

Waterbury 8-10 Ford Road Arundel

Environmental Noise Survey and Acoustic Design Statement Report

25712/ADS1

5 July 2018

For:
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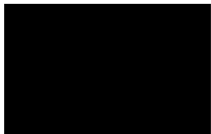


Hann Tucker Associates
Consultants in Acoustics Noise & Vibration



Environmental Noise Survey and Acoustic Design Statement Report 25712/ADS1

Document Control

Rev	Date	Comment	Prepared by	Authorised by
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1.0 Introduction

A residential development is proposed at Waterbury House, Arundel. The proposal comprises the construction of five residential units with ancillary accommodation at an existing care home for people with profound learning disabilities.

Hann Tucker Associates have therefore been commissioned to undertake an environmental noise survey and noise impact assessment in order to assess the suitability of the site for residential use.

This report presents the methodology and findings of our noise survey and assessment in the context of national planning policies and the policy of the Local Authority.

2.0 Objectives

To undertake an environmental noise survey to establish the existing L_{Amax} , L_{Aeq} and L_{A90} environmental road, rail and air traffic noise levels at selected accessible positions.

Based on the results of the survey, to undertake a noise assessment to assess the suitability of the site for residential use in accordance with the Noise Policy Statement for England (NPSE), National Planning Policy Framework (NPPF), Planning Practice Guidance (ProPG), British Standard BS8233:2014 and Local Authority requirements.

3.0 Site Description

3.1 Location

The site is located at 8-10 Ford Road, Ford, Arundel, BN18 0BN.

The location is shown in the Location Map overleaf.



Location Map (Map Data ©2018 Google)

The site falls within the jurisdiction of Arun District Council.

3.2 Description

The site is an existing ground plus two storey Grade II building bound by Ford Road to the west and railway tracks to the south. To the north of the site are a mixture of ground and ground plus one storey residential buildings. To the west of the site is the Gaugemaster model runway superstore. To the south west of the site is the Ford train station. To the east of the site are ground level residential buildings.

The site is shown in the Site Plan overleaf.



Site Plan (Photos ©2018 Google, Map Data ©2018 Google)

4.0 Acoustic Terminology

For an explanation of the acoustic terminology used in this report please refer to Appendix A enclosed.

5.0 Methodology

The survey was undertaken by P. Libene MSc BSc (Hons) AMIOA.

5.1 Procedure

Fully automated environmental noise monitoring was undertaken from approximately 15:45 hours on 14 June 2018 to 15:45 hours on 15 June 2018.

During the periods we were on site the wind conditions were calm and from approximately a north westerly direction. The sky was generally clear. We understand that generally throughout the survey period the weather conditions were dry. These conditions are considered suitable for obtaining representative measurement results.

