Acoustic Associates Sussex Ltd

Noise Assessment

Conditions 9 and 10

Site: **Former Shrublands Nursery, Angmering**
Client: **Sigma Homes**

Report by: George Orton BEng(Hons) MIOA

Date: 13/06/2022
Project: J3058
Issue 1

Acoustic Associates

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1 Introduction

Acoustic Associates have been appointed to undertake an acoustic assessment of the proposed "Former Shrublands Nursery, Angmering" development.

The development has gained planning approval albeit with planning conditions. Planning conditions 9 & 10, both of which relate to noise, are discussed in section 2.

The development will build a residential development on a site previously used as a plant nursery. Existing buildings/greenhouses will be demolished to make way for the new residential development.

At the planning stage a noise assessment, completed by Acoustic Associates, was submitted with the original planning application. This report, for Conditions 9 and 10, should be read in conjunction with the original planning application noise assessment report:

J3058 - Sigma Homes - Land at Shrublands Nursery, Angmering - Issue 2 - 7-9-2021

As part of the planning condition assessment further on site sound level surveys were completed on the empty site

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

- BS8233 (Sound insulation and noise reduction for buildings) 2014
- BS4142 (2014+A1:2019) Method for rating industrial noise affecting mixed residential and industrial areas
- ProPG: Planning & Noise (Professional Practice Guidance on Planning & Noise) 2017
- Building Regulations – Approved Document O Means of Ventilation
- ANC/IOA Acoustic Ventilation Overheating Residential Design Guide (AVOG)

With windows closed the indoor noise levels will easily achieve the guideline values detailed in ProPG and BS8233.

With windows open the Document O and AVOG example criteria are achieved for most plots (apart from the four plots close to Roundstone Lane). The AVOG strictly speaking apply to transportation noise sources. It should be noted that as the noise sources on this site are also commercial sources (less anonymous soundscape) the assessments were completed for a worst case hour time period.

Noise mitigation measures have been recommended and if they are implemented by the developer it is considered that planning Conditions 9 and 10 will be satisfied.

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2 Context, Planning Conditions & Noise Criteria

2.1 Site and Development Description

The following is the development description as detailed in the original planning report:

It is proposed that the (former) Shrublands Nursery will be re-developed into a site with 40 residential dwellings comprising houses and flats.

The site is bounded to the North by Farrowfields Estate – a storage location which also incorporates a vehicle Paint and Repair works.

The site is bounded to the East by Roundstone Lane – a road which runs North – South in both directions.

The site is bounded to the South by Roundstone Boarding Kennels and Cattery and a Canine Hydrotherapy facility. Also, to the south, but to the west of the kennels, it was noted that a residential development is well underway to being constructed.

The development layout (and 2022 survey positions) can be seen below:

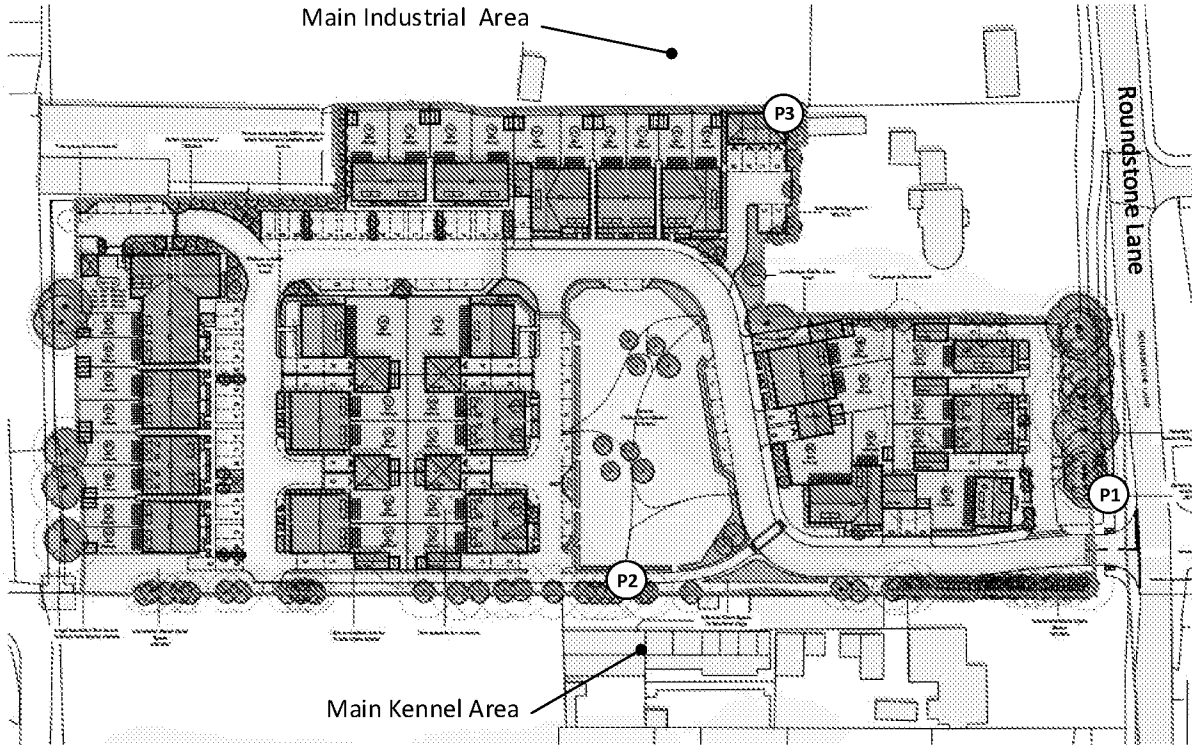

Figure 1: Layout and Survey Positions

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2.2 Planning Condition 9

Prior to commencement of development, the applicant shall submit a fully robust Acoustic Report compiled by a competent acoustician, which identifies all noise sources in the vicinity, and the impact of these noise sources on the proposed new dwellings. Main noise sources will include road noise from Roundstone Lane and noise from commercial operations at Roundstone Kennels and Cattery and Farrowfields industrial site.

The Report which shall be submitted to and approved in writing by the Local Planning Authority, will detail a scheme of appropriate mitigation measures to demonstrate that the internal ambient noise levels within the residential units will conform to the "Indoor ambient noise levels for dwellings" guideline values specified in BS: 8233:2014 and the ProPG 2017, to include both dBLAeq and dBLA,f,max, I minute (8hour) levels (for night-time noise). The assessment shall also give consideration to the principles of BS 4142:2014+A1:2019 where identification of noise sources can be achieved either through the use of manned monitoring, or through the recording of triggered noise events. The Planning Noise Advise Document: Sussex, 2021 can provide useful guidance.

If appropriate, the scheme shall take into account the correct number of air changes required for noise affected rooms and shall be based around a system of mechanical acoustically treated ventilation such as MEV 3 or 4 (Approved Document F - Building Regulations). All works, which form part of the approved scheme, shall be completed before any part of the development is occupied and shall thereafter be retained in perpetuity.

If any residential unit cannot comply with the required standards as described in BS 8233: 2014 Guidance on Sound Insulation and Noise Reduction for Buildings and WHO, with windows open, then consideration must be given to The Agent of Change Principle, paragraph 182, National Planning Policy Framework (NPPF2) 2019 with the aim to protect the amenity of pre-existing businesses here. In this case a written report, detailing suitable mitigation measure shall be submitted to the Local Planning Authority for approval in writing.

If appropriate, details of any acoustic barrier to be erected along the north or southern boundaries of the development site, or both, including details of its ongoing maintenance, shall be submitted to and approved by the Local Planning Authority. The acoustic barrier shall be provided prior to occupation and retained and maintained in perpetuity.

2.3 Planning Condition 10

Prior to the commencement of development, a scheme shall be submitted to and approved in writing by the Local Planning Authority demonstrating that the external noise levels within the curtilage of the residential units and general amenity spaces will conform to the 'design criteria for external noise' desirable guideline value (moderate annoyance) of 50 dB LAeq,T as specified within BS 8233: 2014 Guidance on Sound Insulation and Noise Reduction for Buildings and WHO. The work specified in the approved scheme shall then be carried out in accordance with the approved details prior to occupation of the premises and shall be retained thereafter.

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2.4 BS4142: 2014: Method 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.

