

East Street Littlehampton

Environmental Noise Survey and Noise Impact Assessment Report

26065/ENS1 Rev1

04 December 2018

For:
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Environmental Noise Survey and Noise Impact Assessment Report 26065/ENS1 Rev1

Document Control

Rev	Date	Comment	Prepared by	Authorised by
0	14/11/2018	-	Jacob Tyler Assistant Acoustic Consultant BSc(Hons), AMIOA	Gareth Evans Associate BSc(Hons), MIOA
1	04/12/2018	Revised sections 1.0, 3.2 and 8.1 with information given to us by the client. Policy QE DM1 has been added to Section 8.4. An NEC assessment has been included in Section 9.0 due to Local Authority Policy QE DM1.	Jacob Tyler Assistant Acoustic Consultant BSc(Hons), AMIOA	Gareth Evans Associate BSc(Hons), MIOA

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Environmental Noise Survey and Acoustic Design Statement Report 26065/ENS1 Rev1

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1.0 Introduction

A residential development is proposed in the centre of Littlehampton. Planning permission is required to redevelop the site into residential buildings and two flexible retail units.

The site is located in proximity to the B2187 Franciscan Way and Arun Local Plan Policy QE DM1 requires residential development likely to experience noise from roads to be supported by a noise assessment.

Hann Tucker Associates have therefore been commissioned to undertake an environmental noise survey and noise impact assessment in order to determine 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 inspect the site to familiarise ourselves with its layout and surroundings in order to identify suitable accessible locations for environmental noise measurements.
- To establish by means of an unmanned 24 hour survey the existing L_{Amax} , L_{Aeq} and L_{A90} environmental road, rail and air traffic noise levels at 3No. secure and accessible on-site positions, using fully computerised noise monitoring equipment.
- To carry out an assessment of the proposed scheme with regards to the potential effects of noise and vibration associated with the future operation of the development, and where appropriate, advise on suitable mitigation.
- To review the scheme with reference to the advice of national, strategic and UDP policy including the Noise Policy Statement for England (NPSE), National Planning Policy Framework (NPPF), Planning Practice Guidance (ProPG), British Standard BS8233:2014 and Local Authority guidance/requirements.



3.0 Site Description

3.1 Location

The site is located in a mixed residential and commercial area along Avon Road, Littlehampton. The site is bordered by Franciscan Way to the north, Duke Street to the west, East Street to the East and Anchor Springs to the South.

Directly neighbouring the site are a number of shops and retail units, including bike shops, pharmacies, clothing outlets and supermarkets. Approximately 180 metres north of the site is River Beach Primary School. The High Street is located approximately 80 metres south of the site.

The nearest residential units are located along the eastern boundary of the site.

The location is shown in the Location Map below.



Location Map (Imagery ©2018 Bluesky, DigitalGlobe, Getmapping plc, Infoterra Ltd & Bluesky; Map data ©2018 Google)

The site falls within the jurisdiction of West Sussex County Council and Arun District Council.

3.2 Description

The site is a former Waitrose car park (approx. 50 x 45 m) and supermarket (approx. 72 x 30 m) in the centre of Littlehampton.

The proposed development will be made up of up to 3-storey buildings with balconies and associated amenity area.



The site is located in proximity to the B2187 Franciscan Way and Arun Local Plan Policy QE DM1 requires residential development likely to experience noise from roads to be supported by a noise assessment.

The site is shown in the Site Plan below.



Location Map (Imagery ©2018 Bluesky, DigitalGlobe, Getmapping plc, Infoterra Ltd & Bluesky; 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 Jacob Tyler BSc(Hons) AMIOA.

5.1 Procedure

Fully automated environmental noise monitoring was undertaken at each position during the periods described on the following table.

Position	Survey Period
1	11:30 02 November 2018 – 12:00 05 November 2018
2	14:15 29 October 2018 – 11:45 05 November 2018
3	14:30 29 October 2018 – 12:30 30 October 2018



During the periods we were on site the wind conditions were calm and the sky was generally patchy cloud. We understand that generally throughout the survey period the weather conditions remained the same. These conditions are considered suitable for obtaining representative measurement results.

