

HOME Arches Manchester

Noise Impact Assessment Report

29047/NIA

24 September 2021

Robertson Construction
3 The Parks
Haydock
Newton-le-Willows
WA12 0JQ



Hann Tucker Associates
Consultants in Acoustics Noise & Vibration

Head Office: Duke House, 1-2 Duke Street, Woking, Surrey, GU21 5BA (t) +44 (0) 1483 770 595
Manchester Office: First Floor, 346 Deansgate, Manchester, M3 4LY (t) +44 (0) 161 832 7041
(w) hanntucker.co.uk (e) enquiries@hanntucker.co.uk



Noise Impact Assessment Report Report 29047/NIA

Document Control

Rev	Date	Comment	Prepared by	Authorised by
Draft	24/09/2021	-		
			Cameron Maskew Assistant Consultant BEng (Hons)	Tom Bonnert Principal Consultant BEng (Hons) MIOA



Noise Impact Assessment Report Report 29047/NIA

Contents	Page
1.0 Introduction	1
2.0 Objectives	1
3.0 Site Description	1
4.0 Acoustic Terminology	3
5.0 Project Proposals	4
6.0 Acoustic Standards and Guidelines	4
7.0 Environmental Noise Survey Methodology	9
8.0 Measurement Results	12
9.0 Discussion Of Noise Climate	14
10.0 Fixed Plant Noise Emission	15
11.0 Venue Hall (Music) External Noise Breakout	15
12.0 Conclusions	18

Attachments

Appendix A – Acoustic Terminology

Time History Graph – 29047/TH1.1 and 29047/TH1.2



1.0 Introduction

This proposal is for the provision of acoustic consultancy services for a refurbishment of archways adjacent to HOME, centre for contemporary theatre, film, art and music into 3No railway arches on Whitworth Street in Manchester.

Hann Tucker Associates have therefore been commissioned to assess the potential noise impact the operation of the development may have on nearby existing noise sensitive receptors.

This report presents the noise impact assessment and our advice on further mitigation measures, where necessary.

2.0 Objectives

To visit site to carry out environmental noise level measurements to establish the prevailing external noise climate in the vicinity of the site and nearby receptors.

To review the requirements of the Local Authority pertaining to commercial and entertainment noise control and subsequently set design criteria for the proposed uses.

Based on the above, to assess the potential noise impact of the development units on the nearby external receptors, providing advice on mitigation measures where necessary.

To set plant noise emission limits in line with Local Authority guidance.

3.0 Site Description

3.1 Location

The site HOME, 2 Tony Wilson Place, Manchester, M15 4FN is situated in Manchester City Centre. Three of the arches supporting the adjacent railway are to be developed into studios.

The location is shown on the Location Map below. The site falls within the jurisdiction of Manchester City Council.



Location Map (Map Data ©2021 Google)

3.2 Description

The proposed site sits within a largely commercial area of the city, with some residential apartments to the north.

Given the location in the city centre traffic noise is also a consideration to be taken into account, the B6469 and A5103 being the largest contributors. These roads are considered to both facilitate moderate to heavy traffic flow, especially at rush hour periods.

Given that the proposed site sits within rail arches beneath an operating train-line, this is also expected to be a primary noise source at the site.

The site is shown in the Site Plan below.



Site Plan (Map Data ©2021 Google)

4.0 Acoustic Terminology

For an explanation of the acoustic terminology used in this report please refer to Appendix A enclosed.



5.0 Project Proposals

5.1 Drawings and Information

All acoustic analyses reported herein have been based on the following drawings.

Reference	Title	Date
116H_B1_SK_0005	Proposed Ground Floor Plan	03/07/2021
116H_B1_SK_0006	Section CC	03/07/2021

5.2 Operating Activities

The current proposal outlines multiple uses for the spaces. Arch 2 will be the entrance hub facilitating toilets, a small café, seating areas, toilets, and access to the other two arches. Arches 1 and 3 will be creative spaces, facilitating dance rehearsals, theatre rehearsals, creative workshops. These spaces are expected to play music during the use of the space.

5.3 Operational Hours

At this stage the desired operational times are not known, however it is expected that music will not be played during the night-time, therefore we have considered daytime operation only for music impact assessments.

