



Acoustic Planning Report

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PROJECT:

**THE COTTAGE
SHRIPNEY ROAD
BOGNOR REGIS
PO22 9PA**

CLIENT:

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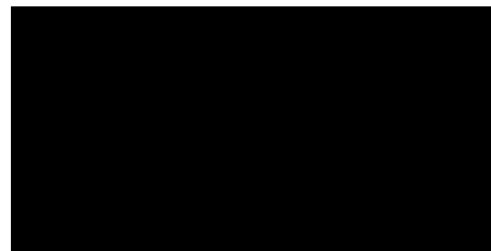
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Executive Summary

Castle Property Developments Ltd is seeking to obtain outline planning permission to redevelop the land known as The Cottage, Shripney Road, Bognor Regis, PO22 9PA to provide 31 residential dwellings, comprising a mixture of houses and apartments.

Noise assessments have been undertaken in respect of internal noise levels within the habitable areas of the proposed dwellings and noise levels in outdoor private and communal amenity areas, in line with the planning requirements of Arun District Council.

As part of this assessment, a comprehensive baseline noise survey was undertaken between Wednesday 19th April and Friday 21st April 2017 to establish and quantify the existing noise levels at the Site, which have been used to calibrate a 3-dimensional acoustic model.

Based on the measured noise levels affecting the site, preliminary façade sound insulation calculations have been undertaken to establish the minimum sound reduction performance requirements of the glazing and ventilation systems in order to comply with the internal noise limits of BS 8233:2014 and WHO:1999.

Preliminary façade calculations indicate that suitable internal noise levels can be achieved on the most exposed (noisiest) residential façade with the use of double glazing achieving a minimum sound reduction performance of dB 34 R_w and trickle ventilation achieving a minimum weighted, normalised element level difference of dB 36 $D_{n,e,w}$.

The assessment of the daytime noise levels in outdoor amenity areas indicate that the noise levels in private gardens will be < 55 dB $L_{Aeq,16hr}$ and are therefore considered compliant with Arun District Councils requirements and relevant industry guidance. Noise levels in communal outdoor amenity areas closer to Shripney Road are predicted to be in excess of this criteria by 5 – 10 dB. However, considering the proximity to Shripney Road, it is not considered practicable to achieve compliant levels in all proposed communal amenity areas.

1. Introduction

Hilson Moran Partnership Ltd has been commissioned by Castle Property Developments Ltd to undertake a noise assessment in support to obtain outline planning permission to redevelop the land known as The Cottage, Shripney Road, Bognor Regis, PO22 9PA. The development comprises 31 residential dwellings and associated access and car parking.

This report considers the Site's suitability for the proposed uses through the measurement of existing noise levels affecting the Site, which have been used to carry out the following works:

- Prediction of façade incident noise levels affecting the buildings of the proposed development using CadnaA noise modelling software.
- Preliminary façade sound insulation assessment to provide early indication of the necessary sound insulation performance required to achieve appropriate internal noise levels in accordance with BS 8233:2014, WHO Guidance and the planning requirements of Arun District Council (ADC).
- Calculations to predict the daytime noise levels in private and communal external amenity areas proposed as part of the development and assessment against the relevant planning requirements of Arun District Council.

Appendix A presents an explanation of the acoustic terminology used within this report.

