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Consultants in Acoustics, Noise & Vibration

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UP Fitness, XYZ Manchester

Acoustic planning report

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Version	Date	Comments	Author	Reviewer
A	8 May 17		Matthew Robinson	James Atha
B	11 May 17	Added assessment of internal noise transfer	Matthew Robinson	James Atha

Summary

Sandy Brown has been appointed by UP Fitness Ltd to provide acoustic advice in relation to the proposed UP Fitness fit-out of the upper basement level of the XYZ Building in Spinningfields, Manchester.

This report provides assessment of activity noise egress and plant noise egress in order to discharge the relevant planning conditions.

Based on the proposals for the gym, the assessment of activity noise egress from amplified music in the gym indicates that activity noise egress limits at the nearest noise sensitive premises would not be exceeded.

Internal structure-borne and airborne noise transfer from the gym to the first floor offices has been assessed and both are expected to be sufficiently controlled.

Based on noise data provided, a noise egress assessment has been carried out for the proposed AHU plant item at basement level. The assessment indicates that noise egress levels do not exceed the external plant noise limits for the gym operator, and therefore the proposed plant items would be expected to comply with the plant noise limits without any additional mitigation measures.

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1 Introduction

Sandy Brown has been appointed by UP Fitness Ltd to provide acoustic advice in relation to the proposed UP Fitness fit-out of the upper basement level of the XYZ Building in Spinningfields, Manchester.

This report provides assessment of activity noise egress, internal structure-borne and airborne noise transfer and plant noise egress in order to discharge the relevant planning conditions.

2 Basis of report

This report is based on the following:

- Manchester City Council planning conditions 11 and 16 (Planning Permission ref. 103505/FO/2013/C1 and 108265/NMC/2015/C1)
- Sandy Brown memo 14353-M010-A *Noise and vibration criteria for the gym operator,* dated 13 November 2015
- Sandy Brown report 13248-R01-B *Environmental noise survey report*, dated 29 August 2013
- Cartwright Pickard architectural drawings, dated 16 November 2016
- Cartwright Pickard architectural information for facade construction and fit-out constructions, received 20 February 2017
- Building services plant information from Sweco, received 13 March 2017.

3 Site description

3.1 The site and its surrounding

The Gym in relation to its surroundings is shown in pink Figure 1. The gym is located at the upper basement level of the new XYZ Building, this is outlined in yellow in Figure 1.

