PEAK acoustics

Noise Impact Assessment

Client: Rallan Pillay

Site: 90 London Street, Reading, RG1 2AR

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Executive Summary

An Environmental Noise Assessment has been undertaken at 90 London Street, Reading where it has been proposed to create 6 studio flats via change of use.

Environmental noise monitoring was undertaken at the site from 13th – 14th July 2023. Noise affecting the development was determined to be primarily from road traffic.

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*
Studio Flat - Front	42 (35)	*Laminated Double Glazing: 8/16/8.8SC*	N/A	*Multi-room Heat Recovery System*
Studio Flat – Rear	30 (26)	*Double Glazing: 4/16/4*	N/A	*Multi-room Heat Recovery System*
Studio Flat – Rear (roofspace)	30 (26)	*Double Glazing: 4/16/4*	N/A	*Multi-room Heat Recovery System*

Site plans are provided within **Appendix G.** No external amenity areas are shown and so these have not been assessed.

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1. Introduction

Proposal

It is proposed to create 6 studio flats via change of use from class E at 90 London Street, Reading. A ground floor office area is to be retained.

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. The assessment aims to provide a sound insulation scheme for the development.

Planning Conditions

The local authority has recommended the following planning condition via an internal memorandum:

> *"No development shall commence on site until a detailed scheme, informed by an assessment of the current noise environment, for protecting the dwellings from the external noise environment of the area has been submitted to and approved, in writing, by the Local Planning Authority. The scheme itself shall be designed, specified and constructed so that the sound insulation performance of the structure and the layout of the dwellings are such that the indoor ambient noise levels do not exceed the values detailed in Table 4 of BS 8233:2014 and the and that the individual noise events do not exceed 45 dB LA,max,F more than 10 times a night. Where opening windows will lead to an internal noise level increase of 5 dBA or greater above BS 8233:2014 recommended internal levels, the scheme shall include provision of alternative mechanical ventilation with minimum performance equivalent to a mechanical heat recovery (MVHR) system with cool air bypass as an alternative means of cooling and ventilation. Noise from the system should not result in BS8233 internal levels being exceeded.*
>
> *Thereafter, the development shall not be carried out other than in accordance with the approved scheme which shall be completed before any part of the accommodation hereby approved is occupied, unless the Local Planning Authority otherwise agrees in writing."*

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

Survey Measurement

To assess the environmental noise levels affecting the proposed development, an unattended noise survey was undertaken at the rear of the site from the 13th – 14th of July 2023. This period was selected to capture events and noise levels on a typical weekday from surrounding roads 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'*.

A shorter simultaneous comparative measurement has also been undertaken at the 'front' of the site to determine the front vs. rear level difference.

Measurement Location

Monitoring position M1 is located out of a 2nd-floor window to the rear of the site. The microphone was positioned approximately 7.5 metres above ground level. A -3dB correction is applied to measured data to account for proximity to a flat reflective surface (the building façade).

Monitoring position M2 is located on the pavement adjacent to London Street approximately 1.5 metres above ground level.

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

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

Monitoring Location (M1) *Site Boundary (Approx.)*

Monitoring Location (M2)

Site Descriptions

The site is located on London Street (A327) in central Reading. London Street is lined on both sides with a mix of shopfronts including a solicitors, an education centre and estate agents.

Church Street passes to the north of the site although this is a very narrow pedestrianised walkway. There is a small car park to the rear of the site and a mixture of residential and commercial buildings.

Noise Affecting the Development

The primary noise sources affecting the development have been identified as:

- Traffic passing the site on London Street.
- The car park to the rear of the site from which cars were observed to enter and leave intermittently.
- Intermittent construction work was observed at the front of the site.
- Pedestrians conversed as they passed the site on London Street and Church Street.
- Extract and A/C systems associated with the nearby bakery house café.

Secondary sources were noted as overhead air traffic and birdsong.