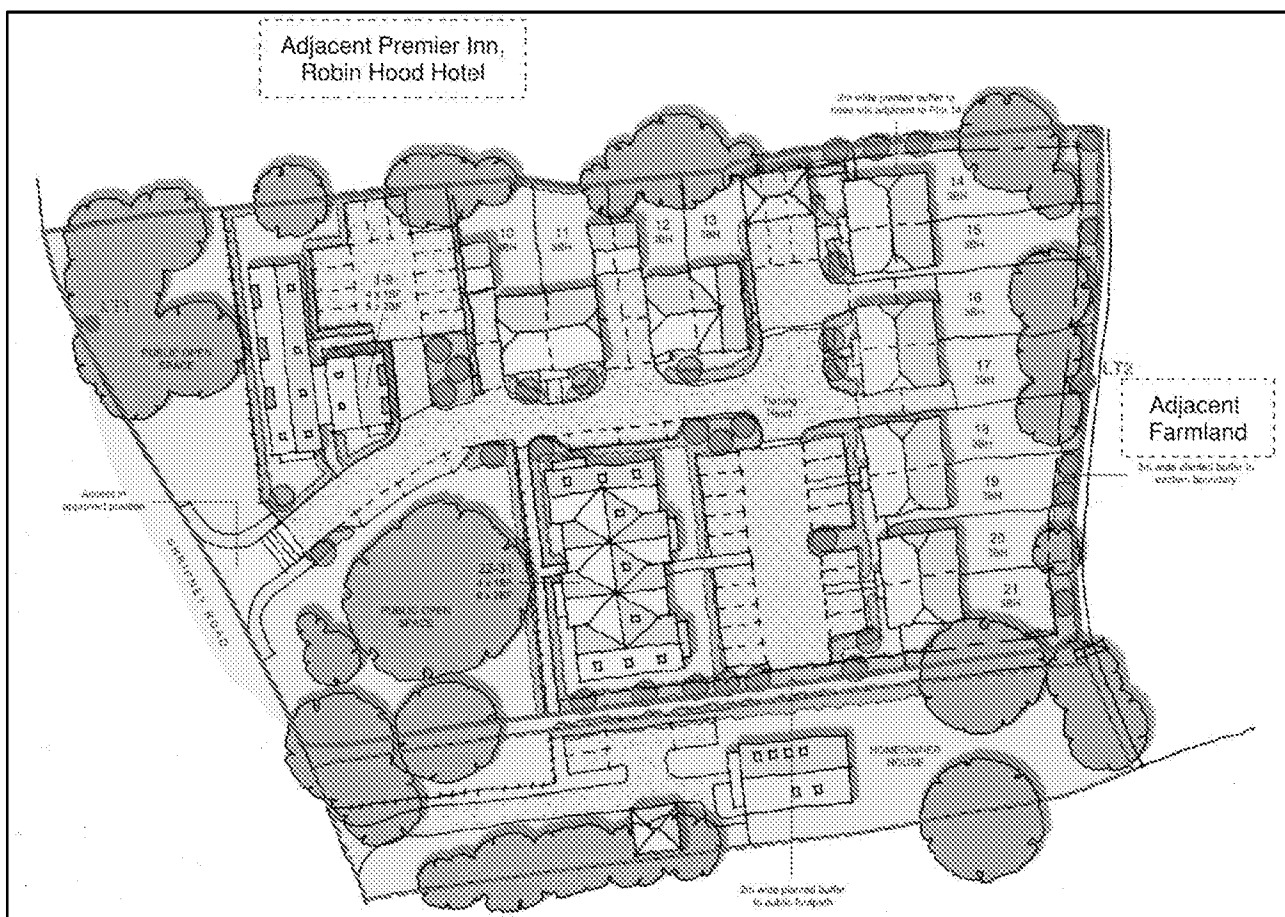
2. The Site, Site Setting and the Proposed Development

2.1. Site Description

The application Site (National Grid Reference: SU 93824 02326) is approximately 0.71 ha in area and is currently occupied by a single dwelling. The Site is situated to the east of Shripney Road and bound to the east by farmland. A hotel (Premier Inn, The Robin Hood) is located directly the north and residential properties and vacant land border the site to the south.

A site location plan is provided as Figure 2.1, showing the location of the Site and orientation with respect to other existing developments, major transport links (Shripney Road) and noise survey measurement locations.

Figure 2.1 Location Plan of the Site and Survey Locations



2.2. Noise Climate Summary

The noise climate of the Site is dominated by noise from road traffic flows along Shripney Road which was noted to experience a mixture of passenger vehicles and HGVs movements. Road traffic noise from the A259, approximately 600 m southeast of the Site was noted to contribute to the daytime noise climate. We anticipate the above would be accurate for night-time periods also, however the extent on HGV movements is expected to be considerably lower.

3. Assessment Criteria

3.1. National Planning Policy Framework

The National Planning Policy Framework (NPPF) is the main source for considering noise within the planning regime. The framework gives local authorities policies and guidance by which they can derive their own set of criteria relevant to their local development plans.

NPPF's aim is to prevent new or existing developments from contributing to existing noise pollution or from being excessively exposed to unacceptable levels of noise pollution.

3.2. ADC Planning Requirements

3.2.1. Internal Noise Levels in Residential Dwellings

The Environmental Health Team of ADC have been consulted and their planning criteria in relation to internal noise levels in residential dwellings has been established. We have been advised that the council requires the internal ambient noise levels to achieve those prescribed in British Standard (BS) 8233:2014.

Table 3.1 summarises the daytime and night-time noise limits presented in BS 8233:2014 for living rooms and bedrooms.

Table 3.1: Summary of Internal Design Criteria for Noise Ingress

Location	Internal Noise Criteria (dB)		
	Daytime (07.00 to 23.00) hours	Night-time (23.00 to 07.00 hours)	
	$L_{Aeq,T}$	$L_{Aeq,T}$	$L_{Amax,F}^1$
Living Rooms	35	-	-
Bedrooms	35	30	45

Notes: ¹ BS 8233:2014 states regular individual noise events can cause sleep disturbance. A guideline value may be set in terms of SEL of $L_{Amax,f}$ depending on the character and number of events per night. WHO guidelines advise for a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB $L_{Amax,f}$ more than 10-15 times per night.

3.3. Noise Levels in External Amenity Areas

There is currently no statutory local or national planning policy that provide mandatory noise limits applicable to outdoor residential amenity areas. However, following discussions with the Environmental Health Team of ADC, we understand that they require a daytime $L_{Aeq,16hr}$ level of 50 dB to be targeted in outdoor living areas (gardens and communal external amenity areas). It is acknowledged by the council that this may not be achievable in all areas where development is desirable, particularly on sites in close proximity with major transport links. ADC therefore stipulate that where this is not achievable, a noise level of 55 dB $L_{Aeq,16hr}$ is targeted in accordance with the WHO guidelines.

