

Acoustic Associates Sussex Ltd

Planning Application Noise Assessment

Site: Land Adjacent to 1 Orchard Way, Fontwell. BN18 0SH.
Client: Quay Contracts Limited

Report by: Scott Castle BSc (Hons) CEnv, MCIEH PGDip: Acoustics AMIOA

Date: 27/07/2018

Project: J2505

Issue 1



Acoustic Associates

ANC
THE ASSOCIATION OF
NOISE CONSULTANTS

ATMA

Sound Insulation Testing - Acoustic Design of Buildings - BS4142 - PPQ24 - Schools Acoustics B883 -
Vibration - Expert Witness Testimony - Noise at Work - Air Tightness Testing - Auditorium Acoustics

Part of the Acoustic Associates Group of consultancies:

DEVON HUMBERSIDE LEICESTERSHIRE NOTTINGHAMSHIRE PETERBOROUGH **SUSSEX** WESSEX WORCESTERSHIRE

Contents

1	Introduction	- 3 -
2	Context, Noise Criteria & Noise Assessment Methodology	- 4 -
2.1	<i>Context</i>	- 4 -
2.2	<i>Location</i>	- 5 -
2.3	<i>Soundscape</i>	- 5 -
2.4	<i>National Planning Policy Framework 2012</i>	- 6 -
2.5	<i>ProPG Planning Guidance, June 2017</i>	- 7 -
2.6	<i>Noise Policy Statement for England (NPSE,2010)</i>	- 7 -
2.7	<i>BS4142: 2014: Methods for rating and assessing industrial and commercial sound</i>	- 8 -
2.8	<i>WHO Internal Noise Criteria</i>	- 8 -
2.9	<i>WHO External Noise Criteria</i>	- 8 -
2.10	<i>BS8233 Noise Criteria</i>	- 9 -
3	Environmental Sound Survey	- 10 -
3.1	<i>Methodology</i>	- 10 -
3.2	<i>Weather Conditions</i>	- 11 -
4	Methodology and Assessment Standards	- 12 -
4.1	<i>Applicable Assessment Standards</i>	- 12 -
5	Results of the Unattended Sound Survey	- 12 -
6	Noise Modelling Software	- 13 -
6.1	<i>Assumptions made and entered into the Noise Model</i>	- 14 -
6.2	<i>Noise Modelling Results</i>	- 14 -
6.3	<i>Noise Model Outcomes</i>	- 16 -
6.4	<i>Assessment of External Amenity Areas</i>	- 16 -
7	Discussion	- 17 -
8	Mitigation Measures	- 17 -
8.1	<i>Glazing</i>	- 18 -
8.2	<i>Ventilation</i>	- 18 -
9	Uncertainty	- 19 -
10	Conclusion	- 19 -

Tables

Table 1: BS8233 Criteria.....	- 9 -
Table 2. Noise Data	- 12 -
Table 3. Number of Occurrences of L_{Amax} at 45dB (A) or above during the night time period assuming an open window in a bedroom.	- 13 -
Table 4. Number of Occurrences of L_{Amax} at 45dB (A) or above during the night time period with an SRI of 25 to keep L_{AMax} levels below 45dB(A) from occurring more than 10 times a night.....	- 13 -
Table 5. Predicted Noise Levels for room types compared against BS8233:2014 requirements.....	- 16 -
Table 6. Assessment of external amenity spaces.....	- 16 -

Figures

Figure 1. Current Site layout, orientated North	- 4 -
Figure 2. Vacant Garden Plot to West of 1 Orchard Way	- 4 -
Figure 3. Proposed site layout, Orientated North	- 5 -
Figure 4. Fence-line looking South onto application site from Dukes Road	- 6 -
Figure 5. Proposed site layout annotated with survey location shown	- 10 -
Figure 6. Unattended survey location showing co-located weather station.	- 11 -
Figure 7. Wind Speeds recorded for the duration of the survey	- 11 -
Figure 8. Noise Modelling Contours for Daytime (07:00-23:00 hours)	- 14 -
Figure 9. Noise Modelling Contours for Night time (23:00-07:00 hours)	- 15 -
Figure 10. 3D model looking South West	- 15 -

Report by: Scott Castle BSc (Hons) CEnv, MCIEH PGDip: Acoustics AMIOA
Checked by: Simon Barrett Bsc (Hons) MSc MIOA

Issue 1	27/07/2018	
---------	------------	--

This report has been prepared for the private and confidential use of Quay Contracts Limited and nb:architects+ only and cannot be reproduced in whole or in part or relied upon by any third party for any use whatsoever without the express written authorisation of Acoustic Associates Sussex Ltd. If any third party whatsoever comes into possession of this report, they rely on it at their own risk and Acoustic Associates Sussex Ltd accepts no duty or responsibility (Including in negligence) to any such third party

1 Introduction

Acoustic Associates Sussex Ltd have been appointed to undertake an acoustic assessment to support a planning application seeking the introduction of two residential properties onto an existing garden plot adjacent to the A27.

Standards and guidance referenced for this assessment include:

- World Health Organisation (WHO) - Guidelines for Community Noise 1999
- BS8233 (Sound insulation and noise reduction for buildings) 2014
- ISO9613 (Attenuation of sound during propagation outdoors) 1996
- National Planning Policy Framework (NPPF) 2012
- ProPG Planning Guidance, June 2017
- NPPG-Noise (2014)

Sound level measurements were taken from the site between 19/7/2018 and 23/7/2018 from a freefield position that was representative of the façade of one of the proposed residential properties.

