NOISE IMPACT ASSESSMENT

SPECTRUM HOUSE, GOSPEL OAK, LONDON NW5 1LP

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OCTOBER 2019

the journey is the reward

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Proposed Change of Use from Office (B1) to Fitness Centre (D2)
Spectrum House, Gospel Oak, London NW5 1LP
Noise Impact Assessment
October 2019

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1 Introduction

1.1 Mayer Brown Ltd. has been instructed by F45 Gospel S.A.R.L to prepare this Noise Assessment, which seeks the change of use of the ground floor of spectrum house, Gospel Oak, London NW5 1LP from B1 (office) to D2 (fitness centre).

1.2 The scope of this Noise Assessment is structured as follows:

- **Section 2** describes the location of the site
- **Section 3** outlines the development proposals.
- **Section 4** presents relevant planning policy;
- **Section 5** discusses the potential noise impact associated with the proposed change of use;
- **Section 6** assesses noise associated with customer arrival and departures;
- **Section 7** assesses airborne sound transfer from the proposed use;
- **Section 8** assesses impact sound transfer from the proposed use;
- **Section 9** assesses noise "break-out" from the development;
- Conclusions are presented in **Section 10.**

A glossary of the acoustic terminology and nomenclature used in this report is presented at **Appendix A**.

2 Site Description

2.1 The building forms part of an existing office block as shown in **Figure 2.1** below:

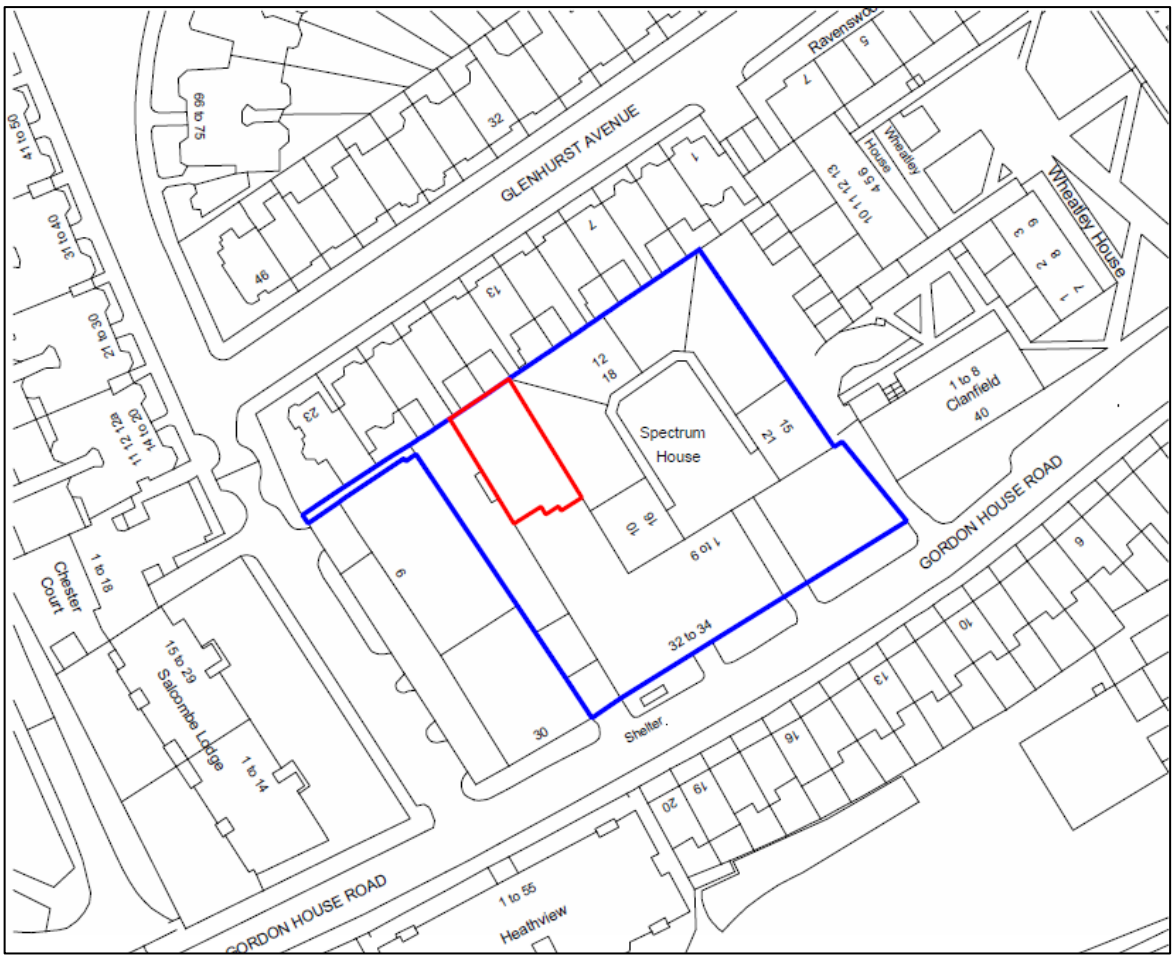


Figure 2.1: Site Location

2.2 The site is located on Gordon House Road and boarded by Glenhurst Avenue to the north. The Site is adjoined to Wheatley House to the east.

2.3 The site is currently occupied by two 1 storey buildings currently providing office space with Units 3 and 4 located to the west of the site with existing residential dwellings to the immediate north.

2.4 The internal arrangement of the existing building is shown in **Figure 2.2** below:

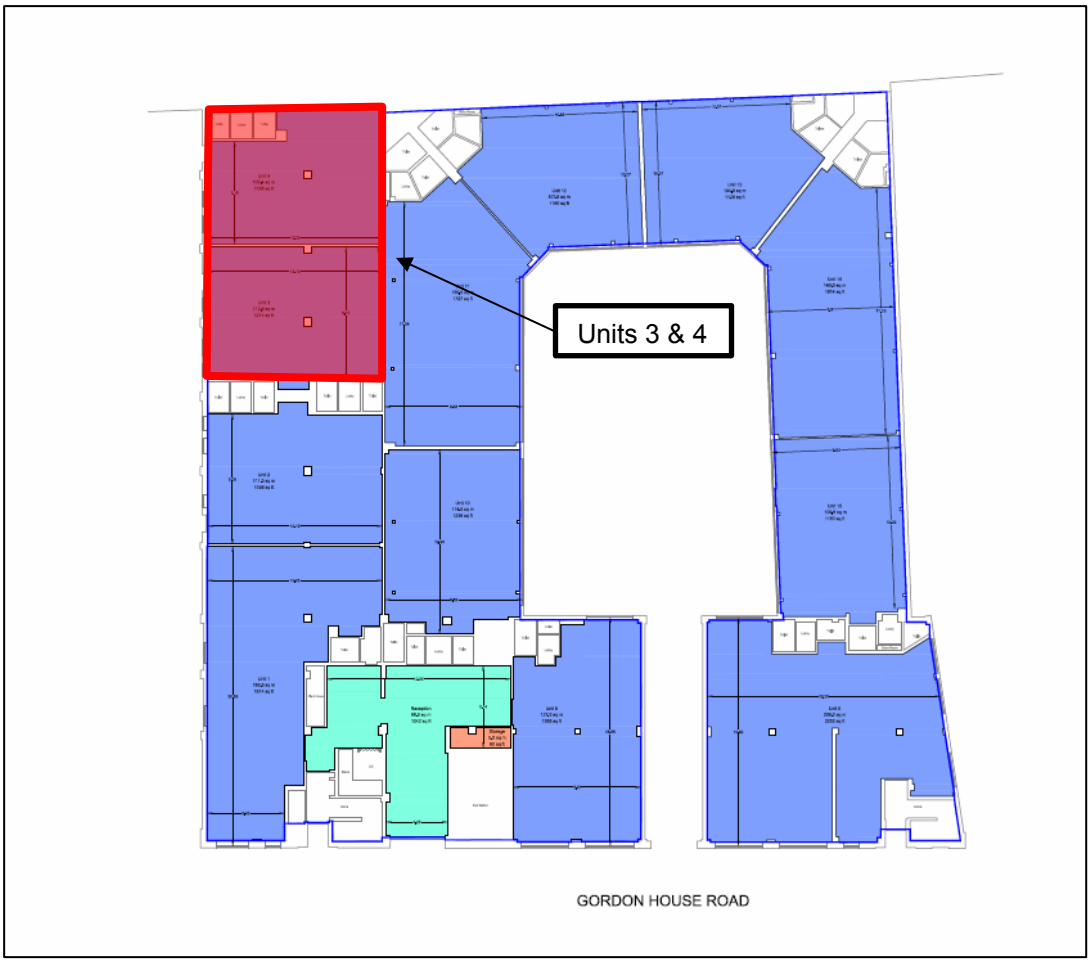


Figure 2.2: Internal arrangement of the existing building

3 Development Proposals

3.1 The planning application seeks to change the exiting use class of the premises from the existing office use (use class B1) to a fitness centre (use Class D2).

