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GROUND FLOOR AND MEZZANINE,
1A STEVENSON SQUARE, MANCHESTER

NOISE IMPACT ASSESSMENT

Report **14055-NIA-01**

Prepared on 16 April 2021

Issued For:

Mr. Wahid Ahmed

Institute of Acoustics sponsoring organisation
committed to CSCS Platinum award
CQMS Safety Scheme
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Executive Summary

This noise impact assessment has been undertaken in order to assess a proposed subdivision of ground floor and first floor commercial units at 1A Stevenson Square, Manchester to form the following units:

- Unit 1A Stevenson Square (Ground Floor)
- The Mezzanine (Mezzanine)
- Unit 1 Spear Street (Ground Floor + Mezzanine)
- Unit 2 Spear Street (Ground Floor + Mezzanine)

A background noise survey has been undertaken as detailed in the report, in order to determine an appropriate noise emission criterion, in accordance with the typical requirements of the Local Authority and relevant British Standards.

Calculations were undertaken for the nearest identified residential receiver, identified as a Hotel/Hostel at 15 Hilton Street, Manchester. It should be noted that if there are closer receivers that Clement Acoustics is not aware of, a reassessment will be necessary, and this should therefore be confirmed by the Client.

It has been demonstrated that compliance with the established criterion is feasible, dependant on the following material considerations:

- Implementation of a Noise Management Plan as detailed, including (but not limited to):
  - Appropriate noise limits on amplified music
  - Currently proposed limits on operating hours
- The external building facade is designed according to the recommendations of this report
- Source and receiver locations are as established in this report and marked on the attached site plan

If there is any deviation from the above, Clement Acoustics must be informed, in order to establish whether a reassessment is necessary.

Clement Acoustics has used all reasonable skill and professional judgement when preparing this report. The report relies on the information as provided to us at the time of writing and the assumptions as made in our assessment.

This report is designed to be suitable to discharge typical planning conditions, as per our original scope of work.

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14055-NIA-01-TH1 Environmental Noise Time History
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Appendix B Acoustic Calculations

Document Revision	Date of Revision	Reasons for Revision	Revision By
0	16/04/2021	First Issue	Duncan Martin MIOA

1.0 INTRODUCTION

Clement Acoustics has been commissioned by Mr. Wahid Ahmed to measure existing background noise levels at 1A Stevenson Square, Manchester. Measured noise levels have been used to determine noise emissions criteria for a proposed subdivision of ground floor and mezzanine commercial spaces, in line with the requirements of the City of Manchester.

This report presents the results of the environmental survey followed by noise impact calculations and outlines any necessary mitigation measures.

An acoustic terminology glossary is provided in Appendix A.

2.0 SITE DESCRIPTION

The site is an existing commercial unit previously in use as a pizza restaurant over ground and mezzanine floors. The surrounding area is predominantly commercial, comprising office buildings, cafes and restaurants, and retail units.

The site is bounded by Stevenson Square to the south, Lever Street to the east, Spear Street to the west and Faraday Street to the north.

Current proposals are to subdivide the existing commercial unit to form the following units:

- Unit 1A Stevenson Square
  - Ground Floor Unit, 203 m^2
- The Mezzanine
  - Mezzanine Unit, 325 m^2
- Unit 1 Spear Street
  - Ground Floor and Mezzanine Unit, Total 88 m^2
- Unit 2 Spear Street
  - Ground Floor and Mezzanine Unit, Total 46 m^2

It is understood the units will have operating hours of 08:00 to 18:00 as standard. However, this assessment will assume worst case operating hours of 08:00 to 23:00 in order to account for any future alterations to applications.

Further to an onsite inspection and searches on Council Tax and Planning resources, no residential dwellings have been found in the vicinity of the site. However, a hostel/hotel premises is understood to operate at 15 Hilton Street. This nearest noise sensitive receiver was identified through observations on-site. If there are any receivers closer to that identified within this report then a further assessment will need to be carried out. Therefore, the closest noise sensitive receiver should be confirmed by the client before works commence.

An assessment will also be undertaken for existing office accommodation above mezzanine level.

Locations are shown in attached site plan 14055-NIA-01-SP1.

3.0 ENVIRONMENTAL NOISE SURVEY

3.1 Unattended Noise Survey Procedure

Measurements have previously been undertaken at one position as shown on indicative site drawing 14055-NIA-01-SP1. The choice of this position was based both on accessibility and on collecting representative noise data in relation to the nearest affected receiver.

