Chartered Building Consultancy

Acoustic South East

Road Traffic Noise Assessment for Discharge of Condition

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Date: 04/10/2024
Project: J3414
Issue 2

Site: **Grainingfold Farm, Horsham Road, Five Oaks, RH14 9AT**
Client: **Susan Hart**

Constructionline Part of Capita plc
CQMS Safety Scheme
ANC THE ASSOCIATION OF NOISE CONSULTANTS
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Report by: Martyn Chambers BA (Hons) MSc PGDip: Acoustics MIOA
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Issue 1	07/02/2023	Original Issue
Issue 2	04/10/2024	Revised Issue to Account for Client Discussions with the Environmental Health Department at HDC

1 Introduction and Executive Summary

Acoustic South East have been appointed to undertake a road traffic noise assessment of a planned conversion of an agricultural barn into two 3-bedroom properties The site is located at Grainingfold Farm, Horsham Road, Five Oaks, RH14 9AT

The development has gained planning consent. Condition 2, of the decision notice: DC/20/1477 relates to the impact of road traffic noise at the location. For convenience it has been reproduced below:

2 - Prior to the commencement of the development hereby permitted a noise impact assessment which quantifies and assesses the impact of road traffic noise on the residential amenity of future occupiers of the dwellings shall be submitted to and approved in writing by the Local Planning Authority. The assessment shall include details of a scheme to protect future residents from any adverse noise impacts. The scheme shall be carried out in accordance with the agreed details prior to the occupation of the dwelling and shall be retained as such thereafter

The purpose of this assessment is to assess the following:

- Measure the environmental noise levels at the location of the planned development.
- Provide mitigation measures (if necessary)

Noise has been measured on the existing site. Noise propagation around the planned development has been predicted using the computer program IMMI (Wolfel).

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
- Pro-PG (Planning and Noise Guidance) 2017
- Planning Noise Advice Document Sussex, 2023

The report shows that Bedroom 1 of Plot 2 would meet the relevant criteria with windows open.

The lounge of Plot 2 would also meet the requirements of BS8233:2014 with windows open of the southern facade. With standard thermal double glazing and MVHR applied, all habitable spaces within plots 1 and 2 comfortably achieve the required internal sound pressure levels in Table 4 of BS8233:2014.

The revised positioning of the external fence line also ensures that external amenity areas are also protected from road traffic noise and easily achieve BS8233:2014 and World Health Organisation Guidelines for Community Noise dated 1999, revised 2108.

The implementation of the suggested mitigation methods protects future residents and will allow the local planning authority to discharge condition 2 of DC/20/1477

2 Context, Noise Criteria & Noise Assessment Methodology

2.1 Site Description

The consented development is to the south of the A264 (Horsham Road). The full address is: Grainingfold Farm, Horsham Road, Five Oaks, RH14 9AT.

The consented conversion will convert an existing agricultural barn into two 3-bedroom properties. One located at the northern half of the barn the second in the southern half of the barn.

2.2 Site Location

The Site Location can be seen below in Figure 1.

