APPENDIX 7.

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SOUND INSULATION AND

BACKGROUND NOISE LEVELS REPORT

MARTEC ENVIRONMENTAL CONSULTANTS LTD

ANC REGISTERED TESTERS NO.134

Report Date:	25th October 2023
Revised:	7th November 2023 [NR & Clarifications]
Ref:	20231107 8258 Middlesborough PEL-2.docx
Site Visit by:	M A Kenyon
Site Visit date:	24th October 2023

Prepared by: M A Kenyon MSc BSc MIOA

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ANC ACOUSTICS & NOISE CONSULTANTS

CONTENTS

1.0 INTRODUCTION

Martec Environmental Consultants Ltd were instructed to carry out sound insulation tests at 58 Albert Road, Middlesborough; the purpose of the tests was to determine whether the tested constructions met the sound insulation performance standards detailed in Appendix H of BS8233:2014, and to make recommendations for improvements where appropriate.

Martec were also instructed to carry out background noise monitoring to enable a suitable planning condition to be applied to any external plant installed as part of the development.

Reference is also made to measurements made by the author of sound insulation elsewhere between the upper floors of the same building for Building Regulations Purposes [Martec Ref.8258 SI Report v34] which is understood have already been submitted to the local authority as part of the current planning application.

This request arose as a result of an application to convert the ground floor retail space from a cafe to licensed premises. The client has provided the following summary of the Environmental Health Department's request for a noise assessment:

"Provide a noise assessment and scheme of sound insulation to demonstrate that the commercial use is viable within this location. The noise assessment should take account of noise from music played within the venue as well as noise from plant/equipment (air conditioning units/odour extraction equipment). The noise assessment should be in compliance with BS8233:2014 and BS4142:2014 as well as considering NR

curves for noise from low frequency noise. In addition, the assessment should consider the most effective sound insulation scheme in line with the above standards and Approved Document E. Mitigation measures will include sound insulation, potentially the need for a noise limiter and/or limiting the operational hours. A noise management plan should also be submitted to demonstrate how noise escape from the premises will be limited from customer noise e.g. use of the doors, customers congregating outside the premises."

This report describes the sound insulation tests and external noise measurements made by Mel Kenyon on Tuesday 24th October 2023, the equipment used, the results obtained, and draws conclusions as to the performance of the structure and proposes a suitable noise condition for external plant.

Appendix 1 is a description of acoustic terms, Appendix 2 contains the author's qualifications and experience and the detailed sound insulation graphs appear at the rear of the report in Appendix 3.

2.0 BACKGROUND TO ASSESSMENT

The development is described in greater detail as part of the application, but in brief, the ground floor of the premises is a former cafe with two residential flats on the first floor [See Figures 1 and 2]; the adjacent shop premises also appear to have flats above.

We are instructed as follows:

1. Music would be played at background/ambient levels only.
2. There would be no live music;
3. Operational hours would be until 1am on Friday and Saturday's only.
4. The beer cellar and its attendant plant are located in the basement of the building; therefore, only the kitchen extract is located externally and consequently, the latest that any external plant would be running would be 9pm.

The construction of the separating floors in the residential sections of the building was described as *"concrete with a timber overboarding and a deep ceiling void."* Currently there did not appear to be any 'ceiling' in the ground floor premises with the underside of the concrete slab visible in many locations through an 'open' feature ceiling.

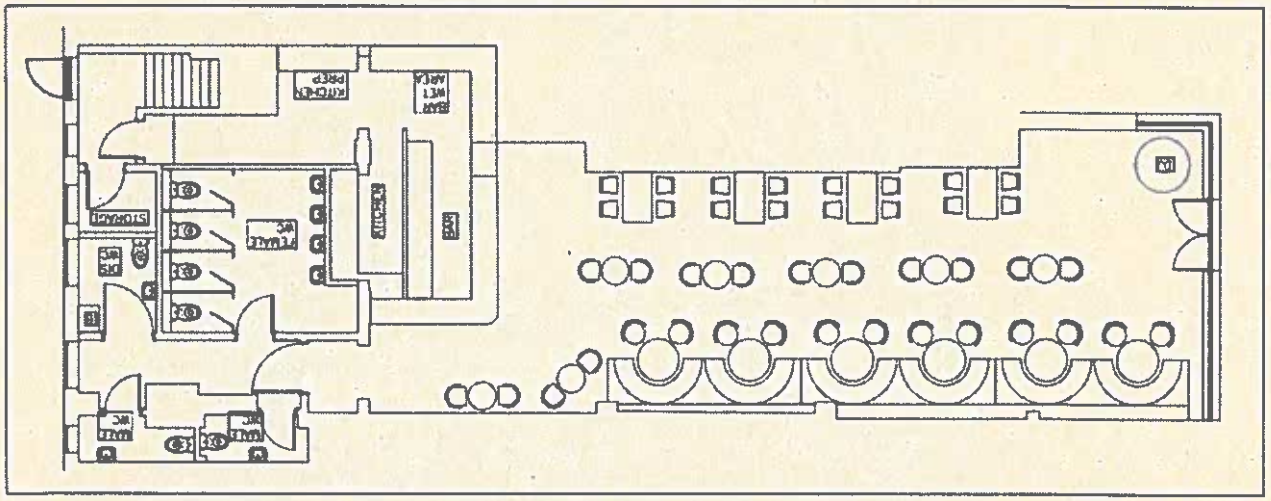


Figure 1: Ground Floor – Restaurant / Cocktail Bar [Front of Bldg to right]