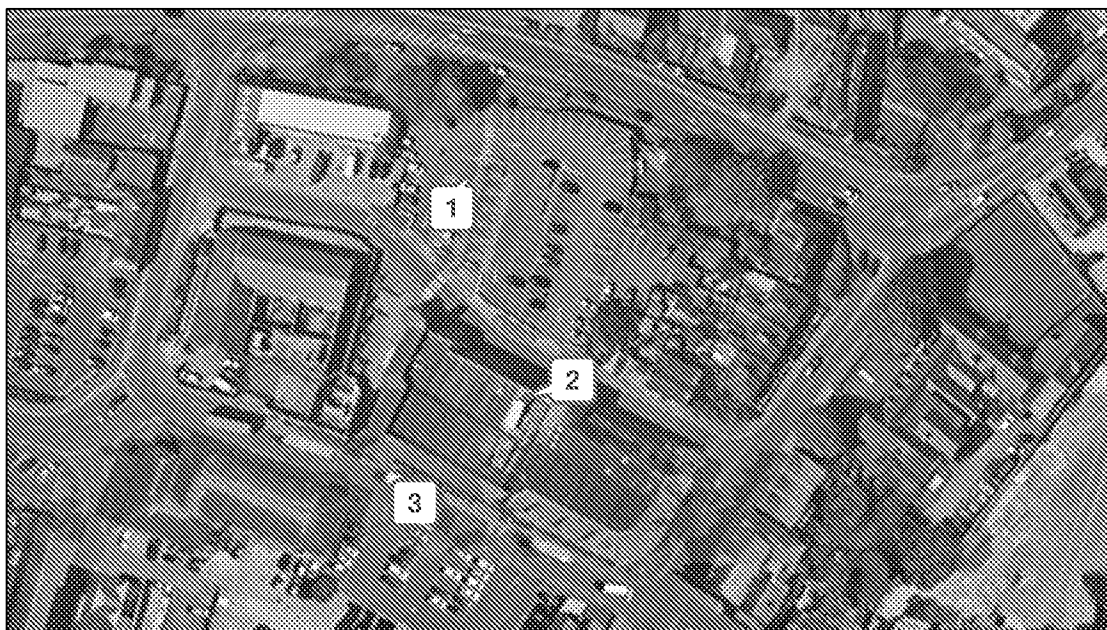
Measurements were taken continuously of the A-weighted (dBA) L_{90} , L_{eq} and L_{max} sound pressure levels over 15-minute periods.

5.2 Measurement Positions

The noise level measurements were undertaken at 3No. positions as described in the table below.

Position No	Description
1	The sound level meter was installed inside a small security box with the microphone protruding approximately 6cm out of the box. The security box was fixed to a lamp post in the old Waitrose car park with the microphone at a height of approximately 4m above ground level. In order to minimise the effect of the box, the microphone was orientated vertically downwards such that it was not screened from the road.
2	The microphone was attached to a pole approximately 1.0 metre above roof level. The microphone was positioned at the north eastern corner of the site's roof facing towards the Waitrose car park.
3	The sound level meter was installed inside a small security box with the microphone protruding approximately 6cm out of the box. The security box was fixed to a lamp post along Anchor Springs with the microphone at a height of approximately 4m above ground level. In order to minimise the effect of the box, the microphone was orientated vertically downwards such that it was not screened from the road.

The positions are shown on the plan below.



Location Map (Imagery ©2018 Bluesky, DigitalGlobe, Getmapping plc, Infoterra Ltd & Bluesky; Map data ©2018 Google)

5.3 Instrumentation

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

Description	Manufacturer	Type	Serial Number	Annual Calibration
Position 1 Type 1 ½" Condenser Microphone	PCB	377B02	107417	Calibration on 09/07/2018
Position 1 Preamp	Larson Davis	PRM902	4158	Calibration on 09/07/2018
Position 1 Type 1 Data Logging Sound Level Meter	Larson Davis	824	3804	Calibration on 09/07/2018
Position 2 Type 1 ½" Condenser Microphone	PCB	377B02	122885	Calibration on 09/07/2018
Position 2 Preamp	Larson Davis	PRM902	3692	Calibration on 09/07/2018
Position 2 Type 1 Data Logging Sound Level Meter	Larson Davis	824	3444	Calibration on 09/07/2018
Position 3 Type 1 ½" Condenser Microphone	PCB	377B02	139312	Calibration on 20/06/2018



Description	Manufacturer	Type	Serial Number	Annual Calibration
Position 3 Preamp	Larson Davis	PRM902	5161	Calibration on 20/06/2018
Position 3 Type 1 Data Logging Sound Level Meter	Larson Davis	824	3443	Calibration on 20/06/2018

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

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

The results have been plotted on Time History Graphs 26065/TH1.1 to 26065/TH1.3 enclosed presenting the 15 minute A-weighted (dBA) L_{90} , L_{eq} and L_{max} levels at each measurement position throughout the duration of the survey.