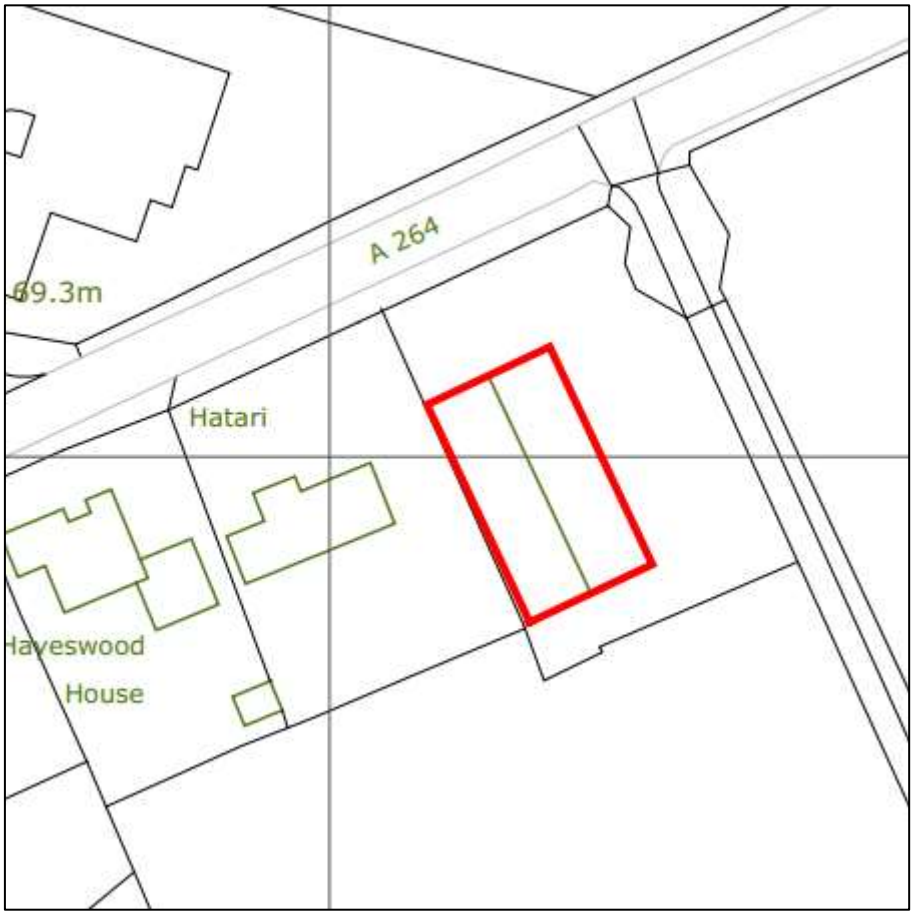

Figure 1: Site Location

2.3 Soundscape

The soundscape at the site is dominated nearly entirely by road traffic noise from the A264 (Horsham Road), which runs past the site to the north.

2.4 Consented Site Layout

The consented ground and first floor layouts can be seen below in figure 2. The unit with the car port will be referred to in the report as Unit 1 and the unit without the car port will be referred to as Unit 2. Unit 1 has rooms that face north towards the A264.

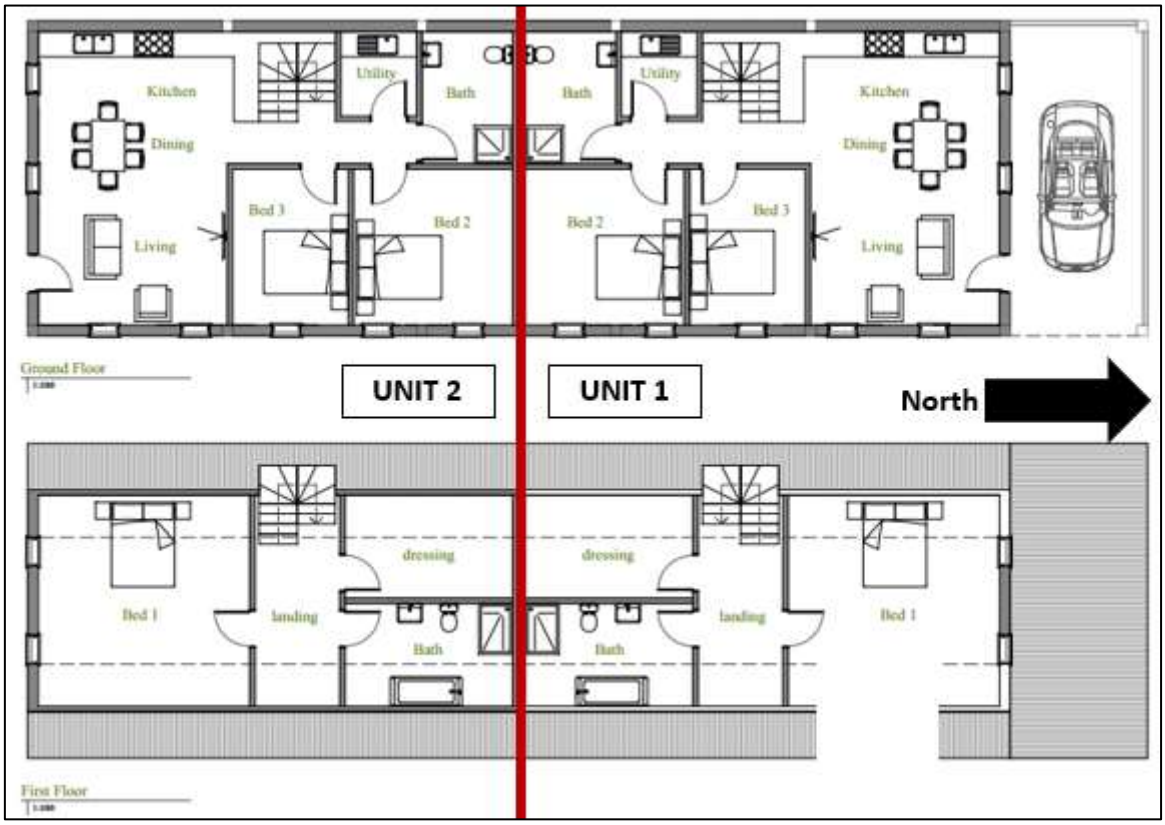

Figure 2: Consented Floor Plan

2.5 Discussions with Horsham District Council

The report has been reissued to account for discussions between the client and Horsham Environmental Health department (Kevin Beer) as technical consultees to the local planning authority.