3.2 The existing and proposed general arrangement of the development is shown in **Figure 3.1** below.

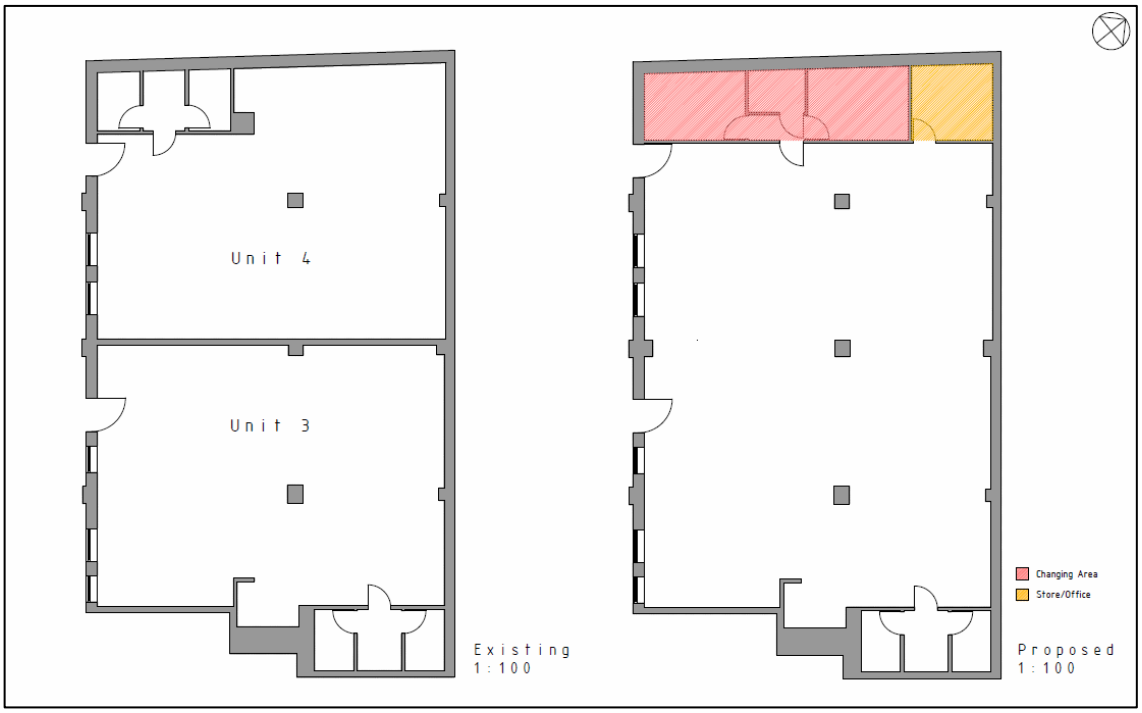


Figure 3.1: Existing & Proposed Ground Floor General Arrangement

3.3 A more detailed plan of the proposed ground floor fitness centre arrangement is shown in **Figure 3.2** below;

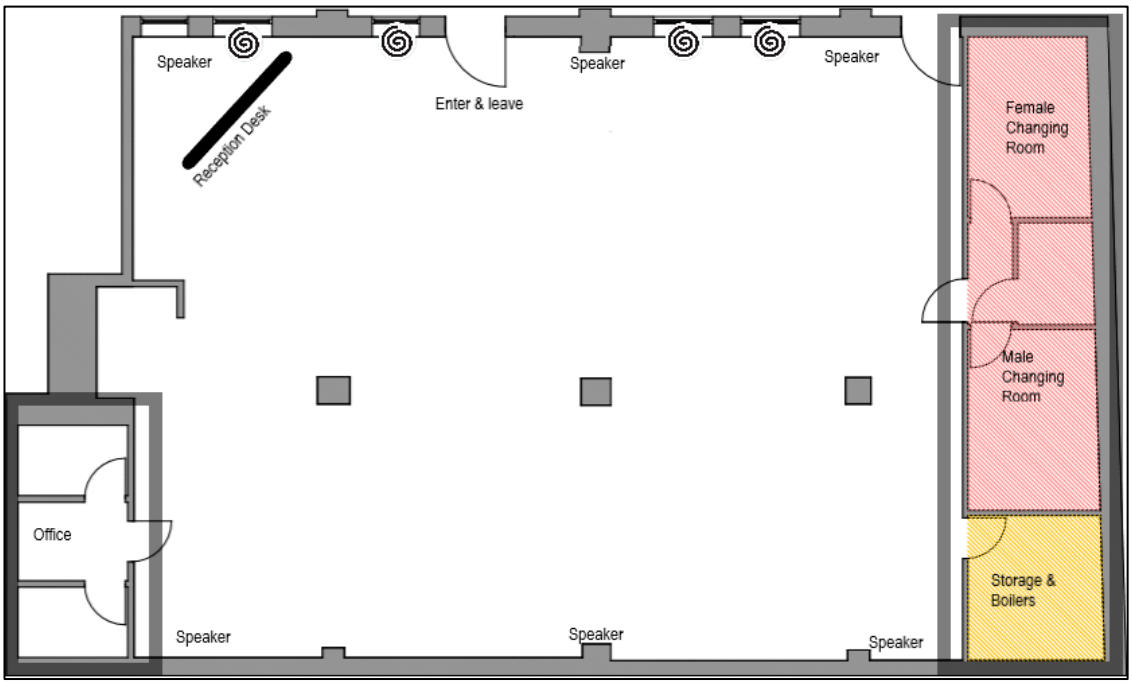


Figure 3.2: Proposed Internal Arrangment

3.4 The intended occupier of the unit is F45 Training (https://f45training.co.uk/) who provide fitness training classes. F45 differ to traditional gyms in that their offering comprises solely of a programme of classes led by fitness instructors. The F45 Training methodology combines elements of high-intensity training (HIIT), circuit training and functional training and is implemented utilising 36 different workout classes.

3.5 Given this offering, F45 therefore differ in that they do not operate in a way that traditional gyms do. There is no resistance or cardio equipment or free weights area for attendees or members to use as the workouts are by classes only. To enable attendance at the fitness centre a class must be pre-booked.

3.6 It is understood that the proposed opening hours of the gym are proposed to be:

- Monday to Friday 06.00 hours to 20.00 hours
- Saturday: 08.30 hours to 13.15 hours
- Sunday: 10.00 hours to 12.00 hours

3.7 The proposed training sessions are as follows;

Monday-Friday classes;

- 4 x 45min classes between 06.00 to 09.00 hours;
- 1 x 45min class between 12.30 to 13.15 hours;

- 2 x 45min classes between 18.00 hours to 20.00 hours.

Saturday and Sunday classes;

- 4 x 60min classes from 8.30 to 13.15 hours (Saturday);
- 2 x 45min classes from 10.00 to 12.00 hours (Sunday).

3.8 Given the proposed number of classes, typical duration of a training session (45 minutes) and associated changing times, etc., it is anticipated that at peak times the proposed use would typically attract around 25 customers per session.

3.9 In light of the above, it is expected that operational noise due to the use of the fitness centre is likely to be characterised by any dynamic noise created by the fitness session, or any music played during the session.

3.10 It is important that any music is controlled to an appropriate level that is compatible with the sound insulation capabilities of the existing structure. More detailed consideration to this is given later in the report.

4 Planning Policy Context

National Planning Policy

National Planning Policy Framework, (NPPF, 2019)

4.1 Current governmental guidance for the determination of planning applications is given in the revised "National Planning Policy Framework" (NPPF), published in February 2019.

4.2 Paragraph 170 of the NPPF advises:

> *"Planning policies and decisions should contribute to and enhance the natural and local environment by:*
>
> *….. e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability."*

4.3 With specific regard to noise, paragraph 180 of the NPPF states:

> *""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; and*
>
> *c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation."*

4.4 Paragraph 182 of the NPPF draw specific attention to the need to ensure that new development is compatible with existing businesses and community facilities and introduces and "agent of change" principle:

> *"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."

4.5 With regard to 'adverse' impacts and 'significant adverse' impacts, the NPPF directs the reader to the advice contained in DEFRA's "Noise Policy Statement for England" (NPSE). This Policy Statement introduces the concept of a "Significant Observed Adverse Effect Level" (SOAEL), "Lowest Observed Adverse Effect Level" (LOAEL) and "No Observed Adverse Effect Level" (NOAEL). These are concepts aligned with toxicology outcomes derived from guidance given by the World Health Organisation.

Noise Policy Statement for England

4.6 Whilst the intent of the NPSE in relation to the NPPF is clear, the NPSE does not, at this time, provide any quantitative threshold values for each identified level of *"effect"*. Indeed, the NPSE carefully highlights that:

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

National Planning Practice Guidance

4.7 The application of national planning is amplified in the governments *"National Planning Practice Guidance"* (NPPG) (July 2019). This seeks to help clarify understanding the perception of noise effects, outcomes and actions that should be taken to align decision making with the NPPF. In line with the NPPF concept of basing decision making on the identification of *"adverse"* or *"significant adverse"* impacts on health and quality of life, the NPPG aligns its guidance with the NPSE.

4.8 The table below summarises this guidance:

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	**No specific measures required**
No Observed Adverse Effect Level (NOAEL)			
Present not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	**No specific measures required**
Lowest Observed Adverse Effect Level (LOAEL)			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; closing windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	**Mitigate and reduce to a minimum**
Significant Observed Adverse Effect Level (SOAEL)			

Table 4.1: NPSE Guidance

4.9 Whilst the NPPF and associated planning practice guidance sets out stringent imperatives to ensure the satisfactory development of land in relation to possible noise impacts, this policy and guidance does not generally provide any detailed technical guidance defining what may be considered to constitute a *"significant"* or *"other"* adverse impact. In the absence of such technical guidance, reference needs to be been made to sustainable development standards set out in local policy and/or relevant 'industry standard' guidance.

4.10 Given that the application relates to the use of A3 premises, it is also considered material to note the guidance given in paragraph 006 (Ref: ID: 30-006-20141224) of the NPPG which states:

"When proposed developments could include activities that would be covered by the licensing regime, local planning authorities should consider whether the potential for adverse noise impacts will be addressed through licensing controls (including licence conditions). Local planning authorities should not however presume that licence conditions will provide for noise management in all instances and should liaise with the licensing authority."

City-Wide Planning Policy

4.11 Policy 7.15 of the current London Plan (*'Reducing and managing noise, improving and enhancing the acoustic environment and promoting appropriate soundscapes'*) states:

"Strategic

A. The transport, spatial and design policies of this plan will be implemented in order to reduce noise and support the objectives of the Mayor's Ambient Noise Strategy.

Planning Decisions

B. Development proposals should seek to reduce noise by:

a. Avoiding significant adverse noise impacts on health and quality of life as a result of new development;

b. Mitigating and minimising the existing and potential adverse impacts of noise on, from, within, as a result of, or in the vicinity of new development without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens on existing businesses;

c. Improving and enhancing the acoustic environment and promotion appropriate soundscapes (including Quiet Areas of spaces of relative tranquillity);

d. Separating new noise sensitive development from major noise sources (such as road, rail, air transport and some types of industrial development) through the use of distance, screening or internal layout – in preference to sole reliance on sound insulation;

e. Where it is not possible to achieve separation of noise sensitive development and noise sources, without undue impact on other sustainable development objectives, then any potential adverse

effects should be controlled and mitigated through the application of good acoustic design principles;

f. *Having particular regard to the impact of aviation noise on noise sensitive development;*

g. *Promoting new technologies and improved practices to reduce noise at source, and on the transmission path from source to receiver.*

LDF preparation

C. *Boroughs and others will relevant responsibilities should have policies to:*

a. *manage the impact of noise through the spatial distribution of noise making and noise sensitive uses;*

b. *identify and nominate new Quiet Areas and protect existing Quiet Areas in line with the procedure in Defra's Noise action Plan for Agglomerations"*

4.12 The Mayor of London has published a draft replacement London Plan. Draft Policy D13 deals with noise:

"Policy D13 Noise

A. *In order to reduce, manage and mitigate noise to improve health and quality of life, residential and other non-aviation development proposals should manage noise by:*

1) Avoiding significant adverse noise impacts on health and quality of life

2) Reflecting the Agent of Change principle as set out in Policy D12. To ensure measures do not add unduly to the costs and administrative burdens on existing noise-generating uses

3) Mitigating and minimising the existing and potential adverse impacts of noise on, from, within as a result of, or in the vicinity of new development without placing unreasonable restriction on existing noise-generating uses development

4) Improving and enhancing the acoustic environment and promoting appropriate soundscapes (including Quiet Areas and spaces of relative tranquillity)

5) *Separating new noise-sensitive development from major noise sources (such as road, rail, air transport and some types of industrial use) through the use of distance, screening, or internal layout, orientation, uses and materials – in preference to sole reliance on sound insulation*

6) *Where it is not possible to achieve separation of noise-sensitive development and noise sources without undue impact on other sustainable development objectives, then any potential adverse effects should be controlled and mitigated through applying good acoustic design principles*

7) *Promoting new technologies and improved practices to reduce noise at source, and on the transmission path from source to receiver.*

B. *Boroughs, and others with relevant responsibilities, should identify and nominate new Quiet Areas and protect existing Quiet Areas in line with the procedure in Defra's Noise Action Plan for Agglomerations."*

4.13 Given that Policy D13 of the draft London Plan closely reflects governmental planning policy objectives, the emerging policies are considered to carry significant weight in relation to their relevance to the determination of this application.

