

SPRATT+HAMER



Noise Impact Report

Project Details

Client	Mr Paul Jagota
Client Address	Derby Road Huyton Liverpool L36 9UQ
Site Address	Derby Road Huyton Liverpool L36 9UQ
Reference	21154

Quality Assurance

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Version	Date	Editor	Notes
V1	25/09/2023	Alejo Garcigoy	First issue



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1 Summary

A noise assessment has been conducted for the proposed gym development at Derby Road, Huyton, Liverpool.

The assessment is to be submitted as part of a planning application for the development site to Knowsley Borough Council in response to a pre-application advice.

The assessment considers the impact of airborne sound transmission of the proposed gym onto potentially noise sensitive adjoining premises. No specific Local Authority's criteria and/or conditions have been provided.

Assessment of noise levels due to normal gym activity indicates no adverse impact on the normal operation of the adjoining commercial offices according to ProGP Gym Acoustics Guidance and BS 8233: 2014 noise criteria should all the considerations and/or assumptions made in this report are met.



2 Introduction

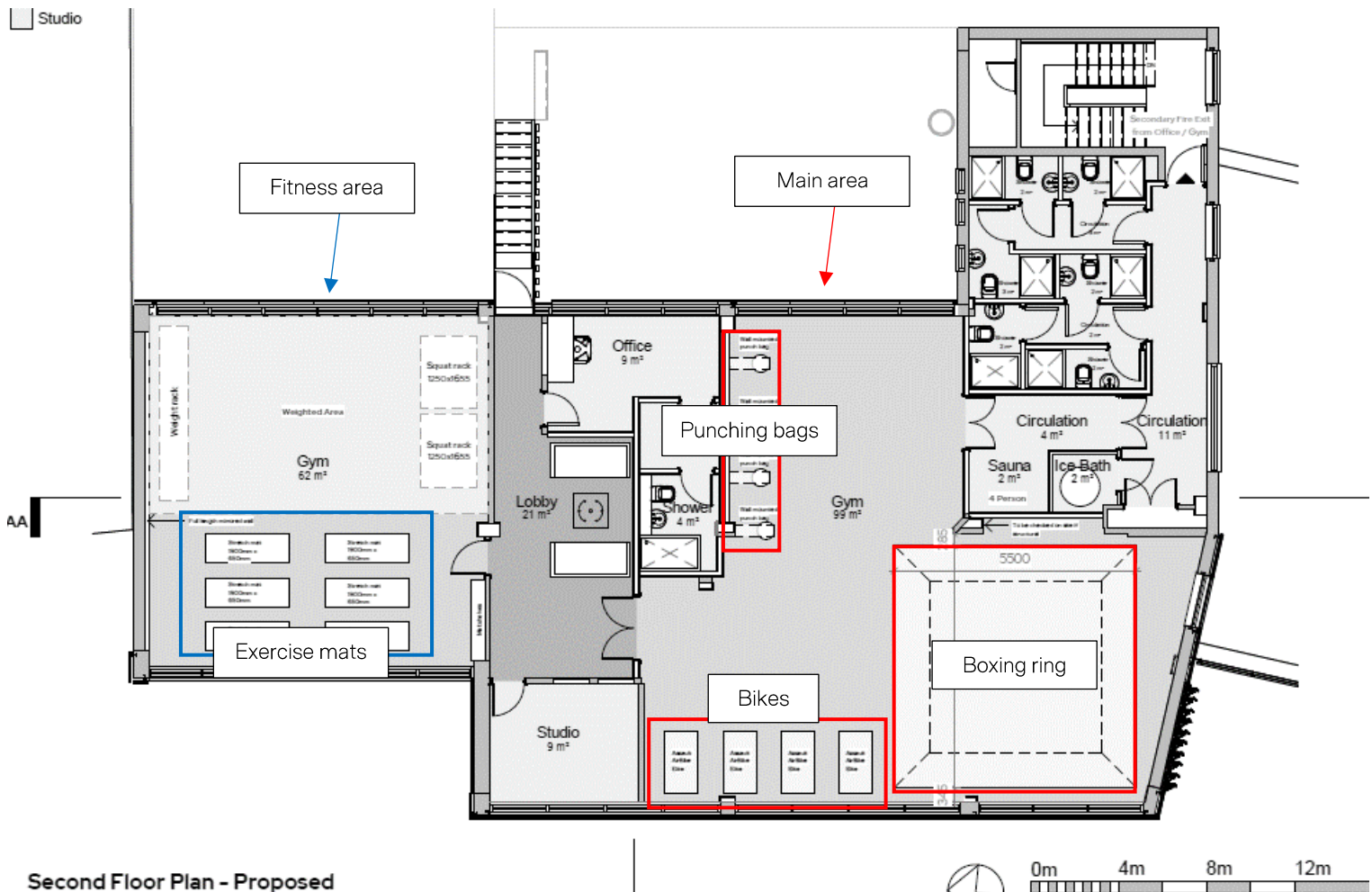
Mr Paul Jagota has instructed Spratt and Hamer Limited to undertake a sound insulation assessment in order to assess the impact of the airborne noise breaking through the separating floor, which may have an impact on the office space situated directly below.