Specifically, it has been decided that the whole of the units will be ventilated using Mechanical Ventilation and Heat Recovery (MVHR) and not passive acoustic ventilation. Revisions have also been made to the positioning of the previously submitted fence line to protect future occupants with regard to external amenity areas and ensuring compliance with BS8233:2014 and the World Health Organisation Guideline for Community Noise dated 1999, revised 2018.

3 Standards and Guidance

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

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

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

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."

3.2 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 $L_{Aeq,16\,hr}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16\,hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16\,hr}$	30 dB $L_{Aeq,8\,hr}$ 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 3: ProPG Criteria

3.3 Relevant Standards Review and Noise Assessment Methodology.

A noise survey was set up to assess the dominant noise source at the location the A264 (Horsham Road).

The report assesses the collected data and used it to construct a computer model of the existing site and consented development.

The results of the noise model were used to calculate the necessary mitigation methods to allow the proposed new rooms of the extension to meet values specified within Table 4 under section 7.7.2 of BS 8233:2014. 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 $L_{Afmax,1\ minute}$ values were used for this section of the assessment.

4 Noise Survey Baseline Conditions and Results

4.1 Survey and Measurement Locations

A sound survey was carried out from 18th to 24th May 2022 in order to assess the soundscape of the site. The unattended survey was the same approximate distance as the consented façade of the barn is to the A264.

The microphone was based on a monopole at approximately 2 meters from the ground. The survey location will be classed as freefield. The location of the sound survey can be seen below in figure 4.



Figure 4: Survey location

4.2 Baseline Conditions

- Survey carried out by:
- Martyn Chambers: BA (Hons) MSc PGDip: Acoustics AMIOA
- Equipment used: Castle Mirus Class 1 sound level meter
- Weather conditions: Variable: (Wet and dry) Wind: variable direction Mainly less than 5ms^{-2}

The Meter was calibrated before and after commencing the noise measurements (@94dB no drift).

It is possible that some agricultural works were conducted during the sound survey. No correction has however been made to the results to compensate for this and the results would therefore be considered worst case.

4.3 Sound Survey Results

The survey data has been used to calculate the external 16hr day time and the 8hr night time period sound pressure levels. Table 2 below shows the entire day and night time period sound levels that were measured at the survey position.

Date (2022) May	Day	Time Period	Free field Level $L_{Aeq,16hr/8hr}$ – dB(A)
19th	Thursday	07:00-23:00hrs	59.6
20th	Friday	07:00-23:00hrs	60.3
21st	Saturday	07:00-23:00hrs	60.0
22nd	Sunday	07:00-23:00hrs	58.5
23rd	Monday	07:00-23:00hrs	59.3
Arithmetic Average	**All days**	**07:00-23:00hrs**	**59.6**
18th/19th	Weds/Thurs	23:00-07:00hrs	53.5
19th/20th	Thurs/Fri	23:00-07:00hrs	52.4
20th/21st	Fri/Sat	23:00-07:00hrs	55.8
21st/22nd	Sat/Sun	23:00-07:00hrs	51.9
22nd/23rd	Sun/Mon	23:00-07:00hrs	52.4
23rd/24th	Mon/Tues	23:00-07:00hrs	52.8
Arithmetic Average	**All Nights**	**23:00-07:00hrs**	**53.1**

Table 2: Survey noise levels

5 Computer Noise Model for Road Traffic Noise

In order to see how noise varies at different positions around the consented development it is possible to produce a noise contour map. A computer noise model has been completed using the computer package IMMI. The survey data and drawings of the proposed development (inducing topographic information) have been used to complete the noise models. IMMI faithfully implements the propagation method of ISO-9613:1996; Acoustics – Attenuation of sound during propagation outdoors. An “existing site” noise model was first completed to allow the calibration of the noise sources A264 (Horsham Road), The existing site model contained nearby buildings and the existing buildings.

The A264 (Horsham Road) was added to the existing noise model as a line source. The line source day/night time sound power was adjusted until the sound pressure level at the survey reception point (RP) matched the survey data in section 3.6. To ensure a robust report the worst-measured day and night readings were used in this model calibration process. The existing day contour noise model can be seen below in figure 6.