Environmental Noise Survey Results

The results from the noise monitoring locations 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	13th & 14th July 2023	Day *(16hr Aggregate Periods)*	52	-
	13th – 14th July 2023	Night *(8hr)*	41	65
M2	13th July 2023	Day (12:50 – 13:05)	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.*

Front Vs Rear Level Difference

Simultaneous measurements of the environmental noise level have been undertaken between 12:50 and 13:05 on Thursday 13th July 2023. Comparison of the front and rear measured levels are provided below:

Measurement	Date(s)	Period	L_{Aeq} (dB)	Level Difference (dB)
M1	13/07/2023	Day (12:50 – 13:05)	49	15
M2			64	

Table 2: Comparative Measurement Level Difference

A 15dB correction will be applied to the M1 data to provide a representative front façade noise level.

Weather Conditions

Daytime temperatures of between 17 - 21°C were noted during the survey with winds between 3-4m/s. Detailed weather conditions are given in **Appendix C**.

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

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 3: 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."*

In considering the noise climate affecting the proposed development, as discussed in Section 2.4, it is deemed appropriate to use guidelines set out in BS8233 and ProPG to ensure the internal criteria set out by the WHO for internal noise maxima L_{Amax} and internal L_{Aeq}.

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.

Façade	Period	$L_{Aeq,T}$ (dB)	L_{Amax} (dB)
Front	Daytime (1hr)	70	-
	Night (1hr)	59	80
Rear	Daytime (1hr)	55	
	Night (1hr)	44	65

Table 4: Assessment Noise Levels

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 'Studio Kazaad' 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

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.

Ventilation Requirement

The council has stated that where internal noise levels increase to 5dB or more above recommended BS8233 criteria then the scheme shall include provision for alternative mechanical ventilation. Assuming a 13dB reduction through an open window, some of the 'desirable' internal noise criteria from BS8233 are exceeded and so the scheme will include mechanical ventilation.

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]
Studio Flat - Front	42 (35)	*Laminated Double Glazing: 8/16/8.8SC*	N/A	*Multi-room Heat Recovery System*
Studio Flat – Rear	30 (26)	*Double Glazing: 4/16/4*	N/A	*Multi-room Heat Recovery System*
Studio Flat – Rear (roofspace)	30 (26)	*Double Glazing: 4/16/4*	N/A	*Multi-room Heat Recovery System*

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?
Living Room – Front Façade	Daytime $L_{Aeq,\ 16hr}$	35	Yes
Bedroom – Front Facade	Daytime $L_{Aeq,\ 16hr}$	35	Yes
	Night-time $L_{Aeq,\ 8hr}$	24	Yes
	Night-time $L_{Amax\ F}$	39	Yes
Living Room – Rear Façade	Daytime $L_{Aeq,\ 16hr}$	29	Yes
Bedroom – Rear Facade	Daytime $L_{Aeq,\ 16hr}$	29	Yes
	Night-time $L_{Aeq,\ 8hr}$	18	Yes
	Night-time $L_{Amax\ F}$	34	Yes
Living Room – Rear Façade (Roofspace)	Daytime $L_{Aeq,\ 16hr}$	29	Yes
Bedroom – Rear Façade (Roofspace)	Daytime $L_{Aeq,\ 16hr}$	29	Yes
	Night-time $L_{Aeq,\ 8hr}$	18	Yes
	Night-time $L_{Amax\ F}$	33	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.

6. Ventilation Strategy

As the scheme includes mechanical ventilation, the following guidance should be adhered to in order to control self-generated noise from the system:

- Noise from the mechanical ventilation system, inclusive of fan case breakout and internal grilles should not exceed 35 dB L_{Aeq} / NR35 and 30 dB L_{Aeq} / NR25 within living rooms and bedrooms respectively.
- Where required, silencers should be installed at the fan inlet and/or outlet.
- Rooms that share supply and/or extract terminations from the same main duct should have cross-talk attenuators implemented within at least one of the corresponding branch ducts to minimise cross-talk between the rooms.
- Ventilation fans should be located within non-habitable rooms or within built-in cupboards. If located in a built-in cupboard, ensure that the access door provides a tight seal to prevent flanking transmission to habitable rooms.
- Fans and ductwork should be fitted using resilient mountings to mitigate vibration and re-radiated structural noise.
- All windows should not include trickle ventilators and walls should not contain passive through-wall vents. As ventilation is to be provided via mechanical means, the passive ventilators will introduce an unnecessary weakness to the building envelope.
- Façade penetrations for inlets/outlets should be routed to the rear façade to benefit from the quieter noise climate and reduce noise transfer through the ductwork.
- Windows should remain closed for the system to work correctly, however, should remain openable for purge ventilation and security reasons.

7. External Amenity Areas

Based on the site plans received from the client, no external amenity areas are included within the proposals and therefore are not assessed.

8. Sound Insulation to Commercial Areas

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 10dB improvement on building regulations criteria for the airborne performance of walls and floors would require a minimum performance value of 53dB $D_{nTw}+C_{tr}$ for the partitions that separate the office area from residential areas. Typically, a 3 – 5dB safety margin would also be recommended in the design, so a target design performance of 56 – 58dB $D_{nTw}+C_{tr}$ is recommended.

9. Conclusions

A noise assessment has been undertaken at 90 London Street, Reading, RG1 2AR in relation to the proposed change of use of the site to create 6 studio flats.

Environmental noise monitoring was undertaken at the site from 13th – 14th July 2023. Noise affecting the development was determined to be primarily from road traffic on London Street.

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	Kit	Start Date	Start Time	End Date	End Time
M1	A3	13/07/2023	12:40	14/07/2023	14:55
M2	A7	13/07/2023	12:50	13/07/2023	13:05

Table 7: Measurement Dates

Figure 2: Site Location Measurement Pictures

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
3	Calibrator	Svantek	SV33	1	43086
A7	Sound Meter	Svantek	977A	1	69273
A7	Pre-Amp	Svantek	SV12L	1	71601
A7	Microphone	ACO	7052E	1	68217