6.0 Acoustic Standards and Guidelines

6.1 Local Planning Requirements

Manchester City Council requirements are outlined in Section 3.0 of Manchester City Council's Planning & Noise *Technical* Guidance document (December 2015).

6.2 Fixed Plant Noise Emissions

Section 3.6.1.5.1 outlines that the noise assessment for fixed plant should be based on BS 4142:2014 and the assessment must demonstrate that:

“Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme so as to achieve a rating level of 5dB (LAeq) below the typical background (LA90) level at the nearest noise sensitive location.”



6.3 Noise Generated by Events and/or Music Noise

Section 3.6.1.2 offers the following guidance regarding music noise:

“Noise from entertainment venues e.g. noise from recorded music, live bands, or karaoke, can be particularly annoying for local residents and businesses if it is not adequately contained within the venue. When considering the potential impact of a proposal for an entertainment venue consultants should consider the overall noise level (Leq) and the 63 Hz and 125 Hz octave band noise levels (Leq).”

The document then proposes the following assessment criteria for structurally connected uses, although this only makes reference to the impact on habitable rooms (not offices):

“Music noise levels in the 63Hz and 125Hz octave centre frequency bands (Leq) should be controlled so as not to exceed (in habitable rooms) 47dB and 41dB (Leq) respectively”.

In relation to noise egress MCC state that planning applications should:

“demonstrate that music noise from the proposal will not be ‘audible’ in nearby residential properties, assuming that the residential properties in question have their windows open. The criterion here is:

‘Entertainment noise (LAeq) should be controlled to 10dB below the background noise level (LA90) without the entertainment noise present, in each octave band at the nearest noise sensitive location.

6.4 Commercial Noise Breakout

Section 3.6.1.5 outlines that the noise assessment for commercial uses should be based on BS 4142:2014 and the design objective should be:

“The development should be designed so as to achieve a rating level of 5 dB (LAeq) below the typical background (LA90) level at the nearest noise sensitive location.”



6.5 Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) was published in March 2010 (i.e. before the NPPF). The NPSE is the overarching statement of noise policy for England and applies to all forms of noise other than occupational noise, setting out the long term vision of Government noise policy which is to:

“Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.”

“Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life.”*

The Explanatory Note to the NPSE has three concepts for the assessment of noise in this country:

NOEL – No Observed Effect Level

This is the level below which no effect can be detected and below which there is no detectable effect on health and quality of life due to noise.

LOAEL – Lowest Observable Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.

None of these three levels are defined numerically and for the SOAEL the NPSE makes it clear that the noise level is likely to vary depending upon the noise source, the receptor and the time of day/day of the week, etc. The need for more research to investigate what may represent an SOAEL for noise is acknowledged in the NPSE and the NPSE asserts that not stating specific SOAEL levels provides policy flexibility in the period until there is further evidence and guidance.



The NPSE concludes by explaining in a little more detail how the LOAEL and SOAEL relate to the three NPSE noise policy aims listed above. It starts with the aim of avoiding significant adverse effects on health and quality of life, then addresses the situation where the noise impact falls between the LOAEL and the SOAEL when *“all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development.”* The final aim envisages pro-active management of noise to improve health and quality of life, again taking into account the guiding principles of sustainable development which include the need to minimise travel distance between housing and employment uses in an area.

6.6 National Planning Policy Framework (NPPF)

The following paragraphs are from the NPPF (published July 2021):

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

- a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;
- b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

187. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or ‘agent of change’) should be required to provide suitable mitigation before the development has been completed.”

Paragraph 185 also references the Noise Policy Statement for England (NPSE). This document does not refer to specific noise levels but instead sets out three aims:



- "Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.
- Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.
- Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development."

6.7 BS 4142:2014

When setting plant noise emission criteria reference is commonly made to BS 4142: 2014 *"Methods for rating and assessing industrial and commercial sound"*.

The procedure contained in BS 4142:2014 provides an assessment of the likely effects of sound on people when comparing the specific noise levels from the source with representative background noise levels. Where the noise contains "a tone, impulse or other characteristic" then various corrections can be added to the specific (source) noise level to obtain the "rating level".