Local Planning Policy

4.14 In addition to the national and city-wide policy, Camden Council have an adopted current Local Plan 2017.

4.15 The policy most relevant to noise is policy A4 of the Local Plan 2017.

4.16 Policy A4 states:

"The Council will seek to ensure that noise and vibration is controlled and managed. Development should have regard to Camden's Noise and Vibrations Thresholds. We will not grant planning permission for:

a. *Development likely to generate unacceptable noise and vibration impacts; or*

b. *Development sensitive to noise in locations which experience high levels of noise, unless appropriate attenuations measures can be provided and will not harm the continued operation of existing uses.*

We will only grant permission for noise generating development, including any plant and machinery, if it can be operated without causing harm to amenity. We will also seek to minimise the impact of local amenity from

deliveries and from the demolition and construction phases of development."

4.17 Other policies related to noise include:

4.18 Policy A1 states:

"The Council will seek to protect the quality of lie of occupiers and neighbours. We will grant permissions for development unless this causes unacceptable harm to amenity.

We will:

a) *Seek to ensure that amenity of communities, occupiers and neighbours is protected;*

b) *Seek to ensure development contributes towards strong and successful communities by balancing the needs of development with the needs and characteristics of local areas and communities;*

c) *Resist development that fails to adequately assess and address transport impacts affecting communities, occupiers, neighbours and the existing transport network; ad*

d) *Require mitigation measures where necessary.*

The factors we will consider include:

e) *Visual privacy, outlook;*

f) *Sunlight, daylight and overshadowing;*

g) *Artificial lighting levels;*

h) *Transport impacts, including the use of Transport Assessments, Travel Plans and Delivery and Servicing Management Plans;*

i) *Impact of the construction phase, including the use of Construction Management Plans;*

j) Noise and vibration levels;

k) *Odour, fumes and dust;*

l) *Microclimate;*

m) *Contaminated land; and*

n) *Impact upon water and waste water infrastructure."*

4.19 Policy TC4 Town Centre Uses states:

"The council will ensure that the development of shopping, services, food, drink, entertainment and other town centre uses does not cause harm to the character, function, vitality and viability of a centre, the local area or the amenity of neighbours.

We will consider:

a) *The effect of development on shopping prevision and the character of the centre in which it is located;*

b) *The cumulative impact of food, drink and entertainment uses, taking into account the number and distribution of existing uses and non-implemented planning permissions and any record of harm caused by such uses;*

c) *The Councils expectations for the mix and balance of uses within frontages for each centre are set out in appendix 4;*

d) *The individual planning objectives for each centre, as set out in the supplementary planning document Camden Planning Guidance on town centres and retail;*

e) *Impacts on small and independent shops and impacts on markets;*

f) *The health impacts of development;*

g) *The impact of the development on nearby residential uses and amenity and any prejudice to future residential development; parking, stopping and servicing and the effect of the development on ease of movement on the footpath;*

h) Noise and vibration generated either inside or outside of the site;

i) *Fumes likely to be generated and the potential for effective and unobtrusive ventilation; and*

j) *The potential for crime and antisocial behaviour, including littering.*

To manage potential harm to amenity or the local area, we will, in appropriate cases, use planning conditions and obligations to address the following issues:

l) *Hours of operation*

m) Noise/vibration, fumes and the sitting of plant and machinery;

n) The storage and disoisak if refuse and customer litter;

o) Tables and chairs outside of premises;

p) Community safety;

q) The expansion of the customer area into ancillary areas such as basements;

r) The ability to change the use of premises from one food and drink use or one entertainment use to another (Within Use Classes A3, A4, A5 and D2); and

s) The use of local management agreements to ensure that the vicinity of premises are managed responsibly to minimise impact on the surrounding area.

Contributions to schemes to manage the off-site effects of a development, including for town centre managements, will be sought in appropriate cases."

4.20 Appendix 3 of the Local Plan makes note to Noise Thresholds

The significance of noise impacts caries dependent on the different noise sources, receptors and times of operations presented for consideration within a planning application. Therefore, Camden's thresholds for noise and vibration evaluate noise impact in terms of various 'effect levels' described in the National Planning Policy Framework and Planning Practice guidance:

- *NOEL – No Observed Effect Level*
- *LOAEL – Lowest Observed Adverse Effect Level*
- *SOAEL – Significant Observed Adverse Effect Level*

Three basic design criteria have been set for proposed developments, these being aimed at guiding applicants as to the degree of detailed consideration needed to be given to noise in any planning application. The design criteria outlined below are defined in the corresponding noise tables. The values will vary depending on the context, type of noise and sensitivity of the receptor:

- *Green – where noise is considered to be at an acceptable level.*

- *Amber – where noise is observed to have an adverse effect level, but which may be considered acceptable when assessed in the context of other merits of the development.*
- *Red – where noise is observed to have a significant adverse effect.*

4.21 The relevant Noise Thresholds produced by the LB Camden are reproduced in **Figure 4.1** below;

Entertainment Noise

Assessments for noise from entertainment and leisure premises must include consideration to amplified and unamplified music, human voices, footfall and vehicle movements and other general activity. Appropriate metrics must be used to measure and assess the noise impact including LAeq and LAmax metrics and appropriate frequency spectrum. Planning permission will not be granted in instances where it is not possible to achieve suitable and sufficient internal noise levels with reference to the most up to date and appropriate guidance within proposed noise sensitive receptors despite appropriate mitigation proposals due to the totality of noise from existing entertainment venues.

Table D: Noise levels applicable to proposed entertainment premises (customer noise)

Noise sensitive receptor	Assess-ment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings	Garden used for amenity (free field)	Day	The higher of 55dB $L_{Aeq,5min}$ Or 10dB below existing $L_{Aeq,5min}$ Without entertainment noise	56dB to 60dB $L_{Aeq,5min}$ Or 9dB to 3dB below existing $L_{Aeq,5min}$ Without entertainment noise	The higher of 61dB $L_{Aeq,5min}$ Or 2dB below existing $L_{Aeq,5min}$ Without entertainment noise
Dwellings	Garden used for amenity (free field)	Evening	The higher of 50dB $L_{Aeq,5min}$ Or 10dB below existing $L_{Aeq,5min}$ Without entertainment noise	51dB to 55dB $L_{Aeq,5min}$ Or 9dB to 3dB below existing $L_{Aeq,5min}$ Without entertainment noise	The higher of 56dB $L_{Aeq,5min}$ Or 2dB below existing $L_{Aeq,5min}$ Without entertainment noise
Dwellings	Garden used for amenity (free field)	Night	The higher of 45dB $L_{Aeq,5min}$ Or 10dB below existing $L_{Aeq,5min}$ Without entertainment noise	46dB to 50dB $L_{Aeq,5min}$ Or 9dB to 3dB below existing $L_{Aeq,5min}$ Without entertainment noise	The higher of 51dB $L_{Aeq,5min}$ Or 2dB below existing $L_{Aeq,5min}$ Without entertainment noise

For entertainment and plant noise rating curves should be measured as a 15 minute linear Leq at the octave band centre frequencies.

Room	Noise rating curve	Design period
Bedrooms	NR25	23:00-07:00hrs
All habitable rooms	NR35	07:00-23:00hrs

Advice note: We recommend that you seek advice from the Environmental Health department in advance of any noise surveys on the location of measurements and the nearest noise sensitive receptor. Further detail will be provided in our supplementary planning document Camden Planning Guidance on amenity.

Figure 4.2: LB Camden Noise Thresholds

Design Guidance

British Standard BS 8233: 2014)

4.22 BS 8233: 2014 *"Sound Insulation and Noise Reduction for Buildings"* offers the following design guidance for indoor ambient noise levels within dwellings and commercial buildings:

Objective	Typical Situations	Design range LAeq,T dB
Typical noise levels for acoustic privacy in shared spaces	Restaurant	40 -55
	Open plan office	45 – 50
	Night club, public house	40 – 45
	Ballroom, banqueting hall	35 – 40
	Living room	35 – 40

Table 4.3: BS 8233 Indoor Ambient Noise Level Design Guidance

4.23 From the details presented in **Table 4.2** above the design approach for ensuring acceptable noise levels within adjacent office space will be to the values detailed above for open plan office space.

4.24 In the absence of specific criterion for low frequency noise it is proposed to control the fitness centre noise levels to NR35 to account for low frequency content from amplified music noise emanating from the fitness centre.

5 Noise Impact Considerations

5.1 The planning application seeks to change the existing use class of the premises to a D2 (fitness centre) use.

5.2 The following potential noise impact considerations relating to the proposed change of use are therefore considered relevant:

i. Whether the proposed change of use will result in an adverse noise impact on the nearest noise sensitive receptors, located on Glenhurst Avenue:

ii. Whether the proposed Change of use could result in an increased level of "airborne" sound transmission to existing the existing offices which are above/below/adjacent to the subject premises;

iii. Whether the proposed change of use could result in an increased level of impact sound transmission to the existing offices within the premises; and

iv. Whether the proposed change of use could result in an increase in noise "break-out" from the premises to the nearest noise sensitive receptors on Glenhurst Avenue;

v. Whether any ancillary air-conditioning plant would result in an adverse impact at the nearest noise sensitive receptors on Glenhurst Avenue;

5.3 The following sections of this report provide a detailed assessment of each of the above sources.

6 Baseline Noise Monitoring

6.1 In order to establish existing ambient noise levels in the vicinity of the site, an unattended noise survey was undertaken between Friday the 20th September to Thursday the 26th September 2019.

6.2 Noise levels where monitored at roof level, overlooking the mews to the west and with a line of site view of the first-floor windows of the nearest dwellings on Glenhusrt Avenue, located approximately 15m away to the immediate north of the development. The microphone was attached to railings and positioned approximately 1.5m from top of the roof in free-field conditions.

