



NOISE IMPACT ASSESSMENT

REEDS FARM, HICKSTEAD

SEPTEMBER 2024

NOISE IMPACT ASSESSMENT REEDS FARM, HICKSTEAD

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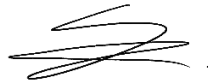
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REVISION HISTORY

Version	Comments	Date	Changes made by	Approved by
1-0	First draft for team comment	26/11/21	RNM	CW
2-0	Updated bund positions	10/09/24	JE	JB

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1 INTRODUCTION

Anderson Acoustics Ltd was commissioned by Work By Here Ltd in May 2024 to update a noise assessment for the development of a new detached property on the land at Reeds Farm, Hickstead. This assessment has been undertaken to determine the resultant change in noise level across the development site with a proposed 5m earth bund in place along the western boundary.

This report presents the results of an environmental noise survey undertaken at the site, which was used to develop a noise model using the software CadnaA (2024 edition). The model has been used to calculate the typical daytime and night-time sound levels across the site in order to determine the requirement for noise mitigation in light of the relevant external and internal noise criteria.

This report is technical in nature, and as such, a glossary of relevant technical terminology can be found [here](#).

2 SITE DEVELOPMENT DETAILS

2.1 Existing Site

The site is located to the east of the A23 and is surrounded to the north, east and south by farmland. The existing residential building is in a dilapidated state and has been demolished and replaced with a new dwelling. There are a number of commercial units on the opposite side of the A23 on the A2300. An aerial view of the site location and surrounding area is shown in Figure 2.1 below.

Figure 2.1: Site location (highlighted in RED) and measurement positions ©2024 Google



2.2 Noise Sources

As to be expected, it was noted during site visits that the noise environment was dominated by road traffic movements from the A23. Bird song was audible during the breaks in traffic. No noise was witnessed from the commercial uses on the other side of the A23.

Gatwick Airport is located approximately 20 km to the north of the site. No noise from aircraft movements were audible during the installation and collection of the sound level monitors.

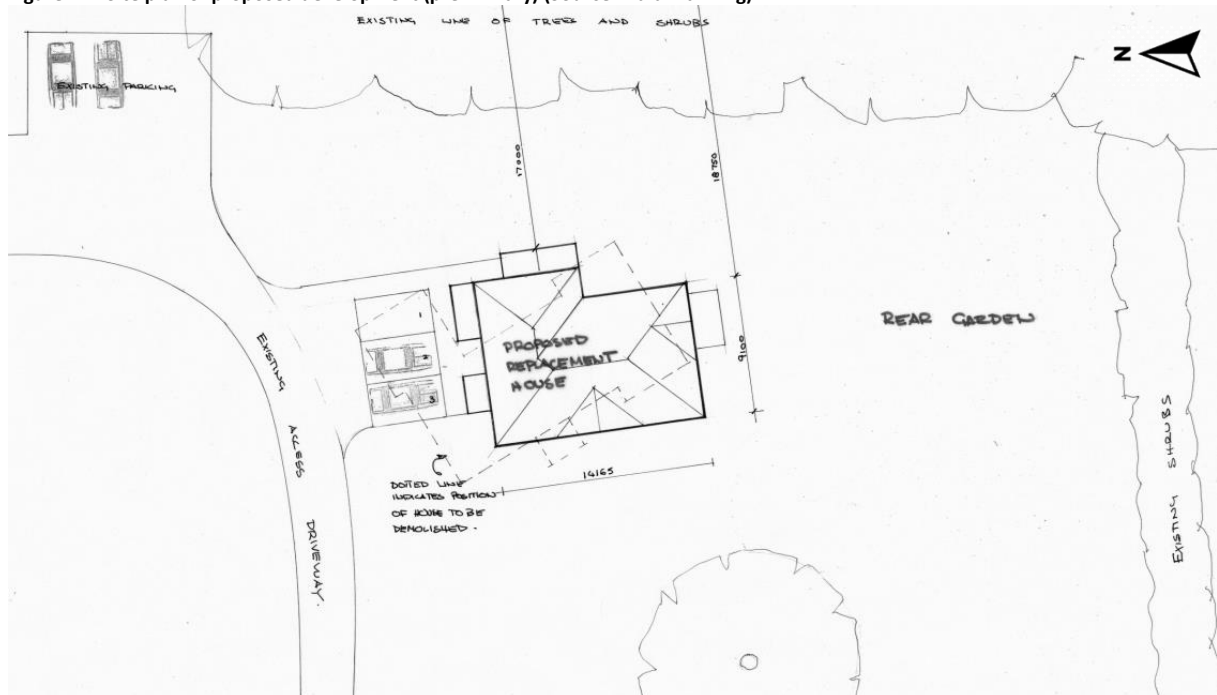
In terms of the assessment, therefore, it is considered sufficient to assume that all sound levels measured originate from the A23.

