A CAF GROUP COMPANY

ACOUSTICS

Custodian Property Income REIT Plc
Arthur House, Chorlton Street
Manchester

Noise Impact Assessment

232366

ACOUSTICS

Custodian Property Income REIT Plc
Arthur House, Chorlton Street
Manchester
Noise Impact Assessment

Birmingham
Livery Place, 35 Livery Street, Colmore Business District
Birmingham, B3 2PB
T: 0121 233 3322

Leeds
Whitehall Waterfront, 2 Riverside Way
Leeds, LS1 4EH
T: 0113 233 8000

London
11 Borough High Street
London, SE1 9SE
T: 0207 407 3879

Manchester
11 Portland Street
Manchester, M1 3HU
T: 0161 233 4260

Nottingham
5th Floor, Waterfront House, Station Street
Nottingham, NG2 3DQ
T: 0115 924 1100

April 2023

DOCUMENT ISSUE RECORD

Document Number:	**ACM-BWB-ZZ-ZZ-RP-YA-0001_NIA_S2_P01**
BWB Reference:	232366

Revision	Date of Issue	Status	Author:	Checked:	Approved:
1	26/04/2023	ISSUE	Nick Mitchell BSc (Hons), TECHIOA	Dawit Abraham MSc, MIOA	Mike Barrett BSc (Hons), MIOA

Notice

This document has been prepared for the sole use of the Client in accordance with the terms of the appointment under which it was produced. BWB Consulting Limited accepts no responsibility for any use of or reliance on the contents of this document by any third party. No part of this document shall be copied or reproduced in any form without the prior written permission of BWB.

EXECUTIVE SUMMARY

A noise impact assessment has been undertaken to ensure noise transmission from uses between a proposed ground floor gymnasium and first floor office area, as well as roof terrace to sixth floor office space does not adversely affect future tenants.

It has been determined through high level calculations that noise from the gymnasium is predicted to exceed the adopted criteria for both L_{eq} and L_{max} levels in low to mid frequencies, however with mtigation in the form of a suitable suspended ceiling, noise transmission can be controlled to within the criteria. Best practice has been recommended to be considered to ensure airborne and impact noise is controlled within the gymnasium along with management of the spaces.

The proposed roof terrace includes seating areas for lunch amenities for the tenants of the building. An assessment of raised speech levels generated by occupants on the roof terrace was undertaken, with the proposed floor separating the roof terrace and level six is sufficient in reducing noise to well within the criteria.

Based on the findings of the assessment, it is considered that noise transfer can be controlled to acceptable levels.

CONTENTS

EXECUTIVE SUMMARY iii
1. INTRODUCTION 3
Introduction 3
Site Setting 3
Proposed Development 4
2. STANDARDS AND GUIDANCE 7
National Planning Policy Framework (NPPF) 7
Manchester City Council's (MCC) Planning & Noise Technical Guidance 7
Professional Practice Guidance (ProPG): Gym Acoustic Guidance (GAG) 7
BS8233:2014: Guidance on Sound Insulation and Noise Reduction for Buildings 9
3. ASSESSMENT 11
Gymnasium - Airborne Sound Transmission 11
Gymnasium - Impact Sound Transmission 13
Roof Terrace 13
4. MITIGATION 14
Gymnasium – Airborne Sound Transmission 14
Gymnasium – Impact Sound Transmission 15
5. CONCLUSION 17
Noise 20
Acoustic Terminology 21

FIGURES

Figure 1.1: Site Location Plan
Figure 1.2: Ground Floor Gymnasium (Ref: 223-YOU-XX-00-DR-I-2001)
Figure 1.3: First Floor Office Relaxation Area (Ref: 223-YOU-XX-01-DR-I-2002)
Figure 1.4: Roof Terrace (Ref: 223-YOU-XX-R1-DR-1-2701)
Figure 1.5: Sixth Floor Office Area, Meeting Rooms and Booth Rooms (Ref: 223-YOU-XX-R1-DR-1-2701)
Figure 2.1: G-Curves Plotted Against The ISO 226:2003 Threshold of Hearing (Minimum Audible Field) For Pure Continuous Tone Perception of Ontologically Normal Persons in The Age Range 18 to 20 Years Inclusively
Figure 3.1: G-Curve Analysis of Gym Noise Transmission, L_{eq}
Figure 3.2: G-Curve Analysis of Gym Noise Transmission, L_{max}
Figure 4.1: Recommended Suspended Ceiling Section Model
Figure 4.2: G-Curve Analysis of Gym Noise Transmission, Leq – with mitigation
Figure 4.3: G-Curve Analysis of Gym Noise Transmission, Lmax – with mitigation

TABLES

Table 2.1: Guidance Internal Sound Target Criteria for Gym Activity – Residential & Other Areas
Table 2.2: Summary of Internal Ambient Noise Levels to be Achieved in Commercial Offices When Assessed in Accordance with BS 8233

APPENDICES

APPENDIX A: Glossary of Terms

1. INTRODUCTION

Introduction

1.1 BWB Consulting Limited (BWB) was instructed by Custodian Property Income REIT Plc (the Client) to undertake an assessment of a noise transfer assessment from the proposed gymnasium at ground floor to the first-floor office space. The assessment will also consider noise transfer from the proposed roof terrace to the sixth-floor office space.

1.2 The Technical Report includes predictive calculations to inform a robust assessment of noise levels expected within the gymnasium and review proposed separating elements to achieve the criteria set out in Section 2.

1.3 Where required, mitigation advice has been provided to reduce noise transmission levels to within the adopted criteria.