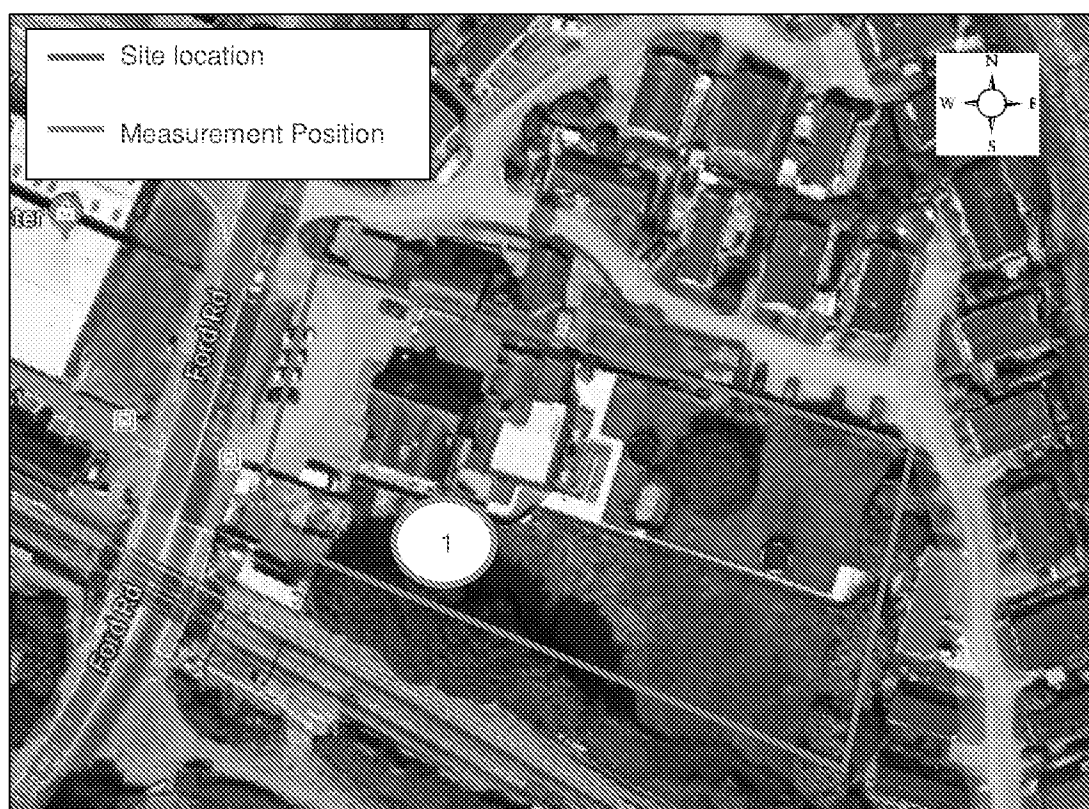


Measurements were taken continuously of the A-weighted (dBA) L_{90} , L_{eq} and L_{max} sound pressure levels over 15 minute periods.

5.1.1 Measurement Position

The microphone was attached to a pole approximately 4 metres above ground level.

The position is shown on the plan below.



Plan Showing Unmanned Measurement Positions (Photos 2018 Google, Map Data 2018 Google)

5.1.2 Instrumentation

The instrumentation used during the survey is presented in the table below:

Description	Manufacturer	Type	Serial Number	Calibration
Type 1 ½" Condenser Microphone	PCB	377B02	122885	Calibration on 16/05/2018
Type 1 Preamp	Larson Davis	PRM902	3692	Calibration on 16/05/2018
Type 1 Data Logging Sound Level Meter	Larson Davis	824	3444	Calibration on 16/05/2018



Description	Manufacturer	Type	Serial Number	Calibration
Type 1 Calibrator	Larson Davis	CAL200	3082	Calibration on 03/07/2017

The sound level meter, including the extension cable, was calibrated prior to and on completion of the surveys. No significant change was found to have occurred (no more than 0.1dB).

Each sound level meter was located in an environmental case with the microphone connected to the sound level meter via an extension cable. The microphone was fitted with a windshield.

6.0 Results

The results have been plotted on Time History Graph 25712/TH1 enclosed presenting the 15 minute A-weighted (dBA) L_{90} , L_{eq} and L_{max} levels at the measurement position throughout the duration of the survey.

6.1 L_{eq} Noise Levels

In order to compare the results of our survey with the relevant guidelines it is necessary to convert the measured $L_{Aeq(15\text{ minute})}$ noise levels into single figure daytime $L_{Aeq(16\text{-hour})}$ (07:00-23:00 hours) and night-time $L_{Aeq(8\text{-hour})}$ (23:00-07:00 hours) levels.

The daytime $L_{Aeq(16\text{-hour})}$ and night-time $L_{Aeq(8\text{-hour})}$ noise levels for each position are presented in the tables below.

Position	Daytime $L_{Aeq(16\text{-hour})}$	Night-Time $L_{Aeq(8\text{-hour})}$
1	60dB	55dB

N.B. The above levels have been corrected for façade reflections where appropriate, for comparison with the free field levels.

6.2 Night-time L_{max} Results

During the night-time period 23:00 hours – 07:00 hours the recorded L_{Amax} events range from 54dB to 83dB. The 10th highest L_{Amax} event recorded was 78dB.

7.0 Discussion Of Noise Climate

During the periods we were on site the dominant noise sources were noted to be rail traffic.



8.0 Relevant Planning Policies and Guidance

8.1 Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) was published in March 2010. The NPSE is the overarching statement of noise policy for England and applies to all forms of noise other than occupational noise, setting out the long term vision of Government noise 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."

That vision is supported by the following aims which are reflected in three of the four aims for planning policies and decisions in paragraph 123 of the NPPF (see paragraph 8.2 (b) below):

"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 Explanatory Note to the NPSE has three concepts for the assessment of noise in this country:

NOEL – No Observed Effect Level

This is the level below which no effect can be detected and below which there is no detectable effect on health and quality of life due to noise.

