Chartered Building Consultancy

Acoustic South East

Noise Impact Assessment – Discharge of Condition

Report by: Scott Castle BSc (Hons) CEnvH, MCIEH MIOA

Date: 31/07/2024

Project: J3875

Issue 1

Site: **106-108 George V Avenue, Worthing. BN11 5RS**

Client: **Revival Investments**

Constructionline Part of Capita plc

CQMS Safety Scheme

ANC THE ASSOCIATION OF NOISE CONSULTANTS

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Acoustic South East is a Trading Name of Acoustic Associates Sussex Ltd, Company Registration No: 5646519

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Report by: Scott Castle BSc (Hons) CEnvH, MCIEH MIOA
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Issue 1	31/07/2024	Original Issue

1 Introduction and Executive Summary

Acoustic South East have been appointed to undertake an acoustic assessment to support a discharge of planning condition. Specifically, Adur and Worthing Council have approved a change of use from class E to residential (C3) under AWDM/1489/23.

Standards and guidance referenced for this assessment include:

- BS8233 (Sound insulation and noise reduction for buildings) 2014
- ProPG2017-Planning and Noise
- Planning Noise Advice Document Sussex November 2023
- World Health Organisation Guidelines for Community Noise dated 1999, Revised 2018

To ensure a thorough understanding of the soundscapes to the front and rear of the premises, two class 1 sound level meters were installed and measured external sound pressure levels between 16-22nd July 2024.

The consented change of use allows residential use (class C3) at first, second and third floors. New thermal double glazing has been installed by the client as well as through frame trickle vents.

The soundscape and subsequent rigorous calculations identify that the internal sound pressure levels comfortably achieve the requirements of condition 6 of AWDM/1489/23.

Sufficient detail has been presented to allow the local planning authority to discharge condition 6 of AWDM/1489/23.

2 Context, Noise Criteria & Noise Assessment Methodology

2.1 Context

Adur and Worthing Council have approved an application under AWDM/1489/23 for a change of use from Class E to residential.

Specifically, condition 6 has been attached to the decision notice and is replicated below for ease of reference.

06. Works to implement the development shall not commence until a scheme for protecting the proposed noise sensitive development from external noise has been submitted to and approved by the local planning authority. All works, which form part of the scheme, shall be completed before any part of the noise sensitive development is occupied. The scheme shall have regard to the principles contained within the World Health Organisation community noise guidelines and achieve the recommended indoor and outdoor ambient noise levels for dwellings specified in BS8233:2014. The scheme should include full details of glazing and a strategy to prevent overheating. The noise level of any ventilation units when in use should not exceed the levels specified in BS8233:2014 and all duct work should be fitted on anti-vibration mounts. Following approval and completion of the scheme, a test shall be undertaken to demonstrate that the attenuation measures proposed in the scheme are effective and protect the residential unit from noise.
Reason: *In accordance with policies SP3 and DM22 of the Worthing Local Plan and because the proposed development is within an area which has been identified by DEFRA as an area of increased road noise.*

A written scheme is therefore required to ensure that the future residents remain protected from adverse noise levels.

It is relevant to note that the scheme is a change of use and accordingly, overheating does not apply.

With regards to the Acoustics, Ventilation and Overheating Guidance (AVOG) (Jan 2020), as well as the newly implemented Building Regulations Approved Document O (ADO), attention is drawn to the fact that these relate to new build developments and not conversions. For the AVOG, 2020, this is found in paras 1.4 and 1.13 and for the ADO, see para 0.3.

The ADO Frequently Asked Questions (FAQ) also referenced that an overheating assessment for a change of use is not applicable- Approved Document O: Overheating, frequently asked questions - GOV.UK (www.gov.uk)

The newly introduced Association of Noise Consultants Q&A Titled Building Regulations Part O and Acoustics, also reinforces this point around residential properties formed via a material change of use.

There are no external amenity areas proposed

This document is therefore required in order to discharge condition 6 of AWDM/1489/23.

Please note that whilst the report covers external soundscape and the building envelope, sound insulation testing between the commercial ground floor and the residential first floor demise has not been assessed.

2.2 Site Location

The consented site is detailed in red in Figure 1.