4. Baseline Conditions

4.1. Environmental Noise Survey

In support of the planning application for the Proposed Development, a comprehensive baseline noise survey was undertaken at the Site in order to establish and quantify the existing noise climate at, and within the vicinity of, the Site.

Long term unattended noise monitoring was undertaken over a one day period between Wednesday 19th April and Thursday 20th April 2017 at LT1 and over a two day period between Wednesday 19th April and Friday 21st April 2017 at LT2. The noise monitoring locations are described in Table 4.1 and illustrated in Figure 2.1.

Table 4.1: Description of Noise Survey Monitoring Positions

Monitoring Position	Description	Observations and Predominant Noise Sources
LT1 (Shripney Road)	Measurements at the southern boundary of the Site adjacent to Shripney Road and existing hotel. Microphone secured to an existing bordering fence, 1m above ground level.	Noise from passing vehicles along Shripney Road. Contributory noise from human activities in the area and distance traffic along the A259.
LT2 (Eastern Border of Site)	Measurements at the eastern boundary of the Site, overlooking adjacent farmland. Microphone secured to a bordering fence, 1.5m above ground level.	

All noise measurements were taken with a calibrated precision grade (Class 1) frequency (one-third-octave band) sound level meter. The sound level meters were set-up to record over consecutive 5-minute periods the L_{eq} , L_{90} , L_{10} , L_1 and L_{max} noise indices in the A-weighting network over 125 ms fast response time constant intervals for the duration of the survey. The indices are described in Appendix A of this report, but roughly translated they describe in turn the average, background, road traffic, maximum noise level excluding one off events and maximum noise levels. Full details of the instrumentation used for the noise measurements, including equipment calibration certificates can be provided upon request.

Weather conditions, whilst not actively measured during the survey period, were monitored remotely throughout. Overall, weather conditions were considered suitable for the measurement of noise, it being mostly fine and dry throughout. Wind was noted to be light to moderate, ranging between 4 to 7 m/s, with only occasional gusts.

4.2. Baseline Noise Results

The full results of the baseline noise survey are displayed graphically in time-history format in Appendix B, whilst a summary of the measured daytime and night-time noise levels for the survey period are provided in Table 4.2.

Table 4.2: Summary of Baseline Noise Monitoring Results

Monitoring Position	Period	Duration	L _{Aeq,T} dB	L _{A90,T} dB	L _{A10,T} dB	L _{AFmax,1min} dB
			Ave(Max) ¹	10 th %ile ²	Ave ³	Min – Max (10 th highest)
LT1 (Shripney Road)	Day	16 hr	68	46	71	43-88 (84)
	Night	8 hr	61	28	53	29-81 (78)
LT2 (Eastern Border of Site)	Day	16 hr	52	47	52	39-83 (72)
	Night	8 hr	50	25	44	24-74 (71)

Notes: ¹ Logarithmic average over the day / night periods (maximum measured L_{Aeq,1hr}); ² The lowest 10th percentile L_{A90,1min} value is presented, which is considered representative of the typically lowest daytime / night-time background levels experienced; ³ Arithmetic average over the day / night periods; All figures are rounded to the nearest whole decibel.

5. Assessment of Noise Ingress

A 3-dimensional noise model of the Site has been prepared using the acoustic software package CadnaA to predict the likely levels of noise incident on the facades of the different buildings. The noise model has been constructed using the architect's site layouts and calibrated using the results of the baseline noise survey.