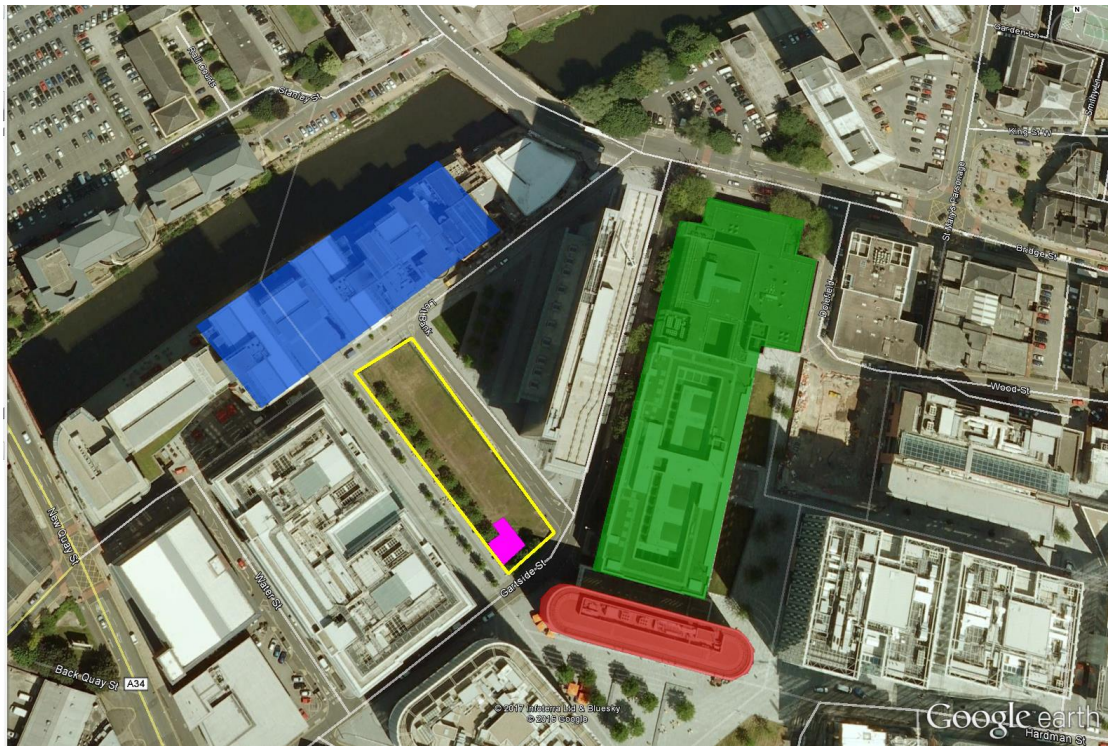


Figure 1 Site map (courtesy of Google Earth Pro)

3.2 Adjacent premises

The surrounding area predominantly consists of retail and office premises. The nearest noise sensitive premises are office building and City Magistrates Court approximately 10 m to the south, these are highlighted in red and green respectively in Figure 1.

The nearest residential accommodation are the Left Bank apartments approximately 100 m to the north, these apartments are highlighted in blue in Figure 1.

The Left Bank apartments are screened from the proposed atmospheric side connection.

4 Planning conditions

4.1 Activity noise egress (Planning Condition 11)

Manchester City Council planning condition 11 states:

> *'Before any A3 and D2 uses hereby approved commence, the premises shall be acoustically insulated and treated to limit the break out of noise in accordance with a noise study of the premises and a scheme of acoustic treatment that has been submitted to and approved in writing by the City Council as Local Planning Authority.'*

In order to meet the requirements of this condition activity noise egress from the proposed gym (D2 use) would have to be limited so that it does not exceed the amplified sound egress limits set out in Sandy Brown memo 14353-M010-A *Noise and vibration criteria for the gym operator*. These are set out in section 5.1.

Following discussion with Graeme Souter of Manchester City Council it is understood that 'break out' also refers to internal noise transfer within the building.

4.2 Plant noise egress (Planning Condition 16)

Manchester City Council planning condition 16 states:

> *'Before first occupation of the development, the building, together with any externally mounted ancillary equipment, shall be acoustically insulated with a scheme submitted to and approved in writing by the City Council as Local Planning Authority in order to secure a reduction in the level of noise emanating from the equipment'*

In order to meet the requirements of this condition plant noise egress would have to be controlled so that it does not exceed the external plant noise limits set out in Sandy Brown memo 14353-M010-A *Noise and vibration criteria for the gym operator*. These are set out in section 7.1.

5 Activity noise egress assessment

5.1 Activity noise egress limits

Based on the results of the survey, detailed in Sandy brown report 13248-R01-B *Environmental noise survey report*, the cumulative noise level resulting from amplified sound egress associated with the gym at 1 m from the most affected windows of the nearest noise sensitive premises should not exceed 10 dB below the existing background (L_{A90}) sound levels. These limits are set out in Table 1.

Table 1 Amplified sound limits at 1 m from the nearest noise sensitive premises (from gym)

Time of day	Maximum amplified sound egress level, $L_{Aeq,5min}$ (dB) Octave-band centre frequency (Hz)						
	63	125	250	500	1000	2000	4000
Daytime (07:00-23:00)	39	34	34	30	27	21	12
Night-time (23:00-07:00)	39	33	33	30	26	20	9

5.2 Proposed arrangement

The proposed gym is located on the upper basement level (see Appendix A). The reception to the gym is directly below and open to the ground floor reception and business centre. The gym reception is separated from the main gym area by glazed screens. Background music is only proposed to main gym area.