Figure 1. Site Location

2.3 Consented Internal Layouts

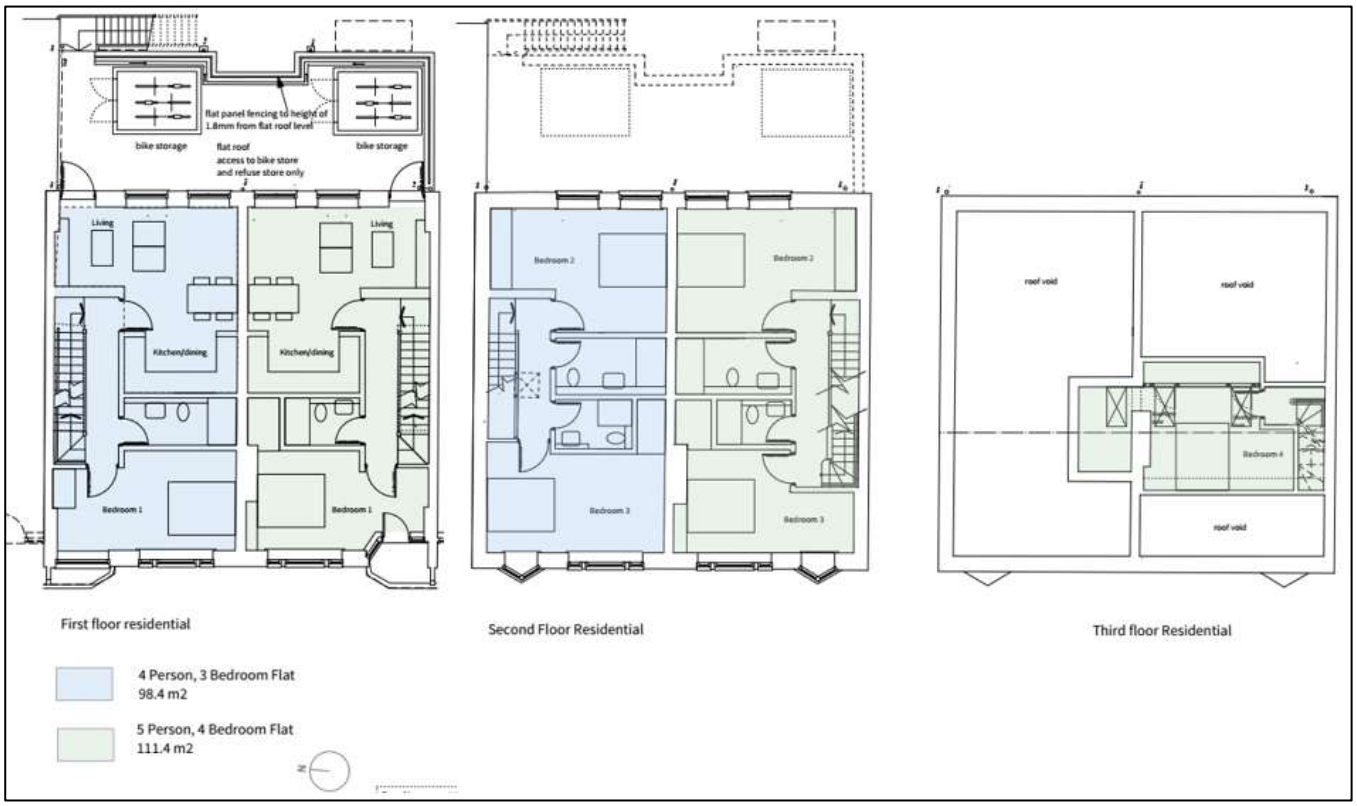

Figure 2. Consented Internal Layouts

2.4 Proposed Site Works

It is noted from the site visit that the windows have been replaced.

2.5 Soundscape

2.5.1 Front

The soundscape at the front was dominated by road traffic noise from vehicles approaching and departing the roundabout.

2.5.2 Rear

The soundscape at the rear did not contain any obvious sound sources. Whilst there was some ground level and wall mounted fixed plant, this was not in a position to influence the proposed rear living room façade. Subjectively, the dominant sound was the rustling of a very large tree located to the rear of the site.

2.6 BS8233:2014 Noise Criteria

Table 4 of BS8233:2014 provides the following guideline values:

Activity	Location	Time period of day	
		07:00-23:00	23:00-07:00
Resting	Living Rooms	35dB $L_{Aeq,16hour}$	-
Dining	Dining Room/Area	40dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35dB $L_{Aeq,16hour}$	30dB $L_{Aeq,8hour}$

Table 1. BS8233:2014 Criteria

It is relevant to note that Table 4 criteria in BS8233:2014 relates to continuous and anonymous sound.

2.7 ProPG, 2017-Planning and Noise

Whilst not specifically stated within the condition it is relevant to consider ProPG 2017 in respect of bedrooms for the night time period to protect future occupants from adverse noise levels.

2.8 World Health Organisation Guidelines for Community Noise dated 1999 (Revised 2018)

Condition 6 is noted to make reference to outdoor noise levels also. With this in mind, the LT2 survey period has been used to be representative of the rear first floor balcony space, as seen in Figure 2 above. The WHO Guidelines for Community Noise basically indicate that where levels exceed 50dB $L_{Aeq,\ 16\ hour}$, these are likely to see the onset of moderate annoyance and above 55dB $L_{Aeq,\ 16\ hour}$, the onset of serious annoyance. It should be noted that the reference daytime period is 07:00-23:00 hours. Reference is also made within BS8233:2014 to external amenity areas.

