

Acoustic South East



Acoustic South East

Road Traffic Noise Survey & Assessment (New Development)

Site: **Land South of Hanlye Lane, Cuckfield**

Client: **Sigma Homes**

Report by: Simon Barrett BSc(Hons) MSc MIOA

Date: 05/10/2023

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Issue: 2

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Issue No.	Date	Comments:
Issue 1	13/09/2023	Initial Issue
Issue 2	05/10/2023	Report Updated to reflect minor site layouts.

1 Introduction & Executive Summary

Acoustic South East have been appointed to undertake an acoustic assessment in support of a proposed planning application for the development of land south of Hanlye Lane, Cuckfield into 55 residential dwellings.

The purpose of this assessment is to assess the following:

- Measure the road traffic noise levels incident upon the site
- Provide recommendations for mitigation measures if necessary

The noise levels for the day and the night time period have been assessed in terms of and following the guidelines of the documents listed below:

- ISO9613 (Attenuation of sound during propagation outdoors) 1996
- BS8233 (Sound insulation and noise reduction for buildings) 2014
- National Planning Policy Framework (NPPF) 2023
- Pro-PG (Planning and Noise Guidance) 2017
- Planning Noise Advice Document: Sussex 2021
- Approved Document O

For the majority of the properties, windows can be opened whilst still achieving the noise criteria for both Daytime and Night time Leq sound levels, as well as night time Lmax levels. A handful of properties cannot rely on open windows, however the worst-case required sound reduction (SRI) of the building envelope is for Plot 19 (Front Façade at 1st floor level), which is only 17.5dB.

Full data can be found in Section 7.2 of this report as to which properties cannot rely on an open window.

This said, the assessment has shown that standard thermal double glazing when closed and with standard trickle vents with a free-area of 8000mm² can still be used and that acoustically enhanced glazing or ventilation units are not required.

In terms of overheating compliance, this development has no issue in complying with the requirements of Approved Document O (See Sub Section 7.7).

It is considered that from the perspective of acoustics, there is no reason for the planning permission to be withheld.

2 Context, Noise Criteria & Noise Assessment Methodology

2.1 Site Description

The proposal is to develop land south of Hanlye Lane, Cuckfield to contain 55 residential dwellings, mostly two-storey, but with a small number of 3-storey town-houses.

The site is situated to the south of Hanlye Lane, Cuckfield – a non-major road, but one which connects Ardingly Road with Borde-Hill Lane

Close to the site are existing residential dwellings to the west, with some to the north and the east, but there is not a large quantity of developed land. The site is currently used by dog-walkers and is generally an empty parcel of land.

2.2 Site Location

The Site Location can be seen below in Figure 1



Figure 1: Site Location

2.3 Soundscape

Road Traffic was the only noticeable source of sound passing by the north of the site. This was determined from both the survey set-up and collection visits.

3 Standards and Guidance

3.1 National Planning Policy Framework 2023

The National Planning Policy Framework (September 2023) 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.

The following paragraphs are relevant within NPPF Section 15 (Conserving and enhancing the natural environment) states the following:

Paragraph 174(e) - Preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans.

Paragraph 185 - Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and

Paragraph 187 – 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. "Agent of Change" is especially relevant here due to the conversion of offices into residential dwellings next to *existing* commercial operations.

3.2 Noise Policy Statement for England (NPSE, 2010)

3.2.1 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".

3.2.2 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.

3.2.3 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
- ProPG: Planning and Noise 2017

3.3 BS8233: Sound insulation and noise reduction for buildings (2014) Noise Criteria

Table 4 of BS8233 provides the following guideline values: for the upper limit of noise levels within habitable spaces

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

Table 1: BS8233 criteria

BS8233:2014, Note 7 which accompanies Table 4 also has the following narrative:

“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.”

N.B. It is also important to note that the values in the above table relate to “anonymous” noise.

3.4 ProPG –Planning and Noise: new residential development

The following has been copied from the Association of Noise Consultants' (ANC) website:

Over recent years, we have seen the introduction of the Noise Policy Statement for England, as well as substantial changes in national planning policy. But these developments have not been accompanied by detailed technical acoustic advice.

The lack of detailed guidance can lead to inconsistent application of policy, that may in turn result in unsatisfactory development and affect quality of life.

To fill that gap and facilitate efficient and consistent decision-making in the development control process, the Institute of Acoustics, the Association of Noise Consultants and the CIEH have joined to produce a Professional Practice Guidance (ProPG) focussing on noise sensitive development.

The following extract has been taken (Figure 2, Page 13) from the May 2017 ProPG document:

ACTIVITY	LOCATION	07:00 – 23:00 HRS	23:00 – 07:00 HRS
Resting	Living room	35 dB $L_{Aeq,16\text{ hr}}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16\text{ hr}}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16\text{ hr}}$	30 dB $L_{Aeq,8\text{ hr}}$ 45 dB $L_{Amax,F}$ (Note 4)

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 internal 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 5 dB 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 5 dB, 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 10 dB, they are highly 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 Criteria

3.5 Approved Document O - Part O – Overheating 2022

Document O details mitigation measures to avoid overheating in new dwellings. A simplified assessment is detailed where a full TM59 overheating assessment is not required (overheating risk is calculated based on geographic location).

Section 2 of the document, entitled “ensuring the overheating mitigation strategy is usable” states the following:

The standards in this section may mean that the standards of the simplified method cannot be met. For example, if external noise is an issue, it is unlikely that windows would be opened by an occupant and therefore the minimum free areas of the simplified method cannot be met. In such cases, dynamic thermal modelling should be used.

The noise criteria details from the document have been copied below:

Noise

- 3.2 In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).
- 3.3 Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.
 - a. 40dB $L_{Aeq,T}$ averaged over 8 hours (between 11pm and 7am).
 - b. 55dB L_{AFmax} more than 10 times a night (between 11pm and 7am).

3.6 ANC/IOA Guide to Demonstrating Compliance with the Noise Requirements of Approved Document O

The document states the following:

“Based on typical assumptions (see note below and Appendix A), the resulting outside-to-inside level difference for window openings necessary to satisfy the simplified method of AD-O are expected to be approximately 4 dB for ‘high’ risk locations and 9 dB for ‘medium’ risk locations.

This is a rough calculation of the outside-to-inside level difference for these opening proportions and calculations should be based on actual sound insulation performance data where available. The outside-to inside level difference may be different for individual noise events (L_{AFmax}) where orientation and free-field propagation are more significant. However, for the purposes of determining the suitability for using the simplified method, it is considered reasonable to use the same values.

With reference to paragraph 3.3 of AD-O, this implies the following limiting external free-field levels above which external noise precludes the use of the simplified method, and dynamic thermal modelling should be used to demonstrate compliance.”

Using the above details the document goes on to detail the external Noise Levels Above Which the Simplified Method Cannot Be Used:

Parameter	High Risk Location	Moderate Risk Location
$L_{Aeq,8hr}$ averaged over 8 hours (between 11pm and 7am)	44 dB	49 dB
L_{AFmax} more than 10 times a night (between 11pm and 7am)	59 dB	64 dB

Figure 3: ANC/IOA ADO External Noise Criteria

It should be noted that the development is located in a moderate risk location.

3.7 Noise Assessment Methodology

A noise survey was set up to assess the road traffic noise affecting the site.

The sound survey was installed to assess the impact of Hanlye Lane.

One microphone location was used, positioned closed to the road as practicably possible, whilst remaining secure and sufficiently distant from foliage to prevent “leaf noise”.

The report assessed the collected data over a period of 4 days and nights.

