PEAK acoustics

Noise Impact Assessment

Client:	Sim Singh
Site:	7 King Street, Gravesend
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Executive Summary

A noise assessment has been undertaken at 7 King Street, Gravesend, DA12 2HH in relation to the proposed change of use of the 1st, 2nd and 3rd floors to residential.

Environmental noise monitoring has been undertaken at the site from 4th – 6th October 2024. Noise affecting the development has been determined to be primarily from pedestrians and 'The Goose' pub opposite the site.

A glazing and ventilation scheme has been given to ensure conditions in habitable rooms remain within the desired design criteria of BS8233:2014. The derived scheme is summarised below.

Glazing & Ventilation Scheme

Internal Space	Glazing		Ventilation	
	Minimum Performance R_w (+C_{tr})	Example Specification	Minimum Performance $D_{ne,W}$,+$C_{tr\ (Open)}$	Example Specification
"Kitchen/Living/Bed"	39 (32)	Secondary Glazing: 6/50/4	45	Passive Thru-Wall Vent: Passivent Fresh 80dB
"Kitchen/Living/Bed" (3F)	39 (32)	Secondary Glazing: 6/50/4	45	Passive Thru-Wall Vent: Passivent Fresh 80dB

Internal noise levels are anticipated to be within the guidelines of BS8233 with comments from ProPG

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1. Introduction

1.1. Proposal

It is proposed to change the use of the 1st – 3rd floors of 7 King Street, Gravesend to residential flats.

1.2. Reason for Assessment

The client has instructed a BS8233 assessment to be undertaken at the site. The noise impact assessment will determine the existing environmental noise levels at the site and minimum acoustic performance for glazing and ventilation elements to achieve desirable internal noise levels within habitable rooms of the proposed development.

1.3. Planning Conditions

No planning application has yet been submitted and no local authority comments or guidance have been provided.

1.4. Assessment Guidance Documentation

Guidance on the assessment and design criteria will be drawn from BS8233:2014 - *Guidance on sound insulation and noise reduction for buildings.* Table 4 in Section 7.7.2 of this standard suggests indoor ambient noise levels for dwellings.

Additional guidance will be drawn from 'ProPG: Planning & Noise' which was published "*to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England.*"

Where necessary, mitigation recommendations will be given to comply with the requirements of the National Planning Policy Framework (2021) and the Noise Policy Statement for England (2010). Further information on all guidance documentation can be found in **Appendix H**.

2. Environmental Noise Survey

2.1. Survey Measurement

To assess the environmental noise levels affecting the proposed development, an unattended noise survey has been undertaken at the site from 4th – 6th October 2024. This period was selected to capture events and noise levels on a typical weekday rush-hour period and weekend periods from nearby Bars as well as noise from other nearby residential and commercial sources.

Measurements of $L_{Aeq,T}$ and L_{AFmax} were logged in 5- minute intervals in accordance with the provisions of BS7445 - 'Description and Measurement of Environmental Noise'.

2.2. Measurement Location

Monitoring position M1 is located out of a 2nd floor front window. The microphone was positioned approximately 7.5 metres above ground level. A -3dB correction is applied to measured data to account for proximity to the building façade. The site and monitoring locations are shown below in **Figure 1**:

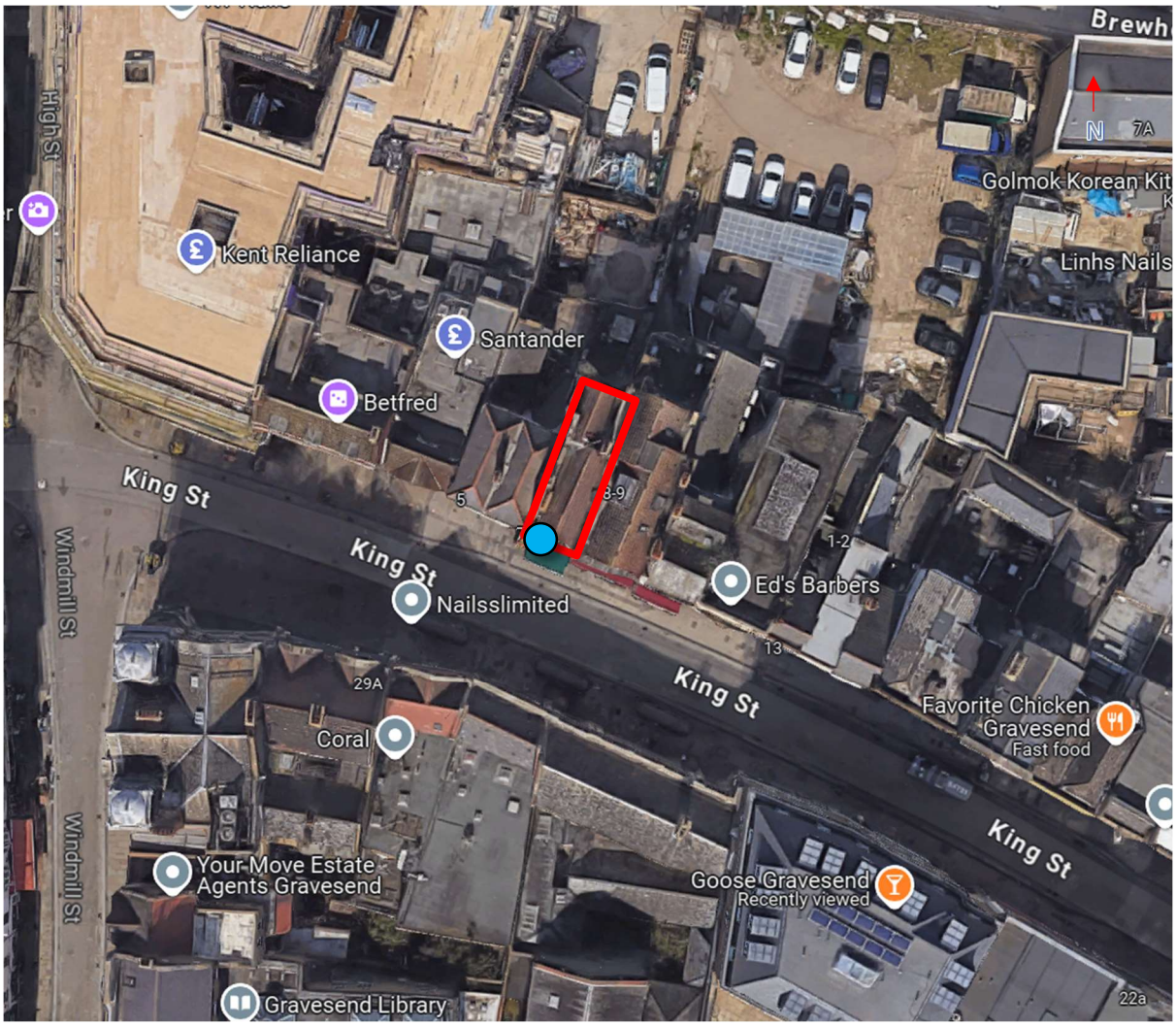


Figure 1: Site & Measurement Locations – google.com/maps

Monitoring Location (M1)

Site Boundary (Approx.)

2.3. Site Descriptions

The site is located midway along King Street in Gravesend. It is proposed to create residential dwellings in the 1st, 2nd and 3rd floors of the site while the ground floor will remain a commercial space which is currently occupied by a green grocer's store. The adjacent ground floor commercial space includes the 'Kings Sports Bar' which is understood to be temporarily closed but with plans to re-open in the near future. Other nearby uses include salons, banks, betting shops, pubs and bars.

2.4. Noise Affecting the Development

The primary noise sources affecting the development have been identified as pedestrians passing the site while conversing and noise from 'The Goose' public house, opposite the site. Secondary sources were noted as customers visiting nearby shops, air traffic and birdsong.

2.5. Environmental Noise Survey Results

The results from the noise monitoring location M1 are summarised below.

The full-time history of the noise monitoring data is given in **Appendix E.**

Measurement	Date(s)	Period	L_{Aeq} (dB)	Typical* L_{AFmax} (dB)
M1	4th October 2024	13:20 – 23:00	57	-
	4th – 5th October 2024	Night (8hr)	59	83
	5th October 2024	Day (16hr)	57	-
	5th – 6th October 2024	Night (8hr)	57	82
	6th October 2024	07:00 – 08:15	53	-

Table 1: Environmental Measurement Summary

* The given 'Typical' L_{AFmax} levels are an average of the spectra of the noisiest 10 events of the night-time period.