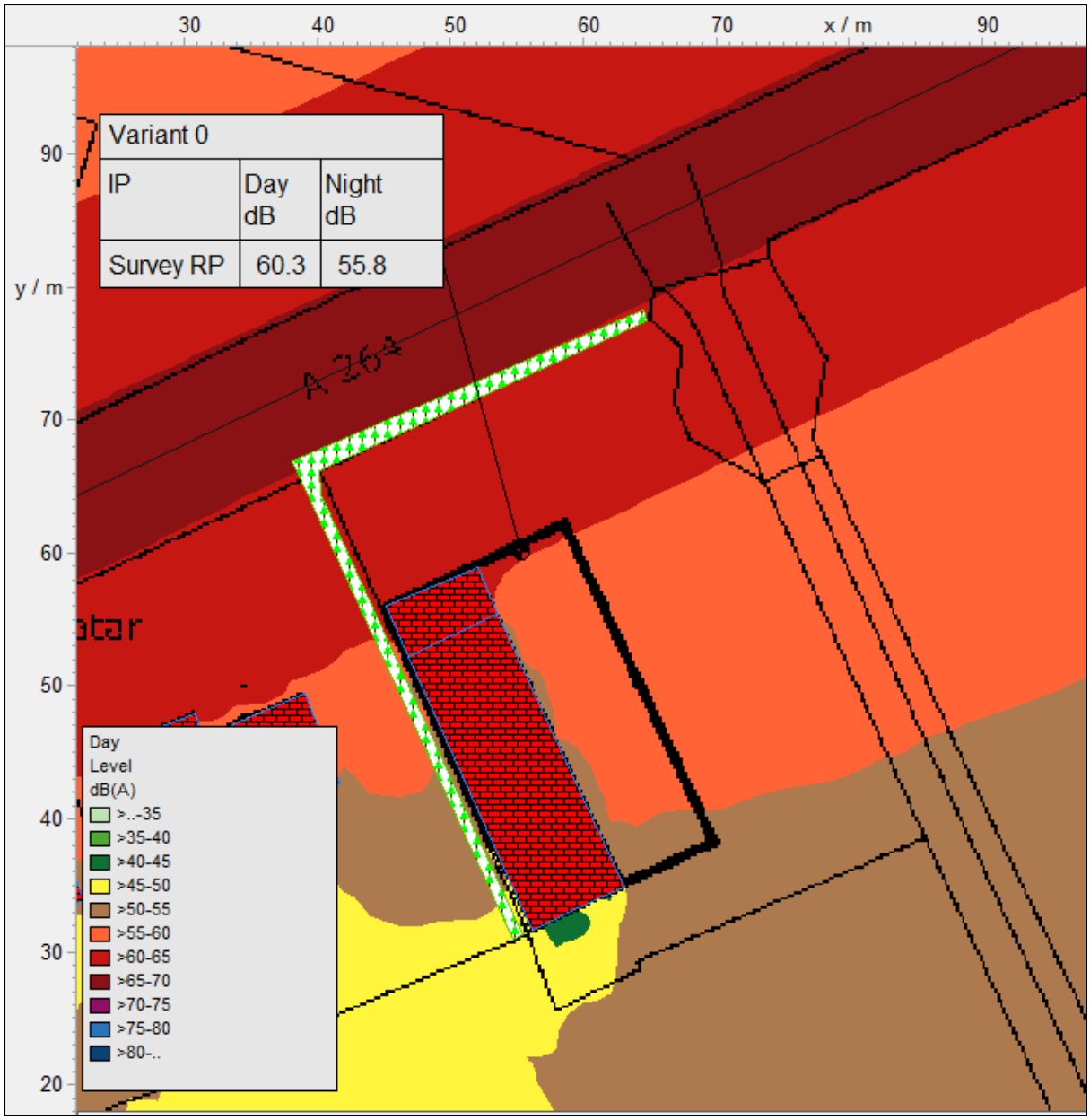

Figure 5: Existing day time period noise contour model (grid at 4m)

5.1 Consented Development Noise Model Methodology

An updated model of the site was then created with reception points (RPs) added at different heights and locations around the consented conversion. The locations were chosen to show how the environmental noise will impact the rooms on the different facades of the proposed conversion.

