

23074-L01-SW

Mal Campbell  
The Trades Club  
Holme St  
Hebden Bridge  
HX7 8EE

10/07/2023

Dear Mal,

## AIRBORNE SOUND INSULATION, THE TRADES CLUB

### Introduction

Further to our recent conversations, we understand that the ground floor space within the Trades Club building may potentially be let to a tenant independent of the Trades Club venue, potentially for use as a boxing gym.

There are concerns regarding noise transfer between the two premises, both in terms of activity in the boxing gym being audible within the Trades Club venue during quieter events, and in terms of noise from louder events in the venue disrupting activity within the ground floor unit.

This letter summarises the results of airborne sound insulation testing of the separating floor as existing, considers the potential mutual noise impact for this scenario, and then further considers the potential for mutual disturbance should the airborne sound insulation of the separating floor be upgraded.

### Existing Condition

The exact construction of the separating floor is not known, but appears to consist of timber floorboards on joists. The ceiling within the ground floor unit has recently been replaced with plasterboard (thickness and number of layers unknown), with mineral wool insulation within the cavity.

Within the ground floor unit, what are assumed to be structural joists encased in plasterboard are visible, which suggests that there is a limited cavity depth above.

Subjective listening tests during an event soundcheck at the Trades Club demonstrated that music noise is currently clearly audible within the ground floor space. As such, more formal sound insulation testing was carried out on Friday 7<sup>th</sup> July 2023.

The room-to-room level difference measured on site is summarised in Table 1, below. At frequencies of over 1kHz, the measured sound insulation was affected by background noise – however, it is frequencies below this which would be most critical when considering the potential for both speech and music noise transfer.

Table 1: Measured Level Difference, Octave Bands (dBd)

	63Hz	125Hz	250Hz	500Hz	1kHz
Measured level difference, dBd	22	22	25	37	45

It can be seen that the airborne sound insulation, particularly at lower frequencies, is relatively poor. This is as would be expected from a relatively lightweight construction, with rigid connections between the floor and ceiling, as described above.

No significant sound flanking routes were identified on site. The separating floor is therefore considered the primary route for noise transfer between the units. However, this is a result of the poor sound insulation performance of the floor, and flanking routes may become evident should the floor be upgraded.

### Assessment of Existing Conditions

#### Music Noise Transfer to Below

The Trades Club hosts a variety of events, ranging from acoustic sets to full amplified rock gigs and DJ nights. It is understood that for noisier events, front of house noise levels can typically exceed 100dB<sub>L<sub>Aeq,T</sub></sub>.

Based on a typical dance music noise spectrum at 98dB<sub>L<sub>Aeq,T</sub></sub>, Calculation 1, below, demonstrates the anticipated music noise level arising within the ground floor space.

#### Calculation 1: Music Noise Transfer to Below, As Existing

	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dBA
Typical noise level in venue, dB <sub>L<sub>Aeq,T</sub></sub>	116	101	96	94	93	89	85	83	<b>98</b>
Measured floor level difference, dBD	22	22	25	37	45	45	45	45	-
Resultant noise level downstairs, dB <sub>L<sub>Aeq,T</sub></sub>	94	79	71	57	48	44	40	38	<b>70</b>

It can be seen that with the floor as existing, with a music noise level of 98dB<sub>L<sub>Aeq,T</sub></sub> within the venue (which can be considered to represent a 'typical' event rather than the worst-case), music noise levels within the ground floor space would be around 70dB<sub>L<sub>Aeq,T</sub></sub>.

This would be clearly audible, and at a noise level which would be expected to make normal speech communication within the ground floor space difficult, and lead to significant annoyance from occupants.

#### Activity Noise Transfer to Above

The Trades Club also hosts a number of acoustic and spoken word events, including recordings for radio broadcast, during which any noise intrusion from the ground floor space would be highly problematic.

It is generally accepted that, for noise transfer to be inaudible or barely audible within an adjacent space, maximum noise levels should be controlled to 10dB below the ambient noise level in each octave band.

Based on ambient noise levels measured in the Trades Club when unoccupied, and maximum instantaneous noise levels measured within a boxing gym, an assessment of noise transfer from the ground to first floor is presented as Calculation 2, below.

**Calculation 2: Activity Noise Transfer, Ground to First Floor as Existing**

	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dBA
Instantaneous noise level in boxing gym, $dB_{L_{F,max}}$	92	91	89	92	89	81	78	78	<b>93</b>
Measured floor level difference, dBD	22	22	25	37	45	45	45	45	-
Resultant noise level upstairs, $dB_{L_{eq,T}}$	70	69	64	55	44	36	33	33	<b>59</b>
Typical ambient noise level in Trades Club, $dB_{L_{eq,T}}$	48	37	40	34	30	23	15	15	<b>36</b>
Excess of activity noise transfer above ambient noise levels, $dB_{L_{eq,T}}$	+22	+32	+24	+21	+14	+13	+18	+18	<b>23</b>

It can clearly be seen from Calculation 2 that noise transfer from maximum noise events in the proposed gym (e.g. shouts, impact noise etc) would significantly exceed the ambient noise level within the venue and would be clearly audible.

It is therefore apparent that simultaneous use of the ground floor space as a boxing gym, and the first floor space as a venue (as existing) cannot be considered acoustically compatible.

