SOUND ANALYSIS

Consultants in Noise and Vibration

Acoustic Consultancy Report
4370-FAC-ATN-1

Report on: Debenhams refurbishment

Client: Genesis Developments

22nd October 2021

Façade Assessment

Report Author

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i) Summary of Brief

A refurbishment is being proposed at the Debenhams Site, 26 Stonehills, Welwyn Garden City

A noise survey has been undertaken and the data assessed, to determine the sites suitability to accommodate residential development and the likely impact of existing noise levels on any future residents.

The proposed building envelope has been reviewed to calculate the resultant internal noise level compared to the requirements set out in BS8233:2014.

This report concludes that with the current construction, internal noise levels can be achieved that will generally comply with the BS8233:2014 design criteria,

ii) Document History

Issue	Date	Issue Details	Issued By	Surveyed By
1	22nd October 2021	Initial Issue	ATN	KC

1. Introduction

1 A refurbishment is being proposed at the Debenhams Site, 26 Stonehills, Welwyn Garden City

A noise survey has been undertaken and the data assessed to determine the building's suitability to accommodate residential development and the likely impact of existing noise levels on any future residents.

The external noise levels have been reviewed to carry out an appraisal of current internal noise levels, and the appraisal of the results compared to the noise level requirements set out in BS8233:2014.

2. Noise Survey

a) Site Description

The general site layout and measurement position are shown in Appendix A.

b) Local Noise Climate

The predominant noise sources were local road traffic. and intermittent noise from workings on the site.

c) Measurements and Instrumentation

The noise monitoring took place from 11.28hrs on Thursday 14th October, to 9:33 hrs on Saturday 5th October 2021

The following instrumentation and equipment was employed during the acoustic survey:

Sound pressure level measurements were obtained using the following instrumentation complying with the Class 1 specification of BS EN 61672:20

- Svantek 977 Sound Level Meter S/N: 12232
- Svantek pre-amplifier SV12L S/N: 13028 with GRAS microphone capsule 40AE S/N: 20859
- Svantek 949 Sound Level Meter S/N:36121
- Svantek pre-amplifier SV12L S/N: 33636 with GRAS microphone capsule 40AE S/N: 58002

Calibration checks were made prior to and after completion of measurements using a Svantek SV30A calibrator, S/N: 10801 complying with Class 1 specification of BS EN 60942:2003, calibration level 94.0 dB @ 1.0 kHz. All acoustic instrumentation carried current manufacturer's certificates of conformance.

Measurements were taken externally on the front façade being the selected secure position for the equipment, and internally.

The measurement periods were considered sufficient to establish the highest noise levels impinging upon the residential façade.

Weather during the survey is shown in Appendix C.

3. Facade External and Internal Measurement Results

The maximum noise levels predicted to impinge upon the façade during the day and night time period are shown in the following table. Full measurement data can be found in Appendix B.

Table 1: Maximum measured external façade noise levels, dB re 2x10^{-5} Pa

Position MP 1	Indices	Octave Band Centre Frequency (Hz)								dB(A)
		63	125	250	500	1k	2k	4k	8k	
Maximum day time sound pressure level	$L_{Aeq,16hr}$	76	57	53	53	53	49	43	38	58
Maximum night time sound pressure level	$L_{Aeq,8hr}$	53	45	45	40	40	37	35	32	45

Table 2: Maximum measured internal noise levels, dB re 2x10^{-5} Pa

Position MP 1	Indices	Octave Band Centre Frequency (Hz)								dB(A)
		63	125	250	500	1k	2k	4k	8k	
Maximum day time sound pressure level	$L_{Aeq,16hr}$	56	37	35	33	33	29	23	18	38
	$L_{Aeq,8hr}$	22	23	21	21	22	18	14	8	25

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3.1 Indoor ambient noise levels

Guidance is provided in BS8233:2014, this is shown in the following table.

In general, for steady external noise sources, it is desirable that the internal ambient noise level does not exceed the guideline values in Table 4.

Table 4 **Indoor ambient noise levels for dwellings**

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	—
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	—
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

4.