The results of the survey were used to find the average noise level incident upon the site from Hanlye Lane.

A computer noise model was then constructed to show how this noise would propagate around the proposed site.

The assessment considers both the Daytime and Night time LAeq.

The report also considers the ProPG:2017 criterion of no more than 10 L_{Amax} events (over 45dB(A)) internally within a bedroom per night: In line with Sussex Planning Noise Advice Document $L_{Amax,1\text{ minute}}$ measurements were used for this section of the assessment.

A simplified assessment in terms of Approved Document O was also carried out in terms of how overheating and acoustics tie together for this development.

4 Unattended Sound Surveys

The un-attended survey was conducted between 21st – 25th August 2023.

The microphone was positioned on a heavy-duty tripod at 2.5m height above the ground and in free-field conditions.

The survey location can be seen below in figure 5 obtained from the What3Words website. The What3Words location was: “destroyer.report.muddy”.

GPS Co-ordinates of the survey location were: 51°0’56” N 0°7’55” W

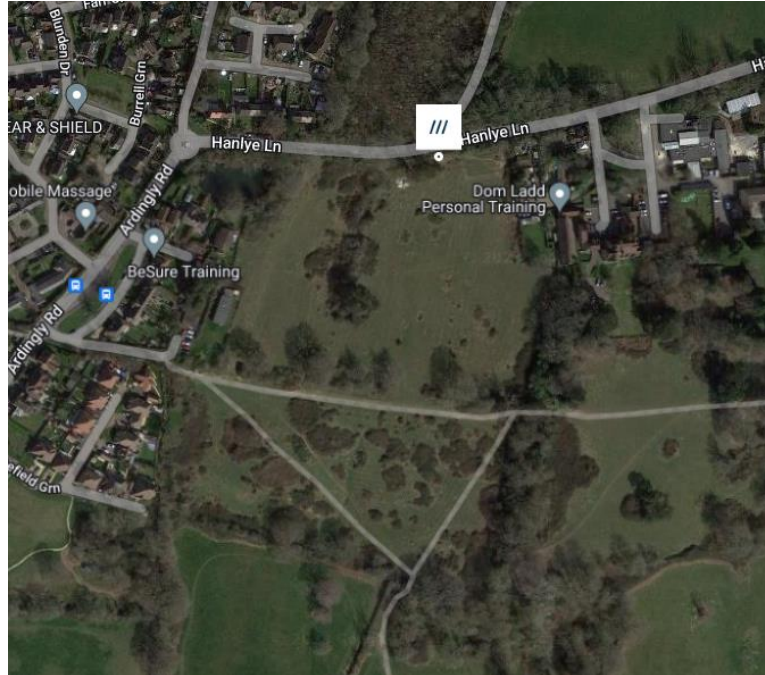


Figure 4: Survey Location

4.1.1 Survey Details

- Survey carried out by:
 - Simon Barrett BSc(Hons) MSc MIOA
- Equipment used:
 - Rion NL18 Integrating Averaging Sound Level Meter

4.1.2 Un-attended Survey Results

Date (2022) September	Time Period	Freefield Level $L_{Aeq,16hr/8hr}$ – dB(A)
Day 1	07:00-23:00hrs	58.9
Day 2	07:00-23:00hrs	58.3
Day 3	07:00-23:00hrs	59.4
Day 4	07:00-23:00hrs	58.7
Arithmetic Average	07:00-23:00hrs	58.8
Night 1	23:00-07:00hrs	51.9
Night 2	23:00-07:00hrs	51.4
Night 3	23:00-07:00hrs	49.9
Night 4	23:00-07:00hrs	51.1
Arithmetic Average	23:00-07:00hrs	51.1

Table 2: Un-attended Survey $L_{Aeq,T}$ Results

5 ProPG Stage 1 Assessment

The ProPG stage one risk assessment does not include a specific location or height which the indicative $L_{Aeq,16hr}$ and $L_{Aeq,8hr}$ should be assessed. The document does however state that a “typical worse case 24 hours” should be assessed. However as per section 3.6 of this report, for the daytime period, the worst-case 1-hour period is being assessed due to the nature of the local soundscape. However, for the night time, the worst-case 8-hour period has been used. This is based on the readings measured at the Un-attended Survey Position. Figure 5, below, shows that the levels at the site are between the low and the medium categories. A more in-depth assessment of the sound pressure level has been conducted regardless, to show the sound propagation around the site and ascertain the mitigation methods needed for the proposed development to meet the relevant noise criteria.

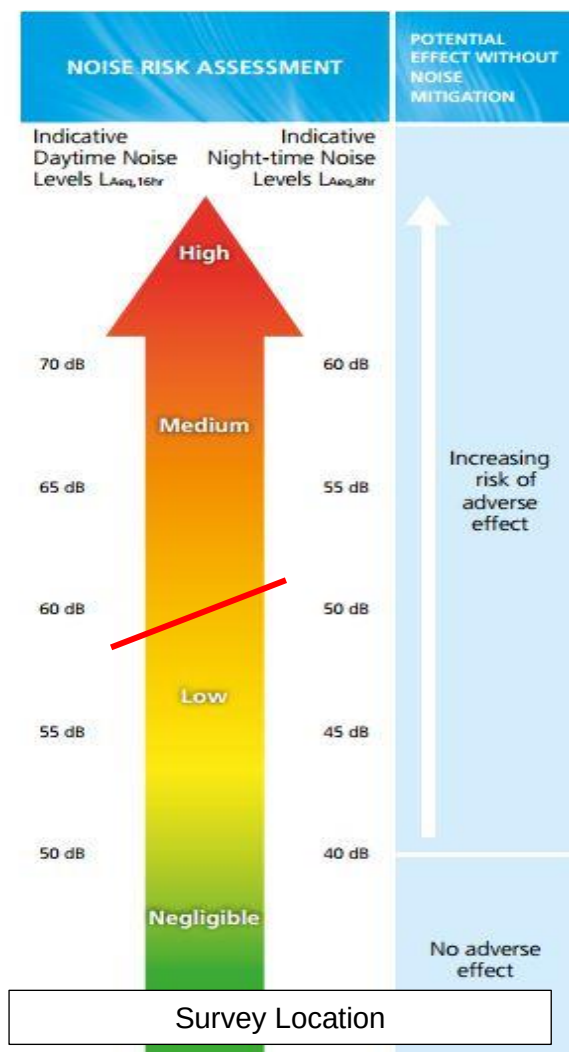


Figure 5: ProPG Stage 1 Assessments

6 Computer Noise Model

6.1 General

Due to the size of the site, a computer model was generated to show how the sound pressure level from the road traffic noise (Hanlye Lane) propagates across the site using the software “Immi” (Wolfel).

A scaled site plan was imported onto which the road and the survey location were added.

The model was calibrated by adjusting the sound power of the road for both daytime and night time so that the survey location “reception point” on the model matched that of the recorded average Leq sound pressure levels as shown in Table 4 of this report.

Once the calibration was complete, a new “variant” was created, to include the above as well as the 55 proposed properties along with reception points for the front and rear of each property and at Ground Floor height and 1st Floor height.

The model was then run to show the sound pressure level at these new reception points and the data output into a table.

Coloured noise level contours were also produced to show in pictorial form how the sound from Hanlye Lane propagates across the site.

Tabulated Data is shown in Section 7 of this report along with the required attenuation.

Noise Contours are shown in the appendix of this report.

