PEAK acoustics



Noise Impact Assessment

Client:	Brent Dowson
Site:	16 Worthing Road, Horsham, RH12 1SL
Reference No.	160124NR
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Executive Summary

A noise assessment has been undertaken at 16 Worthing Road, Horsham, RH12 1SL in relation to the proposed change of use of the site to a residential dwelling.

Additional guidance will be drawn from *'Approved Document Part F – Ventilation',* and *'Approved Document Part O – Overheating'.*

Environmental noise monitoring was undertaken at the site from 7th – 8th February 2024. Noise affecting the development was determined to be primarily from the adjacent Bus Station.

In line with the AVO Guide, results display a 'Medium/Low Risk' for the front façade and 'Negligible Risk' for the rear facade when a partially open window is used for overheating during both the day and night. After consideration of the overheating risk for the site, no further measures to control overheating within the development are deemed necessary.

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*
Living Areas – Rear	30 (26)	*Double Glazing: 4/16/4*	32	*Hit & Miss Trickle Vent (Open): Titon Trimvent XS13 4400EA*
Bedrooms – Rear	30 (26)	*Double Glazing: 4/16/4*	32	*Hit & Miss Trickle Vent (Open): Titon Trimvent XS13 4400EA*
Dining Rooms - Rear	30 (26)	*Double Glazing: 4/16/4*	32	*Hit & Miss Trickle Vent (Open): Titon Trimvent XS13 4400EA*
Bedrooms - Front	37(31)	*Double Glazing: 4/16/10*	45	Passive Thru-Wall Vent: Passivent Fresh 80dB

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

An assessment of the external amenity spaces has also been undertaken. Site plans are provided within **Appendix G.**

Revision History

Rev 0 – 15/02/2024 – Original Report – T. Brown

Rev 1 – 25/03/2024 – Inclusion of AVO Overheating Assessment – T.Brown

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1. Introduction

1.1. Proposal

It is proposed to convert an office into a dwelling at 16 Worthing Road, Horsham. The site is currently used as offices and associated areas across ground and 1st floor levels.

1.2. Reason for Assessment

A noise assessment is to be submitted as part of the planning application to ensure desirable noise levels are met within the habitable rooms of the proposed development and external amenity areas. The assessment aims to provide a sound insulation scheme for the development.

An assessment in line with the '*Institute of Acoustics and Association of Noise Consultants – Acoustics, Ventilation and Overheating – Residential Design Guide'*, (AVO Guide) will also be undertaken to determine the specification of any ventilation required to provide whole dwelling ventilation with windows closed and any cooling system required for overheating mitigation.

1.3. Planning Conditions

No planning conditions are understood to have yet been set with regard to noise impact however the local authority has requested an assessment of the site in accordance with BS8233.

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."

Additional guidance will be drawn from 'Approved Document Part F – Ventilation', 'Approved Document Part O – Overheating' and the 'AVO' guide.

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 was undertaken at the site from the 7th – 8th February 2024. This period was selected to capture events and noise levels on a typical weekday from the adjacent bus station 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 1st floor front window. The microphone was positioned approximately 4.5 metres above ground level. A 3-dB correction has been applied to measured data to account proximity to the building façade.

Monitoring position M2 is located out of a 1st floor rear window. The microphone was positioned approximately 4.5 metres above ground level. A 3-dB correction has been applied to measured data to account proximity to the building façade.

The site and monitoring locations are shown below in **Figure 1**:

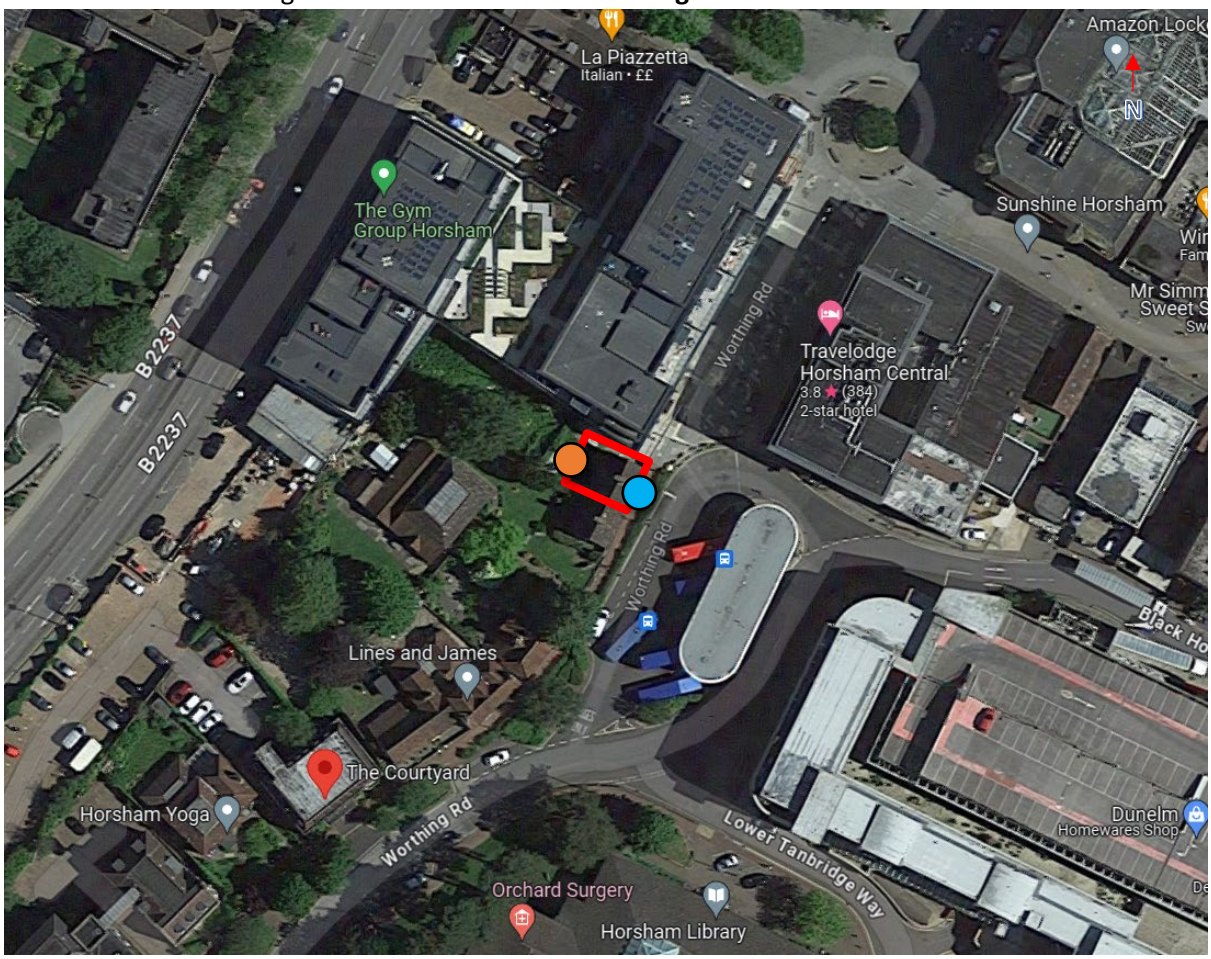


Figure 1: Site & Measurement Locations – google.com/maps

Monitoring Location (M1)

Monitoring Location (M2)

Site Boundary (Approx.)

2.3. Site Descriptions

The site is located on Worthing Road to the rear of Horsham Bus Station. The site is one half of a semi-detached building, the other half of which is a commercial office use. To the North and West of the site is 'The Paperyard' mixed use development comprising apartments and ground floor retail. To the South of the site are a mix of dwellings and commercial properties with some associated amenity spaces. Horsham Bus Station is located to the East of the site opposite the front façade.

2.4. Noise Affecting the Development

The primary noise source affecting the development was identified as the Bus Station with Buses entering and leaving regularly or otherwise idling and occasionally sounding horns. Secondary sources were noted as traffic noise, customers of the nearby Travelodge and contractors working on site.

2.5. Environmental Noise Survey Results

The results from the noise monitoring location M1 and M2 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	7th Feb 2024	Day *(15hr Aggregate Periods)*	61	-
	7th – 8th Feb 2024	Night *(8hr)*	52	75
M2	7th Feb 2024	Day *(15hr Aggregate Periods)*	54	-
	7th – 8th Feb 2024	Night *(8hr)*	44	64

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 between 7 - 12°C were noted during the survey with winds of 4 – 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."*

The front façade of the site is primarily affected by noise associated with the operations of the Bus Station. While traffic noise would be considered 'noise without character', operations of the Bus Station are likely to have characteristics that make it more noticeable.

In accordance with BS4142, 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."

Noise output from the Bus Station has the potential to be both tonal and intermittent. A precautionary criteria rating penalty of 5dB will therefore be applied within the assessment of rooms on the front façade of the site.

The rating-adjusted assessment criteria are provided below:

Activity	Location	07:00 to 23:00	23:00 to 07:00
Sleeping	Bedroom - Front	30 dB $L_{Aeq,16hour}$	25 dB $L_{Aeq,8hour}$
Resting	Living Room – Rear	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room/area – Rear	40 dB $L_{Aeq,16hour}$	-
Sleeping	Bedroom - Rear	35 dB $L_{Aeq,16hour}$	30 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:

Facade	Period	$L_{Aeq,T}$ (dB)	L_{Amax} (dB)
Front	**Daytime (1hr)**	64	-
	Night (1hr)	58	75
Rear	**Daytime (1hr)**	64	-
	Night (1hr)	49	64

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 and have been used to scale room and glazing dimensions. These 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. Ventilation and Overheating Assessment

4.1. The Avo Guide

In line with the Acoustic, Ventilation, Overheating: Residential Design Guide ("*The AVO Guide*") an assessment has been undertaken to satisfy the need to consider acoustics, ventilation and overheating at the planning stage. The AVO Guide provides a methodology for assessing the noise implications surrounding ventilation and overheating control in line with the requirements of '*Approved Document Part F – Ventilation*'.