LOAEL – Lowest Observable 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.

None of these three levels are defined numerically and for the SOAEL the NPSE makes it clear that the noise level is likely to vary depending upon the noise source, the receptor and the time of day/day of the week, etc. The need for more research to investigate what may represent an SOAEL for noise is acknowledge in the NPSE and the NPSE asserts that not stating specific



SOAEL levels provides policy flexibility in the period until there is further evidence and guidance.

The NPSE concludes by explaining in a little more detail how the LOAEL and SOAEL relate to the three aims listed in paragraph (b) above. It starts with the aim of avoiding significant adverse effects on health and quality of life, then addresses the situation where the noise impact falls between the LOAEL and the SOAEL when *“all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development.”* The final aim envisages pro-active management of noise to improve health and quality of life, again taking into account the guiding principles of sustainable development which include the need to minimise travel distance between housing and employment uses in an area.

8.2 National Planning Policy Framework (NPPF)

The National Planning Policy Framework (NPPF) was published in March 2012 and replaced the previous national planning guidance document Planning Policy Guidance 24: *Planning and Noise* (PPG24).

The main reference to noise within the NPPF is at paragraph 123, reproduced below:

“123. Planning policies and decisions should aim to:

- *Avoid noise from giving rise to significant adverse impacts²⁷ on health and quality of life as a result of new development;*
- *Mitigate and reduce to a minimum other adverse impacts²⁷ on health and quality of life arising from noise from new development, including through the use of conditions;*
- *Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established;²⁸ and*
- *Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.”*

The reference numbers 27 and 28 point respectively to the Explanatory Note to the NPSE and the provisions of the Environmental Protection Act 1990 *“and other relevant law”*.



The spirit of the Localism Act and the NPPF would suggest that of the guidelines cited, it is guidelines adopted as policy by the Local Planning Authority (if such exist) that should prevail, at least until the Government publishes relevant technical guidance under the NPPF.

8.3 Planning Practice Guidance on Noise

Planning Practice Guidance (PPG) under the NPPF has been published by the Government as a web based resource at <http://planningguidance.planningportal.gov.uk/blog/guidance/>. This includes specific guidance on noise although, like the NPPF and NPSE the PPG does not provide any quantitative advice. It seeks to illustrate a range of effect levels in terms of examples of outcomes as set out in the following table:

Perception	Examples of Outcomes	Increasing effect level	Action
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.		
		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 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.	Observed Adverse Effect	Mitigate and reduce to a minimum
		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 change in acoustic character of the area.		Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable hard, e.g. auditory and non-auditory.		Prevent



8.4 Local Planning Policy

The Local Policy regarding noise and new residential dwellings is given in the Arun Local Plan 2011-2031 Publication Version issued in October 2014:

“21.2.6 Residential development proposed within First Priority Areas, or in close proximity to noise sources from road, rail and air, should be assessed to determine the noise exposure category (NEC) which the site falls into. This assessment must be carried out at an early stage in order to identify the suitability of the site. Where the NEC assessment has shown that habitable rooms will be exposed to noise levels in excess of NEC A, noise mitigation will be required as part of the design of the development (useful advice is set out in the BRE document 'Sound Control for Homes').

21.2.7 It should be noted however that NEC noise levels should not be used for assessing the impact of industrial noise on proposed residential development because the nature of this type of noise, and local circumstances, may necessitate individual assessment. However, at mixed use sites where industrial noise is present but not dominant, its contribution should be included in the noise level used to establish the appropriate NEC.

NEC	
A	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as a desirable level.
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.
C	Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
D	Planning permission should normally be refused.

Table 21.1 Noise exposure categories for residential development



Noise Source	Noise Exposure Categories			
	A	B	C	D
Road traffic				
07.00-23.00	<55	55-63	63-72	>72
23.00-07.00 ⁽⁹⁵⁾	<45	45-57	57-66	>66
Rail traffic				
07.00-23.00	<55	55-66	66-74	>74
23.00-07.00 ⁽⁹⁶⁾	<45	45-59	59-66	>66
Air traffic ⁽⁹⁷⁾				
07.00-23.00	<57	57-66	66-72	>72
23.00-07.00	<48	48-57	57-66	>66
Mixed Sources ⁽⁹⁸⁾				
07.00-23.00	<55	55-63	63-72	>72
23.00-07.00	<45	45-57	57-66	>66

⁹⁵ Night-time noise levels (23.00-07.00): sites where individual noise events regularly exceed 82dB L_{Amax} (5 time weighting) several times in any hour should be treated as being in NEC C, regardless of the $L_{Aeq, 8h}$ (except where the $L_{Aeq, 8h}$ already puts the site in NEC D).

