

REPORT



51 Winifred Road, Waterloooville

Noise Impact Assessment

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1.0 Introduction

Clear Acoustic Design has been appointed to carry out a noise assessment for the proposed residential development at 51 Winifred Road, Waterloooville, PO7 7TD.

The proposal is seen to be the development of land to the rear of no.51 to create one new residential dwelling.

The noise assessment has been requested in order to safeguard the amenity of the new dwelling from the existing noise sources and potential commercial noise located to the rear of the development.

An assessment to BS 4142: 2014 + A1: 2019 *Methods for Rating and Assessing Industrial and Commercial Sound* has also been undertaken to show that noise from the existing commercial operations at the nearby industrial estate will have a low impact on the future occupiers.

The assessment shows that providing the acoustic specification for the building detailed in the report is adhered to, the internal noise levels in the proposed dwellings will meet the accepted levels as detailed in BS 8233: 2014 *Guidance on Sound Insulation and Noise Reduction for Buildings*.

This report has been approved and issued by Stefan Hannan of Clear Acoustic Design. Stefan is a Company Director with 17 years of acoustic consulting experience. Stefan is also a full corporate member of the Institute of Acoustics (MIOA).

2.0 Legislative and Policy Framework

2.1 National Planning Policy Framework (NPPF)

The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. The NPPF provides a framework within which local people and their council can produce their own distinctive local and neighbourhood plans. With explicit reference to noise, the NPPF states that "Planning policies and decisions should contribute to and enhance the natural and local environment by ... preventing new and existing development from contributing to, being put at unacceptable risk from ... noise pollution".

2.2 Noise Policy Statement for England (NPSE)

The NPPF refers to the Noise Policy Statement for England (NPSE), which applies to most forms of noise including environmental noise. The NPSE sets out the long-term vision of Government policy which is to "Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.". It aims that "Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- Avoid significant adverse impacts on health and quality of life;
- Mitigate and minimise adverse impacts on health and quality of life; and
- Where possible, contribute to the improvement of health and quality of life."

The use of the terms "significant adverse" and "adverse" are key phrases within the NPSE. The guidance establishes the concept of how the level of adverse effect on health and quality of life can be referenced including:

- 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.

Under the first aim of the NPSE (“avoid significant adverse impacts on health and quality of life”), an impact in line with SOAEL should be avoided. Under the second aim (“mitigate and minimise adverse impacts on health and quality of life”), where the impact lies somewhere between LOAEL and SOAEL, requiring that all reasonable steps are taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development, but does not mean that such adverse effects cannot occur.

2.3 Planning Practice Guidance on Noise (PPG-N)

The Planning Practice Guidance on Noise (PPG-N) is part of a suite of web-based guidance which is intended to support the implementation of the policies in the NPPF and the NPSE. It aids in expanding on the definitions from the NPSE of NOEL, LOAEL and SOAEL, by linking these terms to ‘examples of outcomes’, i.e. changes in behaviour and/or attitude to noise. The table below summarises the guidance from PPG-N in this regard.

Perception	Examples of outcomes	Increasing effect level	Action
NOEL - No Observed Effect Level ¹			
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
LOAEL - Lowest Observed Adverse Effect Level			
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up the volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
SOAEL - Significant Observed Adverse Effect Level			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening, and difficulty in getting back to sleep. Quality of life diminished due to a change in the acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate the effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent
¹ This line is an assumption of the adverse effect level and is not explicitly referenced by PPG-N, though this appears to be a safe assumption.			

Figure 1: Noise exposure hierarchy based on the likely average response – adapted from PPG-N

2.4 BS 4142: 2014 + A1: 2019

BS 4142: 2014 + A1: 2019 *Methods for Rating and Assessing Industrial and Commercial Sound* is a method of assessing the noise impact of sources of industrial and/or commercial noise on sensitive receptors such as residential buildings. This is done by comparing the rating level of the commercial/industrial noise ($L_{A,rT}$) against the existing level of background noise (L_{A90}).

The background sound level is an underlying level of sound over a period, T , and might in part be an indication of relative quietness at a given location. It does not reflect the occurrence of transient and/or higher sound level events and is generally governed by continuous or semi-continuous sounds.

BS 4142: 2014 suggests that sources of noise (rating noise level) should not exceed the existing background noise level, depending on the context. If this is achieved, it is a positive indication that the noise impact will be low.

2.5 BS 8233: 2014

BS 8233: 2014 *Guidance on sound insulation and noise reduction for buildings* provides a range of internal noise level targets for many building types, including new residential buildings or buildings undergoing a change of use. This British Standard is commonly used by planning authorities to place acoustic design targets on new residential developments near major sources of noise, such as transportation networks. Design targets are based on World Health Organisation guidelines.

The guideline for internal noise levels in residential buildings, taken from BS 8233: 2014, are shown in the Table 2 below.

Activity	Location	Day (0700-2300)	Night (2300-0700)
Resting	Living Room	35 dB L _{Aeq} , 16hour	---
Dining	Dining Area	40 dB L _{Aeq} , 16hour	---
Sleeping (Daytime Resting)	Bedroom	35 dB L _{Aeq} , 16hour	30 dB L _{Aeq} , 8hour

Table 2: BS 8233: 2014 Internal Noise Level Criteria

2.6 Council Requirements

Havant Borough Council state the following in respect of noise impacts at the proposal

“The proposed dwelling would be located within close proximity to the industrial estate to the rear of the site. A Noise Impact Assessment would need to be provided to show that the proposed dwelling would not be adversely impacted by the noise and disturbance of the industrial units”.

