Acoustic assessment of proposed new restaurant and bar to an adjoining hotel

40 Chorlton Street, Manchester

Client: Dawnvale Group

Report Reference: 221015-R001C

Date: 18th January 2024

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CONTENTS

0. SUMMARY 2
1. INTRODUCTION 3
2. ACOUSTIC CRITERIA 3
3. REVIEW OF SITE LOCATION & DEVELOPMENT PROPOSALS 3
4. SOUND LEVEL SURVEY 5
5. ASSESSMENT OF OPERATIONAL NOISE TO ADJOINING PROPERTIES 6
   5.1. Source Sound Levels 6
   5.2. Acoustic Assessment of Internal Operational Noise Transmission 7
6. RESTAURANT OPERATIONAL NOISE ACOUSTIC MITIGATION TREATMENT 7
   6.1. Ground Floor Mezzanine Restaurant 7
   6.2. Ground Floor Restaurant 10
   6.3. Basement Bar Space 12
   6.4. Sound System 13
7. CONCLUSION 14

Appendix A ..... A

0. SUMMARY

0.1. ACA Acoustics Limited have been commissioned to assess the acoustic impact of a proposed new restaurant and bar at 40 Chorlton Street, Manchester.

0.2. The assessment is required to provide evidence that noise emissions from the restaurant and bar will not be detrimental to the amenity of guests in the adjoining hotel and complies with relevant criteria.

0.3. To protect the amenity of guests within the hotel, ACA Acoustics recommends that noise emissions from the restaurant and bar should be controlled to not exceed a level of LAeq 25dB inside hotel bedrooms, with low frequencies at 63Hz and 125Hz not exceeding the respective values within the NR10 curve.

0.4. Source sound levels have been measured within various similar restaurants and bars to establish likely internal levels when trading. Typical sound levels within the restaurant are anticipated to not exceed LAeq 81dB during a busy weekend dinner service and will be lower for much of the time. Music will be played at 'background' level only. Within the basement bar space typical sound levels are anticipated to not exceed LAeq 94dB.

0.5. Sound insulation tests have been carried out on the existing structure between the upper mezzanine, lower ground floor, and basement areas and residential spaces directly above.

0.6. Using measured sound insulation of the separating floor to the hotel rooms above, assessment of operational noise transmission has been carried out. A scheme of mitigation measures has been designed to ensure noise emissions comply with the recommended criteria. This will provide a good level of amenity to hotel guests and no further noise mitigation is required.

1. INTRODUCTION

ACA Acoustics Limited has been commissioned to carry out an assessment of noise transmission from a proposed new restaurant and bar to adjoining hotel rooms at 40 Chorlton Street, Manchester. The assessment considers operational noise (patrons and music) from the dining spaces at upper and lower ground floor, along with the basement bar area.

The objective of the assessment is to determine the impact that the proposed new restaurant and bar would have on the hotel, and where necessary to make recommendation for suitable noise mitigation treatments.

This report presents results of the sound level surveys and assessment.

2. ACOUSTIC CRITERIA

The client does not have any specific criteria to be achieved within the adjoining residential hotel spaces.

Based on experience of similar projects, ACA Acoustics propose that an acoustic criteria for the restaurant dining and bar spaces to not exceed a sound level of LAeq 25dB, along with low frequency noise at 63Hz and 125Hz to not exceed the respective values within the NR10 curve within the hotel rooms will provide a good level of amenity to hotel guests.

3. REVIEW OF SITE LOCATION & DEVELOPMENT PROPOSALS

A new restaurant and bar is being developed at 40 Chorlton Street, Manchester.

The restaurant will be located at upper and lower ground floor levels with a bar at basement level. There are existing hotel bedrooms located at first-floor level directly above the development site.

Drawings provided by the client are shown in Figure 1, Figure 2, and Figure 3 below.