The reception point sound pressure levels were calculated for the day and night-time (Model says dB but levels are actually dBA values). The daytime noise contour model can be seen below in figure 6:

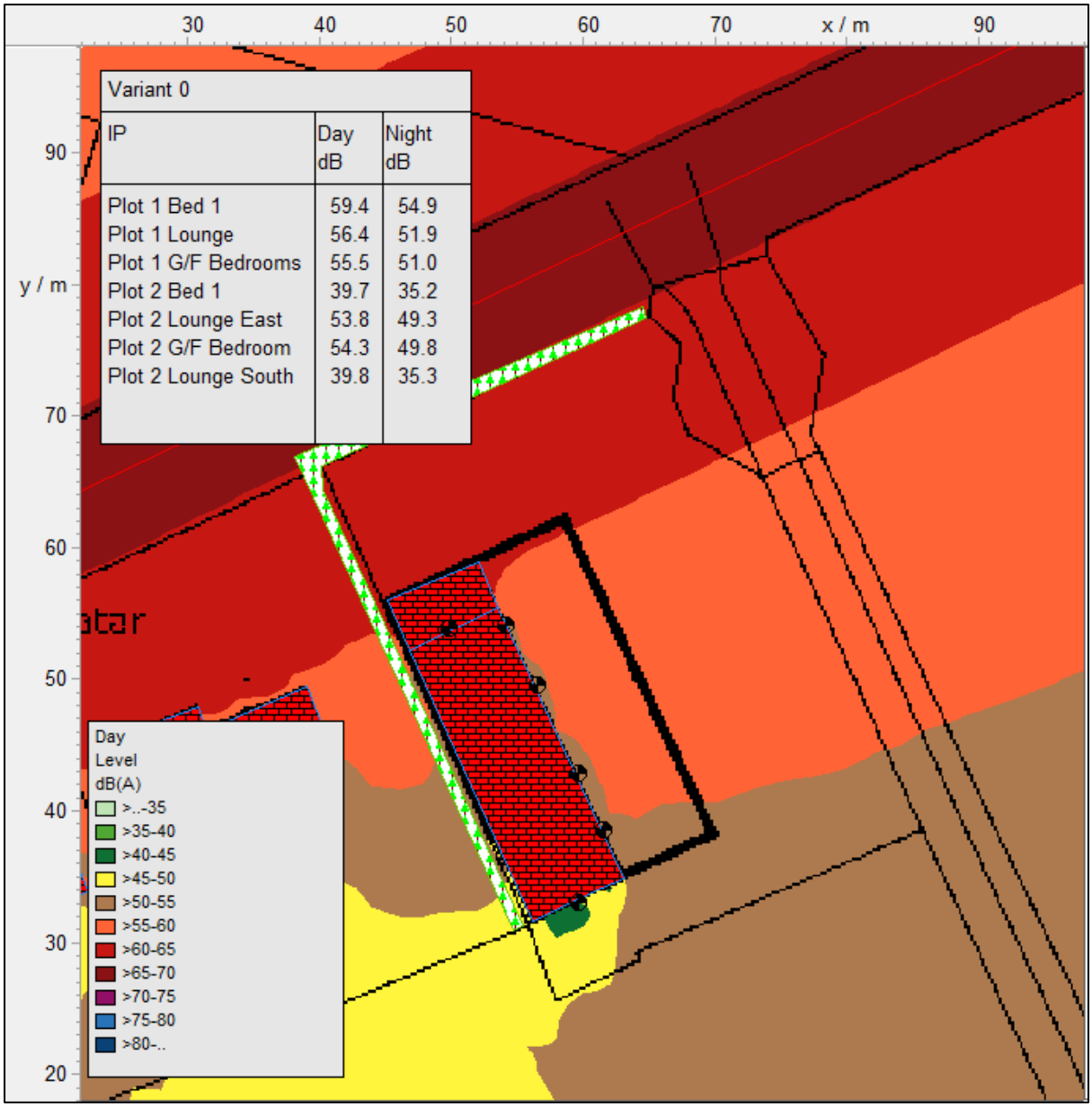

Figure 6: Proposed Noise Model (Contour Grid at 4m)

Table 3 below shows calculated sound pressure levels at the façade of the proposed relevant RPs:

RP	Day: $L_{Aeq,16\text{-}Hour}$	Night: $L_{Aeq,8Hour}$
Plot 1 Bedroom 1	59.4	54.9
Plot 1 Lounge	56.4	51.9
Plot 1 Ground floor Bedrooms	55.5	51.0
Plot 2 Bedroom 1	39.7	35.2
Plot 2 Lounge East	53.8	49.3
Plot 2 Lounge South	39.8	35.3
Plot 2 Ground floor Bedrooms	54.3	49.8

Table 3: Modelled Reception Point Levels dB(A)

6 Noise Mitigation Measures

6.1 Noise Criteria

6.1.1 Continuous Noise Levels

The BS8233:2014 and WHO 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 35/30dB(A) Day/Night $L_{Aeq,\ 16\ hour/8\ Hour}$
- Lounges 35dB(A) Day $L_{Aeq,\ 16\ hour}$

6.1.2 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 LAmax 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.