⁹⁶ Night-time noise levels (23.00-07.00): sites where individual noise events regularly exceed 82dB L_{Amax} (5 time weighting) several times in any hour should be treated as being in NEC C, regardless of the $L_{Aeq, 8h}$ (except where the $L_{Aeq, 8h}$ already puts the site in NEC D).

⁹⁷ Aircraft Noise: daytime values accord with the contour values adopted by the Department for Transport which relate to levels measured 1.2m above open ground. For the same amount of noise energy, contour values can be up to 2dB(A) higher than those of other sources because of ground reflection effects.

⁹⁸ This refers to any combination of road, rail, air and industrial noise sources. The "mixed source" NECs should only be used where no individual noise source is dominant"

8.5 World Health Organisation Guidelines on Community Noise

BS8233:2014 is based upon the current World Health Organisation (WHO) guidance "Guidelines on Community Noise". A summary of the noise guidelines relevant to the proposed development is presented in the table below.

Residential Environment	Critical Health Effect(s)	L_{Aeq}	L_{AFmax}	Time Base
Outdoor living area	Serious annoyance, daytime and evening	55	-	07:00-23:00
	Moderate annoyance, daytime and evening	50	-	07:00-23:00



Residential Environment	Critical Health Effect(s)	L _{Aeq}	L _{AFmax}	Time Base
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	-	07:00-23:00
Inside bedrooms	Sleep disturbance, night-time	30	45	23:00-07:00
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	60	23:00-07:00

These WHO guidelines are based, in almost all cases, on the lower threshold below which the occurrence rates of any particular effect can be assumed to be negligible.

The internal and external noise level criteria presented in BS8233:2014 for residential dwelling are generally consistent with the WHO guidelines, although some differences are apparent. For instance the WHO guidelines refer to research that suggests *"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{AFmax} more than 10-15 times per night."* (Vallet & Vernet, 1991). The current version of BS8233 does not identify a specific L_{AFmax} level although it suggests that a guideline value may be set using that parameter depending on the character and number of individual noise events per night.

8.6 British Standard BS8233: 2014

British Standard 8233: 2014 "Guidance on sound insulation and noise reduction for buildings" provides guidance for the control of noise in and around buildings.

8.6.1 Internal Areas

BS8233:2014 Section 7.7.2 titled "Internal ambient noise levels for dwellings" states:

"In general for steady external noise sources, it is desirable that internal ambient noise levels do not exceed the following guideline values:

Activity	Location	Desirable Internal Ambient Criteria	
		07:00 – 23:00	23:00 to 07:00
Resting	Living Rooms	35 dB L _{Aeq,16hour}	-
Dining	Dining Room/Area	40 dB L _{Aeq,16hour}	-
Sleeping (Daytime Resting)	Bedroom	35 dB L _{Aeq,16hour}	30 dB L _{Aeq,8hour}



Note 1 The above table provides recommended levels for overall noise in the design of a building. These are the sum total of structure-borne and airborne noise sources. Groundborne noise is assessed separately and is not included as part of these targets, as human response to groundborne noise varies with many factors such as level, character, timing, occupant expectation and sensitivity.

Note 2 The levels shown in the above table are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g. 1 hour, may be used, but the level should be selected to ensure consistency with the levels recommended in the above table.

Note 3 These levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks night or New Year's Eve.

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 $L_{Amax,F}$ depending on the character and number of events per night. Sporadic noise events could require separate values.

Note 5 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.

If applicable, any room should have adequate ventilation (e.g. trickle ventilators should be open) during assessment.

Note 6 Attention is drawn to the Building Regulations.

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

8.6.2 External Amenity Areas

BS823:2014 Section 7.7.3.2 titled "Design criteria for external noise" states:

"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these



external amenity spaces, but should not be prohibited.

Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens, and terraces, which might be intended to be used for relaxation. In high-noise areas consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55dB LAeq,T or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space."