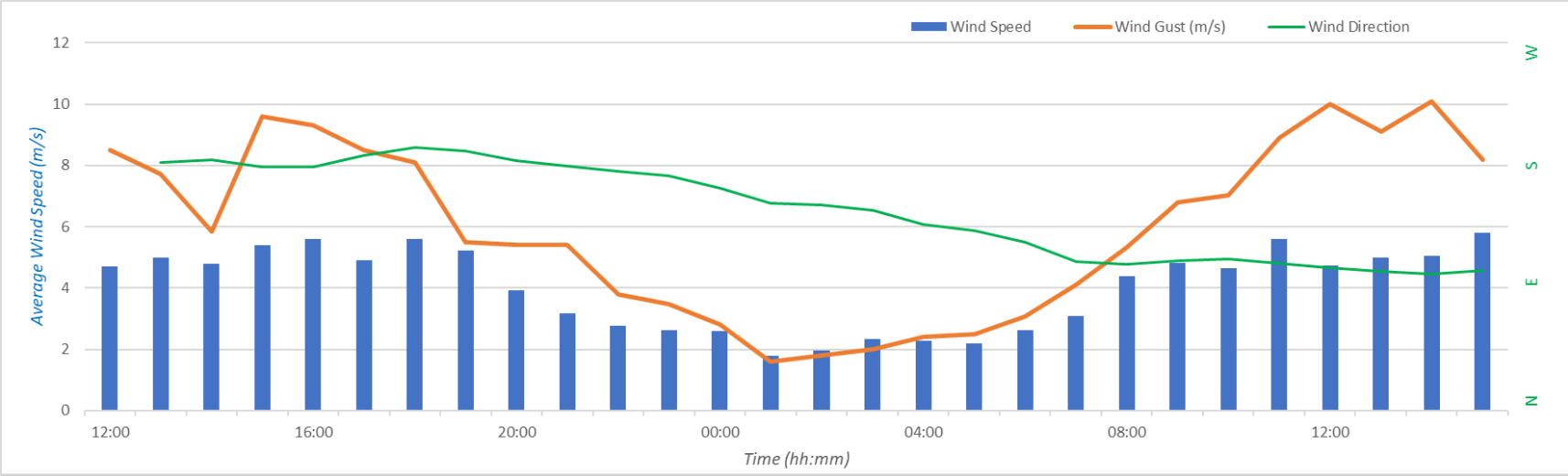
Table 8: Measurement Equipment Details

APPENDIX C - Calibration Details

Measurement	Calibrator Ref Level (dB)	Deviation Before (dB)	Deviation After (dB)
M1	113.80	0.47	0.40
M2	113.80	0.73	0.66