The proposed development site is a gymnasium space which will be situated on the second floor of a commercial development which includes offices and retail premises on the first floor and further retail space on the ground floor. The gym will include multiple workout and fitness stations, including 4 no. static bikes, 4 no. punch bags and 1 no. boxing ring. A fitness area, located within the existing boxing ring room, will be used as a multi activity exercise area with space for 6 no. exercise mats.

It has been confirmed that no weights workout area and, consequently, no impact or vibration assessment, will be included within the final proposal.

It has been advised that amplified music will be played through a stereo system, as measured on site, rather than a multi-speaker distributed system.

The figure below shows the proposed gym premises layout.



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This report is prepared solely for Mr Paul Jagota. Spratt and Hamer Limited accepts no responsibility for its use by any third party.

This document has been prepared using the various documents listed within the appendices of this technical letter, together with drawings, technical information and additional verbal representations made by third parties. We have not audited nor independently verified the content or accuracy of any of the documents and information provided to us in the preparation of this technical letter.

If additional information comes to light subsequent to the production of this technical letter, we reserve the right to revise our opinions and the conclusions reached within this report.



3 Assumptions, Limitations & Uncertainty

- a. All suggested specifications require a good level of workmanship and for materials to be installed as the manufacture intends. Any poor workmanship may lead to weaknesses in the sound attenuation provided by the building elements.
- b. It is assumed that the sound insulation levels of the separating element measured on site are representative of the partition's performance.
- c. It is assumed that the ambient and residual noise levels measured on site during the inspection visit are typical of the proposed gym noise profile.
- d. It is assumed that drawings and all information supplied by the client are up to date and correct and it is reliable.
- e. The fitness area replacing the existing boxing ring room is assumed to not have undergone a change of use.



4 Planning Policies, Guidance and Criteria

The planning policies and criteria listed below are taken from associated relevant guidance documents, all of which should be considered for the internal and/or external noise levels.

4.1 National Planning Policy

The National Planning Policy Framework (NPPF) July 2021 set out the Government's planning policies for England and how they are expected to be applied. It provides a framework within which the Local Authorities are to prepare local plans and use their planning powers to minimise the adverse impact of noise. It should contain the following in relation to noise impacts.

174. Planning policies and decisions should contribute to and enhance the natural and local environment by:

'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.'

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

'mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life'

NPPF previously characterised noise by grading and recommending actions and different effect levels as reproduced in Table 1.



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Perception	Examples of outcomes	Increasing effect level	Action
No Observed Effect Level			
Not present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and 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 change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
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; where there is no alternative ventilation, having to close 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			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

Table 1: Noise exposure hierarchy based on likely average response

4.2 Local Planning Authority Criteria

There is no specific formal method for undertaking an assessment of noise from fitness and exercise spaces. As such, it is necessary to consider guidance in relevant planning policies, standards and other documents such as ProPG: Gym Acoustics Guidance (GAG), March 2023 and BS8233:2014 to determine suitable method of assessment and criteria for the individual noise sources associated with the proposed use.