8.7 ProPG : Planning & Noise : 2017

8.7.1 The primary goal of the ProPG is to assist the delivery of sustainable development by promoting good health and well-being through the effective management of noise. It seeks to do that through encouraging a good acoustic design process in and around proposed new residential development having regard to national policy on planning and noise. It is applicable to noise from existing transport sources (noting that good professional practice should have regard to any reasonably foreseeable changes in existing and/or new sources of noise). The recommended approach is also considered suitable where some industrial or commercial noise contributes to the acoustic environment provided that is "not dominant".

8.7.2 This ProPG advocates a systematic, proportionate, risk based, 2-stage, approach. The approach encourages early consideration of noise issues, facilitates straightforward accelerated decision making for lower risk sites, and assists proper consideration of noise issues where the acoustic environment is challenging.

8.7.3 The two sequential stages of the overall approach are:

- Stage 1 – an initial noise risk assessment of the proposed development site; and
- Stage 2 – a systematic consideration of four key elements.

8.7.4 The four key elements to be undertaken in parallel during Stage 2 of the recommended approach are:

- Element 1 – demonstrating a "Good Acoustic Design Process";
- Element 2 – observing internal "Noise Level Guidelines";
- Element 3 – undertaking an "External Amenity Area Noise Assessment"; and
- Element 4 – consideration of "Other Relevant Issues".



- 8.7.5 The ProPG considers suitable guidance on internal noise levels found in "BS8233:2014: Guidance on sound insulation and noise reduction for buildings". Table 4 in Section 7.7.2 of the standard suggests that "in general, for steady external noise sources, it is desirable that the internal ambient noise level does not exceed the guideline values". The standard states (Section 7.7.1) that "occupants are usually more tolerant of noise without a specific character" and only noise without such character is considered in Table 4 of the standard.

Activity	Location	07:00 – 23:00 Hours	23:00 – 07:00 Hours
Resting	Living Room	35dB $L_{Aeq,16hr}$	-
Dining	Dining Room / Area	40dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35dB $L_{Aeq,16hr}$	30dB $L_{Aeq,8hr}$ 45dB $L_{Amax,F}$

NOTE 1 the Table provides recommended internal L_{Aeq} target levels for overall noise in the design of a building. These are the sum total of structure-borne and airborne noise sources. Ground-borne noise is assessed separately and is not included as part of these targets, as human response to ground-borne noise varies with many factors such as level, character, timing, occupant expectation and sensitivity.

NOTE 2 The internal L_{Aeq} target levels shown in the Table are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g. 1 hour, may be used, but the level should be selected to ensure consistency with the L_{Aeq} target levels recommended in the Table.

NOTE 3 These internal L_{Aeq} target levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks night or New Year's Eve.

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 $L_{Amax,F}$, 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 $L_{Amax,F}$ 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



(see Appendix A).

NOTE 5 Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed, however any façade openings used to provide whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the “open” position and, in this scenario, the internal L_{Aeq} target levels should not normally be exceeded, subject to the further advice in Note 7.

NOTE 6 Attention is drawn to the requirements of the Building Regulations.

NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal L_{Aeq} target levels may be relaxed by up to 5dB and reasonable internal conditions still achieved. The more often internal L_{Aeq} levels start to exceed the internal L_{Aeq} target levels by more than 5dB, the more that most people are likely to regard them as “unreasonable”. Where such exceedances are predicted, applicants should be required to show how the relevant number of rooms affected has been kept to a minimum. Once internal L_{Aeq} levels exceed the target levels by more than 10dB, they are likely to be regarded as “unacceptable” by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing “unacceptable” noise levels at all and where such levels are likely to occur frequently, the development should be prevented in its proposed form (See Section 3.D).

Figure 2. ProPG Internal Noise Level Guidelines (additions to BS8233:2014 shown in blue).

9.0 Proposed Design Target Internal Noise Levels

On the basis of BS8233:2014 we propose the following internal noise levels be adopted as design targets in the proposed habitable rooms:

Activity	Location	Desirable Internal Ambient Criteria	
		07:00 – 23:00	23:00 to 07:00
Resting	Living Rooms	35 dB $L_{Aeq,16hour}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq,16hour}$	-
Sleeping (Daytime Resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$ 45 dB $L_{Amax,F}^*$

Note: 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 $L_{Amax,F}$, 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 $L_{Amax,F}$ 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 (see Appendix A).

Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target noise levels may be relaxed (subject to the requirements of any planning conditions) by up to 5 dB and reasonable internal conditions still achieved.

10.0 Achievable Internal Noise Levels

We have predicted the levels that would be achievable in the worst-case dwellings with windows partially opened and also with windows closed.

10.1 Windows Partially Open

It is generally accepted that the typical noise reduction achieved with partially opened windows is around 15dBA (ref. BS 8233:2014 Annex G.1). This value is the difference between dBA levels measured outside and inside typical dwellings, therefore 3dBA should be added to free field noise levels to determine outside levels.

A simple assessment thus indicates the following noise levels may be expected within the proposed worst case habitable rooms with partially opened windows.

Description	Predicted Worst Case Internal Noise Levels with Windows Partially Opened	
	Daytime $L_{Aeq}(16\text{-hour})$	Night-time $L_{Aeq}(5\text{-hour})$
External free field level	60dBA	55dBA
Façade correction	3dBA	3dBA
Façade noise level	63dBA	58dBA
Noise reduction for conventional thermal double glazing	-15dBA	-15dBA
Predicted internal noise levels	48dBA	43dBA

10.2 Windows Closed

Provision exists to provide appropriate sound insulation solutions as required including, where necessary, suitably specified glazing and attenuated ventilators. We have carried out preliminary calculations to determine the likely façade sound insulation performance requirements for the worst affected (east) façade. Our calculation methods follow those outlined in BS 8233:2014.



Our calculations are based on the following assumptions:

- Conventional brick/block cavity external wall or equivalent
- 75m³ approximate room volume
- 1.6m² approximate window area
- Typical furnishings including beds, sofas, chairs etc.
- Double glazing comprising 10/12/6.4 or equivalent having an R_w of 40dB
- Hit-and-miss ventilator having an R_w of 29dB

The following table summarises our assessment of achievable noise levels within the proposed worst case habitable rooms with closed windows.

Description	Predicted Worst Case Internal Noise Levels with Windows Closed
	Night-time $L_{A_{Max, F}}$
External free field level	79dBA
Noise reduction for closed windows ¹	34dBA
Predicted internal noise levels	45dBA

¹ Calculated in accordance with BS8233:2014 assuming mitigation measures outlined in Section 12.0.

Note: At detailed design stage octave band acoustic specifications will need to be developed, and it will be essential that the prospective glazing/cladding system suppliers can demonstrate compliance with these specifications, rather than simply offering generic glazing configurations as described above.

11.0 External Amenity Area

The acoustic environment of external amenity areas that are an intrinsic part of the overall design should ideally not be above the range of 50-55dB $L_{Aeq,16hr}$ as stated in BS8233:2014.

In the absence of any screening from buildings or barriers the measured $L_{Aeq,T}$ levels exceed the proposed upper limit of 55dB $L_{Aeq,T}$ as is to be expected. We recommend an acoustic barrier (e.g. bund and/or acoustic fence) be constructed to surround the entire site to reduce the noise. The screening provided by the acoustic barrier, in conjunction with the screening provided by the proposed buildings, should ensure that external amenity areas are reduced to achieve the lowest practicable levels and are generally within the recommended range.



It should be noted that BS8233:2014 states:

In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

12.0 Mitigation Measures

Calculations undertaken in accordance with BS8233:2014 demonstrate the following example glazing and ventilator configuration is capable of providing the required levels of noise insulation.

Indicative Minimum Sound Reduction Specification		Example Configurations (For Guidance Only)
Window, R_w (Ctr)	Ventilator, $D_{n,e,w}$ (Ctr)	
40 dB (-6)	29 dB (-2)	• 10 / 12 / 6.4 mm double glazing or equivalent • Hit and miss ventilator

Note it is difficult to give detailed construction guidance regarding glass at this early stage, as there are many non-acoustic influencing factors which need to be taken into consideration by others. At detailed design stage octave band acoustic specifications will need to be developed, and it will be essential that the prospective glazing/cladding system suppliers can demonstrate compliance with these specifications, rather than simply offering generic glazing configurations as described above.

The predicted worst case internal rail traffic noise intrusion levels with windows closed meet the proposed criteria. It is thus demonstrated that acceptable internal noise levels are achievable with conventional double glazing.