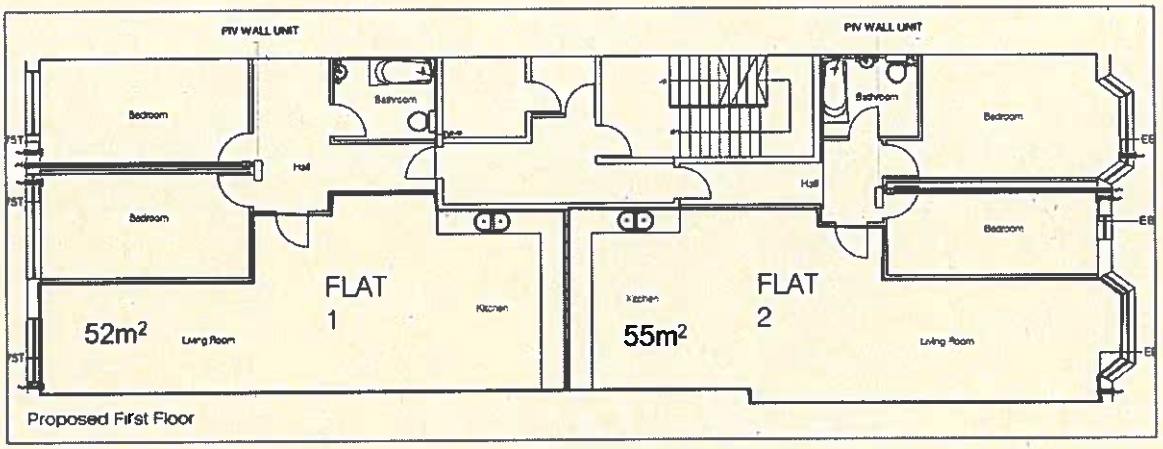


Figure 2: First Floor [Flat numbers transposed - Front of Bldg to right]

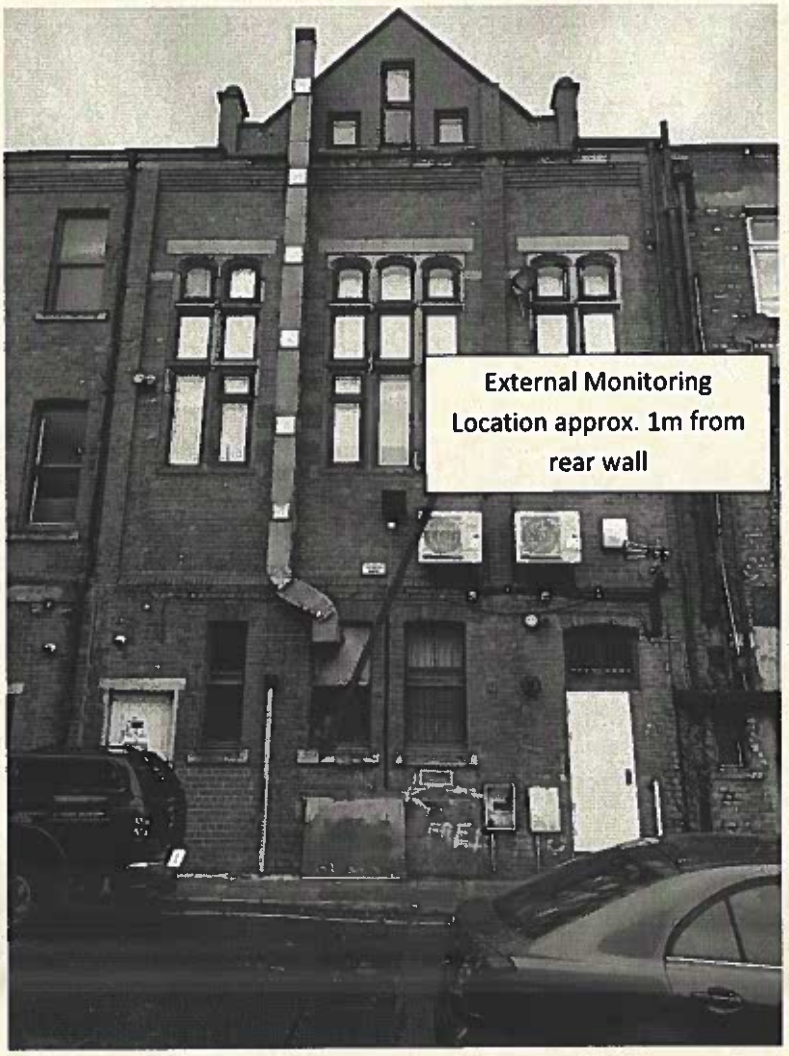


Figure 3: Photograph of Rear of Premises

It is understood that the new kitchen extract plant connects to the former flue located at the rear of the premises; accordingly, monitoring was conducted at the location is shown in Figure 3 above, i.e. directly beneath the kitchen extract.