6.0 Results

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:

Period Beginning	Measured Noise Levels (dBA re 2×10^{-5} Pa)					
	Position 1		Position 2		Position 3	
	Daytime $L_{Aeq}(16\text{-hour})$ (07:00 to 23:00 hours)	Night-Time $L_{Aeq}(8\text{-hour})$ (23:00 to 07:00 hours)	Daytime $L_{Aeq}(16\text{-hour})$ (07:00 to 23:00 hours)	Night-Time $L_{Aeq}(8\text{-hour})$ (23:00 to 07:00 hours)	Daytime $L_{Aeq}(16\text{-hour})$ (07:00 to 23:00 hours)	Night-Time $L_{Aeq}(8\text{-hour})$ (23:00 to 07:00 hours)
Monday 29/10/2018			54dBA	44dBA	61dBA	51dBA
Tuesday 30/10/2018			53dBA	44dBA		
Wednesday 31/10/2018			53dBA	46dBA		
Thursday 01/11/2018			55dBA	44dBA		



Friday 02/11/2018	59dBA	54dBA	53dBA	45dBA		
Saturday 03/11/2018	60dBA	57dBA	60dBA	46dBA		
Sunday 04/11/2018	59dBA	50dBA	53dBA	41dBA		

Note: Results from 03/11/2018 to 04/11/2018 were omitted from calculations in Section 10.0 due to firework night.

7.0 Discussion Of Noise Climate

Due to the nature of the survey, i.e. unmanned, it is not possible to accurately determine the individual noise sources or noise events that occurred throughout the survey duration. However, during the periods we were on site the dominant noise sources were noted to be traffic along Anchor Springs and East Street.

Anchor Springs features a single bus stop (Stop B) with buses arriving every 5-10 minutes. These could be audibly heard from the roof of the existing site whilst the measurement equipment was secured in place.

8.0 Relevant Planning Policies and Guidance

8.1 National Planning Policy Framework (NPPF)

The following paragraphs are from the NPPF (revised July 2018):

"180. 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 impacts 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.

182. 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."

Paragraph 180 also references the Noise Policy Statement for England. This document does not refer to specific noise levels but instead sets out three aims:

"Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development."

8.2 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 acknowledged 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.

8.3 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 Arun Local Plan (2018), Policy QE DM1 states that:

“Residential development likely to experience noise from road, rail or air, in particular development in close proximity to:

- A284/A259 Wick roundabout
- Stretches of the A27 around Arundel and Fontwell
- Sections of the A29 and A259 in Bognor Regis
- A284 in Littlehampton and
- The stretch of railway that runs through Barnham station



must:

- a. *Be supported by a noise exposure category (NEC) assessment and designed to ensure that residents will not be adversely affected by noise.*
- b. *Consider both the likely level of exposure at the time of application and any increase that might be reasonably expected in the foreseeable future."*

The noise exposure categories (NEC) have been set out in the Adoption Arun Local Plan 2011-2031 (2018), Section 21.2 – Tables 21.1 and 21.2:

NEC	Description
A	Noise 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	<45	45-57	57-66	>66
Rail Traffic				
07:00-23:00	<55	55-66	66-74	>74
23:00-07:00	<45	45-59	59-66	>66
Air Traffic				
07:00-23:00	<57	57-66	66-72	>72
23:00-07:00	<48	48-57	57-66	>66
Mixed Sources				
07:00-23:00	<55	55-63	63-72	>72
23:00-07:00	<45	45-57	57-66	>66

Table 21.2 Noise Levels corresponding to the Noise Exposure Categories for New Dwellings LAeq, T dB



We are aware of the following condition which has recently been applied by Arun District Council (in respect of application Ref: A/74/18/OUT) which provides a useful understanding of the Council's practical approach to managing noise in new residential development:

"The applicant shall submit an acoustic report to demonstrate that the internal and external noise levels of the proposed residential units bordering these sites, including access thereto/from, will conform to the indoor ambient noise levels for dwellings and external noise levels for amenity spaces ie. gardens, as specified within BS8233:2014, Guidance on Sound Insulation and Noise Reduction for Buildings and World Health Organisation:2009. The applicant should also demonstrate application of guiding principles from ProPG: Planning & Noise May 2017 as well as from the Planning Noise Advice Document, Sussex, July 2015. Any mitigation measures which may prove necessary are to be specified and such a scheme to be approved in writing by the Local Planning Authority..."