Additional guidance will also be drawn from '*Approved Document Part O – Overheating*'.

4.2. Ventilation

'*Approved Document F*' outlines three main types of ventilation that are summarised in Table 2-1 of the AVO Guide. It also provides four template systems which can be adopted to demonstrate compliance with Building regulations. These are provided in Table 2-2 of the AVO Guide and displayed in the figure below.

Ventilation system	Provision with ADF system / purpose		
	Whole dwelling ventilation	Extract ventilation	Purge ventilation
System 1: Background ventilators and intermittent extract fans	Background ventilators (trickle vents)	Intermittent extract fans	Typically provided by opening windows
System 2: Passive stack ("natural")	Background ventilators (trickle vents) and passive stack ventilation	Continuous via passive stack	Typically provided by opening windows
System 3: Continuous mechanical extract (MEV)	Continuous mechanical extract – minimum low rate Trickle vents provide inlet air	Continuous mechanical extract – minimum high rate Trickle vents provide inlet air	Typically provided by opening windows
System 4: Continuously mechanical supply and extract with heat recovery (MVHR)	Continuous mechanical supply and extract – minimum low rate	Continuous mechanical supply and extract – minimum high rate	Typically provided by opening windows

Figure 2: ADF template systems from the AVO Guide

4.3. Overheating

To comply with '*Approved Document O – Overheating'* provisions for removing excess heat must also be considered, four methods of achieving this are provided within the documentation: opening windows, ventilation louvres in external walls, a mechanical ventilation system or a mechanical cooling system.

Further guidance in '*Approved Document O'* states

> *"NOTE: A system for purge ventilation should be provided in each habitable room to demonstrate compliance with Part F of the Building Regulations. The guidance in Section 1 of*

> *Approved Document F, Volume 1: Dwellings should be followed for the minimum standards for purge ventilation. A larger amount of purge ventilation may be required than that in Approved Document F, Volume 1: Dwellings in order to satisfy requirement O1 on providing an adequate means to remove excess heat from the indoor environment."*

The AVO Guide states the following in regard to overheating:

> "*However, it is important to differentiate between the need to provide 'purge ventilation' as required occasionally under ADF (i.e. to remove smoke from burnt food etc.); against the provision of ventilation to help control overheating"*

4.4. Level 1 Assessment

Following the guidance within the AVO Guide, a Level 1 site risk assessment is to be undertaken. The Level 1 assessment is based on external free-field levels and assumes partially open windows that result in an outside-to-inside level difference of 13 dB.

The levels for each façade provided in **Table 1** are to be assessed against the guidance levels relating to the overheating condition provided in Table 3-2 of the AVO Guide and displayed in the figure below.

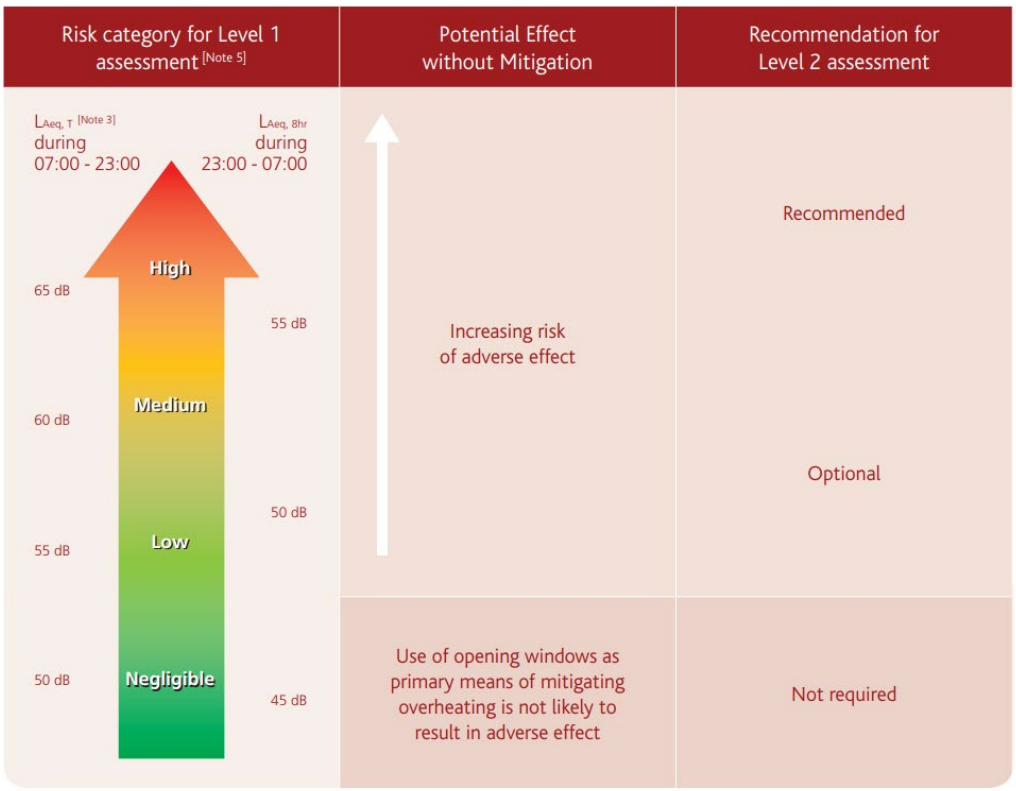


Figure 3: Level 1 risk assessment guidance taken from the AVO Guide

With reference to **Table 1**, according to the Level 1 assessment, the front facade would be placed within the 'Medium/Low' risk category during the day and night and the rear façade within the Negligible category. The result of the Level 1 assessment indicates that a Level 2 assessment is optional for the front façade and not required for the rear façade.