2.5 BS8233 Noise Criteria

Table 5 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

2.6 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 - L_{Aeq} dB (A)**
Living rooms	35 (Daytime only)
Bedrooms	30 (Night)
Room Type	**Maximum Internal Level – L_{Amax} dB(A)**
Bedrooms	45 (not more than 10-15 times per Night)

2.7 ProPG – Noise Criteria

The following extract has been taken (Figure 2, Page 13) from the 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 3.0)**.

Figure 2: ProPG Criteria

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2.8 Approved Document O – Noise Criteria

Although the development may be completed without having to adhere to the new Doc O guidelines the noise criteria in the publication are relevant considering the wording of condition 10

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).

3.4 Where in-situ noise measurements are used as evidence that these limits are not exceeded, measurements should be taken in accordance with the Association of Noise Consultants' *Measurement of Sound Levels in Buildings* with the overheating mitigation strategy in use.

NOTE: Guidance on reducing the passage of external noise into buildings can be found in the *National Model Design Code: Part 2 – Guidance Notes* (MHCLG, 2021) and the Association of Noise Consultants' *Acoustics, Ventilation and Overheating: Residential Design Guide* (2020).

2.9 CIBSE Guidance Mechanical Ventilation Noise

Criteria for noise from mechanical services have been detailed below:

CIBSE Guidance: Mechanical services noise to be ≤ NR25dB in bedrooms

CIBSE Guidance: Mechanical services noise to be ≤ NR30dB in lounges

The lower NR would be harder to achieve.

2.10 ANC/IOA Acoustic Ventilation Overheating Residential Design Guide (AVOG)

Excerpts from the AVO guide have been detailed below:

Table 3-3 Guidance for Level 2 assessment of noise from transport noise sources[Note 1] relating to overheating condition

External ambient noise level [Note 1]			Examples of Outcomes [Note 2]	
Lower Part 1 rating 07:00 – 23:00 (hours)	Lower rating 23:00 – 07:00 (hours)	Indicative noise rating, rating 23:00 – 07:00 (hours)		
> 60 dB	> 55 dB	Unacceptable adverse effect	Noise causes a material change in behaviour e.g. having to keep windows closed most of the time	Avoiding certain activities during periods of intrusion. Having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.
Increasing noise level			Increasing likelihood of impact on reliable speech communication during the day or sleep disturbance at night	At higher noise levels, more significant behavioural change is expected and may only be considered suitable if occurring for limited periods. At noise levels increase, small behaviour changes are expected e.g. turning up the volume on the television; speaking a little more loudly; having to close windows for certain activities, for example ones which require a high level of concentration. Potential for some reported sleep disturbance. Affects the acoustic environment inside the dwelling such that there is a perceived change in quality of life. At lower noise levels, limited behavioural change is expected unless conditions are prevalent for most of the time. [Note 4]
< 57 dB	< 52 dB	Not noticeable [Note 3]	Noise can be heard, but does not cause any change in behaviour	Noise can be heard, but does not cause any change in behaviour, attitude, or other physiological response [Note 4]. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.

Note 1 *The noise levels suggested in Tables 3-2 and 3-3 assume a steady road traffic noise source but may be adapted for other types of transport.*

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Assessment of Individual Noise Events

8.45 Paragraphs 8.29 to 8.35 discuss potential issues with the measurement and assessment of L_{Amax}.

8.46 Higher values may be acceptable for limited periods of the year, depending on the level and frequency of events. Refer to ProPG Appendix A for information on assessing individual noise events.

8.47 The paper *Assessing L_{Amax} for residential developments: the AVO Guide Approach* [24] describes the approach adopted in this guide.

8.48 Table 3-3 indicates that for the overheating design case L_{Amax} levels up to but not normally exceeding 65 dB may be acceptable for limited periods.

8.49 For simplicity, it is considered that the external design case maximum level determined for the overheating condition should not result in the L_{Amax} within bedrooms exceeding a value of 65 dB.

Figure 8-2 'AVO Diagram' indicating noise levels associated with adverse effects during the daytime used in this worked example

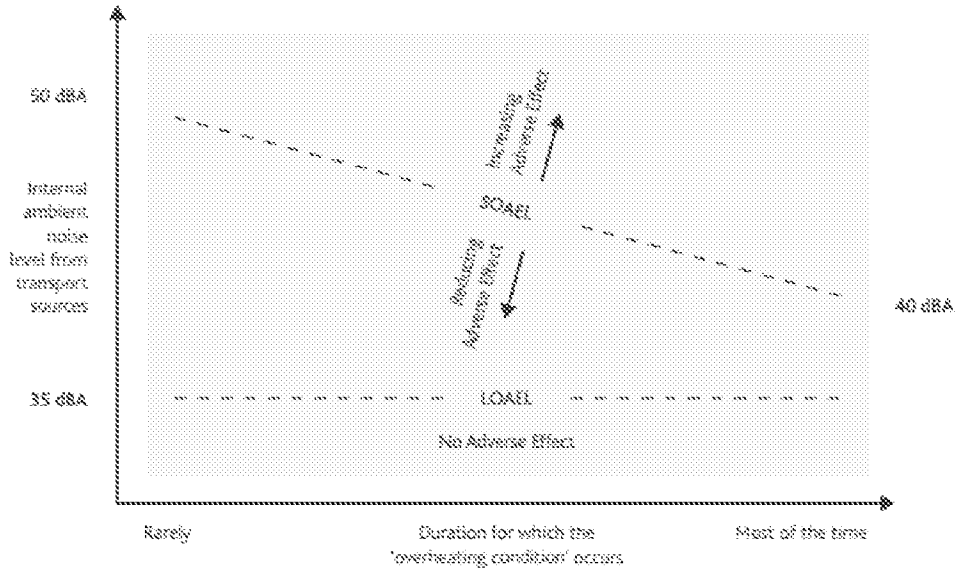
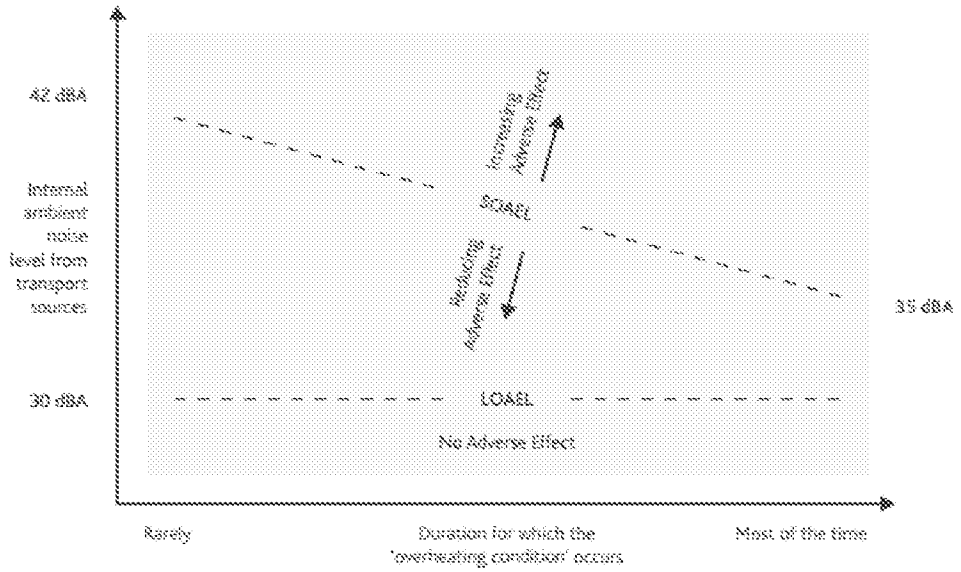


Figure 8-3 'AVO Diagram' indicating noise levels associated with adverse effects during the night-time used in this worked example



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3 2022 - Noise Survey Baseline Conditions & Results

Various sound surveys were carried out in April and May 2022 to assess the noise levels affecting the proposed development. The surveys were carried out after the site was vacated by the previous occupiers. On some days of the surveys site works took place and as such these days have not been included in the assessment. For the surveys on the north and south boundaries, close to the neighboring commercial areas, sound level meters were used that recorded audio clips.