The surroundings and position used for the monitoring location are described in Table 3.1.

Position No.	Description
1	The microphone was mounted on a 1st storey window at the rear corner of the building overlooking Spear Street. The microphone was positioned 1m in front of the window. [1]

Table 3.1: Description of unattended monitoring locations

Note [1]: The position was considered to be free-field according to guidance found in BS 4142: 2014, and a correction for reflections has therefore not been applied.

Continuous automated monitoring was undertaken for the duration of the survey between 16:00 on 14 January 2019 and 16:00 on 16 January 2019.

The measurement procedure generally complied with BS 7445: 1991: '*Description and measurement of environmental noise, Part 2- Acquisition of data pertinent to land use*'.

3.2 Weather Conditions

At the time of set-up and collection of the monitoring equipment, the weather conditions were generally dry with light winds.

It is considered that the weather conditions did not significantly adversely affect the measurements and are therefore considered suitable for the measurement of environmental noise.

3.3 Equipment

The equipment calibration was verified, by means of a field verification check, before and after use and no abnormalities were observed.

The equipment used was as follows.

- 1 No. Svantek Type 977 Class 1 Sound Level Meter
- Norsonic Type 1251 Class 1 Calibrator

4.0 RESULTS

4.1 Unattended Noise Survey Results

The $L_{Aeq: 5min}$, $L_{Amax: 5min}$, $L_{A10: 5min}$ and $L_{A90: 5min}$ acoustic parameters were measured at the location shown in site drawing 14055-NIA-01-SP1.

Measured noise levels are shown as a time history in Figure 14055-NIA-01-TH1, with minimum background noise levels for the stated worst case operating hours summarised in Table 4.1.

It should be noted that the guidance of the latest revision of British Standard 4142: 2014 detailed in Section 8.1 of the standard is as follows:

'The objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods.'

Therefore, by using the minimum measured background noise level, a particularly robust assessment will be presented.

Time Period	Minimum background noise level $L_{90: 5min}$
Worst Case Operating Hours (08:00 to 23:00)	50 dB(A)

Table 4.1: Minimum background noise levels

5.0 NOISE EMISSIONS CRITERIA

5.1 Residential Receivers

The noise emissions criteria, typically set by the local authority are as follows:

> "*The noise level from any plant or activities shall be 10dB or more below the lowest measured external background noise LA90$_T$ at the closest residential window. The equipment shall be installed and constructed in accordance with any approved scheme and be permanently maintained thereafter*."

In order to provide a robust assessment, we propose to set the noise criteria at 40 dB(A), the value 10 dB below the minimum measured background noise during the proposed hours of operation.

It is understood there is also a requirement for spectral noise levels to be 10 dB below the corresponding background noise levels.

5.2 Commercial Receivers

The closest receivers to the proposed commercial uses are existing commercial uses above the proposed mezzanine uses.

In order to assess whether noise emissions will be controlled to an acceptable level, guidance has been sought in British Standard 8233: 2014 '*Guidance on sound insulation and noise reduction for buildings*'

In Table 6 of the Standard, guidance is given on typical noise levels for non-domestic buildings where concentration may be required. The relevant guidance is summarised in Table 5.1.

Objective	Location	Design range $L_{Aeq,T}$ dB
Study and work requiring concentration	Staff/meeting room	35-45 dB(A)
	Executive office	35-40 dB(A)

Table 5.1: BS8233 recommended internal background noise levels

Based on the use of the adjacent space, we would recommend noise emissions should not exceed the design ranges shown in Table 5.1.

5.3 Plant Noise Emissions

Although new plant units are not currently proposed, suitable noise emissions criteria are recommended, in order to ensure any future plant installations are suitably designed.

A suitable criterion for plant noise emissions is as follows:

> *"The 'A' weighted sound pressure level from the plant, when operating at its noisiest, shall not at any time exceed a value of 10 dB below the minimum external background noise, at a point 1 metre outside any window of any residential property."*

Based on the results of the environmental noise survey and requirements recommended above, Table 5.2 presents the proposed plant noise emission criteria.

Period	Plant Noise Emission Limit $L_{eq;T}$
Worst Case Operating Hours (08:00 to 23:00)	40 dB(A)

Table 5.2: Plant noise emission limits

6.0 NOISE IMPACT ASSESSMENT – ENTERTAINMENT NOISE

6.1 Proposed Activities

It is understood that the proposed commercial uses are not yet finalised, and could comprise retail, salon, café/restaurant or yoga/dance studio activities.