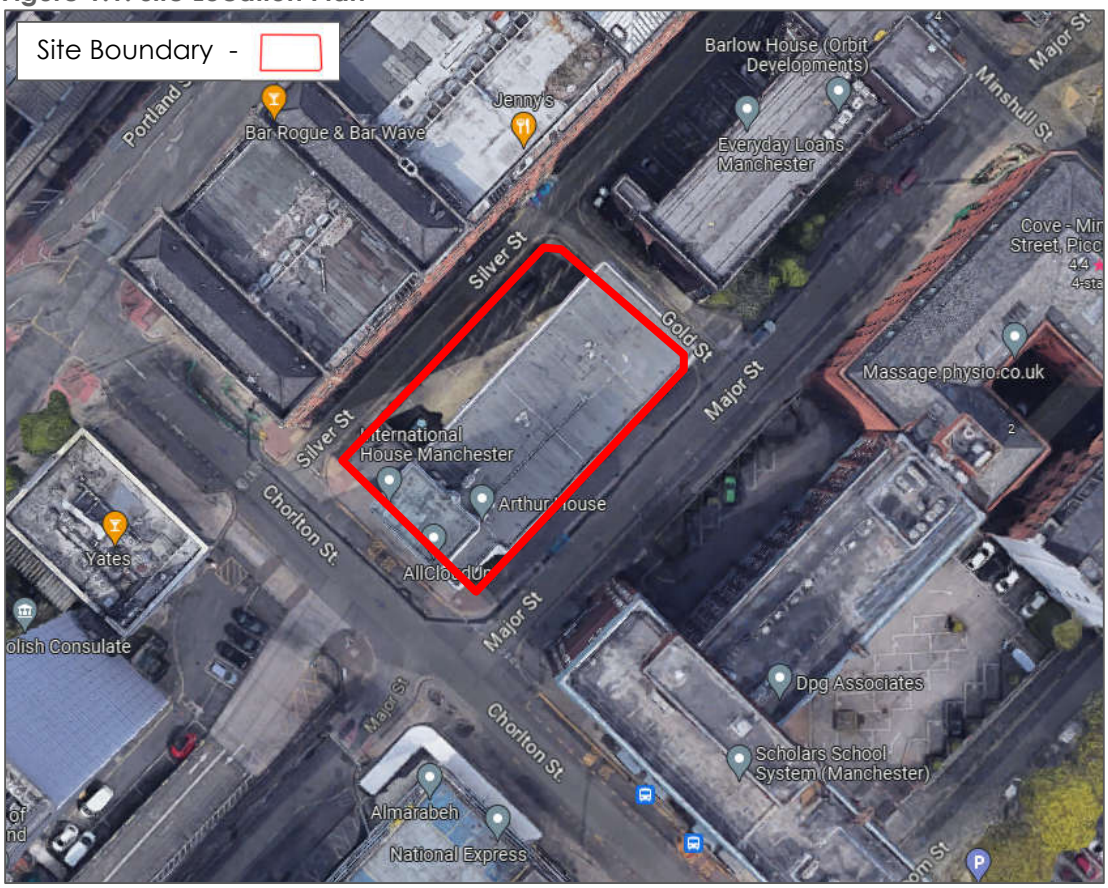
1.4 This report is necessarily technical in nature, so to assist the reader, a glossary of acoustic terminology can be found in **Appendix A**.

Site Setting

1.5 The Site is located in the city centre of Manchester and is currently an unused building comprising of 6No. floors. Arthur House sits in a mixed use area including hotels, offices, commercial bars/restaurants, training/education blocks, and car parking facilities.

1.6 The site is borded by Silver Street to the North, Gold Street to the east, Major Street to the south and Chorlton Street to the west. **Figure 1.1** shows the location of the proposed development.

Figure 1.1: Site Location Plan



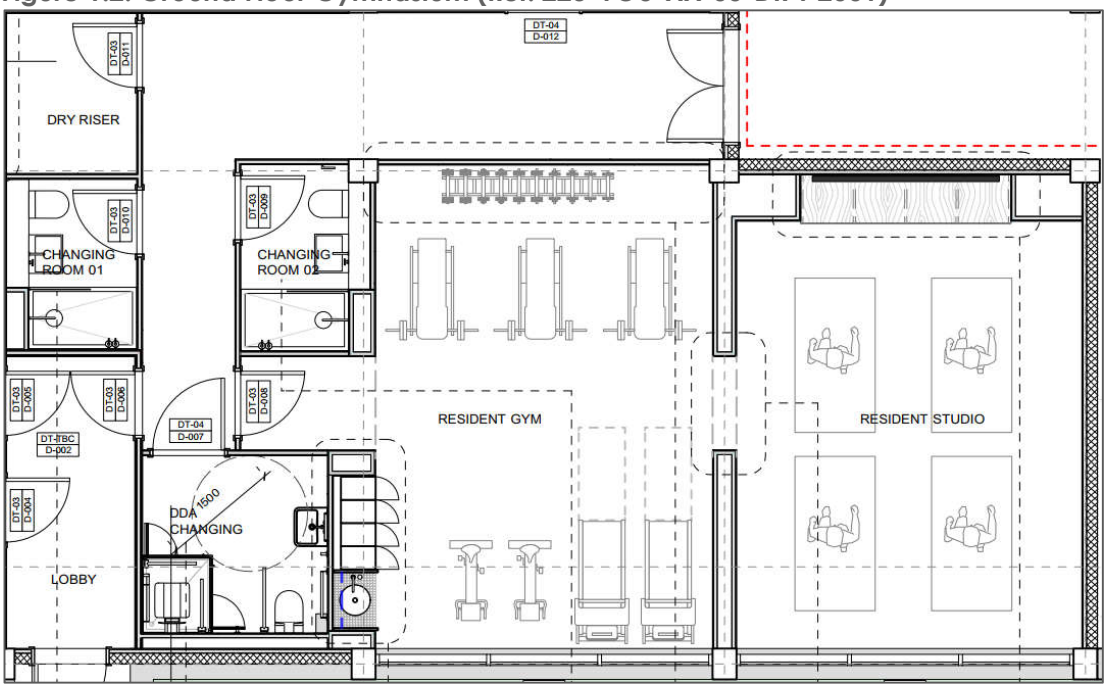
Reference: ©2023 Google Imegry

Proposed Development

1.7 The proposed development comprises 6No. floor offices with a gymnsaium at ground floor level and Roof Terrace at level 7.

1.8 The proposed ground floor gymnasium is divided into two areas which are interconnected with an open partition between the two spaces. The first room includes a fitness suite and has enough room to house 2 no. bicycle machines, 2 no. treadmill machines, 3 no. benches which press machines and a small free weight station. The second room includes a studio for yoga and pilates classes and has enough room to occupy 4 no. persons and potential space for a teacher; overall, 5 no. persons. **Figure 1.2** below details the internal layout.