The predicted worst case internal traffic noise intrusion levels with windows partially opened exceed the proposed target levels (as is often the case). The minimum mitigation available to future occupants would be to close their window. Ventilation (incorporating suitable acoustic attenuation) will be provided to comply with the requirements of the Building Regulations Approved Document F whole dwelling ventilation. The occupants will thus have the option of keeping windows closed for most of the time and opening windows for purge ventilation.



This form of mitigation is supported within the Pro:PG which advises the following:

2.34 Where the LPA accepts that there is a justification that the internal target noise levels can only be practically achieved with windows closed, which may be the case in urban areas and at sites adjacent to transportation noise sources, special care must be taken to design the accommodation so that it provides good standards of acoustics, ventilation and thermal comfort without unduly compromising other aspects of the living environment. In such circumstances, internal noise levels can be assessed with windows closed but with façade openings used to provide “*whole dwelling ventilation*” in accordance with Building Regulations Approved Document F (e.g. trickle ventilators) in the open position (see Supplementary Document 2). Furthermore, in this scenario the internal L_{Aeq} target noise levels should not generally be exceeded.

2.35 It should also be noted that the internal noise level guidelines are generally not applicable under “*purge ventilation*” conditions as defined by Building Regulations Approved Document F, as this should only occur occasionally (e.g. to remove odour from painting and decorating or from burnt food).

At this stage of the design scheme the precise details of window to be used are not known, nor are the precise details of the ventilation.

The external envelope of the proposed residences will incorporate suitably specified glazing so as to achieve the proposed design target internal noise levels presented above.

Where ventilation is provided through the façade it shall be suitably acoustically attenuated to ensure the achievement of the proposed target internal noise levels is not compromised.

The Local Planning Authority may expect to be provided with details of the sound insulation treatments when available. Therefore in granting consent it would be appropriate for a planning condition to be imposed along the following lines, (based on the example condition 1 drawn from PPG24):

“Construction work shall not begin until a scheme for protecting the proposed dwellings from noise from the railway has been submitted to and approved by the local planning authority; all works which form part of the scheme shall be completed before any dwelling is occupied.”



13.0 Conclusions

A detailed environmental noise survey has been undertaken in order to establish the currently prevailing environmental noise climate around the site.

The environmental noise impact upon the proposed dwellings has been assessed in the context of national and local planning policies.

Appropriate target internal noise levels have been proposed. These are achievable using conventional mitigation measures.

Appropriate target internal noise levels have been proposed. These are achievable using conventional mitigation measures. Mitigation advice, including the use of suitably specified glazing and acoustically attenuated ventilation, have been recommended to reduce to a minimum the adverse impact on health and quality life arising from environmental noise.

The assessment shows the site, subject to appropriate mitigation measures, is suitable for residential development in terms of noise.

Appendix A

The acoustic terms used in this report are defined as follows:

dB	Decibel - Used as a measurement of sound level. Decibels are not an absolute unit of measurement but an expression of ratio between two quantities expressed in logarithmic form. The relationships between Decibel levels do not work in the same way that non-logarithmic (linear) numbers work (e.g. 30dB + 30dB = 33dB, not 60dB).
dBA	The human ear is more susceptible to mid-frequency noise than the high and low frequencies. The 'A'-weighting scale approximates this response and allows sound levels to be expressed as an overall single figure value in dBA. The A subscript is applied to an acoustical parameter to indicate the stated noise level is A-weighted It should be noted that levels in dBA do not have a linear relationship to each other; for similar noises, a change in noise level of 10dBA represents a doubling or halving of subjective loudness. A change of 3dBA is just perceptible.
L _{90,T}	L ₉₀ is the noise level exceeded for 90% of the period <i>T</i> (i.e. the quietest 10% of the measurement) and is often used to describe the background noise level.
L _{eq,T}	L _{eq,T} is the equivalent continuous sound pressure level. It is an average of the total sound energy measured over a specified time period, <i>T</i> .
L _{max}	L _{max} is the maximum sound pressure level recorded over the period stated. L _{max} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the L _{eq} noise level.
L _p	Sound Pressure Level (SPL) is the sound pressure relative to a standard reference pressure of 2 x 10 ⁻⁵ Pa. This level varies for a given source according to a number of factors (including but not limited to: distance from the source; positioning; screening and meteorological effects).
L _w	Sound Power Level (SWL) is the total amount of sound energy inherent in a particular sound source, independent of its environment. It is a logarithmic measure of the sound power in comparison to a specified reference level (usually 10 ⁻¹² W).