2.3 Proposed Development

Planning permission was granted in January 2022 for a single detached dwellings with associated landscaping and parking. A site plan of the development is provided in Figure 2.2 below. The footprint of the existing building can just be seen as a dashed line. The access and parking area shown are as per the current arrangements.

At this stage the ventilation strategy is not known and so on this basis, windows have been assumed to be openable for the purposes of purge ventilation during which noise criteria do not apply.

Figure 2.2: Site plan of proposed development (preliminary) (Source: Fluid Planning)



3 NOISE CRITERIA

3.1 External Noise Criteria

BS 8233 [1] recommends that:

...for traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognised that these guideline values are not achievable in all circumstances where development might also be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

Accordingly, levels in the main outdoor amenity space(s) of no more than 50 dB $L_{Aeq,T}$ should be targeted, but where levels of up to 55 dB should also be acceptable. The time period, T, applicable to these thresholds is not given in the Standard; however, in keeping with the equivalent daytime internal noise criteria, and other guidance (such as the WHO Guidelines [2] and the ProPG [3]), the 16 hour period between 07:00 and 23:00 hours is considered applicable. In other words, the limit is 55 dB $L_{Aeq,16h}$ due to the nature of the site.

3.2 Internal Noise Criteria

The criteria recommended in BS 8233 for residential spaces are summarised in Table 3.1.

Table 3.1: Indoor ambient noise levels for dwellings (as per Table 4 of BS 8233)

Activity	Location	07-23 (Daytime)	23-07 (Night-time)
Resting	Living room	35 dB $L_{Aeq,16h}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16h}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16h}$	30 dB $L_{Aeq,8h}$

Further to which, the Standard states that:

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 keeping with the previous version of the Standard, and also the guidance in the aforementioned WHO Guidelines and the ProPG, a limit of 45 dB $L_{Amax,F}$ (also written L_{AFmax}) is typically adopted, which is not to be exceeded more than 10 times per night. In other words, higher levels can be permitted if not occurring regularly.

As a minimum, the above criteria are to be met whilst whole dwelling ventilation (also known as background ventilation) is being achieved. In modern buildings, this is where trickle ventilation units (usually within the window frames) come in to play, with assessments of external noise ingress needing to account for these being open, but where windows can be assumed to be closed.

Further to the whole dwelling ventilation scenario, it is appropriate to consider the situation of windows being opened, either for additional whole dwelling ventilation or as a means of providing cooling. Since this isn't typically required as often as the trickle vents being open, the expectation is that higher noise conditions will be tolerated during such periods, assuming such periods are not atypically prolonged or frequent. BS 8233 doesn't provide any guidance directly on this; however, it states that:

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.

Since the BS 8233 internal criteria are in line with the WHO Guidelines, this indicates that the values presented in Table 3.1 can be relaxed by up to 5 dB and "reasonable internal conditions still achieved." The ProPG expands upon this very point, stating:

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"... 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.

In other words, assuming the risk or occurrence of overheating is low, whereby cooling by opening windows is only required occasional, levels of at least up to 5 dB above those on Table 3.1 are likely to be considered reasonable, with levels up to 10 dB still being acceptable.

4 BASELINE NOISE CONDITIONS

4.1 Introduction

The prevailing noise conditions across the development have been determined by detailed unattended environmental noise survey. This was undertaken over an eight-day period between Wednesday 6th and Thursday 14th October 2021, and managed by a consultant certified as competent in environmental noise monitoring.

The continuous unattended noise measurements were undertaken to the north of the site as shown in Figure 2.1 earlier. The two locations were chosen to characterise the day and night noise emissions from the main source impacting the site, i.e. the A23.

Monitor position 1 (MP1) was located 30m east of the A23 at a height of 1.5m and monitor position 1 (MP2) was located 60m east of the A23 at a height of 2.5m. Both monitors were under free-field conditions. The fact that two positions were adopted was to provide better coverage for calibrating the noise model, as described in Section 5.

4.2 Instrumentation

A full inventory of the monitoring equipment is shown in Table 4.1 below. Calibration certificates are available on request. The sound levels meters used conform to Class 1 specification of BS 61672-1:2013.

Table 4.1: Inventory of Measurement Equipment

Location	Item	Make and Model	Serial Number	Calibration	
				Certificate number	Expiry Date
MP1	Sound Level Meter	Rion NL-52	00732147	UCRT20/2260	18/12/2022
	Preamplifier	Rion NH-25	32175		
	Microphone	Rion UC-59	05339		
	Calibrator	Rion NC-74	34304643	1500367-1	24/5/2022
MP2	Sound Level Meter	Rion NL-32	00872234	UCRT20/1914	23/09/2022
	Preamplifier	Rion NH-25	24096		
	Microphone	Rion UC-59	319496		
	Calibrator	Rion NC-74	34304643	1500367-1	24/5/2022

Each measurement was calibrated at the start of the survey, and the level checked at the end. No significant drift in calibration level was found to have occurred.