The measured internal noise levels Day/Night – 38/25 dB(A), are compliant with the BS8233:2014 Table shown above.

However, this data is taken with windows closed, with windows open, and using the WHO Guideline of a loss of 15 dB(A) with window open, the internal Day/Night Noise levels would be 43/30 dB(A), which would be marginally non-compliant.in the daytime by 8dB

Consequently, if the BS8233 recommended levels of Day/Night 35/30 dB(A) are to be achieved, ventilation will need to be provided, either by a mechanical ventilation system, or by the installation of Tricklevent units havng a performance rating of Dn,e,w 35 Open, combined with intermittent extract ventilation provided by the normal kitchen and bathroom extract fans.

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5.0 Conclusion

An assessment has been undertaken in order to establish the required acoustic performance of the façade of the proposed building, in order to provide acceptable internal living conditions.

The internal ambient noise level target levels have been taken from BS8233:2014 'Sound insulation and noise reduction for buildings – Code of practice.'

The measured Internal Noise Levels are Daytime, 38/dB(A), and Night Time 25dB(A),
These noise levels are compliant with the recommendations of BS8233:2014.

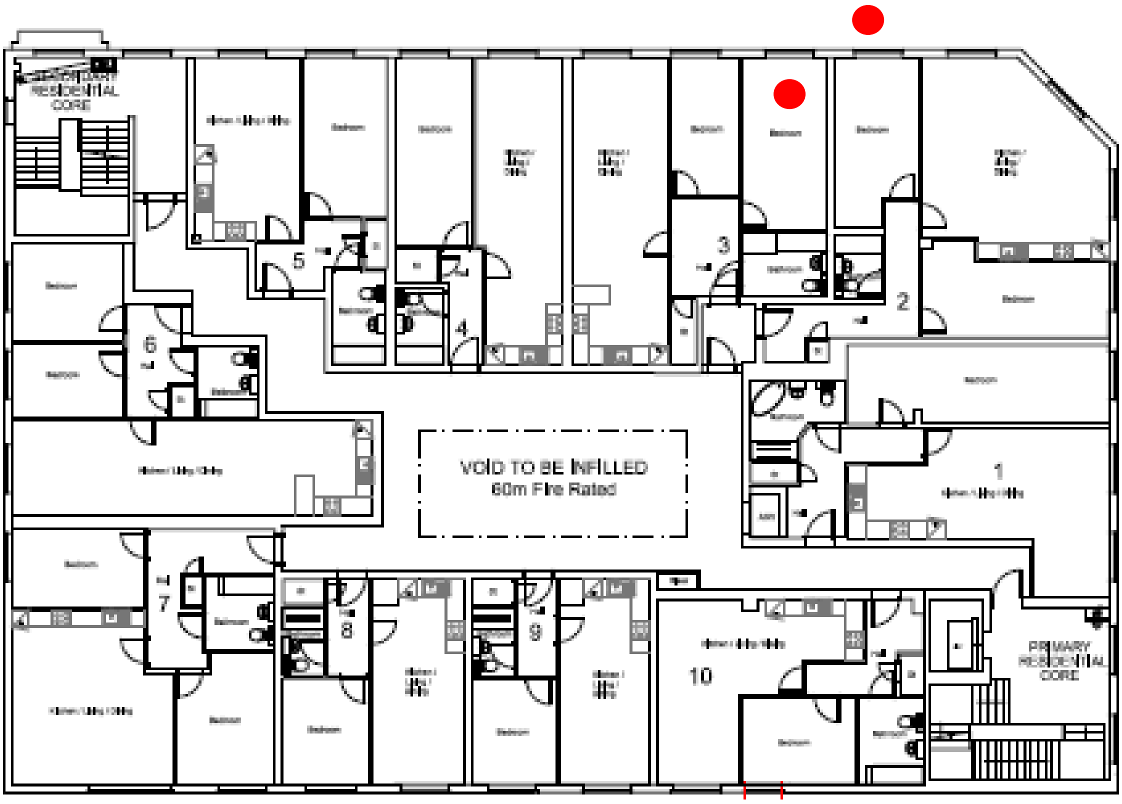
The appraisal of the façade structure is made with windows closed, and therefore ventilation will need to be provided by the installation of. high performance "Tricklevent" units for ventilation of the rooms, which should be rated at Dn,e,w 40 Open, utilising any existing ventilation systems for bathrooms, and kitchens.