2.9 Planning Noise Advice Document Sussex, November 2023

The requirements of the above document have been followed with regards to reporting but also the measurement process to ensure that L_{Amax} events have been considered with regards to bedrooms

2.10 Methodology

To avoid any need for noise modelling, two long term sound level meters were applied to the front and rear facades to measure the soundscapes accordingly. This allowed the calculation of the relevant Sound Reduction Index to ensure that future residents remain protected from external noise.

The components of condition 6 have been considered and included within the reporting. The report has gone above and beyond the condition and also considered ProPG 2017 as a mechanism to ensure that residents remain protected overnight from L_{Amax} events.

3 Sound Survey(s)

Two unattended class 1 sound level meters were placed, one on the front and one on the rear façade of the building to provide an account of the individual soundscapes experienced. These were all façade measurements.

The data was measured in 1 minute intervals as required by the Planning Noise Advice Document Sussex dated November 2023.

For the rear, it was apparent that builders would be resurfacing the rear first floor balcony and the only safe space for the installation was the rear fire escape. Without any obvious sound sources, this was not an issue and did not warrant any additional corrections being made. The resurfacing of the balcony was easily apparent in day 1 of the survey data.

For the LT1 front, due to the enclosed nature of the balcony, a 6dB subtraction was made to the data to convert to freefield conditions.

All data presented hereafter is in freefield conditions.

The measurements were set up to be consistent with the requirements of the Planning Noise Advice Document Sussex dated November 2023, with the data measured using a 1-minute resolution to present a robust assessment of the night time soundscape for the front façade.

Data has been presented in terms of day and night time conditions for the front and rear facades as the second floor also contains bedrooms located to the rear.

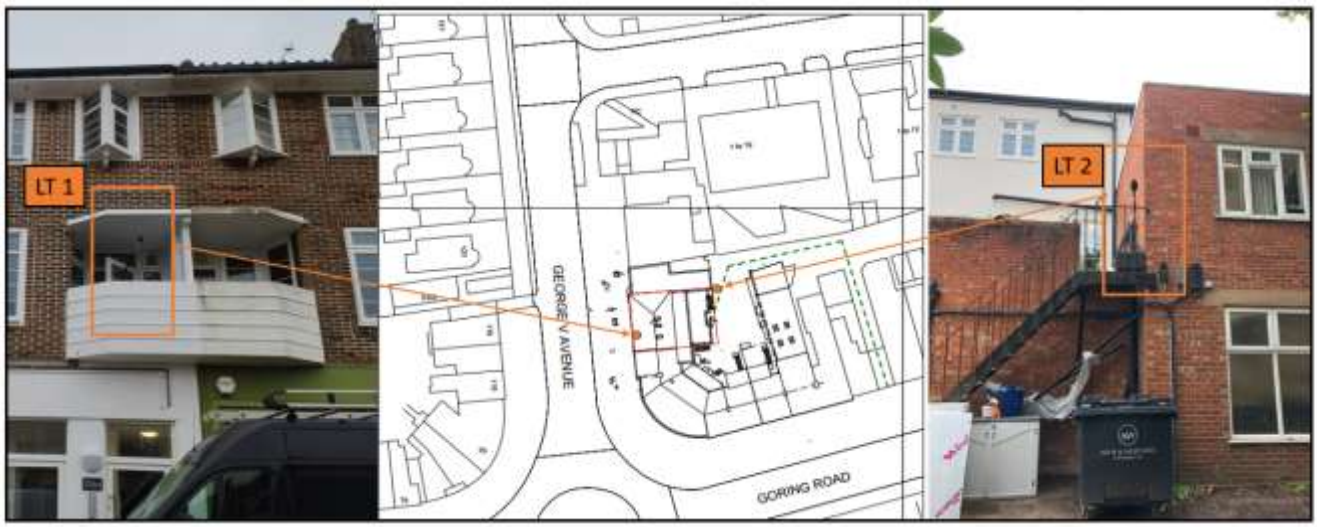

Figure 3. Long Term Survey Positions (LT1 and LT2)

Survey(s) carried out by	Josh Robinson Affiliate Member of the Institute of Acoustics Scott Castle BSc (Hons) CEnvH, MCIEH MIOA
Equipment Used	LT1 01dB Black Solo Class 1 Sound Level Meter – Mounted on Monopole (First floor Balcony-Front) LT2 Norsonic 140 Class 1 Sound Level Meter – Mounted on Monopole (Rear Fire Escape)
Equipment Used	Norsonic Acoustic Calibrator – Serial No. 31699
Location	LT1 – 1st Floor, 5.1 meters from ground level. W3W: broken.nature.margin LT2 – 2nd Floor, 4.6 meters from ground level. W3W: mount.organ.total
Duration	16th to 22nd July 2024

