10-01	11:00	12:00	55.4	64.7	49.6	57.6	52.7
2024-10-01	12:00	13:00	55.3	63.2	49.0	57.5	52.4
2024-10-01	13:00	14:00	54.1	73.3	46.3	56.7	50.5
2024-10-01	14:00	15:00	54.8	66.2	48.6	57.4	51.3
2024-10-01	15:00	16:00	54.6	69.4	47.7	57.2	50.9
2024-10-01	16:00	17:00	53.9	66.4	44.9	56.7	49.2
2024-10-01	17:00	18:00	52.4	69.8	46.7	54.2	49.3
2024-10-01	18:00	19:00	53.8	80.4	47.0	55.9	49.0

Date	Time Period		Measured Sound Pressure Levels (dB)				
	Start	Finish	$L_{Aeq,1hr}$	L_{AFmax}	L_{AFmin}	L_{AF10}	L_{AF90}
2024-10-01	19:00	20:00	55.7	90.9	47.3	56.6	49.6
2024-10-01	20:00	21:00	52.4	68.9	45.9	55.2	49.0
2024-10-01	21:00	22:00	50.8	64.2	44.0	53.7	47.0
2024-10-01	22:00	23:00	49.9	63.7	39.2	52.9	44.3
2024-10-01	23:00	00:00	48.3	63.8	37.3	50.5	41.7
2024-10-02	00:00	01:00	46.6	67.7	35.0	47.4	39.6
2024-10-02	01:00	02:00	44.9	61.7	32.3	47.2	37.1
2024-10-02	02:00	03:00	43.6	60.6	31.5	46.1	35.7
2024-10-02	03:00	04:00	44.6	63.0	31.9	47.0	36.7
2024-10-02	04:00	05:00	46.7	62.5	35.2	49.1	41.4
2024-10-02	05:00	06:00	51.9	67.6	43.6	53.6	47.6
2024-10-02	06:00	07:00	55.3	69.6	48.5	58.1	51.3
2024-10-02	07:00	08:00	59.9	90.1	51.6	60.1	53.7
2024-10-02	08:00	09:00	55.9	81.9	48.2	59.2	51.1
2024-10-02	09:00	10:00	54.5	71.1	47.4	57.8	49.9
2024-10-02	10:00	11:00	53.4	69.4	46.5	56.9	49.0
2024-10-02	11:00	12:00	52.5	65.4	45.6	56.0	48.4
2024-10-02	12:00	13:00	54.7	68.9	45.3	57.2	48.9

APPENDIX C

SOUND LEVEL METER CALIBRATION CERTIFICATES



MTS Calibration Ltd,
The Grange Business Centre,
Belasis Avenue,
Billingham TS23 1LG,
England
Telephone: 01642 876 410

CERTIFICATE OF CALIBRATION

Page 1 of 11 pages

Issued by: MTS Calibration Ltd

Approved Signatory: Tony Sherris

Date of Issue: 25 October 2023 Certificate Number: 38900

Sound Level Meter

Sound Level Meter Periodic Tests to EN 61672-3: 2013 Class 1

Client: Brendan O'Reilly

Instrument Make: Larson Davis
Instrument Model: LxT1L
Serial Number: 0004647

9

Associated Equipment	Make	Model	Serial number
Preamplifier	Larson Davis	PRMLxT1L	055806
Microphone	PCB	377B02	316352
Calibrator	Larson Davis	CAL200	9175
Calibrator supplied by	MTS for this calibration		

The measurements were performed at The Grange Business Centre, Belasis Avenue, TS23 1LD. The results only apply to the items tested.

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 Class 1

Test results summary, detailed results are shown on subsequent pages.