6.2 Required Sound Reduction of Building Envelope – Continuous Noise levels

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

Table 4 below shows the required SRI which will have to be achieved by the building envelope for both the 16-hour day time and the 8-hour night time periods. Please note table 4 does not contain any calculation for the required SRI for the plot's lounges during the night time period, this is because table 4 of BS8233:2014, only provides a day time criterion for this room type.

Location	External Free Field Day: $L_{Aeq,16Hr}$	Criterion	ReqSRI	External Free Field Night $L_{Aeq,8Hr}$	Criterion	ReqSRI
Plot 1 Bedroom 1	59.4	35	24.4	54.9	30	24.9
Plot 1 Lounge	56.4	35	21.4	51.9	N/A	
Plot 1 G/F Bedrooms	55.5	35	20.5	51	30	21
Plot 2 Bedroom 1	39.7	35	4.7	35.2	30	5.2
Plot 2 Lounge	53.8	35	18.8	49.3	N/A	
Plot 2 Lounge South	39.8	35	4.8	35.3	N/A	
Plot 2 G/F Bedrooms	54.3	35	19.3	49.8	30	19.8

Table 4: Required SRI at RP's

6.3 Required Sound Reduction of Building Envelope – L_{Amax}

Table 4 in the above section shows the required SRI for continuous noise levels. However, for this level of sound reduction to be acceptable there is also a requirement to meet the ProPG 2017. This suggests limiting the number of L_{Amax} events (over 45dBA) within a bedroom to no more than 10 occurrences per night-time period (23:00-07:00hrs).

Calculations were achieved by taking into account the difference between the measured sound pressure level at the survey point and the predicted RP in question.

This distance attenuation was then combined with the suggested SRI for the relevant RP from table 4 to see how many $L_{Amax,}$ above 45dBA there would be inside the bedroom over a night-time period (between 23:00 and 07:00). The results are shown below in Table 5.

Location	BS8233 SRI	Night 1	Night 2	Night 3	Night 4	Night 5	Night 6	Average
Plot 1 Bedroom 1	24.9	17	15	12	5	10	8	11.2
Plot 1 G/F Bedrooms	21	17	15	12	5	10	8	11.2
Plot 2 Bedroom 1	5.2	17	15	12	5	10	8	11.2
Plot 2 G/F Bedrooms	19.8	17	15	12	5	10	8	11.2

Table 5: $L_{Amax,\ 1min}$ Calculations With suggested Minimum SRI based on Continuous Noise Levels Criteria.

Unfortunately, neither of the studio flats would have satisfied the L_{Amax} criterion if the SRI was based on a specification necessary to attenuate for only continuous noise levels. Therefore, the trial SRI was adjusted until it reduced the number of L_{Amax} events above 45dBA to below 10 on all nights of the survey at each survey location.

The results of this calculation are provided in the table below

Location	Inputted SRI	Night 1	Night 2	Night 3	Night 4	Night 5	Night 6	Average
Plot 1 Bedroom 1	26	9	4	8	1	3	4	4.8
Plot 1 G/F Bedrooms	22	9	4	8	1	3	4	4.8
Plot 2 Bedroom 1	7	6	3	6	1	3	2	3.5
Plot 2 G/F Bedrooms	21	9	4	6	1	3	4	4.5

Table 6: $L_{Amax,\ 1min}$ with Suggested minimum RP SRI

The required SRIs shown in the above table 6 will therefore be the minimum sound reduction indices required for the assessed noise sensitive receptors.

6.4 Glazing and Ventilation

The ANC published Acoustics Ventilation and Overheating Guidance (AVOG) states that a partially open window would provide a maximum sound reduction index of 13dB(A). At most RP's around the consented development the required SRI would exceed the values provided by an open window. The exceptions would be the RP representing Plot 2 Bedroom 1. This is a south facing window and therefore facing away from the A264. For this reception point the glazing requirements would be driven by thermal considerations outside of the scope of the current assessment.

The second exception would be the RP representing the southern facade of Plot 2's lounge. The sound pressure levels on the eastern facade of Plot 2's lounge would exceed the internal sound pressure levels criterion with windows open. However, the windows of the lounge on the sheltered southern facade would be able to be opened without the internal ambient noise levels within the lounge exceeding the criterion of table 4 of BS8233:2014. Therefore, these windows would be able to provide ventilation to the residents.

