Report VA4283.221103.GNR1.1

F45, 64-68 Brighton Road, Surbiton

Gym Noise Assessment

02 January 2024

F45 Training Surbiton
64-68 Brighton Road
Surbiton

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Contents

1. Introduction 1
2. Background 1
2.1 Site Description 1
2.2 Proposed Use 2
3. Planning Condition 2
4. Site Survey & Equipment 3
4.1 Equipment 3
5. Airborne Sound Insulation 3
5.2 Proposed Fitout / Mitigation 4
6. Slam Ball Testing 5
7. Gym Management 6
7.1 Weights and Slam Ball Use 6
7.2 Limiting Source Music Level 7
7.3 Voices 8
7.4 Neighbour Relations 8
8. Conclusion 8

Attachments

VA4283/AB1 - AB2	Sound Insulation Test Results
Appendix A	Acoustic Terminology

1. Introduction

A new F45 gym facility is proposed at ground floor level of the building at 64-68 Brighton Road, Surbiton.

Venta Acoustics has been commissioned by F45 Training Surbiton to address the requirements of Condition 6 of the Royal Borough of Kingston Upon Thames planning consent (ref: 2/0228/FUL), relating to sound insulation / control of gym activity noise transmission.

To facilitate the necessary assessments, site survey work was carried out to establish the existing baseline airborne sound insulation between ground floor and first floor neighbouring residential units and typical levels of re-radiated noise at first floor level resulting from slam ball throw events at ground floor.

These measurements are used to review the tenant's internal building fabric fitout proposals for the gym demise and provide commentary on anticipated weights drop mitigation. An operational noise management plan is also provided in order to help further minimise gym noise impact on neighbouring residential apartments.

Details of required mitigation measures are also provided, as necessary.

2. Background

2.1 Site Description

The ground floor of 64-68 Brighton Road is a single height commercial unit located beneath several storeys of new residential apartments above. The building is located at the end of a terrace of several other 2-storey commercial buildings located on the crossroads of Brighton Road, Maple Road and Balaclava Road. To the north-west is an access alleyway leading to a new residential development to the rear of the building.

The site is located centrally within Surbiton. There are multiple other commercial premises in the immediate vicinity including shops, public houses and restaurants.

The unit is currently open plan and fitted out to a Cat A standard.

The existing floor separating ground and first floor of the building is formed from a circa-50mm screed on trapezoidal composite steel / concrete deck, which is circa 140mm deep at its widest and 70mm at its shallowest. There is no ceiling currently in situ and the underside of the steel deck is visible from beneath.

The front façade of the unit is predominantly shopfront glazing to full height.

2.2 Proposed Use

The unit is to be used as an F45 fitness gymnasium, which allows only instructor-led group high-intensity-interval-training classes and functional fitness. Free weights use is typically limited to kettle bells and use of slam balls. Barbells and heavy resistance / cable machines are not used.

Music of a moderate level is played during classes.

The reception lobby, changing rooms and toilets will be partitioned off in the north-western half of the demise. The rest of the space will be an open plan studio will be situated in the south-eastern half of the unit.

First classes of the day are understood to be held at 06:00 hours, which represent the greatest potential for impact on neighbouring residential occupiers above.

3. Planning Condition

Planning condition 6 is as follows:

6. *Prior to the commencement of use hereby permitted, the applicant shall provide a scheme to the Local Planning Authority for its written approval detailing sound transmission reduction measures to be installed between the ground floor commercial uses and the first floor flats. The scheme shall be designed to be 5dB better than that given in Approved Document E (2003 Edition incorporating 2004 and 2010 amendments) of the Building Regulations (Table 0.1a, page 12). The scheme shall also include a management plan to control noise from group activities and weight lifting equipment. Once agreed in writing by the Local Planning Authority the approved details shall be installed prior to the development being occupied and retained thereafter.*

For reference, Table 0.1a of Approved Document E is reproduced below:

Dwelling-houses and flats – performance standards for separating walls, separating floors and stairs that have a separating function			
		Airborne sound insulation $D_{nT,w} + C_{tr}$ dB	**Impact sound insulation $L'_{nT,w}$ dB**
Purpose built dwelling houses and flats	Walls	≥ 45	-
	Floors and stairs	≥ 45	≤ 62
Dwelling-houses and flats formed by material change of use	Walls	≥ 43	-
	Floors and stairs	≥ 43	≤ 64

Table 3.1 – Approved Document E 2003 performance standards for dwelling-houses and flats

It should be noted that the wording of Condition 6 lacks precision, in that does not specify whether the "purpose built" or "material change of use" performance standards detailed in Table 0.1a of Approved Document E should be targeted. The inference is that, since the entire building is a new build, review and analysis should target the "purpose built" performance standards.

On this basis, it is offered that the sound insulation between ground floor and first-floor of the building should target performances of **≥ $D_{nT,w} + C_{tr}$ 50 dB** and **≤ $L'_{nT,w}$ 62 dB**.

4. Site Survey & Equipment

Investigative tests were undertaken during a site visit on 01/11/2022.

4.1 Equipment

The following equipment was used in the course of the investigations.

Manufacturer	Model Type	Serial No	Calibration	
			Certificate No.	Date
NTi Class 1 Integrating SLM	XL2	A2A-15993-E0	UCRT21/1390	22/3/21
NTi Class 1 Integrating SLM	XL2	A2A-15892-E0	UCRT21/1389	22/3/21
Larson Davis calibrator	CAL200	13049	UCRT21/1385	22/3/21
Electro Voice	ZLX-12P-EX	095208361761760076	-	-
Electro Voice	ZLX-12P-EX	095208361761760087	-	-

Table 4.1 – Equipment used for the tests

5. Airborne Sound Insulation

Airborne sound insulation testing was undertaken between the ground floor demise and habitable rooms of two vacant apartments directly above at first floor level.

Tests were undertaken in general accordance with the procedures defined in BS EN ISO 140-4: 1998 *Acoustics – Measurement of sound insulation in buildings and of building elements – Part 4: Field measurements of airborne sound insulation between rooms*.

The tests results are shown and are weighted as per the methodology described in BS EN ISO 717-1: 2013 *Acoustics – Rating of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation*.

The results of the tests are summarised in the following table.

Source	Receive	Sound Insulation, $D_{nT,w} + C_{tr}$
Ground floor open plan area	Flat 4 rear bedroom	46 dB
Ground floor open plan area	Flat 5 front bedroom	47 dB

Table 5.1 – Airborne sound insulation test result

The existing airborne sound insulation performance of the floor separating ground and first floor is good, aready meeting the Building Regulation threshold required for new build dwellings. However, performance is several decibels short of meeting the enhanced requirements of Condition 6 of the planning consent.

Although not measured on site, experience suggests that the impact sound insulation offered by the existing construction is also unlikely to be adequate to the standard required.

A second set of tests was undertaken between the areas using a lively, bass heavy piece of dance music. Music with a strong bass character was selected as this provides the most robust test of the sound insulation performance of the structure. The music was played at a high volume and slowly turned down until it became inaudible in the dwellings above. At moderately high source noise levels (L_{Aeq} 75dB), the music, particularly bass frequencies, was clearly audible above the ambient noise levels. With the music turned down to a level of L_{Aeq} 62dB(A), the music was at a very low level in the apartments above, being effectively inaudible.

5.2 Proposed Fitout / Mitigation

The gym demise is currently completed only to Cat A standard and will be fitted out by F45 Training. The proposed fitout works are detailed and reviewed as follows, with respect to the anticipated improvement to sound insulation.