Waterbury, 8-10 Ford Road, Arundel

Position 1

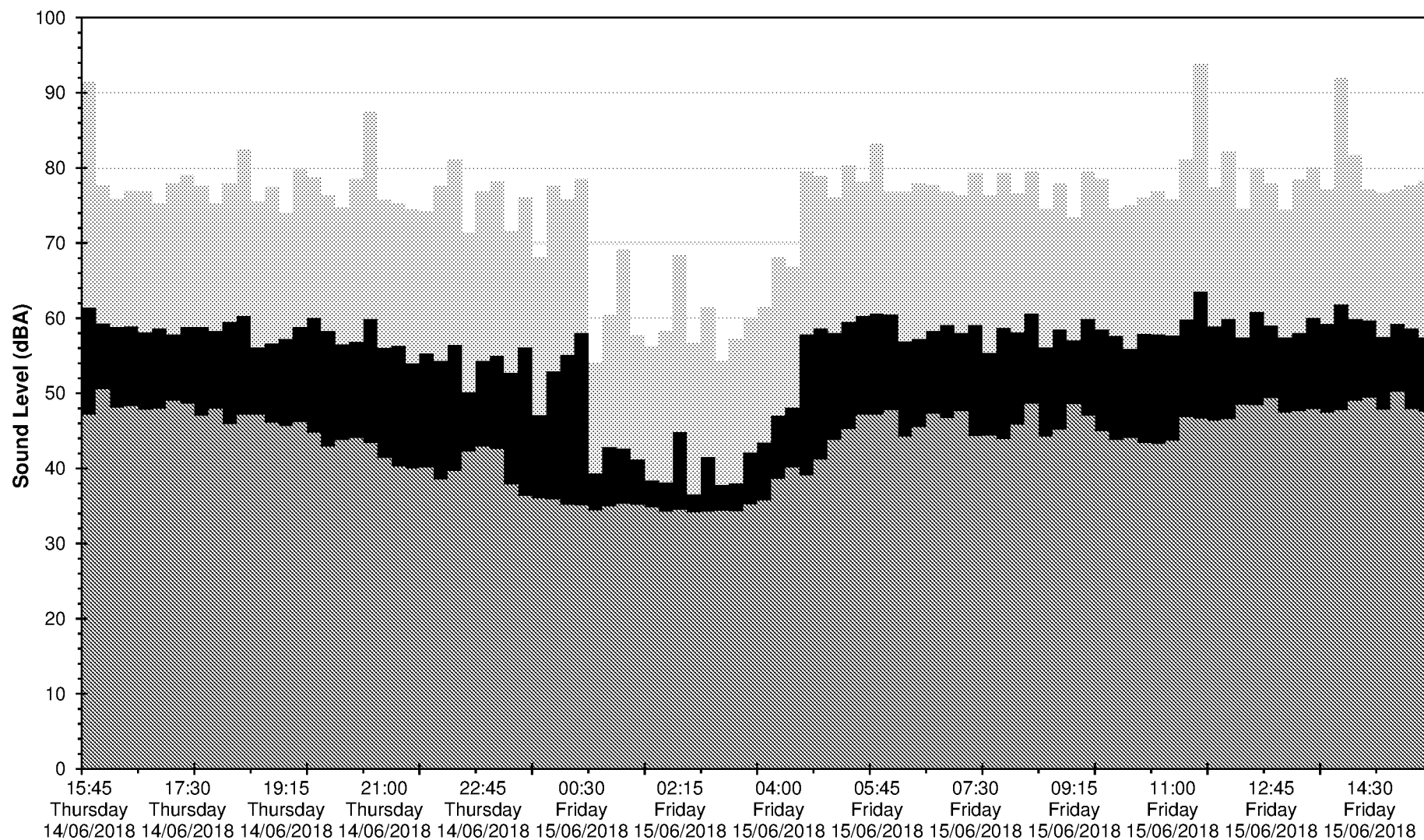
L_{Aeq} , L_{Amax} and L_{A90} Noise Levels

Thursday 14 June 2018 to Friday 15 June 2018

▤ L_{Amax}

■ L_{Aeq}

▤ L_{A90}



Date and Time

25712/TH1