In order to provide a typical worst-case assessment, it will be assumed that all units could have amplified music.

Measurements have previously been taken at a bar with customers present, and music at a level considered to be 'entertainment' and 'background' level.

The measured noise levels are as shown in Table 6.1.

	Sound Pressure Level (dB) in each Frequency Band, at source								
Source	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**	**dB(A)**
Noise Profile 1: *Entertainment Level*	99	101	100	101	97	91	81	76	102
Noise Profile 2: *Background Level*	79	75	76	81	78	74	68	56	82

Table 6.1: Measured Music Noise Levels

In order to present a suitably robust assessment, calculations will be undertaken assuming amplified music at a background level in each of the commercial units.

For all calculated levels shown below, full formulae used and spectral calculations are shown in Appendix B.

6.2 Noise Breakout Assessment – External Noise Breakout

Windows to rooms used for residential purposes have been identified at the location shown in attached site plan 14055-NIA-01-SP1. The closest identified residential windows are located a minimum of 15 m from the closest proposed glazed façade of the commercial units.

Unit 1A Stevenson Square and Units 1 and 2 Spear Street have main entrance doors towards the identified receiver.

In order to present a particularly robust assessment, calculations will be undertaken assuming an open entrance door to each unit. According to BS 8233: 2014, a typical building facade with a partially

open window offers 15 dB attenuation. This will be assumed to be applicable to the entire façade of these units when the front door is opened.

The Mezzanine benefits from a lobbied door area, which is also located away from the identified receiver.

The receiver-facing facade to The Mezzanine is formed of existing glazing. In order to provide a robust assessment, laboratory data for nominal single glazing is as shown in Table 6.2.

	Stated Sound Reduction in Each Frequency Band							
Construction	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
5mm Single Glazing	20	19	23	30	35	27	32	35

Table 6.2: Predicted sound reduction of The Mezzanine facade

Calculations have been undertaken assuming all units have music playing simultaneously, with the doors to Unit 1 Stevenson Square and Units 1 and 2 Spear Street open.

A noise management plan is proposed, as detailed in Section 8.0, in order to ensure operations are representative of the assessed scenarios.

The factors considered in the calculations for each scenario are as detailed below:

With music played back at the above levels, predicted noise emissions levels at nearest residential windows would be as shown in Table 6.3.

Levels have been calculated using the measured background music levels, the stated sound reduction of the venue façade with open doors as stated, and the formula shown in Appendix B1.

Receiver	Operating Hours Criterion	Noise Level at Receiver (due to amplified music)
Closest Residential Receiver	40 dB(A)	36 dB(A)

Table 6.3: Noise levels and criteria at Residential Receiver

As shown in Table 6.3 and Appendix B1, transmission of noise to the nearest sensitive windows due to the effects of the events and activities would meet the set criteria, based on current proposals. The criterion is met both spectrally and overall.

6.3 Noise Breakout Assessment – Commercial Receiver (Offices)

To provide a robust assessment, it has been assumed that offices could be directly above the proposed uses at mezzanine level. The weakest path for noise transmission will be through the separating floor to the adjacent space.

In order to predict the transmission of noise to adjacent spaces, calculations have been undertaken using the following standard acoustic formula:

$$SPL_{receiver} = SPL_{source} - SRI_{separation} + 10\log_{10} S - 10\log_{10} A$$

Where:

- $SRI_{seperation}$ is the sound reduction of the separating floor [*see below*],
- S is the area of the transmitting floor,
- and A is the absorption area of the receiving room.

Based on an onsite observation, the existing floor construction between ground floor and first floor is understood to comprise the following elements:

- Existing timber floorboards
- Existing Joists, assumed minimum 200 mm
    - Mineral wool infill,
- Existing nominal plasterboard or lath & plaster ceiling.

Based on measured performances of similar constructions and through modelling undertaken on proprietary sound insulation modelling software INSUL, the above construction would be expected to present a sound insulation performance in the region R_w 40-45 dB.

With music played back at the levels shown in Table 6.1, noise emissions levels within the adjacent commercial premises due to internal music play back would be as shown in Table 6.4.

Levels have been calculated using the measured amplified music levels, the calculated sound reduction of the separating floor and the formula shown above. Detailed calculations are shown in Appendix B2.

Receiver	Design Range	Noise Level at Receiver (due to amplified music)
Adjacent Office	35-40 dB(A)	39 dB(A)

Table 6.4: Noise levels and criteria at Commercial Receiver

As shown in Table 6.4 and Appendix B2, transmission of noise to the proposed office space above the venue would meet the relevant design range, with music played at a background level.