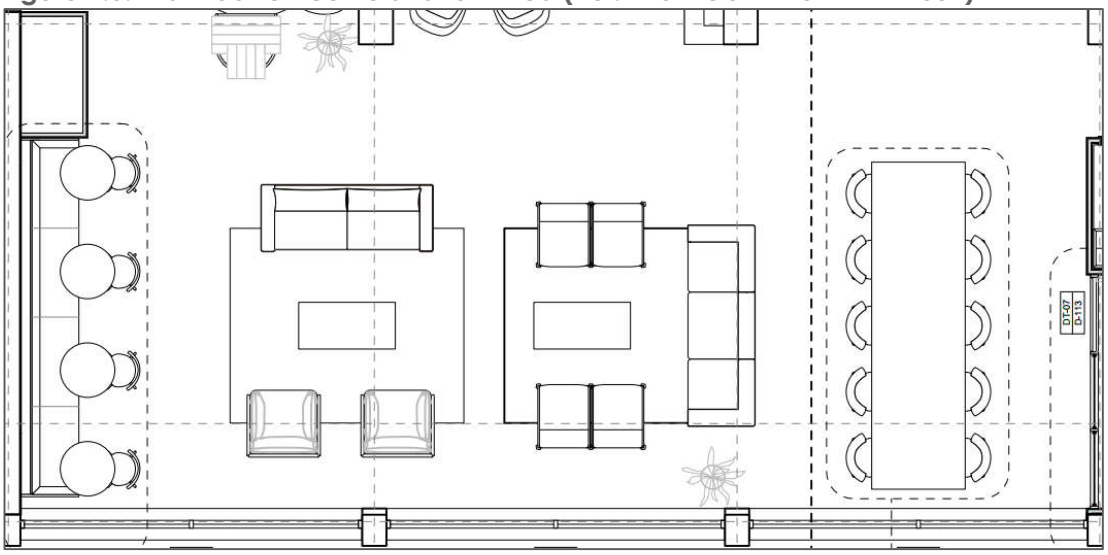
Figure 1.2: Ground Floor Gymnasium (Ref: 223-YOU-XX-00-DR-I-2001)



1.9 The proposed use as communicated by the client, the gymnasium is to be used between the hours of 0600 – 2000.

1.10 The area of assessment in relation to the gym is a lobby/relaxation area above at first floor. **Figure 1.3** below details the area of assessment.

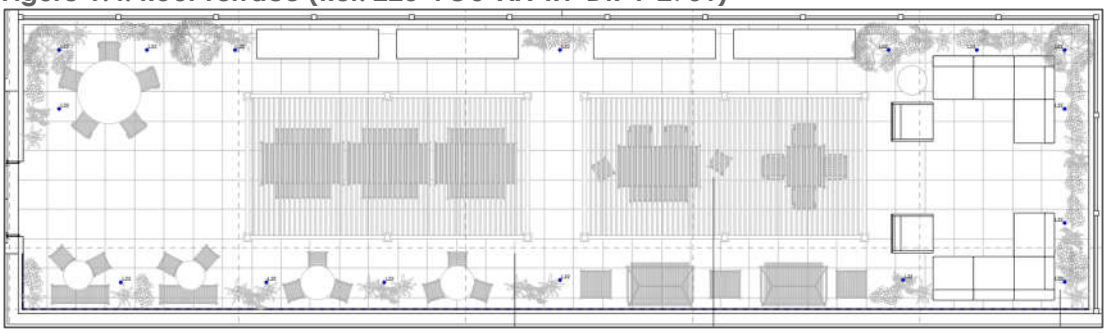
Figure 1.3: First Floor Office Relaxation Area (Ref: 223-YOU-XX-01-DR-I-2002)



1.11 The office relaxation area will have potential to be occupied between the operational times of 0800 – 2100.

1.12 The other area of assessment is in relation to a proposed roof terrace and offices below, at sixth floor level. **Figure 1.4** below details the roof terrace.

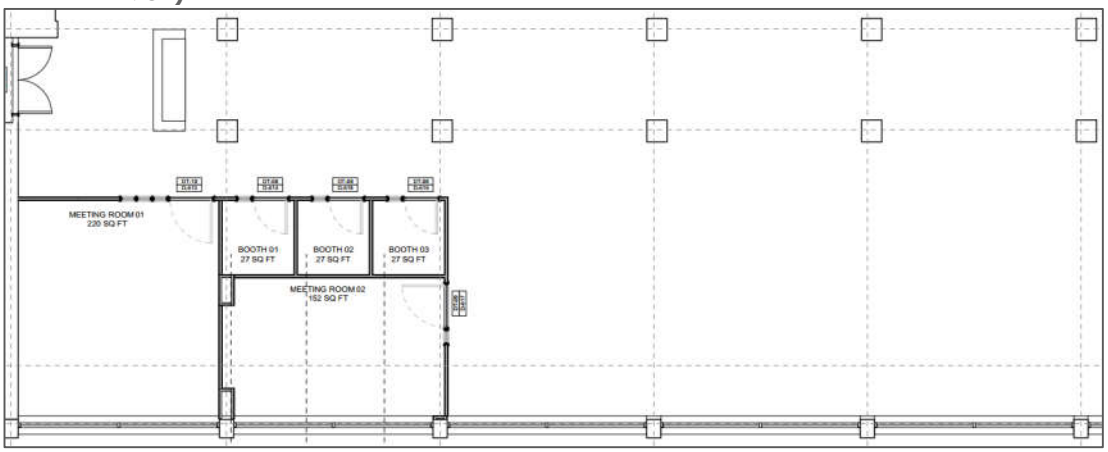
Figure 1.4: Roof Terrace (Ref: 223-YOU-XX-R1-DR-1-2701)



1.13 The roof Ttrrace will have potential to be occupied between the operational times of 0800 – 2100, in line with the office opening hours.

1.14 The area of assessment is in relation to the Roof Terrace is the open plan office space, including meeting rooms and booth rooms. **Figure 1.5** below details the sixth-floor level area.

Figure 1.5: Sixth Floor Office Area, Meeting Rooms and Booth Rooms (Ref: 223-YOU-XX-R1-DR-1-2701)



1.15 The office area will have potential to be occupied between the operational times of 0800 – 2100.

2. STANDARDS AND GUIDANCE

National Planning Policy Framework (NPPF)

2.1 When selecting appropriate criteria for assessment, consideration has been given to relevant planning policy and regulations concerning the Development. Consideration has been given to advice contained within the National Planning Policy Framework (NPPF)[1], the Noise Policy Statement for England (NPSE)[2], and Noise Planning Practice Guidance[3], although direct noise assessment criteria has not been drawn from these documents.

2.2 With regard to acoustic design and noise control, the NPPF provides a set of overarching aims, broadly reflecting those already contained in the NPSE. They are directed towards the avoidance of significant adverse impacts and reduction of other adverse impacts on health and quality of life; set within the context of the Government's policy on sustainable development.

Manchester City Council's (MCC) Planning & Noise Technical Guidance

2.3 Published in 2015, this document sets out the local planning guidance. It makes the following reference to noise in the section entitled Other Potentially Noisy Activites:

"*3.7.1.6 The following types of development proposals or applications may have additional specific guidance published to review noise impacts or may otherwise be a potential source of noise… Gymnasia*".