4.3 Weather Conditions

Weather conditions were dry with light to moderate winds during both the installation and decommissioning of the sound level monitoring equipment. This is understood to have predominantly remained the case for the duration of the survey, whereby the conditions are considered conducive to the reliable measurements of typical noise conditions.

Since, however, the A23 is both close to the site and dominant, we would expect little influence due to changes in meteorological conditions in any case. As shown below, the results day to day are very consistent.

4.4 Noise Survey Results

The 15-minute results are presented in chart form in Appendix A, with the period $L_{Aeq,T}$ levels and the night-time L_{AFmax} levels, as most relevant to the assessment, presented overleaf for MP1 and MP2 in Tables 4.2 and 4.3. Strictly, the L_{AFmax} levels should be determined on an “event” basis. Since, as is often the case for long term data, levels are available on a period basis only – 15-minutes in this case – the 90th percentile levels have been determined.

Table 4.2: Summary Results of the Unattended Noise Survey (Free-Field Levels) – Position 1

Date	Daytime (0700-2300)	Night-time (2300-0700)	
	$L_{Aeq,16h}^1$	$L_{Aeq,8h}^1$	90 th Percentile L_{Amax}^2
Wednesday 21/10/06	70 ³	63	76
Thursday 21/10/07	70	63	76
Friday 21/10/08	70	63	74
Saturday 21/10/09	69	63	80
Sunday 21/10/10	69	64	75
Monday 21/10/11	70	63	75
Tuesday 21/10/12	69	63	75
Wednesday 21/10/13	70	-	-
Average (Highest)	70 (70)	63 (64)	76 (80)

¹ Based on the logarithmic average of the $L_{Aeq,5min}$ levels.

² Used on the 5-minute levels as an alternative to the 10th highest “event” level.

³ Part data from after the equipment was installed (strictly $L_{Aeq,11h}$).

Table 4.3: Summary Results of the Unattended Noise Survey (Free-Field Levels) – Position 2

Date	Daytime (0700-2300)	Night-time (2300-0700)	
	$L_{Aeq,16h}^1$	$L_{Aeq,8h}^1$	90 th Percentile L_{Amax}^2
Wednesday 21/10/06	67 ³	58	69
Thursday 21/10/07	64	58	70
Friday 21/10/08	64	59	69
Saturday 21/10/09	65	58	74
Sunday 21/10/10	65	61	73
Monday 21/10/11	66	59	70
Tuesday 21/10/12	66	60	70
Wednesday 21/10/13	66	-	-
Average (Highest)	65 (67)	59 (61)	71 (74)

¹ Based on the logarithmic average of the $L_{Aeq,5min}$ levels.

² Used on the 5-minute levels as an alternative to the 10th highest “event” level.

³ Part data from after the equipment was installed (strictly $L_{Aeq,11h}$).

The following are observed from the above data:

- All levels are very consistent, with only 1 dB between the average and highest levels. This indicates consistent conditions across the survey and a robust dataset.
- The difference between the daytime and night-time $L_{Aeq,T}$ levels is 7 dB on average, this is to be expected in such a location. This means that relative to the criteria, which are 5 dB apart between the daytime (living room/bedroom) and night-time (bedroom) periods (see Table 3.1), the daytime conditions are relatively higher than the night-time conditions.

- The difference between the night-time $L_{Aeq,8h}$ and L_{AFmax} levels is 10 dB on average. Since the difference between the criteria for these metrics is 15 dB (see Table 3.1), meeting the $L_{Aeq,8h}$ criterion will be the driving factor at night. This is to be expected for such a location.
- The maximum noise levels taken from the 90th percentile are shown as 76 and 71 dB for positions 1 and 2 respectively. A value of 74 dB L_{AFmax} has been used in the following assessment. It is considered to be a reasonable approach to use these maximum noise levels for the assessment given the data and nature of the source/noise.

Overall, the data is entirely as expected, and considered further below.

5 NOISE MODELLING

In order to calculate the sound levels across the site as a whole, i.e. beyond the monitoring location, and account for the effect of boundary screening and the location of the building, a 3D noise model has been built using the proprietary noise modelling software CadnaA. The calculations have been carried out in accordance with ISO 9613 [4], therefore, which allows consideration of the effects of the ground and atmospheric absorption, and acoustic reflections and screening.

Existing site and surrounds topography information has been acquired from the Department for Environment Food & Rural Affairs (Defra) and has been imported into CadnaA.

In terms of noise sources, it is only necessary and practicable to add in the A23. Daytime and night-time flows for this road have been determined based on the average $L_{Aeq,16h}$ and $L_{Aeq,8h}$ levels (as presented in Tables 4.2 and 4.3) measured at both locations (as presented in Table 3.1). Good correlation was found between the levels at both locations, confirming that the A23 was dominant and indicating that the model should be fit for purpose.