6.3 The measurement location is shown in **Figure 6.1** below and the measurement position, relative to the nearest dwellings is shown in **Figure 6.2.**

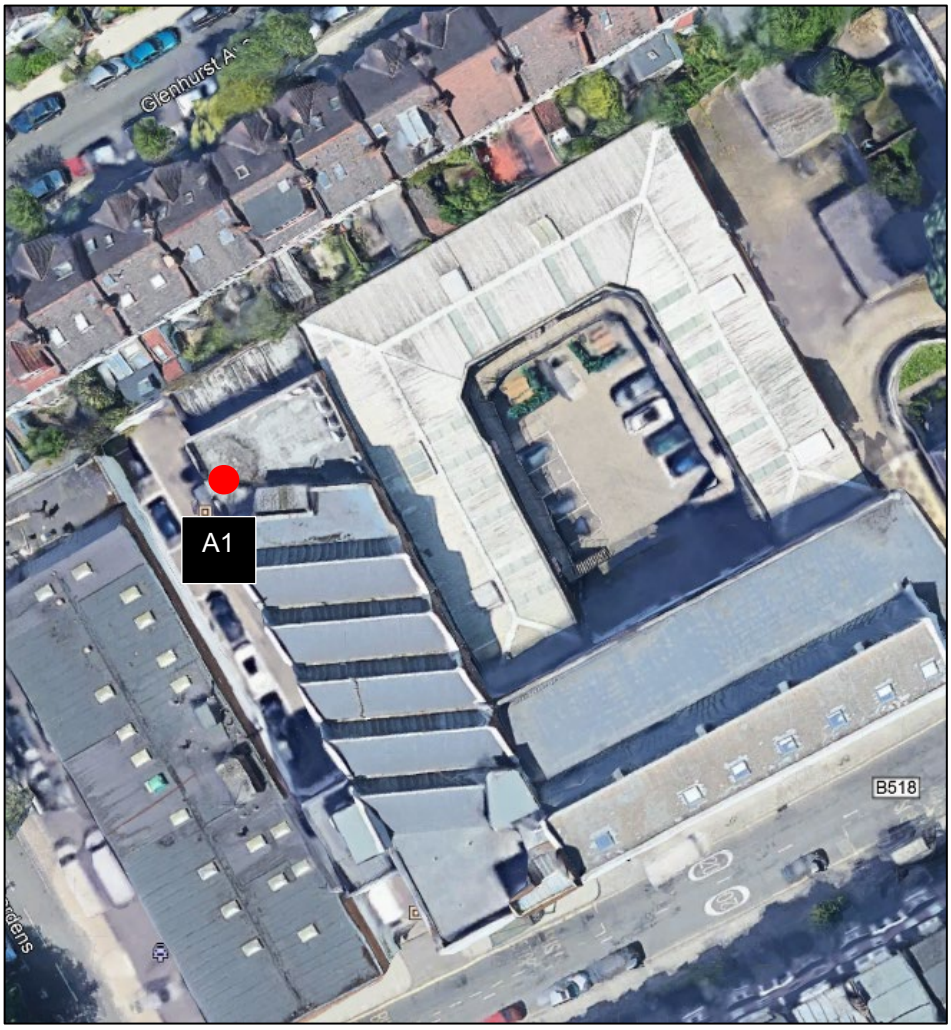


Figure 6.1: Noise Measurement Location

Figure 6.2: Noise Measurement Location Relative to Nearest Dwellings

6.4 The following measurement instrumentation was used for the survey:

Position	Description	Make	Model	S/No.	Calibration
A1	Sound Level Analyser	Svantek	SVAN971	72535	23/04/2018
	Microphone	ACO Pacific	7052E	68260	
	Preamplifier	Svantek	SV18	72235	
	Outdoor Microphone Kit	Svantek	SA271U	--	n/a
	Calibrator	Rion	NC-74	34651766	12/07/2019

6.5 The sound level analyser was calibrated prior to the survey and the calibration checked on completion. No drift in calibration was observed.

6.6 The following noise levels were measured:

Date	$L_{A90,15mins}$	$L_{Aeq,15mins}$	$L_{Amax,fast}$
20/09/2019	43	55	76
21/09/2019	42	50	74
22/09/2019	38	51	71
23/09/2019	42	58	82
24/09/2019	43	57	78
25/09/2019	41	51	76
26/09/2019	45	53	82

Table 6.1: Measured Noise Levels

6.7 A more detailed time history profile showing the variation of noise levels throughout the survey period is presented in **Appendix B.**

6.8 The measurement data has been statistically analysed to determine "typical" daytime and night-time background (L_{A90}) noise levels, as presented in **Figure 6.2** and **Figure 6.3** below.

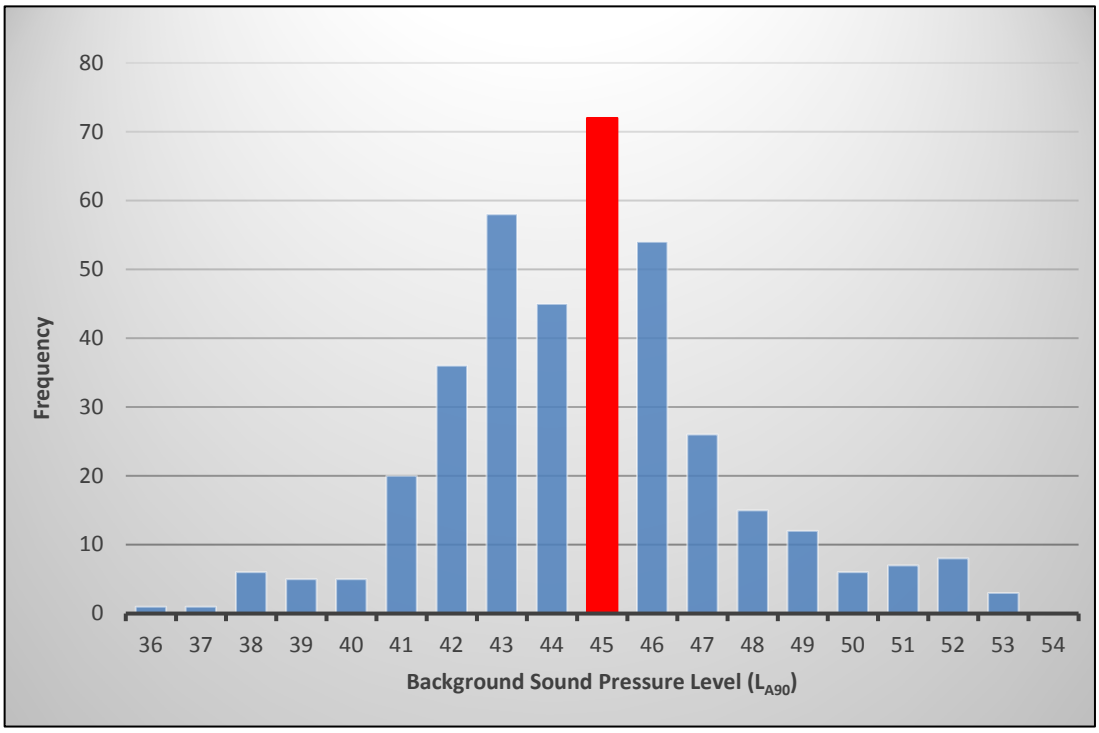


Figure 6.2: L_{A90} Modal Analysis - Daytime

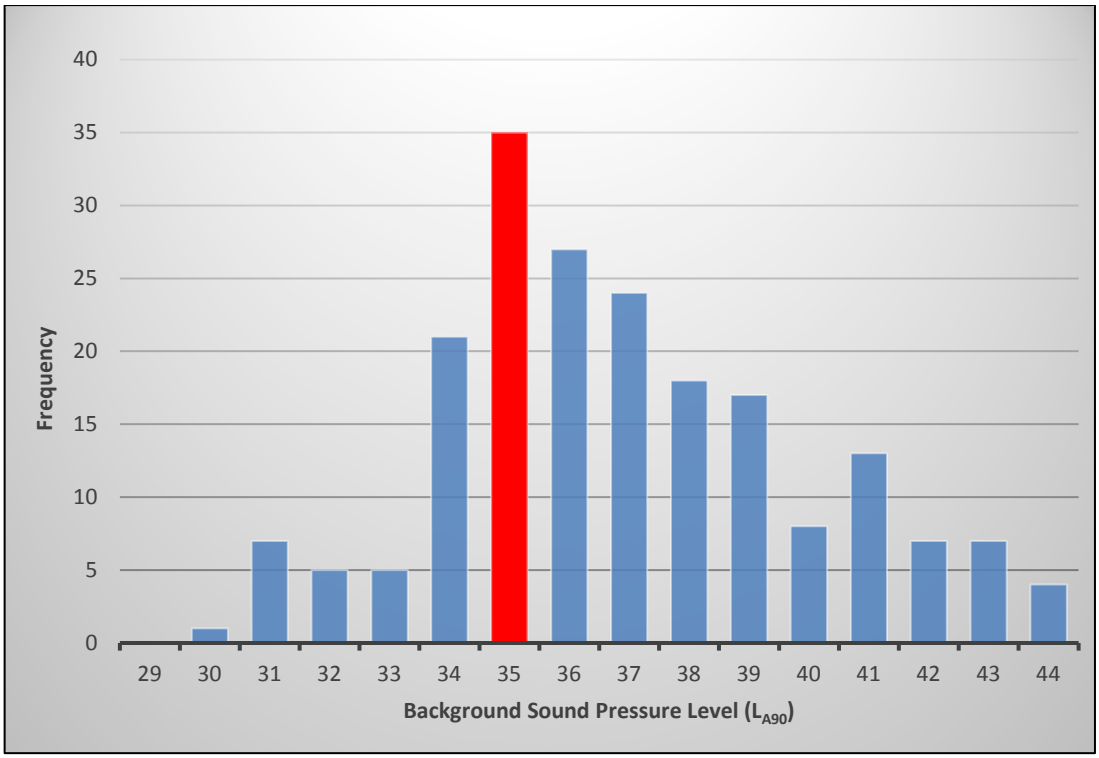


Figure 6.3: L_{A90} Modal Analysis - Night-time

6.9 From the analysis shown, it can be seen that the typical L_{A90} is taken to be **45dB** in the daytime and **35dB** in the night-time, within the vicinity of the nearest noise sensitive receptors.

6.10 It should be noted that whilst the LB Camden's assessment criterion for plant of this nature states that to achieve the Lowest Observed Adverse Effect Leve 'LOAEL' rated noise levels ($L_{Ar,T}$) should be 10dB below background noise levels, we do not agree with this view.

6.11 This criterion appears to be based on the 1997 version of BS4142 which was superseded in 2014. The 1997 version of BS412 included text which indicated that rated noise levels around 10dB below the prevailing background sound level will result in positive indication that complaints are unlikely. Many LA's therefore used this as a basis for their plant noise assessment criterion to safeguard against subsequent noise complaints and to manage 'noise creep' in their respective administrative areas.

6.12 The 2014 version of BS4142 includes additional commentary on Section 11 *'Assessment of Impacts'* and states the following;

> *"d) 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 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".

6.13 Therefore in accordance with the above advice rated noise levels from the installed air-conditioning plant shall not exceed **45 dB** $L_{Ar,\ T}$ for the daytime period and **35dB** $L_{Ar,\ T\ for}$ for the night-time period at the nearest noise sensitive dwellings.

7 Noise Associated with Customer Movements

General

7.1 In order to assess the potential noise impact of customer movements to/from the F45 fitness centre, consideration has been given to the likely number of customers, likely mode of transport and how noise levels would compare to the existing noise environmental characterising the site.

Customer Numbers

7.2 As noted earlier, the fitness is likely to offer a maximum of 7 training classes per day Monday-Friday, 4 training classes on a Saturday and 2 on Sundays with an anticipated 'worst case' customer attraction of around 28 per class at peak times (usually Saturdays).

Accessibility

7.3 It is anticipated that customers would generally reach the site by walking, cycling or other forms of public transport.

7.4 In addition to the above, it is also material to note that Gordon House Road is on an allocated "Green Route". As such, in the unlikely event that customers of the fitness centre did elect to drive to a training session, they would not be able to park outside of the centre.

7.5 It is understood that the operations centre will not require any routine deliveries.

7.6 In light of the above, the principle noise source of external noise created by the fitness centre will be the general access/egress of pedestrian customers, i.e. footfall noise.