For reference, the basic Immi Model (without noise contours) is shown below (Daytime, Ground Floor Level)



Figure 6: Basic Immi Noise Model for the Site

7 Noise Mitigation Measures

7.1 Noise Criteria

7.1.1 L_{Aeq,T} Noise Levels

The BS8233:2014 noise criteria will be used to specify the noise mitigation measures for all habitable rooms. The maximum internal noise level for each area is as follows:

- Bedrooms 30/30dB(A) Day/Night L_{Aeq}, 16 hour/8 Hour
- Lounges 30dB(A) Day L_{Aeq}, 16 hour

7.1.2 Road Noise Maximum Noise Levels

For L_{Amax} events the ProPG noise L_{Amax} criterion will be used to specify the noise mitigation measures for bedrooms only:

For a reasonable standard in noise sensitive rooms at night (e.g. bedrooms) individual noise events should not normally exceed 45dB LAFmax more than 10 times a night.

The above is similar to guidance in the WHO Guidelines for Community Noise 1999 document. However, the ProPG criteria suggests limiting the number of L_{Amax} events (over 45dB(A) to less than 10 times a night as opposed to less than 10-15 times a night as stipulated by the WHO.

7.1.3 Approved Document O

Approved Document O states that people typically close their windows if the noise levels exceed 40dB during a night time period of 8 hours. They will also fully open their windows to try to mitigate overheating issues. In a moderate risk location, there is a 9dB allowance through a fully open window, which would equate to an outside noise level of 49dBA.

Using the above details the document goes on to detail the external Noise Levels Above Which the Simplified Method Cannot Be Used:

Parameter	High Risk Location	Moderate Risk Location
L _{Aeq,8hr} averaged over 8 hours (between 11pm and 7am)	44 dB	49 dB
L _{AFmax} more than 10 times a night (between 11pm and 7am)	59 dB	64 dB

7.2 Required Sound Reduction of Building Envelope – $L_{Aeq,T}$ levels

The Sound Reduction Index (SRI) has initially been calculated so that the $L_{Aeq,T}$ criteria can be achieved (The L_{Amax} events are discussed in the next sub section).

7.2.1 Ground Floor Level

In this table, the computer noise model's output data is shown for the ground floor level plane of 1.5m height (down-stairs windows).

The cells highlighted in green as the worst-case values and the cells highlighted red show the properties which cannot rely upon opening windows for the purpose of background ventilation whilst also achieving the BS8233 criteria (based on a partially open window being able to provide 13dB of attenuation, according to the guidance of ProPG:2017).

This shows that the majority of properties can benefit from open windows for background ventilation and still achieve the daytime and night time period Leq criteria of BS8233:2014.

Caution over green for bad

Reception Point	Daytime Leq,16hr dBA	Night time Leq,8hr dBA	BS8233 Criteria (dBA)		Attenuation Required	
			Day	Night	Day	Night
Survey Location	58.8	51.1	35	30	23.8	21.1
Plot 1 Front Gnd	36.2	28.5	35	30	1.2	-1.5
Plot 2 Front Gnd	38.1	30.4	35	30	3.1	0.4
Plot 3 Front Gnd	40	32.3	35	30	5	2.3
Plot 4 Front Gnd	42.3	34.6	35	30	7.3	4.6
Plot 5 Front Gnd	46.3	38.6	35	30	11.3	8.6
Plot 1 Rear Gnd	37.1	29.4	35	30	2.1	-0.6
Plot 2 Rear Gnd	38.1	30.4	35	30	3.1	0.4
Plot 3 Rear Gnd	39.3	31.6	35	30	4.3	1.6
Plot 4 Rear Gnd	38.8	31.1	35	30	3.8	1.1
Plot 5 Rear Gnd	43.8	36.1	35	30	8.8	6.1
Plot 6 Front	47.2	39.5	35	30	12.2	9.5
Plot 6 Rear	46	38.3	35	30	11	8.3
Plot 7 Front Gnd	48.3	40.6	35	30	13.3	10.6
Plot 8 Front Gnd	48.6	40.9	35	30	13.6	10.9
Plot 9 Front Gnd	48.6	40.9	35	30	13.6	10.9
Plot 10 Front Gnd	40.8	33.1	35	30	5.8	3.1
Plot 11 Front Gnd	38	30.3	35	30	3	0.3
Plot 12 Front Gnd	37.1	29.4	35	30	2.1	-0.6
Plot 13 Front Gnd	23.3	15.6	35	30	-11.7	-14.4
Plot 14 Front Gnd	21.9	14.2	35	30	-13.1	-15.8
Plot 15 Front Gnd	22.1	14.4	35	30	-12.9	-15.6

Plot 16 Front Gnd	23.1	15.4	35	30	-11.9	-14.6
Plot 17 Front Gnd	32.3	24.6	35	30	-2.7	-5.4
Plot 18 Front Gnd	35.2	27.5	35	30	0.2	-2.5
Plot 7 Rear Gnd	30.9	23.2	35	30	-4.1	-6.8
Plot 8 Rear Gnd	30.7	23	35	30	-4.3	-7
Plot 9 Rear Gnd	30.3	22.6	35	30	-4.7	-7.4
Plot 10 Rear Gnd	30.5	22.8	35	30	-4.5	-7.2
Plot 11 Rear Gnd	32.2	24.5	35	30	-2.8	-5.5
Plot 12 Rear Gnd	31	23.3	35	30	-4	-6.7
Plot 13 Rear Gnd	30.2	22.5	35	30	-4.8	-7.5
Plot 14 Rear Gnd	30.4	22.7	35	30	-4.6	-7.3
Plot 15 Rear Gnd	32.7	25	35	30	-2.3	-5
Plot 16 Rear Gnd	35.8	28.1	35	30	0.8	-1.9
Plot 17 Rear Gnd	35.7	28	35	30	0.7	-2
Plot 18 Rear Gnd	36.3	28.6	35	30	1.3	-1.4
Plot 19 Front Gnd	50.8	43.1	35	30	15.8	13.1
Plot 19 Rear Gnd	33	25.3	35	30	-2	-4.7
Plot 20 Front Gnd	34.7	27	35	30	-0.3	-3
Plot 20 Rear Gnd	32.4	24.7	35	30	-2.6	-5.3
Plot 21 Front Gnd	50.5	42.8	35	30	15.5	12.8
Plot 21 Rear Gnd	33.9	26.2	35	30	-1.1	-3.8
Plot 22 Front Gnd	48.8	41.1	35	30	13.8	11.1
Plot 22 Rear Gnd	46.1	38.4	35	30	11.1	8.4
Plot 23 Front Gnd	45.6	37.9	35	30	10.6	7.9
Plot 23 Rear Gnd	43.1	35.4	35	30	8.1	5.4
Plot 24 Front Gnd	43.9	36.2	35	30	8.9	6.2
Plot 24 Rear Gnd	39.3	31.6	35	30	4.3	1.6
Plot 25 Front Gnd	43.5	35.8	35	30	8.5	5.8
Plot 25 Rear Gnd	37.2	29.5	35	30	2.2	-0.5
Plot 26 Front Gnd	41.9	34.2	35	30	6.9	4.2
Plot 26 Rear Gnd	35.5	27.8	35	30	0.5	-2.2
Plot 27 Front Gnd	41.1	33.4	35	30	6.1	3.4
Plot 27 Rear Gnd	34.2	26.5	35	30	-0.8	-3.5
Plot 28 Front Gnd	25.3	17.6	35	30	-9.7	-12.4
Plot 28 Rear Gnd	38.2	30.5	35	30	3.2	0.5
Plot 29 Front Gnd	25.1	17.4	35	30	-9.9	-12.6
Plot 29 Rear Gnd	37.3	29.6	35	30	2.3	-0.4
Plot 30-34 Front Gnd	40.6	32.9	35	30	5.6	2.9
Plot 30-34 Rear Gnd	35.3	27.6	35	30	0.3	-2.4
Plot 35 Front Gnd	41.7	34	35	30	6.7	4
Plot 35 Rear Gnd	37	29.3	35	30	2	-0.7
Plot 36 Front Gnd	42.5	34.8	35	30	7.5	4.8
Plot 36 Rear Gnd	38.1	30.4	35	30	3.1	0.4
Plot 37 Front Gnd	38.7	31	35	30	3.7	1