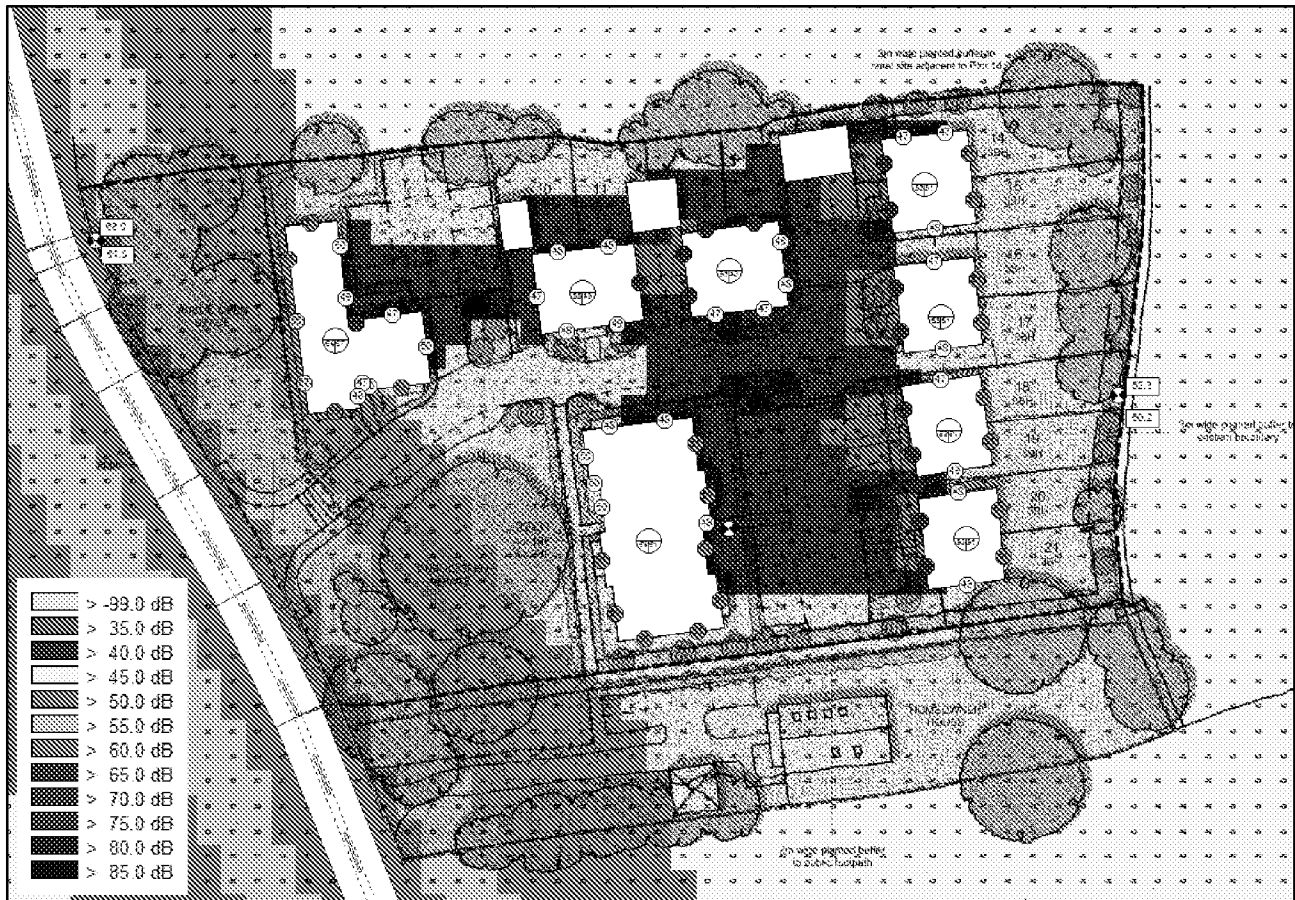
We note that as part of the development, an internal road will be included, which will provide access to the proposed dwellings. With consideration given to the expected travel speed of vehicles and the anticipated volumes of traffic relative to the nearby existing road sources, noise levels from this road are not expected to significantly impact the baseline noise climate and on this basis have been excluded from this assessment.

Modelled noise contour plots showing predicted daytime (07.00 to 23.00 hours) and night-time (23.00 to 07.00 hours) ambient (L_{Aeq}) noise levels incident on each façade of the proposed buildings are presented in Figure 5.1 and Figure 5.2.

Figure 5.1: Daytime Noise Contour Plot of the Site, $dB L_{Aeq,16hr}$



Figure 5.2: Night-time Noise Contour Plot of the Site, $\text{dB } L_{Aeq,8hr}$



The different coloured noise bands correspond to different levels of noise exposure, as per the key provided, with the highest noise levels broadly predicted in areas of the site closest to Shripney Road. Modelled noise levels indicate the worst affected building façades to be the western façade of Block 1-9, overlooking Shripney Road where daytime noise levels of $64 \text{ dB } L_{Aeq,16hr}$ and night-time levels of $57 \text{ dB } L_{Aeq,8hr}$ and $64 \text{ dB } L_{AFmax,10thhighest}$ are predicted to be experienced.

The degree of external environmental noise ingress into internal areas of a building depends on the acoustic performance of all elements of the facade, but is generally influenced by the components providing the least airborne sound reduction, in this case the glazing.

Preliminary calculations have been undertaken to provide an early indication of the minimum sound insulation performance requirements of the glazing in order to achieve the internal criteria set out in Section 3 of this report (with windows closed).

The calculations are based on the methodology set out in BS 8233:2014 and, since the architectural design of the proposed dwellings is not yet sufficiently developed, are based on the following assumptions:

- The non-glazed elements of the façade will comprise a traditional blockwork cavity construction, achieving a minimum sound reduction of at least R_w 52 dB.
- The glazed elements of the façade will have an area of no more than 2.5m² and 5m² for bedrooms and living rooms respectively and will make up no more than 50% of the total external façade area.
- Bedrooms and living rooms will have 1no. and 2no. background trickle ventilators respectively.
- The habitable rooms will have typical internal room finishes, such as carpeted floors, plasterboard walls and ceilings.
- Bedrooms and living rooms will have a volume no less than 25m³ and 50m³ respectively.