BS 4142 states that: *"The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs". An estimation of the impact of the specific noise can be obtained by the difference of the rating noise level and the background noise level and considering the following:*

- *"Typically, the greater this difference, the greater the magnitude of the impact."*
- *"A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context."*
- *"A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context."*
- *"The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."*



The determination of the “rating level” and the “background level” are both open to interpretation, depending on the context.

In summary it is not possible to set plant noise emission criteria purely on the basis of BS 4142:2014. It is reasonable to infer from the above, however, that a difference of around -5dB corresponds to “No Observed Effect Level” as defined in the Noise Policy Statement for England. It is also reasonable to infer from the above that if the plant noise rating level does not exceed the existing background noise level outside any noise sensitive residential window then the plant noise is of “low impact”.

7.0 Environmental Noise Survey Methodology

The survey was undertaken by Tom Bonnert, Principal Consultant BEng (Hons) MIOA and assisted by Cameron Maskew, Assistant Consultant BEng Hons.

7.1 Unmanned Noise Assessment Survey

7.1.1 Procedure

Fully automated environmental noise monitoring was undertaken from approximately 11:00 hours on 8 September 2021 to 14:00 hours on 18 September 2021.

During the periods we were on site the wind conditions were calm. The sky was generally clear. We understand that generally throughout the survey period the weather conditions were stable. These conditions are considered suitable for obtaining representative measurement results.

Measurements were taken continuously of the A-weighted (dBA) L_{90} , L_{eq} and L_{max} sound pressure levels over 5 minute and 15 minute periods

7.1.2 Measurement Position

The microphone was attached to a pole on a tripod approximately 2 metres above ground level. The position was selected to get representative noise measurements of the prevailing noise climate in the vicinity of the site.

The nearest façade was approximately 1.5 meters away (being the façade from the arch itself) and the temporary barrier installed to prevent the public gaining access to the arch. The measurements are therefore considered to be façade sound pressure levels.

The position is shown on the plan below.



Plan Showing Measurement Positions (Map Data ©2021 Google)

7.1.3 Instrumentation

The instrumentation used during the survey is presented in the Table below:

Description	Manufacturer	Type	Serial Number	Calibration
Type 1 Data Logging Sound Level Meter	Larson Davis	820	3157	Calibration on 15/07/2021
Type 1 Calibrator	Larson Davis	CAL200	3083	Calibration on 06/05/2021

The sound level meter, including the extension cable, was calibrated prior to and on completion of the survey. No significant change was found to have occurred (no more than 0.1 dB).

The sound level meter was located in an environmental case with the microphone connected to the sound level meter via an extension cable. The microphone was fitted with a windshield.

7.2 Manned Survey

7.2.1 Procedure

The attended measurements on 8 September 2021 were carried out in accordance with the shortened measurement procedure detailed in the Department of Transport document Calculation of Road Traffic Noise (CRTN) 1988 and Method 3 in the Transport Research Laboratory (TRL) Project Report PR/SE/451/02 'Converting the UK traffic noise index $LA_{10,18h}$ to EU noise indices for noise mapping'. The approach can be summarised as follows:



- Measure three consecutive $L_{A10,1h}$ as per the CRTN shortened procedure;
- Determine the average of the three $L_{A10,1h}$ values;
- Convert $L_{A10,3h}$ to $L_{A10,18h}$ by subtracting 1 dB;
- Apply TRL Method 3 equations to generate the $L_{Aeq,16h}$.

During the survey period the wind conditions were calm. The sky was generally clear. There was no rain during the survey. Road surfaces were dry throughout the survey period.

Measurements were taken of the A-weighted (dBA) L_{90} , L_{eq} and L_{max} sound pressure levels over periods of not less than 15 minutes in each hour. Atypical noises were excluded as far as reasonably possible. The noise levels measured are therefore assumed to be representative of the noise climate during the hour in which the measurements were taken

In addition, at each position typical L_{90} , L_{eq} and L_{max} octave band spectra (from 63Hz to 8kHz) were taken for a daytime period in order to gain a more detailed description of the prevailing noise climate.

7.2.2 Measurement Position

The noise level measurements were undertaken at position 1, on the B6469. The dominant noise source from this position was the traffic from the B6469, with intermittent pass-bys from railway above the measurement position.

The measurements position is shown on the plan below.