The basis of assessment is as follows:

- Typical gym activity noise levels (including background music) as set out in Table 1.
- Glazed screen separating gym reception and main gym area – R_w 45 dB glazed screens, R_w 35 dB door
- Facade to ground floor of XYZ building - R_w 45 dB glazing, R_w 35 dB doors (as per drawing *C3224-232*)
- Minimum distance of 10 m facade of the ground floor reception to the XYZ building and the nearest noise sensitive premises during the daytime (offices on Gartside Street)
- Minimum distance of 70 m between the facade of the ground floor reception to the XYZ building and the nearest noise sensitive premises during the night-time (Left Bank Apartments).

Table 2 Typical gym activity noise levels

	Sound pressure level, $L_{Aeq,5min}$ (dB) Octave-band centre frequency (Hz)						
	63	125	250	500	1000	2000	4000
Typical gym activity noise levels (including background music)	74	80	78	76	74	73	72

5.3 Assessment

Based on noise transfer via the glazed screens to the gym reception, then to the ground floor reception and noise egress via the facade to the XYZ Building ground floor reception and propagation to the offices on Gartside Street and the Left Bank Apartments, amplified sound in the main gym area is predicted to be significantly below (at 20 dB below the octave band noise limits) the activity noise egress limits.

As such activity noise egress from the gym would meet the criteria set out in section 5.1 during the daytime and night-time.

6 Internal noise transfer

6.1 Acoustic criteria

The Landlord criteria states the following regarding noise transfer from free weights areas within gyms:

> *It is recommended that appropriate resilient layers/floated floors be utilised to free weight areas of the gym to ensure that a maximum noise level of L_{AFmax} 45 dB is not exceeded in other lettable office areas of the development due to impacts from free-weights.*

It also states the following in relation to the transmission of vibration:

Vibration generated by activities within the gym should not:

- *Cause the maximum vibration dose value 0.7 $m{\cdot}s^{-1.75}$ as given in to BS 6472-1: 2008 Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz) in other occupied office spaces to be exceeded*
- *Be of a magnitude or attention grabbing in nature where disturbance is caused to other office tenants.*

6.2 Structure-borne noise transfer

Acoustic testing was carried out between the proposed gym unit and first floor office space, on Wednesday 29 March 2017.

Details of the equipment used for the acoustic testing are provided in Appendix B.

6.2.1 Impact sound insulation testing

In order to assess the potential noise levels in the first floor office space from gym activities, measurements were carried out of gym weights being dropped onto a number of floor build-ups. The location of the weight drops is shown in red in Figure 2 and the location of the noise measurements on the first floor is shown in red in Figure 3.

