

Acoustic South East



Noise Assessment

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Date: 23/12/2024

Project: J3960

Issue 1

Site: **Royal George Road, Burgess Hill, West Sussex, RH15 9SE**

Client: **MT Management LTD**

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1 Introduction and Executive Summary

Acoustic South East have been appointed to undertake an acoustic assessment to support a planning application for a change of use at 24 Royal George Road in Burgess Hill, made to Mid Sussex District Council. The building is to undergo development to convert the existing property into 3 new residential flats. The rear half of the commercial building is being changed to a new residential flat at ground floor. Flats 2 and 3 will be above this at the 1st and 2nd floors respectively.

Standards and guidance referenced for this assessment include:

- BS8233 (Sound insulation and noise reduction for buildings) 2014
- National Planning Policy Framework (NPPF), 2024
- ProPG2017 - Planning & Noise, Professional Practice Guidance on Planning & Noise
- Building Regulations Approved Document E – Resistance to the Passage of Sound
- Planning Noise Advice Document Sussex November 2023

A class 1 sound level meter was set up at the site between the 17th and the 20th of December 2024 to assess the site soundscape facing Royal George Road. To ensure robust reporting, short term simultaneous measurements were also undertaken on the façade facing Fairfield Road and also to the rear of the site to better understand how sound propagates around the site.

The freefield external site soundscape at Royal George Road was 62dB $L_{Aeq,16 \text{ hour}}$ for the daytime period (07:00-23:00 hours) and 54dB $L_{Aeq, 8 \text{ hours}}$ for the overnight period (23:00-07:00 hours). The soundscape reduced by as much as 17dB around other facades of the building.

No bedrooms overlook the busier Royal George Road and this is felt to represent good acoustic design.

The proposed first floor terrace/external amenity area is also likely to achieve BS8233:2014 and World Health Organisation Guidelines for Community Noise dated 1999 (revised 2018).

The initial site risk assessment, consistent with ProPG2017 communicates the level of risk to the stakeholders and decision makers alike, provides a worst case of low to medium risk and changes depending on the elevation being assessed. The level of risk is generally aligned with the degree of mitigation measures to protect future residents against external airborne transportation noise.

With regards to glazing and ventilation, the majority of the building is capable of using standard thermal double-glazing products with an R_{traffic} of 25B(A) and acoustic through frame trickle vents to allow an alternative method of ventilation.

There will be a requirement for enhanced soundproofing between the ground floor commercial space and ground floor residential space (horizontal soundproofing) and additionally between the commercial ground floor space and first floor habitable rooms as residential spaces (vertical soundproofing). It is typical for this to be conditioned by the local planning authority.

From the information presented, planning consent should not be withheld on noise grounds.

2 Context, Noise Criteria & Noise Assessment Methodology

2.1 Context

The application site is on the corner of Royal George Road and Fairfield Road. Both are residential areas with Royal George Road being the busier of the two.

Royal George Road is controlled by traffic lights at the Eastern end and parking can cause traffic to back up.

The premises is a former security shop which is now vacant on the ground floor. The premises at the time of the visit were gutted ready for renovation.

Contextually, residential apartments were already present at first and second floors, however the change of use seeks to add a residential space to the ground floor by reducing the commercial space.

The change of use creates three independent flats, with flat 1 at the ground floor, flat 2 at first floor and flat 3 at the second floor.

The noise assessment has been produced at the request of Mid Sussex District Council.

2.2 Site Location and Setting

The application site is detailed in red in Figure 1.



Figure 1. Site Location

It should be noted that the first floor flat over sails a ground floor residential flat at 24B which is accessed via Fairfield Road

2.3 Soundscape

The soundscape noted from previous visits to the site was that of passing road traffic noise from Royal George Road. The road is mostly used by cars and small vans.

2.4 Internal Conditions

Internal conditions at the time of the visit were not consistent with being able to carry out any internal sound testing between the vertical or horizontal partitions.