It is seen that use of BS 4142: 2014 + A1: 2019 *Methods for Rating and Assessing Industrial and Commercial Sound* and BS 8233: 2014 *Guidance on sound insulation and noise reduction for buildings* as outlined above are suitable guides to assess the impacts and effects of the nearby noise source on the proposed dwelling.

3.0 Site Description

3.1 Proposal Location

The proposed development plans are shown below in the plan in Appendix B, Figure 1. The land to the rear of no.51 Winifred Road is to be redeveloped to create a new two-bedroom, two storey house. The new dwelling will have a private rear garden.

The edge of the nearby industrial estate sits immediately south from the proposal, approximately 25 metres from the proposed façade. The industrial estate's location in relation to the proposal can be seen in Appendix B, Figure 2.

All rooms in which the internal noise level targets of BS 8233: 2014 are seen to face south towards the industrial estate.

3.2 Industrial Estate Operations

The industrial estate is made up of several different warehouse units. Many of the units on the estate are seen to be for storage or retail, such as Screwfix and Howdens. The noise from these premises is therefore associated with vehicle movements including that of HGV deliveries.

There are some warehouse units which contain industrial processes, for example a CNC machinery workshop, Repro Engineering, and APR which is a powder coatings facility. Such units are between approximately 35 metres and 125 metres from the façade of the proposal.

It is assumed that there are also items of fixed mechanical plant for each warehouse unit, such as air conditioning and condensing units which run during their operational hours.

The earliest businesses within the industrial estate are seen to start operating from 07:00am. The latest time that businesses operate within the industrial estate is 20:00pm. These hours are generally reduced during weekend periods.

4.0 Environmental Noise Survey

To assess the impact of the noise sources on the proposed development, an environmental noise survey has been undertaken by Clear Acoustic Design at a location representative of the nearest noise sensitive receptor of the proposed development.

The environmental noise survey has provided ambient and background noise levels representative of the receptor location, which will form the basis of the assessment in line with BS 8233: 2014 and BS 4142: 2014. Ambient and background noise levels were measured over an approximate 24-hour period between 25/04/24 and 26/04/24 using a single fixed noise monitor (referred to as F1).

A sound level meter was fixed to a tripod approximately 2 metres above ground level and placed in a position representative of the nearest proposed façade to the industrial estate. This is seen to be the south-facing façade. The location of F1 has been marked in Appendix B, Figure 1.

4.1 Measurement Equipment and Environmental Conditions

The weather was witnessed to be overcast and dry for the duration of the survey with light wind speeds. The following measurement equipment as seen in Table 3 was used for the survey.

Equipment	Serial Number	Calibration Date
Svantek SV 971A Type 1 Sound Level Meter	113218	15/09/23
Svantek SV 18A Preamplifier	113711	15/09/23
ACO 7152 Microphone	80617	15/09/23

Table 3: Measuring Equipment Used for Survey

4.2 Fixed Noise Monitoring Graph – F1

Figure 4 below provides a graph of the measured noise levels at the location of F1.

Measurements were taken over 5 minute intervals. The ambient (L_{Aeq}) and background (L_{A90}) noise levels are shown.

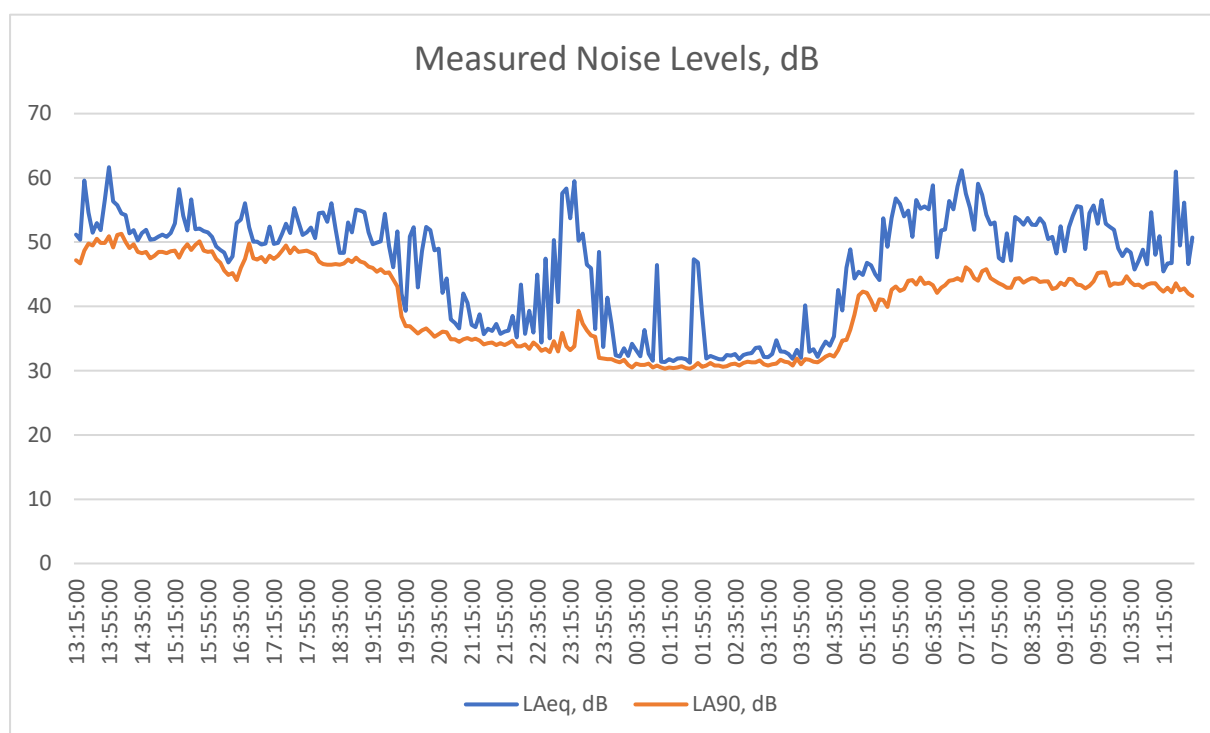


Figure 4: Long Term Measurement Graph of Location F1

4.3 Assessment Ambient Noise Level

To conduct a noise assessment in line with BS 8233: 2014, it is necessary to extrapolate the ambient noise levels from the long-term survey data. These ambient daytime and night-time noise levels are presented in Table 5 below.