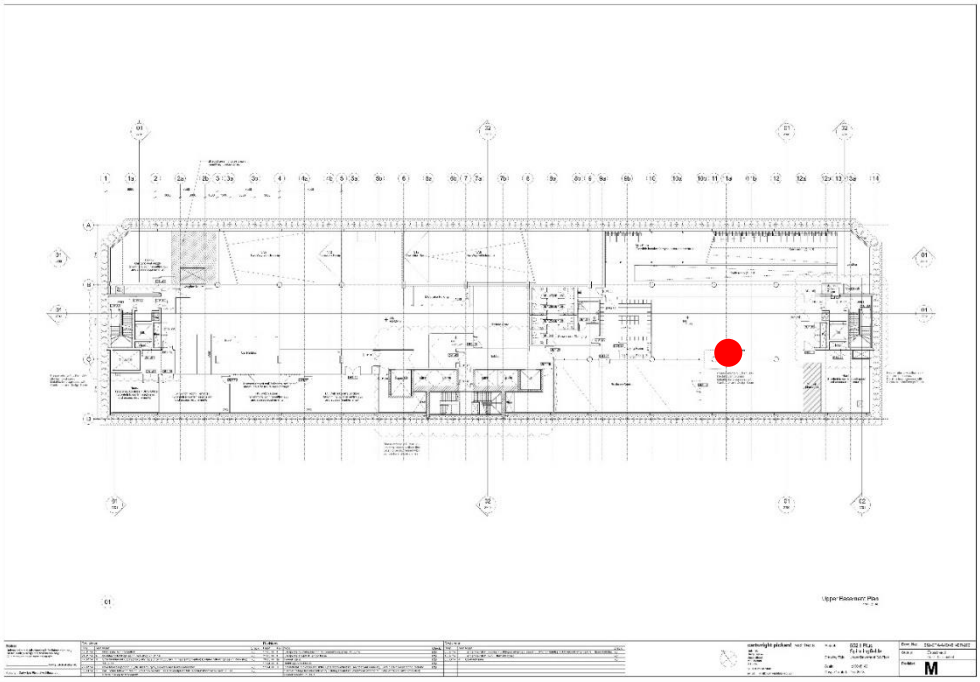


Figure 2 Weight drop location – Upper basement level

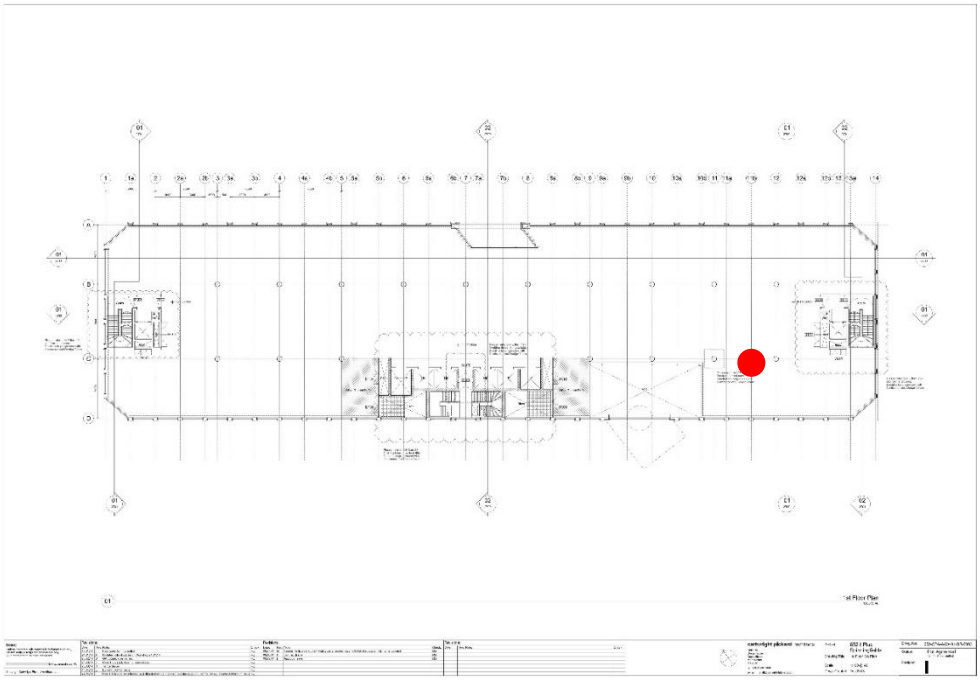


Figure 3 Noise measurement location – First floor

All weights were dropped from knee height (approximately 0.5 m) on to the chosen flooring type, which was placed in the middle of the proposed free-weight area, at least 3 m from the slab edge. The following weights were dropped:

- 2 x 25 kg dumbbell
- 2 x 40 kg dumbbell.