4.2.1 ProPG: Gym Acoustics Guidance (GAG), March 2023

The G-Curves are provided for use with this guidance and are based on interpretations of the NR Curves. They provide single reference ratings which when one-third octave measurement data are plotted against the curves the value which is not broken by the data represents the G-Curve rating. The criteria are presented below.

Receptor type	Guide Criteria	
	Airborne Sound $L_{eq,T}$	Heavy Impact Sound $L_{max,F}$
Commercial Offices	G25-G35	G35-G45
Retail Areas	G30-G45	G35-G50
Residential Areas	G15-G25 (day)	G20-G25 (day)
	G10-G20 (night)	G15-G20 (night)

Table 2: G-Curves criteria

The guidance is not prescriptive as to how a noise impact assessment should be carried out and allow the consultant to consider factors such as frequency spectra, days and times of operation, frequency of operation and any other factor which allows the noise to be assessed in context.

As such, the guidance for gyms and exercise spaces suggests criteria on 1/3 octave bands. However, it is important to note that the problem with this suggestion, and one of the reasons it is not widely used, is due to the difficulty in obtaining 1/3 octave band sound insulation performance data for partitions and subsequent acoustic solutions.

4.2.2 BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings

The British Standard BS 8233:2014, Guidance on Sound Insulation and noise reduction for buildings, provides appropriate internal levels of noise within residential dwellings and non-domestic buildings when unoccupied.

Section 7.3 'Indoor ambient noise criteria' of BS 8233: 2014 states that 'for each space there might be a range of noise levels that are considered acceptable. The designer should select a level appropriate for the particular circumstances. In noise-making workshops, etc., the activity noise is dominant and so the internal ambient noise level is not critical. In most other situations internal ambient noise is important.

Normally, only the maximum desirable noise level needs to be decided. In some cases, such as open-plan offices and restaurants, a moderate noise level might provide masking for acoustic privacy in shared spaces without causing disturbance, so upper and lower noise levels should be considered (see Table 2).

Objective	Typical situations	Design range $L_{Aeq,t}$ (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

Table3: Table 2 of BS 8233:2014 Indoor ambient noise levels in spaces when they are unoccupied and privacy is also important



4.3 Criteria Summary

In order to meet the requirements of Knowsley Borough Council, the assessment and recommendations for the operational noise transmission through the separating floor to the adjoining commercial office space below will be based on *ProPG: Gym Acoustics Guidance* and *BS8233:2014*. A summary of the conditions are set out as follows:

- The airborne sound transmission from gym premises to the commercial office space must achieve the G25 curve criteria, being the upper value the G35 curve, in octave bands.
- The overall level should not exceed the value of 45–50 dB $L_{Aeq,t}$ for 'open plan offices' as per Table 2 of BS8233:2014 – *Indoor ambient noise levels in spaces when they are unoccupied and privacy is also important*.



5 Noise Impact Assessment

It has been advised that area under assessment (main gym space) will include 4 no. bikes, 4 no. punch bags and 1 no. boxing ring and will be playing amplified music.

5.1 Specific Sound Level

Short-term monitoring was undertaken at a similar gym establishment at Brin's Gym, King George V Sports Complex, Longview Lane, Huyton L36 7UN in order to collect representative ambient sound levels at the different exercise stations. The sound level meter was placed on a tripod at 1.5m above the ground level and 3m away from each machine / exercise position whilst some member of the gym staff was utilising the equipment. The boxing ring was occupied by two members of the staff whilst boxing.

It was understood that the equipment was used in what it may be considered as typical usage and amplified music sound level was representative of a typical session.

The table below outlines the measured ambient $L_{eq,t}$ (dB) sound levels.

Description (dB)	63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	Overall (dBA)
Punching bag ambient noise level	62	61	62	59	57	56	54	63
Bikes ambient noise level	50	55	56	58	55	51	48	60
Boxing ring ambient noise level	69	68	67	69	66	65	62	72
Mat exercises ambient noise level	52	59	57	60	55	53	46	61
Amplified music	81	82	69	76	73	66	62	78

Table 4: Ambient Noise Levels

Residual noise levels were also collected when exercise stations were not in operation. The table below outlines the residual noise level within the gym.