The data obtained in ideal environmental monitoring conditions identified that at the survey location, the arithmetic average for the $L_{Aeq,16 \text{ hour}}$ daytime was 63dB and for the $L_{Aeq, 8 \text{ hour}}$ night time period was 57dB. The measured noise levels and the spectral profile of the daytime and night time road traffic were used to inform noise modelling and prediction software (IMMI, Wolfel, 2015) to determine the likely noise levels received at locations on the North and South facades of two proposed new residential properties.

The noise modelling software predictions suggests that internal noise levels for both living and sleeping accommodation are capable of being met for both daytime and night time periods, albeit with windows closed. With windows open, internal noise levels, are likely to exceed the requirements of BS8233:2014.

If windows are closed, there is a need to provide both background ventilation and cooling to the new properties to ensure compliance with Building Regulations Approved Document F. Given the site, it is recommended that a ducted MVHR system will be appropriate and that any intake location feeding the system is orientated on the quieter South Eastern facades.

Whilst external amenity areas are seen to be above those recommended in BS8233:2014 and WHO Guidelines (1999), BS8233:2014 suggests that higher levels may be tolerated where there is a need for housing in sites such as those located adjacent to strategic transport network. It is noted that within a five-minute walk, future residents are capable of being in the South Downs National Park and National Trust Slindon Estate to the North of the A27.

Assuming the implementation of the mitigation measures listed above, it is considered that planning permission would not likely be refused on noise grounds.

2 Context, Noise Criteria & Noise Assessment Methodology

2.1 Context

The planning application seeks the introduction of residential housing into an existing garden area of an already established property at 1 Orchard Way, Fontwell, BN18 0SH. The site has hedge borders to the North and West. The existing site is seen in Figures 1 and 2 below.

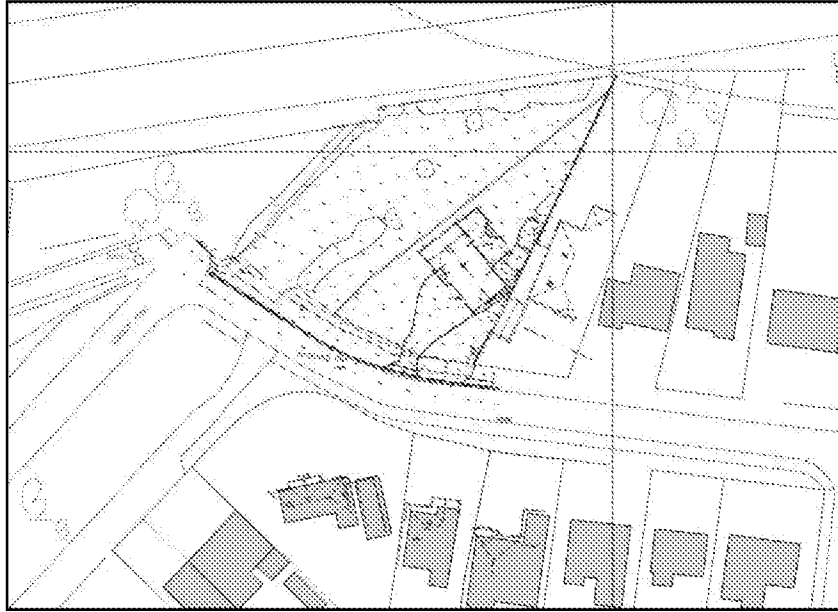


Figure 1. Current Site layout, orientated North



Figure 2. Vacant Garden Plot to West of 1 Orchard Way

Figure 3 below shows the proposed housing layout within the application site.

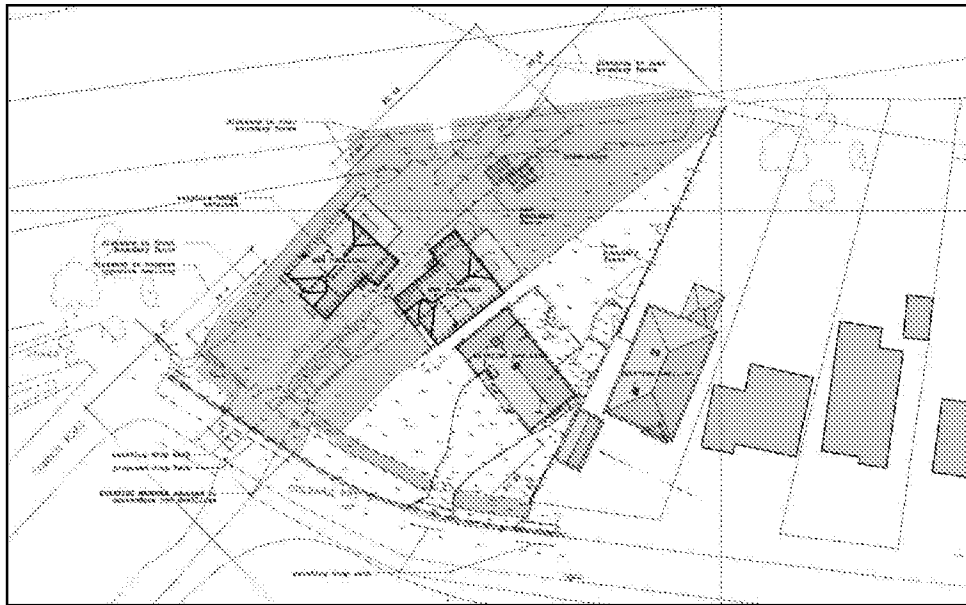


Figure 3. Proposed site layout, Orientated North

2.2 Location

The application site is an existing garden plot with the A27 Westbound carriageway, some 8-12 metres to the North. To the West is over grown scrubland and a walkway which allow pedestrian access under the A27.

