ARDENT
CONSULTING ENGINEERS

THE NORFOLK ESTATE

PROPOSED RESIDENTIAL DEVELOPMENT:

LAND AT TORTINGTON, ARUNDEL

NOISE ASSESSMENT

REPORT REF: NO 173483-06

PROJECT NO: 173483

NOVEMBER 2020

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REV	ISSUE PURPOSE	AUTHOR	CHECKED	APPROVED	DATE
-	DRAFT	LD	MNR	KM	26/10/2020
-	FINAL SUBMISSION	LD	MNR	KM	26/11/2020

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1.0 INTRODUCTION

1.1 Ardent Consulting Engineers were instructed by the Norfolk Estate to undertake a Noise Assessment to support the residential development of Land at Tortington, Ford Road, Arundel. (hereafter referred to as 'the site').

1.2 This Noise Assessment has been produced to accompany an outline planning application submission to Arun District Council (ADC).

Site Location

1.3 The site is situated at the southern side of Arundel and is bound by: Ford Road to the southeast; Priory Lane to the southwest and west; and the rear boundaries of existing residential properties fronting onto Stewards Rise and Dalloway Road to the north and northeast.

1.4 The site is approximately 10 ha and is centred approximately at Ordnance Survey grid co-ordinates 500591mE, 106269mN. The surrounding area and approximate site boundary is shown in Figure 1.1.

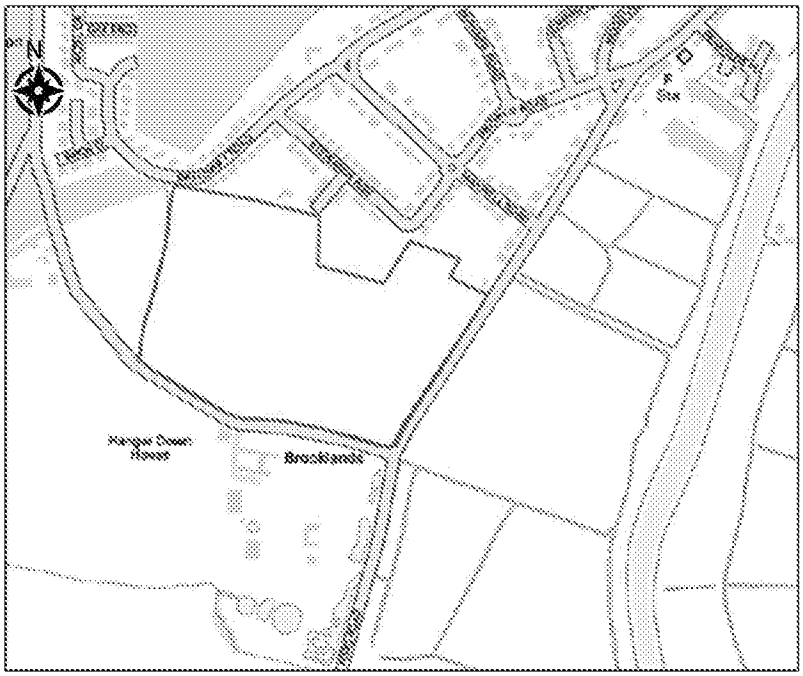


Figure 1.1: Site Location Plan

Development Proposals

1.5 The proposals comprise the development of the site to provide 90 residential dwellings with associated landscaping, parking, and infrastructure. An extract of the indicative proposals is shown in Figure 1.2.