Time Period	Assessment Ambient Noise Level, L_{Aeq} dB
Day (0700-2300)	52 dBA
Night (2300-0700)	51 dBA

Table 5: Assessment Ambient Noise Levels

4.4 Assessment Background Noise Level

To conduct an assessment in line with BS 4142: 2014, it is necessary to extrapolate the representative background noise levels from the long-term survey data. These background daytime and night-time noise levels are presented in Table 6 below.

Time Period	Assessment Background Noise Level, L_{A90} dB,
Day (0700-2300)	49 dBA
Night (2300-0700)	31 dBA

Table 6: Assessment Background Noise Levels

4.5 Initial Assessment of the Measured Noise Levels

The Noise Policy Statement for England (NPSE) sets out an approach to defining noise level effects at residential buildings (as seen in Section 1, Figure 1 of this report).

Following this, the Institute of Environmental Management and Assessment (IEMA) provides a general guideline for the application of the NPSE's Effect Levels on proposals.

IEMA states daytime noise levels from 50dB $L_{Aeq,16hour}$ represent the Lowest Observed Adverse Effect Level. For context, noise levels from 65dB $L_{Aeq,16hour}$ represent a Significant Observed Adverse Effect Level.

For nighttime noise levels, the NPSE states that noise levels from 40dB $L_{Aeq,8hour}$ represent the Lowest Observed Adverse Effect Level. For context, noise levels from 55dB $L_{Aeq,8hour}$ represent a Significant Observed Adverse Effect Level.

At this effect level (seen as the LOAEL across day and nighttime periods at the proposal), the NPSE states that it is reasonable to "mitigate and reduce [the noise levels] to a minimum" for newly proposed development.

4.6 Use of BS 4142: 2014 + A1: 2019 for Assessment

BS 4142: 2014 + A1: 2019 states that "where a new noise-sensitive receptor is introduced and there is extant industrial and/or commercial sound, it should be recognized that the industrial and/or commercial sound forms a component of the acoustic environment. In such circumstances other guidance and criteria in addition to or alternative to this standard can also inform the appropriateness of both introducing a new noise-sensitive receptor and the extent of required noise mitigation."

In this scenario, it is seen that the commercial operations at the existing industrial estate already form part of the acoustic environment. With this, noise mitigation can be provided in the form of an assessment to BS 8233: 2014, which will provide an acoustic specification of the façade elements. This will be provided later in the report.

However, an assessment to BS 4142: 2014 will be undertaken to determine the noise levels produced by the industrial estate and its impact on the proposal.

5.0 Noise Impact Assessment

5.1 Calculation of the Specific Sound Source

As stated within section 4, the ambient sound from the industrial estate is made up of vehicle movements, industrial processes, and fixed mechanical plant.

In order to understand the specific noise level from the industrial estate, representative ambient and background noise levels have been extrapolated from the long-term survey data to understand the noise levels at the proposed receptor when the estate is operational and when it is not, in line with the latest operating times of the nearby warehouses and depicted in the reduction in the measured background noise level at approximately 20:00pm. This is in line with methodology in BS 4142: 2014 for intermittent noise sources.

Representative time periods from when the industrial estate was operational and when it was not operational during the survey have been selected for assessment and can be seen below in Figure 7. The highlighted red area shows an operational period of the industrial estate, and the highlighted green area shows the period immediately after industrial processes had ceased for the day.

The period immediately after the industrial estate ceased operations during the survey is seen to be representative of the existing background noise level at the receptor, and has been chosen as such, in line with BS 4142: 2014 methodology for determining background noise levels with intermittent noise sources.

The ambient and background noise levels from these periods can be seen in Table 8 below.