Figure 2. Internal Conditions

2.5 Existing Floor Plans

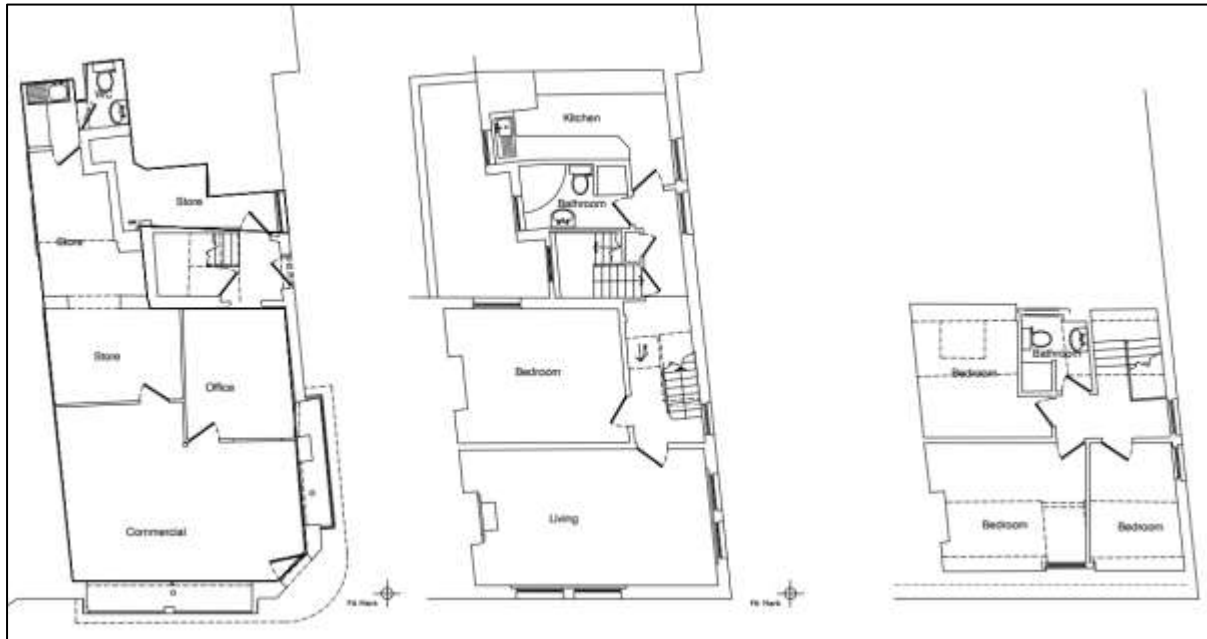


Figure 3. Existing Plan

2.6 Proposed Floor Plans



Figure 4. Proposed Plan

2.7 Good Acoustic Design

From a design perspective, it is noted that no bedrooms overlook the busier Royal George Road and instead have been set back further to overlook Fairfield Road.

2.8 Planning Policy and Relevant Standards

2.8.1 National Planning Policy Framework NPPF, Dec 2024

The National Planning Policy Framework (Dec 2024) defines the Government's planning policies for England and how these are expected to be applied. It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so.

The following paragraphs are relevant within NPPF Section 15 (Conserving and enhancing the natural environment) states the following:

Paragraph 187(e) - Preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability, and

Paragraph 198 - Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- a) mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;
- b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and

Paragraph 200– Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.

2.8.2 BS8233:2014 – Guidance on Sound Insulation and Noise Reduction for Buildings

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.

2.8.3 Planning Noise Advice Document Sussex, Nov 2023

The Planning Noise Advice Document Sussex, which Mid Sussex District Council are signed up to has been followed in the commissioning and reporting of this assessment.

2.8.4 ProPG2017 Planning & Noise, Professional Practice Guidance on Planning & Noise

Planning guidance (ProPG2017) relates to new residential development and airborne transportation noise, which includes exposure to road traffic, railway and aviation noise. Whilst ProPG, 2017 generally mirrors the requirements of BS8233:2014 and the World Health Organisation Guidelines, 1999, it goes further in setting a limit for inside bedrooms for L_{Amax} events and specifically, no more than 10 L_{Amax} events per night time period above 45dB(A).

The internal bedroom L_{Amax} values will be used in accordance with ProPG2017.

2.8.5 Building Regulations, Approved Document O – Overheating

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)

Overheating is therefore not considered as part of this assessment.

2.9 Methodology

An unattended class 1 sound level meter was set up on site at the 1st floor overlooking Royal George Road. The meter was left in position for 3 days to measure the road traffic noise around the site. An attended reading was also conducted on the Fairfield Road façade to compare with the measurements from the long-term survey and inform on the required SRI for the new ground floor window.

3 Sound Survey

A class 1 sound level meter (Svantek 971) was protruded from the first-floor window on the Royal George façade. The meter measured in a 1-minute resolution period and used Fast time weightings and A weighted data. The sound level measured in façade conditions and was battery operated. For future data, 3dB will be subtracted from the dataset to ensure freefield conditions, suitable for calculations to be derived.

The sound level meter was field calibrated at 114dB at 1000Hz at the start and finish of the survey without any significant drift noted.



Figure 5. Long Term Survey Position

Survey(s) carried out by	Scott Castle BSc (Hons) CEnvH, MCIEH MIOA
Equipment Used	Svantek 971 Class 1 Sound Level Meter – Serial No. C111658 – Mounted on Monopole.
Equipment Used	Castle Acoustic Calibrator – Serial No. 041173
Location	Svantek Mirus 971 – 4.6 above ground level
Duration	17/12/2024 to 20/12/2024

Table 2. Survey Details



Figure 6. Short Term Attended Positions

4 Measured Data

4.1 Measured External Data

The data has been presented in Figure 7 below, which are freefield conditions. Note that the highlighted cells represented periods of elevated windspeeds and rainfall leaving only day 2 and night 3 to draw data from.

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	62.4	Night 1	56.0
Day 2	61.5	Night 2	54.6
Day 3	N/A	Night 3	54.0
Arithmetic Average	61.5	Arithmetic Average	54.0

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

4.2 Short Term Measured Data (Outside)

The short-term measurements to be able to compare with the long-term position are shown in Figure 8 below.