Table 9: Calibration Details

APPENDIX D – Meteorological Details



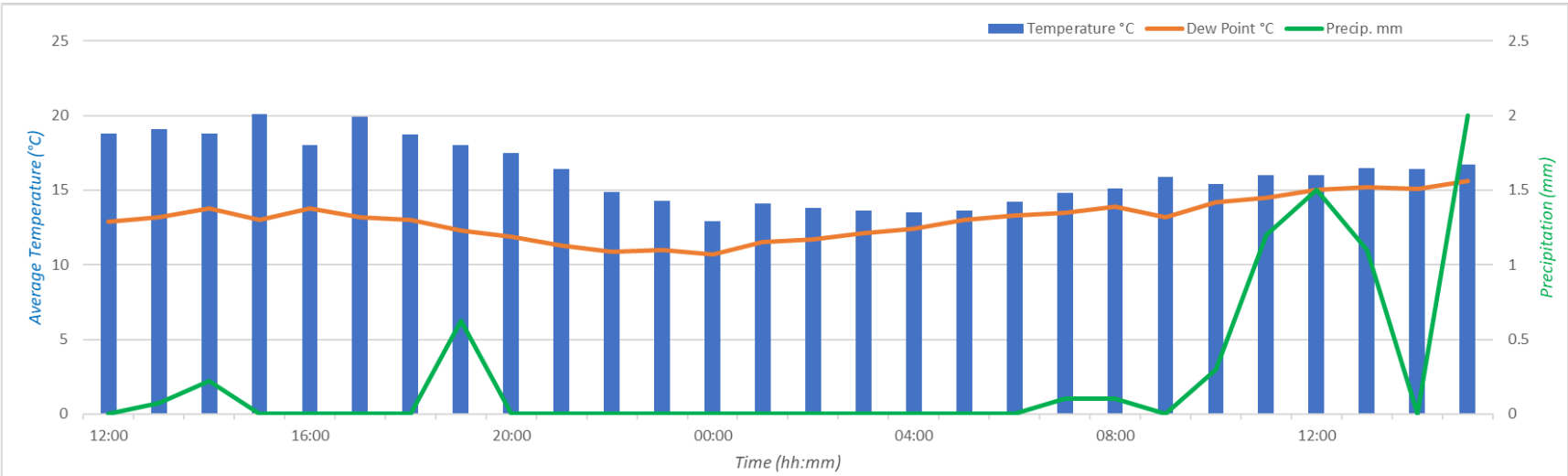


Figure 3: Meteorology Data - www.visualcrossing.com/weather

APPENDIX E – Noise Survey Results

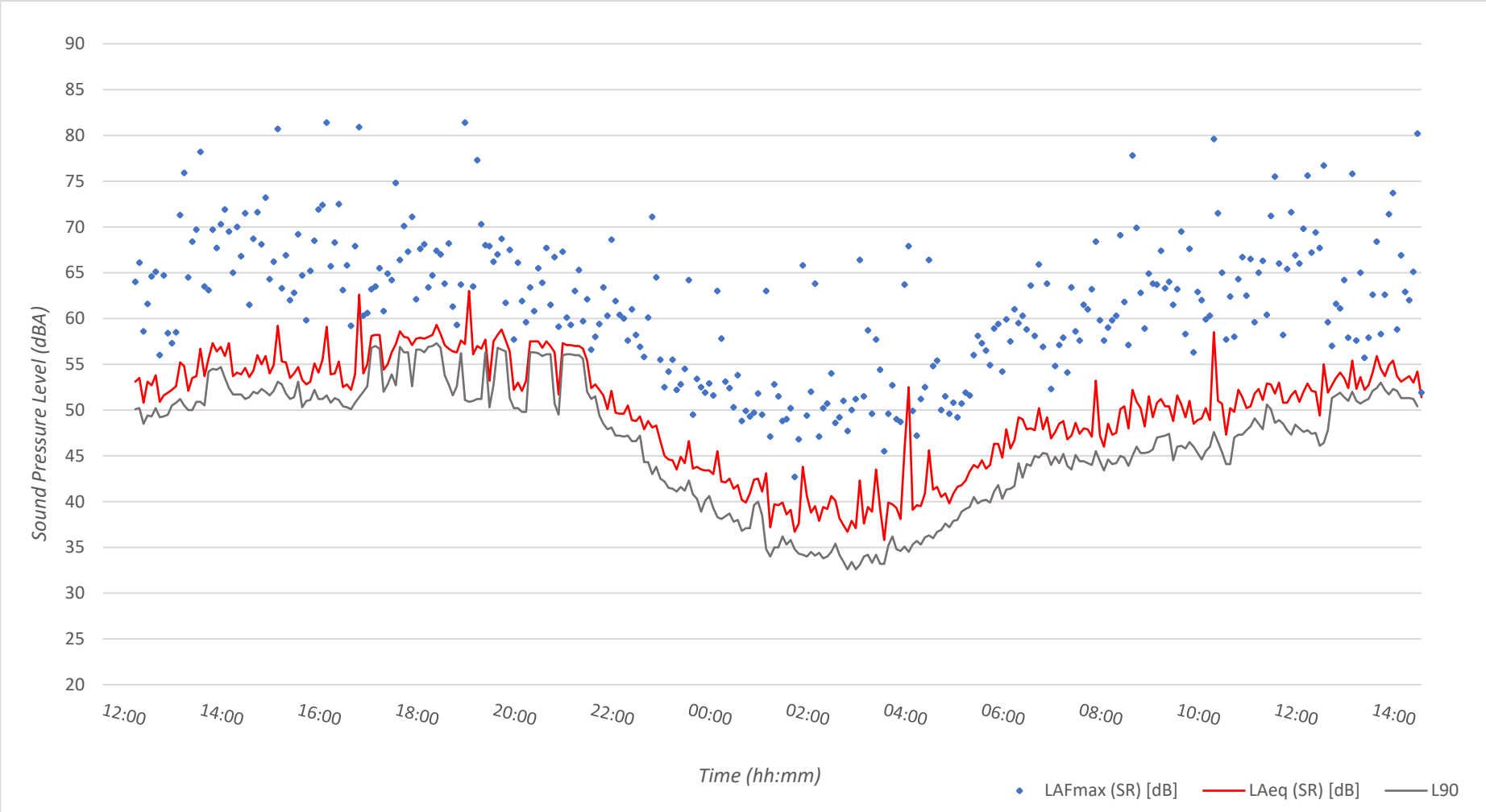


Figure 4: Measured Background Sound Levels Time History (M1): 13th – 14th July 2023