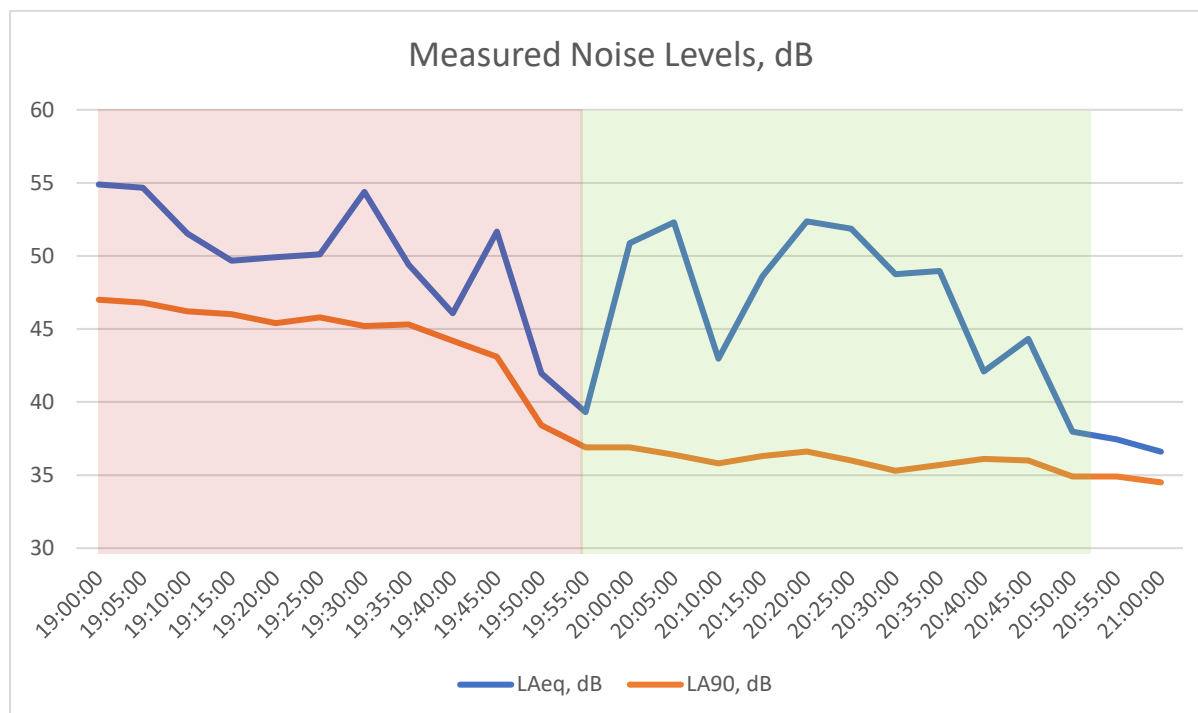


Figure 7: Selected Noise Level Time Periods (Operational – Red; Not Operational – Green)

Time period	Assessment Ambient Noise Level, L_{Aeq} dBA	Assessment Background Noise Level, L_{A90} dBA
When mechanical plant was operational (18:55-19:55)	51dB $L_{Aeq,1\text{ hour}}$	45dB
When mechanical plant was not operational (19:55– 20:55)	47dB $L_{Aeq,1\text{ hour}}$	37dB

Table 8: Assessment Ambient and Background Noise Levels From Selected Time Periods

5.2 Calculated Rating Level of the Industrial Estate

Using methodology from BS 4142: 2014 to correct for the residual sound's effect on the measured ambient noise level, the determination of the noise rating level of the industrial estate can be seen below in Table 9.

Rating Level at Receptor from Commercial Operations ($L_{A,r,1\text{hour}}$, dB)	Difference Between Rating Level Against Existing Daytime Background Noise Level at Receptor (dB)
49	+12

Table 9: Rating Level Against the Background Noise Level at Receptor

The specific noise level at the proposed receptor from the industrial estate is calculated as 49dB $L_{A,rT}$. This corresponds to a rating level from the industrial estate that is 12dB above the background noise level when the industrial estate is not operational during the day.

Out of context, this represents a noise level that is considered a significant adverse effect to the proposed receptor. However, this rating level can be modified because of its context, which is assessed in Section 5.3 below.

5.3 Assessment of the Rating Level of the Industrial Estate

BS 4142: 2014 + A1: 2019 states the following in relation to assessment conclusions of the rating level:

"The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the ... context in which the sound occurs. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context."

The initial estimate of the impact can therefore be modified due to the context of the noise levels because it is recognised that the industrial estate sound forms a component of the existing acoustic environment. It is unreasonable to compare the specific sound from the industrial estate to the background noise level of when it is not operational.

In such scenarios it is "beneficial to compare the specific sound [the industrial estate noise] to that of the ambient sound or residual sound [the ambient sound without the specific sound present] to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound", according to BS 4142: 2014 + A1: 2019.

With this, the spectral content of the industrial estate and of the residual sound are both generally broadband in nature as shown in Table 10 below.

There is not seen to be any tonal content (either high or low) from the industrial estate noise which could be considered annoying or disturbing when compared to the residual sound. It is deduced that the residual sound is likely to be made up from neighbouring properties, distant traffic, and wildlife noise.

Noise Type	63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	dBA
Specific Noise Level (Industrial Estate) at Proposed Receptor	58	57.1	42.4	43.6	46.1	41.4	39.3	49
Residual Noise Level at Proposed Receptor	54.3	54	38.7	37.9	39.4	44.3	40.2	47

Table 10: Spectrum of Measured Specific Sound and Residual Sound

The difference in noise levels when the specific sound is absent is also considered low. There is an increase in ambient noise levels by 4dBA when the specific sound is present during the day.

Further to this, BS 4142: 2014 + A1: 2019 states that it is important to provide evidence of human response to industrial and/or commercial sound where it is available. Therefore it is noted that "a very small number of people who report hearing factory and commercial premises noise are adversely affected by it" - whereby adversely affecting means having at least one of the following reactions: 'personally object', 'irritated', 'disturbed', 'personally concerned', 'annoyed or upset at times', 'a nuisance to you personally' – with approximately 2% of people adversely affected by factory noise, and 2% of people adversely affected by commercial noise, according to the Environmental Noise and Health in the UK report by the Ad Hoc Expert Group on Noise and Health (2010).

In this instance, where the residual and specific noise spectrums are generally similar, the specific sound has no tonal components which may be disturbing or annoying to an occupier, and the difference in noise levels between the residual sound and the ambient sound when the specific sound is present is considered low,

Clear Acoustic Design is of the opinion that only a very small number of people would be adversely affected by the industrial estate noise, in line with the Environmental Noise and Health in the UK report.

In any case, it is recognised that the industrial estate sound forms a component of the existing acoustic environment. Given that the ambient noise levels at the proposal are generally in line with the Lowest Observed Adverse Effect Level, they can therefore be successfully mitigated against with an acoustic specification which is outlined below in Section 6 of this report.

It is deemed by BS 4142: 2014 + A1: 2019 that it is acceptable to mitigate against ambient noise at this particular level for new developments following the relevant guidance from BS 8233: 2014. The NPSE also states that mitigation is the correct course of action in this scenario.