Measured Short Term Positions							
Date	Position	Time	Floor	Elevation	Measured External $L_{Aeq,5minutes}$ Short Term	Comparison Long Term	Difference (dB)
17/12/2024	ST1	17:25-17:35	First	East	60	65	5
20/12/2024	ST1	10:05-10:10	First	East	60	66	6
20/12/2024	ST2	10:15-10:20	First	West	48	65	17
20/12/2024	ST3	10:25-10:30	Second	North	51	66	15

All measurements are in façade, Fast and A weighted conditions

Figure 8. Measured Short Term Simultaneous Data

4.3 Derived External Sound Pressure Levels

Given that there are windows and receptor positions around the building, a number of short-term measurements (see 4.2 above) were used to measure the external sound pressure levels around the building. From the short readings taken and comparing against the long-term position, it is possible to identify the relevant longer term external soundscapes around the building facades.



Figure 9. Positions and Noise Change

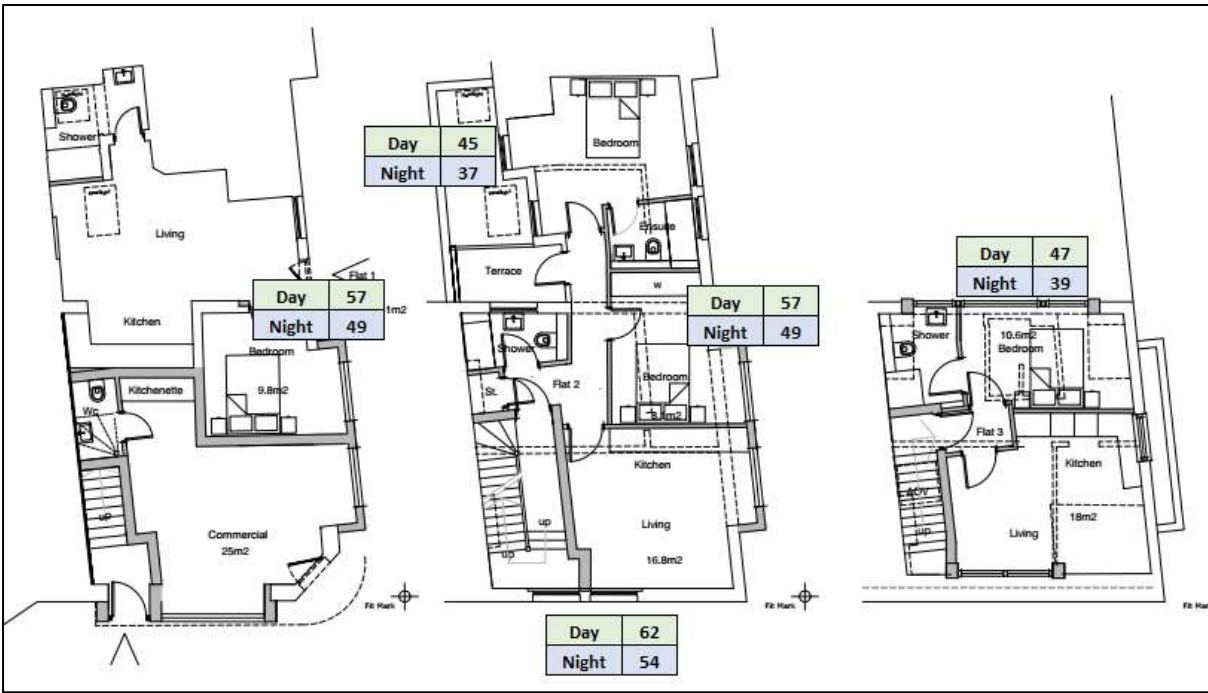


Figure 10. Derived External Freefield Sound Pressure Levels, $L_{Aeq,T}$

5 Discussion

5.1 Sound Reduction Index

By being aware of how the soundscape impacts the proposed properties, a noise modelling approach predicts external sound pressure levels around the building perimeters. Subsequently, the required Sound Reduction Index (SRI) to achieve satisfactory internal sound pressure levels can be calculated.

There are three drivers which 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 each criterion.

An assessment has been made below of all habitable rooms at first and second floor levels.

It is relevant to note that living room and bedroom calculations differ, as whilst 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 adjusted to prevent 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 1 measured night time periods to ensure that no individual night exceeds 10 events of 45dB L_{Amax} inside the bedroom.

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

SRI Requirements			
Flat	Floor	Room	SRI (Worst Case)
1	Ground	Living	22
1	Ground	Bedroom	26
2	First	Living	27
2	First	Bedroom(East)	26
2	First	Bedroom(West)	14
3	Second	Living	27
3	Second	Bedroom	16

Figure 11. SRI Requirements

5.2 Assessment Of Opening Windows

An assessment has been made to determine whether windows are capable of being opened during the daytime and night time periods for the various room spaces. This has been compared against the 5dB relaxation for internal sound pressure levels in the Table 4 values in both BS8233:2014 and the Acoustics, Ventilation and Overheating Guidance dated 2020.

For example, for the daytime period, the internal sound pressure level is no more than 40dB $L_{Aeq,16 \text{ hour}}$ and for the night time period, no greater than 35dB $L_{Aeq, 8 \text{ hour}}$. Living rooms are not considered for the overnight period.