Figure 4. Survey Instrument Location and Data

4 Results of the Survey Results (Freefield Data)

4.1 LT1- Front

LT1- Front Logarithmically Averaged Day and Night time Periods (External - Freefield)-dB(A)			
$L_{Aeq,\ 16\ hour-\ 07:00-23:00}$		$L_{Aeq,\ 8\ hour\ 23:00-07:00}$	
Day 1	57.0	Night 1	49.5
Day 2	56.7	Night 2	48.3
Day 3	57.6	Night 3	50.6
Day 4	56.2	Night 4	48.5
Day 5	54.6	Night 5	48.2
Arithmetic Average	**56.4**	Night 6	48.0
		Arithmetic Average	**48.8**

Figure 5. LT1 Survey Position - George V Avenue

No. of Occurrences of L_{Amax} between 23:00-07:00 hours above 45dB L_{Amax} (SRI-13dB)					
Night 1	**Night 2**	**Night 3**	**Night 4**	**Night 5**	**Night 6**
80	75	76	41	71	70
No. of Occurrences of L_{Amax} between 23:00-07:00 hours above 45dB L_{Amax} (SRI-23dB)					
Night 1	**Night 2**	**Night 3**	**Night 4**	**Night 5**	**Night 6**
8	3	6	8	3	4

Figure 6. L_{Amax} Events for LT1

Figure 6 above contains two tables. The initial table provides an account of the number of L_{Amax} events above 45dB with an open window. ProPG2017 requires that these should not be more than 10 per night. The second table shows the required Sound Reduction Index to ensure that the ProPG2017 conditions for a bedroom are achieved in terms of L_{Amax} events per night.. The protective SRI figure of 23dB therefore ensures that all other measured nights are within the ProPG2017 requirements and achieve no more than 10 L_{Amax} events per night above 45dB inside the bedroom setting.

4.2 LT2 (Rear Position)

Note that LT2 was specifically positioned to avoid disturbance by the workmen who were proposing to carry out resurfacing to the rear balcony area at first floor level. It is evident from day 1 in Figure 7 below that the resurfacing occurred on the Wednesday (17th July 2024).

LT2- Rear Logarithmically Averaged Day and Night time Periods (External - Freefield)-dB(A)			
$L_{Aeq,\ 16\ hour-\ 07:00-23:00}$		$L_{Aeq,\ 8\ hour\ 23:00-07:00}$	
Day 1	62.9	Night 1	46.3
Day 2	47.1	Night 2	45.0
Day 3	46.1	Night 3	45.9
Day 4	44.9	Night 4	43.5
Day 5	47.5	Night 5	47.1
Arithmetic Average	**46.4**	Night 6	45.1
		Arithmetic Average	**45.5**
*Day 1 has not been included within the arithmetic average			

Figure 7. LT2 Continuous $L_{Aeq,T}$ Data

No. of Occurrences of L_{Amax} between 23:00-07:00 hours above 45dB L_{Amax} (SRI-13dB)					
Night 1	**Night 2**	**Night 3**	**Night 4**	**Night 5**	**Night 6**
107	72	102	59	83	84
No. of Occurrences of L_{Amax} between 23:00-07:00 hours above 45dB L_{Amax} (SRI-25dB)					
Night 1	**Night 2**	**Night 3**	**Night 4**	**Night 5**	**Night 6**
6	4	4	2	9	0

Figure 8. L_{Amax} Events for LT2

Figure 8 above contains two tables. The initial table provides an account of the number of L_{Amax} events above 45dB with an open window. ProPG2017 requires that these should not be more than 10 per night. The second table shows the required Sound Reduction Index to ensure that the ProPG2017 conditions for a bedroom are achieved in terms of L_{Amax} events per night.. The protective SRI figure of 25dB therefore ensures that all other measured nights are within the ProPG2017 requirements and achieve no more than 10 L_{Amax} events per night above 45dB inside the bedroom setting.

5 Discussion

5.1 Calculation of the Sound Reduction Index

By being aware of how the soundscape impacts the proposed properties, the required Sound Reduction Index (SRI) to achieve satisfactory internal sound pressure levels can be calculated.

There are three drivers that impact the façade sound reduction index or SRI. These are the daytime continuous noise levels measured over 16 hours in $L_{Aeq'T,}$ the night time continuous noise levels over 8 hours, also measured in $L_{Aeq'T.}$ Thirdly, ProPG2017 requires a consideration of the number of L_{Amax} events which will occur in a bedroom during the night time period. Specifically, ProPG2017 requires no more than ten events exceeding 45dB L_{Amax} measured internally. Whichever of these drivers is highest is applied to ensure that the residents are protected from all criteria.

An assessment has been made below of both Kitchen/Living/Diners and bedrooms at first and second floor levels.

It is relevant to note that living room and bedroom calculations differ, as although living rooms are subject to only the daytime predicted sound pressure levels, bedrooms must consider both daytime and night time continuous sound pressure levels as well as L_{Amax} events during the night to protect sleep.