Accordingly, the (calibrated) model has been used to calculate the day and night-time sound levels across the site with the introduction of the earth bund. The location of the building is as per the current scheme drawings.

The results are summarised in the following figures and tables. The first set of images in Figure 5.2 presents the existing situation, with sound level contour bands representing the daytime $L_{Aeq,16h}$ levels at 4.5 m above ground level (AGL) (equivalent to upper floor window level) as worst case. The second set of images in Figure 5.3 presents the same for the night-time $L_{Aeq,8h}$ period.

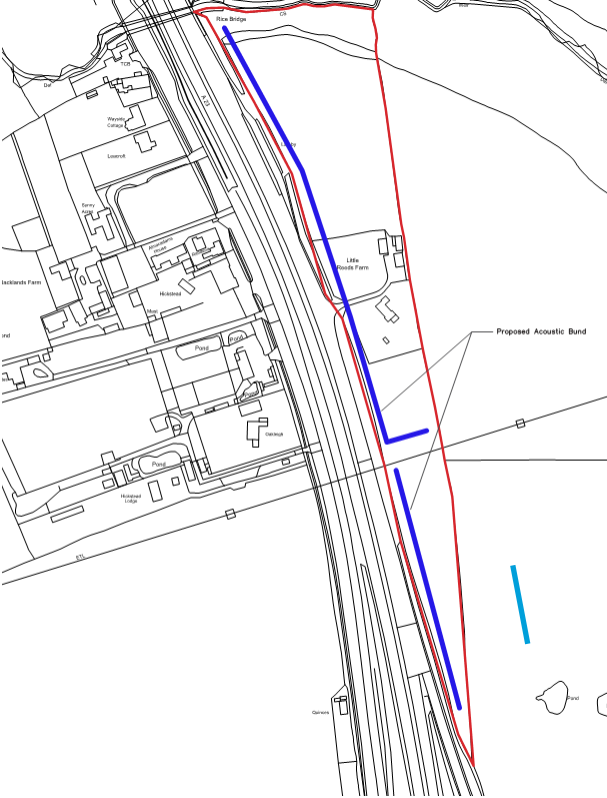
Table 5.1 presents the daytime $L_{Aeq,16h}$ results at ground floor level (1.5 m AGL) and at the upper height (i.e. 4.5 m AGL), where bedrooms would be located. Table 5.2 presents the night-time $L_{Aeq,8h}$ levels at the upper height (i.e. 4.5 m AGL), where bedrooms would be located.

The results are presented and discussed in Section 5.3

5.1 Proposed Bund

The proposed location for the bund is presented in Figure 5.1 below.

Figure 5.1: Indicative Bund Location (blue)



5.2 Results

Graphical noise model results are displayed below in Figures 5.2 and Figure 5.3 for 1.5m AGL and 4.5m AGL, respectively.