2.6. Weather Conditions

Daytime temperatures of 15 - 17°C were noted during the survey with winds of 2 – 6m/s. Detailed weather conditions are given in **Appendix C**.

2.7. Measurement Equipment

Measurement equipment complies with accuracy requirements for common environmental noise measurement standards. Equipment was calibrated before and after use and no significant drift occurred during measurements. Up-to-date calibration certification can be provided upon request. A detailed equipment list is given in **Appendix B** with calibration information in **Appendix D**.

3. Internal Noise Level Assessment

3.1. Design Criteria

BS8233:2014 - *Guidance on sound insulation and noise reduction for buildings* suggests indoor ambient noise levels for dwellings in Table 4, Section 7.7.2. These are summarised below.

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	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

Table 2: Indoor Ambient Noise Levels for Dwellings

BS8233 states that the guideline values given above are for 'noise without character', further stating:

> *"Noise has a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate."*

Table 4 of BS8233 also has accompanying notes that were subject to additions in ProPG. The relevant notes with the additions of ProPG are given below.

> *"In most circumstances in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB LAmax,F more than 10 times a night."*

Review of night-time noise levels measured on Friday and Saturday night show a gradual increase in noise levels between 8pm and 2am followed by a drop from around 2am onwards. This coincides with the stated opening hours of 'The Goose' pub opposite the site and is likely to be due to a combination of music and pedestrian sources.

The BS4142 standard utilises rating penalties whereby the Specific Sound Levels may be corrected for characteristics that make the sound more noticeable at the NSR location such as tonality, impulsivity and intermittency. Section 9.2 of BS4142:2014 gives commentary on these characteristics and appropriate penalties:

> ***"Tonality***
> *For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.*
>
> ***Impulsivity***
> *A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.*
>
> ***Other sound characteristics***
> *Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.*
>
> *NOTE 2 Where tonal and impulsive characteristics are present in the specific sound within the same reference period then these two corrections can both be taken into account. If one feature is dominant then it might be appropriate to apply a single correction. Where both features are likely to affect perception and response, the corrections ought normally to be added in a linear fashion.*
>
> ***Intermittency***
> *When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. This can necessitate measuring the specific sound over a number of shorter sampling periods that are in combination less than the reference time interval in total, and then calculating the specific sound level for the reference time interval allowing for time when the specific sound is not present. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied."*

Using the above guidance taken from the BS4142 standard, rating corrections will be applied to the internal noise criteria of BS8233 for the assessment of internal noise levels at the site.

The night-time noise climate is expected to consist of music and pedestrian sources. These are considered to have clearly perceptible tonality and so a 4dB rating penalty will be applied to the internal criteria.

Music noise is also likely to be impulsive in a way that is also clearly perceptible, giving an additional 6dB penalty to internal criteria.

The day and night-time BS8233 internal LAeq criteria will be reduced by 10dB in accordance with the above, in recognition that the site is affected by noise which has distinct characteristics.

The rating-adjusted assessment criteria are provided below:

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	25 dB $L_{Aeq,16hour}$	-
Dining	Dining room/area	30 dB $L_{Aeq,16hour}$	-
Sleeping	Bedroom	25 dB $L_{Aeq,16hour}$	20 dB $L_{Aeq,8hour}$

Table 3: Assessment Criteria

The average night-time L_{Amax} criteria for the assessment will be 45dB $L_{Amax,F}$.

3.2. Assessment Noise Levels

In the interest of a robust assessment, the loudest of the measurement intervals, subject to irregular events, are to be considered in the assessment of internal noise levels and determining the sound insulation scheme.

The resultant external noise levels for the assessment of internal ambient noise levels are summarised in the table below.

Period	$L_{Aeq,T}$ (dB)	L_{Amax} (dB)
Daytime (1hr)	61	-
Night (1hr)	62	83

Table 4: Assessment Noise Levels

3.3. Internal Noise Calculations

Internal noise levels have been calculated to demonstrate that the proposed dwellings can achieve the desired design criteria when appropriate glazing and ventilation systems are utilised.