The A27 Westbound carriageway travels in a South West direction meeting the A27/A29 roundabout. Located at the roundabout is a Shell fuel station, a Burger King and a Travelodge. These are estimated to be approximately 180m in direct distance, without any line of sight.

To the North of the application site, Dukes Road joins the A27 with a splayed junction.

A 2.4 metre timber barrier is located behind the shrubbery at the Northern end of the garden which extends to the West and stops at the point of the overgrown shrubbery. The fence line separating the A27 and the existing properties finishes approximately in line with Dukes Road close to the North and the scrub land to the North West of the application site. This is shown in Figure 4 below.

2.3 Soundscape

The sounds heard whilst on site were that of road traffic noise from the A27. This is a dual carriageway with national speed limit which is approaching the A27/A29 roundabout where the services discussed in 2.2 above are located.



Figure 4. Fence-line looking South onto application site from Dukes Road

2.4 National Planning Policy Framework 2012

The National Planning Policy Framework (March 2012) defines the Government's planning policies for England and how these are expected to be applied. It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. It provides a framework within which local people, and their answerable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.

Paragraph 123 within NPPF Section 11 (Conserving and enhancing the natural environment) states the following:

Planning policies and decisions should aim to:

- *avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *mitigate and reduce to a minimum other adverse impacts 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; 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.*

2.5 ProPG Planning Guidance, June 2017

Recent planning guidance released in 2017 relates to new residential development and airborne transportation noise, which includes exposure to railway and aviation noise. Whilst ProPG, 2017 generally mirrors the requirements of BS8233:2014 and the World Health Organisation Guidelines, 1999, it goes further in setting a limit for inside bedrooms for L_{Amax} events and specifically, no more than 10 L_{Amax} events per night time period above 45dB(A).

ProPG, 2017 advocates that it is not necessarily about satisfying internal target criteria, but additionally that there should be a demonstration of good acoustic design. The principles of ProPG, 2017 have been followed and are detailed in the report.

2.6 Noise Policy Statement for England (NPSE,2010)

2.6.1 NPSE Mission Statement

The document "Noise Policy Statement for England" sets out the following vision for on- going noise policy:

"Promote good health and quality of life through the effective management of noise within the context of Government policy on sustainable development."

This vision should be achieved through the following Noise Policy Aims:

"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".

2.6.2 NPSE Noise "Effect Levels"

To achieve these objectives the Noise Policy Statement sets out three noise levels to be defined by the assessor:

- NOEL - No Observed Effect Level

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

- LOAEL - Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

- SOAEL - Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.

The Noise Policy Statement considers that noise levels above the SOAEL would be seen to have, by definition, significant adverse effects and would be considered unacceptable.

Where the assessed noise levels fall between the LOAEL and the SOAEL noise levels, the Policy Statement requires that:

"all reasonable steps should be taken to mitigate and minimize adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development... .. This does not mean that such adverse effects cannot occur."

Where noise levels are below the LOAEL it is considered there will be no adverse effect. Once noise levels are below the NOEL there will be no observable change.

2.6.3 Guidance Documents

For guidance as to a numerical definition of LOAEL, while this is not provided specifically, it is helpful to refer to the following Standards.

- BS8233: 2014: Guidance on Sound insulation and noise reduction for buildings
- World Health Organization (WHO) - Guidelines for Community Noise 1999
- BS4142: 2014: Method for rating and assessing industrial and commercial sound

2.7 **BS4142: 2014: Methods for rating and assessing industrial and commercial sound**

This document provides a means of assessing the impact of industrial or commercial sound upon nearby noise-sensitive receptors, including residential properties.

It does this by comparing the Rating Level of the noise from the industrial or commercial source with the pre-existent L_{90} background noise level affecting the same noise-sensitive premises. The Standard provides guidance that:

- a) Typically, the greater the difference, the greater the magnitude of the impact.
- b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- c) A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.
- d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background noise level, this is an indication of the specific sound source having a low impact, depending on the context.

2.8 **WHO Internal Noise Criteria**

The target internal levels are based on guidelines laid out by the World Health Organisation (WHO) and are as follows:

Room Type	Target Maximum Internal Level - Leq dB (A)
Living rooms	35 (Daytime only)
Bedrooms	30 (Night)

The target maximum internal noise level for a bedroom during the night time corresponds to the threshold of sleep disturbance. WHO state that the noise level outside a bedroom window would be less than 45dB(A) this assumes that an open window provides 15dB attenuation.

2.9 **WHO External Noise Criteria**

With regard to outdoor amenity areas WHO states the following:

To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB(A) on balconies, terraces and in outdoor living areas.