Description (dB)	63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	Overall (dBA)
Residual Noise Level (dB)	50	44	42	42	41	38	35	52

Table 5: Residual Noise Level



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Consequently, the specific noise level has been calculated subtracting the residual from the ambient noise level. The results are outlined in the table below.

Description (dB)	63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	Overall (dBA)
Punching bag specific sound level	62	61	62	59	57	56	54	63
Bikes specific sound level	40	55	56	58	55	51	48	59
Boxing ring specific sound level	69	68	67	69	66	65	62	72
Mat exercises specific sound level	48	59	57	60	55	53	46	60
Amplified music	81	82	69	76	73	66	62	78
Cumulative Noise Level inside the gym	81	82	72	77	74	69	65	79

Table 6: Specific Noise Level

The next table outlines the noise emissions of the main room, which includes:

- 4 no. static bikes.
- 4 no. punch bags.
- 1 no. boxing ring.
- Amplified music.

Description (dB)	63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	Overall (dBA)
4no. Punching bag	68	67	68	65	63	62	60	69
4no. Bikes	46	61	62	64	61	57	54	65
1no. Boxing ring	69	68	67	69	66	65	62	72
Amplified music	81	82	69	76	73	66	62	78
Cumulative Lp inside main room	81	82	73	77	74	70	66	80

Table 7: Main Gym room Noise Emissions

As can be seen, the predominant source of noise is the amplified music, followed by activity taking place in the boxing ring. The contribution of the other exercise stations (punching bags and static bikes) can practically be deemed as not significant.

The fitness area is now replacing the existing boxing ring room, located in a separate room. As such, it is understood that the proposed fitness area, situated directly above the existing Halifax offices, is not undergoing a change of use.



5.2 Partition Sound Insulation Levels

The floor partition was tested in order to collect the current levels of insulation of the separating floor. The floor construction comprised a concrete base structure (unknown depth and density) with a lightweight 'office' suspended tiled ceiling.

The table below outlines the results. Test certificates can be found in the appendix.

Description (dB)	63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	R' _w
ABF Test 1 – 2F kitchen to 1F office	33	41	46	48	53	58	63	53
ABF Test 2 – 2F storage to 1F office	32	41	48	53	59	64	63	58

Table 8: Airborne Sound Insulation Test

As can be seen, the levels of insulation of the party floor were not consistent throughout the development. Test 1 was carried out between areas where weaknesses might have been more prominent and moderate flanking routes were noticed, such as service penetrations and limited vertical flanking via the external wall or the poor state of repair of the suspended ceiling. As a worst case scenario, the levels of insulation based on Test 1 will be used in the assessment.

5.3 G Curve Target

The criteria outlines that the airborne sound transmission from the gym to the commercial offices must achieve the G25 curve criteria, being G35 the upper limit.

It should be noted that this target does not mean that all L_{AFmax} or low frequency sound events will be inaudible.

5.4 Required Partition's Sound Reduction

The table below determines the minimum sound reduction index required for the separating floor in order to meet the G25 target in the adjoining offices.

Description	Un-weighted Octave Band Centre Frequency Hz (dB)							Overall
	63	125	250	500	1K	2K	4k	
Main Room Noise Emissions	81	82	73	77	74	70	66	80
G25 Target	54	42	34	28	25	22	18	45
Required Overall SRI	27	40	39	49	49	48	48	35
Partition Sound Reduction (R _w)	33	41	46	48	53	58	63	53
Exceedance	-6	-1	-7	1	-4	-10	-15	-18

Table 9: Required Sound Reduction

As shown in the table above, the internal noise levels within the commercial office space would practically fall within the criteria as set out by ProPG: 'Gym Acoustics Guidance' and BS8233:2014, only exceeding the criteria by 1dB at 500Hz.



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It can be expected that any upgrades to the existing partition will improve the current performance. It is recommended to create an acoustic MF ceiling following the steps outlined below.