6.0 Assessment to BS 8233: 2014

The measured ambient noise levels have been used to calculate the façade elements of the proposed dwelling in order to meet the internal noise criteria of BS 8233: 2014. The bedrooms have also been assessed to 45dB L_{Amax} to meet sleep disturbance guidance from the WHO.

Appendix A Figures 1 to 8 shows the noise ingress calculation during the daytime and nighttime periods for all relevant rooms. Calculations show that the internal noise criteria of BS 8233: 2014 can be achieved with the specification provided in Table 11 below. A further summary of results is provided in Table 12.

With this specification, the living, dining, and sleeping areas of the dwelling will meet the daytime and night-time noise level guidelines of BS 8233: 2014 providing windows are closed and background ventilation is supplied by trickle ventilators that provide enough acoustic attenuation.

The R_w value in Table 11 has been provided for guidance only. The octave band values take precedence as the R_w value does not accurately account for weaknesses in certain frequency bands. Any constructions and products can be specified and installed that meet the level of acoustic performance stated in Table 11.

Element	Type	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	R_w / D_{new}
External Wall	R, dB	44	46	49	55	55	55	53 dB
Glazing	R, dB	24	25	30	33	29	34	31 dB
Roof	R, dB	27	37	43	48	52	52	46 dB
Trickle ventilator – open	D_{ne} , dB	29	22	32	30	29	29	30 dB
Door	R, dB	20	25	27	28	32	32	30 dB

Table 11: Acoustic Performance of Façade Elements

A summary of the predicted internal noise levels with the acoustic performance of the façade elements as specified in Table 11 above can be seen below in Table 12. Supporting calculations can be found in Appendix A.

Location	Day (0700-2300)	Night (2300-0700)
Living Room	27.9 dB $L_{Aeq, 16hour}$	N/A
Kitchen/Dining	28.7 dB $L_{Aeq, 16hour}$	N/A
Bedroom 1	29.3 dB $L_{Aeq, 16hour}$	27.6 dB $L_{Aeq, 8hour}$ / 44.4 dB L_{AFMAX}
Bedroom 2	29.8 dB $L_{Aeq, 16hour}$	28.1 dB $L_{Aeq, 8hour}$ / 44.9 dB L_{AFMAX}

Table 12: Calculated Internal Noise Levels of Proposal

6.1 Construction Types

A summary of the type of constructions that could be used to meet the acoustic specification outlined in Table 11 is provided in Table 13 below. Any constructions and products can be specified and installed that meet the level of acoustic performance stated in Table 11, however.

Element	Type
External Wall	Typical cavity masonry external wall
Glazing	Typical double glazing – 6/12/6
Roof	Tiled or slated roof, with 25mm plasterboard ceiling and 100mm mineral wool insulation
Trickle ventilator	Typical open trickle ventilator
Door (to the dining room)	Typical external door (mass of 25kg/m ²)

Table 13: Typical Construction Types to Meet Acoustic Specification

6.2 Background Ventilation

Background ventilation can be provided in the form of acoustic ventilators which have already been specified in Table 11 (based on two acoustic ventilators per room). Windows should therefore not normally need to be opened to provide background ventilation to the rooms.

Windows can be opened for purge ventilation if this is required, but acoustic requirements do not typically apply during purge ventilations as this is usually a short term form of ventilation.

As a general rule, according to the World Health Organization, internal noise levels with a partially open window are approximately 15dB lower than noise levels at the façade of the building. The approximate internal noise levels for the proposed rooms with partially open windows has been provided in Table 14 below.

It is noted that noise levels are close to the desired internal noise levels of BS 8233: 2014 even when windows are partially open. The resulting internal noise levels are therefore unlikely to cause adverse effects to occupants when the windows are partially open.

Façade	Time Period	Façade Ambient Noise Level, L_{Aeq} dB	Expected Internal Noise Level with Partially Open Window, L_{Aeq} dB
South facing	Day (0700-2300)	52	37
	Night (2300-0700)	51	36

Table 14: Internal Noise Levels with Partially Open Windows

6.3 Noise Levels in the External Amenity Space

It is desirable that the noise level in the external area does not exceed 50 dB $L_{Aeq, 16hour}$ during the daytime with an upper guideline value of 55 dB $L_{Aeq, 16hour}$ according to BS 8233: 2014.

Noise levels in the portion of the garden which is close to the proposed south façade (at the assessment location of F1) are seen to be within the upper limit of this guidance, at 52dB $L_{Aeq, 16hour}$.

Further short term noise measurements were taken at the rear of the garden at the boundary line between the proposal and industrial estate edge on 26/04/24 between 13:00pm and 14:00pm, marked as position F2 in Appendix B. Ambient noise levels at this time were reported at 53dB $L_{Aeq, 1hour}$.

The noise levels within the garden are seen to be within the upper limit of the desired external noise levels specified in BS 8233: 2014.

7.0 Conclusion

Clear Acoustic Design has been appointed to carry out a noise assessment for the proposed residential development at 51 Winifred Road, Waterloooville, PO7 7TD. The proposal is seen to be the development of land to the rear of no.51 to create one new residential dwelling.

The noise assessment has been conducted in order to safeguard the amenity of the new dwelling from the existing industrial noise located to the rear of the development.

The measured noise levels generally represent the Lowest Observed Adverse Effect Level. At this level, mitigation should be provided in order to reduce the noise level, according to the NPSE.

An assessment to BS 4142: 2014 + A1: 2019 *Methods for Rating and Assessing Industrial and Commercial Sound* has also been undertaken to understand the industrial estate's impact on the proposal.