To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 50dB(A) on balconies, terraces and in outdoor living areas.

2.10 BS8233 Noise Criteria

Table 4 of BS8233 provides the following guideline values:

Activity	Location	Time period of day	
		07:00-23:00	23:00-07:00
Resting	Living Rooms	35dB L _{Aeq,16hour}	-
Dining	Dining Room/Area	40dB L _{Aeq,16hour}	-
Sleeping (daytime resting)	Bedroom	35dB L _{Aeq,16hour}	30dB L _{Aeq,8hour}

Table 1: BS8233 Criteria



Figure 6. Unattended survey location showing co-located weather station.

3.2 Weather Conditions

The weather conditions for the survey period were warm and dry, with nil precipitation and ideal for environmental noise monitoring. Windspeeds were all below 5/ms.

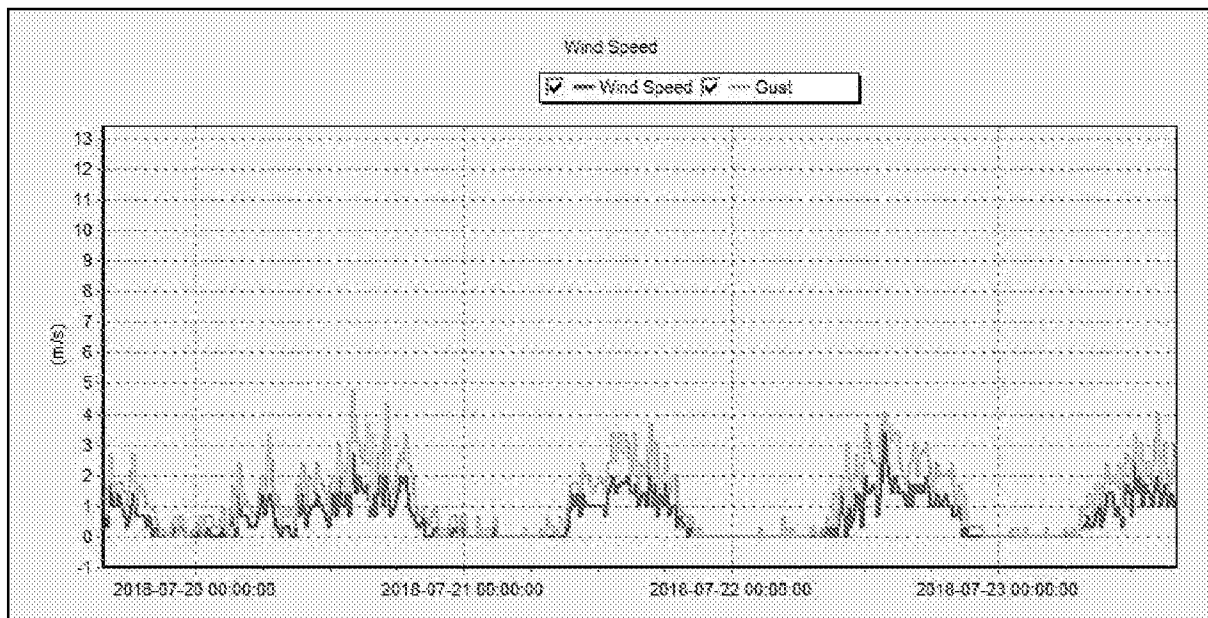


Figure 7. Wind Speeds recorded for the duration of the survey

4 Methodology and Assessment Standards

4.1 Applicable Assessment Standards

Airborne transportation noise is governed by ProPG (2017) and will be applicable for dictating the night time $L_{A_{Max}}$ levels which are incident at the application site and measured inside a bedroom.

BS8233:2014 provides criteria for internal noise levels for new buildings where there are continuous and anonymous noise sources such as road traffic noise. Given the proximity of the A27, BS8233:2014 will be applicable and as 2.10 above shows Table 4 from BS8233:2014 dictates the internal noise levels to be met.

5 Results of the Unattended Sound Survey

Logarithmically Averaged Day and Night time Periods			
L_{Aeq} , 16 hour- 07:00-23:00		L_{Aeq} , 8 hour 23:00- 07:00	
Day 1	63.0	Night 1	57.1
Day 2	62.3	Night 2	55.9
Day 3	62.4	Night 3	55.3
Day 4	62.9	Night 4	57.5
Arithmetic Average	62.6		56.5

Table 2. Noise Data

Table 2 indicates that there is little variation in the noise data between the week days and weekends. With wind speeds recorded and weather conditions ideal for environmental monitoring, there is no reason to discount any of the data set collected.

The data as stated above, was collected in freefield conditions in the existing garden of 1 Orchard Way.

5.1.1 Review of Data for Night Time

There are two main drivers which relate to internal noise levels for restful sleep inside a bedroom at night. These are the measured L_{Aeq} 8-hour of 30dB(A) as stated by Table 4 of BS8233:2014 and additionally, the more recently published ProPG (2017) which requires no more than 10 occurrences per night above 45 dB $L_{A_{max}}$ measured inside the bedroom during the night.

Based on an open window providing a loss of 15dB from outside sound pressure levels to inside sound pressure levels, tables 3 and 4 below may be used to identify if windows are capable of being opened in a residential bedroom.