Plot 37 Rear Gnd	33.1	25.4	35	30	-1.9	-4.6
Plot 38 Front Gnd	38.3	30.6	35	30	3.3	0.6
Plot 38 Rear Gnd	24.5	16.8	35	30	-10.5	-13.2
Plot 39 Front Gnd	32.5	24.8	35	30	-2.5	-5.2
Plot 39 Rear Gnd	23.3	15.6	35	30	-11.7	-14.4
Plot 40 Front Gnd	31.5	23.8	35	30	-3.5	-6.2
Plot 40 Rear Gnd	22.5	14.8	35	30	-12.5	-15.2
Plot 41 Front Gnd	31.3	23.6	35	30	-3.7	-6.4
Plot 41 Rear Gnd	22.9	15.2	35	30	-12.1	-14.8
Plot 42 Front Gnd	29.7	22	35	30	-5.3	-8
Plot 42 Rear Gnd	23.2	15.5	35	30	-11.8	-14.5
Plot 43 Front Gnd	32.1	24.4	35	30	-2.9	-5.6
Plot 43 Rear Gnd	23.7	16	35	30	-11.3	-14
Plot 44 Front Gnd	25.2	17.5	35	30	-9.8	-12.5
Plot 44 Rear Gnd	33.3	25.6	35	30	-1.7	-4.4
Plot 45 Front Gnd	37.7	30	35	30	2.7	0
Plot 45 Rear Gnd	32.4	24.7	35	30	-2.6	-5.3
Plot 46 Front Gnd	37.1	29.4	35	30	2.1	-0.6
Plot 47 Rear Gnd	31.6	23.9	35	30	-3.4	-6.1
Plot 47 Front Gnd	36.7	29	35	30	1.7	-1
Plot 47 Rear Gnd	31.2	23.5	35	30	-3.8	-6.5
Plot 48 Front Gnd	22.3	14.6	35	30	-12.7	-15.4
Plot 48 Rear Gnd	21	13.3	35	30	-14	-16.7
Plot 49 Front Gnd	21.5	13.8	35	30	-13.5	-16.2
Plot 49 Rear Gnd	31.6	23.9	35	30	-3.4	-6.1
Plot 50 Front Gnd	21.4	13.7	35	30	-13.6	-16.3
Plot 50 Rear Gnd	28.5	20.8	35	30	-6.5	-9.2
Plot 51 Front Gnd	21.3	13.6	35	30	-13.7	-16.4
Plot 51 Rear Gnd	29.7	22	35	30	-5.3	-8
Plot 52 Front Gnd	20.9	13.2	35	30	-14.1	-16.8
Plot 52 Rear Gnd	29.7	22	35	30	-5.3	-8
Plot 53 Front Gnd	20.8	13.1	35	30	-14.2	-16.9
Plot 53 Rear Gnd	30.9	23.2	35	30	-4.1	-6.8
Plot 54 Front Gnd	33.4	25.7	35	30	-1.6	-4.3
Plot 54 Rear Gnd	32	24.3	35	30	-3	-5.7
Plot 55 Front Gnd	34	26.3	35	30	-1	-3.7
Plot 55 Rear Gnd	32.7	25	35	30	-2.3	-5

Table 3: Computer Model Tabulated Output Data - Ground Floor Level

7.2.2 1st Floor Level

In this table, the computer noise model's output data is shown for the 1st floor level plane of 4m height (1st Floor window height).

The cells highlighted in green as the worst-case values and the cells highlighted red show the properties which cannot rely upon opening windows for the purpose of background ventilation whilst also achieving the BS8233 criteria (based on a partially open window being able to provide 13dB of attenuation, according to the guidance of ProPG:2017).

This shows that the majority of properties can benefit from open windows for background ventilation and still achieve the daytime and night time period Leq criteria of BS8233:2014.

Reception Point	Daytime Leq,16hr dBA	Night time Leq,8hr dBA	BS8233 Criteria		Attenuation Required	
			Day	Night	Day	Night
Survey Location	58.8	51.1	35	30	23.8	21.1
Plot 1 Front 1st	37	29.3	35	30	2	-0.7
Plot 2 Front 1st	38.9	31.2	35	30	3.9	1.2
Plot 3 Front 1st	40.8	33.1	35	30	5.8	3.1
Plot 4 Front 1st	43.1	35.4	35	30	8.1	5.4
Plot 1 Rear 1st	39.4	31.7	35	30	4.4	1.7
Plot 2 Rear 1st	40.8	33.1	35	30	5.8	3.1
Plot 3 Rear 1st	42.5	34.8	35	30	7.5	4.8
Plot 4 Rear 1st	42.1	34.4	35	30	7.1	4.4
Plot 7 Front 1st	49.4	41.7	35	30	14.4	11.7
Plot 8 Front 1st	49.7	42	35	30	14.7	12
Plot 9 Front 1st	49.7	42	35	30	14.7	12
Plot 10 Front 1st	41.6	33.9	35	30	6.6	3.9
Plot 11 Front 1st	38.8	31.1	35	30	3.8	1.1
Plot 12 Front 1st	37.8	30.1	35	30	2.8	0.1
Plot 13 Front 1st	24	16.3	35	30	-11	-13.7
Plot 14 Front 1st	22.2	14.5	35	30	-12.8	-15.5
Plot 15 Front 1st	23.1	15.4	35	30	-11.9	-14.6
Plot 16 Front 1st	23.9	16.2	35	30	-11.1	-13.8
Plot 17 Front 1st	33.2	25.5	35	30	-1.8	-4.5
Plot 18 Front 1st	36.3	28.6	35	30	1.3	-1.4
Plot 7 Rear 1st	31.4	23.7	35	30	-3.6	-6.3
Plot 8 Rear 1st	31.6	23.9	35	30	-3.4	-6.1
Plot 9 Rear 1st	31.5	23.8	35	30	-3.5	-6.2
Plot 10 Rear 1st	35.8	28.1	35	30	0.8	-1.9
Plot 11 Rear 1st	36.4	28.7	35	30	1.4	-1.3
Plot 12 Rear 1st	35.5	27.8	35	30	0.5	-2.2
Plot 13 Rear 1st	34.2	26.5	35	30	-0.8	-3.5
Plot 14 Rear 1st	33.8	26.1	35	30	-1.2	-3.9
Plot 15 Rear 1st	35.3	27.6	35	30	0.3	-2.4