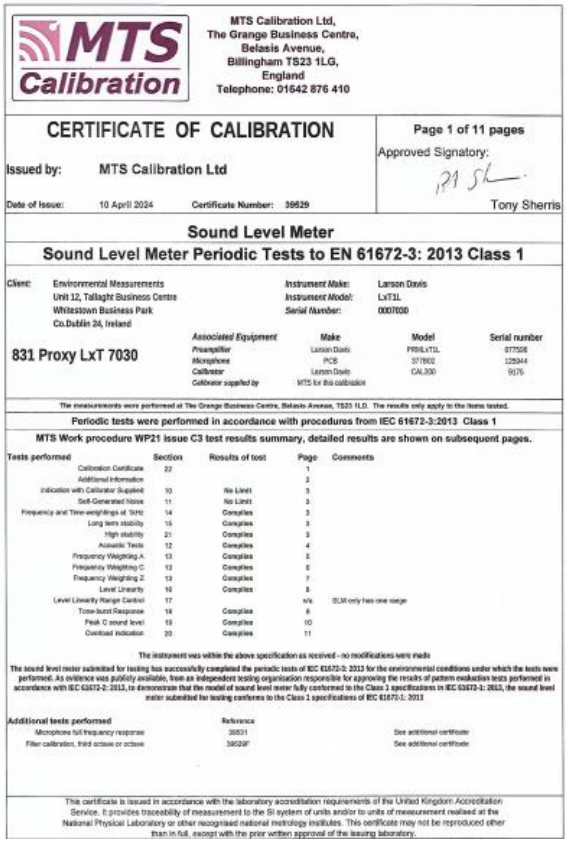
Tests performed	Section	Results of test	Page	Comments
Calibration Certificate	22		1	
Additional information			2	
Indication with Calibrator Supplied	10	No Limit	3	
Self-Generated Noise	11	No Limit	3	
Frequency and Time-weightings at 1kHz	14	Complies	3	
Long term stability	15	Complies	3	
High stability	21	Complies	3	
Acoustic Tests	12	Complies	4	
Frequency Weighting A	13	Complies	5	
Frequency Weighting C	13	Complies	6	
Frequency Weighting Z	13	Complies	7	
Level Linearity	16	Complies	8	
Level Linearity Range Control	17		n/a	SLM only has one range
Tone-burst Response	18	Complies	9	
Peak C sound level	19	Complies	10	
Overload indication	20	Complies	11	

The instrument was within the above specification as received - no modifications were made

The sound level meter submitted for testing has successfully completed the periodic tests of IEC 61672-3: 2013 for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2: 2013, to demonstrate that the model of sound level meter fully conformed to the Class 1 specifications in IEC 61672-1: 2013, the sound level meter submitted for testing conforms to the Class 1 specifications of IEC 61672-1: 2013

Additional tests performed	Reference	
Microphone full frequency response	38902	See additional certificate
Filter calibration, third octave or octave	38903F	See additional certificate

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.



MTS Calibration Ltd,
The Grange Business Centre,
Belasis Avenue,
Billingham TS23 1LG,
England
Telephone: 01642 876 410

CERTIFICATE OF CALIBRATION

Page 1 of 11 pages

Issued by: MTS Calibration Ltd

Approved Signatory: Tony Sherris

Date of Issue: 10 April 2024 Certificate Number: 39529

Sound Level Meter

Sound Level Meter Periodic Tests to EN 61672-3: 2013 Class 1

Client: Environmental Measurements
Unit 12, Tallaght Business Centre
Whitestown Business Park
Co.Dublin 24, Ireland

Instrument Make: Larson Davis
Instrument Model: LxT1L
Serial Number: 0007030

831 Proxy LxT 7030

Associated Equipment	Make	Model	Serial number
Preamplifier	Larson Davis	PRMLxT1L	077508
Microphone	PCB	377B02	125344
Calibrator	Larson Davis	CAL200	9176
Calibrator supplied by	MTS for this calibration		

The measurements were performed at The Grange Business Centre, Belasis Avenue, TS23 1LD. The results only apply to the items tested.

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 Class 1

MTS Work procedure WP21 issue C3 test results summary, detailed results are shown on subsequent pages.

Tests performed	Section	Results of test	Page	Comments
Calibration Certificate	22		1	
Additional information			2	
Indication with Calibrator Supplied	10	No Limit	3	
Self-Generated Noise	11	No Limit	3	
Frequency and Time-weightings at 1kHz	14	Complies	3	
Long term stability	15	Complies	3	
High stability	21	Complies	3	
Acoustic Tests	12	Complies	4	
Frequency Weighting A	13	Complies	5	
Frequency Weighting C	13	Complies	6	
Frequency Weighting Z	13	Complies	7	
Level Linearity	16	Complies	8	
Level Linearity Range Control	17		n/a	SLM only has one range
Tone-burst Response	18	Complies	9	
Peak C sound level	19	Complies	10	
Overload indication	20	Complies	11	

The instrument was within the above specification as received - no modifications were made