Assessment of Openable Windows								
Room	External SPL- Daytime	Open Window (-13dB)	BS8233:2014 +5 Tolerance	Openable	External SPL-Night Time	Open Window (-13dB)	BS8233:201 4 +5 Tolerance	Openable
Flat 1 Living	57	44	40	No	Not Applicable			
Flat 2 Living	62	49	40	No	Not Applicable			
Flat 3 Living	62	49		No	Not Applicable			
Flat 1 Bed	57	44	40	No	49	36	35	Marginal
Flat 2 Bed (East)	57	44	40	No	49	36	35	Marginal
Flat 2 Bed West	45	32	40	Yes	37	24	35	Yes
flat 3 Bed	47	34	40	Yes	39	26	35	Yes

Figure 12. Assessment of Openable Windows

Some windows within the 3 flats will be openable. It should however be remembered that the site was in fact residential prior to this proposed change of use.

Where it might not be practicable to rely upon an openable window for background ventilation, acoustic through frame passive trickle vents may be easily used.

5.3 External Amenity Areas

A small terrace is noted at first floor level. From the short-term readings taken to consider the level difference from the Royal George façade, see Figures 9 and 10, it is likely that the terrace area will easily achieve the requirements of BS8233:2014 and World Health Organisation Guidelines for Community Noise dated 1999.

5.4 ProPG2017 Initial Site Risk Assessment

Consistent with the approach in ProPG2017, the initial site risk assessment to inform stakeholders and decision makers alike is a low to medium risk, as demonstrated by Figure 12 below.

Given the rooms around the building, the elevations have been considered as North, East, South and West accordingly to ensure a fair representation of the site.

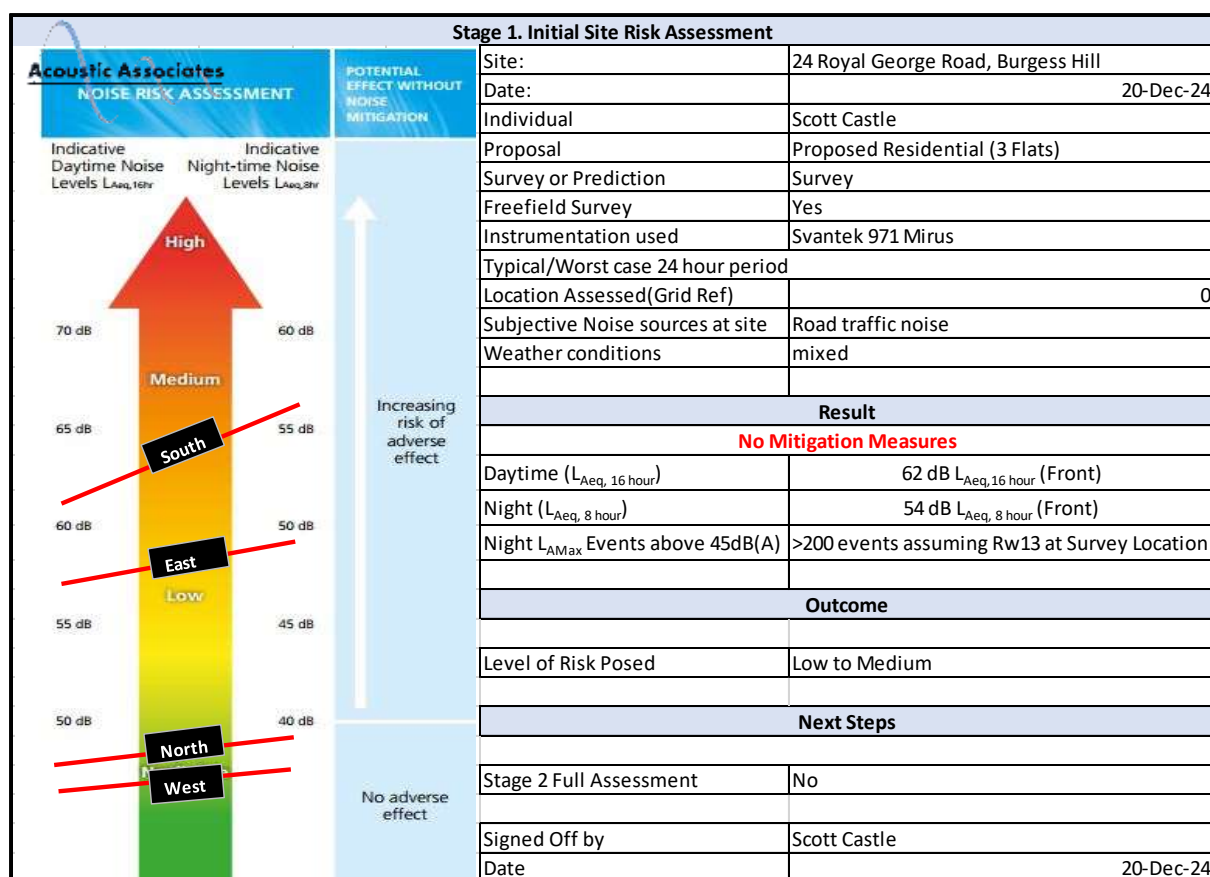


Figure 13. ProPG2017 Initial Site Risk Assessment

5.5 Separation of Commercial and Residential Tenures

It is noted that the tenure will remain as was existing, albeit with a smaller commercial space at the ground floor. Therefore, in accordance with Building Regulations Approved Document E and the Planning Noise Advice Document Sussex dated November 2023, there will be a requirement for enhanced soundproofing between commercial and residential properties.