4.5. Overheating Risk

The Medium/Low risk indicated for the front façade within the Level 1 assessment relates to a single 1st floor bedroom on the East facing facade.

Review of the assessment criteria within the 'Early Stage Overheating Risk Tool' produced by the 'Good Homes Alliance' indicates that the site would be a 'Low Risk' for Overheating and so a Level 2 assessment of the site is not deemed necessary.

4.6. Overheating Results

In line with the AVO Guide, results display a worst-case of a 'Medium Risk' risk when a partially open window is used for overheating for the front facade during the daytime. As the site is a 'Low Risk' for overheating, no further measures to control overheating within the development are deemed necessary.

5. Sound Insulation Scheme

5.1. 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 49 dB R_w.

Where the roof is to be utilised as a voided loft space with thermal insulation, no further details are required. If the proposed dwelling has rooms within the roof space, the additional material build-up will be assumed at a minimum sound reduction of 39 dB R_w.

5.2. 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]
Living Areas – Rear	30 (26)	*Double Glazing: 4/16/4*	32	*Hit & Miss Trickle Vent (Open): Titon Trimvent XS13 4400EA*
Bedrooms – Rear	30 (26)	*Double Glazing: 4/16/4*	32	*Hit & Miss Trickle Vent (Open): Titon Trimvent XS13 4400EA*
Dining Rooms - Rear	30 (26)	*Double Glazing: 4/16/4*	32	*Hit & Miss Trickle Vent (Open): Titon Trimvent XS13 4400EA*
Bedrooms - Front	37(31)	*Double Glazing: 4/16/10*	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.*

6. Internal Noise Levels

It is determined that by using mitigation as specified in **Table 5** for the building façades, the outcome summarised in the following table is achieved.

Internal Space	Noise Parameter	Internal Noise Level (dB)	Within Design Criteria?
Living Room	Daytime $L_{Aeq,\ 16hr}$	34	Yes
Bedroom – Rear	Daytime $L_{Aeq,\ 16hr}$	34	Yes
	Night-time $L_{Aeq,\ 8hr}$	19	Yes
	Night-time $L_{Amax\ F}$	28	Yes
Bedroom - Front	Daytime $L_{Aeq,\ 16hr}$	30	Yes
	Night-time $L_{Aeq,\ 8hr}$	24	Yes
	Night-time $L_{Amax\ F}$	38	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.

The above statements are also applicable to the front façade, adjusting for the rating level criteria.

7. External Amenity Areas

BS8233:2014 provides a desirable guideline of 50 dB $L_{Aeq,16hr}$ for external amenity spaces and an acceptable guideline of 55 dB $L_{Aeq,16hr}$ for noisier environments.

External rear daytime noise levels were measured on-site at position M2 (Figure 1)

Measurement Position	Noise Parameter	Garden Noise Level (dB)	BS8233 Criteria	Attenuation Required (dB)
M1	Daytime $L_{Aeq,\ 16hr}$	54	50 – 55 dB $L_{Aeq,\ 16hr}$	0

Table 7: External Amenity Area Assessment

As this is within the limits of the BS8233 criteria, this value is deemed acceptable.

8. Conclusions

A noise assessment has been undertaken at 16 Worthing Road, Horsham, RH12 1SL in relation to the proposed change of use of the site to a residential dwelling.

Additional guidance has been drawn from '*Approved Document Part F – Ventilation', Approved Document Part O – Overheating'.*

Environmental noise monitoring was undertaken at the site from 7th – 8th February 2024. Noise affecting the development was determined to be primarily from the adjacent Bus Station.

In line with the AVO Guide, results display a 'Medium/Low Risk' for the front façade and 'Negligible Risk' for the rear facade when a partially open window is used for overheating during both the day and night. After consideration of the overheating risk for the site, no further measures to control overheating within the development are necessary.