2.4 MCC do not state any guidance on criteria over noise transmission between gymnasium to office spaces and therefore the assessment looks to incorporate newly developed guidance published by the Institute of Acoustics (IOA), Association of Noise Consultants (ANC), and the Chartered Institute of Environmental Health (CIEH) working group – Professional Practice Guidance (ProPG): Gym Acoustic Guidance (GAG), Mar 2023. This guidance is the first standardised approach for assessing gym acoustics affecting noise-sensitive adjacencies.

Professional Practice Guidance (ProPG): Gym Acoustic Guidance (GAG)

2.5 Published in 2023, this document sets out the new guidance on noise criteria for sensitive spaces adjacent to gymnasia. It makes the following reference to noise in the section entitled Planning:

"*The lower values set out in table 2 would be generally expected to represent the lowest observed adverse effect level (LOAEL), although context is an additional factor that can influence what is suitable criteria. This is clear for the case of a new gym proposed as part of a proposed mixed scheme.*"

[1] Department for Communities and Local Government (DCLG):2012; *'The National Planning Policy Framework', TSO*
[2] Department for Environment, Food and Rural Affairs (DEFRA):2010; *'Noise Policy Statement for England', DEFRA*
[3] DCLG:2014; *'Planning Practice Guidance Website', DCLG*

2.6 Assessment criteria is defined in *Section 2.3 – Guidance on Noise Criteria, and states:*

"The criteria are proposed as guidance only and are formed from experience of the authors and contributors, developed from a low level of public response from the historic use of NR-curve based targets. This new framework is called the G-Curves and provides a way to reference sound spectra data in a single figure, in a similar way to NR, but the reference is in 1/3 octaves to provide improved resolution."

2.7 The basis of G-Curve analysis is to undertake a visual and graphical analysis of the resulting impact noise, which can be crucial to identify compliance at lower frequencies. The graphical analysis can provide a truer assessment of the actual level of resulting noise and therefore of the potential to affect users of adjacent noise-sensitive spaces.

2.8 The values proposed in Table 2 of the document provide a guide for those setting criteria, whilst being mindful of the locality and context. It is recognised that the values in Table 2 will not be suitable in all settings, particularly where the background noise is particularly low. Equally where background levels are higher, more relaxed criteria may be appropriate.

2.9 Furthermore, *Section 2.3 states:*

"It may also be difficult to accurately measure compliance because of the noise floor of Type 1 instruments. In this case compliance should be demonstrated either by calculation or by demonstration that there is an absence of adverse impact."

2.10 The guidance provided includes appropriate internal noise level criteria which are applicable to commercial offices for adjacent gym activity. It is stated that it is desirable that the internal ambient noise level does not exceed the following criteria set out in **Table 2.1.**

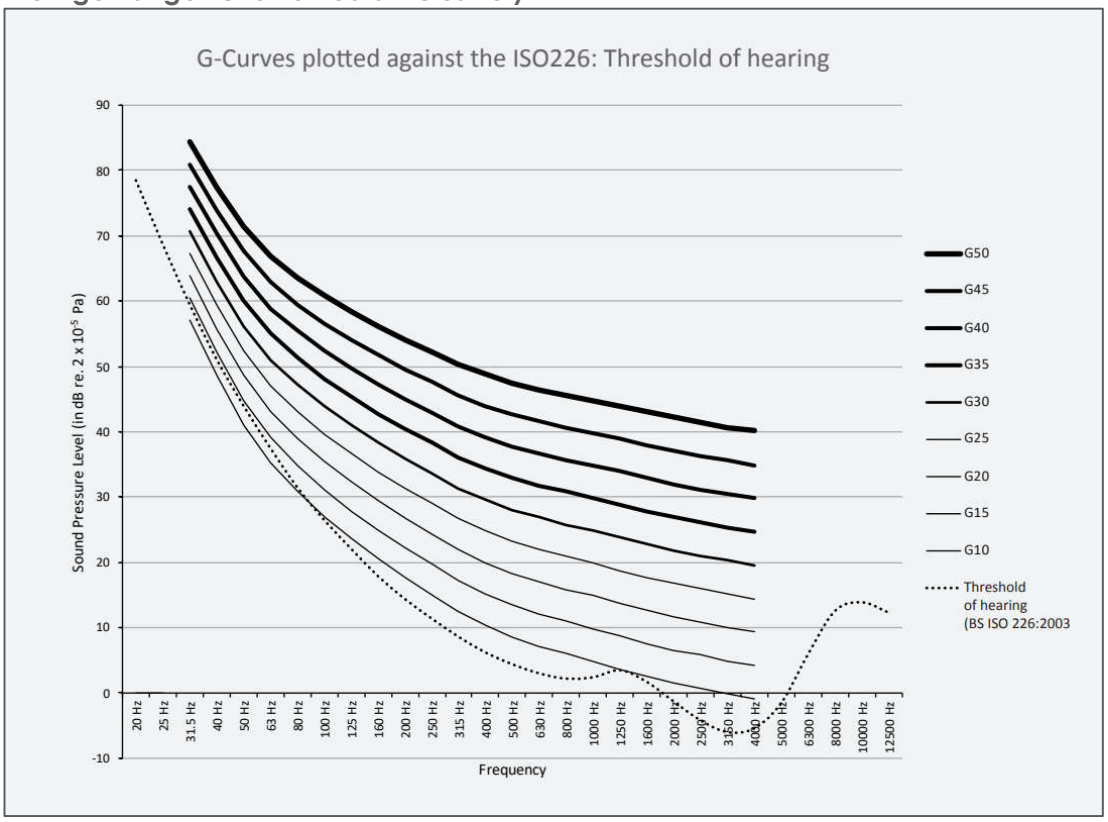
Table 2.1: Guidance Internal Sound Target Criteria for Gym Activity – Residential & Other Areas

Receptor Type	Guide Criteria (for third octave band values plots against the stated G curve – See Figure 2.1)	
	Airborne Sound (e.g., music) $L_{eq,T}$ (31.5Hz to 8kHz)	**Heavy Impact Sound $L_{max,F}$ (31.5Hz to 8kHz)**
Commercial Offices	G25-G35	G35-G45

2.11 It is important to also consider the room adjacencies as part of the assessment criteria. The proposed ground floor gymnasium is situated below a lobby/relaxation area within the office space at first floor. This is a less sensitive area than meeting room/board room, resulting in targeting a relaxed criterion.