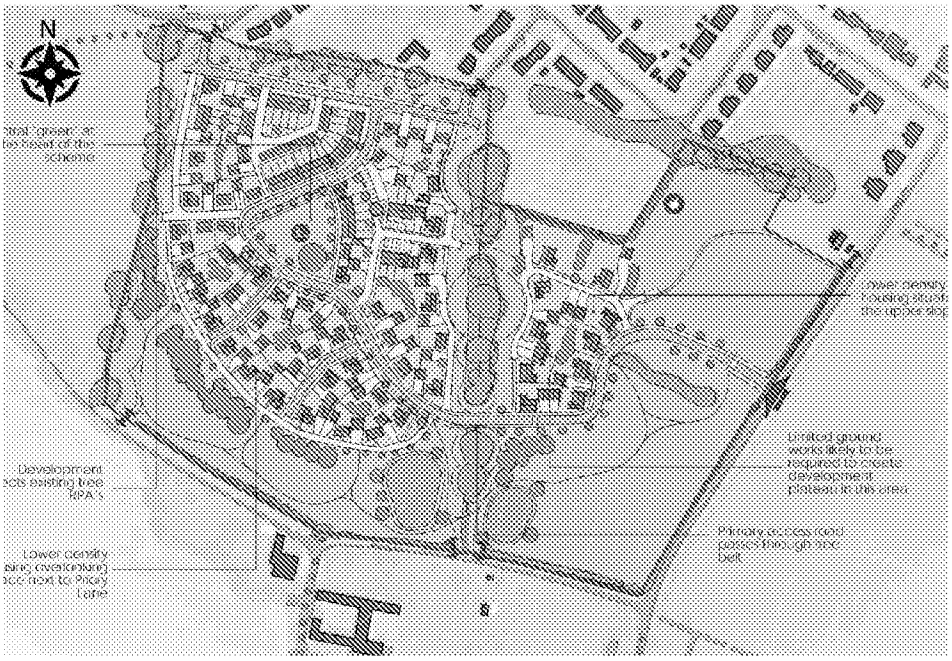


Figure 1.2: Development Proposals ¯ Illustrative Masterplan (Extract)

2.0 RELEVANT POLICY AND GUIDANCE

National Planning Policy Framework (NPPF) ¯ June 2019

2.1 Under the NPPF: paragraph 180 of Section 15, with regard to environmental noise; Planning policies and decisions should aim to: -

- ¿ mitigate and reduce to a minimum, potential adverse impacts resulting from noise from new development ¯ and avoid noise giving rise to significant adverse impacts on health and the quality of life;
- ¿ identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

Noise Policy Statement for England (NPSE)

2.2 To avoid and mitigate adverse noise effects on health arising from and impacting on new development, the NPPF makes reference to NPSE. The NPSE was published in March 2010 and covers all forms of noise, other than occupational noise. For the purposes of this report, `Neighbourhood Noise_ is most relevant as NPSE defined at paragraph 2.5:

`neighbourhood noise which includes noise arising from within the community such as industrial and entertainment premises, trade and business premises, construction sites and noise in the street. `

2.3 NPSE introduces three concepts to the assessment of noise in the UK:

- NOEL ¯ No Observed Effect Level ¯ This is the level below which no effect can be detected and below which there is no detectable effect on health and quality of life due to noise.
- LOAEL ¯ Lowest Observable Adverse Effect Level ¯ This is the level above which adverse effects on health and quality of life can be detected.
- SOAEL ¯ Significant Observed Adverse Effect Level ¯ This is the level above which significant adverse effects on health and quality of life occur.

2.4 NPSE does not numerically define levels for the NOEL, LOAEL or SOAEL rather it makes it clear that the noise level is likely to vary depending upon the noise source, the receptor and the time of day/day of the week, etc.

National Planning Practice Guidance (2014)

2.5 The purpose of the guidance is to complement the NPPF and provide advice on how to deliver its policies.

2.6 The purpose of the guidance is to complement the NPPF and provide advice on how to deliver its policies.

2.7 The guidance includes a table (duplicated below) that summarises "the noise exposure hierarchy, based on the likely average response" and which offers "examples of outcomes" relevant to the NOEL, LOAEL and SOAEL effect levels described in the NPSE.

Perception	Examples of outcomes	Increasing effect level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, eg turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, eg avoiding certain activities during periods of intrusion; where there is no alternative ventilation, 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.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, eg regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, eg auditory and non-auditory	Unacceptable Adverse Effect	Prevent

Table 2.1: Noise exposure hierarchy, based on the likely average response.

Calculation of Road Traffic Noise ¯ 1988

2.8 For new developments, road traffic noise levels should be predicted in accordance with CRTN. This prediction method uses the traffic flow, vehicle speed, and percentage of heavy-duty vehicles (HDVs, over 3.5 tonnes), road gradient and other factors to calculate noise levels at receptor points.

Design Manual for Road and Bridges, Volume 11

2.9 Changes in noise level as a result of additional vehicles on the public highway can be assessed using methodologies presented in Section 3 Part 7 of the Design Manual for Road and Bridges (DMRB), Volume 11. Table 3.2 from DMRB classifies the magnitude of impact for long term increase in traffic noise. Table 3.2 of DMRB is reproduced below at Table 2.2:

Noise Change, $L_{A10(18hour)}$ (dB)	Magnitude of Impact
0	No change
0.1 - 2.9	Negligible
3 ¯ 4.9	Minor
5 ¯ 9.9	Moderate
10+	Major

Table 2.2 (Table 3.2 DMRB)¯ Classification of Magnitudes of Noise Impacts

Control of Pollution Act 1974

2.10 The local authority has powers under the Control of Pollution Act 1974 to control noise from construction sites. Section 60 of the Act allows a local authority to serve a notice of its requirements for the control of site noise. This notice may include specification of plant that is or is not to be used, hours during which the construction works can be carried out and levels of noise emission. Section 61 of the Act allows a contractor or developer to take the initiative and agree with the

local authority the methods of construction, steps to minimise noise and hours of work.