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	A3	07/02/2024	13:20	08/02/2024	12:25
M2	A7	07/02/2024	13:25	08/02/2024	12:25

APPENDIX B - Equipment Details

Kit	Equipment	Make	Model	Class	Serial Number
A3	Sound Meter	Svantek	971	1	41980
A3	Pre-Amp	Svantek	SV18	1	44331
A3	Microphone	ACO	7052E	1	60249
A7	Sound Meter	Svantek	977A	1	69273
A7	Pre-Amp	Svantek	SV12L	1	71601
A7	Microphone	ACO	7052E	1	68217
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)
07/02/2024	7	4	S	87	0.2	8/8
08/02/2024	12	6	SW	92	0.0	8/8

APPENDIX D - Calibration Details

Kit	Calibrator Ref Level (dB)	Deviation Before (dB)	Deviation After (dB)
A3	113.80	0.31	0.30
A7	113.80	0.64	0.50

APPENDIX E – Noise Survey Time History

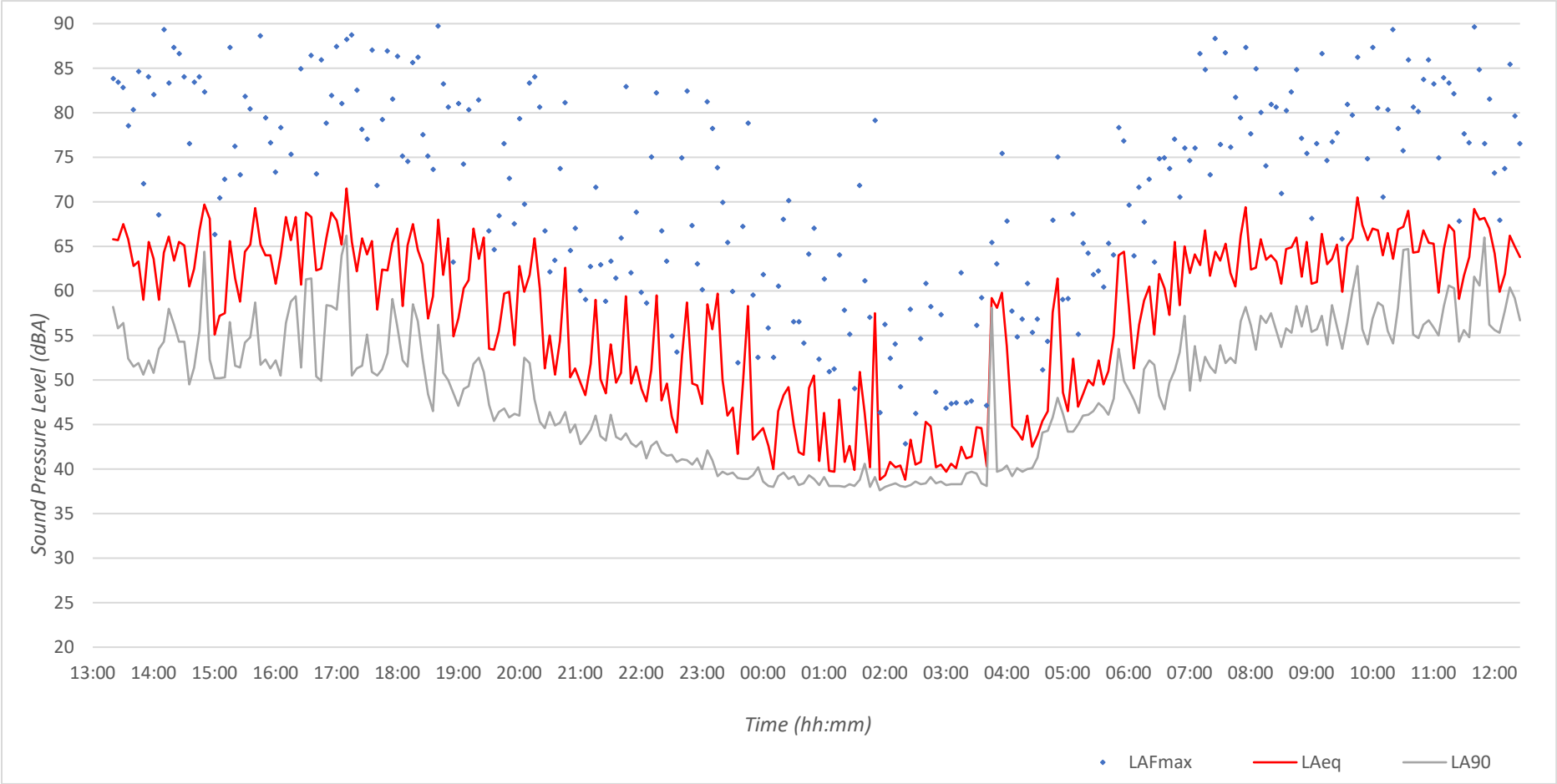


Figure 4: Environmental Noise Measurement M1 Time History

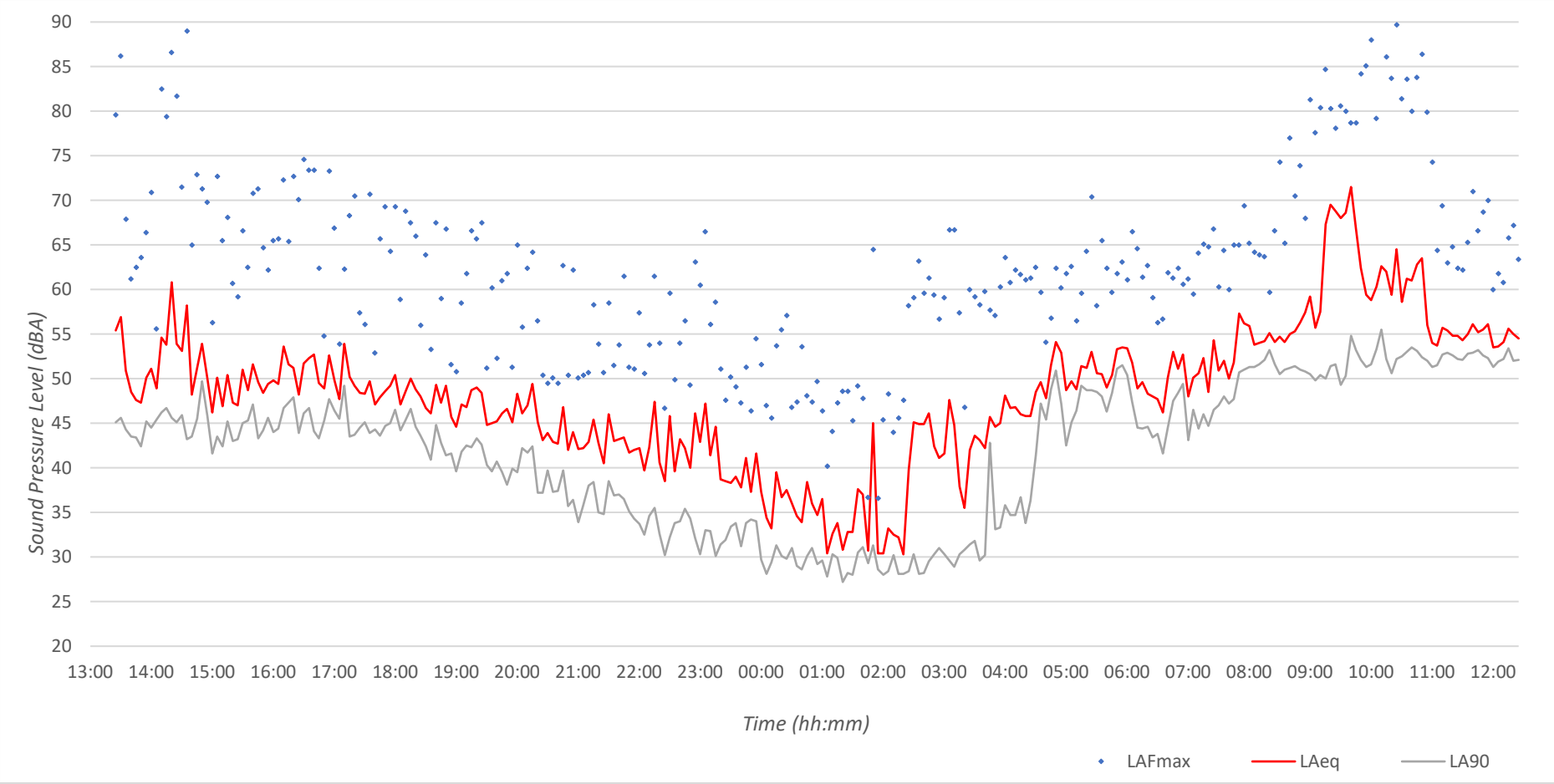


Figure 5: Environmental Noise Measurement M2 Time History

APPENDIX F – BS8233 Rigorous Design Calculations

1. Living Room - Rear

BS8233:2014 Façade Noise Break In Calculator

	125	250	500	1k	2k	dBA
Daytime External Noise Level - LAeq - 1 hour	55.2	54.7	55.8	58.2	57.1	62
Night-time External Noise Level - LAeq - 1 hour						
Night-time Lmax Noise Levels - 10 times per night						

Room Properties					Room Coefficient					