**Potential Mitigation**

The most effective but practical means of enhancing airborne sound insulation between the ground and first floor spaces would be to install a resiliently isolated mass ceiling, with mineral wool insulation in the cavity.

Predictions have been made of the potential improvement in airborne sound insulation between the spaces for a ceiling consisting of two layers of 15mm high density plasterboard on resilient hangers, with a 300mm void (below the existing floor joists) with 100mm mineral wool in the cavity.

The anticipated improvement and resulting level difference is summarised in Table 2, below.

Table 2: Anticipated Improvement With Remedial Works

	63Hz	125Hz	250Hz	500Hz	1kHz
Measured level difference as existing, dBD	22	22	25	37	45
Predicted improvement, dB	16	21	7	6	13
Predicted level difference with remedial works, dBD	38	43	32	43	58

However, it should be noted that improving the sound insulation performance of the floor may reveal flanking issued not apparent at the time of testing, as they were masked by the poor performance of the floor itself.

#### Assessment of Potential Noise Transfer with Mitigation

##### Music Noise Transfer to Below

Calculation 3, below, considers noise transfer from the venue to the ground floor, with a front of house music noise level of 98dB<sub>L<sub>Aeq,T</sub></sub> and mitigation works installed as described above.

##### Calculation 3: Music Noise Transfer to Below, Upgraded Floor

	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dBA
Typical noise level in venue, dB <sub>L<sub>Aeq,T</sub></sub>	116	101	96	94	93	89	85	83	<b>98</b>
Predicted floor level difference, dB	38	43	32	43	58	58	58	58	-
Resultant noise level downstairs, dB <sub>L<sub>Aeq,T</sub></sub>	78	58	64	51	35	29	25	23	<b>57</b>

In this scenario, the resultant noise level in the ground floor space is around 57dB<sub>L<sub>Aeq,T</sub></sub>. This represents a 23dB improvement over the existing floor.

However, music noise, particularly at low frequency, would be clearly audible and lead to potential complaints / annoyance from the ground floor tenants.

### Gym Noise Transfer to Above

Calculation 4, below, considers noise transfer from the ground floor to the venue for maximum noise events in the proposed boxing gym, with mitigation works to the floor as described above.

#### Calculation 4: Activity Noise Transfer, Ground to First Floor, Upgraded Floor

	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dBA
Instantaneous noise level in boxing gym, $dB_{L_{F,max}}$	92	91	89	92	89	81	78	78	<b>93</b>
Predicted floor level difference, dB	38	43	32	43	58	58	58	58	-
Resultant noise level upstairs, $dB_{L_{eq,T}}$	54	48	57	49	31	21	18	18	<b>50</b>
Typical ambient noise level in Trades Club, $dB_{L_{eq,T}}$	48	37	40	34	30	23	15	15	<b>36</b>
Excess of activity noise transfer above ambient noise levels, $dB_{L_{eq,T}}$	+6	+11	+17	+15	+1	+2	-3	-3	<b>14</b>

Again, while a significant improvement over the existing floor could be achieved, maximum noise events within the boxing gym, particularly at lower frequencies, would still be expected to be clearly audible within the Venue above during quiet events.

A further improvement could be afforded by providing a floated mass layer on the first floor. However, due to the law of diminishing returns, it is unlikely that an improvement of 14dB would be achievable even with both mitigation treatments.

This option would require a cradle and batten floated mass layer to the first floor, alongside a very heavy mass ceiling supported on acoustic hangers, and a large cavity, as well as extensive treatment to common walls, columns, joists etc to control flanking, and is unlikely to be a practical or affordable solution.

### Alternative Ground Floor Uses

The assessment presented above demonstrates that, even with the benefit of upgraded airborne sound insulation of the separating floor, simultaneous use of the ground floor space as a boxing gym in conjunction with the existing Trades Club venue is acoustically incompatible, both in terms of gym activity noise being audible during acoustic or spoken word events in the venue, and louder events in the venue affecting the ground floor space.

The potential occupancy of the ground floor space by a tenant generating low noise levels (e.g. using the space as an office) would clearly be preferable in terms of noise impact to the Trades Club above. However, noise transfer from the venue to ground floor would likely still be problematic.

With an upgraded floor construction, Calculation 3 above demonstrates that music noise would be around  $57\text{dB}_{\text{L}_{\text{Aeq,T}}}$  in the ground floor space for a front of house level in the venue of  $98\text{dB}_{\text{L}_{\text{Aeq,T}}}$ . For an open plan office, BS8233:2014 recommends an internal ambient noise level of  $45\text{-}50\text{dB}_{\text{L}_{\text{Aeq,T}}}$ .

It is understood that sound checks within the Trades Club can begin from 15:00h and therefore it cannot be assumed that any office space on the ground floor would be unoccupied during noisier periods.

It is recommended, therefore, that any future use of the ground floor space should be carefully considered to identify usage which would be compatible both with the operating hours and acoustic requirements of the existing venue above.

We trust this information meets your needs at the current time, but please do contact us should you have any questions.

Yours Sincerely,

A handwritten signature in black ink, appearing to read 'S Witterick', written over a faint, illegible printed name.

Susan Witterick

Director, dBx Acoustics Ltd