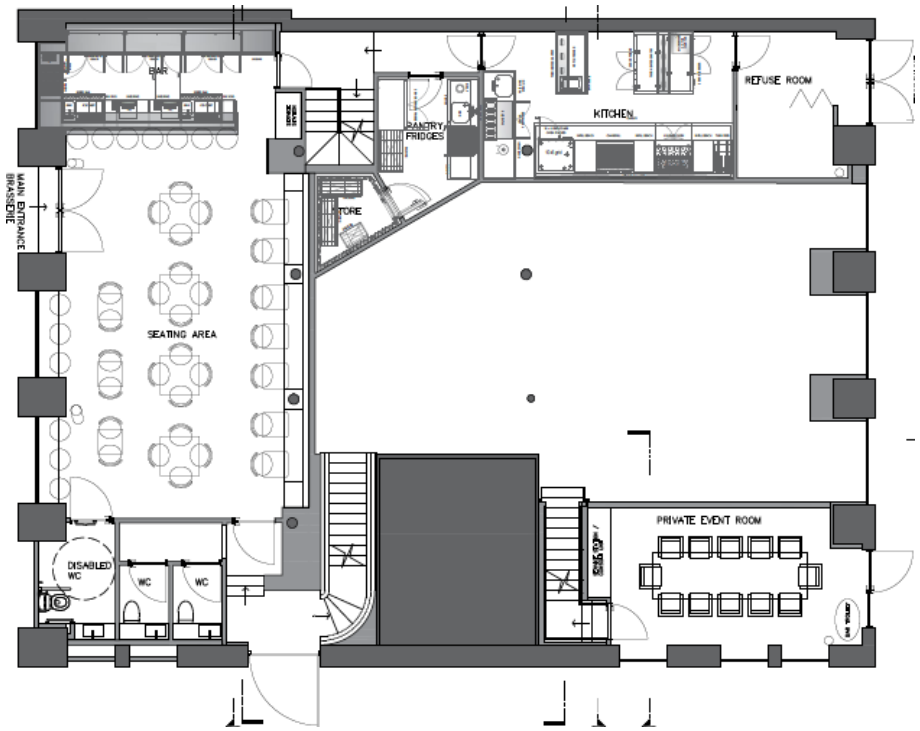


Figure 1: Upper ground floor layout

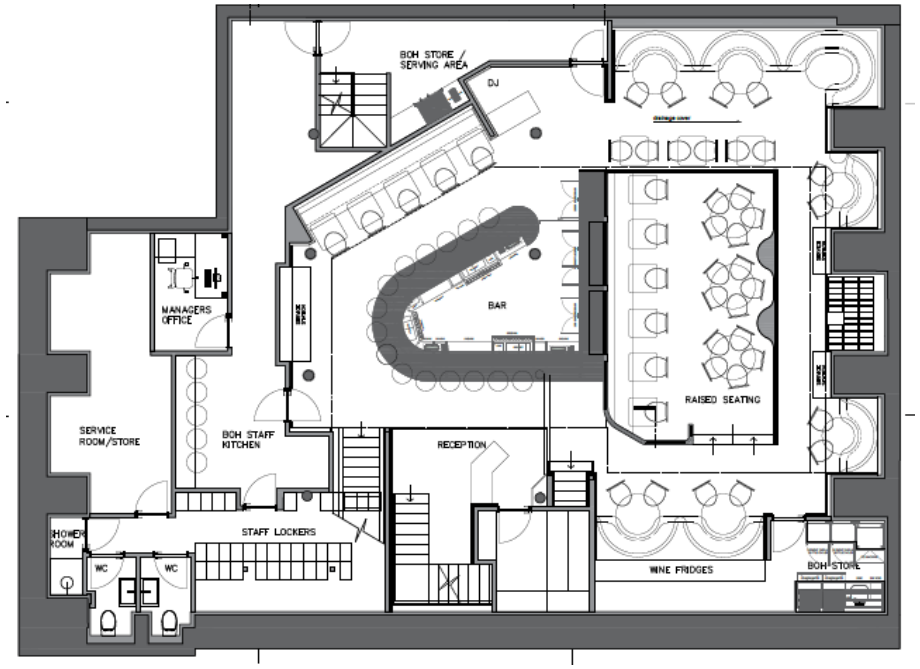


Figure 2: Lower ground floor layout

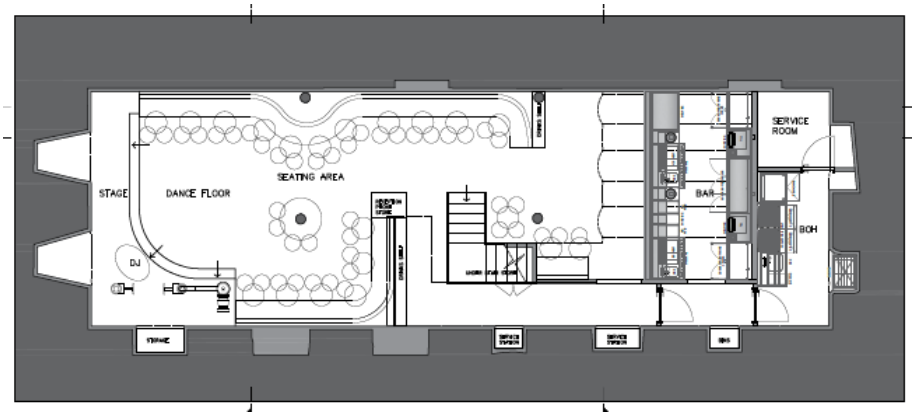


Figure 3: Basement layout

4. SOUND LEVEL SURVEY

To determine the acoustic performance of the separating floors of the proposed restaurant unit and adjoining hotel sound insulation tests were carried out between the existing upper and lower ground and basement floors of the unit and the 1st floor bedrooms.

The survey was conducted by Tommy Burn of ACA Acoustics on 7th November 2022. The sound insulation performance of the separating partitions was measured generally in accordance with procedures set out in BS EN ISO 16283-1:2014 *Acoustics – Field measurement of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation*.

The following equipment was used during the survey; the sound level meter was calibrated before the survey and checked after with no change noted.