The daytime SRI is the predicted external freefield sound pressure level minus 35dB as per the Table 4 values in BS8233:2014 and the same for the night time values (albeit minus 30dB).

The L_{Amax} SRI is achieved by using the predicted night time external sound pressure level and comparing this with the measured night time survey noise level. The SRI figure is then modified to ensure no more than 10 L_{Amax} events per night inside the bedroom environment above 45dB L_{Amax}. The adjustment process takes account of each of the 6 measured night time periods to ensure that no individual night exceeds 10 events of 45dB L_{Amax} inside the bedroom.

The long-term survey positions (LT1 and LT2) have been used to assess night time data and L_{Amax} considerations. The SRI considerations have been split into bedrooms and living rooms for each façade.

Summary of Sound Reduction Index (SRI) Required for Bedrooms								
Location	**Highest Predicted Daytime External Sound Pressure Level ($L_{Aeq, 16 hour}$)- Rounded**	**BS8233:2014 Daytime Criterion**	**Daytime SRI**	**Highest Predicted Night Time External Sound Pressure Level $L_{Aeq, 8 hour}$-Rounded**	**BS8233:2014 Night Time Criterion**	**Night Time SRI**	**SRI to ensure less than 10 L_{Amax} events 45dB(A)**	**SRI to Apply**
Front	58	35 dB $L_{Aeq, 16 hour}$	23	51	30 dB $L_{Aeq, 8 hour}$	21	23	**23**
Rear	48	35 dB $L_{Aeq, 16 hour}$	13	47	30 dB $L_{Aeq, 8 hour}$	12	25	**25**
All data presented is dB(A) and Freefield								

Figure 9. Sound Reduction Index - Front Facade overlooking George V Avenue

Summary of Sound Reduction Index (SRI) Required for Living Rooms (Rear)			
Location	**Highest Predicted Daytime External Sound Pressure Level ($L_{Aeq, 16\ hour}$)- Rounded**	**BS8233:2014 Daytime Criterion**	**Daytime SRI**
Rear	48	35 dB $L_{Aeq, 16\ hour}$	13
All data presented is dB(A) and Freefield			

Figure 10. Sound Reduction Index - Rear Facade

5.2 External Amenity Areas

Given that condition 6 also references outdoor areas, it may be relevant to consider the first-floor balcony area as such a space. It is noted that the worst case (highest) daytime sound pressure level from LT2 is only 48dB $L_{Aeq, 16\ hour}$, so below the lower threshold for the onset of moderate annoyance, as detailed with the WHO, Guidelines for Community Noise dated 1999, revised 1999.

5.3 Openable Windows

A 5dB tolerance is applied to the BS8233:2014 Table 4 values, whilst still achieving reasonable living conditions. The same approach is taken within the Acoustics Ventilation and Overheating Guidance dated Jan 2020. Figure 11 below indicates that whilst the rear windows may be opened, the windows overlooking George V Avenue may not be opened without increasing internal sound pressure levels above BS8233:2014 Table 4 values.

Notwithstanding this, there are no suggestions of fixed closed windows and future tenants have the freedom to open windows and have a connection with the natural environment. Purge ventilation, ie the short-term opening of windows to rapidly ventilate the space does not have any associated criterion. An example of this being opening windows to ventilate paint fumes or burnt toast.

Assessment of whether windows may be opened for background ventilation				
Location	**Highest Predicted Daytime External Sound Pressure Level ($L_{Aeq, 1\ hour}$)**	**Open Window (-13dB)**	**BS8233:2014 Daytime Criterion**	**Openable Windows (Yes/No)**
Front	58	45	40 dB $L_{Aeq, 16\ hour}$	No
Rear	48	35	40 dB $L_{Aeq, 16\ hour}$	Yes
Location	**Highest Predicted Night Time External Sound Pressure Level $L_{Aeq, 8\ hour}$**	**Open Window (-13dB)**	**BS8233:2014 Night Time Criterion**	**Openable Windows (Yes/No)**
Front	51	38	35 dB $L_{Aeq, 8\ hour}$	No
Rear	47	34	35 dB $L_{Aeq, 8\ hour}$	Yes
All predicted External data presented is dB(A) and Freefield				

Figure 11. Assessment of Openable Windows

An alternative ventilation strategy is therefore required for the windows overlooking George V Avenue and it is noted that through frame trickle vents have been applied to the bedrooms. If these are not considered adequate by your M+E consultant, then there is the potential for through wall passive vents to be applied with greater through flow. A Rytons AAC125HP LookRyt for example is an acoustically treated through wall vent which will yield an increased flow rate.