Width (m)	Height (m)	Depth (m)	Glazing	Reverb Time	8	9	9	10	10	A
3.8	2.4	4	1.5	0.6	0.7	0.7	0.6	0.6	0.6	RT

Façade Construction		SRI (Sound Reduction Index)					
		125	250	500	1k	2k	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	4 / 16 / 4	24	18	26	40	45	30(26)
Ventilation Spec	Hit & Miss Trickle Vent (Open)	38.4	36.8	33.8	29.7	33.8	32

Calculation Results			125	250	500	1k	2k	dBA
Daytime Internal Noise Level - LAeq	Target Value <	35	14.3	23.9	25.1	31.5	27.6	34.1
Night-time Internal Noise Level - LAeq	Target Value <							
Internal LAmax Noise Levels	Target Value <							

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**30(26)**	dB $R_{W(+Ctr)}$	*Double Glazing*
			4 / 16 / 4
Ventilation	**32**	$D_{n,e,w+Ctr}$	*Hit & Miss Trickle Vent (Open)*
			Titon Trimvent XS13 4400EA

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

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{ss}}{10}} + \frac{S_{w1}}{S}10^{\frac{-R_{w1}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

2. Kitchen/Dining - Rear

BS8233:2014 Façade Noise Break In Calculator

	125	250	500	1k	2k	dBA
Daytime External Noise Level - LAeq - 1 hour	55.2	54.7	55.8	58.2	57.1	62
Night-time External Noise Level - LAeq - 1 hour						
Night-time Lmax Noise Levels - 10 times per night						