Figure 5.2: Calculated Sound Levels Across the Site at 1.5 m AGL

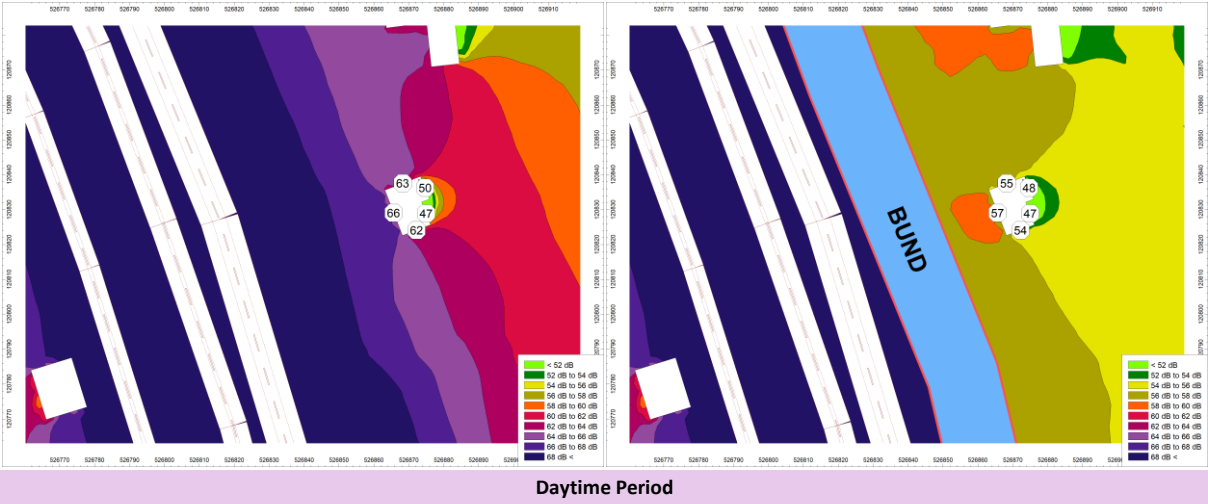
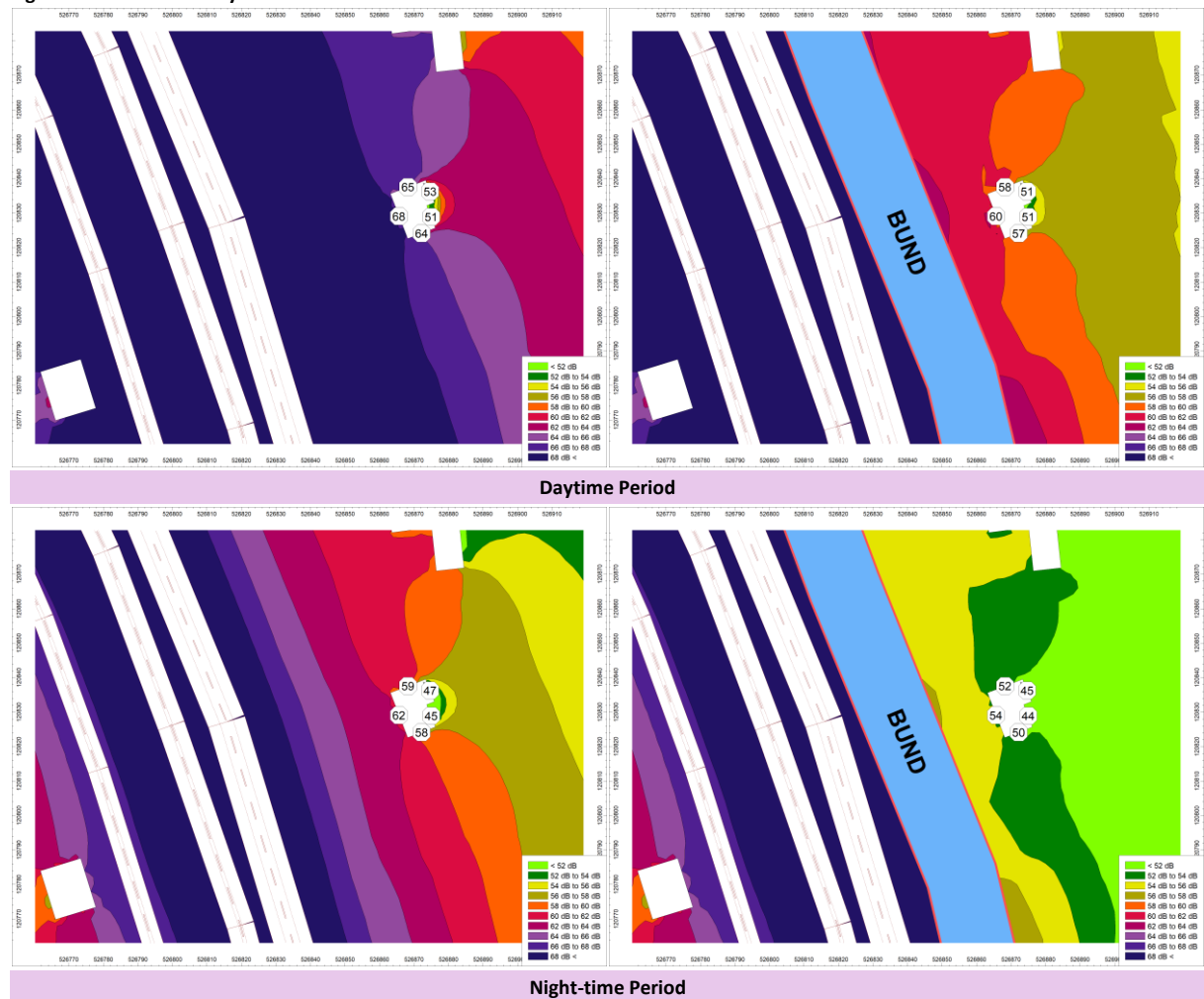


Figure 5.3: Calculated Daytime Sound Levels Across the Site at 4.5 m AGL



The tabulated noise model results are displayed below in Tables 5.1. Values are colour coded according to their difference to the set criteria for outdoor spaces on the ground floor only.