1. Remove the existing decorative ceilings.
2. Install an MF ceiling e.g. Casoline MF ceiling.
3. Create a minimum cavity of 150mm and partially fill with 100mm mineral wool insulation e.g. Isover APR1200.
4. Close with 1 no. layer of 15mm sound/fire rated plasterboard.
5. Ensure any flanking paths are minimised e.g. service penetrations, perimeter edges.

The proposed upgrade would result in an approximately 10-15 dB improvement over the current performance, as predicted with Insul 9.0 sound insulation modelling software. It is important to note that the resulting sound insulation levels have not taken into consideration factors such as flanking paths, geometry or reverberation of the rooms involved, as well as appropriate installation and quality of workmanship.

5.5 Amplified Music Limit Level

Being amplified music the primary contributor of noise levels within the gym, it is important to determine the limits to the maximum playback sound level. This is especially relevant taking into account the nature of the source, where the difference between systems can be significant.

The following table calculates the maximum levels of amplified music that can be reproduced within the premises, accounting for the other noise sources operating as normal.

Description (dB)	63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	Overall
G25 Target	54	42	34	28	25	22	18	45
Partition Sound Reduction R_w	33	41	46	48	53	58	63	47*
Max. cumulative sound level	87	83	80	76	78	80	81	92
Cumulative L_{eq} without amplified music	71	71	71	71	69	67	64	74
Calculated Music Limit Level	87	83	79	74	77	80	81	92
Exceedance over max. cumulative level	0	0	0	0	0	0	0	0
Uncertainty correction	5	5	5	5	5	5	5	5
Music Limit Level	82	78	74	69	72	75	76	87

Table 9: Amplified Music Limit Level Calculation

* $D_{nT,w}$

The music limit level set out in the table below should not be exceeded. Note that the installation of a limiter device and further advice by the relevant specialist may be applicable.



5.6 Context

The noise emissions of the proposed main area of the gym have been considered with all of the exercise stations being in operation continuously and at any one time, thus representing a worst case scenario. It can be assumed that the noise emissions of the main area of the gym will be lower for the majority of the time. As such, it can be considered that the impact on the commercial office below will result in an even lower level of impact.

In addition, although no assessment for impact or vibration is part of the proposal, it is still important that advice is sought from a gym floor specialist to minimise any impact on the adjoining premises.



6 Conclusion

The noise impact report concludes that, based on the information gathered and assumptions made, noise from the proposed gym will have a low impact on the amenity of the adjoining commercial offices with the current floor construction and as long as the following conditions are met:

- No workout area with heavy weight lifting activity must be included within the proposal.
- The number of exercise stations and/or machines should not be altered.
- The proposed use and/or layout of the proposed gym premises should not be altered.
- If the above conditions are not met, further assessment may be applicable.
- Music levels should adhere to the measured amplified music level as shown below.

Description (dB)	63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	Overall (dBA)
Amplified music typical level	81	82	69	76	73	66	62	78

Table 9: Amplified Music Measured Level

On the contrary, a music limit level has been determined which should not be exceeded. The table below outlines the maximum level of amplified music that can be reproduced within the gym premises. Note that the installation of a limiter device and further advice by the relevant specialist would be applicable.

Description (dB)	63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	Overall (dBA)
Amplified music limit level	82	78	74	69	72	75	76	87

Table 9: Amplified Music Limit Level

- It is recommended to install an MF suspended acoustic ceiling as outlined in section 5.4.
- It is advised to seek assistance from a gym floor specialist for impact and/or vibration floor solutions.



7 References

National Planning Policy Framework (NPPF).

BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings.

ProPG: Gym Acoustics Guidance (GAG), March 2023.