Room Properties					Room Coefficient					
Width (m)	**Height (m)**	**Depth (m)**	**Glazing**	**Reverb Time**	**8**	**9**	**9**	**10**	**10**	**A**
3	2.4	5	1	0.6	**0.7**	**0.7**	**0.6**	**0.6**	**0.6**	**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	4 / 16 / 4	**24**	**18**	**26**	**40**	**45**	**30(26)**
Ventilation Spec	Hit & Miss Trickle Vent (Open)	**38.4**	**36.8**	**33.8**	**29.7**	**33.8**	**32**

Calculation Results			125	250	500	1k	2k	dBA
Daytime Internal Noise Level - LAeq	**Target Value <**	40	**14.6**	**22.5**	**25.1**	**32.4**	**28.5**	**34.8**
Night-time Internal Noise Level - LAeq	**Target Value <**							
Internal LAmax Noise Levels	**Target Value <**							

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**30(26)**	dB $R_{W(+Ctr)}$	*Double Glazing*
			4 / 16 / 4
Ventilation	**32**	$D_{n,e,w+Ctr}$	*Hit & Miss Trickle Vent (Open)*
			Titon Trimvent XS13 4400EA

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

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{tot}}{10}} + \frac{S_{W1}}{S}10^{\frac{-R_{W1}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rf}}{S}10^{\frac{-R_{rf}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

3. Bedroom 1 - Front

BS8233:2014 Façade Noise Break In Calculator

	125	250	500	1k	2k	dBA
Daytime External Noise Level - LAeq - 1 hour	69.0	62.7	55.1	59.1	57.6	63
Night-time External Noise Level - LAeq - 1 hour	59.5	58.8	51.1	52.1	51.8	57
Night-time Lmax Noise Levels - 10 times per night	73.2	71.9	67.5	69.5	67.7	73

Room Properties					Room Coefficient					
Width (m)	Height (m)	Depth (m)	Glazing	Reverb Time	9	9	10	10	10	A
4	2.4	4	1.5	0.6	0.7	0.7	0.6	0.6	0.6	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	4 / 16 / 10	27	23	33	41	48	37(31)
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 <	30	26.5	26.7	17.2	17.3	8.6	30.1
Night-time Internal Noise Level - LAeq	Target Value <	25	17.1	22.8	13.3	10.3	2.8	24.4
Internal LAmax Noise Levels	Target Value <	45	30.8	35.9	29.6	27.7	18.7	38.2

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**37(31)**	dB $R_{W(+Ctr)}$	*Double Glazing*
			4 / 16 / 10
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

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{tot}}{10}} + \frac{S_{W1}}{S}10^{\frac{-R_{W1}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

4. Bedroom 2 - Rear

BS8233:2014 Façade Noise Break In Calculator	125	250	500	1k	2k	dBA
Daytime External Noise Level - LAeq - 1 hour	55.2	54.7	55.8	58.2	57.1	62
Night-time External Noise Level - LAeq - 1 hour	44.5	43.9	39.8	41.2	42.4	46
Night-time Lmax Noise Levels - 10 times per night	53.5	52.5	51.6	48.7	51.0	55

Room Properties					Room Coefficient					
Width (m)	Height (m)	Depth (m)	Glazing	Reverb Time	5	6	6	7	7	A
3.6	2.4	2.5	1.5	0.6	0.6	0.6	0.6	0.5	0.5	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	4 / 16 / 4	24	18	26	40	45	30(26)
Ventilation Spec	Hit & Miss Trickle Vent (Open)	38.4	36.8	33.8	29.7	33.8	32

Calculation Results			125	250	500	1k	2k	dBA
Daytime Internal Noise Level - LAeq	Target Value <	35	14.9	25.6	25.9	31.2	27.2	34.2
Night-time Internal Noise Level - LAeq	Target Value <	30	4.2	14.8	9.8	14.2	12.4	19.3
Internal LAmax Noise Levels	Target Value <	45	13.2	23.4	21.7	21.6	21.1	28.2