7.7 It is, however, also possible that there could be conversational noise, for example, if more than one customer attended the centre together, or if one customer's arrival/departure coincided with that of another and the two parties conversed.

Customer Noise Levels

7.8 As noted earlier, customers will likely arrive and depart the fitness centre on foot.

7.9 **Table 7.1** below presents typical "in-house" measurement data for general pedestrian comings and goings.

Activity	Sound Exposure Level, L_{AE} (dB)	Maximum Level, $L_{Amax,fast}$ (dB)
Two customers arriving together, including footfall noise and casual conversation.	66 dB (at 10m)	59 dB (at 10m)

Table 7.1 Typical Pedestrian Noise Levels

7.10 To help explain the "Sound Exposure Level" (L_{AE}) term indicated above, this represents the total amount of sound energy of a single noise "event" – in this case, a single group of patrons arriving/leaving the gym. Based on a knowledge of the number of events, this parameter allows us to calculate the $L_{Aeq,T}$ noise index (which is the normally adopted noise index for characterising environmental noise, as prescribed in relevant industry standard guidance, such as the World Health Organisations "Guideline for Community Noise" and British Standard BS 8233: 2014 "Guidance for Sound Insulation ad Noise Reduction for Buildings").

Noise Sensitive Receptors

7.11 As noted earlier, the entrance to the proposed gym is directly onto a Mews. the nearest noise sensitive property is located on Glenhurst Avenue, where there is a row of terraced properties with rear windows that overlook the entrance to Units 3 and 4.

7.12 For simplicity, and to ensure a "worst case" assessment of noise generation associated with the gym, it is assumed that the peak hour customer attraction of 25 customers will arrive and then depart the centre within a one-hour period.

7.13 For additional rigour, it has been assumed that customers would arrive in pairs, and their arrival/departures would therefore include conversational noise.

7.14 On this basis, calculations indicate that the residential nearest window on Glenhurst Avenue overlooking the entrance to the fitness centre would experience a sound level of 37dB $L_{Aeq,\ 5min}$ and 56dB $L_{Amax,\ fast}$.

Noise Impact Assessment

7.15 If the noise levels predicted at paragraph 7.14 above are compared with the measured existing noise levels, it can be seen that noise levels likely to be generated by the patron

access/egress are around 13dB **lower** than the existing L_{Aeq} values for the most sensitive periods of operation, 0600hrs – 0700hrs and 1900hrs – 2000hrs respectively.

7.16 To put that above into context in subjective terms, it is generally accepted that the human ear is not capable of discerning a sound level difference of less than 3dB(A); that a sound level difference of 5dB would be discernible and that a sound difference of 10dB(A) would be a subjective doubling or halving of loudness.

7.17 Such a conclusion is considered to demonstrate robustly that noise associated with the coming and goings of patrons associated with the proposed fitness centre will be insignificant in the context of existing noise levels. It is therefore concluded that noise generated by the comings and goings of customers would have no significant or other adverse noise impact on health and quality of life in the bus urban location.

8 Airborne Sound Transfer

Airborne Sound Insulation

8.1 In order to determine the existing level of sound insulation between the proposed gym unit and the adjoining offices. The airborne sound insulations tests have been conducted in Units 2, 11 and 43 which are all currently unoccupied. The following test were undertaken;

Ref.	"Source" Room	"Receive" Room	Separating Structure
Test A1	Unit 3	Unit 11	Wall
Test A2		Unit 11	
Test A3		Unit 2	Wall
Test A4		Unit 2	
Test A5		Unit 43	Floor/Ceiling
Test A6		Unit 43	

Table 8.1: Airborne Sound Insulation Test Procedure

8.2 The following instrumentation was used:

Equipment	Description	Make	Model	S/No.	Calibration
Sound Level Meter	Sound Level Analyser	NTi	XL2-TA	A2A-13108-E0	12/07/2019
	Microphone	NTi	M2230A	A14228	
	Preamplifier	NTi	MC230A	6832	
	Outdoor Microphone Kit	NTi		--	n/a
Calibrator	Sound Calibrator	Rion	NC-74	34651766	12/07/2019
Cabinet Speaker	Speaker	ProSound	N89EE	171010	n/a
Signal Generator	Signal Generator	NTi	Minirator	G2P-RAFPS-G0	n/a

Table 8.2: Airborne Sound Insulation Equipment Details

Test Procedure

8.3 The airborne sound insulation tests were conducted in general accordance with BS EN ISO 140-4:1998 *"Acoustics – Methods of Measurement of Sound Insulation in Buildings and of Building Elements. Part 4: Field Measurements of Airborne Sound Insulation Between Rooms".*

8.4 The loudspeaker was located within the "source" room and fed with "pink noise". The resulting sound pressure levels were then measured within the "source" room and within the "receiver" room on the opposite side of the wall. Two sound source locations were used. five static microphone measurement positions were used in the "source" room and in the "receiver" room for each of the two sound source locations. Each set of results was averaged in accordance with the test standard.

Test Results

8.5 Based on the average measured source and receiver sound pressure levels the level the following airborne sound insulation difference values (*D)* were measured:

Location	1/1 Octave Band Frequency (Hz)								
	31.5	63	125	250	500	1000	2000	4000	8000
Unit 2	33.1	27.5	32.8	42.2	46.1	55.1	59.1	61.2	67.8
Unit 11	24.9	28.4	29.9	33.2	39.2	45.3	46.2	48.9	54.3
Unit 43	28.5	32.7	39.0	38.4	43.1	49.8	54.7	59.2	65.0

Table 8.3: 1/1 Octave Band Airborne Sound Level Difference, *D*

8.6 **Figure 8.1** below presents the sound level difference, *D* over the 1/3 octave range from 25Hz to 16KHz.

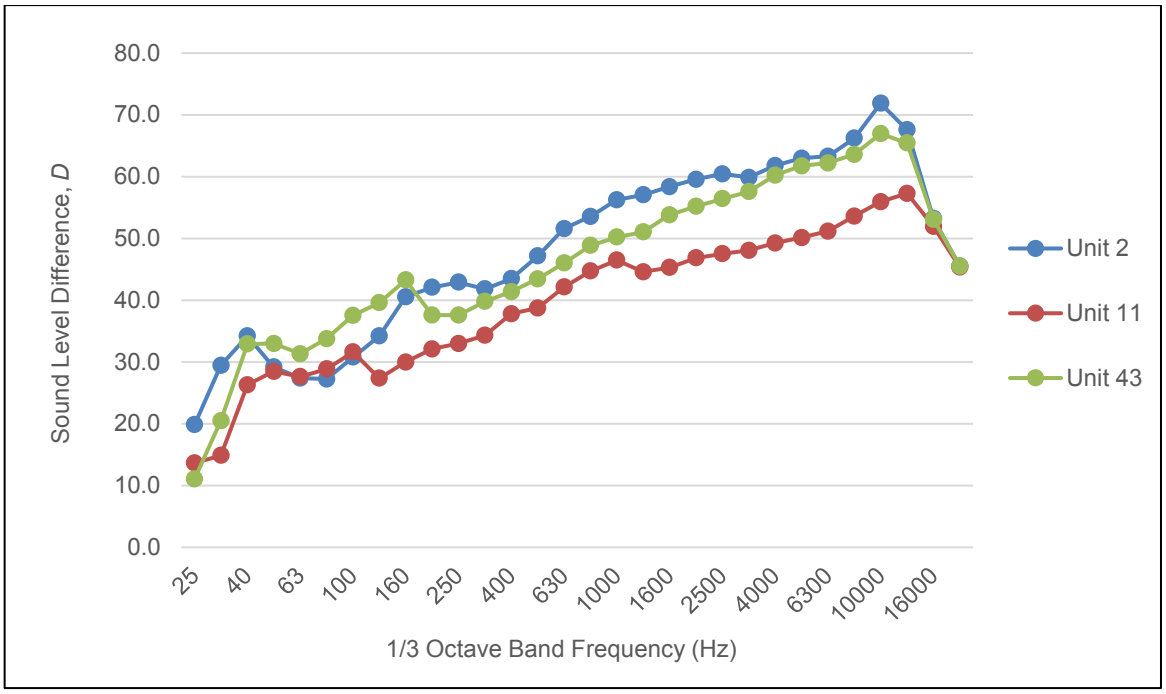


Figure 8.1: 1/3 Octave Band Airborne Sound Level Difference Performance

Gym Noise Levels

8.7 Due to the nature of the gym proposals there will be a requirement for relatively high music noise levels (MNL's) during classes. The predominant airborne sound within the gym will comprise music noise from loudspeakers within the gym and raised voices from instructors during classes.

8.8 Being a class based gym there are no additional noise sources from resistance machines or cardio equipment to consider.

Music Noise Levels

8.9 In order to obtain robust data of operational MNL's within a similar gym to that proposed at Spectrum House noise measurements were taken at an existing operational F45 gym in Chiswick.

8.10 The measurements were obtained during a 'Romans' class, described on F45's website as *'F45's original resistance based workout, consisting of large compound lifts with maximum rest periods. The focus for each member should be to lift as heavy as they can, every single set. Romans is designed to make you stronger and more powerful'.*

8.11 The class comprised approximately 8-10 participants and 2 instructors and involved compound lifts and functional exercises completed in a circuit with 3 sets and rest periods in between.

8.12 During the 15 minute measurement period the ambient noise within the gym consisted predominantly of high energy amplified music noise and the instructors voices. Whilst free weights and other equipment were used during the class they were inaudible due to the dominance of the MNL's.

8.13 The measured gym noise levels are presented in **Table 8.1** below;

	1/1 Octave Band Frequency (Hz)									
	31.5	63	125	250	500	1000	2000	4000	8000	dB(A)
Gym Noise Level	68.4	74.4	79.9	78.5	76.0	75.9	70.9	66.5	60.6	**79.6**

Table 8.4: Operational Gym Noise Levels

8.14 During the 15 minute measurement period the ambient noise within the gym consisted predominantly of high energy amplified music noise and the instructors voices. Whilst free weights and other equipment were used during the class they were inaudible due to the dominance of the MNL's.

8.15 A further point to consider is that the music noise levels within the gym are constrained by the Control of Noise at Work Regulations 2005 which specifies a First Action Level of 80dB $L_{EP,\,d}$ in order to protect employees and customers from the hearing damage.

Predicted Gym Noise Levels – Existing Offices

8.16 Based on the measured gym music noise levels and the sound level difference, *D* of the existing adjoining wall and floor structures within Spectrum House the operational gym noise levels within the existing offices have been predicted and compared against the relevant assessment criteria.