The remainder of the properties would require an alternative source of ventilation to opening windows. Due to the site only being ProPG2017 categorised as low to medium risk it is likely that passive ventilation (trickle ventilators or through the wall ventilators) would be the most practical solution. Notwithstanding this, as previously stated, the client has opted for a system 4, Mechanical Ventilation with Heat Recovery (MVHR) to provide sufficient ventilation to the room spaces.

In order to calculate the required specification of the glazing and mechanical ventilation systems, BS8233 "Rigorous Calculation" have been conducted. This calculation method can be used to predict the sound insulation provided by the building envelope (Calculation detailed in BS8233 Annex G.2) and full details of the calculations can be found in the appendix of the report.

Calculation of Glazing and Ventilation and Resulting SRI and Internal SPL					
Location	**Required SRI**	**Windows**	**Ventilation**	**Internal SPL**	**SRI Achieved**
Plot 1 Lounge	21.4	4\12\4	MVHR	27	30
Plot 1 GF Bedroom	22	4\12\4	MVHR	25	30
Plot 1 Bedroom2	26	4\12\4	MVHR	18	33
Plot 2 Lounge	19	4\12\4	MVHR	25	29
Plot 2 Bedroom 1	7	4\12\4	MVHR	10	40
Plot 2 GF Bedroom 2	21	4\12\4	MVHR	22	32
Plot 2 Bedroom 3	21	4\12\4	MVHR	19	35

Table 7: Glazing/Ventilation Specification

** RE the glazing specification: This is the required $R_{traffic}$ of the frame and glazing together. If the glazing supplier has test results for the glazing on its own an $R_{traffic}$ value 2-3dB higher would be required (glazing tested on its own will outperform glazing that is tested within a window frame).*

In considering MVHR, the client should be aware of design criteria listed in the Acoustics, Ventilation and Overheating Guide dated Jan 2020 in 3.3.1:

"*Evidence [20] indicates that "a more prudent limit for mechanical services noise around 24 – 26 dB(A) is likely to be required to prevent an adverse reaction from most occupants while falling asleep*". The selection of MVHR units should therefore be as quiet as possible when placed into the residential demise.

Table 7 clearly shows that BS8233:2014 table 4 values are comfortably achieved with the use of thermal double glazing and the use of mechanical ventilation (MVHR).

6.5 Outdoor Amenity Spaces.

A noise model was created to assess sound pressure levels predicted within the outdoor amenity space. A privacy fence at 2 meters high was originally included at the northern boundary of the application site. By continuing the fence line to the South along the Eastern boundary, the reception points are noted to be reduced further still to the following:

- Plot 1 Garden – 49.4 dB $L_{Aeq,\ 16\ hour}$ and
- Plot 2 Garden – 47.1 $L_{Aeq,\ 16\ hour}$

The 2D noise contour has been reset from 2m to 0.5m resolution to present more clearly the likely road traffic noise and impact of the additional Eastern noise barrier/fence line. This comfortably satisfies both BS8233:2014 and the World Health Organisation Guidelines for Community Noise dated 1999, revised 2018 with regard to external amenity and noise exposure.

The 2D noise contour extract has also been annotated to provide clarity over the model components to illustrate the road, the existing treeline and the proposed fence positioning.

Any materials proposed to construct the fence line must have a density of no less than 12kg/m^2.