The existing trapezoidal composite deck is to be supplemented with an independent ceiling lining, providing a substantial void to conceal services. The entire floor/ceiling construction, when complete will comprise (top-down):

- 50mm screed;
- Underfloor heating system on 12.5mm EPS insulation board;
- 9mm Isomass Screedcheck XL 9 resilient layer;
- Kingspan MD-60-V2 trapezoidal composite steel / concrete deck (nominal 105mm deep);
- 2 no. 15mm gypsum board ceiling lining (density ≥ 13 kg/m^2 per board), plaster skim finish;
- Ceiling lining suspended on metal frame system, utilising good quality isolating hangers (e.g., Mason UK HD LDS, or similar)
- ≈ 650mm ceiling cavity, filled to 200mm depth with mineral wool batts (density ≥ 40 kg/m^3).

Any gaps left at the perimeter of service pipe penetrations in the composite deck will be filled with a flexible, non-hardening mastic prior to installation of the ceiling.

To allow the new ceiling lining to remain independent of the surrounding structure, a small (circa 5-10mm) gap will be left between the ceiling and steel columns / perimeter walls which will also be filled with a flexible non-hardening mastic.

With the above internal fitout proposals in place, sound insulation between ground and first floor apartments is expected to comfortably achieve ≥ $D_{nT,w}$ + C_{tr} 50 dB airborne and ≤ $L'_{nT,w}$ 62 dB as required by the planning condition.

The this fitout in place, analysis indicates that if source music levels are limited to approximately L_{Aeq} 75 dB, music will be approaching inaudibility in apartments at first floor level, and the risk of disturbance to occupants sleeping or enjoying quiet amenity would be low at all times of day, including during first F45 classes occurring at 06:00 hours.

6. Slam Ball Testing

The F45 use model is understood to be primarily aerobics-based exercise with only slam balls and light weights used in a controlled manner. Weight drops are not expected to be regular occurrences.

The greatest impact is expected to be from the use of a slam ball. This is a repetitive exercise and so the resulting sound levels should be carefully controlled.

In order to inform management and mitigation of weights use, the sound resulting from a slam ball being thrown down onto various samples of flooring covering was measured in a bedroom of first floor Flat 3, which overlooks the rear of the site.

Measurements of tactile vibration were not taken at first floor, as it was quickly established by the attendant consultant that vibration from slam ball throws were not perceptible even when thown directly on the exposed screed.

Testing commenced with a measurement of the ambient noise in the space followed by the slam ball being thrown onto the unfinished screed at ground floor. A number of alternative flooring build up types were then evaluated as described in the following table.

Floor Test	Source Location	Measurement Location	Description of Build Up (top to bottom)
1	Ground Floor	First Floor	TVS Sportec Tile
2	Ground Floor	First Floor	TVS Sportec Tile & 2 no. 10mm Regupol 6010 SH
3	Ground Floor	First Floor	TVS Sportec Tile & 2 no. 12.5mm Sylomer SR42
4	Ground Floor	First Floor	TVS Sportec Tile & 40mm Regupol 40-80
5	Ground Floor	First Floor	TVS Sportec Tile & 4 no. 12.5mm SR42
6	Ground Floor	First Floor	TVS Sportec Tile & 40mm Regupol 40-80 & 4 no. 12.5mm SR42

Table 6.1 – Assessed floor build ups

The findings of the measurements are shown in the following figure.