2.12 The assessment has therefore been based on the upper band for commercial office type, with airborne sound required to meet the target G35 Curve, and heavy impact sound meeting G45 Curve. **Figure 2.1**, shown below, provides a graphical representation.

Figure 2.1: G-Curves Plotted Against The ISO 226:2003 Threshold of Hearing (Minimum Audible Field) For Pure Continuous Tone Perception of Ontologically Normal Persons in The Age Range 18 to 20 Years Inclusively



BS8233:2014: Guidance on Sound Insulation and Noise Reduction for Buildings

2.13 This standard provides guidance for the control of noise in and around buildings. The guidance provided within the document is applicable to the design of new buildings, or refurbished buildings undergoing a change of use, but does not provide guidance on assessing the effects of changes in the external noise levels to occupants of an existing building.

2.14 The guidance provided includes appropriate internal and external noise level criteria which are applicable to offices for steady external noise sources. It is stated that it is desirable that the internal ambient noise level does not exceed the following criteria set out in Error! Reference source not found..

Table 2.2: Summary of Internal Ambient Noise Levels to be Achieved in Commercial Offices When Assessed in Accordance with BS 8233

Objective	Location	Design Range $L_{Aeq,\,T}$ dB
Typical noise levels for acoustic privacy in shared spaces	Open plan office	45 - 55
Study and work requiring concentration	Meeting room	35 - 40
	Executive office	35 - 40

2.15 Whilst BS 8233:2014 recognises that the design criteria should be the noise level in the space during normal hours of occupation, excluding any noise produced by the occupants and their activities, a specific criterion is not stipulated. Therefore, the guideline values above should be achieved with resepect to external noise generated from areas associated with the Proposed Development.

3. ASSESSMENT

Gymnasium - Airborne Sound Transmission

3.1 The assessment of airborne sound transmission is based on BWB empirical noise data obtained in a gymnasium (ref: Dragonds, Lemington Spa). Noise levels were measured in 1/3 octave bands to ensure compliance with the G-Curve criteria.

3.2 Noise data utilised provides a robust assessment of likely ambient and maximum internal noise levels within the small gym space. Sound levels of $L_{Aeq,\,T}$ 88 dBA and $L_{Amax,F}$ 95 dBA have been utilised. The noise data includes sources from voice, music and weights being used.

3.3 It is understood that the proposed floor construction between ground and first floor is to be between 200mm – 250mm solid concrete. This is the same between the sixth floor and roof terrace.

3.4 The proposed ceiling between ground and first floors is understood to be exposed concrete soffit.

3.5 BWB has used empirical data for laboratory tested 203.2mm solid concrete slab, with a sound reduction index (SRI) of R_w (C ; C_{tr}) = 57 (-2 ; -7) dB. The data is provided in 1/3 octave bands, to ensure accuracy in predictive calculations.

3.6 The methodology adopted to determine the acoustic transmission of airborne sound insulation between the proposed training studio and the adjacent relevant areas takes into account the area of each separation element together with each relevant flanking element and correspondent rooms volumes in line with BS EN ISO 16283-1:20144. The method can be briefly described as follows:

Determination of global noise levels within each relevant space in line with the following equation:

$$R' = L_1 - L_2 + 10log\frac{S_s}{A}$$

Where

a) L_1 is the average sound pressure level in the source room, in decibels;

b) L_2 is the average sound pressure level in the receiving room, in decibels;

c) A is the equivalent sound absorption area in the receiving room, in square metres; and

d) S_s is the area of the separating element, in square metres.

[4] BS EN ISO 16283-1:2014, Field measurement of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation, GB

3.7 The results of initial predictions are detailed below in Figure 3.1 and

3.8 **Figure** 3.2.

Figure 3.1: G-Curve Analysis of Gym Noise Transmission, L_{eq}

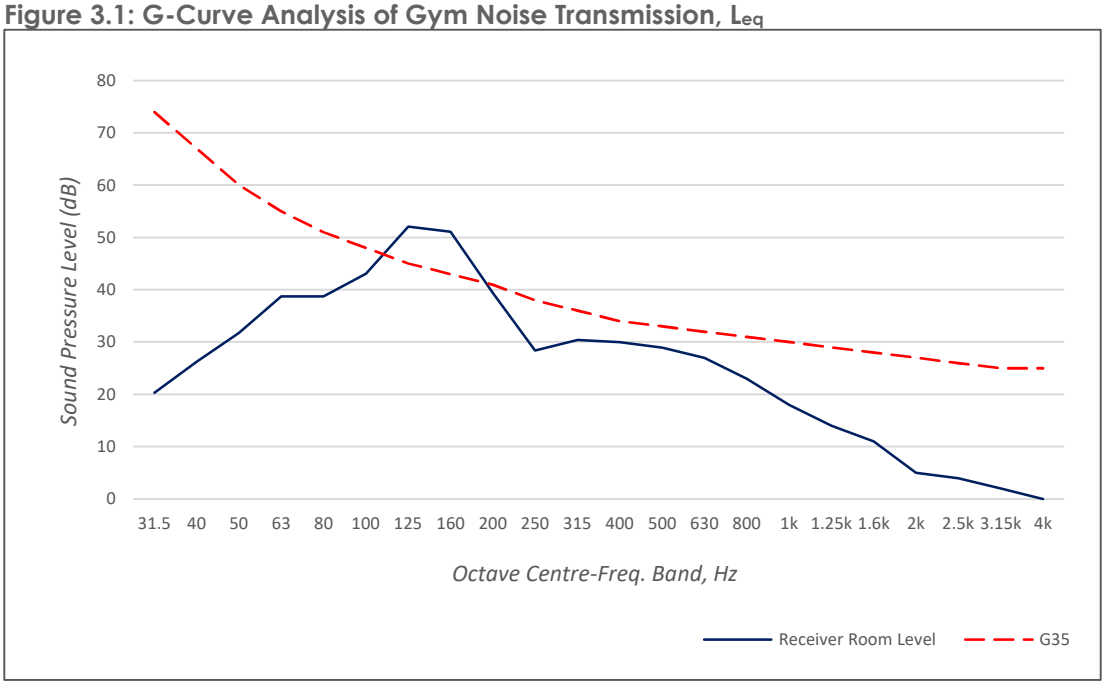
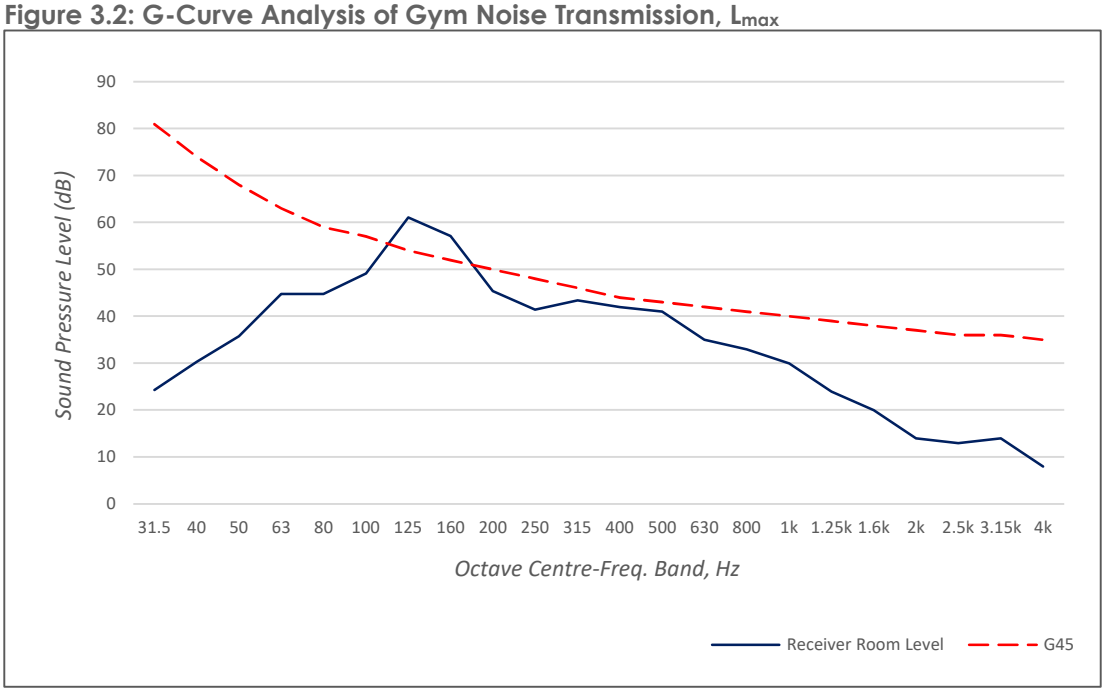