3.1 Noise Survey Details

- Survey carried out by: George Orton BEng (Hons) MIOA
- Equipment used: Castle GA117 - Type 1 Sound Level Meter
  Svantek 971 - Type 1 Sound Level Meter
  01dB Symphonie – Computer Sound Level Meter
- Weather conditions: Variable wind speed average mostly under 5m/s

The meters were calibrated before commencing the noise measurements (@94dB). The calibration was re-checked at the end of the measurements to ensure that no calibration drift had occurred. After survey the calibration showed no significant drift (94dB)

3.2 Noise Survey Locations

The noise survey locations (close to development boundary and nearest noise sources) can be seen on the marked up plan within the previous section.

All noise levels in this report will be free-field noise levels unless stated otherwise (including noise model predictions)

3.3 Noise Survey Results – P1 – Road Position

3.3.1 Results

The survey results summary can be found below:

Date	Day	**Free-field Level - dBA**	
		Daytime 07:00-23:00	**Night Time 23:00-07:00**
		$L_{Aeq,16hr}$	**$L_{Aeq,8hr}$**
10-May	Tue		55
11-May	Wed	64	56
12-May	Thu	64	55
13-May	Fri	64	56
14-May	Sat	64	54
15-May	Sun	63	55
Average		64	55
Original P1		64	55

Table 2: P1 Results

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3.3.2 Discussion

- At night the average 10th highest $L_{Amax,1min}$ was 76dBA
- During the worst case night the10th Highest $L_{Amax,1min}$ was 77dBA
- The steady noise levels were the same as original survey however the latter survey was marginally closer to the road so actually 1dB lower

3.4 Noise Survey Results – P2 – Dog Kennels Position

3.4.1 Results

The survey results summary can be found below:

Date	Day	Free-field Level - dBA	
		Daytime 07:00-23:00	Night Time 23:00-07:00
		$L_{Aeq,16hr}$	$L_{Aeq,8hr}$
14-Apr	Thur	Site Work	46
12-May	Thu		48
13-May	Fri	54	48
14-May	Sat	Site Work	48
15-May	Sun	55	48
16-May	Mon	55	45
Average		55	47
Original P2		51	42

Table 3: P2 Results

3.4.2 Audio Clips and 1 Hour Levels from 14th April Night time Survey

Time	1Hr LAeq	Notes
23:00	47	Dogs Barking
00:00	48	Dogs Barking
01:00	37	No Audio
02:00	37	No Audio
03:00	37	No Audio
04:00	40	No Dogs barking. 4:22 truck on road other clips are occasional birds and seagulls
05:00	58	Birds tweeting and one quiet bark clip at 05:59
06:00	60	Occasional (4 or so barks) dogs barking mostly birds and distant traffic
07:00	56	Occasional dogs barking mostly birds and distant traffic

Table 4: 14/04 Audio Clips

Clear dog barking sounds were recorded at 22:35 and 08:25. The 15 minute sound level was calculated for these times:

Time Period	LAeq	LAmax
22:30-22:45	49	63
08:20-08:35	52	78

Table 5: Dog Barking 15 Minute Levels

For the night time the highest max was at 06:17 and 82dBA but seems to be bird song from audio

The graph below shows the 1s time history for the worst case hour:

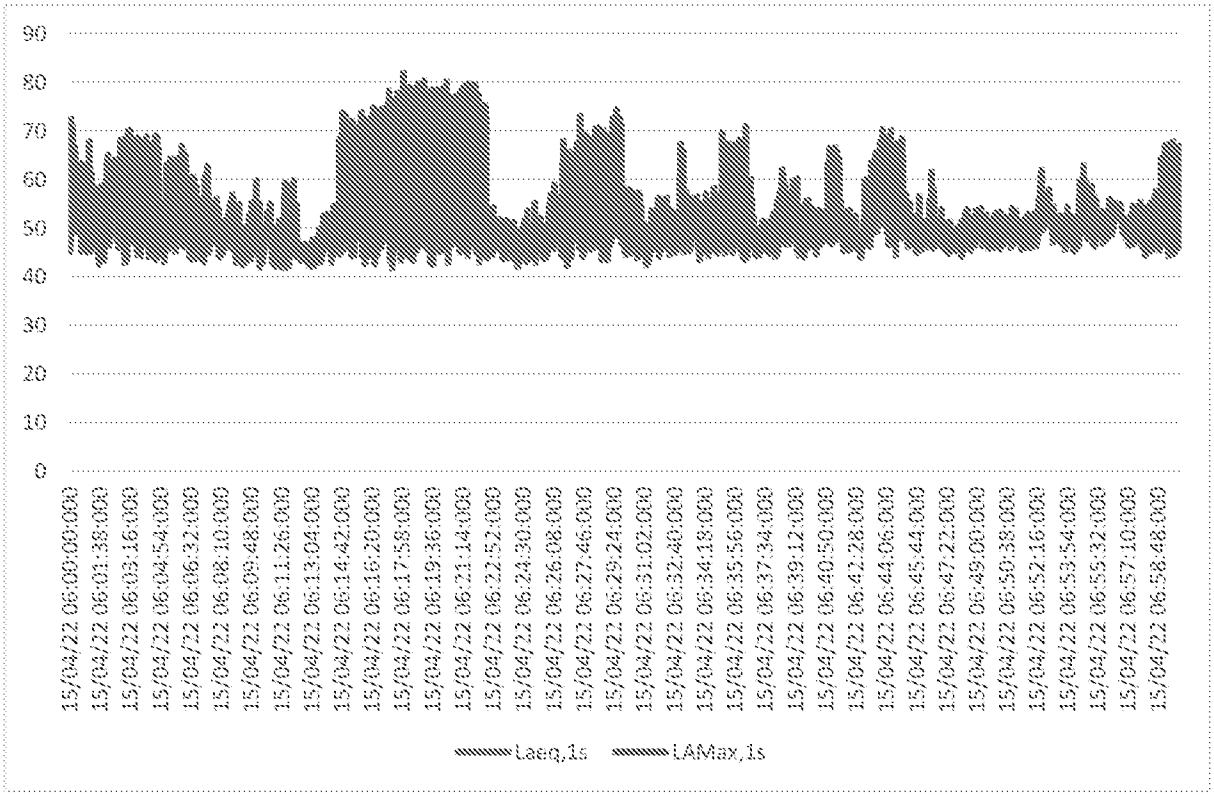

Figure 3: 15/04 06:00-07:00hrs

For the section between 06:15-06:22hrs the highest levels were observed and during this period all audio clips were birdsong. For the whole hour there were around 4 clips with dogs barking (birdsong was also audible in these clips too)

3.4.3 Discussion – May Multiday Survey

- At night the average 10th highest $L_{Amax,1min}$ was 70dBA
- During the worst case night the10th Highest $L_{Amax,1min}$ was 71dBA
- Audio picked up many daytime dog barks. Audio never triggered at night
- Highest 1hr Night (no audio to determine noise source) was 54dBA (L_{Amax} 73dBA)
- A yapping dog was heard in the morning (between 07:00-08:00hrs) on the 15th/16th May. The hour levels were 56/59 dBA (L_{Amax} 81/82 dBA)
- Average 1hour levels were 42/52 dBA (Day/Night)

3.5 Noise Survey Results – P3 – Industrial Estate Position

3.5.1 Results

The survey results summary can be found below:

Date	Day	Free-field Level - dBA	
		Daytime 07:00-23:00	Night Time 23:00-07:00
		$L_{Aeq,16hr}$	$L_{Aeq,8hr}$
11-Apr	Mon	Site Work	48
13-Apr	Wed	Site Work	50
17-May	Tue	51	46
18-May	Wed	Site Work	Thunder storm
19-May	Thu	52	44
20-May	Fri	51	45
21-May	Sat	49	44
22-May	Sun	48	47
23-May	Mon	51	48
Average		50	46
Original P3		48	44

Table 6: P3 Results

3.5.2 Discussion – April Survey

- For the 2 nights of survey highest hour levels were 55/58dBA
- Both were 06:00-7:00hrs and audio was all (1 possible power tool sound which could have been adjacent building site) birdsong
- 2nd Highest hour for the each of the nights was 49/48dBA

3.5.3 Discussion – May Survey

- At night the average 10th highest $L_{Amax,1min}$ was 65dBA
- During the worst case night the10th Highest $L_{Amax,1min}$ was 70dBA
- Night time highest hours always birdsong on audio
- Daytime highest hour that wasn't birds or a helicopter was 54dBA (however there were no audio clips that prove this noise level was created by noise emanating from the industrial estate).