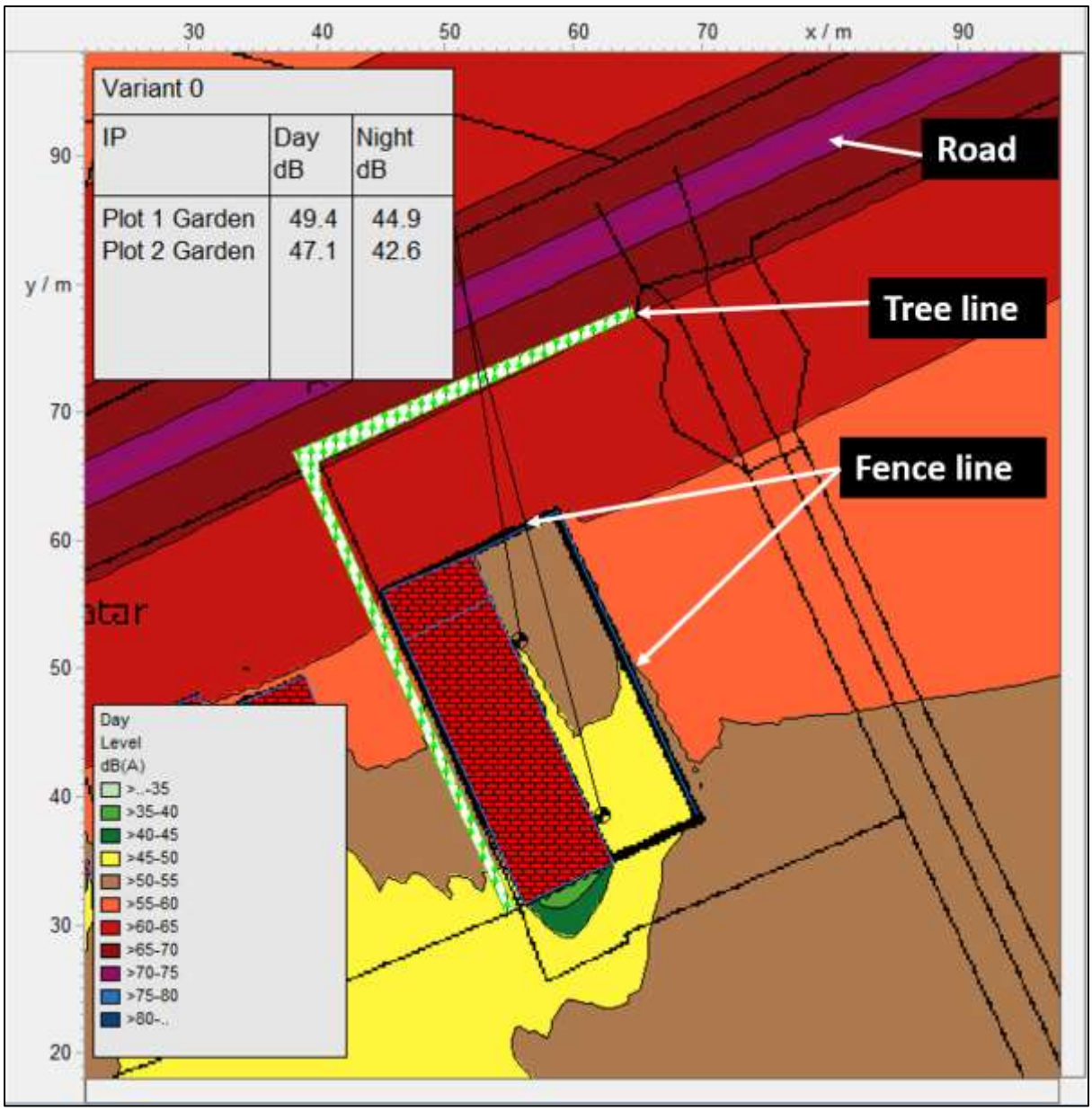

Figure 7: Outdoor amenity space noise model (Noise contour grid at 1.5m)

7 Uncertainty

The data set gathered to conduct the assessment detailed in the report was measured over a number of days that deliberately incorporated a weekend. The worst-case day and night time values were then used to calculate the mitigation methods required to satisfy the relevant criteria.

The sound level meters used were calibrated on site at both the site set up as well as the decommissioning of the equipment to ensure that it was operating as intended. No significant drift was noted.

Ventilation and glazing are inextricably linked, as whilst glazing may provide protection against sound levels incident on the façade, any ventilation strategy must not inadvertently compromise the protection and performance provided by the glazing.

8 Conclusion

A noise assessment has been conducted to assess the consented development in terms of its capability of meeting the requirements of condition 2 of the decision notice DC/20/1477.

Noise has been measured on the existing site. Noise propagation around the planned development has been predicted using the computer noise modelling program IMMI (Wolfel). The results have been compared against Table 4 of BS8233:2014.

The report shows that Bedroom 1 of Plot 2 would meet the relevant criteria with windows open.

The lounge of Plot 2 would also meet the requirements of BS8233:2014 with windows open of the southern facade. With standard thermal double glazing and MVHR applied, all habitable spaces within plots 1 and 2 comfortably achieve the required internal sound pressure levels in Table 4 of BS8233:2014.

The revised positioning of the external fence line also ensures that external amenity areas are also protected from road traffic noise and easily achieve BS8233:2014 and World Health Organisation Guidelines for Community Noise dated 1999, revised 2108.

The implementation of the suggested mitigation methods protects future residents and will allow the local planning authority to discharge condition 2 of DC/20/1477