Table 5.1: Calculated Sound Levels for Mitigation Options Compared to Existing

Floor	Façade	Scenario	
		Existing	5m bund
Daytime Period, dB L _{Aeq,16h}			
Ground Floor (1.5 m AGL)	West façade	66	57 (-9)
	North façade	63	55 (-8)
	East façade	50	48 (-2)
	South façade	62	54 (-8)
First Floor (4.5 m AGL)	West façade	68	60 (-8)
	North façade	65	58 (-7)
	East façade	53	51 (-2)
	South façade	64	57 (-7)

Floor	Facade	Scenario	
		Existing	5m bund
Night-time Period, dB L _{Aeq,8h}			
First Floor (4.5 m AGL)	West façade	62	54 (-8)
	North façade	59	52 (-7)
	East façade	47	45 (-2)
	South façade	58	50 (-8)

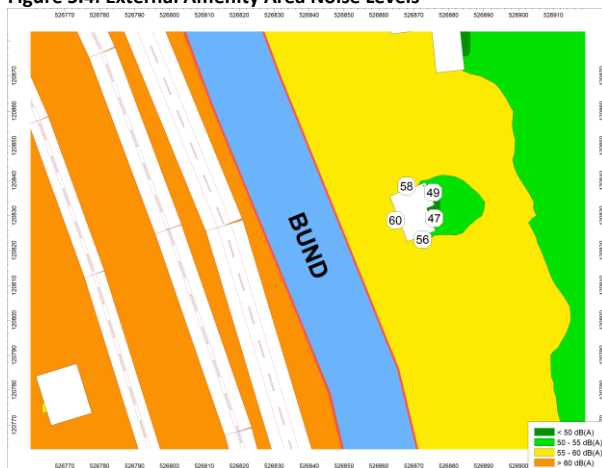
6 NOISE CONTROL SCHEME

6.1 External Noise Conditions

As quoted earlier, BS 8233 states that “...for traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments.” Accordingly, an upper target of 55 dB $L_{Aeq,16h}$ is considered appropriate in this instance.

Predictions indicate that the upper target of 55 dB would be met for ground floor spaces towards the east of the building with a 5m bund in place. Therefore, with the dwelling modelled in the proposed location, there are external areas around the property that demonstrate conformity with BS 8233.

Figure 5.4: External Amenity Area Noise Levels



6.2 Internal Noise Conditions

Similarly, the internal sound levels should conform to the standard(s) identified by BS 8233. These are presented in Table 3.1, where a level of 35 dB $L_{Aeq,16h}$ applies to living rooms and bedrooms during the day, and a level of 30 dB $L_{Aeq,8h}$ applies to bedrooms at night. In addition to which, though not given in BS 8233, a level of 45 dB L_{AFmax} would also typically apply to bedrooms at night.

It should be borne in mind that, as stated in BS 8233, these levels are based on annual average data and do not have to be achieved in all circumstances.

The difference between the external and internal conditions will be dictated by the windows and means of ventilation. The first place to start is to consider the sound insulation performance of an open window, such as for ventilation or cooling purposes. As per the value given in BS 8233, a performance of 15 dB is usually adopted for the purpose of a partially open window.

We have assumed, at least, the following glazing units will be used with a single slot vent required per bedroom.

Table 6.1: Acoustic performance of the windows and ventilation units

Element	Description	SRI (dB) at Octave Band Frequencies (Hz)						$R_w(C_{tr}) / D_{n,e,w}(C_{tr})$
		125	250	500	1k	2k	4k	
Glazing	6/12/6 mm double glazing	20	19	29	38	34	45	31 (-4)
Vent	Standard acoustic trickle vent	30	33	38	37	36	36	38 (-2)

For the non-glazed façade elements, the following are applicable.

Table 6.2: Acoustic performance of the walls and roof

Element	Description	SRI (dB) at Octave Band Frequencies (Hz)						$R_w(C_{tr})$
		125	250	500	1k	2k	4k	
Walls	Brick-block cavity wall	41	45	45	54	58	58	52 (-4)
Roof	Tiled roof, 12 mm plasterboard ceiling, sound absorbing layer	24	34	40	45	49	49	43 (-6)

6.2.1 Partially Open Window

Based on the above, and room and element dimensions estimated for a dwelling of this size, the calculated internal sound levels are as follows for partially open windows in Tables 6.3 to 6.5.

Values are colour coded according to their difference to the set criteria for that metric. As mentioned in Section 3, assuming the risk or occurrence of overheating is low, whereby cooling by opening windows is only required occasionally, levels of at least up to 10 dB above those in Table 3.1 are likely to be considered acceptable.

This assumption is considered reasonable since the development is for a detached, multi-aspect property, surrounding by green infrastructure. The colours are coded to **less than or equal to +5 dB**, **between +6 and +10 dB** and **greater than +10 dB**.