No. of Occurrences of L_{Amax} between 23:00-07:00 hours above 45dB L_{Amax} (SRI15)			
Night 1	Night 2	Night 3	Night 4
96	95	96	95

Table 3. Number of Occurrences of L_{Amax} at 45dB (A) or above during the night time period assuming an open window in a bedroom.

Table 3 concludes that with an open window there are a significant number of occurrences which exceed the ten per night, as prescribed in ProPG2017.

No. of Occurrences of L_{Amax} between 23:00-07:00 hours above 45dB L_{Amax} (SRI25)			
Night 1	Night 2	Night 3	Night 4
10	8	7	4

Table 4. Number of Occurrences of L_{Amax} at 45dB (A) or above during the night time period with an SRI of 25 to keep L_{Amax} levels below 45dB(A) from occurring more than 10 times a night.

Table 4 shows the Sound Reduction Index (SRI) needed as being 25dB for the window to ensure that the number of L_{Amax} occurrences may be acceptable for sleep. With a closed standard thermal double-glazed window providing 33dB or 33 R_w , a closed standard thermal double-glazed window will suffice.

6 Noise Modelling Software

The IMMI (Wolfel, 2015) noise modelling software is useful as it applies and faithfully replicates the methodology in ISO 9613 for sound propagation. The A27 is the major contribution to the site soundscape and is located to the North of the two proposed residential dwellings.

To ensure that the model remains as accurate as possible, care was taken to replicate site conditions with items such as vegetation and any local barriers and their respective heights placed into the model. With this in mind, two noise models were constructed.

The first model, shows the survey location on the existing property with the 2.4 fence-line separating the A27 to the North. By building and calibrating the first model, this allows an accurate determination of the road traffic noise from the A27.

To ensure further accuracy and limit uncertainty in the calculations the modelling software performs, the spectral profile of road traffic noise at the receiving survey position has been logarithmically averaged for both daytime and night time. This is done to limit and prevent any under reporting where barriers are present on site, as opposed to the model only calculating the effectiveness of the barrier at 500Hz.

The second noise model, once the sound power level of the A27 has been determined and entered, then contains, the relevant footprint of the proposed residential dwellings, the fence-lines, the bike sheds and any other barriers which are likely to impact the propagation of sound across the site.

6.1 Assumptions made and entered into the Noise Model

It is noted that the two dwellings are joined by a gated fence line (1.8m) at the Southern end of the properties. The proposed new dwellings also have a separating privacy fence between the existing dwelling and the two new properties. All fence lines have been plotted at 1.8m in height. On the Western elevation, the existing hedgerow will be retained.

It is also important to use the measured spectral profile of the road traffic noise to enter into both the daytime and night time models to determine how any barriers are likely to perform.

Windows have been entered into the model as receiving positions, at their respective heights, as has a central point in the rear garden area, in order to assess the external amenity areas.

6.2 Noise Modelling Results

The results of the IMMI (Wolfel) Noise modelling software can be seen in Figures 8-10 below and include 2D and 3D perspectives.