6 Rigorous Calculations

Rigorous calculations, as per Annex G2 of BS8233:2014 consider the worst-case measured external (freefield levels) sound pressure level, but rather than using a simplistic external to internal sound pressure level subtraction, the Sound Reduction Index (SRI) is achieved using ratios of window sizes, facades, glazing specification as well as the proposed ventilation considerations. The rigorous calculations have taken account of the following:

- The worst case highest daytime sound pressure levels have been used.
- All rigorous calculations use freefield data.
- The calculations have assumed a masonry cavity wall
- 35dB $L_{Aeq,16\ hour}$ has been applied as the daytime criteria for a Kitchen/Lounge/Diner
- Given that standard thermal double glazing with trickle vents has been installed, these have been used within the calculations.
- For the first floor bedroom overlooking George V Avenue, the room was selected on being the worst case room with increased amounts of glazing. Logic dictates that if the room is capable of achieving the required internal sound pressure levels, then those rooms with less fenestration will perform equally or better than the bedroom assessed.
- For the third-floor bedroom overlooking George V Avenue, this has 3 roof lights. These have assumed an additional distance of 4.1m from the LT1 survey position resulting in a small amount of attenuation (1.8dB) for distance. No cavity walls were applied and only the roof sides and windows were used.

Three examples have been presented to indicate that the construction provides the required level of attenuation as per the SRI requirements in section 5.1. When reviewing Figures 13 to 15 below, attention is drawn to not only the internal sound pressure level achieved, which needs to be less than 35dB $L_{Aeq,16\ hour}$ for the daytime period, but equally, the predicted building envelope SRI achieved stated. The latter predicted building envelope SRI figure must and does accord with the minimum SRI requirements in section 5.1 above.

Non Frequency Dependent Variables		
Term	Derivation	Value
Ao	Given in BS EN 20140-10 = 10 (m^2)	10
Sf	Total Facade Area (m^2)	14.64
Swi	Window Area (m^2)	7.4
Sew	External Wall Area (m^2)	7.24
Srr	Ceiling Area (m^2)	0.00001
S	Total Area sound enters the room (m^2)	14.64001

Key for Table Below	
Rwi	Sound Reduction of Window (Octave)
Rew	Sound Reduction Index of External Wall (Octave)
Rrr	Sound Reduction Index of Roof/Ceiling (Octave)
A	Equivalent Absorbtion Area of Rx Room
Dn,e	Insulation of Trickle Vent (BS EN 20140-10)

Frequency Dependent Variables							
		Octave Band Centre Frequency					
Term	Description	125	250	500	1000	2000	4000
Leq,ff	Free-Field External Noise Level	60	56	54	54	51	44
Dn,e	Greenwood 5000EA(5230mm2)	39.5	37.3	35.5	32	31	33.5
Rwi	4_12_4	24	20	25	35	38	35
Rew	Cavity Masonry (Brick Cavity with Insulation lightweight block)	41	39	44	52	60	65
Rrr	No Roof	100	100	100	100	100	100
A	Equivalent Absorbtion Area of Room (Copied from BS8233)	11.00	14.00	16.00	16.00	15.00	15.00

BS8233 Calculation Details						
	Octave Band Centre Frequency					
Term From Equation Below	125	250	500	1000	2000	4000
Leq,ff	60	56	54	54	51	44
Ao/S . 10^(-Dn,e/10)	7.66E-05	0.000127	0.000193	0.000431	0.000543	0.000305112
Swi/S . 10^(-Rwi/10)	0.002012	0.005055	0.001598	0.00016	8.01E-05	0.000159842
Sew/S . 10^(-Rew/10)	3.93E-05	6.23E-05	1.97E-05	3.12E-06	4.95E-07	1.56386E-07
Srr/S . 10^(-Rrr/10)	6.83E-17	6.83E-17	6.83E-17	6.83E-17	6.83E-17	6.8306E-17
10log10(S/A)+3	4.241487	3.194133	2.614214	2.614214	2.894501	2.894501143
Leq,2	37.52164	36.39084	29.19248	24.35167	21.84063	13.57005525
A-Weighting	-16.1	-8.6	-3.2	0	1.2	1
A-Weighted Leq	**21.42164**	**27.79084**	**25.99248**	**24.35167**	**23.04063**	**14.57005525**

A-Weigted Level Outside	**58**
BS8233 Predicted Internal A-Weigted Level	**32**
Prediced Building Envelope SRI	**26**

First Floor Bed 1

BS8233 Calculation can be seen below:

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Figure 12.Rigorous Calculation - First Floor Bedroom-George V Avenue

Non Frequency Dependent Variables		
Term	Derivation	Value
Ao	Given in BS EN 20140-10 = 10 (m^2)	10
Sf	Total Facade Area (m^2)	7.68
Swi	Window Area (m^2)	2.86
Sew	External Wall Area (m^2)	4.82
Srr	Ceiling Area (m^2)	0.00001
S	Total Area sound enters the room (m^2)	7.68001