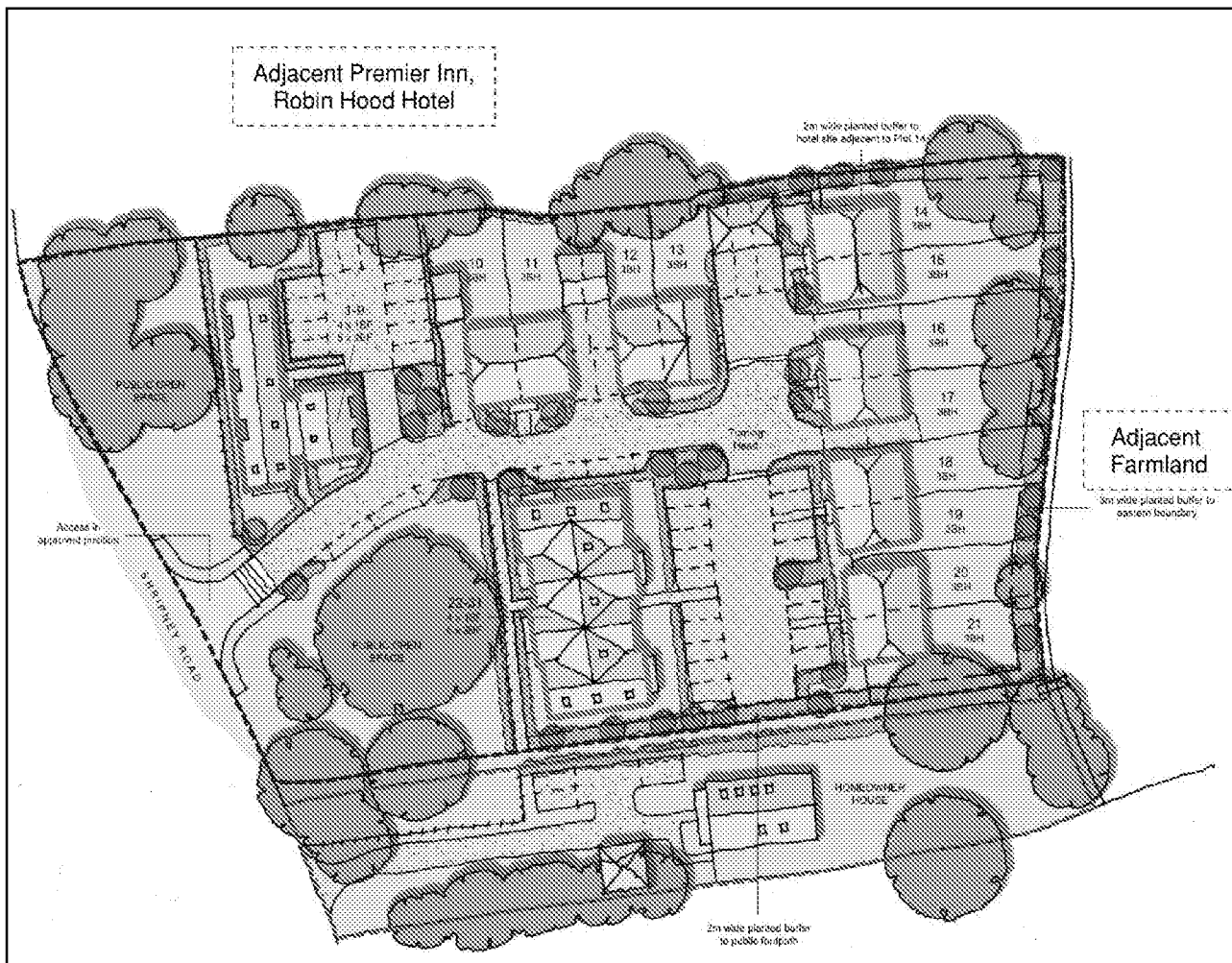
Based on the above, the minimum laboratory weighted sound reduction performance (R_w) for the glazing to each façade has been calculated and categorised in Table 5.1. In addition, details of suitable background ventilation strategies that could be employed whilst maintaining suitable internal noise levels have been provided. The table below should be read in conjunction with Figure 5.3, which presents an annotated site plan, indicating the location and extent of each façade category.

Table 5.1: Minimum Sound Reduction Requirements for Glazing Systems

Façade Category	Minimum Glazing Sound Reduction (dB, R_w)	Suitable Background Ventilation Strategies
A	34	In-frame ventilator achieving minimum $D_{ne,w}$ 36 dB or mechanical ventilation
B	30	In-frame ventilator achieving minimum $D_{ne,w}$ 33 dB or mechanical ventilation

The recommendations provided above are for planning guidance only and a detailed assessment of noise ingress should be undertaken during the subsequent design stages, incorporating octave band Sound Reduction Indices (SRI) to be achieved by the window system as a whole, including frames, seals, opening lights etc.

Figure 5.3 Extent and Location of Façade Sound Reduction Categories



6. Assessment of Outdoor Amenity Areas

Using the results of the 3-dimensional acoustic model, an assessment has been undertaken to establish the likely daytime ambient (L_{Aeq}) noise levels in the private (gardens) and communal external amenity areas (public open spaces) throughout the development. The results of the assessment are shown in Figure 6.1 and summarised in Table 6.1.