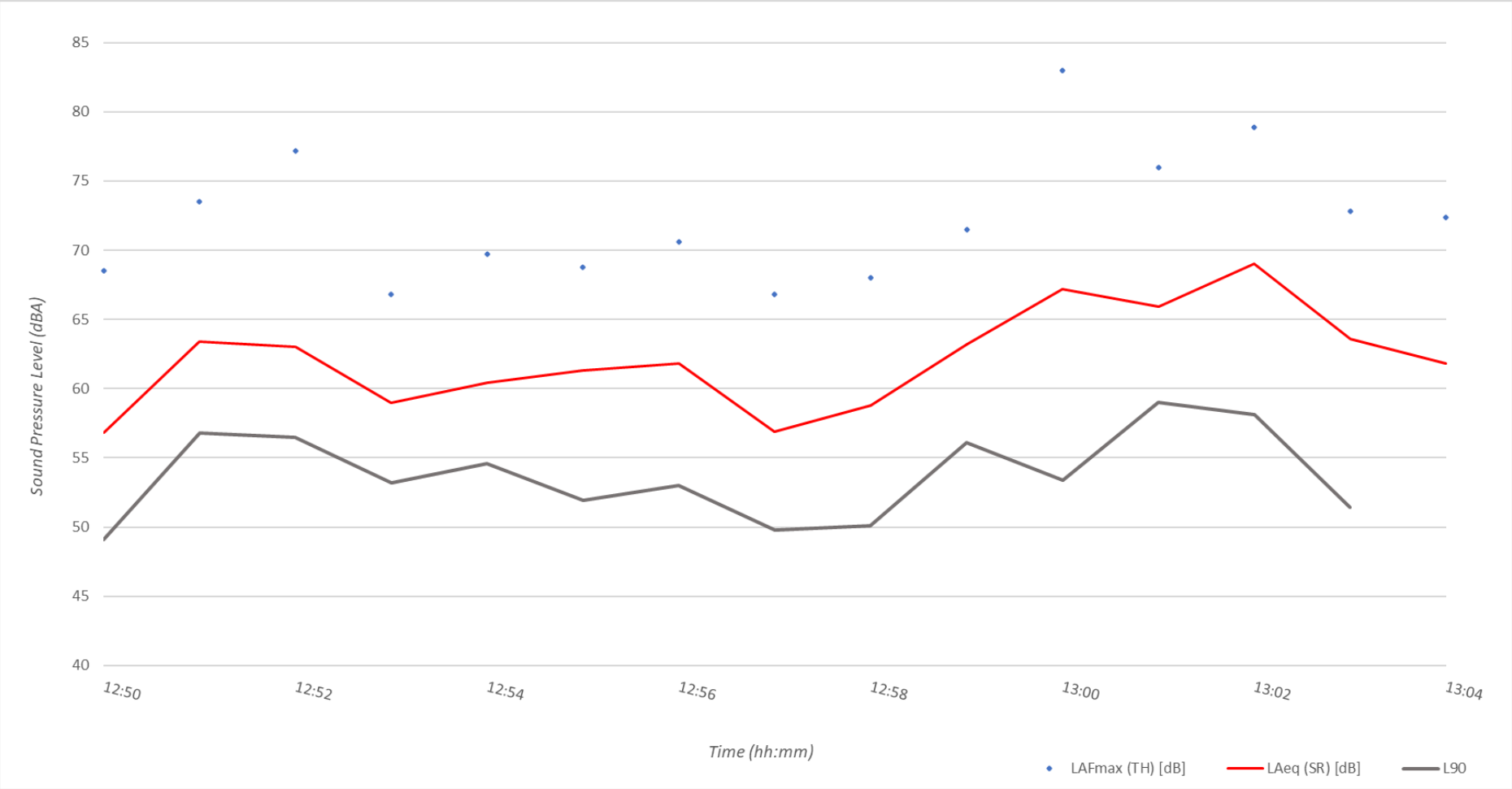


Figure 5: Measured Background Sound Levels Time History (M2): 13th July 2023

APPENDIX F – BS8233 Rigorous Design Calculations

GF - Studio Living / Bedroom - Front Façade

BS8233:2014 Façade Noise Break In Calculator

	125	250	500	1k	2k	dBA
Daytime External Noise Level - LAeq - 1 hour	72.2	71.9	67.8	63.1	64.2	70
Night-time External Noise Level - LAeq - 1 hour	62.7	60.1	56.2	53.5	50.7	59
Night-time Lmax Noise Levels - 10 times per night	73.5	72.1	79.0	74.1	72.4	80