Plan Showing Unmanned Measurement Positions (Map Data ©2021 Google)



7.2.3 Instrumentation

The instrumentation used during the manned survey is presented in the table below:

Description	Manufacturer	Type	Serial Number	Calibration
Type 1 Precision Sound Level Meter	Brüel and Kjær	2260	5104	B & K calibration on 15/07/2021
Type 1 Calibrator	Brüel and Kjær	CAL200	3083	B & K calibration on 06/05/2021

The sound level meter was mounted on a tripod and was fitted with a Brüel and Kjær microphone windshield.

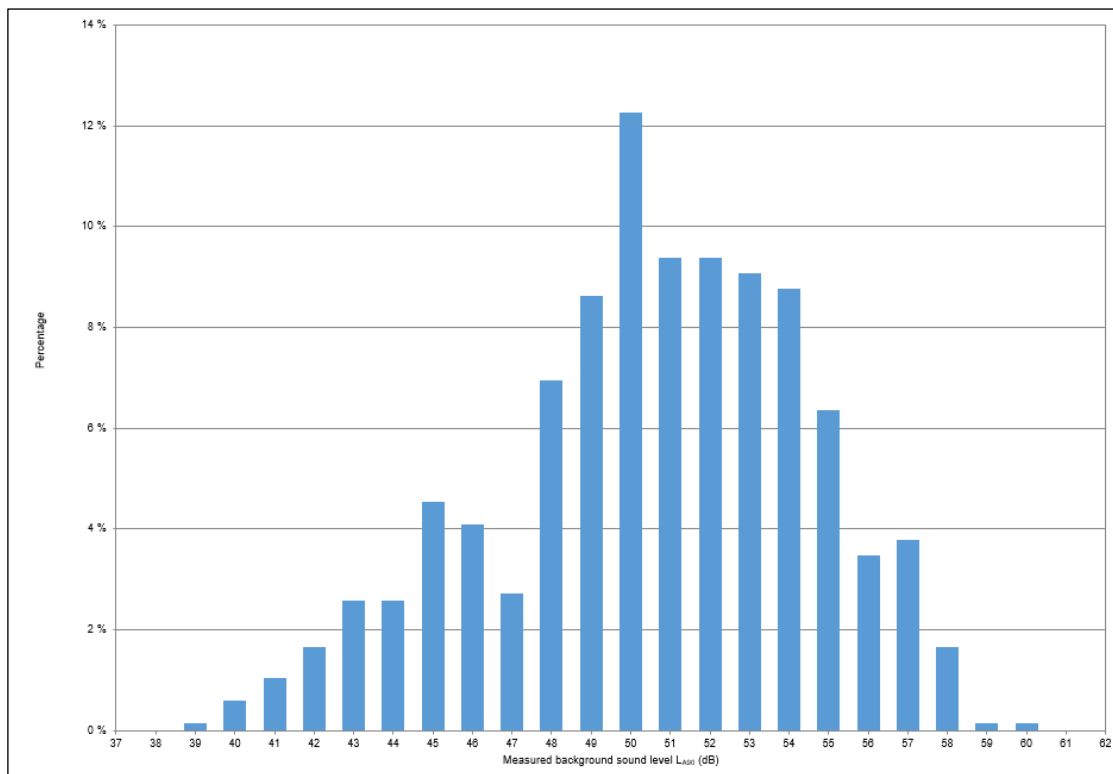
The sound level meter was calibrated prior to and on completion of the survey. No significant change was found to have occurred (no more than 0.1dB).