7.1 Drawing References

1242-03-03-006-Second Floor – Proposed

1242-02-SKP-003 - Commercial Entrance – Proposed

1242-02-SKP-002 - Landsdowne Way – Proposed

1242-02-SKP-001 - Derby Road – Proposed

1242-02-05-004 - Rear and Right Side Elevation – Proposed

1242-02-05-003 - Front and Left Side Elevation – Proposed

1242-02-05-002 - Rear and Right Side Elevation – Existing

1242-02-05-001 - Front and Left Side Elevation – Existing

1242-02-03-005 - First Floor – Proposed

1242-02-03-004 - Ground Floor – Proposed

1242-02-03-003 - Second Floor Plan – Existing

1242-02-03-002 - First Floor Plan – Existing

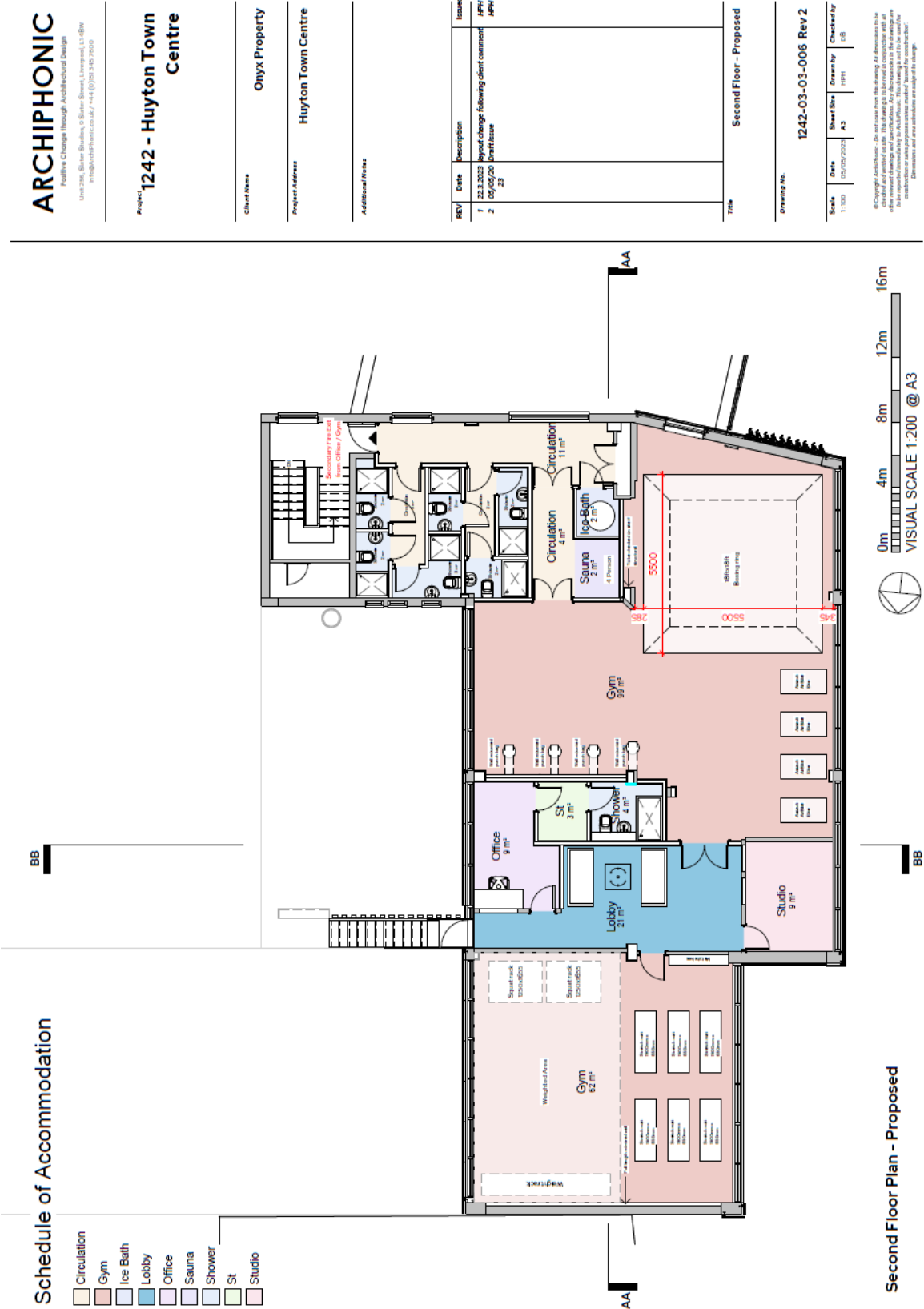
1242-02-03-001 - Ground Floor Plan – Existing