Key for Table Below	
Rwi	Sound Reduction of Window (Octave)
Rew	Sound Reduction Index of External Wall (Octave)
Rrr	Sound Reduction Index of Roof/Ceiling (Octave)
A	Equivalent Absorbtion Area of Rx Room
Dn,e	Insulation of Trickle Vent (BS EN 20140-10)

Frequency Dependent Variables							
		Octave Band Centre Frequency					
Term	Description	125	250	500	1000	2000	4000
Leq,ff	Free-Field External Noise Level	50	46	44	44	41	34
Dn,e	Greenwood 5000EA(5230mm2)	39.5	37.3	35.5	32	31	33.5
Rwi	4_12_4	24	20	25	35	38	35
Rew	Cavity Masonry (Brick Cavity with Insulation lightweight block)	41	39	44	52	60	65
Rrr	No Roof	100	100	100	100	100	100
A	Equivalent Absorbtion Area of Room (Copied from BS8233)	11.00	14.00	16.00	16.00	15.00	15.00

BS8233 Calculation Details						
	Octave Band Centre Frequency					
Term From Equation Below	125	250	500	1000	2000	4000
Leq,ff	50	46	44	44	41	34
Ao/S . 10^(-Dn,e/10)	0.000146	0.000242	0.000367	0.000822	0.001034	0.000581619
Swi/S . 10^(-Rwi/10)	0.001483	0.003724	0.001178	0.000118	5.9E-05	0.000117762
Sew/S . 10^(-Rew/10)	4.99E-05	7.9E-05	2.5E-05	3.96E-06	6.28E-07	1.98466E-07
Srr/S . 10^(-Rrr/10)	1.3E-16	1.3E-16	1.3E-16	1.3E-16	1.3E-16	1.30208E-16
10log10(S/A)+3	1.439691	0.392337	-0.18758	-0.18758	0.092705	0.092705265
Leq,2	23.68885	22.46198	15.77025	13.55882	11.48259	2.541071157
A-Weighting	-16.1	-8.6	-3.2	0	1.2	1
A-Weighted Leq	**7.588855**	**13.86198**	**12.57025**	**13.55882**	**12.68259**	**3.541071157**

A-Weigted Level Outside	**48**
BS8233 Predicted Internal A-Weigted Level	**20**
Prediced Building Envelope SRI	**28**

Rear First Floor KLD

BS8233 Calculation can be seen below:

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Figure 13. Rear First Floor Kitchen/Living/Diner (KLD)

Non Frequency Dependent Variables		
Term	Derivation	Value
Ao	Given in BS EN 20140-10 = 10 (m^2)	10
Sf	Total Facade Area (m^2)	26.4
Swi	Window Area (m^2)	2
Sew	External Wall Area (m^2)	24.4
Srr	Ceiling Area (m^2)	0.000001
S	Total Area sound enters the room (m^2)	26.4

Key for Table Below	
Rwi	Sound Reduction of Window (Octave)
Rew	Sound Reduction Index of External Wall (Octave)
Rrr	Sound Reduction Index of Roof/Ceiling (Octave)
A	Equivalent Absorbtion Area of Rx Room
Dn,e	Insulation of Trickle Vent (BS EN 20140-10)

Frequency Dependent Variables							
		Octave Band Centre Frequency					
Term	Description	125	250	500	1000	2000	4000
Leq,ff	Free-Field External Noise Level	58.2	54.2	52.2	52.2	49.2	42.2
Dn,e	Greenwood 5000EA(5230mm2)	39.5	37.3	35.5	32	31	33.5
Rwi	4_12_4	24	20	25	35	38	35
Rew	Cavity Masonry (Brick Cavity with Insulation lightweight block)	43	43	43	43	43	43
Rrr	No Roof	100	100	100	100	100	100
A	Equivalent Absorbtion Area of Room (Copied from BS8233)	11.00	14.00	16.00	16.00	15.00	15.00

BS8233 Calculation Details						
	Octave Band Centre Frequency					
Term From Equation Below	125	250	500	1000	2000	4000
Leq,ff	58.2	54.2	52.2	52.2	49.2	42.2
Ao/S . 10^(-Dn,e/10)	4.25E-05	7.05E-05	0.000107	0.000239	0.000301	0.000169198
Swi/S . 10^(-Rwi/10)	0.000302	0.000758	0.00024	2.4E-05	1.2E-05	2.39566E-05
Sew/S . 10^(-Rew/10)	4.63E-05	4.63E-05	4.63E-05	4.63E-05	4.63E-05	4.63218E-05
Srr/S . 10^(-Rrr/10)	3.79E-18	3.79E-18	3.79E-18	3.79E-18	3.79E-18	3.78788E-18
10log10(S/A)+3	6.802113	5.754759	5.17484	5.17484	5.455127	5.455126843
Leq,2	30.91742	29.37202	23.31484	22.27832	20.20862	11.44776168
A-Weighting	-16.1	-8.6	-3.2	0	1.2	1
A-Weighted Leq	**14.81742**	**20.77202**	**20.11484**	**22.27832**	**21.40862**	**12.44776168**