Equipment	**Serial Number**
NTi Audio Class 1 sound level meter type XL2-TA	A2A-16877-E0
Svantek calibrator type SV33B. Compliant to IEC 60942:2003	57595
Yamaha DSR112 loudspeaker	BFYJ01026
NTi Audio pink noise generator type Minirator MR-PRO	G2P-RAEVK-G0

Table 1: Equipment used

Results of the measured level difference, in terms of weighted single-figure value, is shown in the table below.

Full results may be found within Appendix A.

Test Reference	Source Room	Receiving Room	Level Difference D,w (dB) (+ C'tr)
AF01	Upper ground floor, restaurant unit	1st floor room 001	57(-8) dB
AF01	Lower ground floor, restaurant unit	1st floor room 002	54(-7) dB
AF03	Basement bar	1st floor room 002	67(-6) dB

Table 2: Sound insulation test results

The sound insulation results on the existing structure confirm that the building is providing a reasonable standard of sound insulation.

5. ASSESSMENT OF OPERATIONAL NOISE TO ADJOINING PROPERTIES

5.1. Source Sound Levels

To calculate the potential impact of the proposed development it is necessary to establish typical sound levels within the new restaurant and bar once it is trading; this is the source sound level data.

Sound levels have been recorded in a number of similar restaurants and bars for previous projects. Spectra used in the assessment for the upper and lower ground floor areas equates to an overall sound level of LAeq 81dB. This is representative of the internal sound level within a restaurant on a busy weekend evening during dinner service. The measurement includes the restaurant at full capacity with patrons talking and laughing simultaneously at different tables and background music.

At basement level it is understood there is to be a DJ booth and a dance floor area. A source sound level of LAeq 94dB has been measured in other similar venues and is considered appropriate.

Confirmation of the source sound level data used in the assessment is shown in Table 3 below.

Description	Octave Band Frequency (Hz) – LAeq (dB)							
	63	125	250	500	1k	2k	4k	LAeq
Upper and lower ground floor dining spaces	71	77	74	80	77	73	64	81
Basement space	87	97	94	92	89	81	77	94

Table 3: Measured source sound levels inside similar venues

5.2. Acoustic Assessment of Internal Operational Noise Transmission

Based on the anticipated source sound level and the measured level difference of the stripped-out structure, resultant sound levels inside the hotel rooms above are shown below. Note these levels do not include the benefit of any proposed mitigation.

Source LAeq	Calculated level of sound transmission	Criteria
81dBA in upper and lower ground floor restaurant	LAeq 31dB 63Hz 47dB 125Hz 42dB	LAeq 25dB NR 10 @ 63Hz 43dB NR 10 @ 125Hz 31dB
94dBA in basement bar	LAeq 35dB 63Hz 45dB 125Hz 48dB	LAeq 25dB NR 10 @ 63Hz 43dB NR 10 @ 125Hz 31dB

Table 4: Calculated sound levels from the restaurant with no treatment with upper and lower ground floor restaurant and basement bar operating

Results in Table 4 confirm that with no mitigation works then noise emissions to the hotel rooms would be above the recommended criteria.

To comply with the required acoustic criteria, it is recommended that an improvement of up to 10dBA will be necessary, with higher levels of reduction required at low frequencies.

6. RESTAURANT OPERATIONAL NOISE ACOUSTIC MITIGATION TREATMENT

As discussed above, a scheme of noise mitigation measures is recommended to ensure the recommended criteria is achieved. Details of a proposed scheme discussed in Section 5 is provided below.

Once the mitigation scheme has been incorporated then sound transmission to the hotel bedrooms from the proposed restaurant and bar will comply with the criteria shown in Section 2.

6.1. Ground Floor Mezzanine Restaurant

6.1.1. Music Volume Limiter

It is understood that the client requires that the vaulted ceiling above the ground floor mezzanine space remains uncovered. As a result it is necessary to reduce sound levels from the mezzanine

space from impacting the adjoining hotel rooms through other means than installation of an acoustic ceiling.

It is recommended that the sound level within the dining space should not exceed the following octave band frequencies in order to achieve the recommended criteria.

63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
67dB	65dB	70dB	76dB	73dB	69dB	60dB	49dB

Table 5: Maximum permissable sound levels within ground floor mezzanine area

The volume limiter should be specified and installed as per the requirements within Section 6.5.

6.1.2. Acoustic partition between main dining space and mezzanine

It is recommended that a partition is installed separating the mezzanine dining space from the main lower ground floor dining space.

Specification for a suitable acoustic partition and flanking walls and columns will typically comprise:

- Two layers 12.5mm SoundBloc plasterboard, supported on twin independent studs with 150mm cavity and 100mm rockwool insulation in the void. All plasterboard joints should be staggered, taped, and skimmed.
- Where the partition abuts the ceiling and the walls, the partition must not be structurally connected, but be independent, with any gaps sealed with a flexible, non-hardening mastic.
- It is recommended the acoustic linings are imperforate. Necessary small penetrations, such as for cables, must be sealed with a flexible mastic.