1242-02-02-002 - Site Layout Plan – Proposed

1242-02-02-001 - Site Layout Plan – Existing



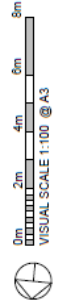
Appendix
Figure 1: Site Plans





Schedule of Accommodation

- Double office
- Kitchen
- Lobby
- Open plan office
- Single office
- WC
- WC



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Project Title	1242 - Huyton Town Centre	First Floor - Proposed
Client Name	Onyx Property	1242-02-03-005
Project Address	Huyton Town Centre	Issued by RPH
Date	02/03/23	Scale 1:100
Drawn by	AC	Checked by DB

First Floor Plan - Proposed

Ref	Scale	Description	Revision



Figure 2: Sound Insulation Certificates

Airborne Sound Insulation Floor Test
Field measurements of airborne sound insulation between rooms

Test 1

Client Name	Mr. Paul Jagota
Site Address	Proposed Gym, Derby Road, Huyton, Liverpool
Date of Test	18/08/2023
Name of Technician	Ben Bielicki BSc (Hons) PGDip MIOA
Source Room	Second Floor, Kitchen
Source Room Volume	65.2m³
Receiver Room	First Floor, Office
Receiver Room Volume	23.3m³
Area of Test Element	6.6m²
Construction Type	Concrete Plank
Construction Detail	Detail Unknown

Rating according to ISO 717-1
(Higher $D_{nT,w}$ + C_{tr} figures denote better sound insulation performance)

$D_{nT,w} = 47$ dB

$C_{tr} = -4$ dB

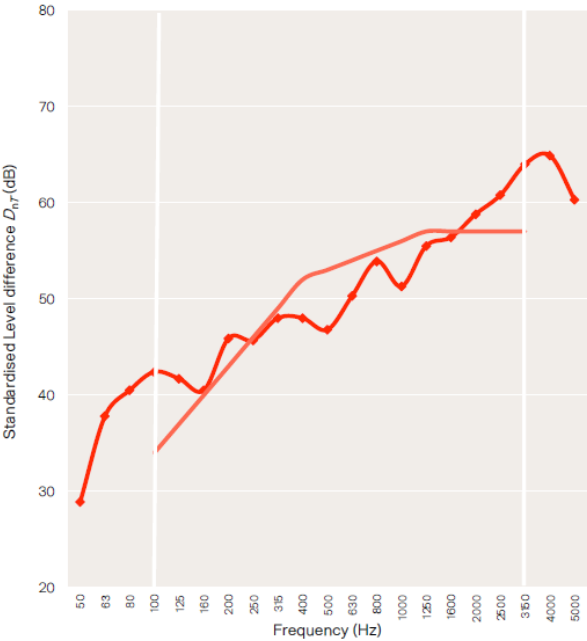
$R'_w = 53$ dB

Apparent Sound Reduction Index according to BS EN ISO 16283-1:2014+A1:2017

Frequency (Hz)	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
R' (dB)	28.9	37.8	40.5	42.4	41.7	40.5	45.9	45.7	48.0	48.0	46.8	50.3	53.9	51.3	55.5	56.4	58.8	60.8	64.0	≥64.9	≥60.3

' ≥ ' shows the limit of measurement due to background noise

Test Reference: 21544S-1 V1



Frequency range according to the curve of reference values (ISO 717-1)
Evaluation based on field measurement results obtained by an engineering method



Airborne Sound Insulation Floor Test

Field measurements of airborne sound insulation between rooms

Test 2

Client Name	Mr. Paul Jagota
Site Address	Proposed Gym, Derby Road, Huyton, Liverpool
Date of Test	18/08/2023
Name of Technician	Ben Bielicki BSc (Hons) PGDip MIOA
Source Room	Second Floor, Store
Source Room Volume	68.6m³
Receiver Room	First Floor, Office
Receiver Room Volume	37.0m³
Area of Test Element	5.4m²
Construction Type	Concrete Plank, Carpet
Construction Detail	Detail Unknown