The typical method of assessment in BS 4142: 2014 + A1: 2019 of such noise sources is not applicable in this scenario as it recognised that the noise from the industrial estate forms part of the existing acoustic environment.

As such, an assessment of the spectral content and noise levels of the industrial estate in comparison to the residual sound at the assessment location shows that noise levels from the industrial estate are unlikely to give rise to an adverse impact to the future occupiers of the proposal.

In scenarios where industrial noise forms part of the existing acoustic environment, BS 4142: 2014 + A1: 2019 states that is appropriate to provide mitigation for the noise levels.

The proposal can successfully mitigate against the existing noise levels with an acoustic specification of the façade elements outlined in Table 11. The assessment shows that daytime and night-time internal noise levels in the living room, dining room, and bedrooms of the

proposed dwelling will meet the desired levels as detailed in BS 8233: 2014 *Guidance on Sound Insulation and Noise Reduction for Buildings* and sleep disturbance guidelines from the World Health Organisation. Supporting calculations can be seen in Appendix A.

The noise levels in the garden will also be within the upper desired noise level limit specified in BS 8233: 2014.

As such, Clear Acoustic Design are of the opinion that the noise from the industrial estate should not hinder the granting of planning permission for the proposal.

Appendix A – Specific Noise Level Calculations

The noise level in a room due to sound penetrating a façade element may be calculated according to BS EN 12354-3 and BS 8233 from:

$$L_2 = L_{1,in} - R + 10 \times \text{Log}(S/V) + 10 \times \text{Log}(T) + 11$$

Where:

- L_2 = noise level in room due to sound through façade portion of area S and mean sound reduction index R , dB
- $L_{1,in}$ = external free-field noise level at the position of the façade, dB
- R = sound reduction index of portion, dB
- S = area of façade portion, m^2
- V = room volume, m^3
- T = reverberation time, s

For small façade components, such as ventilators, the noise level in a room may be calculated according to the same standards as above from:

$$L_2 = L_{1,in} - D_{n,e} - 10 \times \text{Log}(V) + 10 \times \text{Log}(T) + 21$$

Where:

- $D_{n,e}$ = element-normalised sound level difference of the ventilator.
(Other components have the same meaning as above).

The sound reduction of the masonry portion of the facade is much higher than that of the glazing and ventilation provision, therefore noise penetration through the masonry is disregarded as insignificant compared to noise penetration through the glazing and ventilation provision. The noise penetration through the vents and the glazing is calculated as above and then combined in each frequency band to give an overall internal level from the external sources by these routes.

CLEAR BS8233 Noise Break-in Calculation ACOUSTIC DESIGN		125	250	500	1000	2000	4000	dB(A)
Noise Level at Façade		58	42.7	41.9	43.4	48.3	44.2	52
Additional Safety	3 dB	3.0	3.0	3.0	3.0	3.0	3.0	
Facade Corrections	Lff	0.0	0.0	0.0	0.0	0.0	0.0	
Volume of room	60 m3							
Reverberation Time in room	0.5 s	0.5	0.5	0.5	0.5	0.5	0.5	
A = Total absorption is Sabines		19.3	19.3	19.3	19.3	19.3	19.3	
10*log(S/A)		2.8	2.8	2.8	2.8	2.8	2.8	
Facade Details								
Total Façade Area		37.0 m2						
Brick (336mm) plastered		29 m2						
External Wall		44	46	49	55	55	55	
Noise ingress through element		18.8	1.5	-2.3	-6.8	-1.9	-6.0	5.7
Double - 6/12/6		6 m2						
Glazing		24	25	30	33	29	34	
Noise ingress through element		31.9	15.6	9.8	8.3	17.2	8.1	21.2
25kg/m2 well sealed		2 m2						
Roof		20	25	27	28	32	32	
Noise ingress through element		31.2	10.9	8.1	8.6	9.5	5.4	17.8
Trickle Vent - n=1 = one trickle vent		n = 2						
Basic Trickle Vent		29	22	32	30	29	29	
Trickle Vent		26	19	29	27	26	26	
Noise ingress through element		32.2	24.2	13.2	16.8	22.2	18.1	26.3
Total Noise Level in Room		125	250	500	1000	2000	4000	dB(A)
		36.6	24.9	15.7	17.9	23.5	18.7	27.9

A1: Internal Noise Levels with Specified Façade, LAeq dB (Dining Room)

CLEAR ACOUSTIC DESIGN		BS8233 Noise Break-in Calculation						
Noise Level at Façade		125	250	500	1000	2000	4000	dB(A)
		58	42.7	41.9	43.4	48.3	44.2	52
Additional Safety	3 dB	3.0	3.0	3.0	3.0	3.0	3.0	
Facade Corrections	Lff	0.0	0.0	0.0	0.0	0.0	0.0	
Volume of room	49 m3							
Reverberation Time in room	0.5 s							
A = Total absorption in Sabines		0.5	0.5	0.5	0.5	0.5	0.5	
10*log(S/A)		15.8	15.8	15.8	15.8	15.8	15.8	
		2.3	2.3	2.3	2.3	2.3	2.3	
Facade Details								
Total Façade Area		27.0 m2						
Brick (336mm) plastered		19 m2						
External Wall		16						
Noise ingress through element		17.8	0.5	-3.3	-7.8	-2.9	-7.0	
Double - 6/12/6		8 m2						
Glazing								
Noise ingress through element		34.1	17.8	12.0	10.5	19.4	10.3	
Trickle Vent - n=1 = one trickle vent		n = 2						
Basic Trickle Vent								
Trickle Vent								
Noise ingress through element		33.0	25.0	14.0	17.6	23.0	18.9	
Total Noise Level in Room		125	250	500	1000	2000	4000	dB(A)
		36.6	25.8	16.2	18.4	24.6	19.5	28.7