Unit 2	1/1 Octave Band Frequency (Hz)									Resultant value
	31.5	63	125	250	500	1000	2000	4000	8000	
Gym MNL's	68.4	74.4	79.9	78.5	76.0	75.9	70.9	66.5	60.6	**79.6 dB(A)**
Level Difference	33.1	27.5	32.8	42.2	46.1	55.1	59.1	61.2	67.8	
Office MNL's	35.3	46.9	47.1	36.3	29.9	20.8	11.8	5.3	-7.2	**34dB(A)**
Assessment Criteria (NR35)	79.2	63.1	52.4	44.5	38.9	35.0	32.0	29.8	28.0	**NR29**

Table 8.5: Predicted Gym Noise Levels – Unit 2

Unit 11	1/1 Octave Band Frequency (Hz)									Resultant value
	31.5	63	125	250	500	1000	2000	4000	8000	
Gym MNL's	68.4	74.4	79.9	78.5	76.0	75.9	70.9	66.5	60.6	**79.6 dB(A)**
Level Difference	24.9	28.4	29.9	33.2	39.2	45.3	46.2	48.9	54.3	
Office MNL's	43.6	46.0	50.0	45.3	36.8	30.6	24.7	17.6	6.3	**41dB (A)**
Assessment Criteria (NR35)	79.2	63.1	52.4	44.5	38.9	35.0	32.0	29.8	28.0	**NR31**

Table 8.6: Predicted Gym Noise Levels – Unit 11

Unit 43	1/1 Octave Band Frequency (Hz)									Resultant value
	31.5	63	125	250	500	1000	2000	4000	8000	
Gym MNL's	68.4	74.4	79.9	78.5	76.0	75.9	70.9	66.5	60.6	**79.6 dB(A)**
Level Difference	28.5	32.7	39.0	38.4	43.1	49.8	54.7	59.2	65.0	
Office MNL's	40.0	41.7	40.9	40.1	32.9	26.1	16.2	7.2	-4.4	**35dB(A)**
Assessment Criteria (NR35)	79.2	63.1	52.4	44.5	38.9	35.0	32.0	29.8	28.0	**NR30**

Table 8.7: Predicted Gym Noise Levels – Unit 43

8.17 The results are presented graphically in **Figure 8.2** to **Figure 8.4** below;

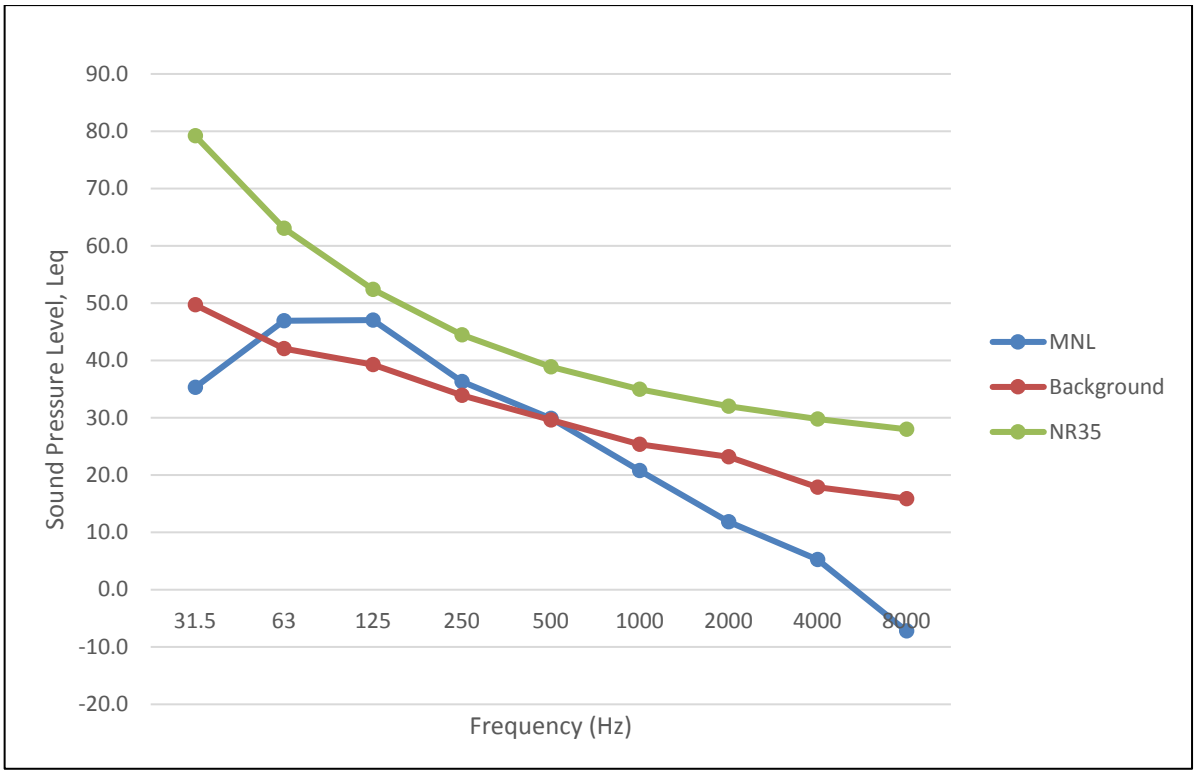


Figure 8.2: Predicted Operational Gym Noise Level – Unit 2, Spectrum House

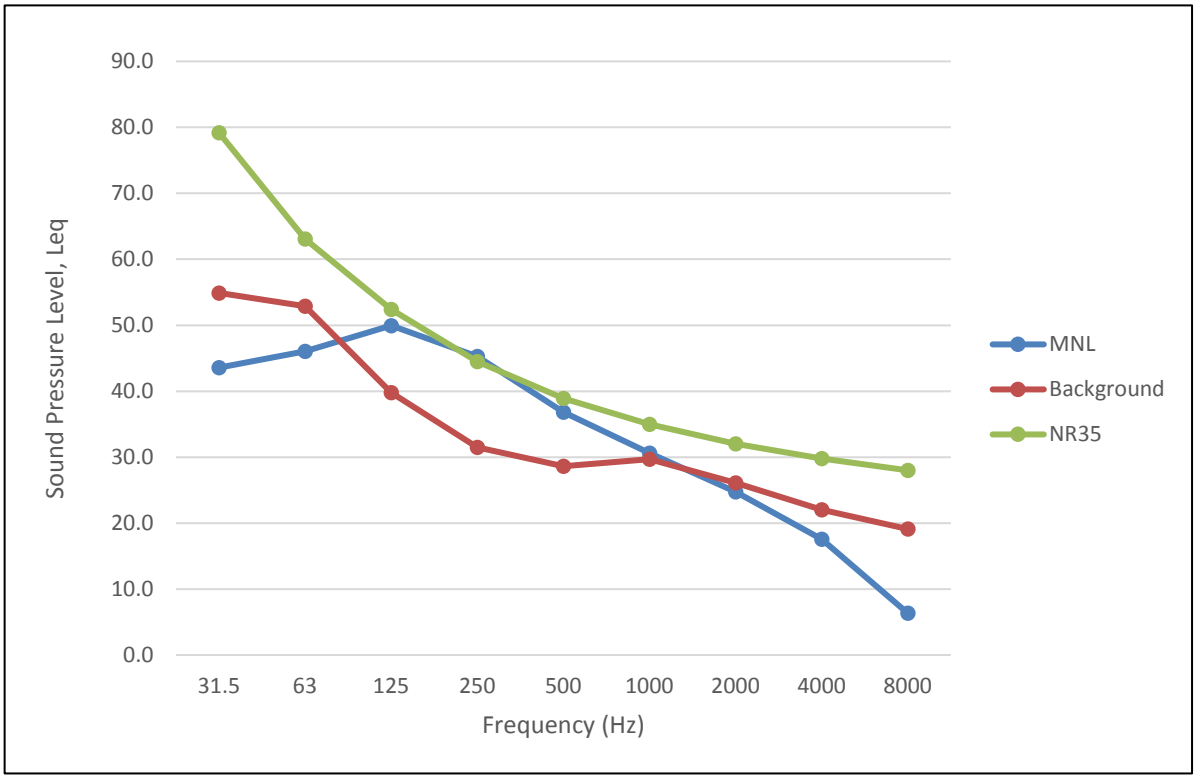


Figure 8.3: Predicted Operational Gym Noise Level – Unit 11, Spectrum House

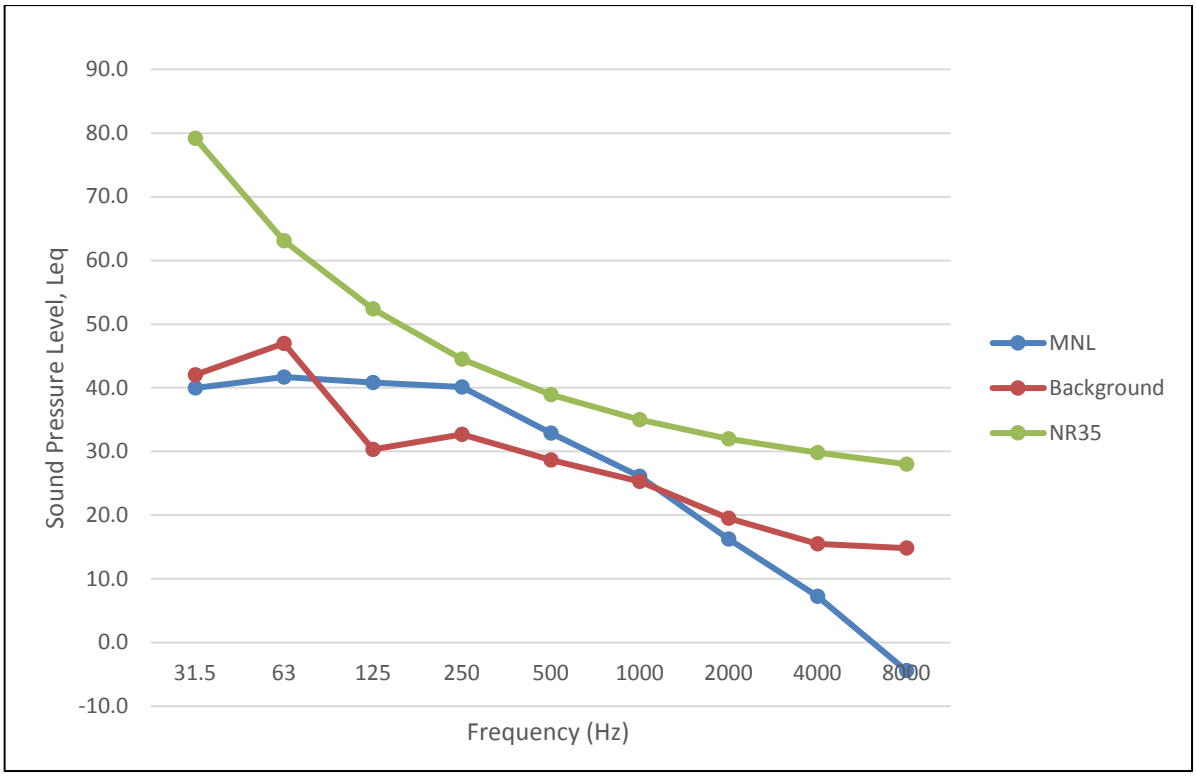


Figure 8.4: Predicted Operational Gym Noise Level – Unit 43, Spectrum House

8.18 **Figure 8.2** to **Figure 8.4** demonstrate that the predicted gym noise levels within the offices are compliant with the NR35 assessment criterion in all Units and are as low as NR29.

8.19 **Tables 8.5** to **Table 8.7** highlight that the overall 'A' weighted values are consistent with noise levels for office space in accordance with the recommendations of BS:8233. with modest noise levels predicted.