Figure 6.1: Daytime Noise Contour Plot of the External Amenity Areas, $dB L_{Aeq,16hr}$

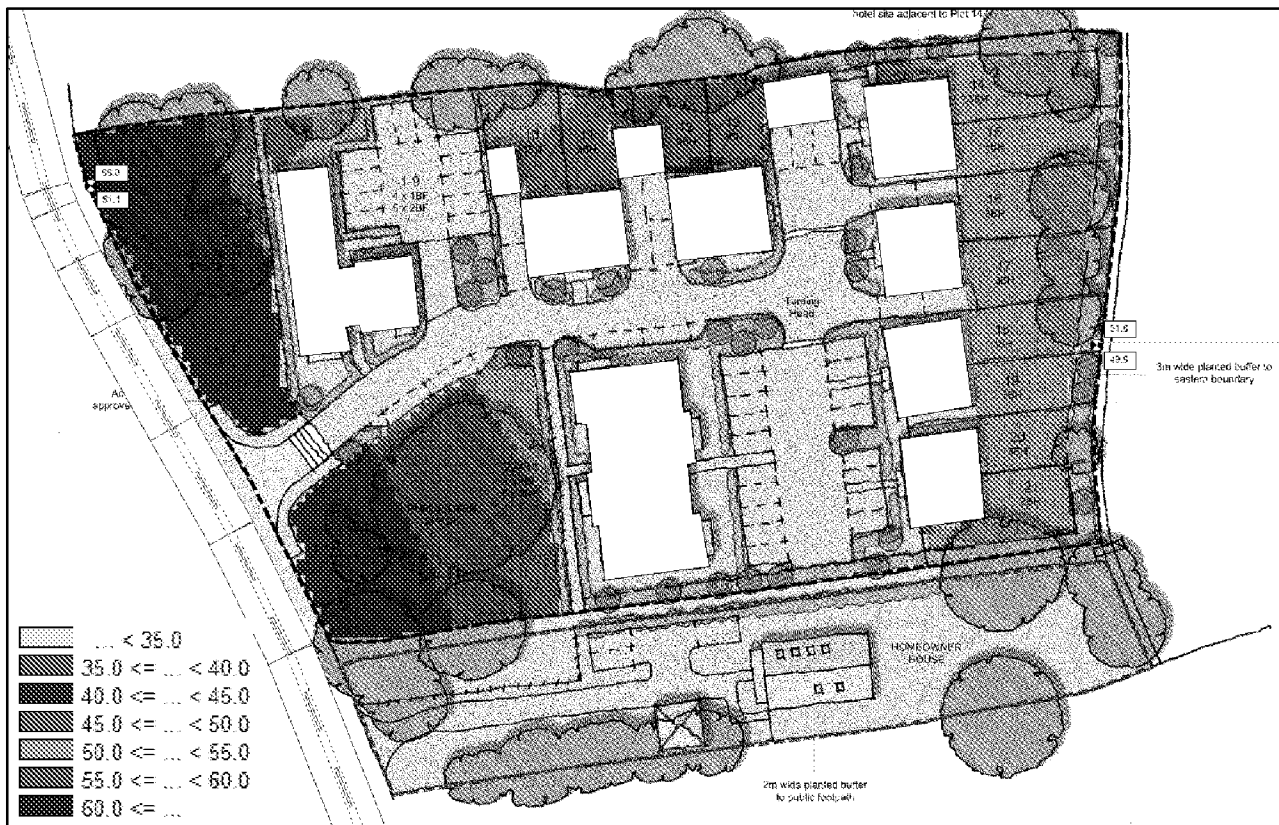


Table 6.1 Predicted Approximate Areas of External Amenity Noise Exposure Levels

Colour Code	Noise Range (dB, $L_{Aeq,16hr}$)	Approximate Predicted Area (m^2)	Percentage of Total
Green	45 - 50	298	10 %
Orange	50 – 55	1,261	43 %
Red	55 – 60	516	18 %
Purple	60 +	858	29 %

From a review of the noise contour map in Figure 6.1, it can be seen that all proposed private gardens are predicted to be in compliance with the 55 dB $L_{Aeq,16hr}$ requirement of Arun District Council (green and orange categories).

The public open spaces proposed along the west of the site are subject to higher ambient noise levels due to their proximity to Shripney Road, resulting in an exceedance of 5 – 10 dB of the targeted limit of 55 dB.

In order to reduce the noise levels in these areas to achieve compliance with ADC's requirements, a solid and impermeable construction circa 3 m would be required along the entire western boundary (excluding access), which is unlikely to be practical and desirable.

Furthermore, it should be recognised that BS 8233:2014 *Sound insulation for buildings* provides the following with respect to noise level in external amenity areas:

'these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted.'

Based on the above, and on the basis that all areas of private amenity are predicted to be compliant with ADC's requirements, the development should be considered to provide adequate area of satisfactorily quiet outdoor amenity for the use of the residents, as far as is reasonably practicable in this area.

Appendix A – Glossary of Acoustic Terminology

The following table contains a list of frequently used acoustic terms we use in our reports, along with an explanation of what each of the terms mean.