Specifically, this relates to the horizontal separation between the commercial ground floor space and the bedroom (9.8m²) and living room of flat 1. Additionally, the vertical separation between the commercial ground floor space and the living room above for flat 2 (16.9m²) will also require improved sound insulation performance.

Given that the client has control of the building, this is likely to allow treatments from below, ie making good of all areas, potential for a reduced ceiling, and potential wall linings, as well as treatments from above. Above floor treatments will likely include introduced dense mineral wool into joists, new above joist layers and floor treatments as well as perimeter isolation around the wall edges.

The Sussex guidance, which Mid Sussex District Council are signed up to, indicates that there should be greater than 5dB above building regulations for the different residential and commercial tenures. As a change of use this will be 43dB+5, therefore a minimum requirement to exceed 48dB $D_{nTw}+C_{tr}$.

It is common for the local planning authority to secure such soundproofing through a suitably worded condition. Baseline testing was not practical in situ due to the condition of the premises.

5.6 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:

- Daytime sound pressure levels have been used.
- All rigorous calculations use freefield data.
- The calculations have assumed a masonry cavity wall and lightweight inner blockwork
- 35dB $L_{Aeq,16\text{ hour}}$ has been applied as the daytime criteria for a Kitchen/Lounge/Diner
- Glazing used is Pilkington 4\12\4 with an R_{traffic} of 25
- Where there is more than one window for a room space, the glazing has been summed and the noisier façade attributes applied within the calculation. For example, for Flat 3, there is a large amount of glazed dormer on the south façade (noisiest) as well as an additional window on the East façade. The glazing is therefore summed and uses the worst-case external sound pressure level in order to assess the effectiveness of the façade.
- For flat 3 it is also noted that the wall attributes have been removed and replaced with roofing tiles to ensure a robust assessment as this is effectively within the roof space.
- Through frame acoustic passive vents have been used for each window (Greenwood EA5000 with a 5230mm² opening).

Rigorous Calculations Summary							
Location	External	SRI Needed	Windows	Vents	Internal	SRI	SRI Achieved
KLD1	57	27	4\12\4	Greenwood5000EA	28	29	Yes
KLD2	62	27	4\12\4	Greenwood5000EA	35	27	Yes
KLD3	62	27	10\12\4	Greenwood5000EA	35	28	Yes
Flat 1- bed	57	26	4\12\4	Greenwood5000EA	29	29	Yes
Flat 2 Bed (East)	57	26	4\12\4	Greenwood5000EA	35	29	Yes
Flat 2 Bedroom (West)	45	14	4\12\4	Greenwood5000EA	16	29	Yes
Flat 3 Bedroom	47	16	4\12\4	Greenwood5000EA	20	27	Yes

Figure 14. Summary of Rigorous Calculations

The majority of windows are capable of using standard thermal double glazing. The exception is flat 3 with the reason being the windows being introduced are close to 6m².

6 Recommendations

6.1 Workmanship and Making Good

Where windows are defective and being replaced, they should be replaced with high quality glazing as stated below. It was noted on site that some windows were damaged and showed signs of cracking. The Velux roof window on the rear of the second floor also indicated signs that it was poorly fitted.

Where dormers are being introduced to the front and rear elevations, these should have suitable mass and soundbloc board(15mm) placed to the inner sides of the cheeks and dormer roof to prevent these being a weak pathway for sound energy.

A high standard of workmanship must be included in and around the windows as well as attention being paid to ensuring that any all penetrations to the building fabric are sealed. Also on the second-floor north elevation, direct penetrations through the roof were noted and need to be remedied.

It is strongly advised that for the second floor (ie within the roof), staggered layers of soundbloc wall board (15mm and 12mm) with edges taped are used on the underside of the ceiling to introduce further mass into the façade. High density mineral wool should also be used to replace any mineral wool removed from the joists.

6.2 Glazing

The assessment indicates that the majority of the windows are capable of utilising standard thermal double glazing. The glass used within the assessment was Pilkington glass. Should the client choose an alternative provider, it is critical to ensure that the only metric compared is that of the R_{traffic} or R_w+C_{tr} .

The relevant comparisons are as follows:

Sound Insulation Performance of Window Units			
Brand	Window Specification	R_w	R_{traffic}
Pilkington Double	4\12\4	31	25
Pilkington Double	10\12\4	36	29

Figure 15. Glazing R_w+C_{tr} Specification

N.B. This is the required R_w+C_{tr} of the frame and glazing together. If the glazing supplier has test results for the glass on its own an R_w+C_{tr} value 2-3dB higher would be required (glazing tested on its own will outperform glazing that is tested within a window frame). Please note R_w+C_{tr} is also referred to as R_{traffic} .

6.3 Rooflight

A rooflight is noted in the living room area at ground floor. This is unlikely to be a high noise area due to the relatively enclosed space and will likely also be a laminated glazed area on safety grounds.

6.4 Ventilation

The room calculations have been achieved with a single greenwood 5230mm² openable space. The vents are acoustically treated and have a $D_{new} + C_{tr}$ rating of 33dB. Should an alternative supplier/provider be approached, then as with glazing above, the only comparable metric is the $D_{new} + C_{tr}$ value. Also, the test values must only be compared for the vent OPEN values.