It is important to note our Field Technician's comments on the survey conditions:-

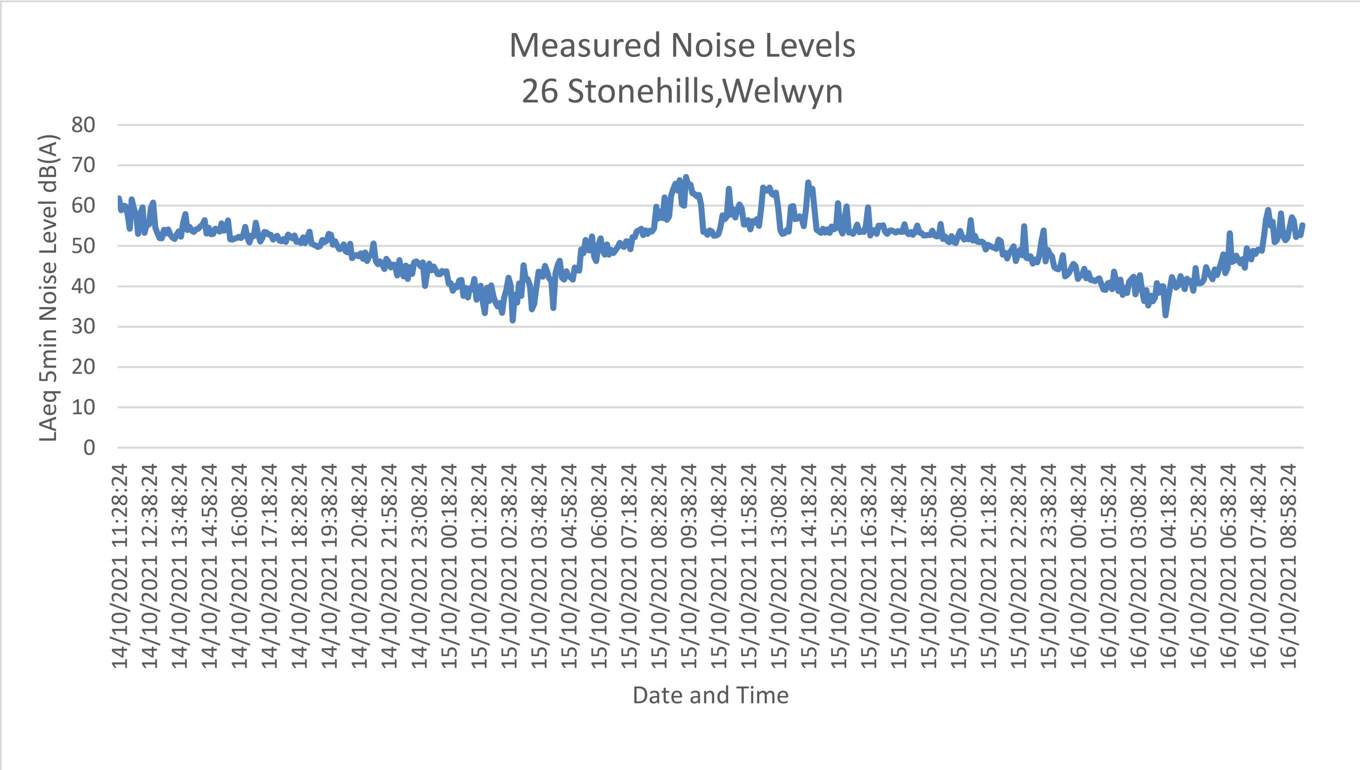
During the survey the workforce on site were in the process of removing the internal elevator system. I was informed that the site is all closed off at 17.00hrs on a daily basis. On returning the site was once again operational. The local council was also working on the external paving directly outside the main facade where the external meter was located.

Given these conditions, future normal noise levels could be expected to reduce.