Figure 4 below shows a view of the externally mounted plant opposite the rear of the premises; the operation of these units appeared to be associated with the beer cellar of the 'Sky Sports Bar' opposite.

Figure 4: External Plant of 'Sky Sports Bar'

3.0 CRITERIA

3.1 British Standard 8233

BS8233:2014 is entitled "Guidance on sound insulation and noise reduction for buildings" and Annex H contains "Examples of design criteria adopted by hotel groups".

For airborne sound insulation, Annex H sets out criteria in terms of a single number value either in terms of $D_{nT,w}$ or in terms of $D_{nT,w}+C_{tr}$; these are forms of weighted averages of performance across the range of frequencies. C_{tr} is a spectrum adaptation term designed to give more weight to the performance of separating structures at low frequencies.

In Annex H of BS.8233:2014 the nearest category to this case is a recommended sound insulation of 60 dB $D_{nT,w}$ between a bedroom and a restaurant/bar within the same hotel.

In Annex H, there is also the criteria for "Bedroom - Other tenancies" of 65 dB $D_{nT,w}$. The Association of Noise Consultants commented on Annex H of BS8233:2014; in fairness they didn't like most of the recommendations in Annex H; they stated:

"The most obvious examples of flaws are the criteria for bedroom to other tenancies (which could vary from a library to a nightclub) or plant room (which could vary from a tank room to a diesel generator) or bar (which could vary from a small boutique bar or to a large one with loud music or raucous groups watching football)."

Given the proposed operational hours, the proposed character of the bar/restaurant, and comments of the ANC, it is considered that the "Bedroom - Restaurant/bar" criterion of 60 dB $D_{nT,w}$ would apply.

Annex H does not contain suggested sound insulation levels between a bar and a living room, but given the less sensitive nature of living rooms, it is considered that is the same sound insulation criterion were applied then adequate protection would be ensured.

3.2 Plant Noise

It is common for local authorities to require plant noise not to exceed pre-existing background noise levels in the area.

4.0 MEASUREMENTS

4.1 Sound Insulation Tests

Measurements were made between the ground floor commercial space at the front of the building, and the smaller bedroom in the flat directly above this location, i.e. also at the front of the building a wholly and directly over the 'patron space' in the ground floor premises.

The airborne sound insulation of the separating structure was tested in full accordance with the methodology of ISO 140:1998 Part 4 and single number values for $D_{nT,w}$ & $D_{nT,w}+C_{tr}$ were calculated using the methodology of ISO 717: 1996 part 1.

The source level in the commercial space was determined according to the following method. The sound sources were placed on stands with the second source position was at least 1.4m from the first, with neither speaker facing towards the partition tested; the minimum distance from each speaker to any room boundary was at least 500mm and the minimum difference in those distances was 100mm. The speakers operated simultaneously using separate, uncorrelated, pink noise sources.

A preliminary sweep measurement was made over the course of at least 30 seconds and any differences between adjacent 1/3 octaves, greater than 6 dB, were eliminated by a combination of adjusting the source settings, moving the loudspeakers or by moving diffusers (or furniture). Subsequently 10 second measurements were made at least five microphone positions for both the source and receiver rooms (received levels and background noise measurements).

No microphone position was closer than 0.5m from the room boundaries and each was at least 0.7m from other microphone positions.

4.1.1 Instrumentation

Details of the measuring instrumentation are shown in Table 1 below:

Model	Instrument	Serial No.	Lab Cal Certificate	Re-Calibration Due
E Svan 957	Sound Level Meter	23202	1504880-3	20/03/2025
Svan SV12L	Preamp	33542	1504880-3	20/03/2025
MTG MK255	Microphone	15795	1504880-3	20/03/2025
B&K 4231	Calibrator	2084928	1504880-1	20/03/2025
Behringher Eurolive B115	Speakers	S181100088AEA	n/a	n/a
Stereo recording of pink noise played on in-built MP3 player			n/a	n/a

Table 1: Instrumentation Used On-Site

4.1.2 Reverberation Time Measurements

The reverberation times were determined by using the sound level meter [meter 'E' in Table 1] and its internal software or external PC software. The average value of T20 for five starting pistol impulses at five different source and receiver positions was used. Reverberation time calculations were made using the "reverse-Schroeder integration method". The approved methodology requires six impulses to be measured; however, only five impulses were suitable for analysis. It is not considered that the overall results or conclusions to the report have been significantly affected.