Plot 16 Rear 1st	37.7	30	35	30	2.7	0
Plot 17 Rear 1st	38.2	30.5	35	30	3.2	0.5
Plot 18 Rear 1st	39.4	31.7	35	30	4.4	1.7
Plot 19 Front 1st	52.5	44.8	35	30	17.5	14.8
Plot 19 Rear 1st	33.9	26.2	35	30	-1.1	-3.8
Plot 20 Front 1st	34.7	27	35	30	-0.3	-3
Plot 20 Rear 1st	33.3	25.6	35	30	-1.7	-4.4
Plot 21 Front 1st	52.1	44.4	35	30	17.1	14.4
Plot 21 Rear 1st	34.7	27	35	30	-0.3	-3
Plot 22 Front 1st	50.3	42.6	35	30	15.3	12.6
Plot 22 Rear 1st	47.4	39.7	35	30	12.4	9.7
Plot 23 Front 1st	46.7	39	35	30	11.7	9
Plot 23 Rear 1st	45.1	37.4	35	30	10.1	7.4
Plot 24 Front 1st	44.8	37.1	35	30	9.8	7.1
Plot 24 Rear 1st	42.4	34.7	35	30	7.4	4.7
Plot 25 Front 1st	44.3	36.6	35	30	9.3	6.6
Plot 25 Rear 1st	40.9	33.2	35	30	5.9	3.2
Plot 26 Front 1st	42.6	34.9	35	30	7.6	4.9
Plot 26 Rear 1st	38.5	30.8	35	30	3.5	0.8
Plot 27 Front 1st	41.8	34.1	35	30	6.8	4.1
Plot 27 Rear 1st	37.7	30	35	30	2.7	0
Plot 28 Front 1st	27.9	20.2	35	30	-7.1	-9.8
Plot 28 Rear 1st	41.2	33.5	35	30	6.2	3.5
Plot 29 Front 1st	26.7	19	35	30	-8.3	-11
Plot 29 Rear 1st	41	33.3	35	30	6	3.3
Plot 30-34 Front 1st	41.3	33.6	35	30	6.3	3.6
Plot 30-34 Rear 1st	38.2	30.5	35	30	3.2	0.5
Plot 35 Front 1st	42.5	34.8	35	30	7.5	4.8
Plot 35 Rear 1st	40.8	33.1	35	30	5.8	3.1
Plot 36 Front 1st	43.4	35.7	35	30	8.4	5.7
Plot 36 Rear 1st	41.5	33.8	35	30	6.5	3.8
Plot 37 Front 1st	39.3	31.6	35	30	4.3	1.6
Plot 37 Rear 1st	34.7	27	35	30	-0.3	-3
Plot 38 Front 1st	38.8	31.1	35	30	3.8	1.1
Plot 38 Rear 1st	26.1	18.4	35	30	-8.9	-11.6
Plot 39 Front 1st	35.3	27.6	35	30	0.3	-2.4
Plot 39 Rear 1st	23.6	15.9	35	30	-11.4	-14.1
Plot 40 Front 1st	34.9	27.2	35	30	-0.1	-2.8
Plot 40 Rear 1st	22.9	15.2	35	30	-12.1	-14.8
Plot 41 Front 1st	34.5	26.8	35	30	-0.5	-3.2
Plot 41 Rear 1st	23.3	15.6	35	30	-11.7	-14.4
Plot 42 Front 1st	33.3	25.6	35	30	-1.7	-4.4
Plot 42 Rear 1st	23.7	16	35	30	-11.3	-14
Plot 43 Front 1st	34.9	27.2	35	30	-0.1	-2.8

Plot 43 Rear 1st	24.5	16.8	35	30	-10.5	-13.2
Plot 44 Front 1st	25.4	17.7	35	30	-9.6	-12.3
Plot 44 Rear 1st	35.8	28.1	35	30	0.8	-1.9
Plot 45 Front 1st	38.5	30.8	35	30	3.5	0.8
Plot 45 Rear 1st	34.6	26.9	35	30	-0.4	-3.1
Plot 46 Front 1st	37.9	30.2	35	30	2.9	0.2
Plot 47 Rear 1st	33.7	26	35	30	-1.3	-4
Plot 47 Front 1st	37.5	29.8	35	30	2.5	-0.2
Plot 47 Rear 1st	33.3	25.6	35	30	-1.7	-4.4
Plot 48 Front 1st	22.7	15	35	30	-12.3	-15
Plot 48 Rear 1st	21	13.3	35	30	-14	-16.7
Plot 49 Front 1st	21.8	14.1	35	30	-13.2	-15.9
Plot 49 Rear 1st	33.3	25.6	35	30	-1.7	-4.4
Plot 50 Front 1st	21.6	13.9	35	30	-13.4	-16.1
Plot 50 Rear 1st	30.1	22.4	35	30	-4.9	-7.6
Plot 51 Front 1st	21.5	13.8	35	30	-13.5	-16.2
Plot 51 Rear 1st	31.1	23.4	35	30	-3.9	-6.6
Plot 52 Front 1st	21.1	13.4	35	30	-13.9	-16.6
Plot 52 Rear 1st	30.8	23.1	35	30	-4.2	-6.9
Plot 53 Front 1st	21	13.3	35	30	-14	-16.7
Plot 53 Rear 1st	32	24.3	35	30	-3	-5.7
Plot 54 Front 1st	33.8	26.1	35	30	-1.2	-3.9
Plot 54 Rear 1st	33.3	25.6	35	30	-1.7	-4.4
Plot 55 Front 1st	34.5	26.8	35	30	-0.5	-3.2
Plot 55 Rear 1st	34.3	26.6	35	30	-0.7	-3.4

Table 4: Computer Model Tabulated Output Data - 1st Floor Level

7.3 Lmax Data

As well as the Daytime and Night time Leq,T data as per the requirements of BS8233:2014, there is also the necessity to assess the Lmax data during night time hours of 23:00-07:00.

Using the tabulated data from the computer model, the difference between the survey position and the nearest property to the road was determined. This difference was applied to the Lmax data from the survey to show the number of occurrences an Lmax,1min would exceed 45dB within the property during the night time. The criterion of ProPG:2017 is that there should be no more than 10 occurrences in a bedroom during the night time.

The smallest difference was 6.3dB (for the nearest property to the road – Plot 19 Front 1st). With this distance difference plus the attenuation of an open window being 13dB, the Lmax data was processed to show how many Lmax occurrences of greater than 45dB existed.

There was an average of 130 occurrences for the 4 nights measured.

This calculation was carried out for all other properties at 1st floor height and the following Reception Points were found to have more than 10 occurrences of Lmax >45dB during the night time:

Reception Point	Average No. of Lmax Occurrences >45dBA
Plot 19 Front 1 st Floor	130
Plot 21 Front 1 st Floor	118
Plot 22 Front 1 st Floor	71
Plot 8 Front 1 st Floor	53
Plot 9 Front 1 st Floor	53
Plot 7 Front 1 st Floor	47
Plot 22 Rear 1 st Floor	16
Plot 23 Front 1 st Floor	10

Table 5: Reception Points with internal Lmax levels exceeding 45dB more than 10 times

7.4 Glazing

In all cases, standard thermal double glazing, when closed will comfortably provide sufficient attenuation to meet both the BS8233:2014 requirements for the Daytime and Night time Leq,T and the ProPG:2017 requirements for Night time Lmax within bedrooms and in the majority of cases, open windows will also be sufficient, except for those highlighted in Sections 7.2 and 7.3 of this report.

7.5 Ventilation

A BS8233 Rigorous calculation has been carried out for the worst-case property (Plot 19 Front 1st Floor) to show if trickle vents (with a free area of 8000mm² as per the requirement of Approved Document L) can still allow the façade to provide sufficient sound reduction.

The calculation showed that even with such a ventilator in the open position the 1st floor of Plot 19 that faces Hanlye Lane would comfortably achieve the criteria of BS8233:2014 for Leq,T sound levels during the daytime and night time as well as the ProPG:2017 requirements for Lmax during the night time.

The Rigorous Calculation is shown in the appendices of this report.