8.0 Measurement Results

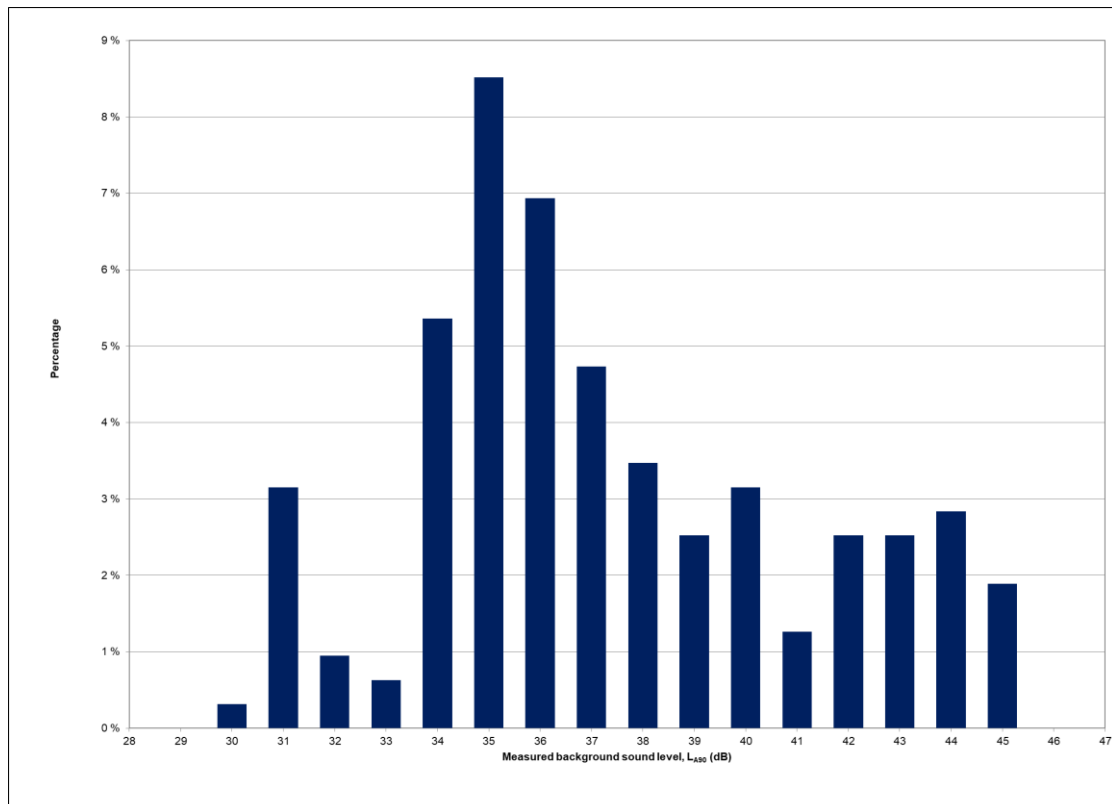
8.1 Results of Unattended Survey

The results have been plotted on Time History Graphs 29047/TH1.1 to 29047/TH1.2 enclosed presenting the 15 minute A-weighted (dBA) L_{90} , L_{eq} and L_{max} levels at each measurement position throughout the duration of the survey.

BS 4142 states that “the background sound level must be reliable and suitably represent the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods.” Taking this into account, the following histograms have been created which display the occurrence of each sound level (L_{90}) as a percentage for the day and night time periods.



[MP1] Statistical Analysis of Daytime Background Noise Levels (07:00-23:00)



[MP1] Statistical Analysis of Night-time Background Noise Levels (23:00-07:00)



A summary of the results from the environmental noise survey, as used to inform subsequent assessments of environmental noise impact, are presented in the table below as free-field levels.

Position	Daytime (07:00 – 23:00) Hours		Night-Time (23:00 – 07:00) Hours		
	L _{Aeq} , 16h	Typical Lowest L _{A90,15min}	L _{Aeq} , 8h	Typical Lowest L _{A90,15min}	15 th Highest L _{AFmax,5min}
1	64 dB	44 dB	61 dB	35 dB	83 dB

8.2 Results of Attended Survey

The following results were acquired based on manned measurements in the position presented in Section 7.2.2. A summary of the results from the shortened CRTN noise survey, as will be used to inform subsequent assessments of environmental noise impact, are presented in the table below as façade sound pressure levels.

Measurement position	Description	Sound Pressure Level (dB re 2x 10 ⁻⁵ Pa)
1	L _{A10,3h}	69
	L _{Aeq,16h}	66

Other descriptors were obtained during the manned noise survey, however in the interest of brevity these have not been included in this report.

9.0 Discussion Of Noise Climate

During the periods we were on site the dominant noise sources were noted to be intermittent re-radiated noise as well as airborne noise from the passing overhead trains reflected off HOME's main building façade. Whilst we were on site, trains were noted to pass in both directions approximately every 5 minutes during the daytime.