4.2 Evening Background Noise Measurements

The external background noise measurements were made at the rear of the premises, after dark, in a poorly lite alley off the city centre; there was nowhere where the equipment could securely be left unattended; accordingly hand-held measurements were made, approximately 1m from the rear of the building at the location shown in Figure 3 above.

The measurements approximated to façade levels and were made using the sound level meter and calibrator detailed in Table 1 above.

Initially sample measurements were made for 1 minute every 10 minutes or so; however, it became clear that the LA90 levels varied very significantly depending on the operation of one of the units shown in Figure 2 operated; accordingly, it was decided that a longer terms

measurement would need to be made and this occurred from approximately 19:22 to 19:52 hours.

4.3 People [Source] Noise Levels

4.3.1 Defra

Defra has funded research into the noise impact from pubs and clubs; Phase I of the study ["Noise from Pubs and Clubs – Phase I" Contract No. NANR 92] was a report on likely source noise levels and assessment methodologies at the time [October 2005]. At Section 2.1.1.4 it is stated

"...Noise levels measured in bars and restaurants during quiet periods showed noise levels of 65-70 dB LAeq. Noise levels of up to 88 dB LAeq were measured during busy periods in bars not playing music, i.e. just customer noise."

When predicting noise impact through building structures, it is necessary to know, not only the overall level of noise, but also the spectrum shape of the noise. Unfortunately, the Defra research did not provide any details of the spectrum of 'customer noise'; therefore, mention of McDonalds and KFC below is not an error – in order to predict noise levels upstairs, this report requires the use of a source spectrum for 'people noise' downstairs and the measurements of 'people noise' were made made in McDonalds and KFC.

4.3.2 Martec People [Source] Measurements

In connection with another matter, Martec made measurements at two restaurants of patron noise and reported as follows:

" Measurements were made at two similar McDonalds Restaurants which it is considered are a similar size to the proposed KFC at Southport. In both cases, measurements were made as close to the centre of the restaurant area as could be achieved...

The Ormskirk MacDonald's was visited on Friday 1st February 2002 during mid-afternoon; it is a town centre restaurant and at the time of the measurements was mostly frequented by clients from late teens upwards and was about one-quarter full. The third-octave results appear in Figure 1; the 1-hour LAeq was 67.5 dBA, which would lead to an estimated noise level of maximum capacity of 73.5 dBA [67.5 + 6].

The Aintree MacDonald's was visited on Sunday 3rd February 2002 it is a drive through facility on a trading estate, but its restaurant area appeared to be of a similar size. The facility was almost full, with almost all seats occupied; the clientele ranged from infant school children involved in a children's party in a separate room to many adults. The third-octave results appear in Figure 1 [Not included]*; the 15-minute LAeq was 74.8 dBA. The overall level and spectrum shape agree well with the results from the Ormskirk branch."*

For the purposes of this assessment, a figure of 88 dB LAeq from the Defra research, and the "Aintree" spectrum has been assumed in the predictions of noise in the first-floor dwelling; these predictions appear in Section 6.2 below.

5.0 RESULTS

5.1 Sound Insulation Test Results

The detailed results appear in the Chart towards the rear of the report; the summary results are within Table 2 below:

Table 2: Airborne Sound Insulation Results [dB] - 24/10/2023						Criterion	Results
ANC Test	Source	Vol (m3)	Receiver	Vol (m3)	Element	$D_{nT,w}$ (dB)	$D_{nT,w}$ (dB)
Not Applicable	Ground Floor Commercial	>382	1st Floor Flat 1 - Bed 2	29	Floor	≥60	49

5.2 Background Noise Measurements

The background noise readings are shown in Table 2 below:

End Date & time	Duration	LAmax,F	LAmin	LAeq	LA01	LA10	LA50	LA90
24/10/2023 18:22:36	00:01:00	64.2	60.2	61.7	63.7	62.6	61.6	60.8
24/10/2023 18:34:30	00:01:00	60.4	52.8	55.7	58.9	56.9	55.5	54
24/10/2023 18:46:26	00:01:00	58	53.4	55.7	57.9	56.9	55.6	54.3
24/10/2023 18:58:04	00:01:00	61.1	51.5	55.1	60.7	56.9	54.4	53
24/10/2023 19:10:02	00:01:00	60.8	53.4	56.3	60.4	58	55.9	54.2
24/10/2023 19:20:38	00:01:00	70.3	60.2	62.4	70	63.9	61.6	60.4
24/10/2023 19:52:08	00:31:00	77.8	49.7	59.3	64.4	61.8	56.8	53
24/10/2023 19:53:47	00:01:35	62.2	53.8	60.7	62.6	61.8	60.9	56.5
24/10/2023 19:58:54	00:05:04	73.3	51.6	55.8	64.6	56.7	54.3	52.8

Table 2: Background Noise Levels [dBA facade]

6.0 DISCUSSION OF RESULTS

6.1 British Standard 8233:2014

From Table 1 in Section 5.1 above, it can be seen that the measured sound between the ground floor premises and the bedroom above does not currently meet the Annex H recommended level of 60 dB $D_{nT,w}$; therefore, additional works are required to improve the sound insulation.