Figure 3.2: G-Curve Analysis of Gym Noise Transmission, L_{max}



3.9 As shown in airborne sound transmission for L_{eq} and L_{max} parameters, an exceedance occurs at 125 Hz and 160 Hz**.** Therefore, mitigation is required to meet the criteria.

Gymnasium - Impact Sound Transmission

3.10 The assessment does not consider the potential structural-borne noise impact from free-weights being dropped onto the gym floor and transmitting onto the walls and floor above, as there is no practical standard method available to predict such scenario. The highly complex process of any such prediction would be restricted by the characterisation of the structural borne '*sound power level'* of the source, as well as several other factors including, but not limited to, the number and type of flanking elements, construction details and radiating surface areas etc.

3.11 However, advisory solutions have been provided as a matter of good practice on the isolation of any free-weights area of the gym and detailed in Section 4.

Roof Terrace

3.12 The roof terrace is proposed to be utilised for an amenity break area for residents of the offices. The proposed hours of operation align with the opening times of the offices, between 0800 – 2100.

3.13 The maximum steady noise level for reliable speech conversation at a distance of 1m is 57dB(A) for normal voice and 62dB(A) for raised voice. For robustness, the assessment considers raised voice.

3.14 Based on limited maximum occupant capacity of 20 persons, equivalent to an occupant density of 1.5 m^2/person that reasonably allows for circulation, and to identify the potential impact on the occupants that might reasonably be expected, an assessment has been undertaken of the attenuation afforded by the roof construction.

3.15 The separating floor between the roof is a proposed 200mm solid concrete slab (excluding a suspended ceiling) with an Rw (C; Ctr) = 57 (-2; -7). Using the calculation method described in paragraph 3.6, the resultant internal level in the office space below is calculated at 22dB(A). It is therefore considered that the criteria for internal ambient noise levels within the open plan office and any board/meeting rooms, detailed in Error! Reference source not found. have been met.

3.16 Based on this, and the above assumptions, occupants within the building are unlikely to experience any direct noise intrusion via the Roof.

4. MITIGATION

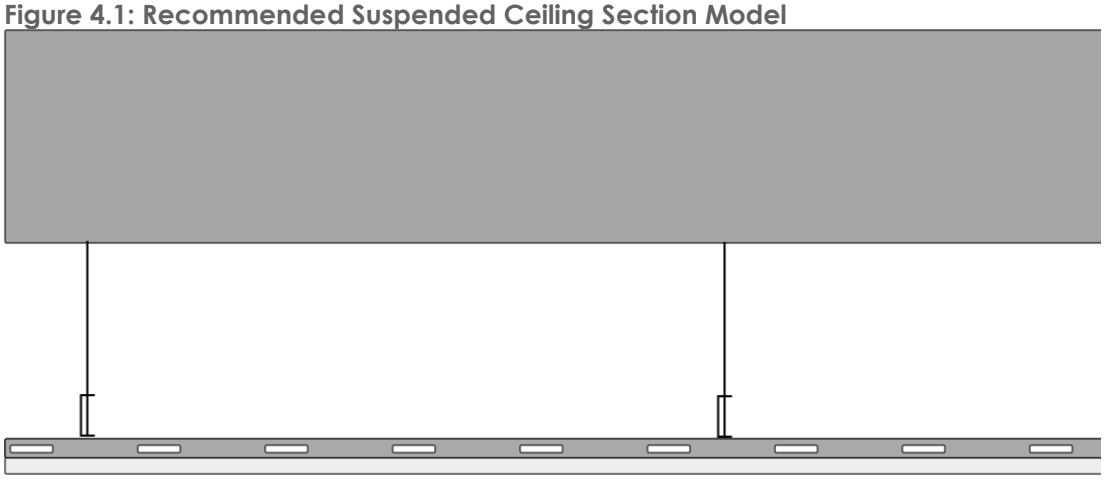
Gymnasium – Airborne Sound Transmission

4.1 In Section 3 it was identified that mitigation would need to be considered to reduce the potential for airborne sound transmission from the gym to affect the space above.