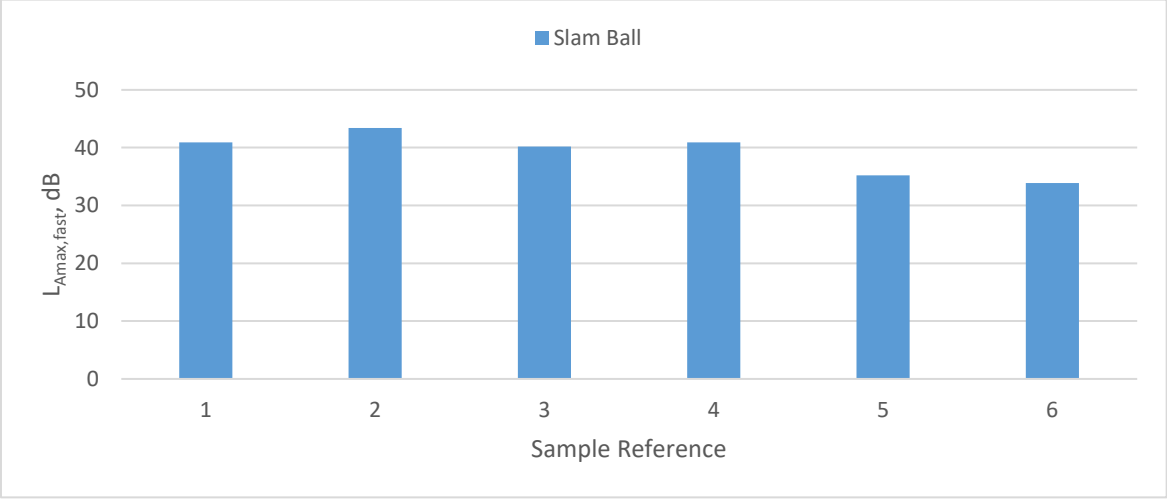


Figure 6.1 – Measured noise levels due to slam ball

For residential adjacencies, it is recommended that re-radiated noise levels in neighbouring demises resulting from gym activity are limited to “effective inaudibility”.

In this instance, all slam ball drops noted were audible to the attendant acoustician at first floor level regardless of floor build-up. As such, it is offered that none of the tested simple matted overlay combinations are suitable to sufficiently mitigate re-radiated weight drop noise from slam ball use, although this approach would likely be sufficient to mitigate occasional drops of kettle bells and other light weights.

As such, an active approach to mitigation and management is likely to be required.

7. Gym Management

As with all gyms located adjacent to noise sensitive uses, careful management of the facility with regards to gym etiquette and dropping of weights would be required to prevent disturbances to surrounding tenants. Despite the practical measures described above, any one single weight drop event could contravene the suggested limits if weights use is not properly supervised and managed.

A policy of considerate use should be embraced by the gym staff and membership.

7.1 Weights and Slam Ball Use

Given the moderate airborne sound insulation offered by the current separating floor construction, there is an expectation that airborne noise generated by the slam ball testing described in Section 6 may have somewhat contributed to overall levels measured at first floor. Audibility of slam ball events may therefore be somewhat reduced after fitout of the ground floor unit with the suspended ceiling and independent linings discussed in Section 5.2.

However, analysis of low frequencies generated at first floor as a result of slam ball use indicates that a low frequency “boom” is still likely to be audible at first floor, even after fitout. Especially with repetitive events such as slam ball usage, this could cause significant disturbance to neighbouring residential occupants.

As such, additional, highly damped catch pad systems will be used specifically for slam ball use.

Gym users will direct the slam ball down onto the catch pad, rather than onto the gym floor. A typical system appropriate for this use is the Ziva Slam Ball Landing Pad.

It is anticipate that, along with an appropriate approach to gym management, sufficient mitigation to occasional drops of kettle bells and other light weights can be adequately mitigated through a standard gym mat floor finish, such as the 30mm-40mm TVS Sportec range of tiles.

It should be noted that, although the above measures would mitigate impact noise from reasonable gym use, this will not adequately control all weight drops, such as heavy weight drops, or drops from heights.

Irresponsible use of equipment could generate higher levels of noise and vibration, and it is recommended that gym staff monitor and control equipment use in order to avoid extreme events.

It is important that any activities involving impacts on the floor are only undertaken in the areas that have had appropriate mitigation measures provided, as discussed above.

It is recommended that the gym operator include discussion of the appropriate use of weights, including avoiding dropping of weights and permitted areas of use, in their member induction.

Staff should supervise the use of the gym at all times and provide verbal reminders to members using weights in an inconsiderate manner. Instructors will ensure that clients are not attempting to use weights they are not able to control.

With the above measures in place, re-radiated noise levels at first floor of the building and above are expected to be suitably managed, so as to avoid significant impact.