6.1.3. Acoustic Assessment of Operational Noise Transmission through the external façade

A computer model has been used to calculate sound transmission via the shopfront to within the hotel bedrooms above. The model uses the methodology of BS EN 12354-4:2000 to predict the transmission of indoor sound to outside and then the environmental corrections of ISO 9613-2:1996 to account for the distance from the shopfront to the residential windows, acoustic reflections, and acoustic screening.

In order to calculate sound levels to within the habitable rooms, ACA Acoustics have assumed that the glazing to the residential apartments has a sound insulation performance of at least Rw+C'tr 30dB. This is considered to be a low value in order to ensure a robust assessment and it is considered that the actual glazing performance will be higher than this. The residential windows are openable and as such assessment has been undertaken with both the residential windows open and closed.

The brasserie dining space windows will not be openable. Figure 4 below indicates the design of the facade.

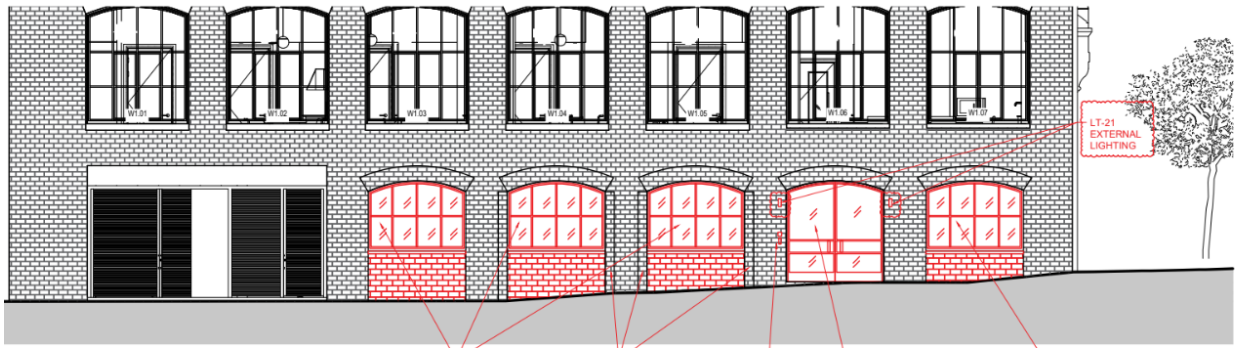


Figure 4: Brasserie shopfront

Summary of calculated sound emissions via the shopfront to outside the residential windows are shown in the table below.

Operational Usage	Internal Sound Level	Calculated sound level outside residential windows	Calculated sound level inside residential apartments with residential windows open
General dining/use	LAeq 77dB	22dB	LAeq 7dB

Table 6: Summary of calculated sound emissions via the shopfront to outside noise-sensitive properties

Calculated sound levels through the external facade will be low and will comfortably achieve the required acoustic criteria within Section 2.

6.2. Ground Floor Private Dining Space

6.2.1. Music Volume Limiter

It is understood that the client requires that the ceiling above the private dining space remains uncovered due to head-height constraints. As a result it is necessary to reduce sound levels from the space from impacting the adjoining hotel rooms through other means than installation of an acoustic ceiling.

It is recommended that the sound level from entertainment noise within the dining space should not exceed the following octave band frequencies in order to achieve the recommended criteria.

63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
67dB	65dB	70dB	76dB	73dB	69dB	60dB	49dB

Table 7: Maximum permissable sound levels within ground floor mezzanine area

This will preclude the use of amplified live music within the space, and any music will need to be at a background level.

The volume limiter should be specified and installed as per the requirements within Section 6.5.

6.2.2. Acoustic partition between main dining space and private dining space

It is recommended that a partition is installed separating the private dining space from the main lower ground floor dining space to ensure the transmission path from the dining space trough the private dining space and into the upper floor hotel bedrooms is mitigated.

Specification for a suitable acoustic partition and flanking walls and columns will typically comprise:

- Two layers 12.5mm SoundBloc plasterboard, supported on twin independent studs with 150mm cavity and 100mm rockwool insulation in the void. All plasterboard joints should be staggered, taped, and skimmed.
- Where the partition abuts the ceiling and the walls, the partition must not be structurally connected, but be independent, with any gaps sealed with a flexible, non-hardening mastic.
- It is recommended the acoustic linings are imperforate. Necessary small penetrations, such as for cables, must be sealed with a flexible mastic.

Note that a higher performance partition may be preferable depending on the privacy requirements of the private dining space.

6.3. Ground Floor Restaurant

6.3.1. Reception Space Beneath Lower Hotel Lobby Floor

The client has informed ACA Acoustics that the headroom to the reception space is insufficient for an acoustic ceiling.

In order to ensure sound levels from the dining space do not enter the separating structure, it is necessary to ensure the flanking path is removed. This would require a partition around the entrance lobby such that the concrete structure of the building is not exposed to sound levels from the dining space at any point.