The event of simultaneously dropping 2 dumbbells from knee height is not intended to occur in the gym as part of its usage. The test conditions are therefore considered to represent a worst case scenario where a prospective patron of the gym acts outside of the guidance provided by the operator causing potentially high levels of structure-borne noise transfer. The events that form the basis of this assessment are therefore considered to be worst case and should only occur very rarely, if at all.

A selection of lightweight flooring types was provided and the build-ups are given below (top to bottom). All the flooring configurations were loose laid and provided by Total Vibration Solutions Ltd.

1. 40 mm Sportec gym tile, 1 layer of 15 mm Team Cup, 1 layer of 17 mm Acousticork U71 dims – overall depth 72 mm
2. 40 mm Sportec gym tile, 12.5 mm Sylomer SR28, 12.5 mm Sylomer SR42 – overall depth 65 mm.

6.2.2 Measured results

Each gym weight drop event was measured over a short period to measure the maximum noise level generated. Typically 3 repetitions of each gym weight being dropped were measured and the worst case measurement for each case is presented in Table 3.

No tactile vibration was perceptible during any of the measurements.

Table 3 Summary of measurements – First floor office space above the proposed gym unit

Source	Floor type	Maximum sound pressure level, L_{AFmax} (dB)
2 x 25 kg dumbbell (dropped from approximately 0.5 m onto the flooring)	1	45
2 x 20 kg dumbbells (dropped from approximately 0.5 m on to flooring)	1	44
	2	42

The measured results for floor types 1 and 2 are in line with the maximum noise criteria stipulated in the Landlord requirements. Given that the test drops are considered to represent a worst case scenario, this is a good indication that exceedances in the criteria would not occur if either of these floor build-ups were installed in the free weights area of the gym.

In order to sufficiently control potential structure-borne noise from gym weights being dropped, in line with the Landlord requirements, it is recommended that either floor type 1 or 2 is installed in the gym unit.

6.3 Airborne noise transfer

There are no specific criteria for airborne noise transfer from the proposed gym unit to the office floors. The airborne noise transfer from the gym unit to the office floors has been assessed based on the following:

- The gym is located at upper basement level and is not directly adjacent to the first floor offices
- The typically gym activity noise levels provided in Table 2
- The structural floors comprise 250 mm concrete and would typically achieve a sound insulation ≥ $D_{nT,w}$ 55 dB
- The building services in the first floor offices have been design to meet an internal noise level of NR 40.

On the basis of the above the airborne noise transfer from activity noise in the gym to the first floor offices would be at least 10 dB below the building services noise level in the offices, in

each octave band from 63 Hz to 4 kHz. Therefore airborne noise transfer from the gym to the first floor offices would be sufficiently controlled in order to reduce the risk of disturbance.

7 Plant noise egress assessment

7.1 Plant noise egress limits

Based on the results of the survey, detailed in Sandy brown report 13248-R01-B *Environmental noise survey report*, the cumulative noise level resulting from building services plant associated with the gym, when measured externally 1 m from any window of the nearest noise sensitive receptor, should not exceed the limits set out in Table 4

Table 4 Plant noise limits at the nearest noise sensitive premises (from plant associated with the gym)

Time of day	Maximum amplified sound egress level, $L_{Aeq,5min}$ (dB) Octave-band centre frequency (Hz)						
	63	125	250	500	1000	2000	4000
Daytime (07:00-23:00)	39	34	34	30	27	21	12
Night-time (23:00-07:00)	39	33	33	30	26	20	9

If the proposed plant noise contains attention catching features (such as tonal elements, whines, whistles, bangs etc), the plant should be designed to achieve a limit 5 dB below those set in Table 4.

7.2 Plant noise information

It is proposed that a new AHU unit be installed at upper basement level (B1), the supply is connected to the atmospheric side via a louvre on the ground floor at high level to the south of the site overlooking Gartside Street.

The exhaust is connected to a lower basement level (B2) louvre to carpark. The exhaust is not directly connected to the atmospheric side, and therefore has not been considered in the noise egress assessment.