Room Properties					Room Coefficient					
Width (m)	Height (m)	Depth (m)	Glazing	Reverb Time	17	18	18	20	18	A
4.5	2.4	7.5	5	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	8 / 16 / 8.8SC	24	31	40	49	51	42(35)
Ventilation Spec	Heat Recovery System	0	0	0	0	0	N/A

Calculation Results			125	250	500	1k	2k	dBA
Daytime Internal Noise Level - LAeq	Target Value <	35	31.5	30.2	25.5	16.7	14.4	34.6
Night-time Internal Noise Level - LAeq	Target Value <	30	22.0	18.4	14.0	7.1	0.9	24.1
Internal LAmax Noise Levels	Target Value <	45	32.8	30.3	36.8	27.7	22.6	39.3

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**42(35)**	dB $R_{W(+Ctr)}$	*Laminated Double Glazing*
			8 / 16 / 8.8SC
Ventilation	**N/A**	$D_{n,e,w+Ctr}$	*Heat Recovery System*
			Multi-room Heat Recovery System

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

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

GF - Studio Living / Bedroom - Rear Façade

BS8233:2014 Façade Noise Break In Calculator

	125	250	500	1k	2k	dBA
Daytime External Noise Level - LAeq - 1 hour	57.2	56.9	52.8	48.1	49.2	55
Night-time External Noise Level - LAeq - 1 hour	47.7	45.1	41.2	38.5	35.7	44
Night-time Lmax Noise Levels - 10 times per night	58.5	57.1	64.0	59.1	57.4	65

Room Properties					Room Coefficient					
Width (m)	Height (m)	Depth (m)	Glazing	Reverb Time	16	17	18	19	17	A
8	2.4	4	2.5	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	Flat Timber Joist Roof	22	37	43	49	57	0
Glazing Spec	4 / 16 / 4	24	18	26	40	45	30(26)
Ventilation Spec	Heat Recovery System	0	0	0	0	0	N/A

Calculation Results			125	250	500	1k	2k	dBA
Daytime Internal Noise Level - LAeq	Target Value <	35	25.4	25.8	19.3	7.0	3.0	29.1
Night-time Internal Noise Level - LAeq	Target Value <	30	15.9	13.9	7.7	-2.5	-10.5	18.4
Internal LAmax Noise Levels	Target Value <	45	26.7	25.9	30.5	18.0	11.2	33.1

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**30(26)**	dB $R_{W(+Ctr)}$	*Double Glazing*
			4 / 16 / 4
Ventilation	**N/A**	$D_{n,e,w+Ctr}$	*Heat Recovery System*
			Multi-room Heat Recovery System

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

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

1F - Studio Living / Bedroom - Rear Façade

BS8233:2014 Façade Noise Break In Calculator

	125	250	500	1k	2k	dBA
Daytime External Noise Level - LAeq - 1 hour	57.2	56.9	52.8	48.1	49.2	55
Night-time External Noise Level - LAeq - 1 hour	47.7	45.1	41.2	38.5	35.7	44
Night-time Lmax Noise Levels - 10 times per night	58.5	57.1	64.0	59.1	57.4	65

Room Properties					Room Coefficient					
Width (m)	Height (m)	Depth (m)	Glazing	Reverb Time	11	12	12	13	13	A
7	2.4	3	3.6	0.7	0.7	0.7	0.7	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	Heat Recovery System	0	0	0	0	0	N/A

Calculation Results			125	250	500	1k	2k	dBA
Daytime Internal Noise Level - LAeq	Target Value <	35	15.9	28.3	21.3	5.9	3.2	29.3
Night-time Internal Noise Level - LAeq	Target Value <	30	6.4	16.4	9.8	-3.6	-10.2	17.7
Internal LAmax Noise Levels	Target Value <	45	17.2	28.4	32.6	16.9	11.5	34.2