Any laminated or toughened glazed partition will be sufficient from an acoustics perspective, however the partition and door should be sealed around the edges such that there are no gaps, and the door should be fully sealed at the edges and on automatic closers to ensure it is not held open.

This space should not contain amplified music.

6.3.2. Acoustic Ceiling

It is recommended that an acoustic ceiling is installed over the restaurant area throughout the ground and mezzanine floor areas and any adjoining space which may be subject to the same

internal source sound levels (e.g., a lobby or corridor separated by a door which will be regularly opened).

Specification for a suitable ceiling will typically comprise:

- Minimum two layers of 15mm SoundBloc plasterboard, supported on steel spring hangers such as Mason UK's Mason HDQF-X Spring Hangers or equivalent.
- All plasterboard joints should be taped and skimmed.
- The ceiling shall be installed to form a minimum 200mm void to the soffit above. Minimum 100mm dense Rockwool insulation shall be laid in the void.
- Where possible it is recommended that the ceiling is imperforate. Necessary small penetrations, such as for cables, must be sealed with a flexible mastic.
- The ceiling must be fully independent of the structure, including side walls and columns. Gaps at the perimeter should be sealed airtight with a flexible mastic.
- Any decorative ceiling may be installed below the acoustic ceiling. The decorative ceiling and other services may be supported from the acoustic ceiling, where this additional weight has been accounted for when selecting the appropriate ceiling hangers.

A lower specification ceiling may be appropriate for areas where sound levels will be lower, such as back-of-house areas

6.3.3. Acoustic Linings to Flanking Walls and Columns

It is recommended that the flanking structural walls and columns within the restaurant are lined with independent acoustic lining.

Specification for a suitable acoustic lining to the flanking walls and columns will typically comprise:

- Two layers 15mm Soundbloc plasterboard, supported on independent steel studs set off the wall/column. All plasterboard joints should be staggered, taped, and skimmed.
- Where required for structural support the studs may be tied back to the structure using Mason UK Limited's DNSB acoustic wall ties and AB-716 head support brackets, or equivalent. The number of bracing/supports should be restricted to the minimum possible.
- The new linings should form a cavity of nominally 100mm to the column. 50mm dense Rockwool insulation should be hung in the void.
- It is recommended the acoustic linings are imperforate. Necessary small penetrations, such as for cables, must be sealed with a flexible mastic.

6.3.4. Suspended Bar Ceiling

It is recommended that the bar ceiling within the main dining space indicated in Figure 5 below, should be suspended using steel spring hangers such as Mason Uk's HDQF-X steel spring hangers or equivalent from the soffit, to ensure the ceiling does not present a flanking path into the building

structure. The acoustic ceiling should be sealed around the hangers using a non-hardening flexible mastic.

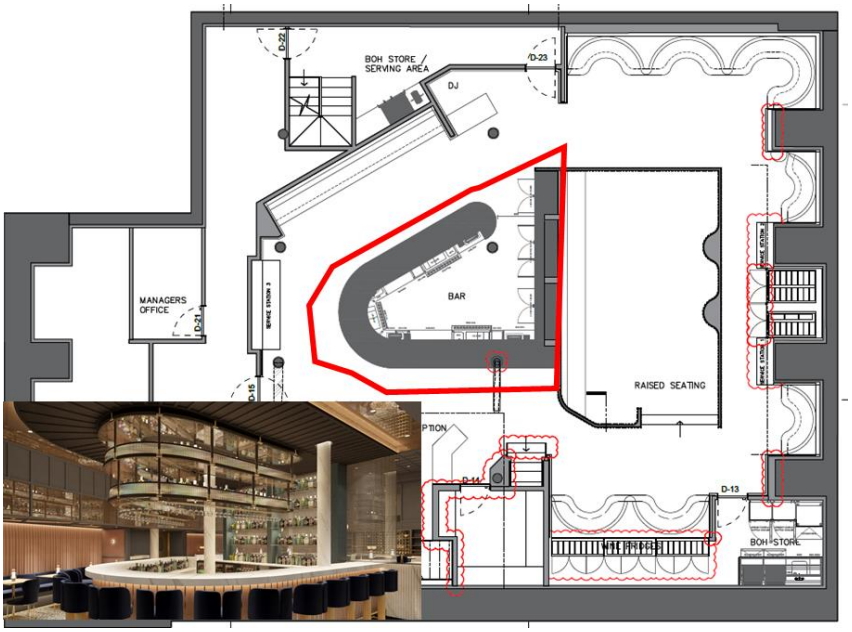


Figure 5: Ground floor bar layout

6.4. Basement Bar Space

6.4.1. Basement Stairwell and Entrance

It is understood that the hotel area immediately above the ground floor entrance foyer to the basement bar is a non-sensitive space.

It is recommended that the basement stairwell and entrance foyer at ground floor is enclosed with acoustic wall linings and glazed partition to the main dining area as detailed in Section 6.3.

A lobby area will need to be formed either with a door to the foot of the stairs in the basement, or a lobby formed around the head of the stairs at lower ground floor level. Doors to the lobby should incorporate acoustic seals to the jambs, head, and dropdown seals at the threshold.