7.6 Building Fabric

Usually the weakest part, in terms of noise ingress, of a building's façade are the windows and trickle ventilators. The ANC/IOA AVOG guide states that a sound reduction of around 21dB can be achieved with standard glazing and trickle vents.

As the highest sound reduction required is 17.5dB standard glazing and trickle vents would therefore be acceptable. This confirms the outcome of Sub Sections 7.4 & 7.5 above.

7.7 Open Windows – ADO Assessment

The model shows that, due to the layout, there will be no facades incident to night time noise levels as high as 49dBA (the highest night time noise level is 44.8dBA).

Based on the IOA/ANC guidance the level, inside the worst-case bedrooms, will be 35.8dBA which therefore comfortably achieves the Document O (simplified Method) noise criteria.

The above relates to wide open windows. When less cooling is required, windows could be closed or only partially open which would reduce the associated internal noise level.

In terms of Lmax events, for the worst-case plots where the external level is 44.8dBA, there should be no more than 3 events, per night, over the ADO 55dBA limit (with window open).

7.8 Outdoor Amenity Spaces.

BS8233:2014 states that to protect from moderate annoyance, the daytime Leq,16 hour in an outdoor amenity space (i.e. the garden) should not exceed 50dBA.

The contours from the computer model show that all garden spaces for the 55 properties comfortably achieve this criterion.

8 Conclusion & Summary

The ProPG Stage 1 Assessment of the location shows that sound pressure levels at the site are between the Low and the bottom of the medium risk category.

Regardless, an in-depth assessment of the soundscape has been conducted to ascertain the mitigation methods needed for the proposed development to meet the relevant noise criteria for each of the 55 properties at their front and rear facades and at ground and first floor levels by the use of a computer noise modelling software.

The mitigation strategy for the development is summarised below:

For the majority of the properties, windows can be opened whilst still achieving the noise criteria for both Daytime and Night time Leq sound levels, as well as night time Lmax levels. A handful of properties cannot rely on open windows, however the worst-case required sound reduction (SRI) of the building envelope is for Plot 19 (Front Façade at 1st floor level), which is only 17.5dB.

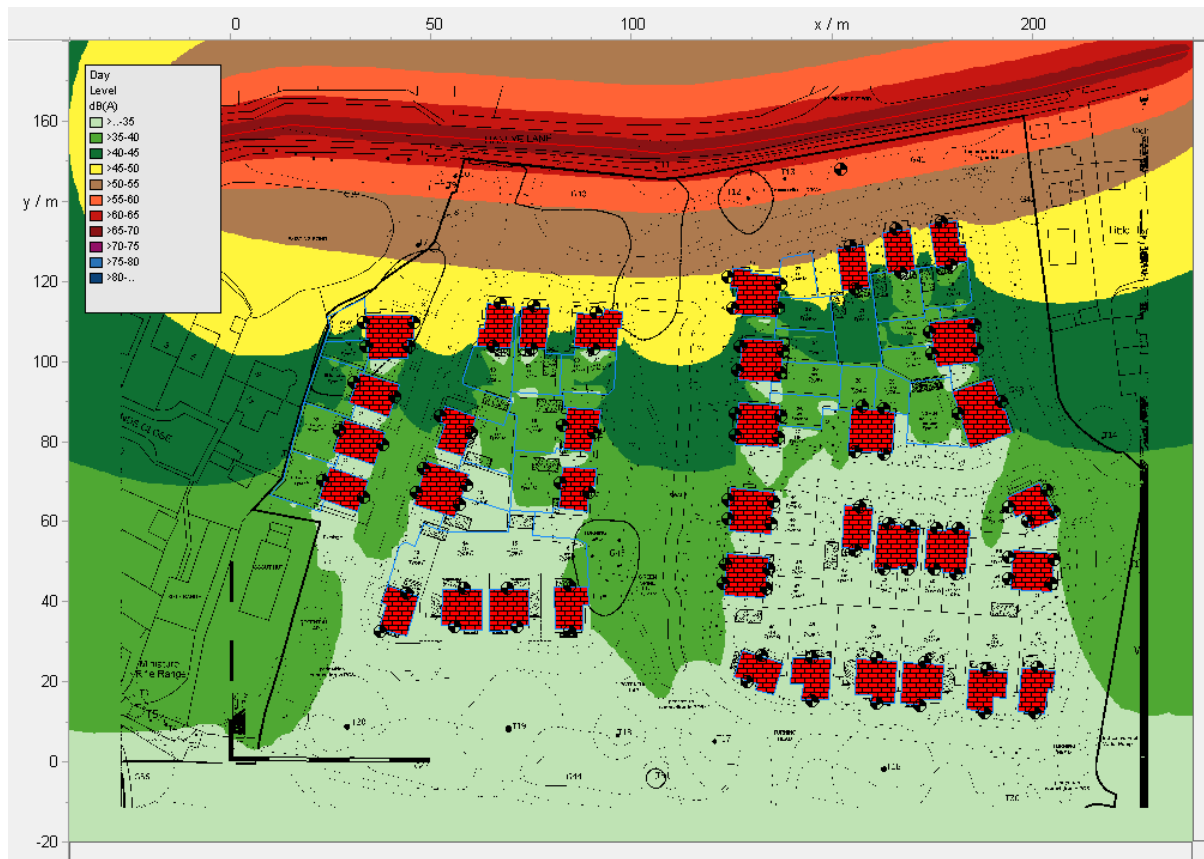
Full data can be found in Section 7.2 of this report as to which properties cannot rely on an open window.

This said, the assessment has shown that standard thermal double glazing when closed and with standard trickle vents with a free-area of 8000mm² can still be used and that acoustically enhanced units are not required.

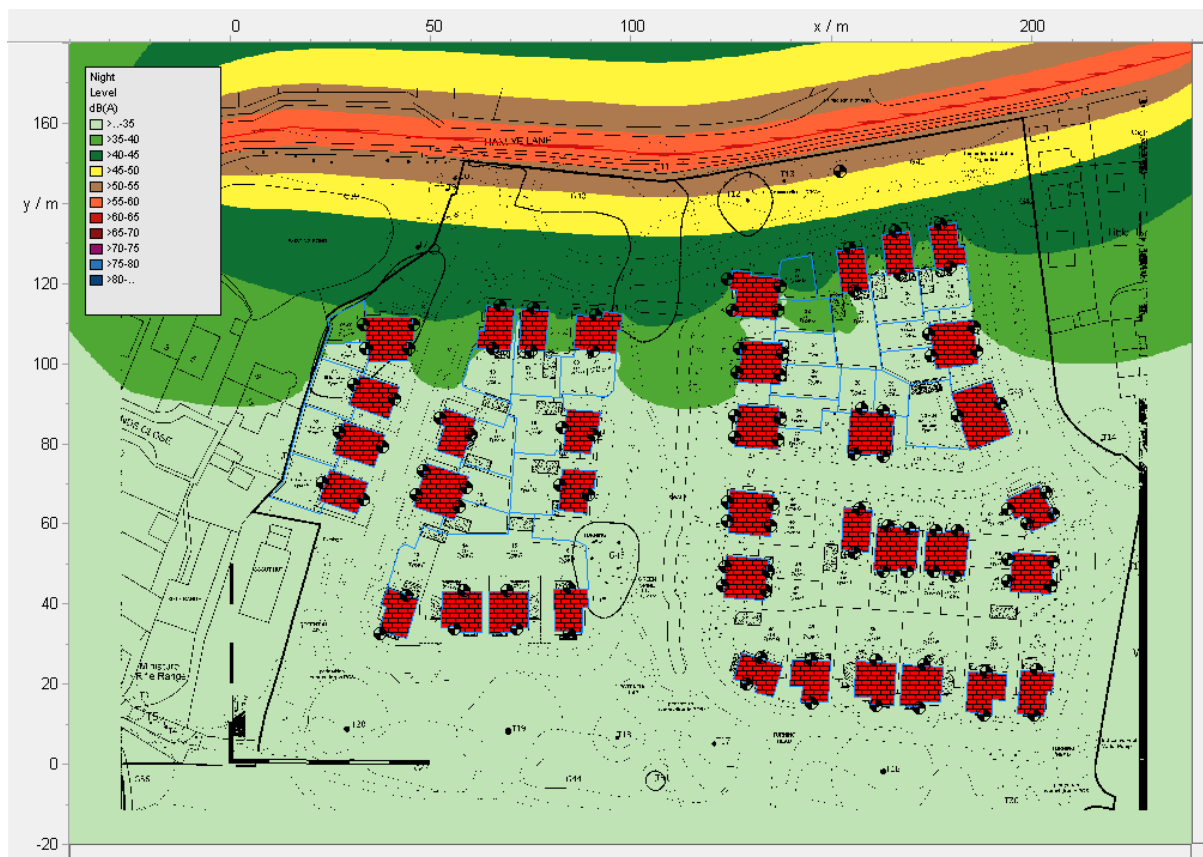
In terms of overheating compliance, this development has no issue in complying with the requirements of Approved Document O (See Sub Section 7.7).