Table 6.3: Calculated Internal Daytime Sound Levels within Ground Floor Rooms (with a Partially Open Window)

Option	Daytime dB $L_{Aeq,16h}$ (Comparison with default BS 8233 Criterion, dB)			
	West façade	North façade	East façade	South façade
None	51 (+16)	48 (+13)	35 (+0)	47 (+12)
5 m Bunds	42 (+7)	40 (+5)	33 (-2)	39 (+4)

Table 6.4: Calculated Internal Night-time Sound Levels within 1st Floor Bedrooms (with a Partially Open Window)

Option	Night-time dB $L_{Aeq,8h}$ (Comparison with default BS 8233 Criterion, dB)			
	West façade	North façade	East façade	South façade
None	47 (+17)	44 (+14)	32 (+2)	43 (+13)
5 m Bunds	39 (+9)	37 (+7)	30 (+0)	35 (+5)

Table 6.5: Calculated Internal Maximum Night-time Event Levels within 1st Floor Bedrooms (with a Partially Open Window)

Screening	Night-time dB L_{AFmax} (Comparison with default Criterion, dB)			
	West façade	North façade	East façade	South façade
None	59 (+14)	57 (+12)	46 (+1)	56 (+11)
5 m Bunds	51 (+6)	50 (+5)	44 (-1)	48 (+3)

It can be seen that, based on the assumption of low risk of overheating, sound levels are likely to remain acceptable with a window partially open in all instances (as represented by the green and amber colours) with the use of the 4 m bunds. More instances of green colouring are shown with the 5 m bund in place, but amber colouring is shown for the north/west façade.

Accordingly, the use of a 5 m bund is considered to result in acceptable internal noise conditions should windows be opened for ventilation or overheating mitigation.

6.2.2 Windows Closed

The next step is to consider the performance of the window(s) closed, with the trickle vent(s) open (assuming these are the choice for whole dwelling ventilation), which has been done following the 'more rigorous calculation' method set out in BS 8233.

Tables 6.6 to 6.8 give the predicted internal levels with **windows closed and the trickle vent slot open**.

Table 6.6: Calculated Sound Levels within Ground Floor Rooms (with Window(s) Closed and Slot Vent Open)

Screening	Daytime dB $L_{Aeq,16h}$ (Comparison with default BS 8233 Criterion, dB)			
	West façade	North façade	East façade	South façade
None	38 (+3)	36 (+1)	19 (-16)	30 (-5)
5 m Bunds	29 (-6)	28 (-7)	17 (-18)	22 (-13)

Table 6.7: Calculated Sound Levels within 1st Floor Bedrooms (with Window(s) Closed and Slot Vent Open)

Screening	Night-time dB $L_{Aeq, 8h}$ (Comparison with default BS 8233 Criterion, dB)			
	West façade	North façade	East façade	South façade
None	32 (+2)	27 (-3)	15 (-15)	28 (-2)
5 m Bunds	24 (-6)	20 (-10)	13 (-17)	20 (-10)

Table 6.8: Calculated sound levels within 1st floor bedrooms (with window(s) closed and slot vent open)

Screening	Night-time dB L_{AFmax} (Comparison with default Criterion, dB)			
	West façade	North façade	East façade	South façade
None	44 (-1)	39 (-6)	27 (-18)	40 (-5)
5 m Bunds	36 (-9)	32 (-13)	25 (-20)	32 (-13)

It can be seen that, when windows are closed (and vents open), the criteria are met in all instances. The situation of windows being used for ventilation or cooling purposes is further considered below.

6.3 Discussion

The above results demonstrate that internal sound levels within the habitable rooms as per the current layout can be suitably controlled with the construction of a 5 m bund. The inclusion of a bund could allow windows to be opened whilst maintaining "reasonable" or at least "acceptable" internal sound levels (i.e. level no more than 10 dB above the default BS 8233 criteria), thus avoiding the potential for acoustic conditions to be unacceptable during the use of windows to mitigate overheating, regardless of the frequency of occurrence.

7 SUMMARY

Anderson Acoustics has undertaken an assessment to determine the effect of a 5 m bund proposed along the western boundary of the Reeds Farm site, Hickstead in relation to traffic noise from the A23.

An unattended survey was carried out to understand the current sound climate at various locations across the site, with the results having been used to calibrate a 3D noise model of the site and surrounds.

In terms of the external spaces, the relevant BS 8233 upper target of 55 dB would be met for ground floor spaces towards the east of the proposed dwelling with the 5 m bund in place.

In terms of the internal spaces, the assessment has shown that for sound levels to remain “acceptable” with windows partially open for ventilation or cooling purposes, with the proposed bund in place. With windows closed (and trickle vents, where present, open), the default BS 8233 (and L_{AFmax}) noise criteria would be met in all instances.

It has been shown, therefore, that despite the high sound levels from the A23, options are available to achieve suitable noise conditions within both the external and internal noise-sensitive areas. It is considered, therefore, planning permission could be granted from the proposed development subject to suitable noise-related planning conditions. It is anticipated that a condition will be required to confirm the noise control strategy based on the final designs for the development, including any boundary screening.

The impact of transportation noise associated with the development on nearby existing noise sensitive receptors show that noise level increase is marginal and falls into the “No Observed Adverse Effect Level” NPSE category. As such, it is considered that the noise level increase as a result of the development is not likely to unduly affect the nearest noise sensitive receptors.