3.6 Noise Survey Results – $L_{90,15min}$

For the positions (2&3) further from the road the most commonly occurring background sound level has been determined:

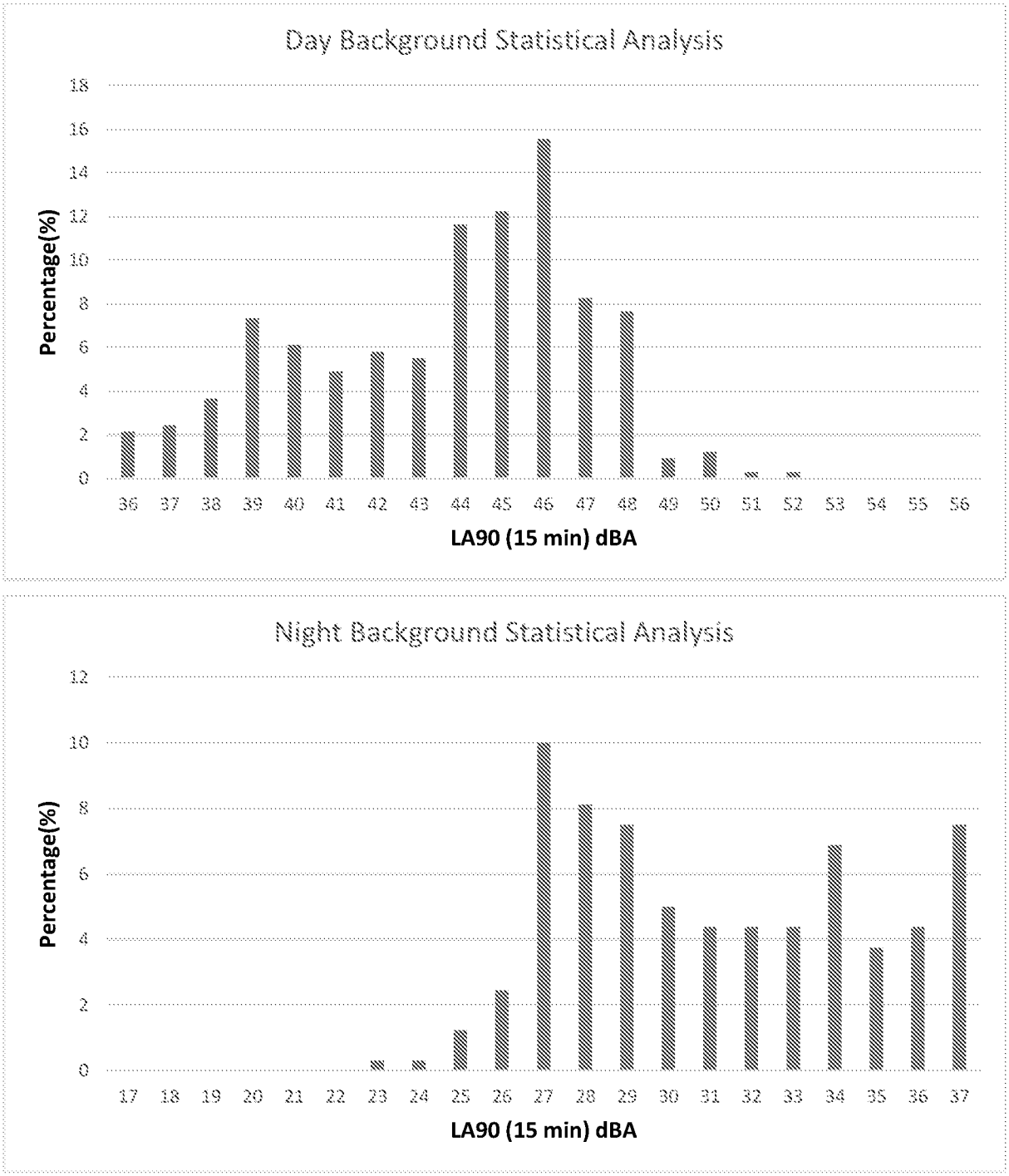

Figure 4: P2 L90 Data

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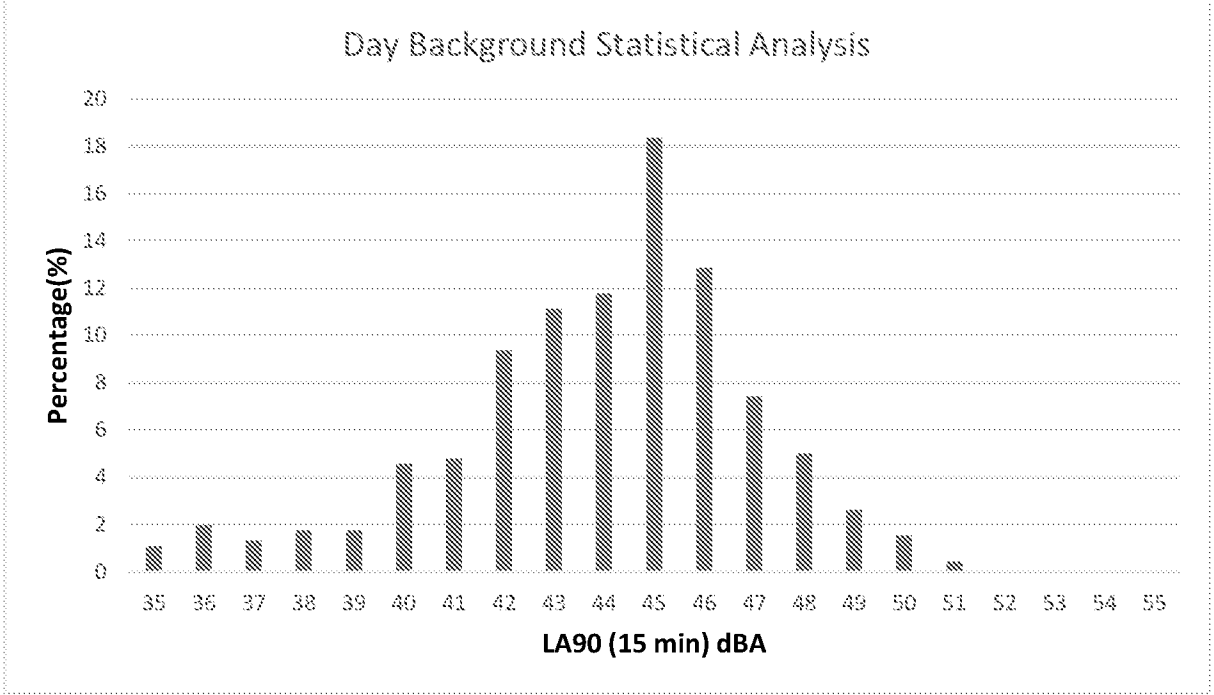