The lobby and stairs should incorporate acoustically ‘soft’ finishes, such as a carpeted floor or acoustic ceiling tiles, etc.

The doors should be fitted with automatic closing devices and management procedures should be put in place to ensure that doors are kept closed when not in active use and must not be fixed or held open when the basement bar is in use.

6.4.2. Basement Walls and Ceiling

The ceiling and walls of the basement bar should match the performance of those proposed within Section 6.3. This will form a “box within a box” type enclosure and will reduce flanking noise from the basement bar.

6.4.3. Basement Floor

It is recommended that a floating floor is formed in the basement to reduce flanking sound transmission. A suitable floor would typically comprise a layer of cement particle board or similar on resilient battens. Mineral wool insulation would be laid in the formed void.

6.5. Sound System

6.5.1. Loudspeakers

It is recommended that the sound system comprise multiple smaller loudspeakers rather than a smaller number of large speakers. This reduces the overall volume, whilst retaining the quality of the sound.

Speakers should be supported on resilient hangers to reduce vibration transmission into the structure.

6.5.2. Music Volume Limiter

The music system should be a modern networked system such as Soundweb or incorporate a separate volume limiter. This allows the maximum music volume to be set and locked, which cannot be overridden by staff. A suitable limiter will include a graphic equaliser, allowing individual frequencies to be set at the required level.

Once the system has been installed then should any small excess remain above the recommended criteria then the music volume limiter may be used to mitigate this accordingly.

Where appropriate the music volume limiter would be set in conjunction with the sound engineer, and ACA Acoustics. Music would be played in the venue while noise monitoring and subjective listening is undertaken in the hotel rooms above to confirm an acceptable level has been achieved.

7. CONCLUSION

ACA Acoustics have assessed sound transmission between a proposed bar and restaurant and an adjoining hotel above at 40 Chorlton Street, Manchester.

A detailed mitigation scheme has been designed to ensure that sound emissions from the restaurant to adjoining hotel rooms will be low, and will not impact occupants of the adjoining rooms.

Appendix A

Sound Insulation Test Results

ACA acoustics

Level Difference Measured in Accordance with ISO 16283-1

Field measurements of airborne sound insulation between rooms

Project Name	40 Chorlton Street, Manchester	**Client**	
Project Reference	221015	**Test Date**	22/11/2022

221015-SI-AF01

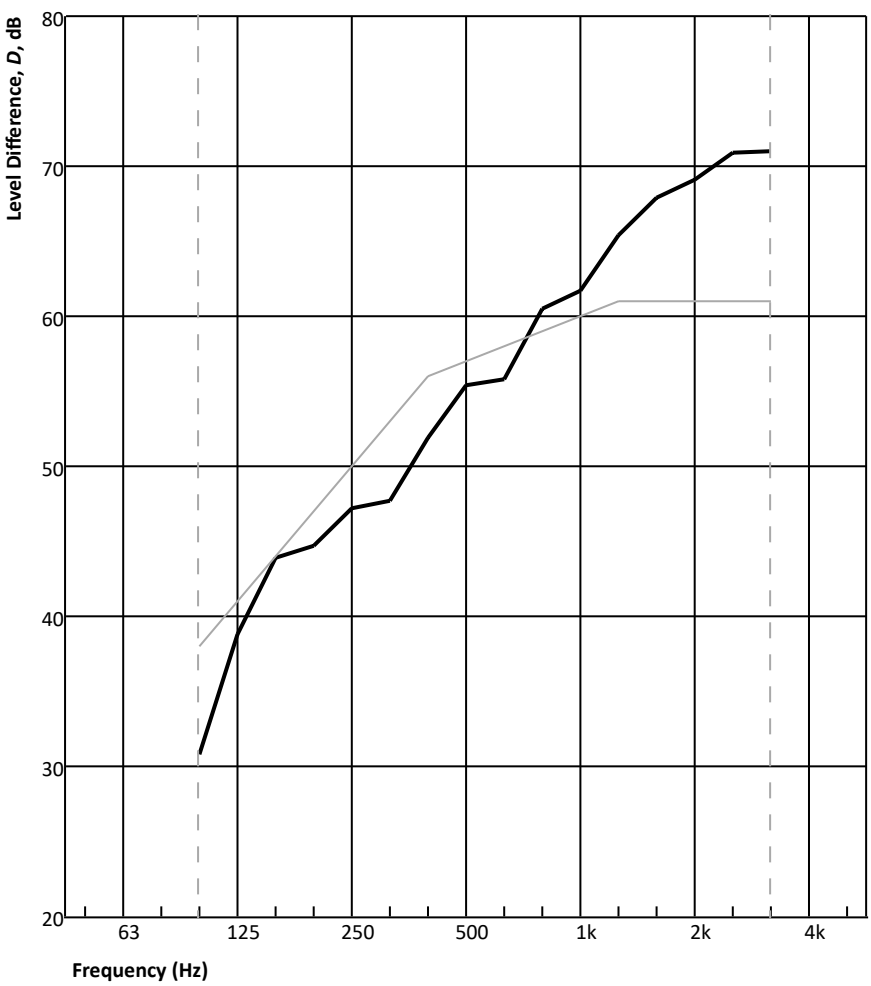
Test on Floor between Ground Floor mezz and Room 001 Bedroom