A2: Internal Noise Levels with Specified Façade, L_{Aeq} dB (Living Room)

CLEAR BS8233 Noise Break-in Calculation ACOUSTIC DESIGN		125	250	500	1000	2000	4000	dB(A)
Noise Level at Façade		58	42.7	41.9	43.4	48.3	44.2	52
Additional Safety	3 dB	3.0	3.0	3.0	3.0	3.0	3.0	
Facade Corrections	Lff	0.0	0.0	0.0	0.0	0.0	0.0	
Volume of room	40 m3							
Reverberation Time in room	0.5 s							
A = Total absorption in Sabines		0.5	0.5	0.5	0.5	0.5	0.5	
10*log(S/A)		12.9	12.9	12.9	12.9	12.9	12.9	
		5.3	5.3	5.3	5.3	5.3	5.3	
Facade Details								
Total Façade Area		44.0 m2						
Brick (336mm) plastered		16 m2						
External Wall		16						
Noise ingress through element		17.9	0.6	-3.2	-7.7	-2.8	-6.9	4.8
Double - 6/12/6		2 m2						
Glazing								
Noise ingress through element		28.9	12.6	6.8	5.3	14.2	5.1	18.2
Tiled/slatted roof, 25mm p/bd ceiling, 100mm m/w		26 m2						
Roof								
Noise ingress through element		37.1	11.8	5.0	1.5	2.4	-1.7	21.2
Trickle Vent - n=1 = one trickle vent		n = 2						
Basic Trickle Vent								
Trickle Vent								
Noise ingress through element		33.9	25.9	14.9	18.5	23.9	19.8	28.1
Total Noise Level in Room		39.2	26.3	16.0	18.8	24.4	20.0	29.3

A3: Internal Daytime Noise Levels with Specified Façade, L_{Aeq} dB (Bedroom 1)

CLEAR ACOUSTIC DESIGN		BS8233 Noise Break-in Calculation							
		125	250	500	1000	2000	4000	dB(A)	
Noise Level at Façade		58	42.7	41.9	43.4	48.3	44.2	52	
Additional Safety	3 dB	3.0	3.0	3.0	3.0	3.0	3.0		
Facade Corrections	Lff	0.0	0.0	0.0	0.0	0.0	0.0		
Volume of room	40 m3								
Reverberation Time in room	0.5 s								
A = Total absorption in Sabines		0.5	0.5	0.5	0.5	0.5	0.5		
10*log(S/A)		12.9	12.9	12.9	12.9	12.9	12.9		
		5.3	5.3	5.3	5.3	5.3	5.3		
Facade Details									
Total Façade Area		44.0 m2							
Brick (336mm) plastered		13 m2							
External Wall		16							
Noise ingress through element		44	46	49	55	55	55		
		17.0	-0.3	-4.1	-8.6	-3.7	-7.8	3.9	
Double - 6/12/6		5 m2							
Glazing		24	25	30	33	29	34		
Noise ingress through element		32.9	16.6	10.8	9.3	18.2	9.1	22.2	
Tiled/slatted roof, 25mm p/bd ceiling, 100mm m/w		26 m2							
Roof		27	37	43	48	52	52		
Noise ingress through element		37.1	11.8	5.0	1.5	2.4	-1.7	21.2	
Trickle Vent - n=1 = one trickle vent		n = 2							
Basic Trickle Vent		29	22	32	30	29	29		
Trickle Vent		26	19	29	27	26	26		
Noise ingress through element		33.9	25.9	14.9	18.5	23.9	19.8	28.1	
Total Noise Level in Room		125	250	500	1000	2000	4000	dB(A)	
		39.8	26.5	16.7	19.1	25.0	20.2	29.8	

A4: Internal Daytime Noise Levels with Specified Façade, L_{Aeq} dB (Bedroom 2)

CLEAR ACOUSTIC DESIGN		BS8233 Noise Break-in Calculation						
Noise Level at Façade		125	250	500	1000	2000	4000	dB(A)
		56	43	40.5	41.2	46.5	42.3	51
Additional Safety	3 dB	3.0	3.0	3.0	3.0	3.0	3.0	
Facade Corrections	Lff	0.0	0.0	0.0	0.0	0.0	0.0	
Volume of room	40 m3							
Reverberation Time in room	0.5 s							
A = Total absorption is Sabines		0.5	0.5	0.5	0.5	0.5	0.5	
10*log(S/A)		12.9	12.9	12.9	12.9	12.9	12.9	
		5.3	5.3	5.3	5.3	5.3	5.3	
Facade Details								
Total Façade Area		44.0 m2						
Brick (336mm) plastered		16 m2						
External Wall		16						
Noise ingress through element		15.9	0.9	-4.6	-9.9	-4.6	-8.8	3.1
Double - 6/12/6		2 m2						
Glazing								
Noise ingress through element		26.9	12.9	5.4	3.1	12.4	3.2	
Tiled/slated roof, 25mm p/bd ceiling, 100mm m/w		26 m2						
Roof								
Noise ingress through element		35.1	12.1	3.6	-0.7	0.6	-3.6	
Trickle Vent - n=1 = one trickle vent		n = 2						
Basic Trickle Vent								
Trickle Vent								
Noise ingress through element		31.9	26.2	13.5	16.3	22.1	17.9	26.4
Total Noise Level in Room		37.2	26.6	14.6	16.6	22.6	18.1	27.6

125	250	500	1000	2000	4000	dB(A)
37.2	26.6	14.6	16.6	22.6	18.1	27.6

A5: Internal Nighttime Noise Levels with Specified Façade, L_{Aeq} dB (Bedroom 1)