7.2 Limiting Source Music Level

Once the sound system and loudspeakers have been installed, the volume control of the system will be calibrated and marked with an appropriate limit to ensure that source music levels are limited to approximately L_{Aeq} 75 dB within the gymnasium.

The requirement for observing this limiting level will be detailed in the staff handbook which will be issued to all members of staff and regularly reinforced at team meetings.

To avoid excessively high sound pressure levels at certain areas of the gym, a system of multiple smaller speakers distributed throughout the space will be used to play music, rather than a single stereo pair of larger PA speakers. These will be directed downwards, and not towards the ceiling. This will allow users to perceive the same music noise levels whilst maintaining a lower overall noise level in the room.

Smaller loudspeakers with a limited low frequency extension will be selected to avoid excessive levels of bass.

To avoid compromising sound insulation, loudspeakers will be wall mounted and will not be soffit-mounted into the new suspended ceiling.

Loudspeakers will be mounted to walls on isolated brackets and not fixed rigidly to structural columns or walls.

Care will be taken to carefully control the sound levels in the space so as to not disturb neighbouring uses.

7.3 Voices

Members should be discouraged from raising their voices unreasonably within the gym. Staff will be instructed to quickly remind any members shouting of the policy of considerate use.

It is recommended that instructors are not provided with microphones to amplify their voices. This will be communicated as a policy to all staff and external instructors.

Members waiting for classes in the early morning or evening should be encouraged to wait inside the building. It is not expected that members would congregate outside the building before or after use of the gym. However, staff would remind members of their proximity to neighbours if groups of members are noticed outside the building.

These points will be reinforced in the staff handbook and at team meetings.

7.4 Neighbour Relations

The management should endeavour to maintain a friendly, open and informative relationship with the nearby residents to allow concerns to be raised and addressed without hostility.

A phone number and email address should be provided to surrounding uses to allow efficient notification of the premises if noise levels are causing a disturbance. Clear instructions should be given to those likely to answer on these procedures for handling complaints.

8. Conclusion

Sound insulation investigations have been undertaken by Venta Acoustics to address the requirements of Planning Condition 6 of Kingston Upon Thames planning consent ref: 2/0228/FUL, with regard to the proposed use of the ground floor of 64-68 Brighton Road, Surbiton as an F45 gym.

Airborne sound insulation and slam ball impact investigations have been undertaken to the residential apartments directly above the proposed premises.

The proposed fitout and agreed mitigation solutions for control of airborne noise, re-radiated noise and control of noise at source have been highlighted.

As necessary for all gyms located near to noise sensitive neighbours, careful management of the facility with regards to gym etiquette and use of weights / slam balls will be ensured to prevent disturbances to other tenants.

With the recommended mitigation measures in place, control of music noise levels to the stated limits and healthy approach to gym management, it is anticipated that the gym use can successfully coexist with the adjoining residences without significant impact.

On this basis, it is offered that the requirements of Condition 6 of the planning consent have been adequately addressed.

Ben Alexander MIOA

Airborne Sound Insulation Test

Figure : VA4283/AB1

Standardised level difference according to ISO 140-4

Field measurements of airborne sound insulation between rooms

(NB Higher $D_{nT,w} + C_{tr}$ figures denote better sound insulation performance)

Construction Tested:

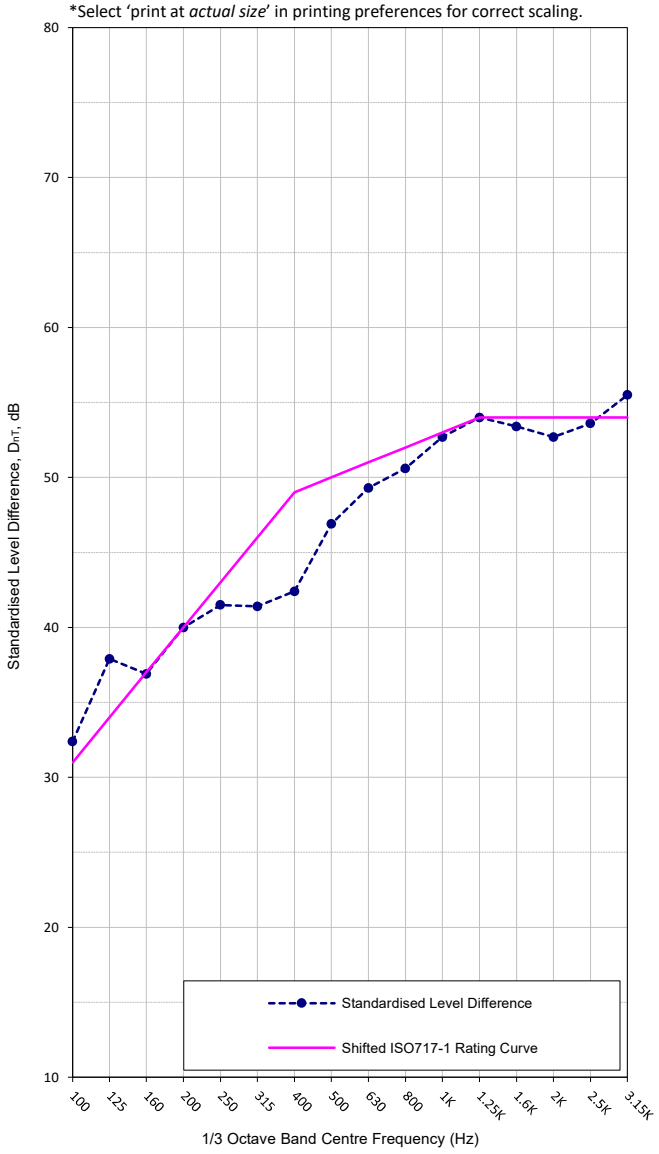
50mm screed; Underfloor heating system on 12.5mm EPS insulation board; 9mm Isomass Screedcheck XL 9 resilient layer; Kingspan MD-60-V2 trapezoidal composite steel / concrete deck (nominal 105mm deep);

Rooms Tested From : ***Ground Floor Demise***

To : ***Flat 4 rear bedroom***

Frequency Hz	D_{nT} dB
100	32.4
125	37.9
160	36.9
200	40.0
250	41.5
315	41.4
400	42.4
500	46.9
630	49.3
800	50.6
1k	52.7
1.25k	54.0
1.6k	53.4
2k	52.7
2.5k	53.6
3.15k	55.5

*Select 'print at *actual size*' in printing preferences for correct scaling.



Shift Curve By:	-2 dB
Sum of Adverse Deviations =	21.6 dB
C_{tr} =	-4 dB
$D_{nT,w}$ =	50 dB

$D_{nT,w} + C_{tr}$ = 46 dB

Evaluation based on field measurement results obtained in one-third octave bands by an engineering method.

Test Standard: *BS EN ISO 140-4*

Rating Standard: *BS EN ISO 717-1*

Test Date: *01/11/2022*

VA Project Number: *VA4283*

VENTA ACOUSTICS

Client: *F45 Training Surbiton*

Site: *F45, 64-68 Brighton Road, Surbiton*

Airborne Sound Insulation Test

Figure : VA4283/AB2

Standardised level difference according to ISO 140-4

Field measurements of airborne sound insulation between rooms

(NB Higher $D_{nT,w} + C_{tr}$ figures denote better sound insulation performance)

Construction Tested:

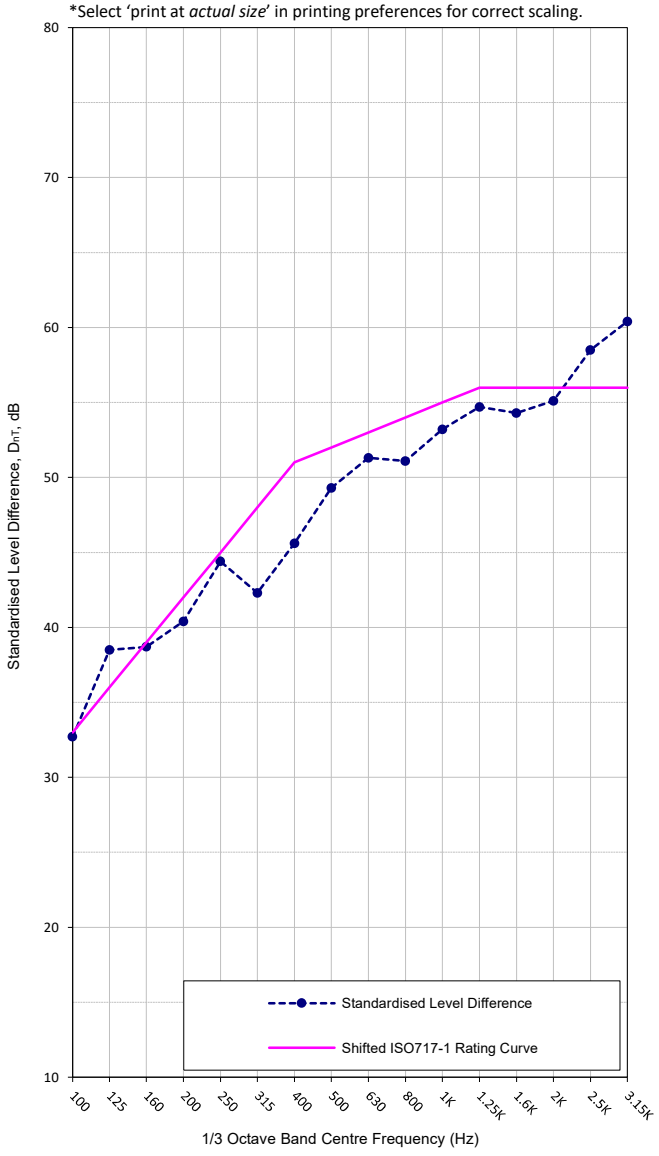
50mm screed; Underfloor heating system on 12.5mm EPS insulation board; 9mm Isomass Screedcheck XL 9 resilient layer; Kingspan MD-60-V2 trapezoidal composite steel / concrete deck (nominal 105mm deep);

Rooms Tested From : ***Ground Floor Demise***

To : ***Flat 5 front bedroom***

Frequency Hz	D_{nT} dB
100	32.7
125	38.5
160	38.7
200	40.4
250	44.4
315	42.3
400	45.6
500	49.3
630	51.3
800	51.1
1k	53.2
1.25k	54.7
1.6k	54.3
2k	55.1
2.5k	58.5
3.15k	60.4

*Select 'print at *actual size*' in printing preferences for correct scaling.



Shift Curve By:	0 dB
Sum of Adverse Deviations =	26.9 dB
C_{tr} =	-5 dB
$D_{nT,w}$ =	52 dB

$$D_{nT,w} + C_{tr} = 47 \text{ dB}$$

Evaluation based on field measurement results obtained in one-third octave bands by an engineering method.