Description and identification of the building construction:

Source Room Volume (m^3) -

Receive Room Volume (m^3) -

	D (one-third octave) dB
50	-
63	-
80	-
100	30.8
125	38.8
160	43.9
200	44.7
250	47.2
315	47.7
400	51.9
500	55.4
630	55.8
800	60.5
1k	61.7
1,25k	≥ 65.4
1,6k	≥ 67.9
2k	69.1
2,5k	70.9
3,15k	71.0
4k	-
5k	-



Rating according to ISO 717-1

D_w (C ; C_{tr}) = 57 (-2 ; -8) dB;

$C_{50\text{-}3150}$ = -2 dB; $C_{50\text{-}5000}$ = -1 dB; $C_{100\text{-}5000}$ = -1 dB

$C_{tr,\,50\text{-}3150}$ = -10 dB; $C_{tr,50\text{-}5000}$ = -10 dB; $C_{tr,100\text{-}5000}$ = -8 dB

Evaluation based on field measurement results obtained by an engineering method

Date: 08/12/2022

Name of Test Institute: ACA Acoustics

Report Reference: 221015 R1

Signature: Tommy Burn

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ACA acoustics

Level Difference Measured in Accordance with ISO 16283-1

Field measurements of airborne sound insulation between rooms

Project Name	40 Chorlton Street, Manchester	**Client**	
Project Reference	221015	**Test Date**	22/11/2022

221015-SI-AF02

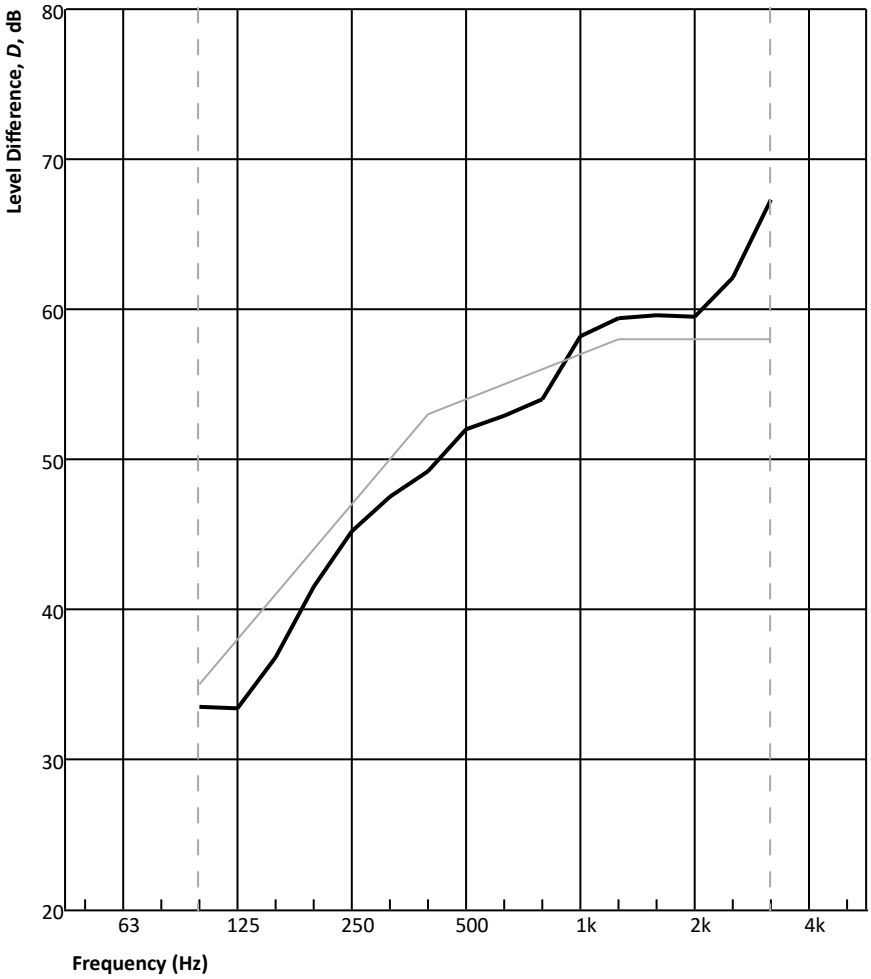
Test on Floor between Lower Ground and Room 002

Description and identification of the building construction:

Source Room Volume (m^3) -

Receive Room Volume (m^3) -

	D (one-third octave) dB
50	-
63	-
80	-
100	33.5
125	33.4
160	36.8
200	41.5
250	45.2
315	47.5
400	49.2
500	52.0
630	52.9
800	54.0
1k	58.2
1,25k	59.4
1,6k	59.6
2k	59.5
2,5k	62.1
3,15k	67.3
4k	-
5k	-