As discussed above, the author previously made sound insulation measurements on the upper floors of the building and the results shown in Table 4 below [and in Charts at the rear of the report] were obtained:

Table 3: Airborne Sound Insulation Results [dB] - 28/03/2018

ANC Test	Source	Vol (m3)	Receiver	Vol (m3)	Element	$D_{nT,w}$
1345458602	FF Front Flat 2 [1] Kit/Liv	132	2F Front Flat 4 [3] Kit/Liv	113	Floor	67
1345458604	FF Rear Flat 1 [2] Kit/Liv	125	2F Rear Flat 3 [4] Kit/Liv	86	Floor	60

The above results did meet the target value of Annex H, and the main constructional difference between the floor/ceiling [ground-first] as compared with the floor/ceilings above is the absence of any form of ceiling at ground floor level. It seems probable that the concrete base floor will be the same, consequently the installation of a similar ceiling for the ground floor should ensure the same performance levels.

6.2 Predicted Bedroom Noise Levels

The results of the sound insulation tests on the existing floor [assuming as above that a similar ceiling is installed and using the uncorrected difference in levels between first and second floors at the rear of the building] can be combined with the derived source noise levels and

spectrum shape in Section 4.2 above, to predict the resultant noise levels in the upstairs bedroom as shown in Table 4 below.

Condition	Third Octave Band Centre Frequency [Hz]																dBA	NR
	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150		
Aintree Spectrum	69.5	67.5	68	68	63	62	62	64.5	67	67	65	65	65	64	64.5	69	78	
Adjusted to [dBA] & Level	79	77	78	78	73	72	72	74	77	77	75	75	75	74	74	79	88	
Measured 'D' Kit/Liv [2-4]	43	43	48	50	49	51	53	54	57	59	63	66	68	71	74	77		
Resultant Internal Level	36	34	30	27	23	21	18	20	20	17	12	9	7	3	1	2	27	20

Table 4: First Floor Rear Bedroom Noise Level – Existing Sound Insulation [dB LAeq]

Using the measured levels of existing sound insulation , and the measurements of restaurant noise spectrum and the level of a "Busy non-music" bar from the Defra Study, the predicted noise level in the first-floor bedroom would be 27 dB LAeq or NR 20.

6.3 Background Noise Levels – Plant Noise

It can be seen that most of the measurements indicated that the background level was 53-54 LA90 at the rear façade. Higher levels of 61 LA90 were encountered associated with the sporadic operation of plant associated with the Sky Sports Bar.

On a precautionary basis it is considered that the lowest measured value during the monitoring should be used to represent the evening background noise levels [52.8 LA90].

7.0 CONCLUSIONS AND RECOMMENDATIONS

The current levels of sound insulation between the ground floor and bedroom do not meet the criteria of Annex H of BS8233:2014, and accordingly additional works are required; as discussed above from previous measurements in this building, if the same structure [mainly the

'missing' ceiling] can be installed on the ground floor as elsewhere, then the sound insulation performance should meet the criteria of Annex H of BS8233.

On a precautionary basis:

- The layers of the ceiling 'sandwich' a layer of "Green Glue" or "Quiet Glue Pro" **and no others** following the manufacturer's instructions [if the ceiling structure elsewhere only has one plasterboard layer, then it will be necessary to install an additional layer].
- If there is no mineral wool absorption in the ceiling elsewhere, Insert a layer of mineral wool in the ceiling void - minimum thickness 100mm, minimum density 10kg/m^3.
- Any decorative ceiling, such as currently exists, will need to be located below the acoustic ceiling, without prejudicing the performance of the acoustic ceiling.
- Should for any reason the above measures not improve the sound insulation sufficiently, then it would be possible to add a layer of Acoustilay15 [or similar and approved] to the floor above, but this would require access to the apartments above; however, it is understood that the both the ground and first floors of the building are in common ownership.

It is considered that with suitably worded conditions, the noise impact should not bar the grant of planning consent for the ground floor restaurant/cocktail bar.

Regarding any externally mounted plant, which we understand would only operate until 9pm, this should be designed to achieve a level no higher than 53 dB LAeq,1hr [façade], i.e. existing evening background noise levels 1m outside the windows of the nearest habitable rooms.

APPENDIX 1
EXPLANATION OF ACOUSTIC TERMS

The **dB** or the decibel, is the unit of noise. The number of decibels or the level, is measured using a sound level meter. It is common for the sound level meter to filter or 'weight' the incoming sound so as to mimic the frequency response of the human ear. Such measurements are designated dB(A) or **dBA**.

A doubling of the sound is perceived, by most people, when the level has increased by 10 dB(A). The least discernible difference is 2 dB(A). Thus, most people cannot distinguish between, say 30 and 31 dB(A).