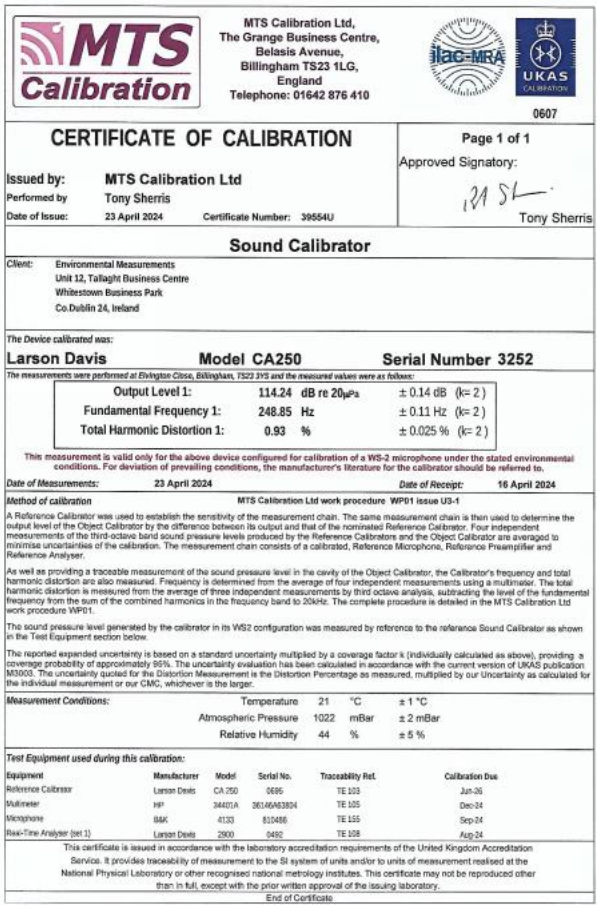
The sound level meter submitted for testing has successfully completed the periodic tests of IEC 61672-3: 2013 for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2: 2013, to demonstrate that the model of sound level meter fully conformed to the Class 1 specifications in IEC 61672-1: 2013, the sound level meter submitted for testing conforms to the Class 1 specifications of IEC 61672-1: 2013

Additional tests performed	Reference	
Microphone full frequency response	39531	See additional certificate
Filter calibration, third octave or octave	39529F	See additional certificate

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

APPENDIX D

ACOUSTIC CALIBRATOR CALIBRATION CERTIFICATE



MTS Calibration Ltd,
The Grange Business Centre,
Belasis Avenue,
Billingham TS23 1LG,
England
Telephone: 01642 876 410

0607

CERTIFICATE OF CALIBRATION

Page 1 of 1

Approved Signatory:

Tony Sherris

Issued by: MTS Calibration Ltd
Performed by Tony Sherris
Date of Issue: 23 April 2024 Certificate Number: 39554U

Sound Calibrator

Client: Environmental Measurements
Unit 12, Tallaght Business Centre
Whitestown Business Park
Co.Dublin 24, Ireland

The Device calibrated was:

Larson Davis Model CA250 Serial Number 3252

The measurements were performed at Elvington Close, Billingham, TS23 3YS and the measured values were as follows:

Output Level 1:	114.24	dB re 20µPa	± 0.14 dB (k= 2)
Fundamental Frequency 1:	248.85	Hz	± 0.11 Hz (k= 2)
Total Harmonic Distortion 1:	0.93	%	± 0.025 % (k= 2)

This measurement is valid only for the above device configured for calibration of a WS-2 microphone under the stated environmental conditions. For deviation of prevailing conditions, the manufacturer's literature for the calibrator should be referred to.

Date of Measurements: 23 April 2024 Date of Receipt: 16 April 2024

Method of calibration MTS Calibration Ltd work procedure WP01 issue U3-1

A Reference Calibrator was used to establish the sensitivity of the measurement chain. The same measurement chain is then used to determine the output level of the Object Calibrator by the difference between its output and that of the nominated Reference Calibrator. Four independent measurements of the third-octave band sound pressure levels produced by the Reference Calibrators and the Object Calibrator are averaged to minimise uncertainties of the calibration. The measurement chain consists of a calibrated, Reference Microphone, Reference Preamplifier and Reference Analyser.

As well as providing a traceable measurement of the sound pressure level in the cavity of the Object Calibrator, the Calibrator's frequency and total harmonic distortion are also measured. Frequency is determined from the average of four independent measurements using a multimeter. The total harmonic distortion is measured from the average of three independent measurements by third octave analysis, subtracting the level of the fundamental frequency from the sum of the combined harmonics in the frequency band to 20kHz. The complete procedure is detailed in the MTS Calibration Ltd work procedure WP01.

The sound pressure level generated by the calibrator in its WS2 configuration was measured by reference to the reference Sound Calibrator as shown in the Test Equipment section below.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k (individually calculated as above), providing a coverage probability of approximately 95%. The uncertainty evaluation has been calculated in accordance with the current version of UKAS publication M3003. The uncertainty quoted for the Distortion Measurement is the Distortion Percentage as measured, multiplied by our Uncertainty as calculated for the individual measurement or our CMC, whichever is the larger.

Measurement Conditions:			
Temperature	21	°C	± 1 °C
Atmospheric Pressure	1022	mBar	± 2 mBar
Relative Humidity	44	%	± 5 %

Test Equipment used during this calibration:

Equipment	Manufacturer	Model	Serial No.	Traceability Ref.	Calibration Due
Reference Calibrator	Larson Davis	CA 250	0695	TE 103	Jun-26
Multimeter	HP	34401A	3614A63804	TE 105	Dec-24
Microphone	B&K	4133	810486	TE 155	Sep-24
Real-Time Analyser (set 1)	Larson Davis	2900	0492	TE 108	Aug-24

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

End of Certificate