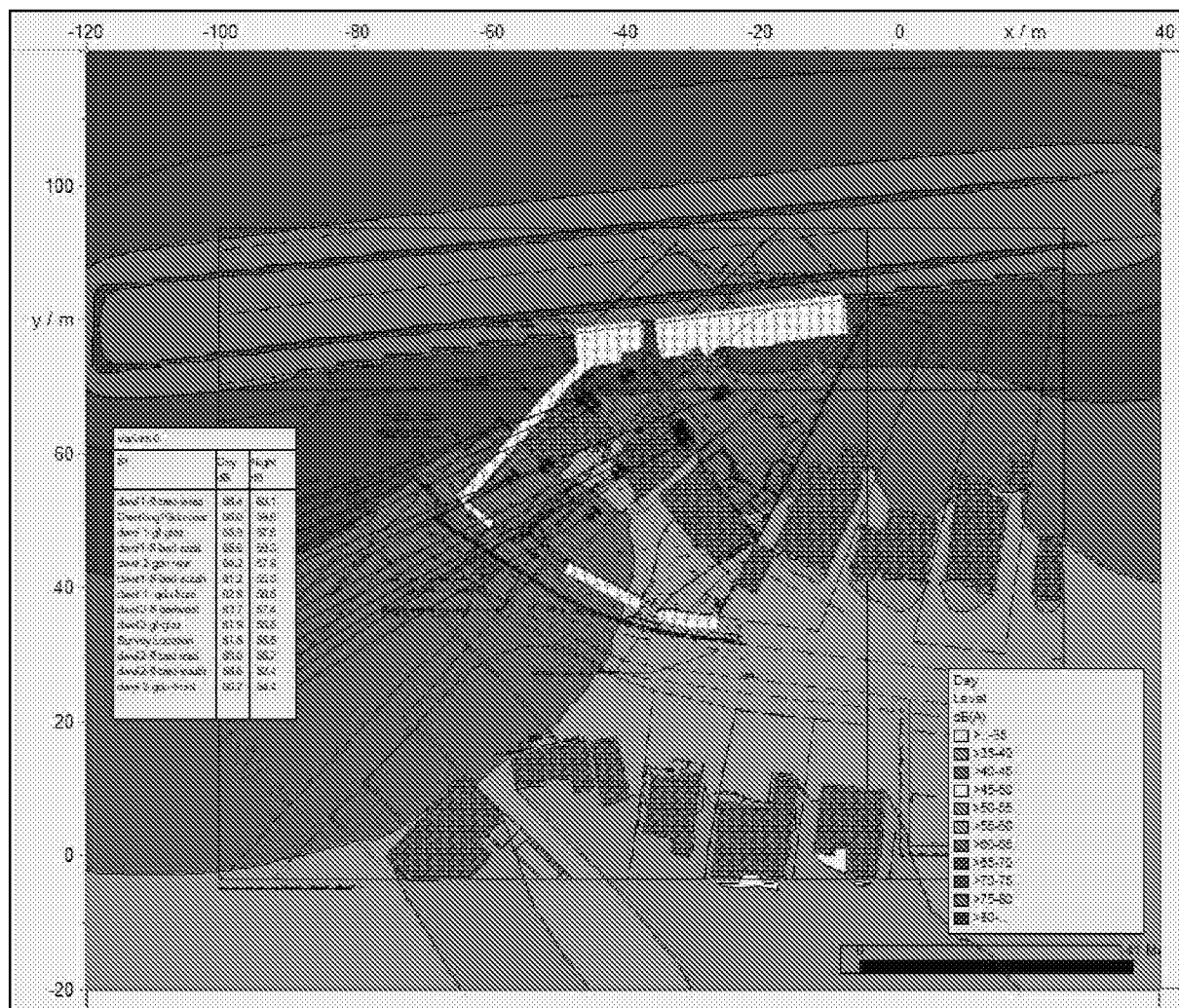
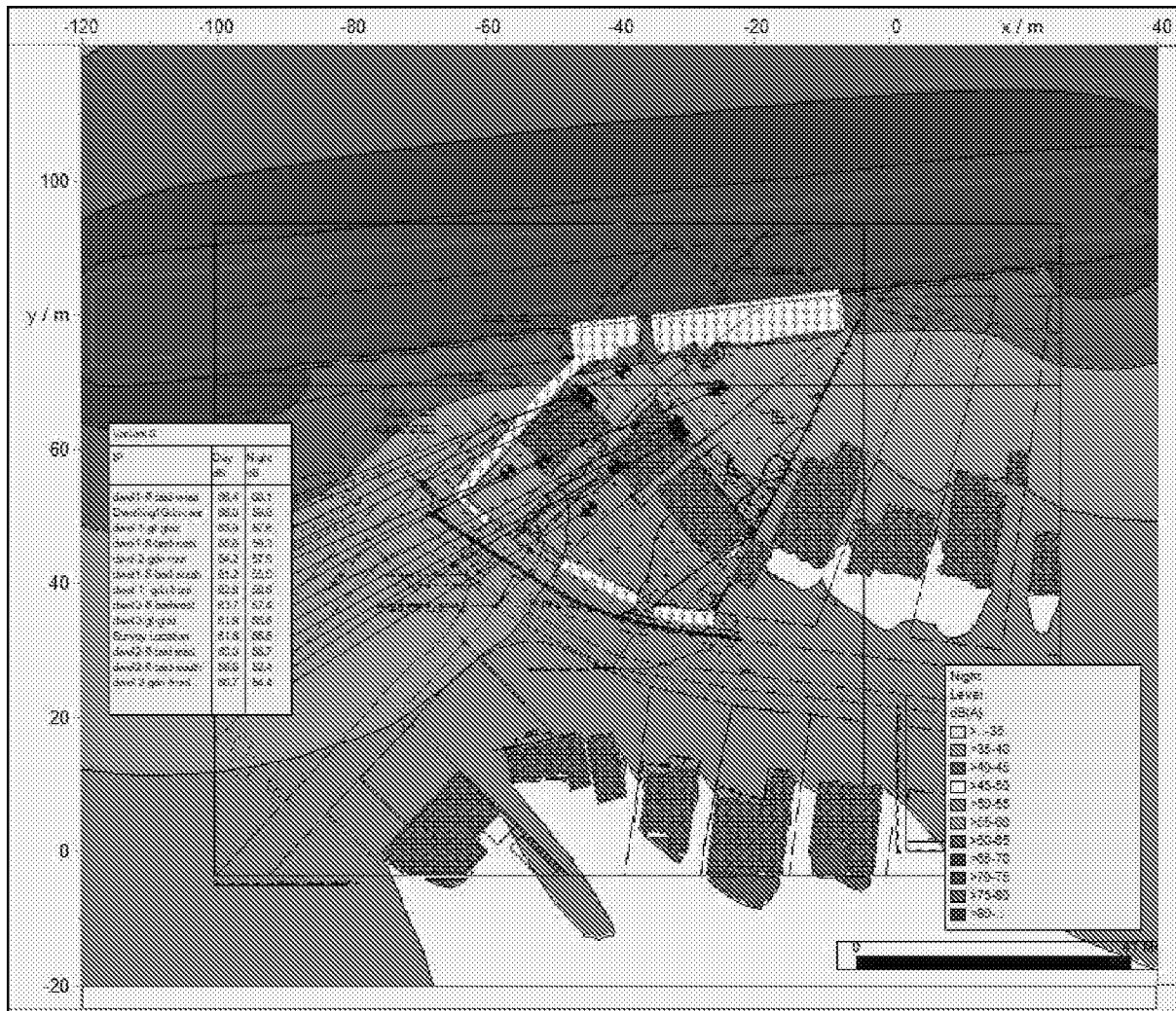


Figure 8. Noise Modelling Contours for Daytime (07:00-23:00 hours)



6.3 Noise Model Outcomes

The predictions made by the IMMI noise modelling software can also be viewed in a table which compares the predicted daytime and night time noise levels with those in BS8233:2014 which are specific for such continuous and anonymous noise sources.