8.20 When compared with the measured background noise levels within the Units there are exceedances, however it is noteworthy that the measured background values were obtained in empty offices in the evening period when background noise levels within the Units were very quiet. Resultant gym noise levels are likely to reduced when offices are occupied and furnished.

8.21 It is likely that the background noise levels will be higher than the measured values, particularly during 'normal' office hours when the gym is in operation and when other Units in Spectrum House are occupied and noise from the prevailing background noise in the vicinity i.e road traffic noise and noise from plant and servicing noise in and around Spectrum House is elevated.

Predicted Break Out Noise to Residential Dwellings

8.22 An assessment of potential noise break out from the operational gym has been undertaken and compared against the LB Camden's assessment criterion to ensure adverse impacts on the nearest noise sensitive dwellings are avoided. The calculation has taken into account noise breakout from inside of the gym to outside has assumed that the weakest element of the façade is the single glazed roof light windows.

8.23 The results are presented in **Table 8.8** below;

Breakout to residential	1/1 Octave Band Frequency							Resultant Values
	63	125	250	500	1000	2000	4000	
Gym MNL's	74.4	79.9	78.5	76.0	75.9	70.9	66.5	**79.6 dB(A)**
Inside to outside correction	-6	-6	-6	-6	-6	-6	-6	
Area of glazing ($0.7m^2$)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	
Window SRI	-15	-18	-25	-31	-36	-30	-38	
Distance attenuation (8m)	-10	-10	-10	-10	-10	-10	-10	
Noise level at 1m from residential facade	41.8	44.2	35.9	27.4	22.3	23.3	10.9	**32.9 dB(A)**

Table 8.8: Noise Breakout Calculation

8.24 The resultant predicted value meets the LB Camden's night-time assessment criterion of **45dB $L_{Aeq,\ 5m}$**. Additionally, when allowing 15dB for a partially open window, this equates to an internal noise level of approximately 15dB $L_{Aeq,5m}$ within the nearest dwelling, when allowing 15dB for a partially open window.

9 Impact Sound Transfer

9.1 Tests have been undertaken to determine the impact of the use of free weights on the adjoining offices, Units 2, 11 and 43 which are all currently unoccupied.

9.2 A 32kg kettlebell weight was used in the adjoining offices and tests conducted of the impact of the dropping the weight from knee height on to a combination of floor finishes. This comprised directly dropping the weight onto the existing floor with hard wood finish and testing various gym flooring samples to determine the most effective in mitigating impact noise.

9.3 Subjective observations were made and it was noted that with the worse-case test which was dropping the weight with no gym flooring the noise was noticeable and intrusive in Units 11 and 43 and clearly audible in Unit 2. It was also noted that background noise levels in the Units were very low, with little or no masking sound.

9.4 The best performing flooring combination was a combination of TVS RV250 40mm and TVS Vibsorb-10 17mm where the impact noise was noticeably reduced and whilst still audible was not considered intrusive in any of the adjacent Units.

9.5 An example results of the impact tests performance of the TVS flooring combination is shown in **Figure 9.1** below;

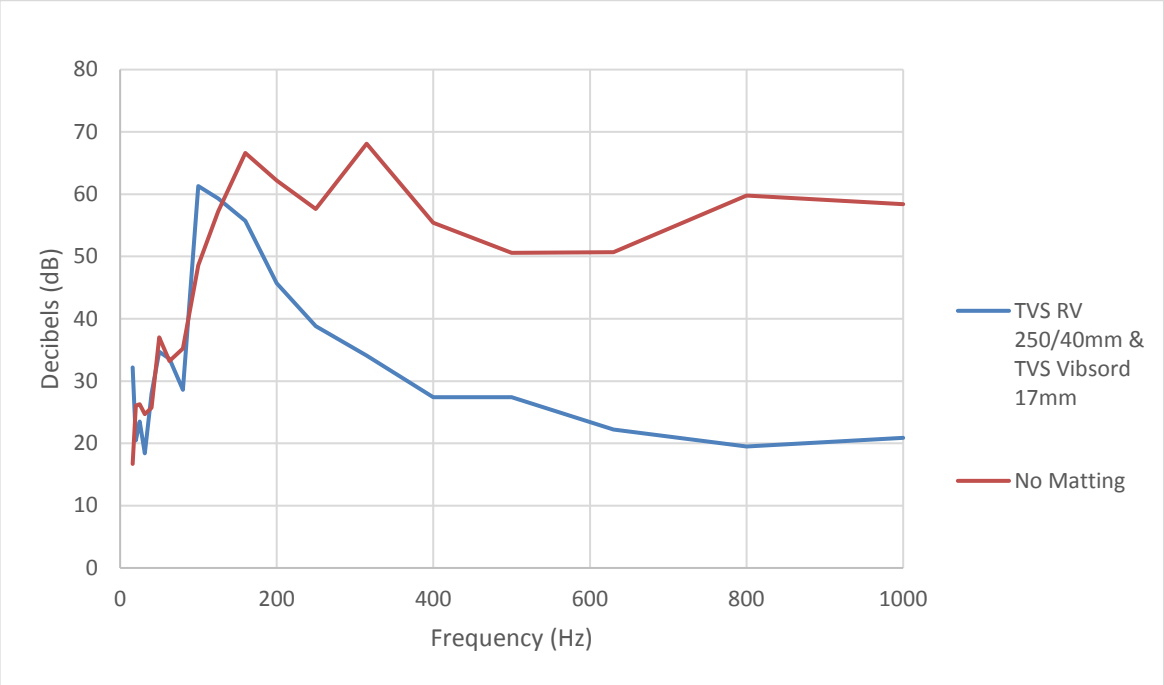


Figure 9.1: Impact Test with TVS Flooring Sample – Unit 43

9.6 It is of relevance that the dropping of free weights will not be considered normal within the context of the operational gym. Weights may be dropped occasionally but will most likely involve weights less than the 32kg kettlebell used during the testing. The testing conducted is therefore seen as very much a worse case assessment.

9.7 The nature of the F45 gym is that it is a class based offering therefore every session is run by an instructor(s). This provides for constant supervision and instruction therefore good management and advice from instructors will ensure that the dropping of free weights is not the norm.

9.8 This is issue is further safeguarded by the fact that users/members do not have access to weights outside of classes unlike traditional gyms which often have unsupervised free weights areas that members can access as and when they choose.

10 Conclusions

10.1 The planning application seeks a change of use of Units 3 and 4 of Spectrum House to D2 use as a fitness centre.

10.2 Consideration has been given to the potential noise impacts of the proposed change of use including:

- Noise associated with patrons entering/leaving the fitness centre;
- Operational (airborne) sound transmitted to adjoining offices;
- Operational (impact) sound transmitted to adjoining offices;
- Operational noise “break-out” via the external fabric of the building.

10.3 It is concluded that:

- Operational noise associated with customer comings and goings would have no significant or other adverse noise impact on the health and quality of life of neighbouring noise sensitive receptors;
- Operational noise will be characterised by background music. Noise transference to adjoining offices is compatible with the sound insulation afforded by the existing constructions and resultant levels are estimated to be consistent with guidance values of BS:8233 and an NR35 value to control low frequency noise;
- Operational impact noise tests determined that the dropping of weights was noticeable and intrusive unmitigated. Testing with bespoke gym flooring samples established that impact noise transmission to adjoining units can be controlled to acceptable levels. Noise transmission will be further controlled by the nature of the F45 offering, which is solely instructor led classes;
- Operational noise break-out from the proposed fitness centre would be substantially lower than the existing noise levels and it can be safely concluded that noise break-out from the fitness centre would not have any adverse noise impact on neighbouring dwellings with windows overlooking the gym;
- Plant noise emissions are to be controlled through the achievement of recommended target noise criterion, set to ensure that adverse impacts from plant noise emissions at nearby residential dwellings comply with current government policy and industry standards;

10.4 It is concluded that any potential noise impacts associated with the proposed change of use can be mitigated and reduced to a minimum and the proposed development can

avoid any significant adverse impact on the health and quality of life of neighbouring residential properties.

10.5 The proposed change of use is therefore considered to comply fully with national, city-wide and local planning policy objectives.

APPENDIX A: Glossary of Acoustic Terminology

GLOSSARY OF ACOUSTIC TERMINOLOGY

General

A vibrating surface or turbulent fluid flow will cause pressure fluctuations in the surrounding air. These pressure fluctuations are perceived by the human ear as “sound”.

Measurement Units

The human ear can detect sound pressures as low as about 20 µPa, and can tolerate (for short periods) sound pressures as high as 200 Pa, an amplitude range of 10 million times. To take account of this huge amplitude range, sound pressure levels (often written in “acoustic shorthand” as SPL or Lp) are quantified using a logarithmic scale, the decibel (dB) scale. This is based on a reference pressure of 20µPa, thus a sound pressure of 20µPa would equate to 0dB and a pressure of 200Pa would equate to 140dB.

Frequency (Pitch) Characteristics

The sound received at any particular location is not solely influenced by the sound pressure level, the frequency characteristics (pitch) of the noise is also an important factor. Noise audible to a human (with “normal” hearing), typically covers the frequency range 20 Hertz to 20,000 Hertz. Hertz (Hz) are defined as the number of times the sound pressure fluctuates in one second. “Low” pitched sounds fluctuate less times per second than “high” pitched sounds. Whilst humans are capable of detecting a wide range of frequencies, the ear is not equally sensitive to all frequencies – the ear is most sensitive at frequencies towards the middle of the audible range and less sensitive to the lower and higher frequencies.

To take account of this frequency response, sound pressure fluctuations are normally quantified by applying a frequency-weighting network or filter which simulates the frequency response of the ear. In essence, this means that more significance is given to the frequencies at which the ear is most sensitive and less significance to those at which the ear is less sensitive. Noise measurements relating to human reaction are generally made using an “A-weighting” network. These measurements are reported as A-weighted decibels or dB(A). The A-weighted sound pressure level is written in “acoustic shorthand” as L_A.

Variation of Sound with Time

It will be appreciated that the sound pressure level of most noise sources will fluctuate with time. In order to take account of the way in which the human ear perceives noise, it is normal for the sound pressure level to be quantified using a time weighting network, to mimic the speed of response of the human ear. The standardised setting for most types of noise is a “Fast” time weighting.

The manner in which sound fluctuates with time can also influence the subjective manner in which noise is perceived. Noise can be continuous (showing no significant variation with time as in the case of a fan), intermittent (i.e. the noise is transient in it’s nature, such as a train pass-by) or impulsive (i.e. there is a sudden build up of noise - this can range from “clanking” types sounds as might be experienced next to railway goods yard or a high energy discharge such as an explosion)

Measurement of Sound

Sound pressure levels are measured using equipment comprising a pressure-sensitive microphone, associated amplifier, frequency weighting network, time weighted network and output indicator. In its simplest form this is a small hand-held instrument called a sound level meter. More sophisticated instrumentation (a sound level analyser) is also available which allows the real-time output of the frequency characteristics of the sound to be quantified.