Rating according to ISO 717-1
(Higher $D_{nT,w}$ + C_{tr} figures denote better sound insulation performance)

$D_{nT,w}$ = 55 dB
 C_{tr} = -5 dB

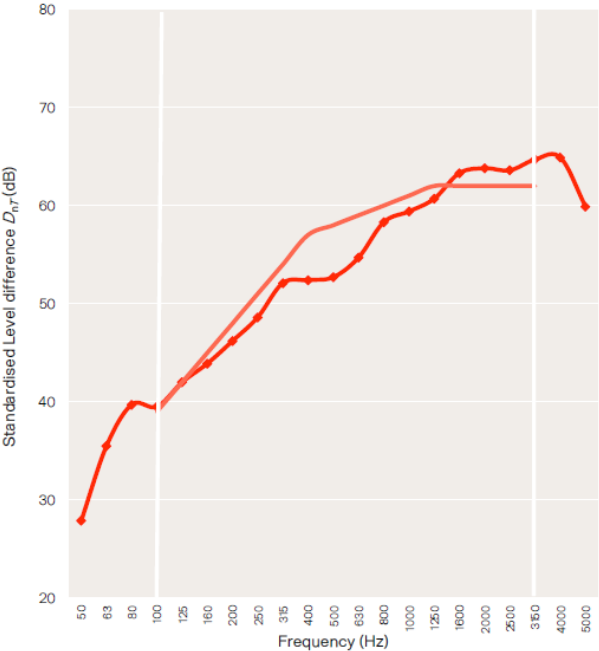
R'_w 58 dB

Apparent Sound Reduction Index according to BS EN ISO 16283-1:2014+A1:2017

Frequency (Hz)	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
R' (dB)	≥27.9	35.5	39.7	39.5	42.0	43.9	46.2	48.6	52.1	52.4	52.7	54.7	58.3	≥59.4	≥60.7	63.3	≥63.8	≥63.6	≥64.7	≥64.9	≥59.9

' ≥ ' shows the limit of measurement due to background noise

Test Reference: 21544S-3 V1



Frequency range according to the curve of reference values (ISO 717-1)
Evaluation based on field measurement results obtained by an engineering method



Glossary of Acoustical Terms

A-weighting

Noise levels are corrected to represent human response to sound.

L_{Aeq}

This is a continuous equivalent of time varying noise, or effectively the average measured (A weighted) noise level over a defined period of time.

$L_{Aeq,16hour}$

A 16 hour long measurement of the L_{Aeq} over the period between 07:00 and 23:00, also known as a daytime measurement.

$L_{Aeq,8hour}$

An 8 hour long measurement of the L_{Aeq} over the period between 23:00 and 07:00, also known as a night time measurement.

L_{AFmax}

The highest, or maximum A-weighted sound pressure level measured over a specified time period. The 'F' defines a time weighting in Fast.

L_{A90}

The A-weighted noise level or average level which is exceeded for 90 percent of the measured time period. Also known as a background level.

L_{A10}

The A-weighted noise level or average level which is exceeded for 10 percent of the measured time period.

1:1 & 1:3 octave spectrum analysis

A single measurement that is separated into frequency bands to allow for a more detailed analysis of the noise source in question.

R_w

The weighted sound reduction index of a partition or facade. A single number value based on the performance of a partition between two rooms across the frequency range 100Hz to 3150Hz. The level is adjusted for the effects of reverberation and background noise.



$D_{n,e,w}$

The weighted level difference of a partition or façade which takes into account a small element such as a grill or vent.

SEL (sound exposure level)

A measure of A-weighted sound energy used to describe a particular event, such as a train pass. It is the sound energy, which, if occurring over one second would contain the same energy as the event.

Free field sound pressure

Is where the radiation or spread of sound is completely unaffected by the presence of any reflecting surfaces or boundaries.

Low Frequency Noise

A term generally used for sound below a frequency of 100 to 150Hz.





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