Test Standard: *BS EN ISO 140-4*

Rating Standard: *BS EN ISO 717-1*

Test Date: *01/11/2022*

VA Project Number: *VA4283*

VENTA ACOUSTICS

Client: *F45 Training Surbiton*

Site: *F45, 64-68 Brighton Road, Surbiton*

APPENDIX A

Acoustic Terminology & Human Response to Broadband Sound

Frequency	The rate per second of vibration constituting a wave, measured in Hertz (Hz), where 1Hz = 1 vibration cycle per second. The human hearing can generally detect sound having frequencies in the range 20Hz to 20kHz. Frequency corresponds to the perception of 'pitch', with low frequencies producing low 'notes' and higher frequencies producing high 'notes'.
dB(A):	Human hearing is more susceptible to mid-frequency sounds than those at high and low frequencies. To take account of this in measurements and predictions, the 'A' weighting scale is used so that the level of sound corresponds roughly to the level as it is typically discerned by humans. The measured or calculated 'A' weighted sound level is designated as dB(A) or L_A.
L_{eq} :	A notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (e.g. 8 hour, 1 hour, etc). The concept of L_{eq} (equivalent continuous sound level) has primarily been used in assessing noise from industry, although its use is becoming more widespread in defining many other types of sounds, such as from amplified music and environmental sources such as aircraft and construction. Because L_{eq} is effectively a summation of a number of events, it does not in itself limit the magnitude of any individual event, and this is frequently used in conjunction with an absolute sound limit.
L_{10} & L_{90} :	Statistical L_n indices are used to describe the level and the degree of fluctuation of non-steady sound. 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 as such can be regarded as a typical maximum level. Similarly, L_{90} is the typical minimum level and is often used to describe background noise. It is common practice to use the L_{10} index to describe noise from traffic as, being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic flow.
L_{max} :	The maximum sound pressure level recorded over a given period. L_{max} is sometimes used in assessing environmental noise, where occasional loud events occur which might not be adequately represented by a time-averaged L_{eq} value.
D	The sound insulation performance of a construction is described in terms of the difference in sound level on either side of the construction in the presence of a sound source on one side and the reverberant characteristics of the adjoining 'receive' space. *D* is the arithmetic *Level Difference* in decibels between the source and receive sound levels when filtered into frequency bands.
D_{nT}	*Weighted Standardised Level Difference.* As defined in BS EN ISO 717-1, representing the *Weighted Level Difference*, when standardised for reference receiving room reverberant characteristics.
R_w D_w $D_{nT,w}$ $D_{n,e,w}$ $D_{n,f,w}$	Value of parameter, determined as above, but weighted in accordance with the procedures laid down in BS EN ISO 717-1 to provide a single-figure value.
C, C_{tr}	*S*pectral adaptation terms to be added to a single number quantity such as $D_{nT,w}$, to take account of the sound insulation within frequency ranges of particular interest.
$L'_{nT,w}$	*Weighted Standardised Impact Sound Pressure Level* as defined in BS EN ISO 717-2, representing the level of sound pressure when measured within a space where the floor above is under excitation from a calibrated tapping machine, standardised for the receiving room reverberant characteristics.

1.1 Octave Band Frequencies

In order to determine the way in which the energy of sound is distributed across the frequency range, the International Standards Organisation has agreed on "preferred" bands of frequency for sound measurement and analysis. The widest and most commonly used band for frequency measurement and analysis is the Octave Band. In these bands, the upper frequency limit is twice the lower frequency limit, with the band being described by its "centre frequency" which is the average (geometric mean) of the upper and lower limits, e.g. 250 Hz octave band extends from 176 Hz to 353 Hz. The most commonly used octave bands are:

APPENDIX A

Acoustic Terminology & Human Response to Broadband Sound

Octave Band Centre Frequency Hz	63	125	250	500	1000	2000	4000	8000

1.2 Human Perception of Broadband Noise

Because of the logarithmic nature of the decibel scale, it should be borne in mind that sound levels in dB(A) do not have a simple linear relationship. For example, 100dB(A) sound level is not twice as loud as 50dB(A). It has been found experimentally that changes in the average level of fluctuating sound, such as from traffic, need to be of the order of 3dB before becoming definitely perceptible to the human ear. Data from other experiments have indicated that a change in sound level of 10dB is perceived by the average listener as a doubling or halving of loudness. Using this information, a guide to the subjective interpretation of changes in environmental sound level can be given.

Change in Sound Level dB	Subjective Impression	Human Response
0 to 2	Imperceptible change in loudness	Marginal
3 to 5	Perceptible change in loudness	Noticeable
6 to 10	Up to a doubling or halving of loudness	Significant
11 to 15	More than a doubling or halving of loudness	Substantial
16 to 20	Up to a quadrupling or quartering of loudness	Substantial
21 or more	More than a quadrupling or quartering of loudness	Very Substantial