Term	Description
Decibel, dB	The decibel is a logarithmic unit of measurement used for quantifying sound. It is derived from the logarithm to base 10 of the ratio of two quantities. Use of a logarithmic scale has the advantage that it compresses the very wide range of sound pressures to which the ear may typically be exposed to a more manageable range of numbers.
Frequency, Hz	In sound, the number of cycles per second of a pressure fluctuation and frequency in sound is proportional to its pitch. Different frequencies are divided into octave and one third octave bands.
Sound Pressure Level, L_p	This is the unweighted or linear level which is measured prior to any weightings being applied. The sound pressure level is 20 times the logarithm to base 10 of the ratio of the reference sound pressure (2×10^{-5}) and the measured sound pressure.
Sound Power Level, L_w	This is the total sound energy radiated from a given source. The sound power Level is 10 times the logarithm to base 10 of the ratio of the reference sound power level (1×10^{-12}) and the measured power.
Frequency Weightings	Weightings can be applied to a spectrum of sound and act as a filter to account for different sensitivities and conditions.
Time Weightings	A time weighting to denote the response of the sound level meter. For most measurements the Fast time weighting is selected (F) however, a slow time weighting (S) is often used to for the measurement train noise and vibration.
A-weighted sound pressure level, L_{pA}	The sound pressure level with the A-weighting applied. The A-weighting is used for most environmental noise measurements and is used to weight a spectrum of sound to match the sensitivity of the human ear.
Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$	The L_{Aeq} is an energy average and defined as the level of sound which, over a given period of time, would equate to the same A-weighted sound energy as the actual fluctuating sound.
Octave Bands	A band of frequencies in which the upper limit of the band is twice the frequency of the lower limit.
Maximum noise Level, L_{AFmax}	The maximum instantaneous noise level measured during a given period of time. The time weighting to which the meter is set for this measurement parameter is always indicated by either an F or S.
Percentile level, $L_{AN,T}$	A-weighted sound pressure level obtained using time-weighting F, which is exceeded for N% of a specified time interval. An example of this is background noise which is quantified with the L_{A90} descriptor, which is the A-weighted level which is exceeded for 90% of the measurement period.
Sound exposure level, L_{AE}	A level of a sound, of 1 s duration, that has the same sound energy as the actual noise event considered.
Rating Level, $L_{Ar,Tr}$	The equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise.
Ambient Noise Level	The noise level in a given environment whilst it is subject to all of its normal sources of noise.

Term	Description
Background Sound / Noise Level, L_{A90}	These are amongst the lowest noise levels measured over a given period of time and exclude short term, intermittent noise sources. The background noise level is quantified by the L_{A90} descriptor and is therefore the level which is exceeded for 90% of a given period of time.
Reverberation Time, T	The time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped. The descriptor T , often includes other nomenclature to describe the type of reverberation time measurement or if the reverberation time is an average taken for specific frequencies. For example a T_{mf} is the mid-frequency reverberation time.
Absorption Coefficient, α	The fraction of reverberant sound energy absorbed by a material. It is expressed as a value between 1.0 which equates to perfect absorption and 0 which equates to zero absorption.
Absorption, A	The acoustic absorption derived from the multiplication of the absorption coefficient by the surface area of a given material.
Acoustic Class, A - E	Classification of sound absorbers into Sound Absorption Classes A-E, according to BS EN ISO 11654, including frequencies 200-5000 Hz
NRC	A single-number rating system used to compare the sound-absorbing characteristics of building materials. A measurement of the acoustical absorption performance of a material, calculated by averaging its Sound Absorption Coefficients at 250, 500, 1000 and 2000 Hz
Sound Reduction Index, R	The laboratory measured sound insulation properties of a material or building element in octave or third octave bands.
Weighted Sound Reduction Index, R_w	A single number which represents the sound reduction of a material. It is derived by plotting the sound reduction index against a set of reference curves. The curves are shifted until a best-fit is established and the curve which best fits the sound reduction spectrum is used to represent the single figure value.
Weighted Level Difference, D_w	The weighted level difference between a pair of rooms, stated as a single figure.
Standardized Weighted Level Difference, $D_{nT'w}$	The standardized, weighted difference in sound level between a pair of rooms, stated as a single figure. The level difference in octave bands is first normalized to a reference reverberation time and then plotted against a set of reference curves to establish a single figure value.
Weighted, Normalised Flanking Level Difference, D_{nFw}	The normalised, weighted difference in sound level between a pair of rooms via a flanking element, such as mullion or ceiling detail. The level difference in octave bands is first normalized to a reference amount of absorption and then plotted against a set of reference curves to establish a single figure value.
Normalised Element Level Difference, D_{ne}	The normalised difference in sound level between a pair of rooms via a small element such as a trickle ventilator. The level difference in octave bands is normalized to a reference amount of absorption.
Weighted, Normalised Element Level Difference, D_{new}	The normalised, weighted difference in sound level between a pair of rooms via a small element such as a trickle ventilator, stated as a single figure. The level difference in octave bands is normalized to a reference amount of absorption and then plotted against a set of reference curves to establish a single figure value.
C_{tr}	A correction term applied to the sound insulation single-number values (R_w , D_w , and $D_{nT,w}$). Applying the C_{tr} penalises a construction's performance if its low frequency performance is poor in relation its performance at higher frequencies.