Noise emitted from the B6469 and A5103 was also considered to be a main noise contributor during our time on site, with a moderate traffic flow observed during the daytime.



10.0 Fixed Plant Noise Emission

10.1 Plant Noise Emission Limits

Based on the aforementioned acoustic standards and guidance, and on the results of our noise survey, the following plant noise emission criteria are proposed to be achieved at 1 m from the worst affected noise sensitive residential window with all plant operating simultaneously.

These limits are 5 dB below the lowest typical background sound levels measured, and are presented as façade noise levels.

Period	Cumulative Plant Noise Emission Limit (BS 4142:2014 Rating Level)
Daytime (07:00-23:00)	39 dBA
Night-time (23:00-07:00)	30 dBA

Noise shall be assessed in accordance with BS 4142:2014 with corrections applied for any plant emitting noise of a tonal or irregular quality. Emergency plant items (e.g. standby generators, smoke extract equipment) should be subject to more relaxed criteria.

The above limits shall be subject to the final approval of Manchester City Council.

11.0 Venue Hall (Music) External Noise Breakout

11.1 Expected Internal Noise Levels

To inform our assessment of the spaces, we have drawn upon typical noise levels within similar spaces that incorporate music. These typical highest 1-hour noise levels are presented below.

Description	Reverberant Noise Level (dB L _{eq,1hr}) at Octave Band Centre Frequency (Hz)							dBA
	63	125	250	500	1k	2k	4k	
Entertainment establishment with music played at a moderately high level at 5 m from loudspeakers	81	80	75	79	78	73	70	82
Typical internal noise levels in a bar with background music playing:	71	74	75	75	72	68	63	77

11.2 Criteria

MCC recommends that noise (L_{eq}) breaking out through the building frontage of an entertainment venue should not exceed 10 dB below the background noise level (L₉₀) at all octave band frequencies at the nearest noise sensitive windows. For this development, the nearest residential receptor is 23m to the north of the site.



We therefore propose the following noise limits when measured at 1m from nearby noise sensitive windows. These limits are 10 dB below the typical lowest background noise levels at each octave band during the operational hours and are subject to the final approval of MCC.

Description	Entertainment Noise Level Limit (dB L _{90,15min}) at Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Daytime (07:00 – 23:00)	47 ^[1]	41 ^[1]	32	31	32	24	13
Night-time (23:00 – 07:00)	47 ^[1]	41 ^[1]	25	23	21	11	9

¹ Based upon threshold of audibility, see below.

At low-frequencies, achieving 10 dB below the minimum background levels at this particular site is unnecessarily onerous, the breakout noise limits have therefore been increased to 47 dB and 41 dB at 63 Hz and 125 Hz, respectively. These limits are based upon the MCC criterion for entertainment noise intrusion to bedrooms, which itself is based upon the threshold of audibility at low frequencies. It is expected, therefore, that relaxing the limits in this way will have no effect on the impact to nearby sensitive receptors.

11.3 Window Glazing Calculation

We understand the Arches are to be fully enclosed internally with glazing that has yet to be determined. We have performed our calculations using low performance glass (ie 4mm glazing) to demonstrate the ability to comply with the aforementioned criteria, and our assessment is therefore considered to be worst-case and robust given that glazing will likely be thicker for safety/security reasons, thus increasing any acoustic performance achieved.

The expected acoustic performance for 4mm glazing is as follows:

Description	Estimated Sound Reduction Index (dB R) at Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
4mm Single Glazing	12	17	32	31	32	24	13

11.4 Assessment

We have assessed noise breakout to the nearest receptors based on standard calculation procedures for reverberant noise breakout and source noise levels in Section 11.1. The resultant external noise level has been calculated using the following equation.

$$SPL_{out} = SPL_{in} - SRI + 10 \log_{10} \left(\frac{S}{r^2} \right) - 14$$



Where:

SRI estimated sound reduction performance of façade element

r distance from radiating element to receptors

S approximate area of radiating element

The tables presented below outline summary calculations for the different operational noise levels assumed, with 4mm glazing. Daytime criteria have been used as it is assumed that the studios will not see any night-time use.