Details of proposed building services equipment have not yet been developed at this stage of the design. As such, it is recommended that a detailed noise impact assessment is undertaken during the detailed design stages of the development.

With the above in mind, providing the above is incorporated in the design of the development, our recommendation to the decision maker would be to grant planning consent.

8 REFERENCES

- [1] BS8233:2014 - Guidance on Sound Insulation and Noise Reduction for Buildings.
- [2] World Health Organisation (WHO) Guidelines for Community Noise, 2000.
- [3] Professional Practice Guidance on Planning & Noise (ProPG: Planning & Noise, 2017) for New Residential Development.
- [4] ISO 9613-2: 1996 Acoustics - Attenuation of Sound During Propagation Outdoors.

APPENDIX A

NOISE SURVEY TIME HISTORY GRAPHS



Figure A-1: Noise survey's time history – Monitoring Position 1

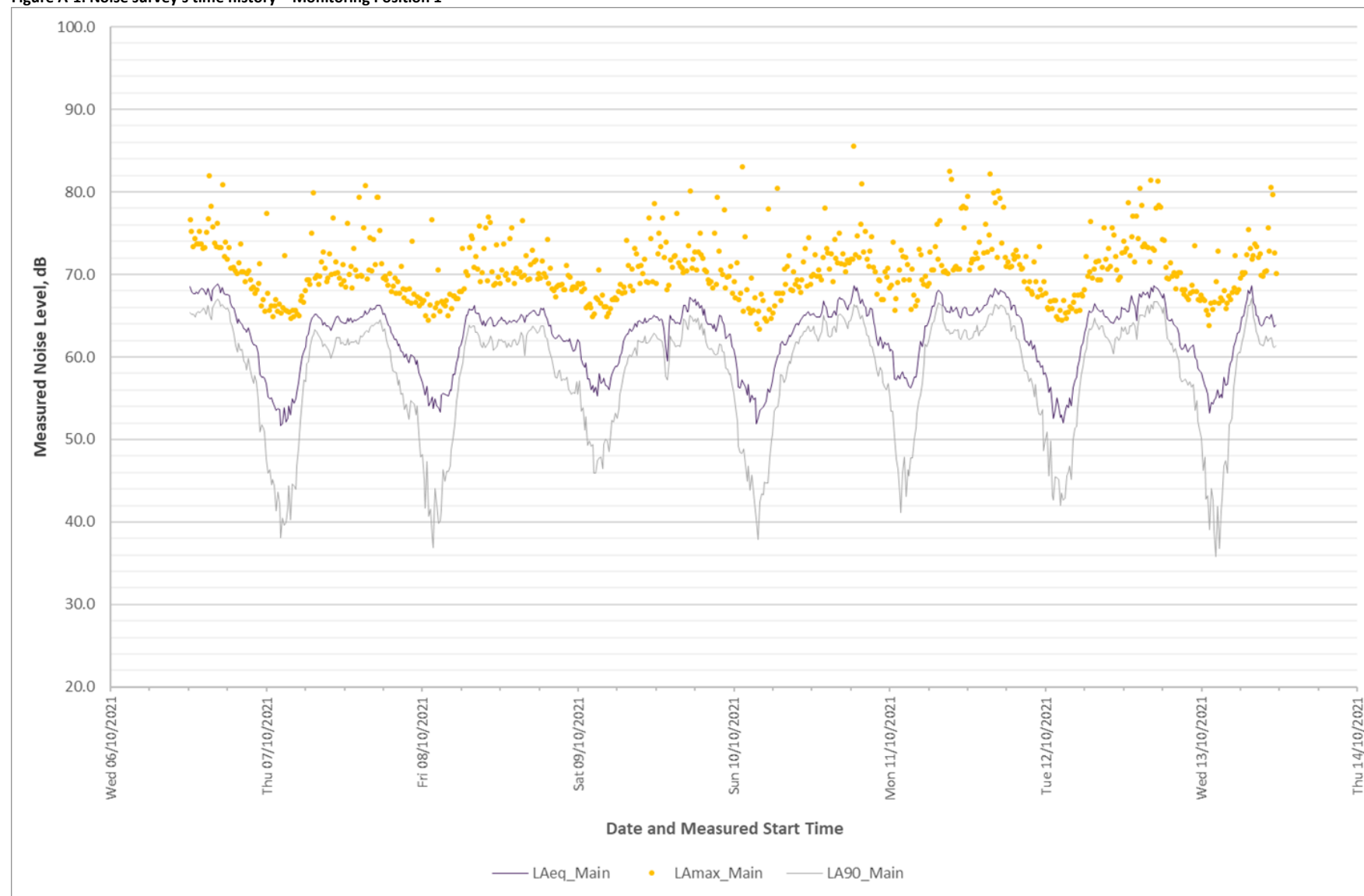


Figure A-2: Noise survey's time history – Monitoring Position 2