Internal arrangements of the dwellings have been submitted by the client, proposed drawings by 'Dream Design Develop' have been used to scale room and glazing dimensions and can be found in **Appendix G**.

Assessment is not required for each individual room therefore a worst-case situation will be used in which the worst affected rooms/floors will be used.

Calculations of internal ambient noise levels have been undertaken using the 'rigorous calculation' method given in Annex G2 of BS8233:2014. Full details of the calculations are provided in **Appendix F.**

4. Sound Insulation Scheme

4.1. External Building Envelope

Material build-up of the façade will significantly dictate the noise levels within the proposed dwelling. For the purposes of this report, the heavyweight construction of the façade is assumed to provide a minimum sound reduction of 49dB R_w.

The 3rd floor dwelling is considered as a room within the roof-space. Material build-up of the roof has been assumed at a minimum sound reduction of 57dB R_w. The assumed construction specification is provided within **Appendix J.**

4.2. Glazing and Ventilation

The following glazing and ventilation scheme for the development has been derived with a view of achieving the internal noise level criteria given in Table 2.

Internal Space	Glazing		Ventilation	
	Minimum Performance R_w (+C_{tr})[1]	Example Specification[2]	Minimum Performance $D_{ne,W}$,+$C_{tr\ (Open)}$	Example Specification[3]
"Kitchen/Living/Bed"	39 (32)	Secondary Glazing: 6/50/4	45	Passive Thru-Wall Vent: Passivent Fresh 80dB
"Kitchen/Living/Bed" (3F)	39 (32)	Secondary Glazing: 6/50/4	45	Passive Thru-Wall Vent: Passivent Fresh 80dB

Table 5: Glazing & Ventilation Scheme

N.B. Note that other glazing configurations and ventilators can achieve the given minimum performance requirements.

[1] *The sound insulation value of the glazing should take into account the glass as well as the frame and perimeter seal.*

[2] *Example glazing specification format given as 'XXmm Float / 16mm Air gap / XXmm Float'*

[3] *It is noted that BS8233 section 7.2.2 states 'If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level'. This statement implies that the use of closed windows and an alternative means of ventilation is acceptable.*

5. Internal Noise Levels

It is determined that by using mitigation as specified in **Table 4** for the building façades, the outcome summarised in the following table is achieved.

Internal Space	Noise Parameter	Internal Noise Level (dB)	Within Design Criteria?
Kitchen/Living/Bedroom	Daytime $L_{Aeq, 16hr}$	25	Yes
	Night-time $L_{Aeq, 8hr}$	19	Yes
	Night-time $L_{Amax\ F}$	40	Yes
Kitchen/Living/Bedroom (3F)	Daytime $L_{Aeq, 16hr}$	25	Yes
	Night-time $L_{Aeq, 8hr}$	20	Yes
	Night-time $L_{Amax\ F}$	41	Yes

Table 6: Internal Noise Levels

For the daytime assessment for living areas, the desirable limit of BS8233:2014 suggests a guideline of 35 dB $L_{Aeq,16hr}$ for resting conditions, and up to 40 dB is considered acceptable for necessary developments.

All results, with the implementation of the derived sound insulation scheme given in **Table 5**, would place the internal daytime noise levels below 35 dB, therefore within the desired limit.

For the night-time assessment for bedrooms, BS8233:2014 suggests a desirable guideline of 30 dB $L_{Aeq, 8hr}$ for sleeping conditions, with an acceptable limit of 35 dB $L_{Aeq, 8hr}$.

Implementation of the derived sound insulation scheme given in **Table 5** would place the internal continuous night-time noise levels below 30 dB, therefore within the desirable category.

For the night-time assessment for bedrooms, ProPG suggests that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night.

Implementation of the derived sound insulation scheme given in **Table 5** would place the internal $L_{Amax,F}$ night-time events below 45 dB, therefore within the criteria.

Internal noise levels also achieve the rating-adjusted internal criteria stated within **Table 3.**

6. External Amenity Areas

Plans provided for the development do not show any external amenity associated with the dwellings and so this has not been considered.

7. Sound Insulation to Retail Units

The guidance in Approved Document E (ADE) regarding commercial uses is simply that a higher standard of sound insulation may be required between spaces separating domestic and non-domestic purposes, and that the appropriate level of sound insulation required will depend on the noise generated in the non-domestic space.