Sound Insulation Requirement

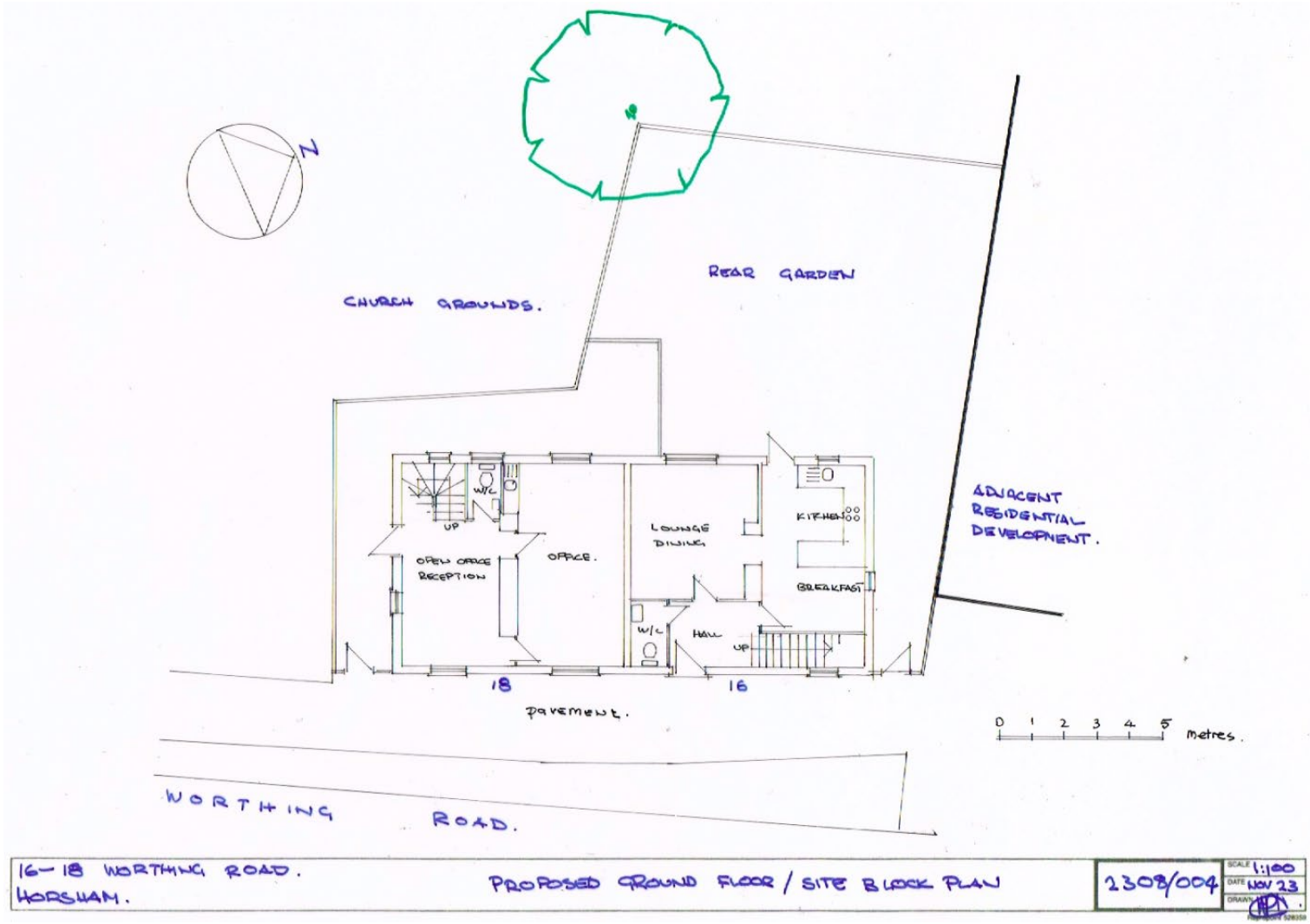
	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**30(26)**	dB $R_{W(+Ctr)}$	*Double Glazing*
			4 / 16 / 4
Ventilation	**32**	$D_{n,e,w+Ctr}$	*Hit & Miss Trickle Vent (Open)*
			Titon Trimvent XS13 4400EA

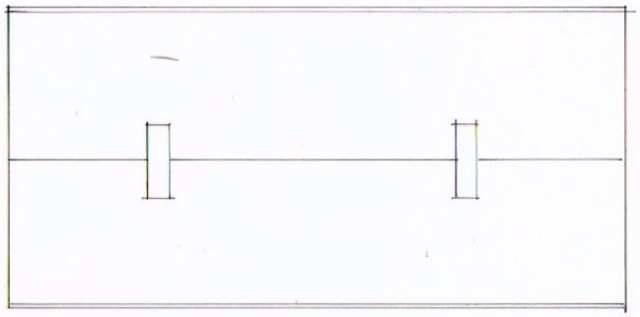
Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

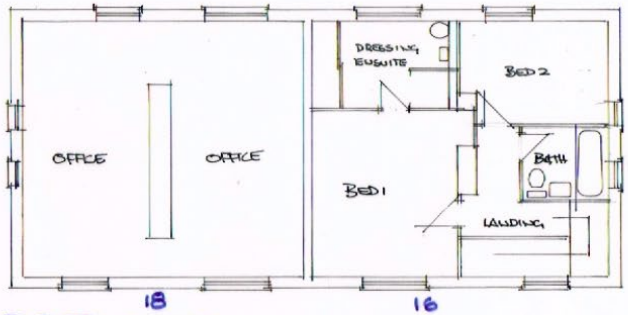
$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{ls}}{10}} + \frac{S_{w1}}{S}10^{\frac{-R_{w1}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

APPENDIX G – Site Plans





ROOF PLAN.



FIRST FLOOR.



16-18 WORTHING ROAD.
HORSHAM. RH12 1SL

PROPOSED FIRST FLOOR AND ROOF PLANS.

2308/005

SCALE 1:100
DATE DEC 23
DRAWN

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.