A-Weigted Level Outside	**56**
BS8233 Predicted Internal A-Weigted Level	**28**
Prediced Building Envelope SRI	**29**

3rd Floor Bedroom Overlooking George V Avenue

BS8233 Calculation can be seen below:

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Figure 14. Third Floor Bedroom overlooking George V Avenue

Non Frequency Dependent Variables		
Term	Derivation	Value
A_o	Given in BS EN 20140-10 = 10 (m^2)	10
S_f	Total Facade Area (m^2)	14.64
S_{wi}	Window Area (m^2)	7.4
S_{ew}	External Wall Area (m^2)	7.24
S_{rr}	Ceiling Area (m^2)	0.00001
S	Total Area sound enters the room (m^2)	14.64001

Key for Table Below	
R_{wi}	Sound Reduction of Window (Octave)
R_{ew}	Sound Reduction Index of External Wall (Octave)
R_{rr}	Sound Reduction Index of Roof/Ceiling (Octave)
A	Equivalent Absorbtion Area of Rx Room
$D_{n,e}$	Insulation of Trickle Vent (BS EN 20140-10)

Frequency Dependent Variables							
		Octave Band Centre Frequency					
Term	Description	125	250	500	1000	2000	4000
$L_{eq,ff}$	Free-Field External Noise Level	60	56	54	54	51	44
$D_{n,e}$	Rytons AAC125HP Look Ryt	42	37	34	43	57	64
R_{wi}	4_12_4	24	20	25	35	38	35
R_{ew}	Cavity Masonry (Brick Cavity with Insulation lightweight block)	41	39	44	52	60	65
R_{rr}	No Roof	100	100	100	100	100	100
A	Equivalent Absorbtion Area of Room (Copied from BS8233)	11.00	14.00	16.00	16.00	15.00	15.00

BS8233 Calculation Details						
	Octave Band Centre Frequency					
Term From Equation Below	125	250	500	1000	2000	4000
$L_{eq,ff}$	60	56	54	54	51	44
Ao/S . 10^(-Dn,e/10)	4.31E-05	0.000136	0.000272	3.42E-05	1.36E-06	2.71931E-07
Swi/S . 10^(-Rwi/10)	0.002012	0.005055	0.001598	0.00016	8.01E-05	0.000159842
Sew/S . 10^(-Rew/10)	3.93E-05	6.23E-05	1.97E-05	3.12E-06	4.95E-07	1.56386E-07
Srr/S . 10^(-Rrr/10)	6.83E-17	6.83E-17	6.83E-17	6.83E-17	6.83E-17	6.8306E-17
10log10(S/A)+3	4.241487	3.194133	2.614214	2.614214	2.894501	2.894501143
Leq,2	37.45264	36.39836	29.37892	19.5632	13.03095	8.943026523
A-Weighting	-16.1	-8.6	-3.2	0	1.2	1
A-Weighted Leq	**21.35264**	**27.79836**	**26.17892**	**19.5632**	**14.23095**	**9.943026523**

A-Weigted Level Outside	**58**
BS8233 Predicted Internal A-Weigted Level	**31**
Prediced Building Envelope SRI	**27**

First Floor Bed 1

BS8233 Calculation can be seen below:

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Figure 15. Front First Floor Bedroom-Through Wall Ventilation

7 Rigorous Calculations Summary

The rigorous calculations above indicate that the SRI has been easily achieved for both habitable room spaces overlooking George V Avenue and those spaces overlooking the rear elements of the building.

Room Space	Façade	Required SRI	External Daytime Sound Pressue Level- $L_{Aeq,16\ hour}$	Windows	Ventilation	Internal Sound Pressure Level- $L_{Aeq,16\ hour}$	SRI Achieved	SRI Met
Bedroom	Front	23	58	4\12\4	Trickle Vents	32	26	Yes
Bedroom	Front	23	58	4\12\4	Through Wall Vents	31	27	Yes
KLD	Rear	25	48	4\12\4	Trickle Vents	20	28	Yes
Bedroom	Rear	25	48	4\12\4	Trickle Vents	20	28	Yes

Figure 16. Summary of Rigorous Calculations

8 Conclusion

To ensure a thorough understanding of the soundscapes to the front and rear of the premises, two class 1 sound level meters were installed and measured external sound pressure levels between 16-22nd July 2024.

The consented change of use allows residential use (class C3) at first, second and third floors. New thermal double glazing has been installed by the client as well as through frame trickle vents.

The soundscape and subsequent rigorous calculations identify that the internal sound pressure levels comfortably achieve the requirements of condition 6 of AWDM/1489/23.

Sufficient detail has been presented to allow the local planning authority to discharge condition 6 of AWDM/1489/23.