For guidance, an improvement of +10dB compared with the normal residential sound insulation requirements might typically be suitable for general commercial use.

A typical basic floor construction may be of a timber joist construction with wooden floorboards to the top side, a single layer of plaster board below and fibreglass type insulation between the joists. This would give an airborne sound insulation of approximately 28dB Rw+Ctr. A 25dB uplift would be required.

An example of an uprated floor would include the addition of resilient bars to the underside of joists with 2 layers of acoustic board below. A mass loaded vinyl/rubber layer would be added above the floor boards and an additional layer of particle board added above this.

The above type of floor would achieve around 54dB Rw+Ctr and achieve the 10dB uplift on building regs discussed.

8. Conclusions

A noise assessment has been undertaken at 7 King Street, Gravesend, DA12 2HH in relation to the proposed change of use of the 1st, 2nd and 3rd floors to residential.

Environmental noise monitoring has been undertaken at the site from 4th – 6th October 2024. Noise affecting the development has been determined to be primarily from pedestrians and 'The Goose' pub opposite the site.

A glazing and ventilation scheme has been given to ensure conditions in habitable rooms remain within the design criteria.

Internal noise levels are anticipated to be within the guidelines of BS8233 with comments from ProPG.

APPENDIX A – Measurement Details

Measurement(s)	Kit	Start Date	Start Time	End Date	End Time
M1	A1	04/10/2024	13:20	06/10/2024	08:15

APPENDIX B - Equipment Details

Kit	Equipment	Make	Model	Class	Serial Number
A1	Sound Meter	Svantek	958	1	34525
A1	Pre-Amp	Svantek	SV12L	1	32484
A1	Microphone	Microtech Gefell	MK255	1	11561
2	Calibrator	Svantek	SV33	1	83715