It is considered that from the perspective of acoustics, there is no reason for the planning permission to be withheld.

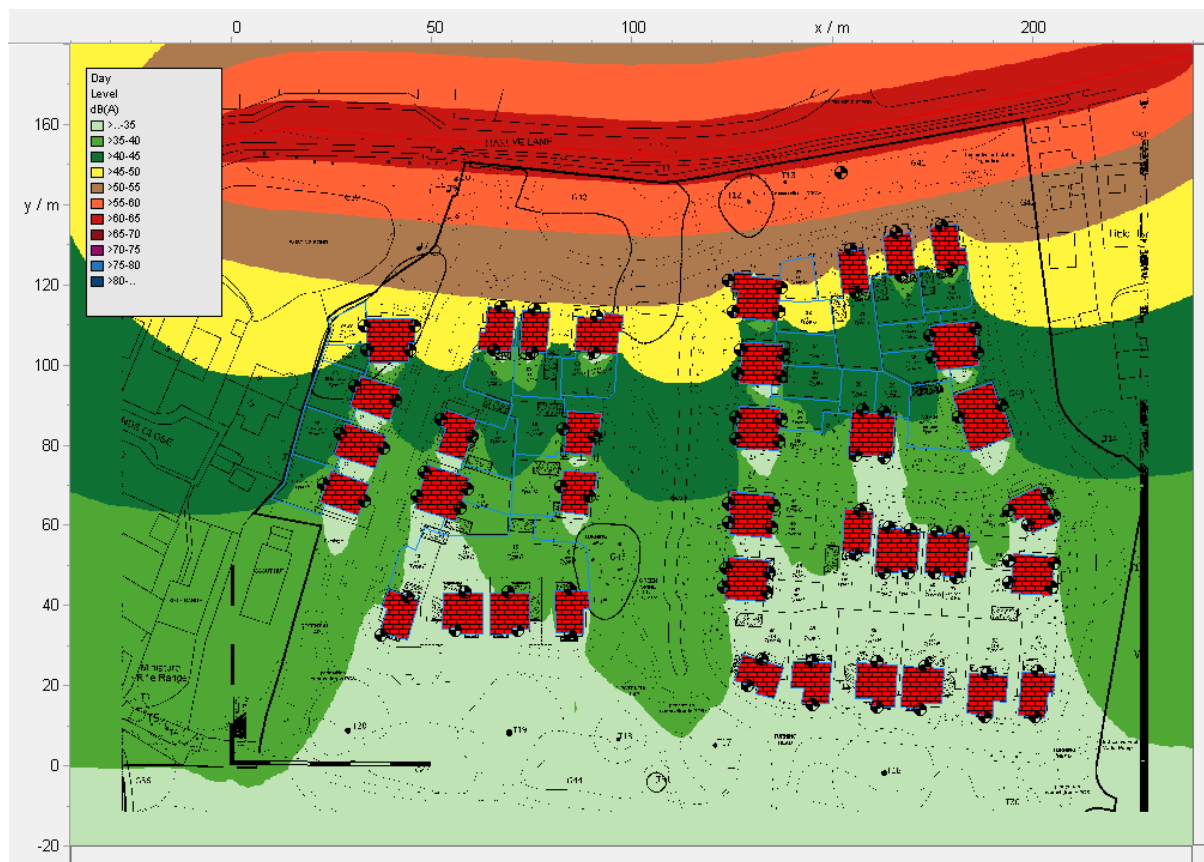
Ground Floor Level – Daytime



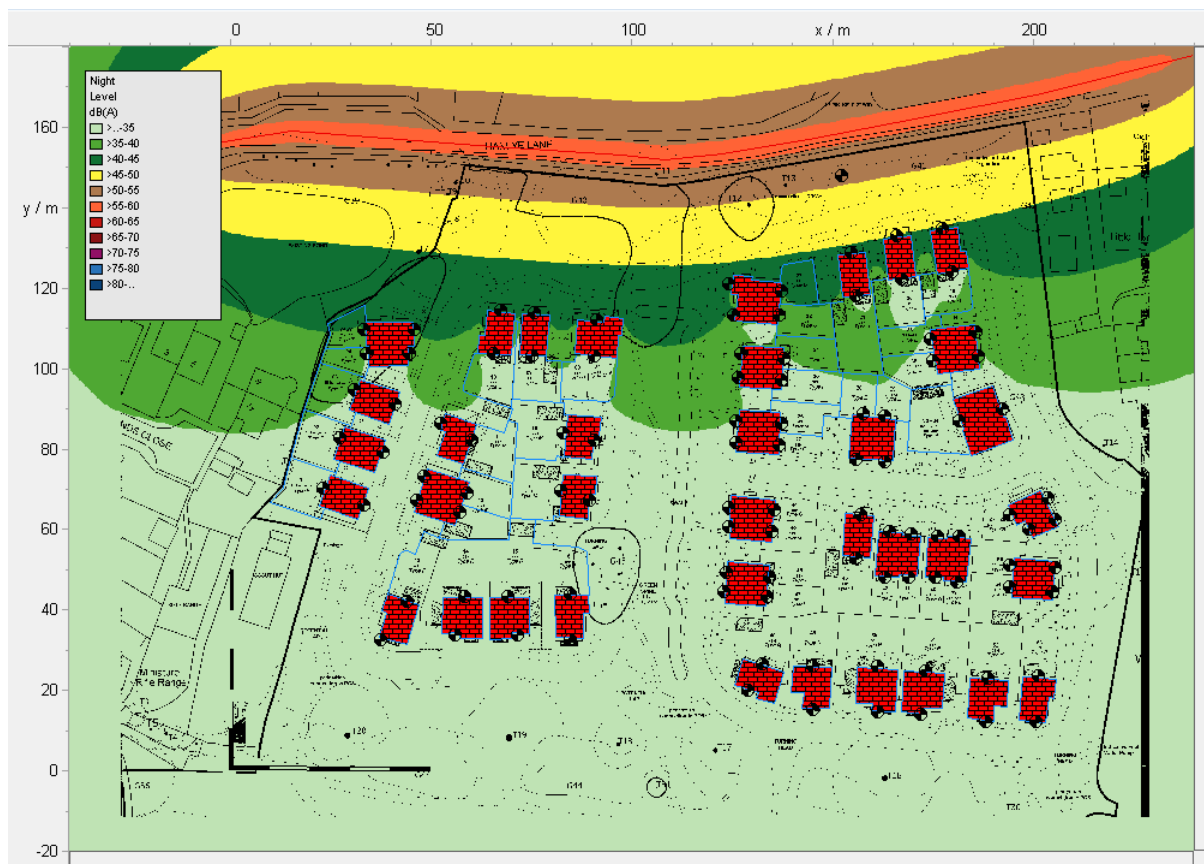
Ground Floor Level – Night time



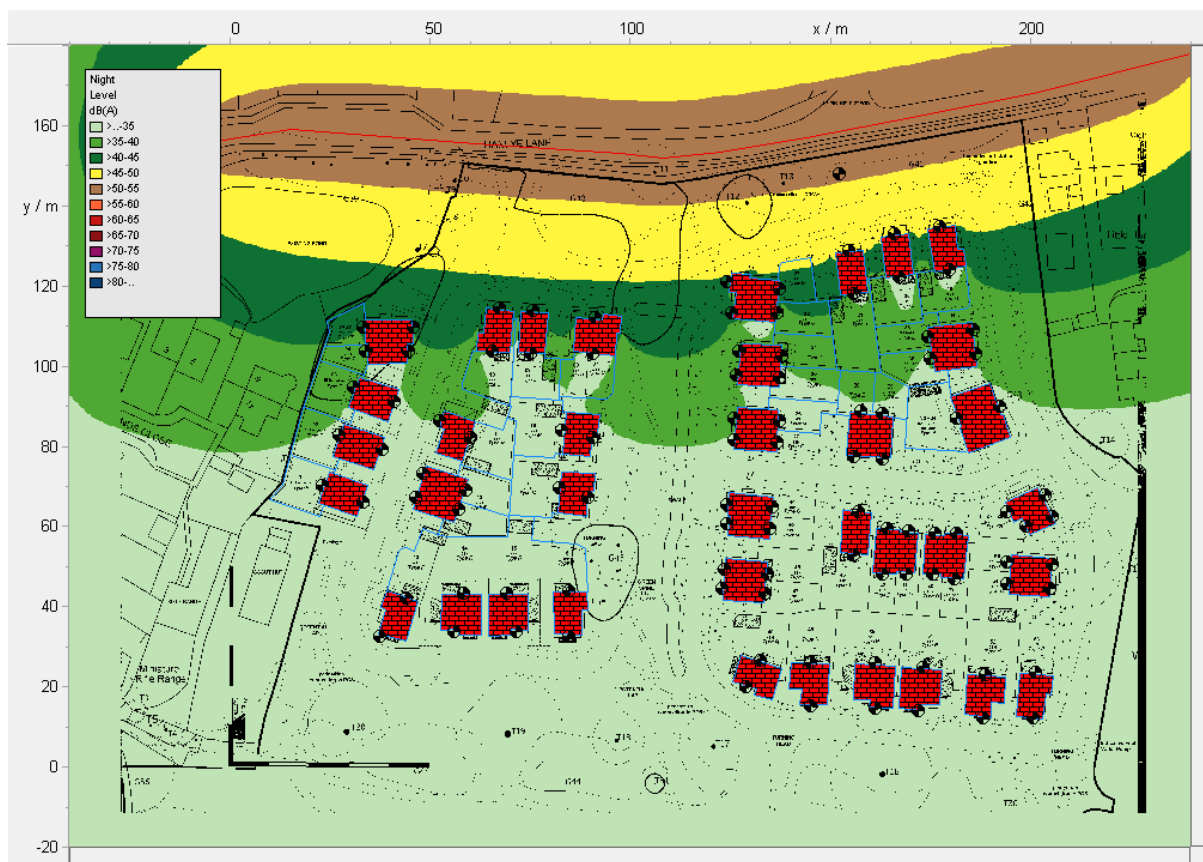
1st Floor Level – Daytime



1st Floor Level – Night time



2nd Floor Level – Night time



Appendix B – BS8233 Rigorous Calculation – Plot 19 1st Floor Front

For the purposes of this report, only the rigorous calculation for the 1st floor of the worst-case plot is shown below:

Non Frequency Dependent Variables			Key for Table Below	
Term	Derivation	Value	R _{wi}	Sound Reduction of Window (Octave)
A _o	Given in BS EN 20140-10 = 10 (m ²)	10	R _{ew}	Sound Reduction Index of External Wall (Octave)
S _f	Total Facade Area (m ²)	16.5	R _{rr}	Sound Reduction Index of Roof/Ceiling (Octave)
S _{wi}	Window Area (m ²)	3.5	A	Equivalent Absorbtion Area of Rx Room
S _{ew}	External Wall Area (m ²)	13.5	D _{n,e}	Insulation of Trickle Vent (BS EN 20140-10)
S _{rr}	Ceiling Area (m ²)	0.001		
S	Total Area sound enters the room (m ²)	16.5		

Frequency Dependent Variables							
Term	Description	Octave Band Centre Frequency					
		125	250	500	1000	2000	4000
Leq,ff	Free-Field External Noise Level	65.0	48.1	46.1	46.1	43.1	36.1
D _{n,e}	Greenwood 8000HD	32.6	31.6	29.1	28.4	30.1	33.5
R _{wi}	4 12 4	24	20	25	35	38	35