6.4 Internal Noise Transmission to Residential Spaces

With residential premises identified across Spear Street, the commercial and residential buildings are not connected.

This would be expected to reduce noise transmission from the commercial uses to an imperceptible level.

We would recommend certain steps to avoid transmission of structure-borne noise to surrounding uses generally (See Section 7.0).

7.0 PROPOSED NOISE MANAGEMENT PLAN

7.1 Noise Management

In order to ensure the calculated noise emission levels are not exceeded, we would recommend following certain steps when operating the function room, as detailed below:

- Commercial uses should be permitted between 08:00 and 23:00 only
- We would recommend ensuring noise levels do not exceed the predicted internal noise levels as follows[1]:

Source	Low Frequency Limits		Overall Limit
	63Hz	125Hz	
Background Music	79 dB	75 dB	82 dB(A)

- The above limits could typically be implemented through the use of an inline noise limiter, installed in the audio chain before the amplifier, to compresses any signal and ensure the limit isn't exceeded.
- All loudspeakers should be isolated from the building structure. For fixed speakers, this should be achieved using neoprene fixings for all speaker mountings. For free standing speakers, these should be sited on a suitable isolating material.
- Patrons should also be reminded of the nature of surrounding premises and behaviour outside the premises should be monitored accordingly.
- No deliveries or waste collection should be undertaken outside daytime hours.
- If any external plant is proposed, it must be designed according to the criteria stated in this report

[1] It must be noted that these noise limits are a prediction only, based on the expected performance of the external façade, separating floor, and acoustic formulae. A final commissioning exercise should be undertaken to determine the appropriate limits in practice, which could be lower.

The above noise management plan is considered suitable for the existing building, and uses as predicted. If there is any desire to alter the stipulated noise management plan, for example to allow later opening or louder activities, tenants should undertake a noise impact assessment accordingly. This should determine what mitigation measures are required in order to account for the changes, for example enhanced external facades, lobbied entrance doors and upgrades to the existing ceiling.

8.0 CONCLUSION

An environmental noise survey has been undertaken at 1A Stevenson Square, Manchester. The results of the survey have enabled criteria to be set for noise emissions from the proposed activities in accordance with typical requirements.

A noise impact assessment has then been undertaken using library noise data to predict the noise levels, due to the proposed activities, at the nearby noise sensitive receivers.

Calculations show that compliance with typical requirements is feasible with the recommended mitigation and noise management as stated herein.

Alterations to the noise management plan would require additional noise impact assessments to be submitted.

Author	**Duncan Martin** Director BSc (Hons) MIOA		16 April 2021
Approved	**John Smethurst** Director BSc (Hons) MIOA		16 April 2021