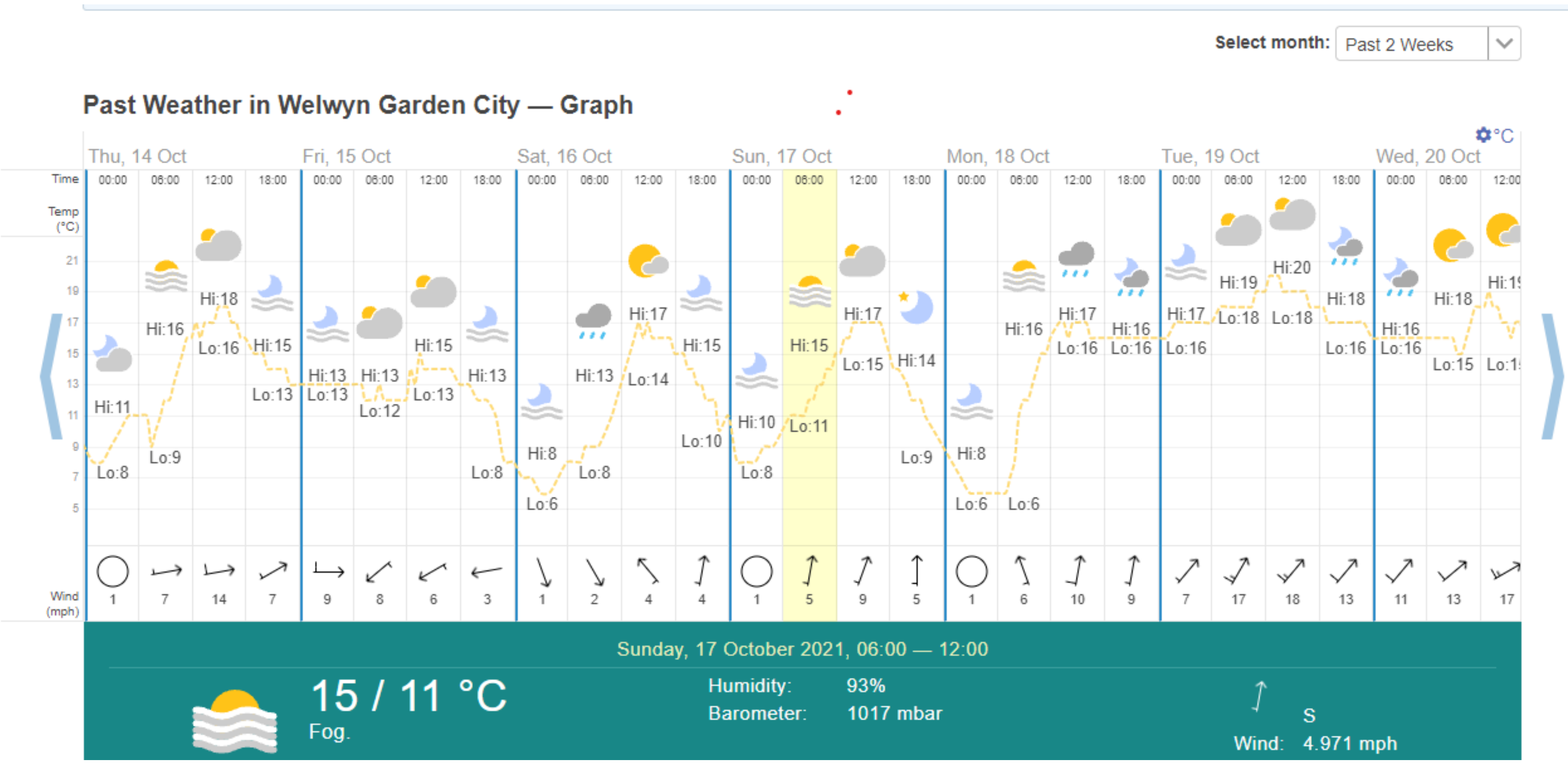
Appendix A: Site Plan – measurement positions



Appendix B: Measured Noise Levels



Appendix C: Weather Conditions



Appendix D: Glossary

The list below details the major acoustical terms and descriptors, with brief definitions:

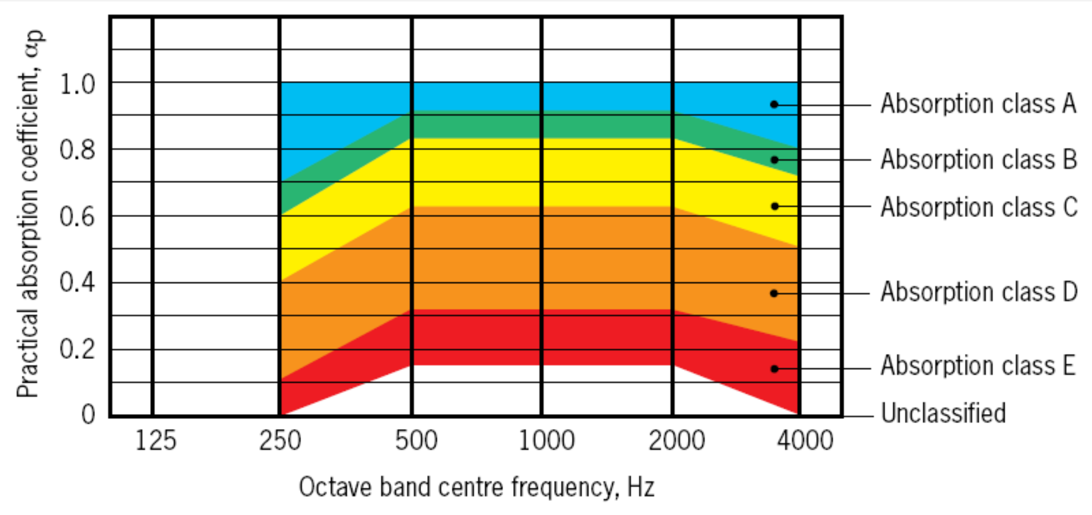
'A' Weighting

Weighting applied to the level in each stated octave band by a specified amount, in order to better represent the response of the human ear. The letter 'A' will follow a descriptor, indicating the value has been 'A' weighted. An 'A' weighted noise level may also be written as dB(A).

Absorption Class

In order to categorise the absorptive effects of different elements (such as ceiling tiles), classes from A to E were derived, as per BS EN ISO 11654:1997. A class 'A' absorber would be very acoustically absorptive, a Class 'E' absorber would be less absorptive and more reflective. A product that is highly reflective may not be classified.

The chart shown below has been extracted from BB93, and demonstrates the characteristics of each class according to BS EN ISO 11654:1997.



Absorption Coefficient (α)

A value usually between 0 and 1 assigned to a material to indicate how acoustically absorptive it is. 0 indicates a material is entirely reflective (and therefore not absorptive), and 1 indicates a material is entirely absorptive (and therefore not reflective). Absorption coefficients are usually given for each octave band between 125Hz and 4kHz, or as an overall 'practical' coefficient.

Airborne Noise

Noise transmitted through air.	
Ambient Noise	
The total noise level including all ‘normally experienced’ noise sources.	
dB or Decibel	
Literally meaning ‘a tenth of a bel’, the bel being a unit devised by the Bell Laboratory and named after Alexander Graham Bell. A logarithmically based descriptor to compare a level to a reference level. Decibel arithmetic is not linear, due to the logarithmic base. For example:	
30 dB + 30 dB ≠ 60 dB	30 dB + 30 dB = 33 dB
D_{nTw}+C_{tr}	
The weighted, normalised difference in airborne noise levels measured in a source room (L1) and a receive room (L2) due to a separating partition.	
D	Is simply L1 – L2.
D_{nT}	Is the normalisation of the measured level difference to the expected (in comparison to the measured) reverberation time in the receiving room.
D_{nTw}	Is the weighted and normalised level difference. This value is the result of applying a known octave band weighting curve to the measured result.
C_{tr}	Is a correction factor applied to the D_{nTw} to account for the known effects of particular types of noise, such as loud stereo music or traffic noise.
Frequency (Hz)	
Measured in Hertz (after Heinrich Hertz), and represents the number of cycles per second of a sound or tone.	
Impact Noise	
Re-radiated noise as a result of impact(s) on a solid medium, such as footfalls on floors. Measured in L'_{nTw}.	
Insertion Loss, dB	

The amount of sound reduction offered by an attenuator or louvre once placed in the path of a noise level.