If a noise varies over time then the equivalent continuous level, or **LAeq**, is the notional constant level of noise which would contain the same amount of acoustic energy as the time varying noise.

T_{mf} is a measure of the average reverberation time (echoiness) in mid frequencies for a space. The larger (longer) the Tmf the more echoy or "live" the space.

The R_w is a laboratory measure of the intrinsic airborne sound insulation capabilities of a structure. The $D_{nT,w}$ is a measurement (or prediction) of the overall airborne sound insulation in situ and as such will depend flanking conditions, the proportion of the separating structure's area to the receiving room volume, and well as the maximum permissible reverberation time of the receiver room. The larger the R_w or $D_{nT,w}$ the better the sound insulation.

L_{nw} and $L_{nT,w}$ are the corresponding terms to Rw and DnT,w respectively for impact sound (footfalls) measurements and values, but in this case the smaller the Lnw and LnT,w the better the impact sound insulation.

APPENDIX 2
QUALIFICATIONS AND EXPERIENCE OF M.A. KENYON

My full name is Melville Alexander Kenyon. I am the principal of the firm of Martec Environmental Consultants Ltd, a consultancy company that specialises in environmental noise assessment and control. I graduated in 1982 with a Bachelor's degree in Engineering and subsequently a Master's degree in Environmental Acoustics. I have been a corporate member of the professional body for noise and vibration specialists, the Institute of Acoustics, since 1988, and have sat on the British Standards Committee dealing with noise in buildings [BS.8233:1999].

I have lectured at Liverpool John Moores University on the Diploma of Acoustics course and at Manchester Metropolitan University on their Environmental Health degree course.

Martec was formed in the 1970's and joined The Association of Noise Consultants in 1996 becoming accredited for sound insulation testing in 2005 [ANC Accredited Testers No.134].

Since its formation, Martec has advised many groups of both residents and developers about the problems of noise and vibration in the environment.

APPENDIX 3
SOUND INSULATION TESTS

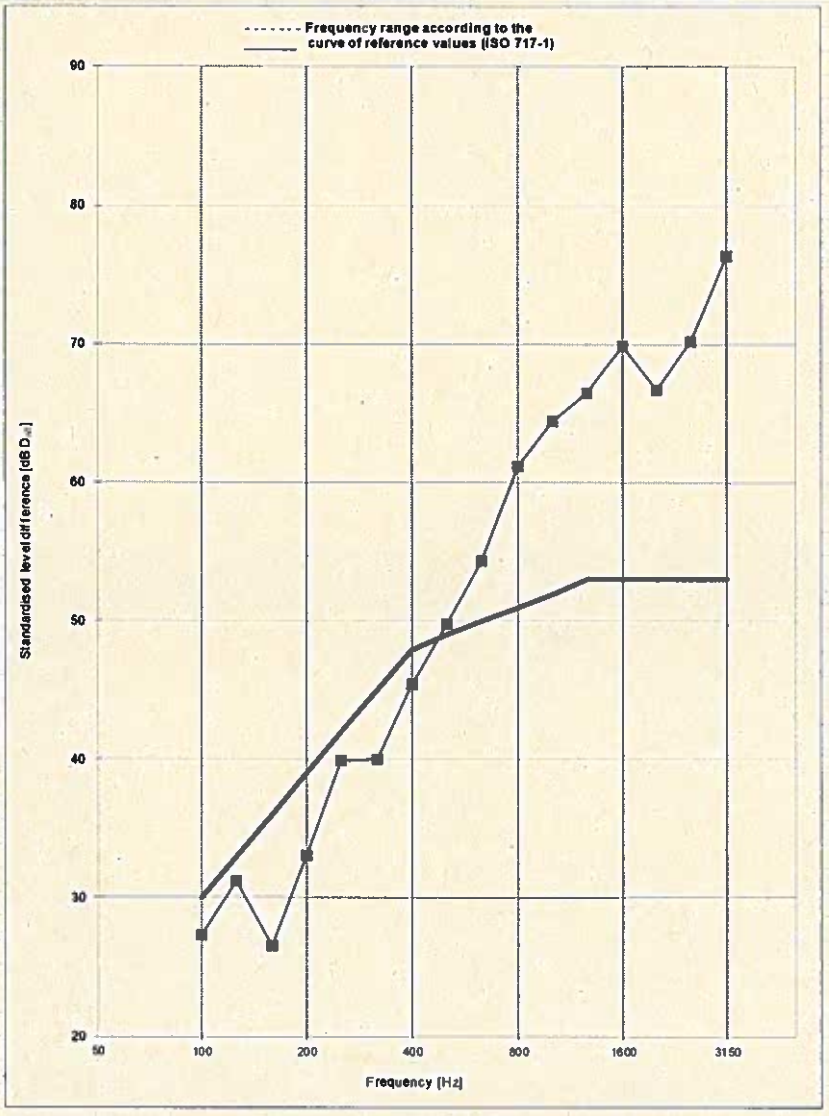
A3.1 2023 Test

ISO 140-4:Part 4 - Standardised level Difference
Field measurements of airborne sound insulation between rooms