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**30(26)**	dB $R_{W(+Ctr)}$	*Double Glazing*
			4 / 16 / 4
Ventilation	**N/A**	$D_{n,e,w+Ctr}$	*Heat Recovery System*
			Multi-room Heat Recovery System

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

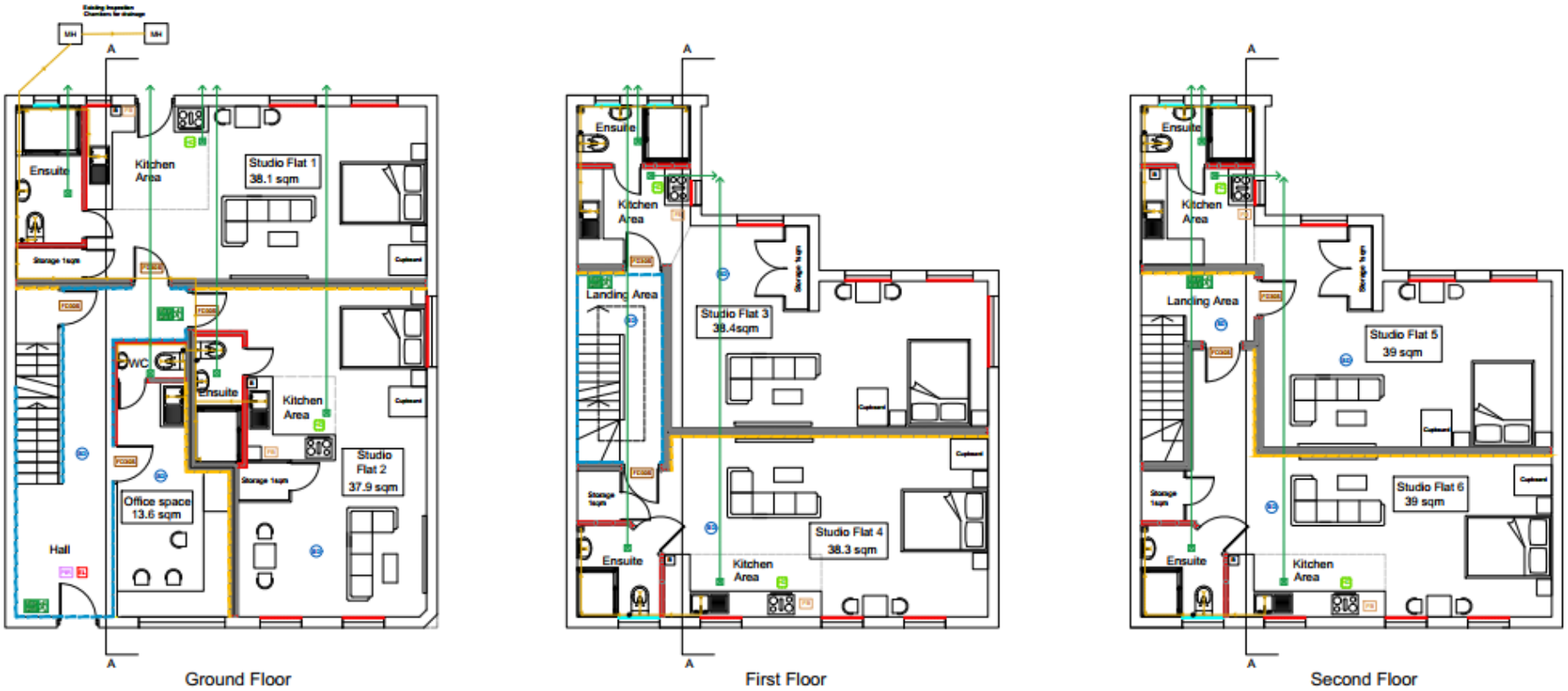


Figure 6: Site Plans Provided by 'Studio Kazaad'

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 140 dB. 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 be used to take into account different source spectra. 'C_{tr}' is the A-weighted urban traffic noise spectrum.