Comparison of Sound Levels

To put the significance of noise measurement into context, the following Table presents the A-weighted sound pressure level of some typical sources:

Sound Pressure Level, dB(A)	Typical Noise Source . Activity
160	Saturn Rocket Taking Off
140	Military Jet Taking Off at 30m
100	Nightclub
90	Heavy goods vehicle driving past at 7m
80	Busy urban road
70	Domestic vacuum cleaner at 3m
60	Busy office environment
55	Normal speech at 1m
40	Whispered conversation at 2m
30	Bedroom at night (BS 8233: 1999)
20	Remote country location
0	Threshold of hearing – a very eery silence

Addition of Sound Levels

It is important to note that the use of a logarithmic scale to describe noise does not allow normal arithmetic addition. This means that two noise sources each generating a level of, say, 60dB(A) will not generate a combined sound level of 120dB(A). The values must be added logarithmically, which would actually yield a combined sound level of 63dB(A) in this example.

Subjective Perception of Sound Levels Changes

With regard to the human perception of sound level changes, the human ear:

- Cannot generally perceive a sound level difference of less than 3dB(A)
- Will perceive a sound level difference of 4-5dB(A) as “noticeable”
- Will perceive a sound level difference of 10dB(A) as a doubling (or halving) of loudness.

Acoustic Terminology

As stated previously, most sources of noise will fluctuate with time. In order to characterize such noise, it is therefore normal to represent the noise climate using a variety of noise parameters and statistical indices. The most commonly adopted noise parameters are described below:

$L_{Aeq,T}$ This is the equivalent continuous A-weighted sound level measured over a specified time period "T". This is the notional continuous sound level which, over the time T, contains the same amount of energy as the actual fluctuating sound being measured. This parameter is widely accepted as being the most appropriate noise descriptor for most environmental noise and the effects of noise on humans.

$L_{Amax,fast}$ This is maximum A-weighted sound pressure measured with a fast frequency response recorded during the stated measurement period. It is typically used to characterise the highest sound level caused during a noise event.

$L_{A90,T}$ This is the A-weighted sound pressure level exceeded for 90% of the specified time period "T". It is normally used to describe the underlying background noise level of an environment since it inherently excludes the effects of transient noise sources.

Noise Rating (NR) Level

When describing noise from building services installations, it is common to express noise levels in terms of a Noise Rating (NR) Level. The NR level is determined by plotting the measured frequency spectrum of a noise against a series of reference curves, which roughly approximate to equal loudness values. This method permits higher sound levels at low frequencies corresponding to the sensitivity of the human ear. The NR level is defined as the value of the highest curve "touched" by the plotted frequency spectrum. For typical sources of building services noise, the overall A-weighted sound level is numerically around 5-6dB higher than the NR level of the noise.

Airborne Sound Insulation Measurement Parameters

The ability of a building element to reduce airborne noise can be described by a number of different parameters relevant to both laboratory and on-site performance evaluation. In general, the higher these values, the better the resistance of the construction to the transmission of airborne sound. The most commonly used parameters include:

R_w The **"Weighted Sound Reduction Index"** (R_w) is a single value measure of the intrinsic sound reduction capabilities of a construction, as measured in an acoustic laboratory. Measurement values are determined in accordance with the BS EN ISO 10140 series of standards and weighted in accordance with BS EN ISO 717-1: 2013.

R'_w The **"Weighted Apparent Sound Reduction Index"** (R'_w) is a single value measure of the apparent sound reduction capabilities of a construction, when installed on-site (which will normally be some way lower than the laboratory value due to less favourable installation conditions, the quality of workmanship, etc.). Measurement values are determined in accordance with the BS EN ISO 10140 series of standards and weighted in accordance with BS EN ISO 717-1: 2013. In practice, the R'_w of a construction can only be reliably determined if "direct" sound transfer through the partition can confidently be taken as the dominant noise transfer path (i.e. there is no "flanking" sound transmission.

D_w The **"Weighted Sound Level Difference"** (D_w) is a single value measure of the on-site sound reduction between two rooms. This value inherently includes "direct" sound transmission through any separating construction and "flanking" transmission through other building elements. Measurement values are determined in accordance with BS EN ISO 140-4: 1998 (for Building Regulations compliance purposes) or BS EN ISO 16283-1: 2014 and weighted in accordance with BS EN ISO 717-1: 2013.

$D_{n,fw}$ The "**Weighted Normalised Flanking Level Difference**" ($D_{nf,w}$) is a single figure measure of the sound reduction between two rooms solely due to sound transmission through a specified flanking path. This parameter is frequently used to provide an indication of the sound reduction capabilities of suspended ceiling and raised access floor constructions where there is common void between adjacent rooms or as a measure of sound that may be transmitted between rooms through external curtain walling. Measurements are undertaken in accordance with BS EN ISO 10848-2: 2017 and weighted in accordance with BS EN ISO 717-1: 2013.

Impact Sound Insulation Measurement Parameters

Some building elements also have the potential to generate "impact" noise, for example due to human "footfall" on floor structures, or the impact of rainfall on lightweight roofing components. A variety of parameters are again available to define the amount of noise likely to be generated. In general, the lower these values, the less sound the construction will generate as a result of impacts. Typical measurements parameters include:

$L_{nT,w}$ The "**Standardised Impact Sound Pressure Level**" is a "single number" rating describing the intrinsic impact sound insulation capabilities of a construction (such as a floor system) as measured in an acoustics laboratory. Values are determined in a vertical sound transmission suite by locating a "tapping machine" in the upper room of the suite and measuring the amount of sound radiated by the floor in the room below. Measurement values are determined in accordance with the BS EN ISO 10140 series of standards and weighted in accordance with BS EN ISO 717-2: 2013.

$L_{nf,w}$ The "**Normalised Flanking Impact Sound Pressure Level**" is a "single number" rating describing the amount of flanking sound that would be transmitted to an adjoining space (separated by a partition) due to impacts on the test sample. It is, for example, used to indicate the amount of noise that may be generated due to footfall noise on a raised access floor system. Values are determined in a horizontal sound transmission suite by locating a "tapping machine" one side of a separating partition built off the test sample and measuring the amount of noise radiated by the floor in the adjoining space on the other side of the partition. Measurement values are determined in accordance with BS EN ISO 10848-2: 2017 and weighted in accordance with BS EN ISO 717-2: 2013.

Room Acoustic Measurements

T The "**Reverberation Time**" (T) of a room is defined as the time taken for the sound energy produced by a source Time (RT)to decay by 60 dB after the source has been switched off. The reverberation time of a space can be calculated by considering the volume of the room and the areas and sound absorption qualities of room surface finishes. Small, "soft" rooms tend to give low reverberation times, whilst large, "hard" rooms tend to give long reverberation times.

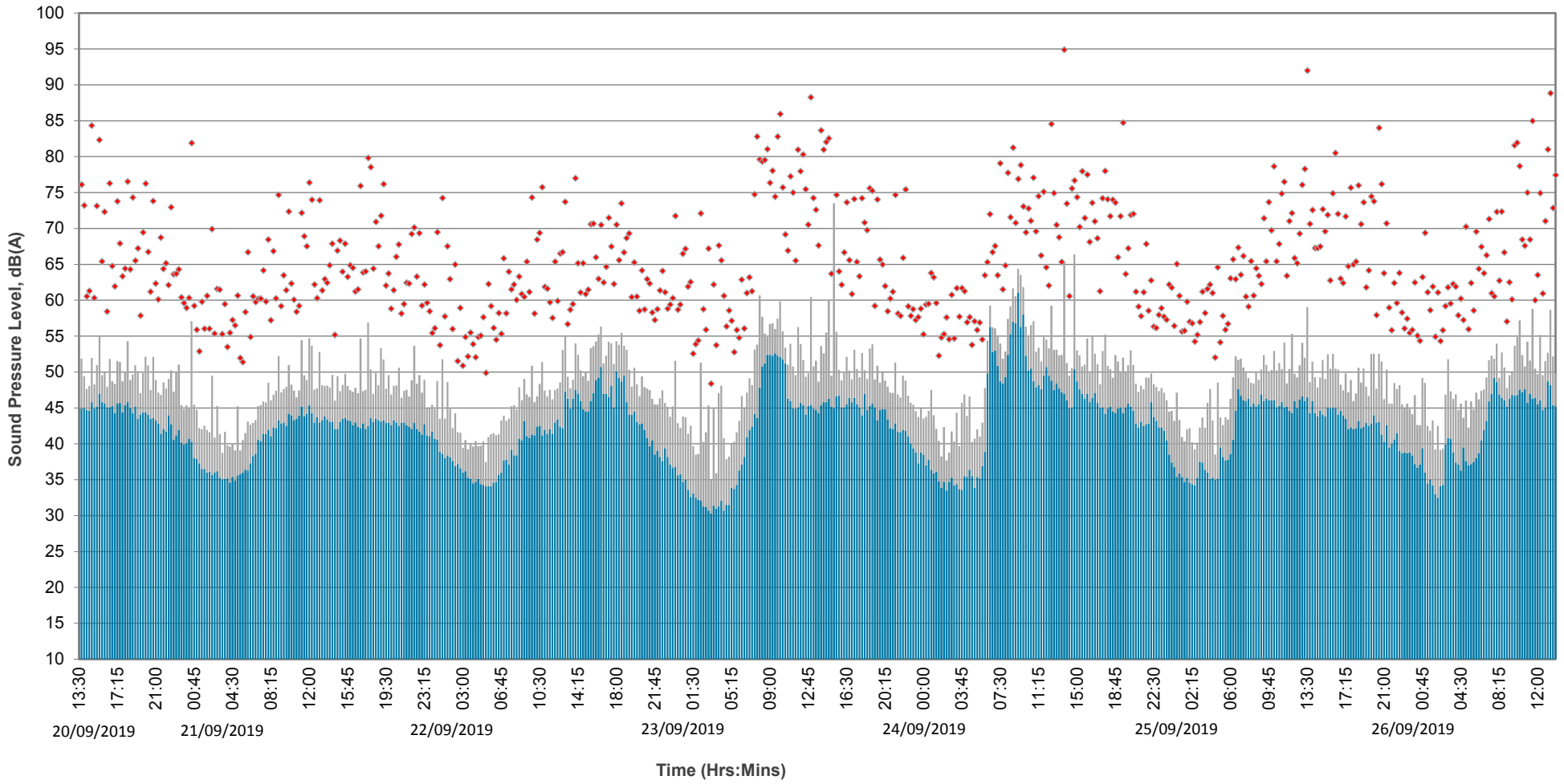
α_p The "**Practical Acoustic Absorption Coefficient**" (α_p) is a measure of how much sound energy is absorbed by a building element at a particular frequency, as measured in accordance with BS EN ISO 354: 2003.

α_w The "**Weighted Absorption Coefficient**" (α_w) is a single figure measure of the overall sound absorption capabilities of a building element determined in accordance with BS EN ISO 11654: 1997.

APPENDIX B: Noise Monitoring Time History Plots

Time History Graph A1

Project:	SpectrumHouse(N).9
Measurement Location:	A1
Survey Period:	20/09/2019 - 26/09/2019



KEY: $L_{A90,15mins}$ $L_{Aeq,15mins}$ $L_{Amax,fast}$

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