Table 5 below shows that with standard thermal double glazing when set in a masonry façade, the glazing is likely to provide a 15dB loss for an open window and 33dB loss from outside to inside. These R_w losses are commensurate with those listed in Annex G.1 of BS8233:2014.

		Predicted Noise Level		Daytime				Night time			
Dwelling and Room Type		DAY	NIGHT	window open	8233 met	window closed	8233 met	window open	8233 met	window closed	8233 met
Dwelling 1	Living Area Glazing	64	58	49	No	31	Yes	N/A			N/A
Dwelling 1	First Floor Bedroom-West	66	60	51	No	33	Yes	45	No	27	Yes
Dwelling 1	First Floor Bedroom-East	66	59	51	No	33	Yes	44	No	26	Yes
Dwelling 1	First Floor Bedroom-South	61	55	46	No	28	Yes	40	No	22	Yes
Dwelling 2	Living Area Glazing	62	56	47	No	29	Yes	41	No	23	Yes
Dwelling 2	First Floor Bedroom-West	64	57	49	No	31	Yes	42	No	24	Yes
Dwelling 2	First Floor Bedroom-East	63	57	48	No	30	Yes	42	No	24	Yes
Dwelling 2	First Floor Bedroom-South	59	52	44	No	26	Yes	37	No	19	Yes

Table 5. Predicted Noise Levels for room types compared against BS8233:2014 requirements

The R_w losses for both open and closed windows have been used in Table 5 and indicate that with windows open for both daytime and night time, internal noise levels, will exceed the requirements for internal living spaces as required in table 4 of BS8233:2014. The red cells show where BS8233:2014 criterion have not been met.

However, internal noise levels are capable of being achieved with closed windows.

As discussed above, the drivers for internal noise levels for bedrooms during the night time period are both 30dB $L_{Aeq,8 \text{ hour}}$ and no more than 10 occurrences of 45dB L_{Amax} during the night. With the windows closed providing an R_w of 33, this is comfortably achieved, as the Sound Reduction Index (SRI) needed to control the number of L_{Amax} events is 25.

6.4 Assessment of External Amenity Areas

When considering external amenity areas or gardens, as per section 2.8 above, the $L_{Aeq, 16 \text{ hour}}$ noise level should not exceed 50dB(A) to protect the majority of people from being moderately annoyed. It should be remembered that the 50dB(A) would be assessed over a 16-hour day.

Garden areas were entered into the noise model as receiver points at 1.5 metres at positions both North and South of the proposed new dwellings.

Dwelling	Location	Predicted Noise Level ($L_{Aeq, 16 \text{ hour}}$)
Dwelling 1	Northern Garden	66 dB(A)
Dwelling 1	Southern Garden	62.8 dB(A)
Dwelling 2	Northern Garden	64.2 dB(A)
Dwelling 2	Southern Garden	60.7 dB(A)

Table 6. Assessment of external amenity spaces

It is noted that whilst the current garden areas enjoyed by 1 Orchard Way exceeds the requirements of 50dB $L_{Aeq,16\text{ hour}}$, the predicted noise levels in both the rear Northern gardens and Southern gardens exceed the recommendations for external amenity spaces.

BS8233:2014 does however state as follows:

"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."

The NPPG-Noise, 2014 also recognises that in some instances, where external amenity areas may be above those in BS8233:2014, impact may be offset if residents have access to a relatively quiet, protected, external publicly accessible amenity space (eg a public park or a local green space designated because of its tranquillity) that is nearby (eg within a 5 minutes walking distance). It is noted that within a minutes' walk, a resident, may pass underneath the A27 and reach the South Downs National Park and National Trust Slindon Estate a few more minutes further North for reduced noise levels, greater tranquillity and a woodland landscape.

7 Discussion

It is apparent that for the proposed two residential properties, by opening windows, internal noise levels would exceed the requirements for both living and sleeping accommodation. With windows closed, internal noise criteria are met, however, there will be a requirement for background ventilation and cooling of the property.

External amenity areas are likely to be dominated by road traffic noise from the A27 at levels above those recommended in the World Health Organisation Guidelines for Community Noise and BS8233:2014.

Whilst the bike sheds form a useful function for the end residents, it may be possible to create a quieter area within the garden by building the sheds higher and longer and orientating them East to West across the two property gardens. The effect of re-orientating the bike sheds is to create a shadow zone and additional barrier from the road traffic noise where residents might have some respite from the current noise levels. It is however recognised that this may be subject to further planning.

8 Mitigation Measures

The mitigation measures being recommended will ensure that both daytime and night time criteria from BS8233:2014 are met for the proposed residential properties.

As discussed above, restful sleep in a bedroom depends not only internal L_{Aeq} noise levels being achieved throughout the 8-hour night time period, but also in restricting the number of L_{AMax} events which are likely to occur inside the bedroom above 45 dB L_{AMax} , as these have the potential to impact sleep.