CLEAR ACOUSTIC DESIGN		BS8233 Noise Break-in Calculation						
Noise Level at Façade		125	250	500	1000	2000	4000	dB(A)
		56	43	40.5	41.2	46.5	42.3	51
Additional Safety	3 dB	3.0	3.0	3.0	3.0	3.0	3.0	
Facade Corrections	Lff	0.0	0.0	0.0	0.0	0.0	0.0	
Volume of room	40 m3							
Reverberation Time in room	0.5 s							
A = Total absorption is Sabines		0.5	0.5	0.5	0.5	0.5	0.5	
10*log(S/A)		12.9	12.9	12.9	12.9	12.9	12.9	
		5.3	5.3	5.3	5.3	5.3	5.3	
Facade Details								
Total Façade Area		44.0 m2						
Brick (336mm) plastered		13 m2						
External Wall		16						
Noise ingress through element		15.0	0.0	-5.5	-10.8	-5.5	-9.7	2.2
Double - 6/12/6		5 m2						
Glazing								
Noise ingress through element		30.9	16.9	9.4	7.1	16.4	7.2	
Tiled/slatted roof, 25mm p/bd ceiling, 100mm m/w		26 m2						
Roof								
Noise ingress through element		35.1	12.1	3.6	-0.7	0.6	-3.6	
Trickle Vent - n=1 = one trickle vent		n = 2						
Basic Trickle Vent								
Trickle Vent								
Noise ingress through element		31.9	26.2	13.5	16.3	22.1	17.9	26.4
Total Noise Level in Room		125	250	500	1000	2000	4000	dB(A)
		37.8	26.8	15.3	16.9	23.2	18.3	28.1

A6: Internal Nighttime Noise Levels with Specified Façade, L_{Aeq} dB (Bedroom 2)

CLEAR ACOUSTIC DESIGN		BS8233 Noise Break-in Calculation						
Noise Level at Façade		125	250	500	1000	2000	4000	dB(A)
		75	61.1	59.5	57.4	61	58.5	67
Additional Safety	3 dB	3.0	3.0	3.0	3.0	3.0	3.0	
Facade Corrections	Lff	0.0	0.0	0.0	0.0	0.0	0.0	
Volume of room	40 m3							
Reverberation Time in room	0.5 s							
A = Total absorption is Sabines 10*log(S/A)		0.5	0.5	0.5	0.5	0.5	0.5	
		12.9	12.9	12.9	12.9	12.9	12.9	
		5.3	5.3	5.3	5.3	5.3	5.3	
Facade Details								
Total Façade Area	44.0 m2							
Brick (336mm) plastered	16 m2	44	46	49	55	55	55	
External Wall		16						
Noise ingress through element		34.9	19.0	14.4	6.3	9.9	7.4	21.0
Double - 6/12/6	2 m2	24	25	30	33	29	34	
Glazing		45.9	31.0	24.4	19.3	26.9	19.4	
Noise ingress through element		27	37	43	48	52	52	
Tiled/slated roof, 25mm p/bd ceiling, 100mm m/w		26 m2						
Roof		54.1	30.2	22.6	15.5	15.1	12.6	38.2
Noise ingress through element								
Trickle Vent - n=1 = one trickle vent	n = 2	29	22	32	30	29	29	
Basic Trickle Vent		26	19	29	27	26	26	
Trickle Vent		50.9	44.3	32.5	32.5	36.6	34.1	42.7
Noise ingress through element								
Total Noise Level in Room		125	250	500	1000	2000	4000	dB(A)
		56.2	44.7	33.6	32.8	37.1	34.3	44.4

A7: Internal Nighttime Noise Levels with Specified Façade, L_{AFMAX} dB (Bedroom 1)

CLEAR ACOUSTIC DESIGN		BS8233 Noise Break-in Calculation							
		125	250	500	1000	2000	4000	dB(A)	
Noise Level at Façade		75	61.1	59.5	57.4	61	58.5	67	
Additional Safety	3 dB	3.0	3.0	3.0	3.0	3.0	3.0		
Facade Corrections	Lff	0.0	0.0	0.0	0.0	0.0	0.0		
Volume of room	40 m3								
Reverberation Time in room	0.5 s								
A = Total absorption is Sabines									
10*log(S/A)		0.5	0.5	0.5	0.5	0.5	0.5		
		12.9	12.9	12.9	12.9	12.9	12.9		
		5.3	5.3	5.3	5.3	5.3	5.3		
Facade Details									
Total Façade Area		44.0 m2							
Brick (336mm) plastered		13 m2							
External Wall		16							
Noise ingress through element		44	46	49	55	55	55		
		34.0	18.1	13.5	5.4	9.0	6.5	20.1	
Double - 6/12/6		5 m2							
Glazing									
Noise ingress through element		24	25	30	33	29	34		
		49.9	35.0	28.4	23.3	30.9	23.4	37.2	
Tiled/slatted roof, 25mm p/bd ceiling, 100mm m/w		26 m2							
Roof									
Noise ingress through element		27	37	43	48	52	52		
		54.1	30.2	22.6	15.5	15.1	12.6	38.2	
Trickle Vent - n=1 = one trickle vent		n = 2							
Basic Trickle Vent									
Trickle Vent									
Noise ingress through element		29	22	32	30	29	29		
		26	19	29	27	26	26		
		50.9	44.3	32.5	32.5	36.6	34.1	42.7	
Total Noise Level in Room		125	250	500	1000	2000	4000	dB(A)	
		56.8	44.9	34.3	33.1	37.7	34.5	44.9	

A8: Internal Nighttime Noise Levels with Specified Façade, L_{AFMAX} dB (Bedroom 2)



B2: Location of Industrial Estate (Blue); Proposal (Red)