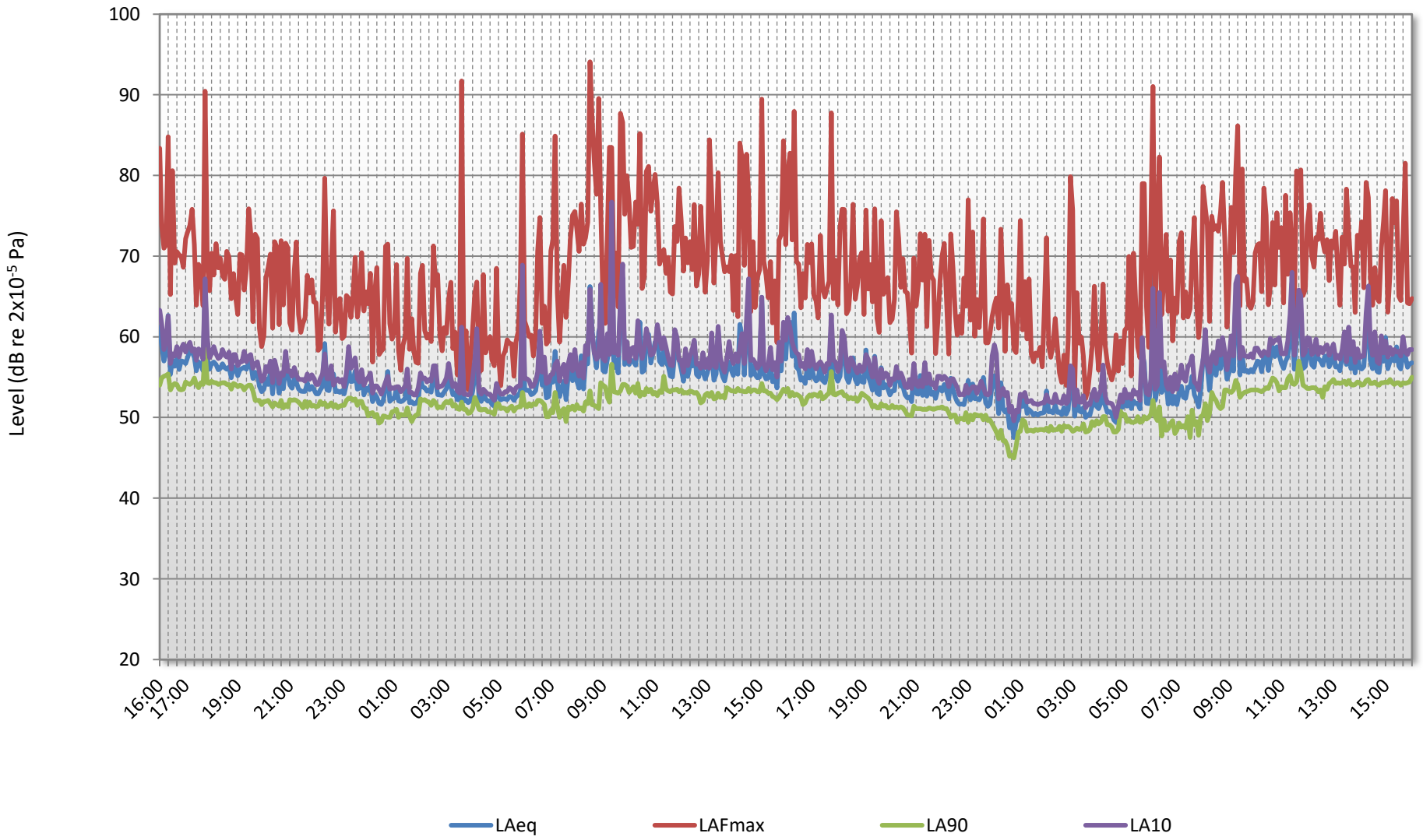


14055-NIA-01-SP1 Site plan indicating noise monitoring position and nearest noise sensitive receiver

Date: 16 April 2021

1-3 Stevenson Square, Manchester

Environmental Noise Time History
14 January 2019 to 16 January 2019



APPENDIX A

GLOSSARY OF ACOUSTIC TERMINOLOGY

dB(A)

The human ear is less sensitive to low (below 125Hz) and high (above 16kHz) frequency sounds. A sound level meter duplicates the ear's variable sensitivity to sound of different frequencies. This is achieved by building a filter into the instrument with a similar frequency response to that of the ear. This is called an A-weighting filter. Measurements of sound made with this filter are called A-weighted sound level measurements and the unit is dB(A).

L_{eq}

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level L_{eq}. The L_{eq} is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

L_{10}

This is the level exceeded for not more than 10% of the time. This parameter is often used as a "not to exceed" criterion for noise

L_{90}

This is the level exceeded for not more than 90% of the time. This parameter is often used as a descriptor of "background noise" for environmental impact studies.

L_{max}

This is the maximum sound pressure level that has been measured over a period.

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 10 such octave bands whose centre frequencies are defined in accordance with international standards.

Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than one alone and 10 sources produce a 10 dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Sound intensity is not perceived directly at the ear; rather it is transferred by the complex hearing mechanism to the brain where acoustic sensations can be interpreted as loudness. This makes hearing perception highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a reasonable guide to help explain increases or decreases in sound levels for many acoustic scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud
20	About 4 times as loud

Barriers

Outdoor barriers can be used to reduce environmental noises, such as traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and its construction.

Reverberation control

When sound falls on the surfaces of a room, part of its energy is absorbed and part is reflected back into the room. The amount of reflected sound defines the reverberation of a room, a characteristic that is critical for spaces of different uses as it can affect the quality of audio signals such as speech or music. Excess reverberation in a room can be controlled by the effective use of sound-absorbing treatment on the surfaces, such as fibrous ceiling boards, curtains and carpets.