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
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 $L_{Aeq,T}$ ¹, 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 $L_{Aeq,T}$ 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

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".

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.

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.

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".

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 $L_{Aeq,16hr}$ 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 Noise Exposure Category Assessment

Local Planning Policy QE DM1 requires a noise assessment to determine the noise exposure category (NEC) that the site falls into. The following table presents the typical L_{Aeq} noise levels for each position:

Period	Typical $L_{Aeq,T}$ Noise Level		
	Position 1	Position 2	Position 3
Day	59dBA	53dBA	61dBA
Night	54dBA	44dBA	51dBA

The noise levels at the site fall into NEC B, between the ranges of 55-63dBA during daytime periods and 45-57dBA during night-time periods. Therefore Policy QE DM1 states that:

“Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.”



10.0 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}

Note: For this site the L_{Aeq,T} noise parameter alone is considered to be sufficient (with reference to Note 4 of Section 7.7.2 of BS8233:2014) given the character of the noise climate we have measured.

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.

11.0 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.

11.1 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					
	Position 1		Position 2		Position 3	
	Daytime L _{Aeq} (16-hour)	Night-time L _{Aeq} (8-hour)	Daytime L _{Aeq} (16-hour)	Night-time L _{Aeq} (8-hour)	Daytime L _{Aeq} (16-hour)	Night-time L _{Aeq} (8-hour)
External free field level	59dBA	54dBA	53dBA	44dBA	61dBA	51dBA
Façade correction	+3dBA	+3dBA	N/A	N/A	+3dBA	+3dBA
Correction to ground floor level	0	0	+3dBA	+3dBA	0	0
Distance correction	+3dBA	+3dBA	0	0	0	0
Façade noise level	65dBA	60dBA	56dBA	47dBA	64dBA	54dBA
Noise reduction for conventional thermal double glazing	-15dBA	-15dBA	-15dBA	-15dBA	-15dBA	-15dBA
Predicted internal noise levels	50dBA	45dBA	41dBA	32dBA	49dBA	39dBA

11.2 Windows Closed

It is generally accepted that the typical noise reduction achieved by conventional thermal double glazing is 33dBA for road traffic noise. This value is taken from PPG24 (now superseded) and 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 dwellings with conventional thermal double glazing:



Description	Predicted Worst Case Internal Noise Levels with Windows Closed					
	Position 1		Position 2		Position 3	
	Daytime L _{Aeq} (16-hour)	Night-time L _{Aeq} (8-hour)	Daytime L _{Aeq} (16-hour)	Night-time L _{Aeq} (8-hour)	Daytime L _{Aeq} (16-hour)	Night-time L _{Aeq} (8-hour)
External free field level	59dBA	54dBA	53dBA	44dBA	61dBA	51dBA
Façade correction	+3dBA	+3dBA	N/A	N/A	+3dBA	+3dBA
Correction to ground floor level	0	0	+3dBA	+3dBA	0	0
Distance correction	+3dBA	+3dBA	0	0	0	0
Façade noise level	65dBA	60dBA	56dBA	47dBA	64dBA	54dBA
Noise reduction for conventional thermal double glazing	-33dBA	-33dBA	-33dBA	-33dBA	-33dBA	-33dBA
Predicted internal noise levels	32dBA	27dBA	23dBA	14dBA	31dBA	21dBA

12.0 Mitigation Measures

The predicted worst case internal noise 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 noise 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 the windows 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.

13.0 External Amenity Area

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

The current proposal includes balconies on each façade of the buildings. In these areas with a direct line of sight to Franciscan Way, Avon Road and Anchor Springs, noise levels exceed the 55dB criteria.

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."

14.0 Conclusions

The existing L_{Amax} , L_{Aeq} and L_{A90} environmental road, rail and air traffic noise levels have been established by means of an unmanned 24 hour survey at up to 4No. secure and accessible on-site positions, using fully computerised noise monitoring equipment.

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.

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 T (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, T .
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 2×10^{-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).