8.1 Glazing

The calculations been carried out on the basis of a standard thermal double-glazed window of 4/12/4 providing an acoustic loss from outside to inside of 33 dB or 33 R_w , when set in a masonry façade. An open window is estimated to provide a 15 dB loss or 15 R_w . This approach is commensurate with that of Annex G.1 of BS8233:2014.

Standard thermal double glazing will be satisfactory for the site, but when it comes to opening windows, both proposed dwellings, will receive noise levels inside either living areas or bedrooms which exceed the requirements of Table 4 of BS8233:2014.

There will therefore be a requirement to ensure that both living areas and bedrooms are capable of being sufficiently ventilated in line with Building Regulations Approved Document F.

It is strongly recommended that through frame vents or trickle vents are avoided, as these have the potential to compromise internal noise levels.

The plans also indicate that there are Velux windows in the roof which serve bedroom 3 and the en-suite bathroom area of Bedroom 1. The Velux windows need to be a minimum of the glazing standard as discussed above, to ensure that the windows do not act as a weak point.

A lantern area is also noted from the plans which provides light into the ground floor living area and again, the minimum acoustic performance as standard thermal double glazing must be used, preventing the lantern being a weak point in the building fabric.

8.2 Ventilation

There are a number of ways of ventilating and providing fresh air into a property. When considering ventilation, there must be sufficient air changes but also compliance with the building regulations (Approved Document F).

The options are as follows:

System 1 - Background ventilation using trickle vents

System 2 - Passive stack ventilation

System 3 - Continuous mechanical extraction ventilation (MEV)

System 4 - Mechanical Ventilation and Heat Recovery (MVHR)

Whilst residents have the freedom to open their windows, by doing so, the internal noise levels are likely to be exceeded. However, for purge ventilation, it is important to note that noise levels are not applicable. Purge ventilation is the process of allowing rapid turnover of air changes when for example one wishes to remove cooking odours or paint fumes from inside the property.

Given the relatively high external noise levels, it is suggested that the integrity of the building envelope be retained (ie avoiding breaks in the building façade) and the applicant consider the use of a ducted MVHR system (system 4) in order to provide sufficient background ventilation.

It is recommended that the ducted MHVR system take fresh air from the quietest facades, ie the South East of the proposed two dwellings.

It is strongly recommended that an M&E consultant be contacted to ensure the selection of appropriate ventilation.

9 Uncertainty

In line with professional guidance, steps have been taken to reduce and report uncertainty in the report writing and data collection process.

To ensure robust data capture, a sound level meter was positioned at the proposed window/Northern façade of dwelling 2, closest to 1 Orchard Way to determine freefield sound levels at the application site.

The sound level meter used was calibrated before and after the survey in situ, without any drift having occurred, to ensure that the information and data being obtained was representative and that the sound level meter was operating correctly.

Weather conditions were also considered to be ideal for environmental monitoring. This was confirmed through the use of a co-located weather station as a matter of good and professional practice and recorded wind speeds are shown in Figure 6 above.

With any calculations made, including the determination of ambient sound levels, there has not been any additional rounding of numbers to prevent double handling, this has only occurred once at the final part of the sum and is presented to the reader with an easy to understand reference level or single figure.

As discussed in section 6, using a logarithmically averaged profile of the received road traffic noise spectrum for both daytime and night time is important to reduce uncertainty and increase accuracy in the modelling process. The use of the road traffic spectra is also useful in preventing any under reporting when barriers are used in noise models, such as the 2.4m barrier separating the A27 from the gardens.

Care has also been taken to replicate site conditions as closely as possible within the noise modelling software, including appropriate fences, vegetation and placement of properties.

10 Conclusion

Sound level measurements were taken from the site between 19/7/2018 and 23/7/2018 from a freefield position that was representative of the façade of one of the proposed residential properties.

The data obtained in ideal environmental monitoring conditions identified that at the survey location, the arithmetic average for the $L_{Aeq,16 \text{ hour}}$ daytime was 63dB and for the $L_{Aeq, 8 \text{ hour}}$ night time period was 57dB. The measured noise levels and the spectral profile of the daytime and night time road traffic were used to inform noise modelling and prediction software (IMMI, Wolfel, 2015) to determine the likely noise levels received at locations on the North and South facades of two proposed new residential properties.

The noise modelling software predictions suggests that internal noise levels for both living and sleeping accommodation are capable of being met for both daytime and night time periods, albeit with windows closed. With windows open, internal noise levels, are likely to exceed the requirements of BS8233:2014.

If windows are closed, there is a need to provide both background ventilation and cooling to the new properties to ensure compliance with Building Regulations Approved Document F. Given the site, it is recommended that a ducted MVHR system will be appropriate and that any intake location feeding the system is orientated on the quieter South Eastern facades.

Whilst external amenity areas are seen to be above those recommended in BS8233:2014 and WHO Guidelines (1999), BS8233:2014 suggests that higher levels may be tolerated where there is a need for housing in sites such as those located adjacent to strategic transport network. It is noted that within a five-minute walk, future residents are capable of being in the South Downs National Park and National Trust Slindon Estate to the North of the A27.

Assuming the implementation of the mitigation measures listed above, it is considered that planning permission would not likely be refused on noise grounds.