The location of the AHU unit and the atmospheric side air supply connection are highlighted in red Figure 4 and indicated in blue in Figure 5

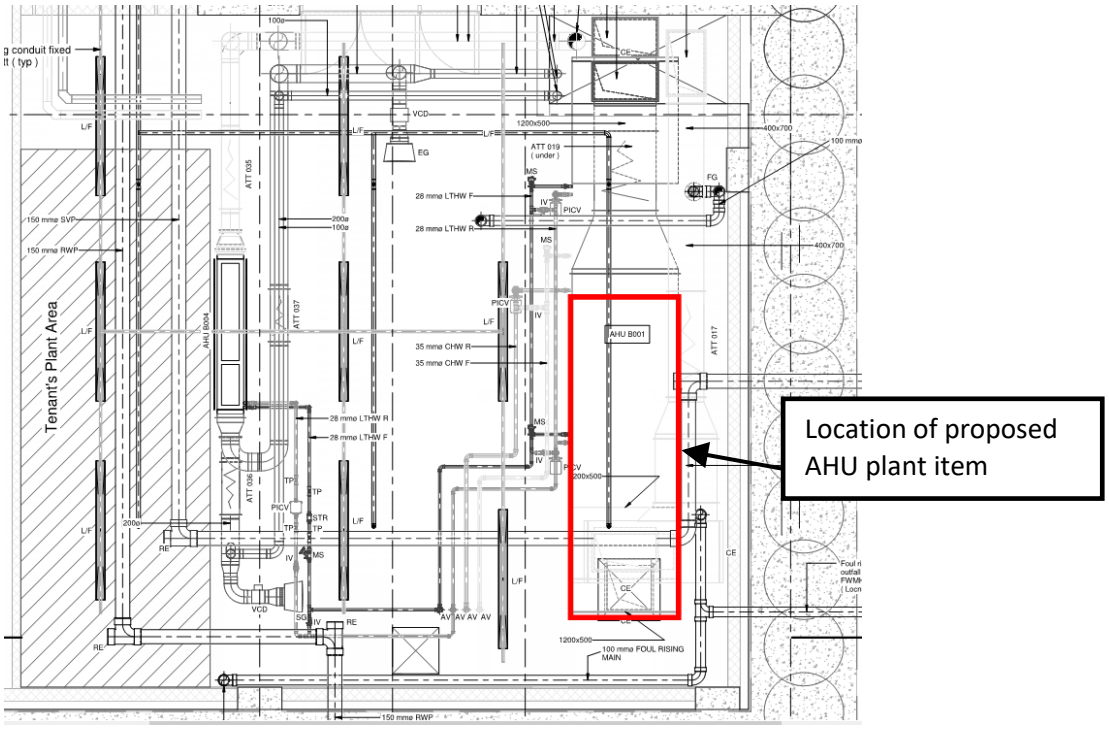


Figure 4 Excerpt of plant room basement 1 drawing indicating proposed AHU location