Typical internal noise levels in an entertainment establishment with music being played at a moderately high level. This data was captured 5 meters away from the loudspeaker:

Assessment to Residential Receptor	Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Internal noise level (dB L_{eq}) SPL_{in}	81	80	75	79	78	73	70
Distance & radiating area propagation correction (dB) $10\log_{10}\left(\frac{S}{r^2}\right)$	-10	-10	-10	-10	-10	-10	-10
Internal diffuse field to external free-field hemispherical radiation correction (dB) -14	-14	-14	-14	-14	-14	-14	-14
4mm glazing sound reduction (dB R) SRI	12	17	32	31	32	24	16
External noise level (dB L_{eq}) SPL_{out}	45	39	31	29	22	16	13
Criteria (dB L_{eq})	47	41	32	31	32	24	13
Compliance Note	✓	✓	✓	✓	✓	✓	✓

Typical internal noise levels in a bar with background music playing:

Assessment to Residential Receptor	Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Internal noise level (dB L_{eq}) SPL_{in}	71	74	75	75	72	68	63
Distance & radiating area propagation correction (dB) $10\log_{10}\left(\frac{S}{r^2}\right)$	-10	-10	-10	-10	-10	-10	-10
Internal diffuse field to external free-field hemispherical radiation correction (dB) -14	-14	-14	-14	-14	-14	-14	-14
4mm glazing sound reduction (dB R) SRI	12	17	32	31	32	24	16
External noise level (dB L_{eq}) SPL_{out}	35	33	31	25	16	11	6
Criteria (dB L_{eq})	47	41	32	31	32	24	13
Compliance Note	✓	✓	✓	✓	✓	✓	✓



It is likely when glazing is specified for the project, a higher performance glass will be needed to attenuate incoming noise in-line with the Clients' quality aspirations (though not considered to be a planning matter). Therefore, the data above intends to demonstrate a 'worst case scenario' situation, with the compliance being met across the spectrum.

12.0 Conclusions

A detailed environmental noise survey has been undertaken in order to establish the prevailing noise climate at the development site.

The acoustic requirements of local planning and current industry guidelines have been reviewed and used to inform an assessment of environmental noise sources affecting the proposed development.

An indicative assessment of music noise egress from the development has been undertaken to inform on the suitability of the site for its intended use. Our assessment indicates that acceptable noise levels should be achievable at the nearest noise sensitive receptor through the appropriate specification of glazing and ventilation solutions.

Noise emission limits have been set for new items of fixed plant and operational noise related to the development.

Appendix A

The acoustic terms used in this report are defined as follows:

dB	Decibel - Used as a measurement of sound level. Decibels are not an absolute unit of measurement but an expression of ratio between two quantities expressed in logarithmic form. The relationships between Decibel levels do not work in the same way that non-logarithmic (linear) numbers work (e.g. 30dB + 30dB = 33dB, not 60dB).
dBA	The human ear is more susceptible to mid-frequency noise than the high and low frequencies. The 'A'-weighting scale approximates this response and allows sound levels to be expressed as an overall single figure value in dBA. The _A subscript is applied to an acoustical parameter to indicate the stated noise level is A-weighted It should be noted that levels in dBA do not have a linear relationship to each other; for similar noises, a change in noise level of 10dBA represents a doubling or halving of subjective loudness. A change of 3dBA is just perceptible.
L _{90,T}	L ₉₀ is the noise level exceeded for 90% of the period <i>T</i> (i.e. the quietest 10% of the measurement) and is often used to describe the background noise level.
L _{eq,T}	L _{eq,T} is the equivalent continuous sound pressure level. It is an average of the total sound energy measured over a specified time period, <i>T</i> .
L _{max}	L _{max} is the maximum sound pressure level recorded over the period stated. L _{max} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the L _{eq} noise level.

Sound Pressure Level (L_p) is the sound pressure relative to a standard reference pressure of 2×10^{-5} Pa. This level varies for a given source according to a number of factors (including but not limited to: distance from the source; positioning; screening and meteorological effects).