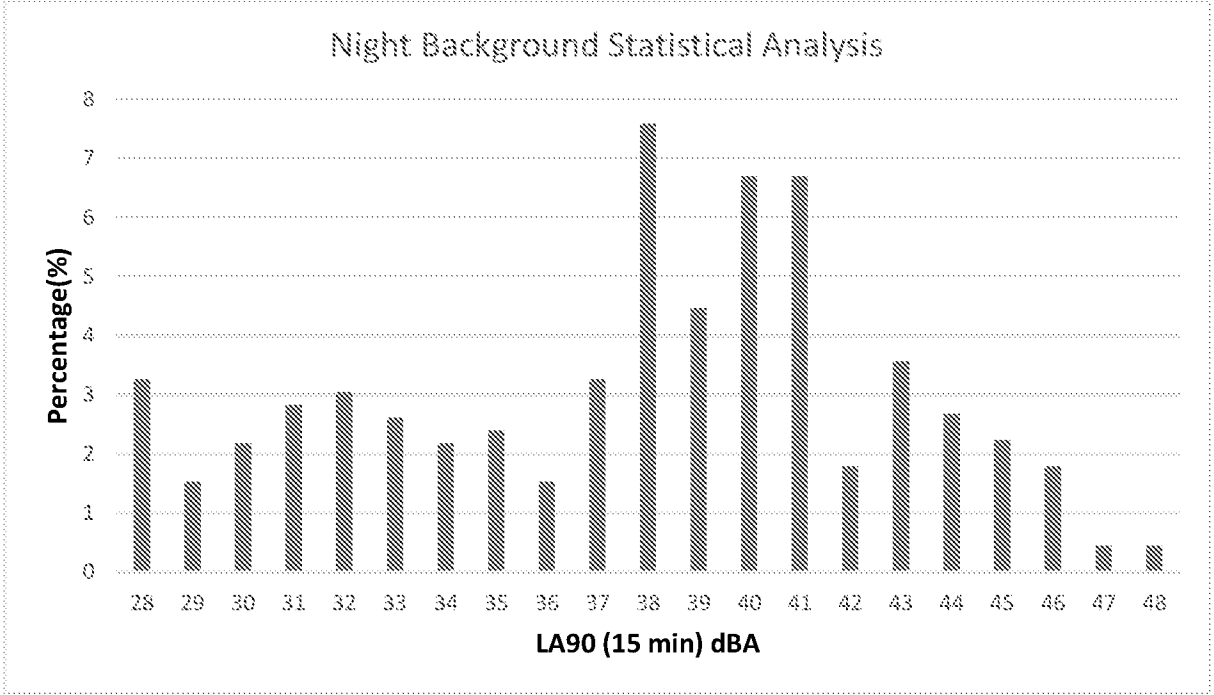

Figure 5: P2 L90 Data

From the above graphs the representative background sound level for areas away from the road will be taken as:

- Daytime background sound level = 45dBA
- Night time background sound level = 30dBA

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4 Computer Noise Model

The original planning model was updated to reflect the noise levels measured in the 2022 survey. The model predicts the full day and night time period noise levels (later assessments also look at shorter time period sound levels). The new model uses area sources for the kennels and industrial estates.

4.1 Model Calibration

From the survey data it was unclear if the site to the North operates at night. To err on the side of caution the sound power level was set so the predicted night time level was3dB below as measured (I.E. for the survey data night time environmental noise equals night time industrial noise).

As distant environmental noise sources have not been add to the model the position 3 night levels are marginally underestimated:

Short list		- Unnamed -			
Noise prediction					
Variant 0		Setting: Copy of reference			
		Day		Night	
		LV	L r,A	LV	L r,A
		/dB	/dB	/dB	/dB
fPkt001	Survey Pos 1		64.182		55.184
fPkt002	Survey Pos 2		55.367		47.334
fPkt003	Survey Pos 3		49.911		42.282

Figure 6: Model Calibration Reception Points

4.2 Main 2022 Model

For the model 2.2m noise barriers were added on the north and south boundaries (exact details of location can be seen later on in the report).

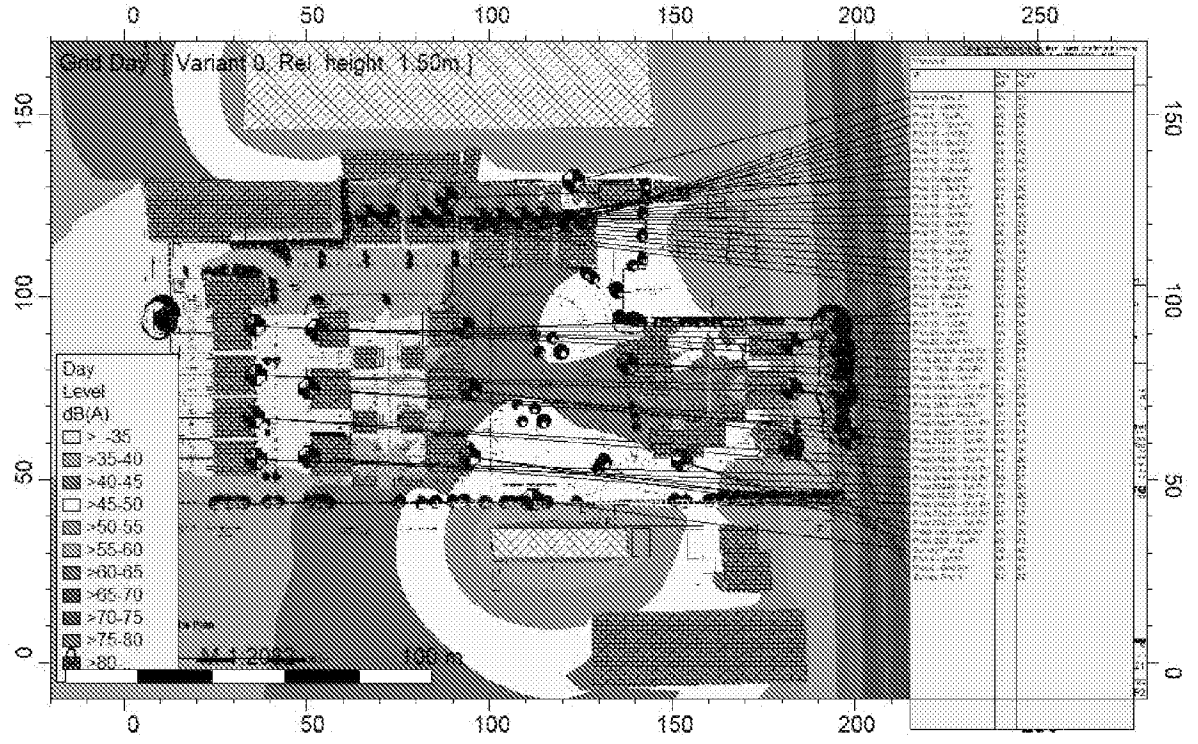

Figure 7: Daytime Noise Model

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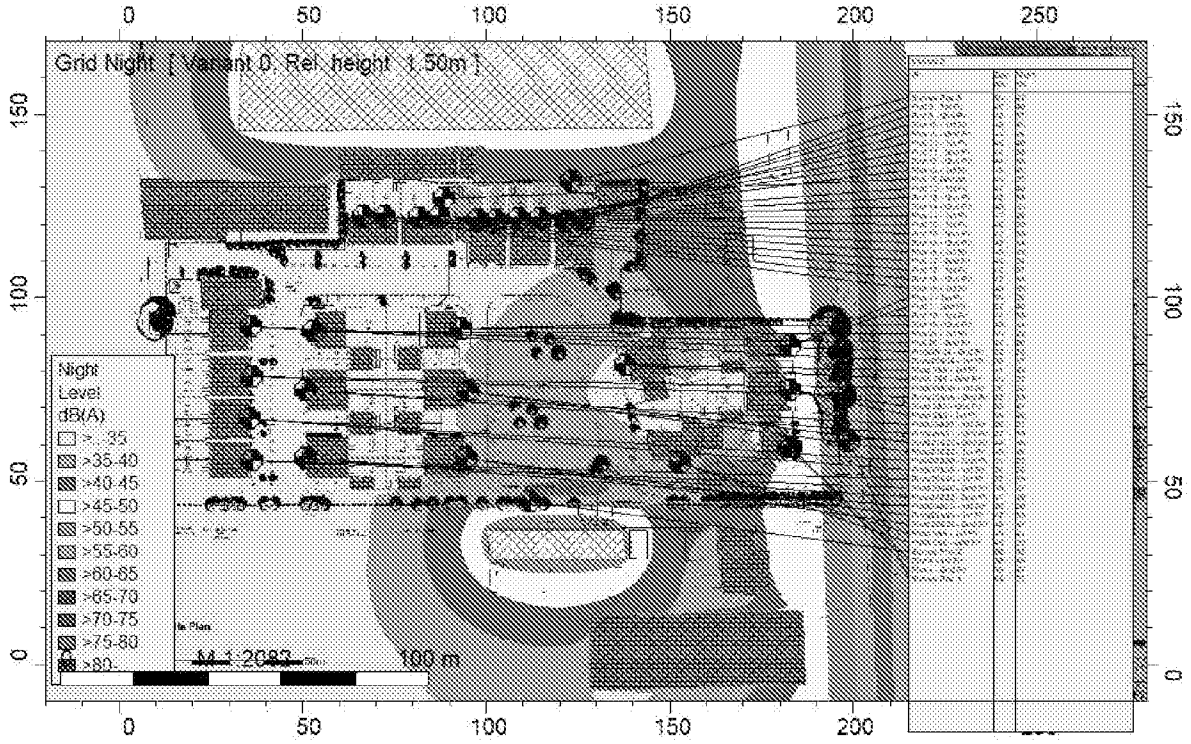