Client:	Amy Cowan	Test Date	24/10/2023
Type	Floor	Version	2.51
Site	Tigerlvy, 58 Albert Road Middlesborough TS1 2TN	Source Rm	Ground Floor Commercial
Cnstrn	Concrete Slab	Receiver Rm	1st Floor Flat 1 - Bed 2
Room vols [m3]			
Source	>382		
Rec	29.3		

Freq Hz	D_{nT} [1/3 oct] dB
50	--
63	--
80	--
100	27.3
125	31.2
160	26.6
200	33.1
250	39.9
315	40.0
400	45.4
500	49.8
630	54.4
800	61.2
1000	≥ 64.4
1250	≥ 66.5
1600	≥ 69.9
2000	≥ 66.7
2500	≥ 70.2
3150	≥ 76.4
4000	--
5000	--

Background noise
Traffic and Voices



Rating According to ISO 717-1

$D_{nT,w}$ 49 $D_{nT,w} + C_w$ 41 dB

Evaluation based on field measurement results obtained in one-third octave bands by an engineering method

Test No.	8258 -A1	Test Institute: Martec Environmental Consultants Ltd	
ANC Test	Not Applicable		
Date of Report	25-Oct-23	Signature:	M.A.Cowan

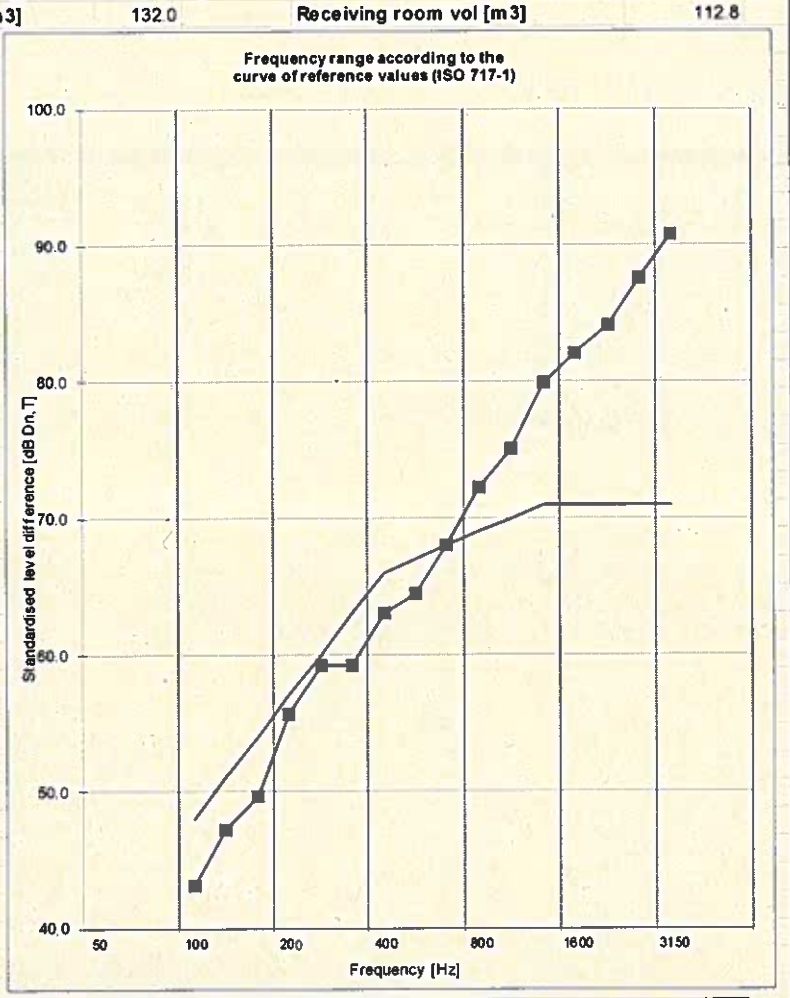
A3.2 2018 Tests

ISO 140-4:Part 4 - Standardised level Difference
Field measurements of airborne sound insulation between rooms

Client:			
MES Building Solutions		**Date of Test:**	28/03/2018
Desc:			
Site	58 Albert Rd, Middlesborough TS1 1QD		
Source	FF Front Flat 2 [1] Kit/Liv	**Version**	2.08
Receiver	2F Front Flat 4 [3] Kit/Liv		
Type	Floor		
Cnstrn	Timber flooring, Concrete Base, Deep floor void		
Source room vol [m3]	132.0	**Receiving room vol [m3]**	112.8

Freq-Hz	D_{nT} [1/3 oct] dB
50	0.0
63	0.0
80	0.0
100	43.1
125	47.2
160	49.7
200	55.7
250	59.2
315	59.2
400	63.0
500	64.5
630	68.0
800	72.2
1000	75.1
1250	≥ 79.9
1600	≥ 82.1
2000	≥ 84.1
2500	≥ 87.5
3150	≥ 90.8
4000	0.0
5000	0.0