4.2 There is scope to mitigate noise transmission through the use of a suspended ceiling. The effect of a suspended ceiling to the gym with a 200mm cavity and 15mm acoustic soundboard on the underside has been considered. BWB uses industry standard predictive modelling software *INSUL – Marshall Day Acoustics* to determine the sound insulation performance. **Figure 4.1** displays a diagram of the recommended mitigation, the material build up is detailed below:

- 200mm solid conctrete slab
- 200mm lightweight suspended ceiling
- 1 no. 15mm acoustic soundboard

Figure 4.1: Recommended Suspended Ceiling Section Model



4.3 The acoustic model has a sound reduction index (SRI) of R_w (C; C_{tr}) = 66 (-1 ; -6) dB. INSUL stipulates that the modelling software includes a +/- 3 dB error margin for airborne predictions, and this has been considered within calculations.

4.4 The results of the predictions are detailed below in **Figure 4.2** and **Figure 4.3.**

Figure 4.2: G-Curve Analysis of Gym Noise Transmission, Leq – with mitigation

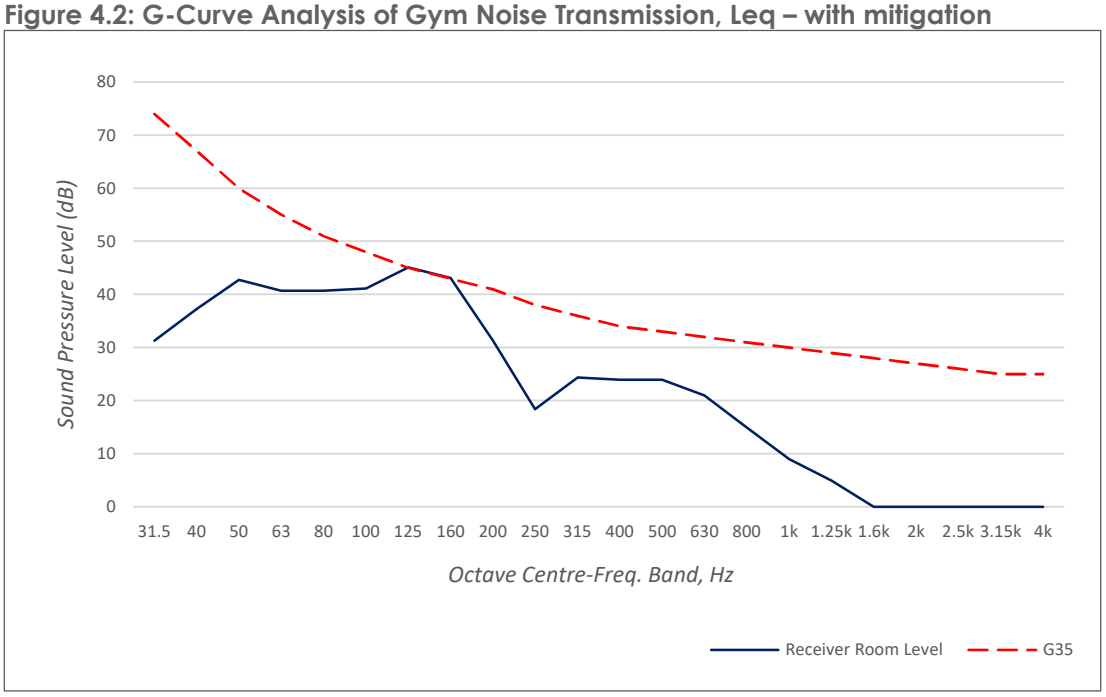
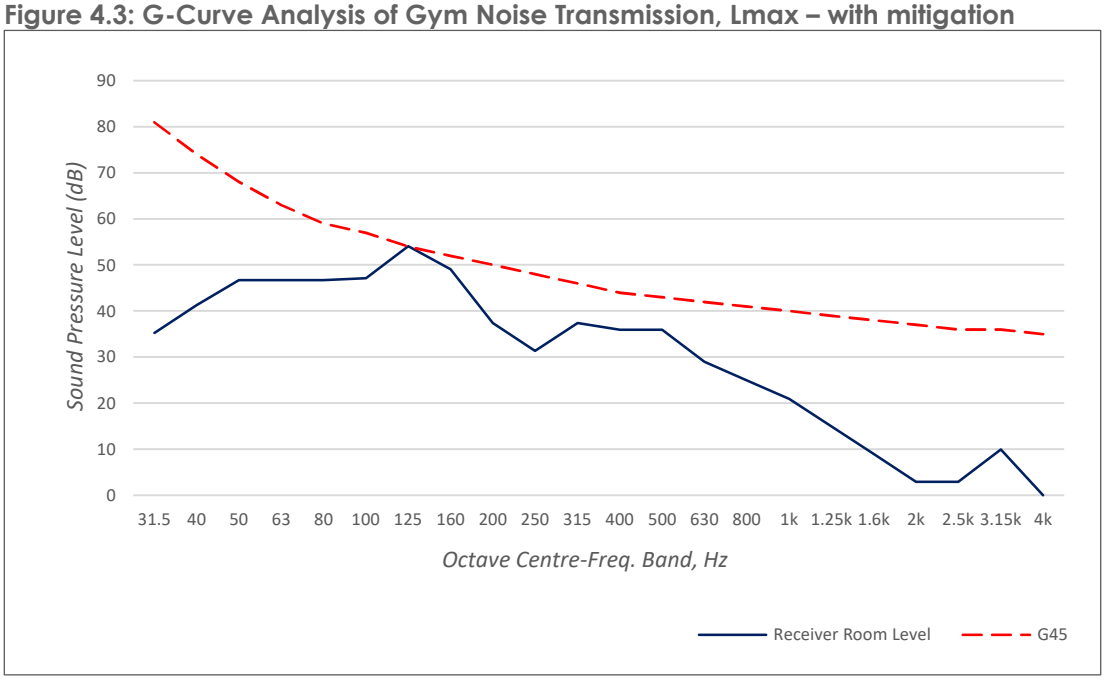


Figure 4.3: G-Curve Analysis of Gym Noise Transmission, Lmax – with mitigation



4.5 As shown in the graphical analysis, the recommended suspended ceiling should ensure that noise levels in 1/3 octave bands meet the internal criteria for L_{eq} and L_{max} in accordance with the guidance.

Gymnasium – Impact Sound Transmission

4.6 Management of the fitness suite and yoga/pilates area should be undertaken to ensure proper use of equipment. More often than not, maximum noise levels within gyms are a result of this. Therefore, building management will be to manage the proper use of the

gymnasium to ensure accidental weight drops are kept to a minimum so that it does not cause a disturbance.

4.7 Other mitigation measures such as impact resistant and anti-vibration mats for weights will need to be considered as the design for the fitness suite developments. In addition, a careful selection of gym equipment will need to be considered. Using bumper plate or coated weights help reduce impact noise when dropped from height.