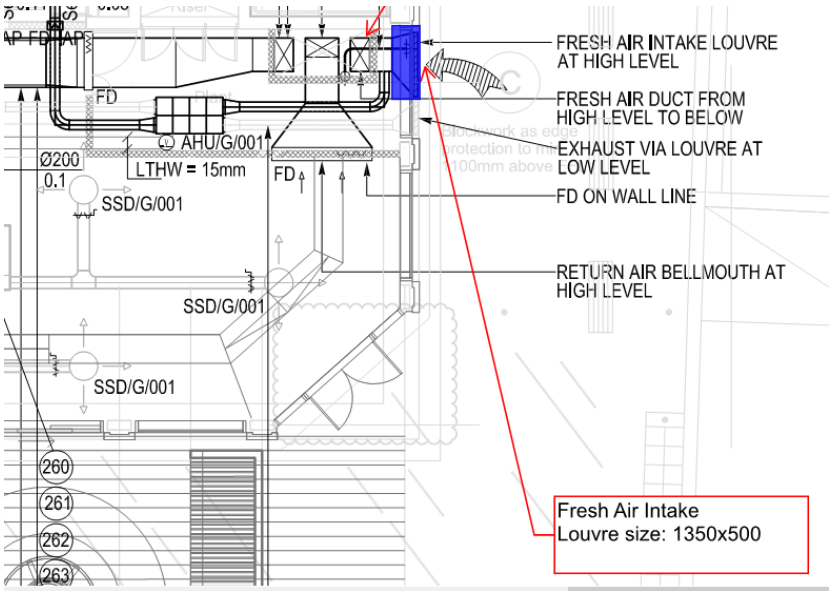


Figure 5 AHU location supply atmospheric side connection at ground floor level

Noise data for the proposed AHU unit (provided by Sweco) is provided in Table 5.

Table 5 Noise data for the proposed AHU plant item

Plant item	Sound power levels, L_w (dB) Octave band centre frequency (Hz)						
	63	125	250	500	1k	2k	4k
Supply	53	60	61	57	58	58	52

The insertion losses for the proposed attenuator to the AHU supply route is given in Table 6.

Table 6 Insertion losses for the proposed AHU supply attenuator

Attenuator	Attenuator insertion losses, Octave-band centre frequency (Hz)						
	63	125	250	500	1k	2k	4k
AHU (supply)	-	3	12	13	18	21	17

7.3 Assessment

Calculations have been carried out to determine the external noise egress level from the proposed AHU plant item. The calculation takes into account the following:

- Attenuation due to distance and screening
- The calculation takes into account a 3 dB correction for reflections from the nearby wall
- Regenerated noise from the attenuators is controlled
- AHU supply ductwork size and routing shown in drawings 2106434/-011 and 2106434/M/1101.

The predicted noise egress from the proposed plant item at the nearest noise sensitive premises are given in Table 7.

Table 7 Predicted noise egress from proposed AHU at the nearest noise sensitive premises

Nearest noise sensitive premises	Predicted sound egress level, $L_{Aeq,T}$ (dB) Octave-band centre frequency (Hz)						
	63	125	250	500	1000	2000	4000
Office building on Gartside Street							
Daytime (07:00-23:00)	25	32	20	10	11	6	8
Night-time (23:00-07:00)	25	32	20	10	11	6	8
Left bank apartments							
Daytime (07:00-23:00)	13	20	8	≤5	≤5	≤5	≤5
Night-time (23:00-07:00)	13	20	8	≤5	≤5	≤5	≤5

The predicted noise egress levels are significantly below the plant noise limits set out in Table 4 therefore the proposed plant items would be expected to comply with the plant noise limits without any additional mitigation measures.

As the plant noise egress level at the noise sensitive premises are significant below the plant noise limits and the background sound levels, any attenuation catching features (intermittency or tonal characteristics) would not be expected to be readily distinctive or highly perceptible against the residual acoustic environmental at the receptor. Therefore no corrections for attention catching features are considered to be appropriate.

8 Conclusions

An assessment of activity noise egress and external plant noise egress has been carried out in order to discharge Planning Conditions 11 and 16 respectively.

Based on the proposals for the gym, the assessment of activity noise egress from amplified music in the gym indicates that activity noise egress limits at the nearest noise sensitive premises would not be exceeded.

Internal structure-borne and airborne noise transfer from the gym to the first floor offices has been assessed and both are expected to be sufficiently controlled.

Based on noise data provided for the proposed AHU plant, the predicted noise egress levels do not exceed the external plant noise limits for the gym operator, and therefore the proposed plant items would be expected to comply with the plant noise limits without any additional mitigation measures.