Background noise
Traffic-C



Rating According to ISO 717-1

$D_{nT,w}$ (C ; C_{tr}) ≥ 67 (-1 ; -7) dB $D_{nT,w} + C_{tr}$ ≥ 60 dB

Test No.	8258 -A2	Test Institute: Martec Environmental Consultants Ltd	
ANC Test	1345458602		
Date of Report	29-Mar-18	**Signature:**	M.A. Kenney

ISO 140-4:Part 4 - Standardised level Difference
Field measurements of airborne sound insulation between rooms

Client:
MES Building Solutions

Date of Test: 28/03/2018

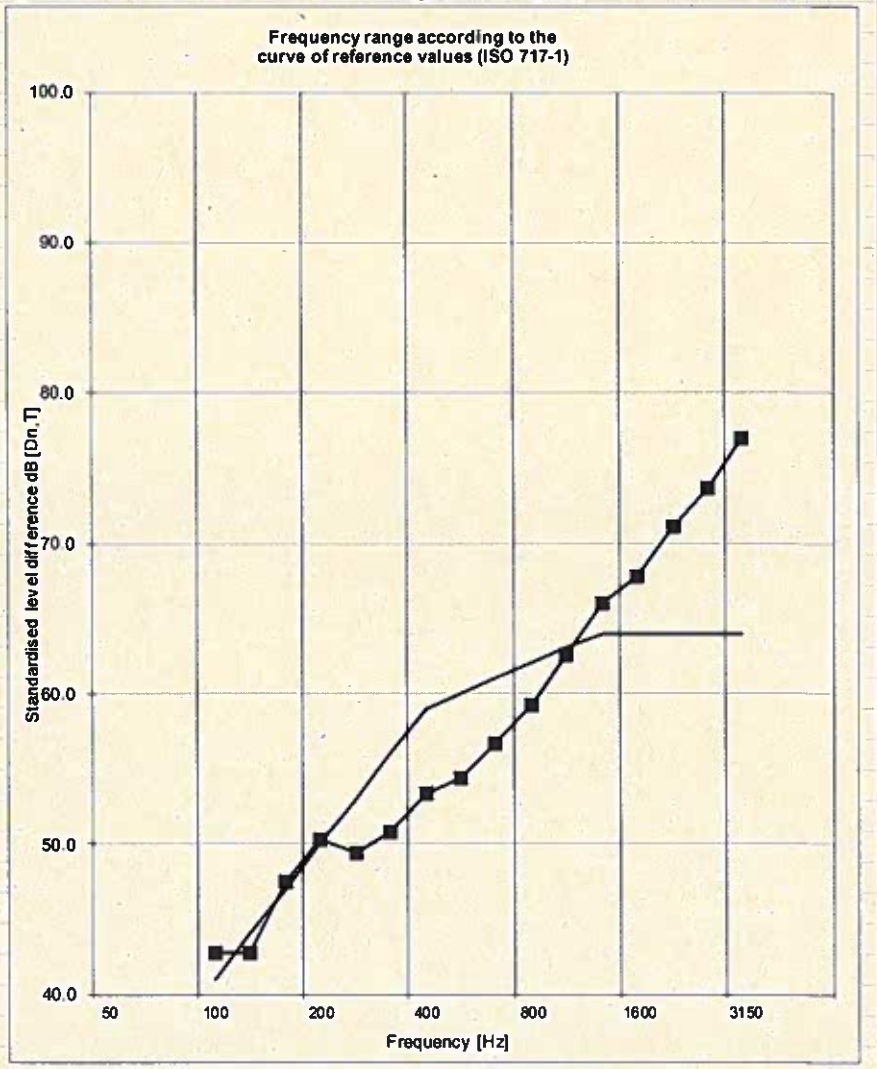
Desc:
Site 58 Albert Rd, Middlesborough TS1 1QD
Source FF Rear Flat 1 [2] Kit/Liv
Receiver 2F Rear Flat 3 [4] Kit/Liv
Type Floor
Cnstrn Timber flooring, Concrete Base, Deep floor void

Version 2.08

Source room vol [m3] 124.8 **Receiving room vol [m3]** 86.4

Freq Hz	D_{nT} [1/3 oct] dB
50	0.0
63	0.0
80	0.0
100	42.7
125	42.7
160	47.5
200	50.3
250	49.4
315	50.8
400	53.3
500	54.4
630	56.7
800	59.2
1000	62.5
1250	66.0
1600	67.8
2000	71.1
2500	73.6
3150	76.9
4000	0.0
5000	0.0

Background noise
0



Rating According to ISO 717-1
$D_{nT,w}(C;C_{tr})$ = 60 (-1 ; -5) dB $D_{nT,w}+C_{tr}$ = 55 dB

Test No. 8258 -A4
ANC Test 1345458604
Date of Report 29-Mar-18

Test Institute: Martec Environmental Consultants Ltd
Signature: M.A.Kaaag