$L_{A90, T}$

The 'A' weighted noise level exceeded for 90% of the time period T, described or measured. The '90' can be substituted for any value between 1 and 99 to indicate the noise level exceeded for the corresponding percentage of time described or measured.

$L_{Aeq, T}$

The 'A' weighted 'equivalent' noise level, or the average noise level over the time period T, described or measured.

L_{Amax}

The 'A' weighted maximum measured noise level. Can be measured with a 'slow' (1 sec) or 'fast' (0.125 sec) time weighting.

L_{Amin}

The 'A' weighted minimum measured noise level.

L'_{nTw}

The weighted, normalised impact sound pressure level measured in a receive room below a source room.

L	Is the spatially averaged impact sound pressure level measured in a receive room.
L'_{nT}	Is the normalisation of the measured impact sound pressure level to the expected (in comparison to the measured) reverberation time in the receiving room.
L'_{nTw}	Is the weighted and normalised impact sound pressure level. This value is the result of applying a known octave band weighting curve to the measured result.

NR

Noise Rating (NR) level. A frequency dependent system of noise level curves developed by the International Organisation for Standardisation (ISO). NR is used to categorise and determine the acceptable indoor environment in terms of hearing preservation, speech communication and annoyance in any given application as a single figure level. The US predominantly uses the Noise Criterion (NC) system.

Octave

The interval between a frequency in Hz (f) and either half or double that frequency (0.5f or 2f).

Pa

Pascals, the SI unit to describe pressure, after physicist Blaise Pascal.

Reverberation Time, T_{mf}, RT60, RT30 or RT20

The time taken in seconds for a sound to diminish within a room by 1,000 times its original level, corresponding to a drop in sound pressure of 60 dB. When taking field measurements and where background noise levels are high, the units RT20 or RT30 are used (measuring drops of 20 or 30 dB respectively). Sometimes given as a mid-frequency reverberation time, T_{mf} which is the average of reverberation time values at 500Hz, 1kHz and 2kHz.

R_w

The sound reduction value(s) of a constructional element such as a door, as measured in a laboratory, with a known octave band weighting curve applied to the result.

Sound Power Level

A noise level obtained by calculation from measurement data, given at the face of an item of plant or machinery. Referenced to 10^{-12} W or 1pW.

Sound Pressure Level

A noise level measured or given at a distance from a source or a number of sources. Referenced to $2x10^{-5}$ Pa.

Speech Intelligibility, Speech Transmission Index (STI)

Speech intelligibility is the measure of how well a speaker's voice can be heard within a given space. Speech intelligibility within a room depends on a number of factors, including reverberation time and background noise.

The Speech Transmission Index or STI has emerged as the favoured method of describing speech intelligibility.

Subjective Effect of Changes in Sound Pressure Level

A basic example to illustrate the assessment of difference in noise levels follows.

A background noise survey is undertaken that yields a lowest background noise level of L_{A90} 30 dB.

As the existing background noise level is low, a rating level for new plant noise of $L_{Aeq,\ T}$ 30 dB is set.

After calculation, the plant noise is predicted to achieve $L_{Aeq,T}$ 30 dB at the nearest residential property.

After the addition of the plant predicted noise level (or Rating Level), the new overall ambient noise level will be 33 dB. The background noise level measured originally will therefore be increased by 3 dB. In terms of the subjective impression of an increase of this order, the change in levels will be 'just perceptible'.

The table below details the subjective effects of variations in sound pressures (adapted from Bies and Hansen).

Difference between background noise and rating levels	**Increase in ambient noise level in 'real terms'**	**Change in apparent loudness**
+ 10 dB	+ 10 dB	Twice as loud
+ 5 dB	+ 6 dB	Clearly noticeable
0 dB	+ 3 dB	Just perceptible
-10 dB	0 dB	No change

W

Watts, the SI unit to describe power, after engineer James Watt.