The Greenwood values are as follows:

6.5 Sound Insulation

The sound insulation performance required will be a minimum of 48dB $D_{nTw} + C_{tr}$ between the ground floor commercial and the ground floor flat 1 and first floor flat 2. This is capable of being conditioned by Mid Sussex District Council.

7 Conclusion

A class 1 sound level meter was set up at the site between the 17th and the 20th of December 2024 to assess the site soundscape facing Royal George Road. To ensure robust reporting, short term simultaneous measurements were also undertaken on the façade facing Fairfield Road and also to the rear of the site to better understand how sound propagates around the site.

The freefield external site soundscape at Royal George Road was 62dB $L_{Aeq,16 \text{ hour}}$ for the daytime period (07:00-23:00 hours) and 54dB $L_{Aeq, 8 \text{ hours}}$ for the overnight period (23:00-07:00 hours). The soundscape reduced by as much as 17dB around other facades of the building.

No bedrooms overlook the busier Royal George Road and this is felt to represent good acoustic design.

The proposed first floor terrace/external amenity area is also likely to achieve BS8233:2014 and World Health Organisation Guidelines for Community Noise dated 1999 (revised 2018).

The initial site risk assessment, consistent with ProPG2017 communicates the level of risk to the stakeholders and decision makers alike, provides a worst case of low to medium risk and changes depending on the elevation being assessed. The level of risk is generally aligned with the degree of mitigation measures to protect future residents against external airborne transportation noise.

With regards to glazing and ventilation, the majority of the building is capable of using standard thermal double-glazing products with an $R_{traffic}$ of 25B(A) and acoustic through frame trickle vents to allow an alternative method of ventilation.

There will be a requirement for enhanced soundproofing between the ground floor commercial space and ground floor residential space (horizontal soundproofing) and additionally between the commercial ground floor space and first floor habitable rooms as residential spaces (vertical soundproofing). It is typical for this to be conditioned by the local planning authority.

From the information presented, planning consent should not be withheld on noise grounds.

8 Appendix A – Rigorous Calculations

Non Frequency Dependent Variables			Key for Table Below	
Term	Derivation	Value	R _{wi}	Sound Reduction of Window (Octave)
A _o	Given in BS EN 20140-10 = 10 (m ²)	10	R _{ew}	Sound Reduction Index of External Wall (Octave)
S _f	Total Facade Area (m ²)	19.32	R _{rr}	Sound Reduction Index of Roof/Ceiling (Octave)
S _{wi}	Window Area (m ²)	4.71	A	Equivalent Absorption Area of Rx Room (m ²)
S _{ew}	External Wall Area (m ²)	14.61	D _{n,e}	Insulation of Trickle Vent (BS EN 20140-10)
S _{rr}	Ceiling Area (m ²)	0.0001		
S	Total Area sound enters the room (m ²)	19.3201		

Frequency Dependent Variables							
Term	Description	Octave Band Centre Frequency					
		125	250	500	1000	2000	4000
Leq,ff	Free-Field External Noise Level	64	60	58	58	55	48
D _{n,e}	Greenwood 5000EA(5230mm2)	39.5	37.3	35.5	32	31	33.5
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}	Tile on Felt, Pitched Roof, 100mm mineral wool on plasterboard ceiling	43	43	43	43	43	43
A	Equivalent Absorption Area of Room (Copied from BS8233)	11.00	14.00	16.00	16.00	15.00	15.00

BS8233 Calculation Details						
Term From Equation Below	Octave Band Centre Frequency					
	125	250	500	1000	2000	4000
Leq,ff	64	60	58	58	55	48
A _o /S . 10 [^] (-D _{n,e} /10)	5.81E-05	9.64E-05	0.000146	0.000327	0.000411	0.000231
S _{wi} /S . 10 [^] (-R _{wi} /10)	0.000971	0.002438	0.000771	7.71E-05	3.86E-05	7.71E-05
S _{ew} /S . 10 [^] (-R _{ew} /10)	6.01E-05	9.52E-05	3.01E-05	4.77E-06	7.56E-07	2.39E-07
S _{rr} /S . 10 [^] (-R _{rr} /10)	2.59E-10	2.59E-10	2.59E-10	2.59E-10	2.59E-10	2.59E-10
10log ₁₀ (S/A)+3	5.446167	4.398813	3.818894	3.818894	4.099181	4.099181
Leq,2	39.81516	38.59747	31.58197	27.93023	25.63647	16.9922
A-Weighting	-16.1	-8.6	-3.2	0	1.2	1
A-Weighted Leq	23.71516	29.99747	28.38197	27.93023	26.83647	17.9922

A-Weighted Level Outside	62
BS8233 Predicted Internal A-Weighted Level	35
Predicted Building Envelope SRI	27

Royal George Road - Flat 2 - KLD

BS8233 Calculation can be seen below:	
$L_{eq,2} \approx L_{eq,ff} + 10 \log_{10} \left(\frac{A_0}{S} 10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S} 10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S} 10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S} 10^{\frac{-R_{rr}}{10}} \right) + 10 \log_{10} \left(\frac{S}{A} \right) + 3$	