APPENDIX B1

14055

1A Stevenson Square, Manchester

Acoustic Calculation used for Indoor to Outdoor Transmission:

$$SPL_{outdoor} = SPL_{indoor} - SRI_{composite} + 10\log_{10} S + 10\log\left(\frac{Q}{4\pi r^2}\right) - 6dB$$

Receiver 1: Identified Hotel Window
Source: Amplified Music Levels

	Frequency, Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Internal Sound Pressure Level									
Predicted Source Noise Level Within 1A Stevenson Square	79	75	76	81	78	74	68	56	82
Predicted Sound Reduction of façade (open door) (SRI)	-15	-15	-15	-15	-15	-15	-15	-15	
Correction for total area of building facade (S = 12m^2)	11	11	11	11	11	11	11	11	
Correction for directivity (Q) and distance (r) (Q=2, r = 15m)	-32	-32	-32	-32	-32	-32	-32	-32	
Correction for directivity	-6	-9	-9	-9	-9	-9	-9	-9	
Non reverberant correction	-6	-6	-6	-6	-6	-6	-6	-6	
Sound pressure level at receiver due to music play back	**31**	**24**	**25**	**30**	**27**	**23**	**17**	**4**	**31**

	Frequency, Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Internal Sound Pressure Level									
Predicted Source Noise Level Within The Mezzanine	79	75	76	81	78	74	68	56	82
Predicted Sound Reduction of façade (single glazing) (SRI)	-20	-19	-23	-30	-35	-27	-32	-35	
Correction for total area of building facade (S = 12m^2)	11	11	11	11	11	11	11	11	
Correction for directivity (Q) and distance (r) (Q=2, r = 15m)	-32	-32	-32	-32	-32	-32	-32	-32	
Non reverberant correction	-6	-6	-6	-6	-6	-6	-6	-6	
Sound pressure level at receiver due to music play back	**32**	**29**	**26**	**24**	**16**	**20**	**9**	**-6**	**26**

	Frequency, Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Internal Sound Pressure Level									
Predicted Source Noise Level Within 1 Spear Street	79	75	76	81	78	74	68	56	82
Predicted Sound Reduction of façade (open door) (SRI)	-15	-15	-15	-15	-15	-15	-15	-15	
Correction for total area of building facade (S = 12m^2)	11	11	11	11	11	11	11	11	
Correction for directivity (Q) and distance (r) (Q=4, r = 22m)	-32	-32	-32	-32	-32	-32	-32	-32	
Correction for directivity	-6	-9	-9	-9	-9	-9	-9	-9	
Non reverberant correction	-6	-6	-6	-6	-6	-6	-6	-6	
Sound pressure level at receiver due to music play back	**31**	**24**	**25**	**30**	**27**	**23**	**17**	**5**	**31**

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Internal Sound Pressure Level									
Predicted Source Noise Level Within 2 Spear Street	79	75	76	81	78	74	68	56	82
Predicted Sound Reduction of façade (open door) (SRI)	-15	-15	-15	-15	-15	-15	-15	-15	
Correction for total area of building facade (S = 12m^2)	11	11	11	11	11	11	11	11	
Correction for directivity (Q) and distance (r) (Q=4, r = 30m)	-35	-35	-35	-35	-35	-35	-35	-32	
Correction for directivity	-6	-9	-9	-9	-9	-9	-9	-9	
Non reverberant correction	-6	-6	-6	-6	-6	-6	-6	-6	
Sound pressure level at receiver due to music play back	**28**	**21**	**22**	**27**	**24**	**20**	**14**	**4**	**28**
Cumulative sound pressure level at receiver	**37**	**31**	**31**	**34**	**31**	**28**	**21**	**9**	**36**
Spectral background noise levels	**51**	**50**	**49**	**48**	**45**	**43**	**32**	**19**	**50**
Difference between noise emissions and background	**-14**	**-18**	**-18**	**-14**	**-14**	**-15**	**-11**	**-10**	**-14**

APPENDIX B2

14055

1A Stevenson Square, Manchester

Acoustic Calculation used for Room to Room Transmission:

$$SPL_2 = SPL_1 - R + 10\log_{10} S - 10\log_{10} A$$

APPENDIX B1: Offices Above Mezzanine Level

Source: Mezzanine Music Playback Levels

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Internal Measured Sound Pressure Level									
Predicted Music Source Noise Level Within Mezzanine	79	75	76	81	78	74	68	56	82
Predicted Sound Reduction of separating floor, dB (R)	-35	-38	-34	-41	-46	-50	-54	-52	
Correction for area of office floor (S = 30m^2)	15	15	15	15	15	15	15	15	
Correction for absorption area of receiver room	-16	-16	-16	-16	-16	-16	-16	-16	
Sound pressure level at receiver	**43**	**36**	**41**	**39**	**31**	**23**	**13**	**3**	**39**

Design Criterion	**35-40**