R _{ew}	Cavity Masonry (Brick Cavity with Insulation lightweight block)	41	39	44	52	60	65
R _{rr}	No Roof	100	100	100	100	100	100
A	Equivalent Absorbtion Area of Room (Copied from BS8233)	11.00	14.00	16.00	16.00	15.00	15.00

BS8233 Calculation Details						
Term From Equation Below	Octave Band Centre Frequency					
	125	250	500	1000	2000	4000
Leq,ff	65	48.1	46.1	46.1	43.1	36.1
A _o /S . 10 [^] (-D _{n,e} /10)	0.0003331	0.000419	0.000746	0.000876024	0.000592265	0.000270717
S _{wi} /S . 10 [^] (-R _{wi} /10)	0.0008445	0.002121	0.000671	6.70786E-05	3.36189E-05	6.70786E-05
S _{ew} /S . 10 [^] (-R _{ew} /10)	6.499E-05	0.000103	3.26E-05	5.16238E-06	8.18182E-07	2.58732E-07
S _{rr} /S . 10 [^] (-R _{rr} /10)	6.061E-15	6.06E-15	6.06E-15	6.06061E-15	6.06061E-15	6.06061E-15
10log10(S/A)+3	4.7609126	3.713559	3.13364	3.133639616	3.413926852	3.413926852
Leq,2	40.70393	26.03536	20.84425	19.00293728	14.48453843	4.803796345
A-Weighting	-16.1	-8.6	-3.2	0	1.2	1
A-Weighted Leq	24.60393	17.43536	17.64425	19.00293728	15.68453843	5.803796345

A-Weighted Level Outside	53
BS8233 Predicted Internal A-Weighted Level	27
Prediced Building Envelope SRI	25

BS8233 Calculation can be seen below:	
$L_{eq,2} \approx L_{eq,ff} + 10 \log_{10} \left(\frac{A_o}{S} 10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S} 10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S} 10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S} 10^{\frac{-R_{rr}}{10}} \right) + 10 \log_{10} \left(\frac{S}{A} \right) + 3$	