Figure 8: Night Time Model

Prediction Location	$L_{Aeq16/8hr}$		Prediction Location	$L_{Aeq16/8hr}$	
	Day	Night		Day	Night
Plot 1 - Gnd Flr	57	48	Plot 1 - 1st Flr	59	50
Plots 2&3 - Gnd Flr	56	47	Plots 2&3 - 1st Flr	58	49
Plot 4 - Gnd Flr	56	47	Plot 4 - 1st Flr	58	49
Plots 5&6 - Gnd Flr	48	39	Plots 5&6 - 1st Flr	49	41
Plots 7&8 - Gnd Flr	40	32	Plots 7&8 - 1st Flr	41	33
Plot 9 - Gnd Flr	45	37	Plot 9 - 1st Flr	49	40
Plot 10 - Gnd Flr	44	36	Plot 10 - 1st Flr	48	40
Plot 11 - Gnd Flr	44	36	Plot 11 - 1st Flr	48	40
Plot 12 - Gnd Flr	44	36	Plot 12 - 1st Flr	48	40
Plot 13 - Gnd Flr	43	36	Plot 13 - 1st Flr	47	40
Plot 14 - Gnd Flr	43	35	Plot 14 - 1st Flr	47	39
Plot 15 - Gnd Flr	43	35	Plot 15 - 1st Flr	46	38
Plot 16 - Gnd Flr	42	34	Plot 16 - 1st Flr	45	38
Plot 17 - Gnd Flr	42	34	Plot 17 - 1st Flr	45	37
Plot 18 - Gnd Flr	42	34	Plot 18 - 1st Flr	45	38
Plot 19 - Gnd Flr	43	34	Plot 19 - 1st Flr	44	35
Plots21&22 - Gnd Flr	44	36	Plots21&22 - 1st Flr	45	36
Plots22&23 - Gnd Flr	46	37	Plots22&23 - 1st Flr	47	39
Plots24&25 - Gnd Flr	27	19	Plots24&25 - 1st Flr	28	20
Plots26&27 - Gnd Flr	27	19	Plots26&27 - 1st Flr	29	21
Plot 28 - Gnd Flr	27	20	Plot 28 - 1st Flr	30	22
Plots29-34 - Gnd Flr	32	24	Plots29&34 - 1st Flr	35	27
Plots35&36 - Gnd Flr	33	25	Plots35&36 - 1st Flr	36	28
Plots37&38 - Gnd Flr	31	23	Plots37&38 - 1st Flr	34	26
Plots39&40 - Gnd Flr	35	27	Plots39&40 - 1st Flr	37	29

Table 7: Model Prediction Table

5 Required Sound Reduction of Building Envelope

The model predictions will be used to predict the required sound reduction of the building envelope (Glazing, vents etc.). For positions closer to the commercial sources (where noise levels are less steady and anonymous) the worst case hour levels will be used. The model prediction function was used to see which noise source was dominant at each position.

5.1 Assumptions

- Road Noise
  - 10th highest LAmax is 22dB higher than the 8hr night time level
- Kennel Noise
  - 10th highest LAmax is 24dB higher than the 8hr night time level
  - The day time worst case hour is 4dB higher than the 16hr day time level
  - The night time worst case hour is 7dB higher than the 8hr night time level
- Industrial Estate Noise
  - 10th highest LAmax is 24dB higher than the 8hr night time level
  - The day time worst case hour is 4dB higher than the 16hr day time level
  - Night time level is as predicted by the model as no night time activities occur

5.2 Sound Reduction Table

The table blow shows the worst case locations (where sound reduction required exceeds 13dB (With an open window the sound reduction would be around 13dB as stated in the AVO guide)

Position	Dominant Source	$L_{Aeq,16/8hr}$		Required Sound Reduction				
		Day	Night	35dB	Day 1hr	30dB	Night 1hr	Max $45_{10times}$
Plot 1 - 1st Flr	Road	59	50	24		20		27
Plots 2&3 - 1st	Road	58	49	23		19		26
Plot 4 - 1st Flr	Road	58	49	23		19		26
Plot 1 - Gnd Flr	Road	57	48	22		18		
Plots 2&3 - Gnd	Road	56	47	21		17		
Plot 4 - Gnd Flr	Road	56	47	21		17		
Plots 5&6 - 1st	Kennels	49	41	14	18	11	18	20
Plot 9 - 1st Flr	Ind/Road	49	40	14	18	10		17
Plot 10 - 1st Flr	Ind/Road	48	40	13	17	10		17
Plot 11 - 1st Flr	Ind/Road	48	40	13	17	10		17
Plot 12 - 1st Flr	Ind/Road	48	40	13	17	10		17
Plots 5&6 - Gnd	Kennels	48	39	13	17	9		
Plot 13 - 1st Flr	Ind/Road	47	40	12	16	10		17
Plots22&23 - 1st	Kennels	47	39	12	16	9	16	18
Plot 14 - 1st Flr	Ind/Road	47	39	12	16	9		16
Plot 15 - 1st Flr	Ind/Road	46	38	11	15	8		15
Plots22&23Gnd	Kennels	46	37	11	15	7		
Plot 16 - 1st Flr	Ind/Road	45	38	10	14	8		15
Plot 18 - 1st Flr	Ind/Road	45	38	10	14	8		15
Plot 17 - 1st Flr	Ind/Road	45	37	10	14	7		14
Plot 9 - Gnd Flr	Ind/Road	45	37	10	14	7		
Plots21&22 - 1st	Kennels	45	36	10	14	6	13	15

Table 8: Sound Reduction Table

6 Open Window Assessment

6.1 Criteria - Open Windows

Possible criteria, for when windows are open for cooling, have been detailed below:

The newly published document O states the following:

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).

3.4 Where in-situ noise measurements are used as evidence that these limits are not exceeded, measurements should be taken in accordance with the Association of Noise Consultants' *Measurement of Sound Levels in Buildings* with the overheating mitigation strategy in use.

NOTE: Guidance on reducing the passage of external noise into buildings can be found in the *National Model Design Code: Part 2 – Guidance Notes* (MHCLG, 2021) and the Association of Noise Consultants' *Acoustics, Ventilation and Overheating: Residential Design Guide* (2020).

The AVO guide states the following with regard to overheating design assessments:

"Table 3-3 indicates that for the overheating design case LAFmax levels up to but not normally exceeding 65 dB may be acceptable for limited periods.

For simplicity, it is considered that the external design case maximum level determined for the overheating condition should not result in the LAFmax within bedrooms exceeding a value of 65 dB."

The guide also infers that if there high risk of overheating, reasonable inside levels should be acceptable when the windows are open (I.E. 40/35dBA Day/night). If the overheating risk is lower higher indoor levels may be deemed acceptable (up to 50/42dBA day/night).

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6.2 Assessment - Open Windows

The open Window Assessment has been detailed below:

Position	Indoor Level Open Window		40/35dBA Day/night		LAmax Assessment	
	Lounge Day	Bed Night	Lounge	Bed	55≤10times	Highest for all survey data
Plot 1 - 1st		37		x	x	70 (over 65)
Plots 2&3 - 1st		36		x	x	69 (over 65)
Plot 4 - 1st		36		x	x	69 (over 65)
Plot 1 - Gnd	44		x			
Plots 2&3 - Gnd	43		x			
Plot 4 - Gnd	43		x			
Plots 5&6 - 1st		28		✓	✓	62
Plot 9 - 1st		27		✓	✓	60
Plot 10 - 1st		27		✓	✓	60
Plot 11 - 1st		27		✓	✓	60
Plot 12 - 1st		27		✓	✓	60
Plots 5&6 - Gnd	35		✓			60
Plot 13 - 1st		27		✓	✓	60
Plots22&23 - 1st		26		✓	✓	59
Plot 14 - 1st		26		✓	✓	59
Plot 15 - 1st		25		✓	✓	58
Plots22&23 - Gnd	33		✓			
Plot 16 - 1st		25		✓	✓	58
Plot 18 - 1st		25		✓	✓	58
Plot 17 - 1st		24		✓	✓	57
Plot 9 - Gnd	32		✓			
Plots21&22 - 1st		23		✓	✓	57

Table 9: Open Window Assessment

6.3 Discussion - Open Windows

As shown above the facades close to and facing Roundstone lane fail to achieve the AVOG and Document O noise criteria.