Non Frequency Dependent Variables			Key for Table Below	
Term	Derivation	Value	R _{wi}	Sound Reduction of Window (Octave)
A _o	Given in BS EN 20140-10 = 10 (m ²)	10	R _{ew}	Sound Reduction Index of External Wall (
S _f	Total Facade Area (m ²)	8.4	R _{rr}	Sound Reduction Index of Roof/Ceiling (
S _{wi}	Window Area (m ²)	1.62	A	Equivalent Absorbtion Area of Rx Room (
S _{ew}	External Wall Area (m ²)	6.78	D _{n,e}	Insulation of Trickle Vent (BS EN 20140-10
S _{rr}	Ceiling Area (m ²)	13.5		
S	Total Area sound enters the room (m ²)	21.9		

Frequency Dependent Variables							
Term	Description	Octave Band Centre Frequency					
		125	250	500	1000	2000	4000
Leq,ff	Free-Field External Noise Level	47	43	41	41	38	31
D _{n,e}	Greenwood 5000EA(5230mm2)	39.5	37.3	35.5	32	31	33.5
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}	100mm flat concrete roof (230 kg/m2)	52	52	52	52	52	52
A	Equivalent Absorbtion Area of Room (Copied from BS8233)	11.00	14.00	16.00	16.00	15.00	15.00

BS8233 Calculation Details						
Term From Equation Below	Octave Band Centre Frequency					
	125	250	500	1000	2000	4000
Leq,ff	47	43	41	41	38	31
A _o /S . 10 [^] (-D _{n,e} /10)	5.12E-05	8.5E-05	0.000129	0.000288	0.000363	0.000204
S _{wi} /S . 10 [^] (-R _{wi} /10)	0.000294	0.00074	0.000234	2.34E-05	1.17E-05	2.34E-05
S _{ew} /S . 10 [^] (-R _{ew} /10)	2.46E-05	3.9E-05	1.23E-05	1.95E-06	3.1E-07	9.79E-08
S _{rr} /S . 10 [^] (-R _{rr} /10)	3.89E-06	3.89E-06	3.89E-06	3.89E-06	3.89E-06	3.89E-06
10log10(S/A)+3	5.990514	4.943161	4.363241	4.363241	4.643529	4.643529
Leq,2	18.72161	17.32644	11.14768	10.37854	8.425677	-0.71388
A-Weighting	-16.1	-8.6	-3.2	0	1.2	1
A-Weighted Leq	2.62161	8.726443	7.947681	10.37854	9.625677	0.286123

A-Weighted Level Outside	45
BS8233 Predicted Internal A-Weighted Level	16
Prediced Building Envelope SRI	29

Royal George Road - Flat 2 - BED
2(West)

BS8233 Calculation can be seen below:

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

Non Frequency Dependent Variables			Key for Table Below	
Term	Derivation	Value	R _{wi}	Sound Reduction of Window (Octave)
A _o	Given in BS EN 20140-10 = 10 (m ²)	10	R _{ew}	Sound Reduction Index of External Wall (
S _f	Total Facade Area (m ²)	17.52	R _{rr}	Sound Reduction Index of Roof/Ceiling (
S _{wi}	Window Area (m ²)	4.8	A	Equivalent Absorbtion Area of Rx Room (
S _{ew}	External Wall Area (m ²)	0	D _{n,e}	Insulation of Trickle Vent (BS EN 20140-10
S _{rr}	Ceiling Area (m ²)	10.6		
S	Total Area sound enters the room (m ²)	28.12		

Frequency Dependent Variables							
Term	Description	Octave Band Centre Frequency					
		125	250	500	1000	2000	4000
Leq,ff	Free-Field External Noise Level	49	45	43	43	40	33
D _{n,e}	Greenwood 5000EA(5230mm2)	39.5	37.3	35.5	32	31	33.5
R _{wi}	4_12_4	24	20	25	35	38	35
R _{ew}	Roofing tiles	43	43	43	43	43	43
R _{rr}	Tile on Felt, Pitched Roof, 100mm mineral wool on plasterboard ceiling	43	43	43	43	43	43
A	Equivalent Absorbtion Area of Room (Copied from BS8233)	11.00	14.00	16.00	16.00	15.00	15.00

BS8233 Calculation Details						
Term From Equation Below	Octave Band Centre Frequency					
	125	250	500	1000	2000	4000
Leq,ff	49	45	43	43	40	33
A _o /S . 10 [^] (-D _{n,e} /10)	3.99E-05	6.62E-05	0.0001	0.000224	0.000282	0.000159
S _{wi} /S . 10 [^] (-R _{wi} /10)	0.00068	0.001707	0.00054	5.4E-05	2.71E-05	5.4E-05
S _{ew} /S . 10 [^] (-R _{ew} /10)	0	0	0	0	0	0
S _{rr} /S . 10 [^] (-R _{rr} /10)	1.89E-05	1.89E-05	1.89E-05	1.89E-05	1.89E-05	1.89E-05
10log10(S/A)+3	7.076226	6.028873	5.448953	5.448953	5.729241	5.729241
Leq,2	24.75885	23.56245	16.63722	13.1802	10.89359	2.37889
A-Weighting	-16.1	-8.6	-3.2	0	1.2	1
A-Weighted Leq	8.658853	14.96245	13.43722	13.1802	12.09359	3.37889

A-Weighted Level Outside	47
BS8233 Predicted Internal A-Weighted Level	20
Prediced Building Envelope SRI	27

Royal George Road - Flat 3 - BED 1

BS8233 Calculation can be seen below:

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

Non Frequency Dependent Variables			Key for Table Below	
Term	Derivation	Value	R _{wi}	Sound Reduction of Window (Octave)
A _o	Given in BS EN 20140-10 = 10 (m ²)	10	R _{ew}	Sound Reduction Index of External Wall (
S _f	Total Facade Area (m ²)	22.56	R _{rr}	Sound Reduction Index of Roof/Ceiling (
S _{wi}	Window Area (m ²)	5.94	A	Equivalent Absorbtion Area of Rx Room (
S _{ew}	External Wall Area (m ²)	0	D _{n,e}	Insulation of Trickle Vent (BS EN 20140-10
S _{rr}	Ceiling Area (m ²)	18		
S	Total Area sound enters the room (m ²)	40.56		

Frequency Dependent Variables							
Term	Description	Octave Band Centre Frequency					
		125	250	500	1000	2000	4000
Leq,ff	Free-Field External Noise Level	64	60	58	58	55	48
D _{n,e}	Greenwood 5000EA(5230mm2)	39.5	37.3	35.5	32	31	33.5
R _{wi}	10_12_4	25	22	33	40	43	44
R _{ew}	Roofing tiles	43	43	43	43	43	43
R _{rr}	Tile on Felt, Pitched Roof, 100mm mineral wool on plasterboard ceiling	28	34	43	43	43	43
A	Equivalent Absorbtion Area of Room (Copied from BS8233)	11.00	14.00	16.00	16.00	15.00	15.00

BS8233 Calculation Details						
Term From Equation Below	Octave Band Centre Frequency					
	125	250	500	1000	2000	4000
Leq,ff	64	60	58	58	55	48
A _o /S . 10 [^] (-D _{n,e} /10)	2.77E-05	4.59E-05	6.95E-05	0.000156	0.000196	0.00011
S _{wi} /S . 10 [^] (-R _{wi} /10)	0.000463	0.000924	7.34E-05	1.46E-05	7.34E-06	5.83E-06
S _{ew} /S . 10 [^] (-R _{ew} /10)	0	0	0	0	0	0
S _{rr} /S . 10 [^] (-R _{rr} /10)	0.000703	0.000177	2.22E-05	2.22E-05	2.22E-05	2.22E-05
10log10(S/A)+3	8.667053	7.619699	7.03978	7.03978	7.320067	7.320067
Leq,2	43.43758	38.21389	27.21797	27.88292	25.85003	16.72519
A-Weighting	-16.1	-8.6	-3.2	0	1.2	1
A-Weighted Leq	27.33758	29.61389	24.01797	27.88292	27.05003	17.72519

A-Weighted Level Outside	62
BS8233 Predicted Internal A-Weighted Level	35
Prediced Building Envelope SRI	28

Royal George Road - Flat 3- KLD

BS8233 Calculation can be seen below:

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

Non Frequency Dependent Variables			Key for Table Below	
Term	Derivation	Value	R _{wi}	Sound Reduction of Window (Octave)
A _o	Given in BS EN 20140-10 = 10 (m ²)	10	R _{ew}	Sound Reduction Index of External Wall (
S _f	Total Facade Area (m ²)	7.92	R _{rr}	Sound Reduction Index of Roof/Ceiling (
S _{wi}	Window Area (m ²)	2.7	A	Equivalent Absorbtion Area of Rx Room
S _{ew}	External Wall Area (m ²)	5.22	D _{n,e}	Insulation of Trickle Vent (BS EN 20140-10
S _{rr}	Ceiling Area (m ²)	0.00001		
S	Total Area sound enters the room (m ²)	7.92001		

Frequency Dependent Variables							
Term	Description	Octave Band Centre Frequency					
		125	250	500	1000	2000	4000
Leq,ff	Free-Field External Noise Level	59	55	53	53	50	43
D _{n,e}	Greenwood 5000EA(5230mm2)	39.5	37.3	35.5	32	31	33.5
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						
Term From Equation Below	Octave Band Centre Frequency					
	125	250	500	1000	2000	4000
Leq,ff	59	55	53	53	50	43
A _o /S . 10 [^] (-D _{n,e} /10)	0.000142	0.000235	0.000356	0.000797	0.001003	0.000564
S _{wi} /S . 10 [^] (-R _{wi} /10)	0.001357	0.003409	0.001078	0.000108	5.4E-05	0.000108
S _{ew} /S . 10 [^] (-R _{ew} /10)	5.24E-05	8.3E-05	2.62E-05	4.16E-06	6.59E-07	2.08E-07
S _{rr} /S . 10 [^] (-R _{rr} /10)	1.26E-16	1.26E-16	1.26E-16	1.26E-16	1.26E-16	1.26E-16
10log10(S/A)+3	1.57333	0.525977	-0.05394	-0.05394	0.226345	0.226345
Leq,2	32.48002	31.23977	24.59001	22.52991	20.46967	11.50008
A-Weighting	-16.1	-8.6	-3.2	0	1.2	1
A-Weighted Leq	16.38002	22.63977	21.39001	22.52991	21.66967	12.50008

A-Weighted Level Outside	57
BS8233 Predicted Internal A-Weighted Level	29
Prediced Building Envelope SRI	29

Royal George Road - Flat 1 - BED 1

BS8233 Calculation can be seen below:

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