5. CONCLUSION

5.1 A noise impact assessment has been undertaken to ensure noise transmission from uses between a proposed ground floor gymnasium and first floor office area, as well as roof terrace to sixth floor office space does not adversely affect future tenants.

5.2 It has been determined through high level calculations that noise from the gymnasium is predicted to exceed the adopted criteria for both L_{eq} and L_{max} levels in low to mid frequencies, however with mtigation in the form of a suitable suspended ceiling, noise transmission can be controlled to within the criteria. Best practice has been recommended to be considered to ensure airborne and impact noise is controlled within the gymnasium along with management of the spaces.

5.3 The proposed roof terrace includes seating areas for lunch amenities for the tenants of the building. An assessment of raised speech levels generated by occupants on the roof terrace was undertaken, with the proposed floor separating the roof terrace and level six is sufficient in reducing noise to well within the criteria.

5.4 Based on the findings of the assessment, it is considered that noise transfer can be controlled to acceptable levels.

APPENDICES

APPENDIX A: Glossary of Terms

Noise

Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20 Hz (deep bass) to 20,000 Hz (high treble) and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality or impulsiveness may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source.

The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq}, L_{A90} etc., according to the parameter being measured.

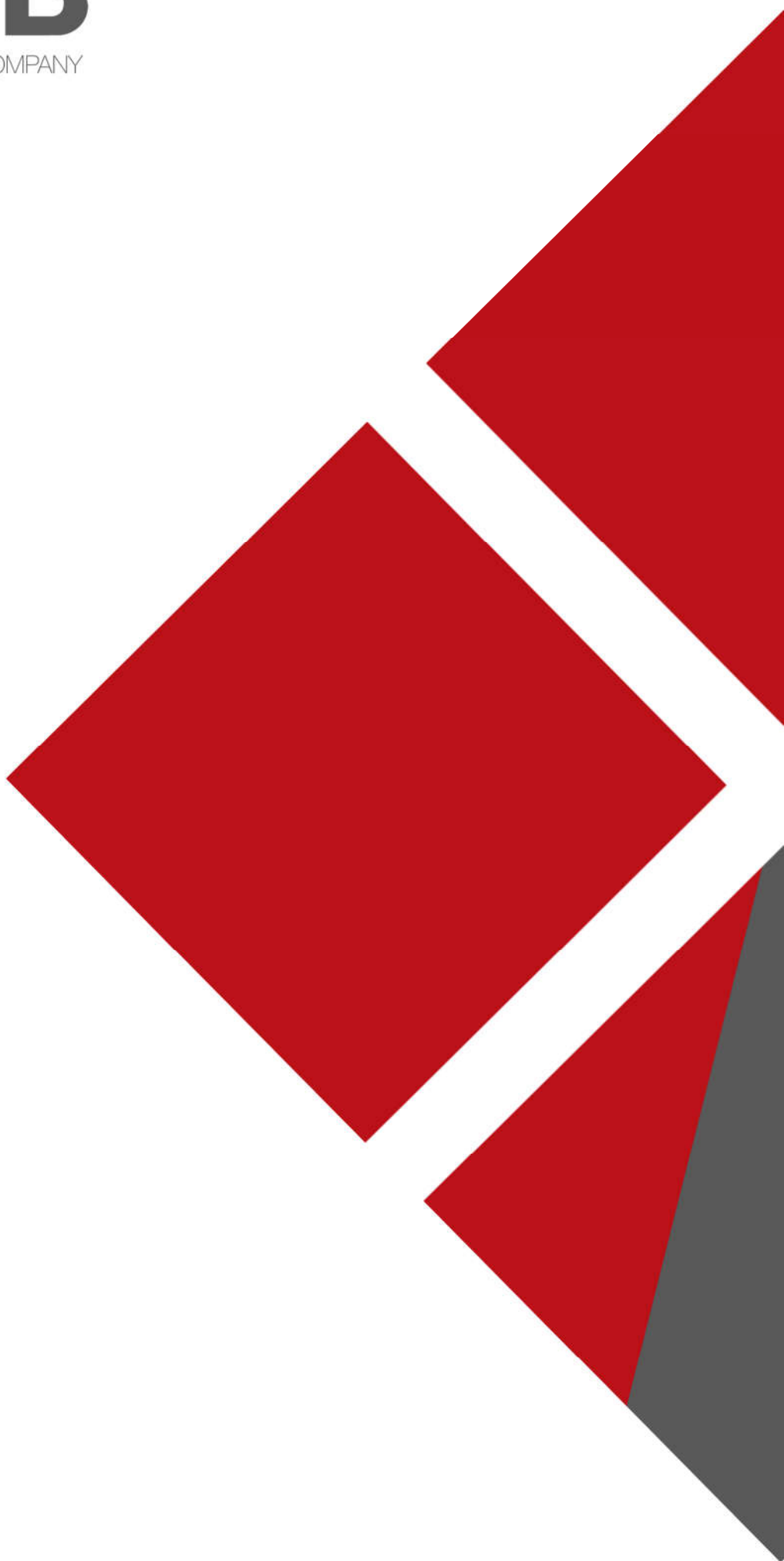
The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions.

Acoustic Terminology

Term	Description
dB (decibel)	The scale on which sound pressure level is expressed. Sound pressure level is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2x10-5Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' - weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
$L_{Aeq,T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A - weighted fluctuating sound measured over that period.
L_{Amax}	L_{Amax} is the maximum A - weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L_{10} and L_{90}	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{10} is the level exceeded for 10% of the time, and the L_{90} is the level exceeded for 90% of the time.
Free-field Level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally as measured outside and away from buildings.
Façade Level	A sound field determined at a distance of 1m in front of a large sound reflecting object such as a building façade.
$D_{nT,w}$	A single number quantity characterising the on-site airborne sound insulation performance of a construction, including transmission of sound via flanking paths (e.g. adjoining floors/walls). The higher the $D_{nT,w}$ of a construction, the better its airborne sound insulation performance; the higher the $D_{nT,w}$ requirement, the more stringent the criteria.
R_w	A single number quantity characterising the laboratory based airborne sound insulation performance of a construction, independent of transmission of sound via flanking paths. As with $D_{nT,w}$, the higher the R_w, the better the sound insulation performance; the higher the R_w requirement, the more stringent the criterion.
C_{tr}	C_{tr} is a correction term applied against weighted sound insulation values (R_w, $D_{nT,,w}$ etc.) which describes low frequency performance.

BWB

A CAF GROUP COMPANY



www.bwbconsulting.com