The design of the affected plots does help mitigate potential problems:

- Plots 1-3 have kitchens on the front façade so the predicted levels should be OK (all less than 40+5dBA so reasonable level ac)
- Plot 4 has a lounge window facing the road, however the room is dual aspect so windows on the quiet façade could be opened for cooling
- Plot 1 top floor bedroom has additional velux window on north facing pitched roof
- Plot 2/3 top floor bedrooms have additional velux windows (rear facing) above dressing area

7 BS4142 Assessment

7.1 Background Sound

From the graphs in the results section the representative background sound level for areas away from the road will be taken as:

- Daytime background sound level = 45dBA
- Night time background sound level = 30dBA

7.2 Rating Level Corrections

It is important to differentiate between noise rating level and specific noise level. Certain acoustic features can increase the likelihood of complaint.

- Kennels
    - Daytime: Dogs were heard barking on site and on audio record. The barrier and plot positioning will help mitigate daytime noise however in this case a 6dB penalty will be added.
    - Audio clips did not reveal many occasions when dogs barked at night time. For this reason only a 3dB penalty will be added.
- Industrial Estate

  From the audio clips there seems to be little or zero night time activity. During the day the site was visited around 6 times in order to complete the 2022 survey. Apart from one visit (when a transit van started and drove off) there was no audible activity from the neighbouring site. No penalty will be added.

7.3 Assessment Table

The noise data and details in the sections above have been used to create a BS4142 assessment table.

The model allows the user to view the source level for each source individually for each reception point. This has allowed the kennel/industrial predicted level to be shown without any affects from the road noise source. The specific noise level (shorter time period) is 4dB higher than day time level and 7dB higher than the night time level as shown in the results section.

However for the night time kennel noise +7dB factor is likely to be incorrect based on the very few night time barking events that were recorded (4 barks in the last hour of the night when there were also many more (and louder) birdsong recordings).

Barking was audible just before the night time period that was calculated to be 49dBA as a 15 minute level. At the closest plot the level will be 10dB lower at 39dBA. This will be used as the night time specific noise level (in effect specific noise is 2dB higher than night time level).

Location	Time	Source	Specific	Correction	Rating	Background - Rating
Plots 5&6 Gnd	Day	Kennels	46	6	52	7
Plots22&23 Gnd	Day	Kennels	47	6	53	8
Plot 9 Gnd	Day	Ind	45	0	45	0
Plots 5&6 1st	Night	Kennels	38	3	41	11
Plots22&23 1st	night	Kennels	39	3	42	12

Table 10: BS4141 Assessment table

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7.4 Discussion

As shown above the facades close to and facing the kennels have sound rating levels well above the background sound level.

The design of the affected plots does help mitigate potential problems:

- Plots 5 only has a kitchen on the front façade
- Plot 6 has a lounge window facing the kennels, however the room is dual aspect so windows on the quiet façade could be opened for cooling.

At night time it appears that in general there are few or zero dog barking events during the night time hours. This was based on survey audio clips completed during June which may be considered worst case due to the early sunrise times. The times when dogs were heard barking at nigh time were towards the end of the night when birdsong and traffic noise levels were higher too.

For the affected bedroom the open window assessment shows that the night time AVOG and Document O criteria should be achieved when windows are open (even when considering the worst case short term levels (no audio proof of dogs barking) which may overestimate the night time kennel noise level.

7.5 Uncertainty

- Noise levels detailed in the report were completed during suitable weather conditions
- Corrections and assumptions were generally completed to predict worst case scenario.

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8 Mitigation Measures

8.1 Noise Ingress

8.1.1 Affected Plots

The AVOG publication states that with normal glazing and trickle vents the sound reduction of the façade should be at least 21dB.

Based on the previous assessment that calculated the required sound reduction the following rooms will require enhanced glazing and ventilation elements:

- Plot 1
  - Bedroom 1
  - Bedroom 4
- Plot 2/3
  - Bedroom 1
  - Bedroom 2
- Plot 4
  - Bedroom 1
  - Bedroom 2
  - Bedroom 4
  - Study
  - Living Room

8.1.2 Solution – Plots 1-4 Glazing Specification

It is understood that the plots above will be fitted with MVHR ventilation systems (for whole house ventilation, cooling ventilation is discussed later on). With no trickle vents the Rw+Ctr (or $R_{traffic}$) for the glazing affected rooms should be at least Rw+Ctr=25dB.

It is important that the glazing is "Rw+Ctr" at least 25dB as opposed to Rw at least 25dB. (Rw+Ctr will always be lower than Rw)

8.1.3 Other Plots

For other plots basic glazing and trickle vents should be acceptable (also see note below regarding plots close to the kennels)

8.2 BS4142 Findings

For plots 5, 6, 22, & 23 which are closest to the kennels, the BS4142 assessment for worst case times was not positive. However the noise levels predicted are such that reasonable criteria (as recommended in AVOG and Doc O) are achieved. To help address the negative BS4142 assessment and MVHR systems and Rw+Ctr=25dB glazing could be installed within these plots (so very good internal levels can be achieved with windows closed)

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8.3 Cooling

As stated in a previous section the facades close to and facing Roundstone lane fail to achieve the AVOG and Document O noise criteria (for an overheating scenario when windows are open)

The design of the affected plots does help mitigate potential problems. However the following rooms may benefit from cooling systems to alleviate the need for an open window (if overheating is likely based on window size and sunlight calculations etc.):

- Plot 1
  - Bedroom1
- Plots 2&3
  - Bedroom 2
  - Bedroom 2
- Plot 4
  - Bedroom 2
  - Bedroom 4

MVHR systems in most cases will not move enough air to provide adequate cooling (unless cooling requirement is low and a boost setting can be implemented that provides enough air flow). Therefore if the above rooms require cooling additional fans may be the best option (as opposed to less sustainable comfort cooling AC systems)

The MVHR units for the above plots as well as for plots 5, 6, 22, & 23 should have a summer bypass facility (so incoming air is not heated by warm extract air)

8.4 Sound Barrier

The noise model assumed a sound barrier will be installed on the northern and southern boundary.

Due to the metal containers (in adjacent industrial estate) on the northern boundary the barrier may only be required in the location shown below:

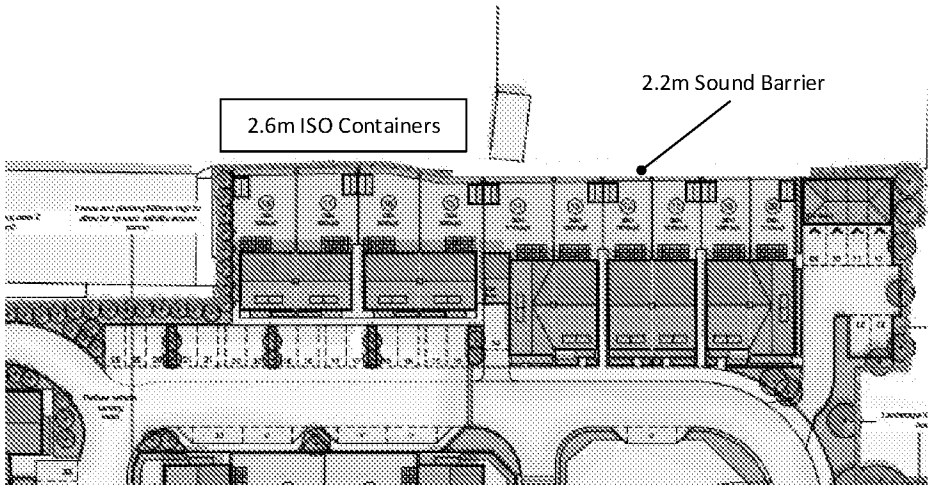

Figure 9: Northern Boundary Barrier

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The southern boundary barrier (minimum length) location can be seen below:

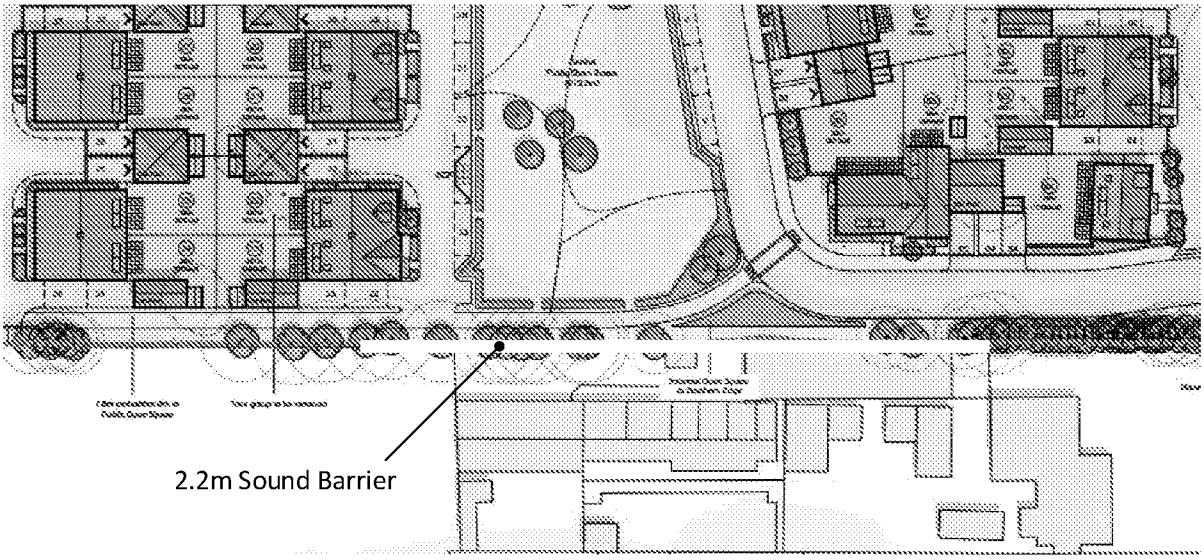

Figure 10: Northern Boundary Barrier

8.4.1 Self-Built Barrier Example

A timber self-built barrier could be used. It is important that the mass per unit area is over 15Kg/m2 as detailed in the documents below

https://www.jacksons-security.co.uk/blog/acoustic-fencing-the-most-common-questions

https://www.cassallen.co.uk/guide-noise-barriers

Once a theoretical value of around 10Kg/m2 is exceeded the improvement in sound insulation diminishes (all sound over barrier so improvements to barrier thickness/mass yield no further improvement).

The value of 15Kg/m2 has been used to counteract any inaccuracies between the stated mass per unit area and the actual figure for the wood supplied.

It is important that quality timber is sourced that is already dried (s that in time the mass per unit area does not decrease as the wood dries). Poor quality and/or high water content timber is also more likely to warp and bend that could create weaknesses in the timber barrier.

8.4.2 Proprietary Barrier

A propriatory sound barrier could also be used (again the barrier should meet the minimum mass per unit are requirements detailed above.

8.5 Garden Noise Level

The noise model shows that for the daytime period the noise levels in the gardens will be less than 50dBA.

The assessment showed that the worst case 1 hour levels (for adjacent commercial activities) would be no more the 4dB higher than the daytime (16hr) level. Therefore of the daytime level is less than 46dBA the 1hour level will be less than 50.

The model printout below shows that even the 1hr worst case levels will be below 50dBA (planning condition requirement):for areas close to the kennels and industrial estate where 1hr noise levels may be higher than the daytime level

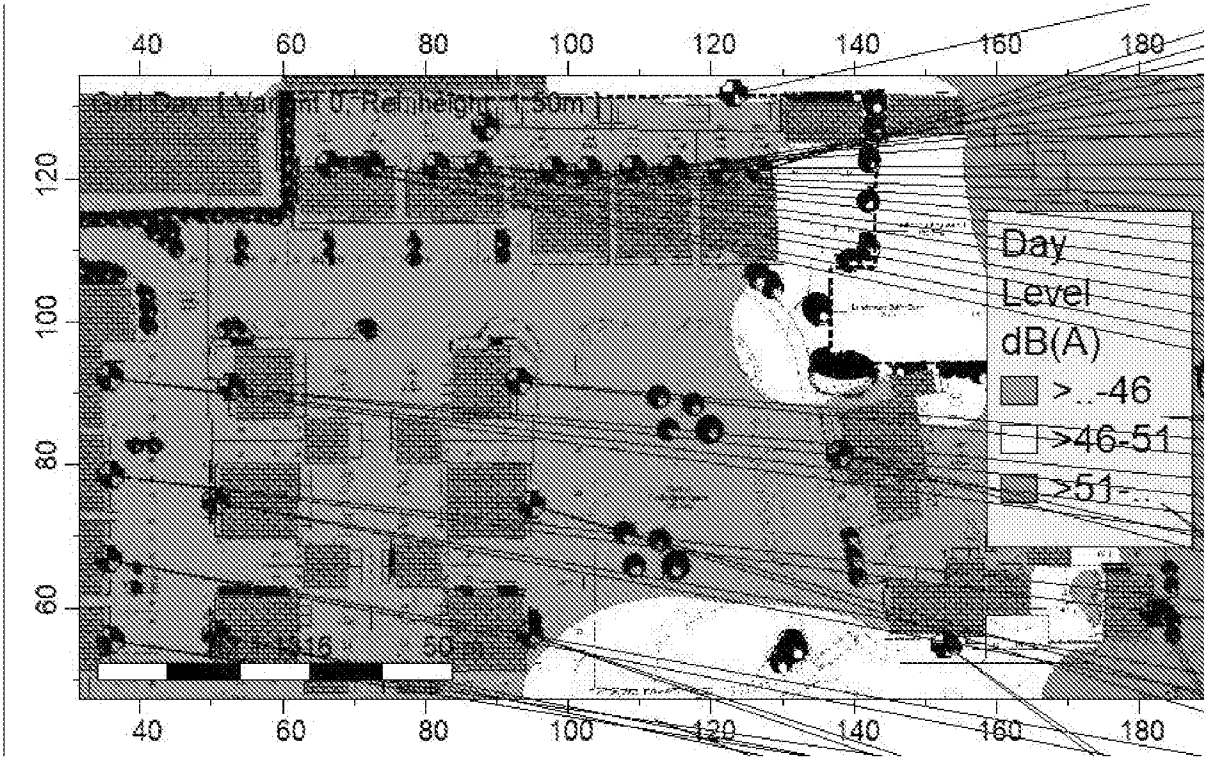

Figure 11: Mid site Garden Noise Levels

Acoustic Associates

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9 Conclusion

At the planning stage a noise assessment, completed by Acoustic Associates, was submitted with the original planning application.

As part of the planning condition assessment further on site sound level surveys were completed on the empty development site

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

- BS8233 (Sound insulation and noise reduction for buildings) 2014
- BS4142 (2014+A1:2019) Method for rating industrial noise affecting mixed residential and industrial areas
- ProPG: Planning & Noise (Professional Practice Guidance on Planning & Noise) 2017
- Building Regulations – Approved Document O Means of Ventilation
- ANC/IOA Acoustic Ventilation Overheating Residential Design Guide (AVOG)

9.1 Condition 9 – Internal Noise Levels

With windows closed the indoor noise levels will easily achieve the guideline values detailed in ProPG and BS8233.

With windows open the Document O and AVOG example criteria are achieved for most plots. The AVOG strictly speaking apply to transportation noise sources. It should be noted that as the noise sources on this site are also commercial sources (less anonymous soundscape) the assessments were completed for a worst case hour time period.

The most affected plots/rooms (facing Roundstone Lane) may require additional cooling systems as with windows open the noise levels are probably above what would be deemed the significant observed adverse effect level.

Whole house ventilation systems for the plots close to the kennels may be beneficial.

9.2 Condition 10 – External Noise Levels

The noise model shows that for the daytime period the noise levels in the gardens will be less than 50dBA as required by planning condition 10. Even when considering the worst case 1 hour levels the garden noise levels are all also below 50dBA

Noise mitigation measures have been recommended and if they are implemented by the developer it is considered that planning Conditions 9 and 10 will be satisfied.