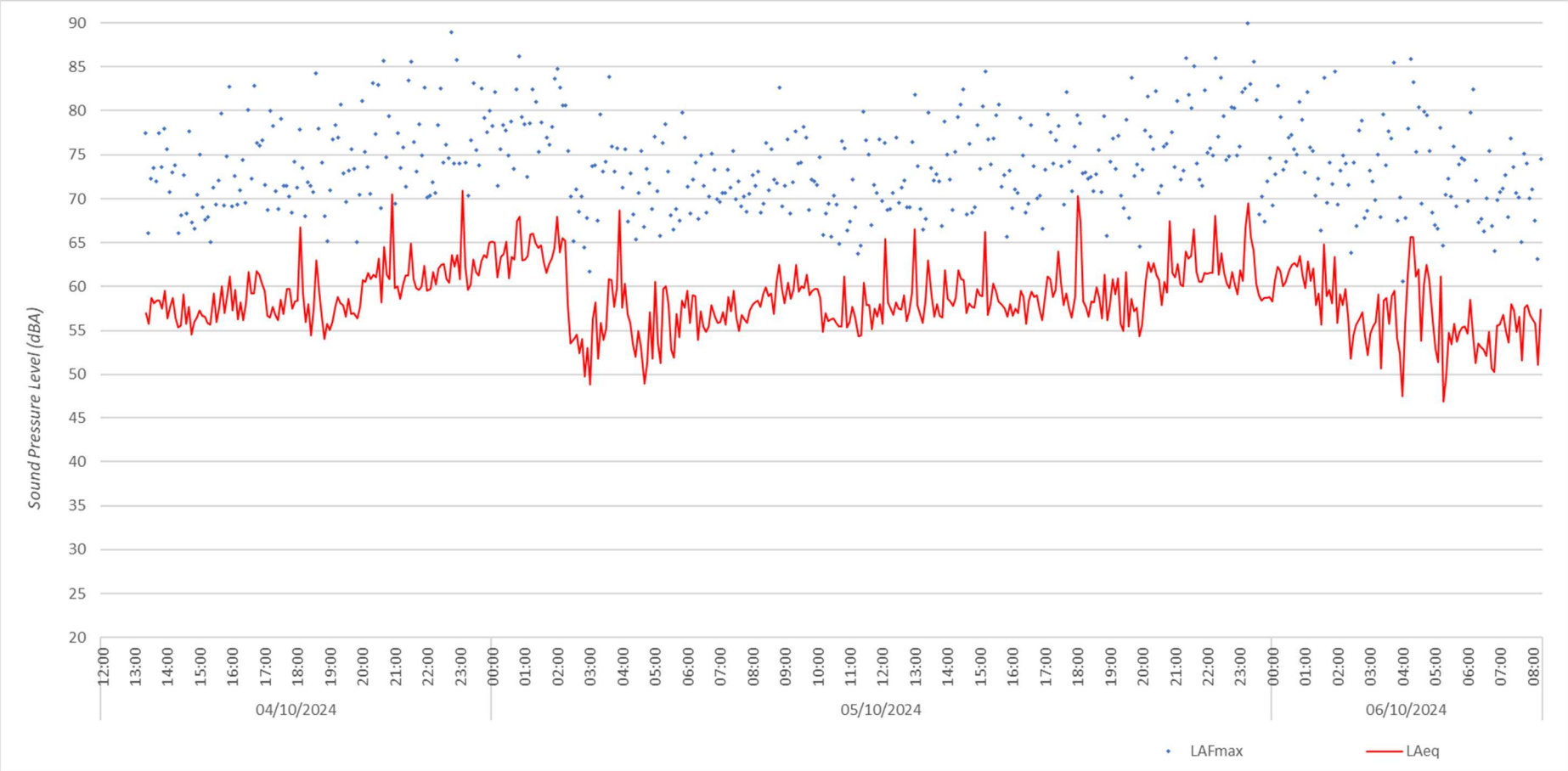
APPENDIX C - Meteorology Details

Date	Temp C°	Wind Speed m/s	Wind Direction	Humidity %	Precipitation mm	Cloud Cover (Oktas)
04/10/2024	15	2	SE	65	0	5/8
07/10/2024	17	6	SW	72	0	3/8

APPENDIX D - Calibration Details

Kit	Calibrator Ref Level (dB)	Deviation Before (dB)	Deviation After (dB)
A1	113.80	0.80	0.80

APPENDIX E – Noise Survey Time History



Environmental Noise Measurement M1 Time History: 4th – 6th October 2024

APPENDIX F – BS8233 Rigorous Design Calculations

Kitchen/Living/Bedroom - 1F/2F

BS8233:2014 Façade Noise Break In Calculator

	125	250	500	1k	2k	dBA
Daytime External Noise Level - LAeq - 1 hour	63.7	61.6	59.0	55.5	48.8	60
Night-time External Noise Level - LAeq - 1 hour	56.0	55.1	54.4	53.2	55.7	59
Night-time Lmax Noise Levels - 10 times per night	72.0	73.9	76.4	77.5	78.1	82

Room Properties					Room Coefficient					
Width (m)	Height (m)	Depth (m)	Glazing	Reverb Time	16	17	18	19	17	A
4	2.4	8	4	0.7	0.8	0.7	0.7	0.7	0.7	RT

Façade Construction		SRI (Sound Reduction Index)					Rw
Wall Construction	Brick and block, 75mm cavity, 60mm Fibreglass	31	46	43	49	56	49(44)
Roof Construction	Not Within Roof Space	0	0	0	0	0	N/A
Glazing Spec	6 / 50 / 4 (Secondary Glazing)	28	36	42	48	48	39(32)
Ventilation Spec	Passive Thru-Wall Vent	42	43	43	49	64	45

Calculation Results			125	250	500	1k	2k	dBA
Daytime Internal Noise Level - LAeq	Target Value <	25	21.5	17.6	19.3	12.8	1.1	24.9
Night-time Internal Noise Level - LAeq	Target Value <	20	13.9	11.2	14.7	10.5	8.1	19.3
Internal LAmax Noise Levels	Target Value <	45	29.9	29.9	36.7	34.8	30.5	40.3

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**39(32)**	dB $R_{W(+Ctr)}$	*Selectaglaze S10 Slider 4mm Toughened Glass*
			6 / 50 / 4 (Secondary Glazing)
Ventilation	**45**	$D_{n,e,w+Ctr}$	*Passive Thru-Wall Vent*
			Passivent Fresh 80dB