Term	Description
Impact Sound	The noise generated by an impact on a structure. This is normally used to describe the noise created by people walking on a floor structure.
Weighted standardized impact sound pressure level, $L_{nT,w}$	A single-number quantity used to characterize the impact sound insulation of floors over a range of frequencies.
Cross-talk	Noise transmission between one room and another room or space via a duct or other path.
Insertion Loss, IL	The reduction of noise level due to the presence of a noise control device such as an attenuator, excluding any regeneration noise created by its presence.
Dynamic Insertion Loss, DIL	The reduction of noise level due to the presence of a noise control device such as an attenuator, including any regeneration noise created by its presence.
NR	The Noise Rating level. This is a single figure value derived by plotting a noise spectrum against a set of curves. The curve under which the spectrum fits is the resulting NR level.
Vibration	The vibratory motion of a surface can be characterised by: (a) displacement (m), (b) velocity (m/s), or (c) acceleration (m/s^2). The magnitude of the vibration can be quantified in several ways: Peak to Peak - The total excursion of the oscillation about the zero datum. Peak - This value gives the maximum excursion of the oscillation above or below the zero datum. r.m.s. - This value gives the root mean square of the time history over a specific time interval (time constant). dB - Vibration levels can be expressed in dB. A reference level of $10^{-6} m/s^2$ r.m.s. is usually used for acceleration.
Ground borne noise	Audible noise caused by the vibration of elements of a structure, for which the vibration propagation path from the source is partially or wholly through the ground.
Structure borne noise	Audible noise caused by the vibration of elements of a structure, the source of which is within a building or structure with common elements.
V.D.V,	The VDV is the Vibration Dose a person is expected to be exposed to over the course of the day or night. The VDV is given by the fourth root of the time integral of the fourth power of the acceleration after it has been frequency-weighted.
eVDV	The estimated vibration dose value based on short duration measurements of transients with known durations and occurrences.

Appendix B – Noise Monitoring Results

Figure 1: Noise Time History Graph at Position LT1 (Western Boundary of Site, Adjacent to Shripney Road)

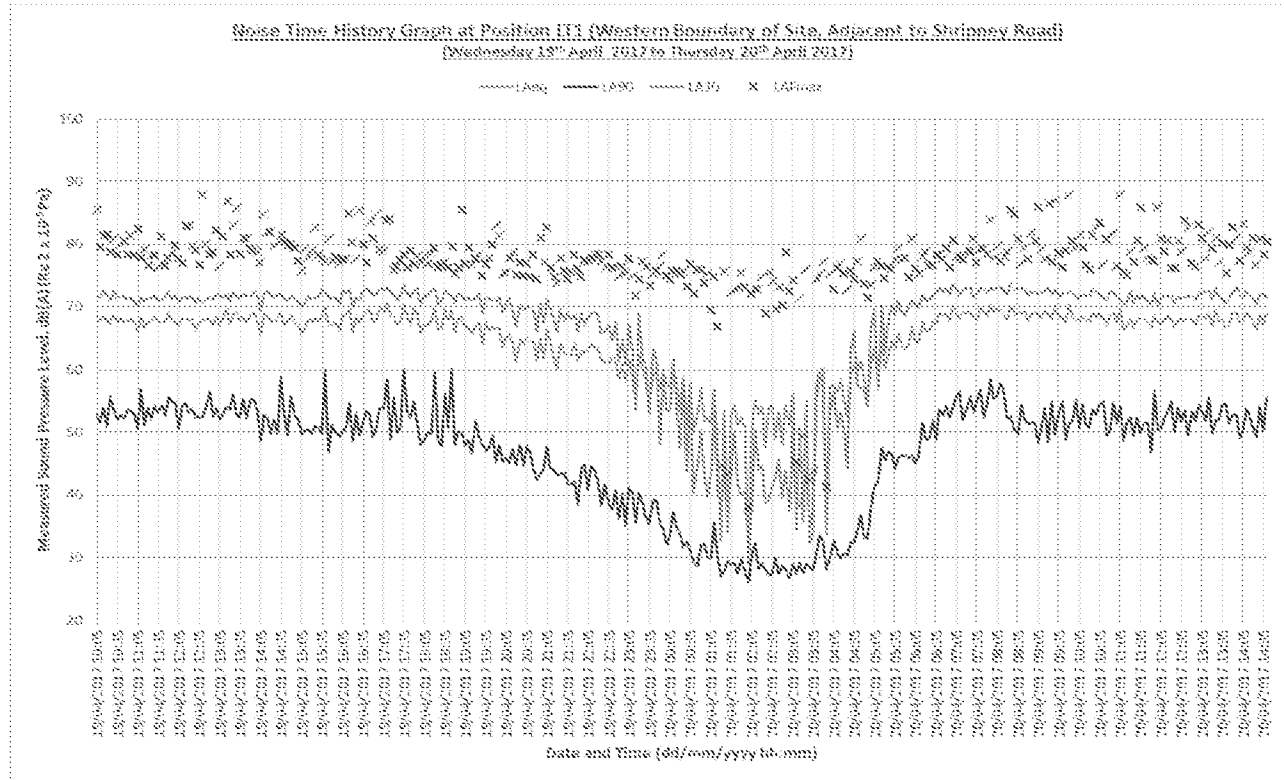


Figure 2: Noise Time History Graph at Position LT2 (East Boundary of Site, Adjacent to Farmland)