Appendix A

Proposed gym layout

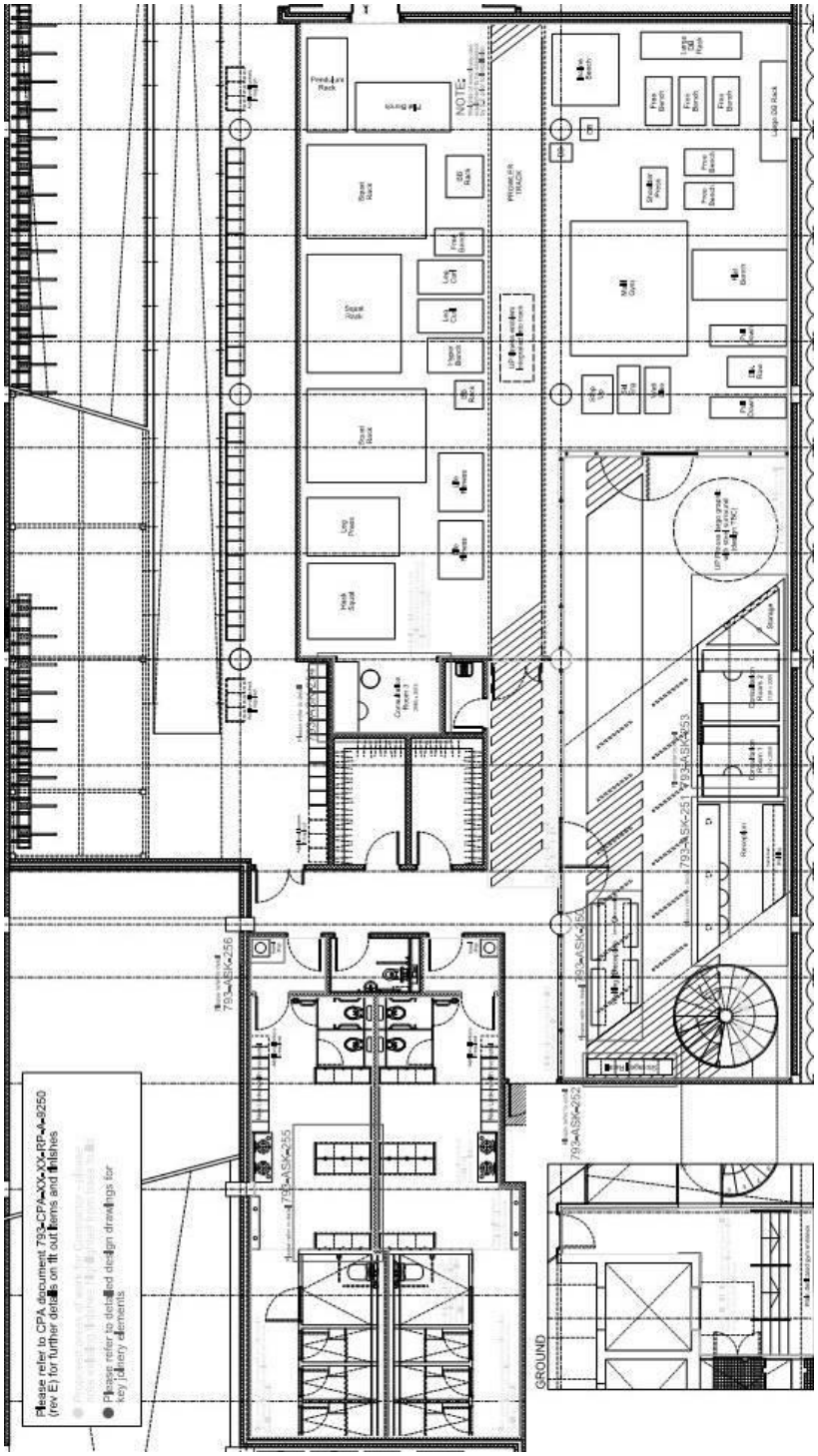


Figure A1 Proposed gym layout