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

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

Kitchen,Living,Bedroom - 3F

BS8233:2014 Façade Noise Break In Calculator

	125	250	500	1k	2k	dBA
Daytime External Noise Level - LAeq - 1 hour	63.7	61.6	59.0	55.5	48.8	60
Night-time External Noise Level - LAeq - 1 hour	56.0	55.1	54.4	53.2	55.7	59
Night-time Lmax Noise Levels - 10 times per night	72.0	73.9	76.4	77.5	78.1	82

Room Properties					Room Coefficient					
Width (m)	Height (m)	Depth (m)	Glazing	Reverb Time	16	17	18	19	17	A
4	2.4	8	4	0.7	0.8	0.7	0.7	0.7	0.7	RT

Façade Construction		SRI (Sound Reduction Index)					Rw
Wall Construction	Brick and block, 75mm cavity, 60mm Fibreglass	31	46	43	49	56	49(44)
Roof Construction	Tiled Pitched Roof	44	52	59	63	62	61 (56)
Glazing Spec	6 / 50 / 4 (Secondary Glazing)	28	36	42	48	48	39(32)
Ventilation Spec	Passive Thru-Wall Vent	42	43	43	49	64	45

Calculation Results			125	250	500	1k	2k	dBA
Daytime Internal Noise Level - LAeq	Target Value <	25	21.8	18.0	19.4	13.0	1.9	25.1
Night-time Internal Noise Level - LAeq	Target Value <	20	14.1	11.5	14.8	10.6	8.8	19.5
Internal LAmax Noise Levels	Target Value <	45	30.1	30.2	36.8	35.0	31.2	40.5

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**39(32)**	dB $R_{W(+Ctr)}$	*Selectaglaze S10 Slider 4mm Toughened Glass*
			6 / 50 / 4 (Secondary Glazing)
Ventilation	**45**	$D_{n,e,w+Ctr}$	*Passive Thru-Wall Vent*
			Passivent Fresh 80dB

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

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

APPENDIX G – Site Plans

APPENDIX H – Legislation, Policy and Guidance

Guidance for the assessment of noise affecting new residential development is given in the National Planning Policy Framework (NPPF). Section 15 of the NPPF states:

> *"174. Planning policies and decisions should contribute to and enhance the natural and local environment by:*
> *e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of…noise pollution."*

Section 185 further states:

> *"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."*

Section 187 states:

> *"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."*

To avoid and mitigate adverse noise effects on health arising from and impacting on new development, the NPPF makes reference to NPSE. The Noise Policy Statement for England (NPSE) was published in March 2010 and covers all forms of noise other than occupational noise.

The Noise Policy Statement for England (NPSE) states the following aims in paragraph 2.2.

> **NOEL – No Observed Effect Level.**
> *This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.*
>
> **LOAEL – Lowest Observed Adverse Effect Level**.
> *This is the level above which adverse effects on health and quality of life can be detected.*
>
> **SOAEL – Significant Observed Adverse Effect Level.**
> *This is the level above which significant adverse effects on health and quality of life occur.*

The NPSE does not define the SOAEL numerically, stating in paragraph 2.22:

> *"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the "NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."*

There is no local or national guidance on how the three terms should be defined numerically, it is for the assessor to collate and interpret appropriate guidance on noise, such as may be found in British Standards, and correlate the guidance with the concepts of NOEL, LOAEL and SOAEL.

BS8233:2014 - *Guidance on sound insulation and noise reduction for buildings* suggests indoor ambient noise levels for dwellings in Table 4, Section 7.7.2. These are summarised below.

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	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

BS8233 states that the guideline values given above are for 'noise without character', further stating:

> *"Noise has a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate."*

Table 4 of BS8233 also has accompanying notes that were subject to additions in ProPG. The relevant notes with the additions of ProPG are given below.

> *"NOTE 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or LAmax,F, depending on the character and number of events per night. Sporadic noise events could require separate values. In most circumstances in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB LAmax,F more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events."*

"NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal LAeq target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved."

APPENDIX I – Acoustic Terminology

To aid the understanding of acoustic terminology and the relative difference between noise levels the following background information is provided.

We perceive sound when the ear detects fluctuations in air pressure (sound waves), which are then processed by the brain and perceived as sound. Humans can hear an incredibly wide range of sound intensities ranging from jet engines to fingertips lightly brushing against each other. This range is quantified using a logarithmic scale called the decibel scale (dB). The comfortable range of the decibel scale typically ranges from 0dB (the threshold of hearing) to around 140dB. Here are some examples of common environments and their typical noise levels.