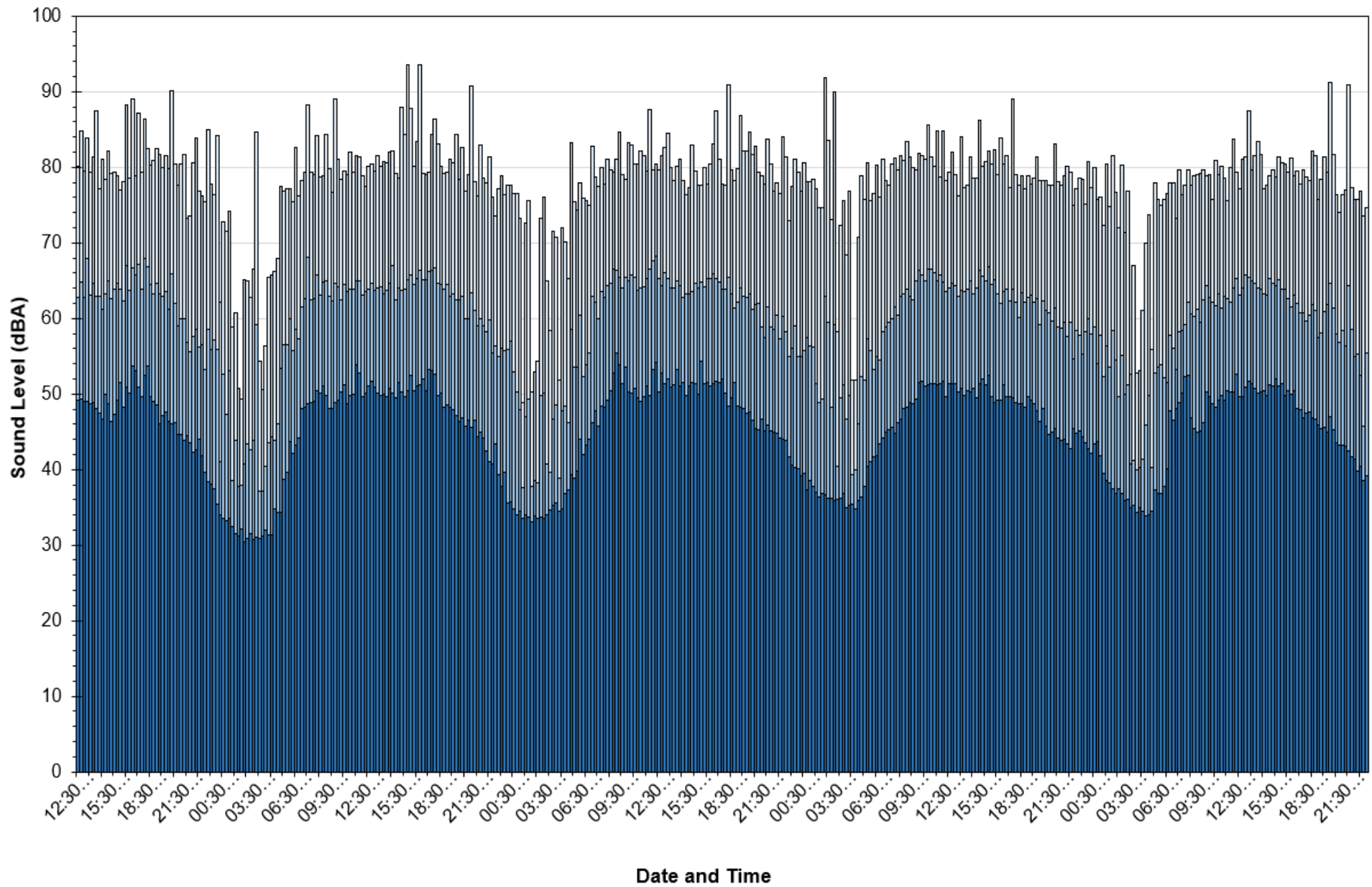
Sound Power Level (SWL or L_w) is the total amount of sound energy inherent in a particular sound source, independent of its environment. It is a logarithmic measure of the sound power in comparison to a specified reference level (usually 10^{-12} W).

HOME Arches

Position 1

L_{eq} , L_{max} and L_{90} Noise Levels

Wednesday 8 September 2021 to Sunday 12 September 2021



HOME Arches

Position 1

L_{eq} , L_{max} and L_{90} Noise Levels

Sunday 12 September 2021 to Saturday 18 September 2021