Rating according to ISO 717-1

D_w (C ; C_{tr}) = 54 (-2 ; -7) dB;

$C_{50\text{-}3150}$ = -3 dB; $C_{50\text{-}5000}$ = -2 dB; $C_{100\text{-}5000}$ = -1 dB

$C_{tr,\,50\text{-}3150}$ = -12 dB; $C_{tr,50\text{-}5000}$ = -12 dB; $C_{tr,100\text{-}5000}$ = -7 dB

Evaluation based on field measurement results obtained by an engineering method

Date: 08/12/2022

Name of Test Institute: ACA Acoustics

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Signature: Tommy Burn

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Level Difference Measured in Accordance with ISO 16283-1

Field measurements of airborne sound insulation between rooms

Project Name	40 Chorlton Street, Manchester	**Client**	
Project Reference	221015	**Test Date**	22/11/2022

221015-SI-AF03

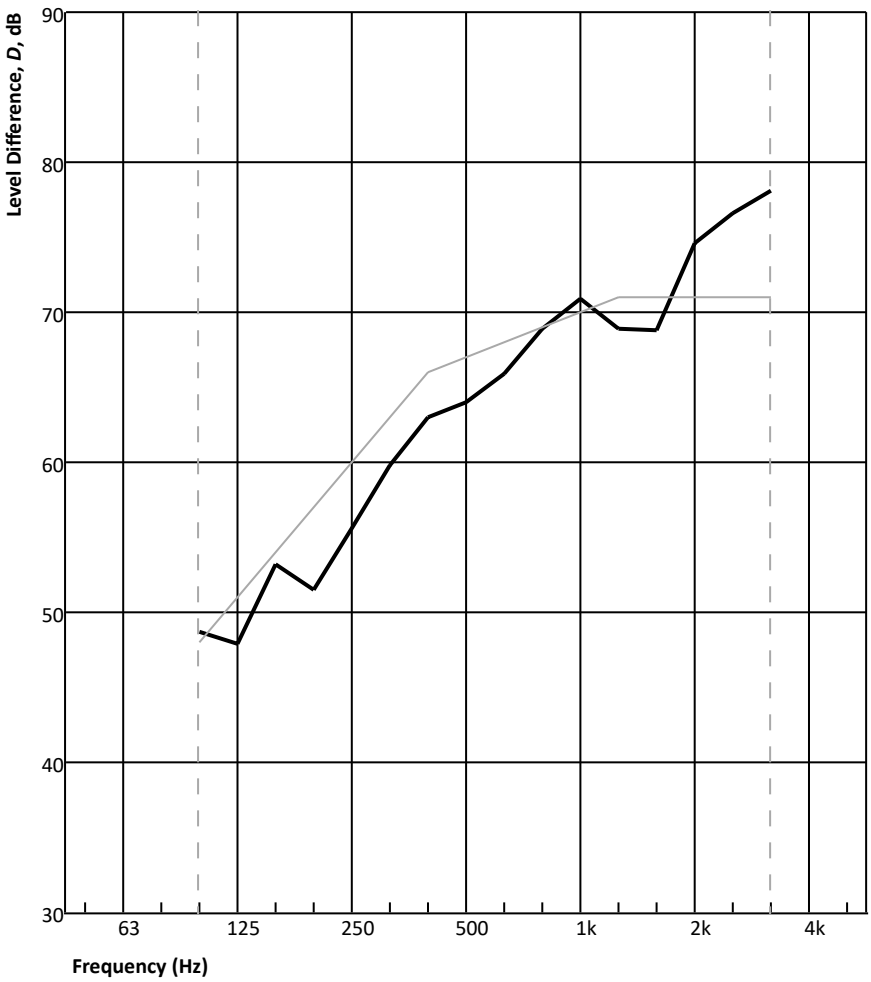
Test on Floor between Basement and Room 002

Description and identification of the building construction:

Source Room Volume (m^3) -

Receive Room Volume (m^3) -

	D (one-third octave) dB
50	-
63	-
80	-
100	48.7
125	47.9
160	53.2
200	51.5
250	55.6
315	59.8
400	≥ 63.0
500	≥ 64.0
630	≥ 65.9
800	≥ 68.9
1k	≥ 70.9
1,25k	≥ 68.9
1,6k	≥ 68.8
2k	≥ 74.6
2,5k	≥ 76.6
3,15k	≥ 78.1
4k	-
5k	-



Rating according to ISO 717-1

D_w (C ; C_{tr}) = 67 (-2 ; -6) dB;

$C_{50\text{-}3150}$ = -2 dB; $C_{50\text{-}5000}$ = -1 dB; $C_{100\text{-}5000}$ = -1 dB

$C_{tr,\,50\text{-}3150}$ = -9 dB; $C_{tr,50\text{-}5000}$ = -9 dB; $C_{tr,100\text{-}5000}$ = -6 dB

Evaluation based on field measurement results obtained by an engineering method

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