Noise Level	Environment
0 dB(A)	Threshold of hearing
20 to 30 dB(A)	Quiet bedroom at night
30 to 40 dB(A)	Living room during the day
40 to 50 dB(A)	Typical office
50 to 60 dB(A)	Inside a moving car
60 to 70 dB(A)	Typical high street
100 to 110 dB(A)	Fire alarm at 1 meter away
140 dB(A)	Threshold of pain

Terminology

dB (decibel) – A unit used to quantify the pressure level of sound. Defined as 20 times the logarithm of the ratio between the root-mean-square pressure of a given sound field and a reference pressure level ($2x10^{-5}$ Pa – threshold of hearing).

$L_{Aeq, T}$ – The equivalent continuous sound pressure level over a stated period. It quantifies a fluctuating sound level over a given period as the equivalent continuous sound level over which the same amount of acoustic energy is contained over. This is A-weighted in order to assess human perception.

L_{Amax} – the maximum RMS A-weighted sound pressure level occurring within a specified time period; the time weighting is typically either Fast or Slow.

A-Weighting – A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.

R_w – The Weighted Sound Reduction Index (R_w) is a number used to rate the effectiveness of a soundproofing system or material.

$D_{n,e,W}$ – The Weighted Sound Reduction Index specifically for ventilators.

C_{tr} – C_{tr} is a spectrum adaptation term which method is defined in BS EN ISO 717. The standard uses a reference curve to determine the weighted value of airborne sound insulation. The spectrum adaptation terms C and C_{tr} may are used to take into account different source spectra. 'C_{tr}' is the A-weighted urban traffic noise spectrum.

APPENDIX J – Assumed Roof Specification

Sound Insulation Prediction (v9.0.24)

Program copyright Marshall Day Acoustics 2017
Margin of error is generally within Rw ±3 dB
- Key No. 5547
Job Name:
Job No.: Initials:tombr
Date:23/10/2024
File Name:Roof Spec.ixl

Notes:

Rw 61 dB
C -1 dB
Ctr -5 dB

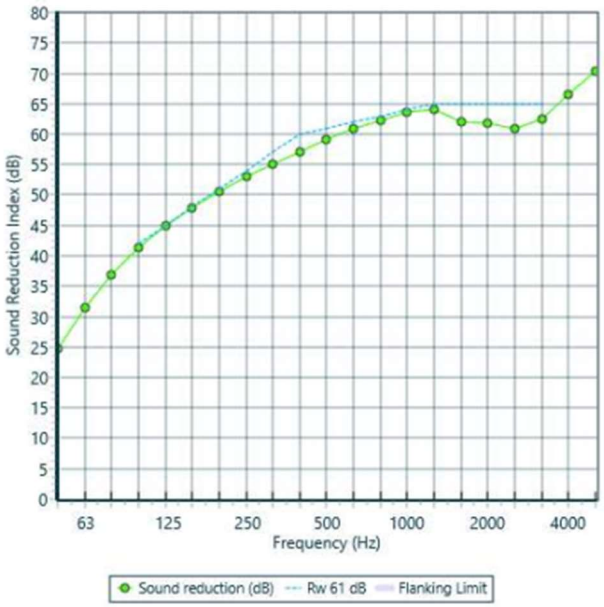
Mass-air-mass resonant frequency = =33 Hz

Panel Size = 2.7 m x 4.0 m

Partition surface mass = 65.1 kg/m²

System description

Panel 1 : 1 x 14 mm Roofing tiles + 1 x 17.5 mm Plywood

Frame: Solid Joist with resilient rail (1.5E2 mm x 45 mm), Stud spacing 400 mm ; Cavity Width 168 mm , 1 x Fibreglass (10kg/m3) 60mm Thickness 60 mm ...
Panel 2 : 2 x 12.5 mm Gyproc SoundBloc 12.5mm

freq.(Hz)	R(dB)	R(dB)
50	25	
63	31	28
80	37	
100	41	
125	45	44
160	48	
200	51	
250	53	52
315	55	
400	57	
500	59	59
630	61	
800	62	
1000	64	63
1250	64	
1600	62	
2000	62	62
2500	61	
3150	62	
4000	66	65
5000	70