The Environmental Protection Act 1990

2.11 Local authorities have a duty to deal with statutory nuisances under the Environmental Protection Act 1990. For noise to amount to a statutory nuisance, it must be "prejudicial to health or a nuisance" as outlined in Section 79 of the Act. Any proposed development should not result in a statutory nuisance being declared. Should the Local Authority declare a development to cause a statutory nuisance, an abatement notice can be served to the developer who has up to 21 days to appeal to Magistrates˘Court, as detailed in Section 80 of the Act.

The Building Regulations 2010

2.12 Building Regulations approvals are required for most new buildings and for most types of works on existing buildings. Part 10 of The Building Regulations 2010 contains provisions, including power for local authorities to test building work, take samples, and provision to ensure compliance. Part E of the Regulation :Resistance to the passage of sound˘ is expanded in Approved Document E, which provides robust details to control and mitigate noise within buildings. This Document is separated over four parts which include:

- ¿ E1: Protection against sound from other parts of the building and adjoining buildings;
- ¿ E2: Protection against sound within dwelling-house etc.;
- ¿ E3: Reverberation in the common internal parts of buildings containing flats or rooms for residential purposes;
- ¿ E4: Acoustic conditions in schools.

World Health Organisation

2.13 The WHO document Guidance on Community Noise specifies additional information for noise affecting noise sensitive receptors and forms the basis of many noise limitations and design ranges for internal and external ambient noise levels. It defines noise as :a class of sounds that are considered unwanted˘ (by the listener), :that adversely affects, or may affect the physiological and psychological wellbeing of people.˘ Much of the research around this study is based on transportation noise.

2.14 Further guidance on the recommended levels is given in the World Health Organisation (WHO) Guidelines for Community Noise. In this document it is stated that:

`To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55 dB L_{Aeq} on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50 dB L_{Aeq}._

2.15 WHO also states the following paragraph with regard to the effects of L_{Amax} events in a night-time period:

`For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB L_{Amax} more than 10-15 times per night (Vallet & Vernet 1991)._

2.16 WHO guidance :Night Noise Guidelines for Europe˘ is concerned with the longer-term average noise levels that are covered by the EU Directive on Environmental Noise, although this does appear to suggest external maximum noise levels of around 57dBA outside bedrooms during the night to achieve internal maximum levels of 42dBA.

2.17 The World Health Organisation has recently published Environmental Noise Guidelines ¯ for the European Region (2018) to provide recommendations for protecting human health from exposure to noise sources such as transportation (road traffic, railway and aircraft), wind turbine noise and leisure noise.

2.18 The guidance document defines the :strength˘ of recommendation (for protecting against noise exposure) as either :strong˘ or conditional˘, outlined below.

Strength of Recommendation

`A strong recommendation can be adopted as policy in most situations. The guideline is based on the confidence that the desirable effects of adherence to the recommendation outweigh the undesirable consequences. The quality of evidence for a net benefit ¯ combined with information about values, preference and resources ¯ inform this recommendation, which should be implemented in most circumstances._

`A conditional recommendation requires a policy-making process with substantial debate and involvement of various stakeholders. There is less certainty of its efficacy owing to lower quality of evidence of a net benefit, opposing values and preferences of individuals and populations affected or the high resource implications of the recommendation, meaning there may be circumstances or settings in which it will not apply._

2.19 External (free-field) recommendations included in the Environmental Noise Guidelines for the European Region are presented in Table 2.3 for specific noise sources.

Noise source	dB L_{den}	dB L_{night}	dB $L_{Aeq,\ 24hr}$ (yearly average)	Recommendation
Road Traffic	53	45	-	Strong
Railway	54	44	-	Strong
Aircraft	45	40	-	Strong
Wind Turbine	45	-	-	Conditional
Entertainment	-	-	70	Strong/Conditional

Table 2.3: Extract from Environmental Noise Guidelines for the European Region

BS8233:2014 - Guidance on Sound Insulation and Noise Reduction for Buildings

2.20 Formerly a Code of Practice, the 2014 revision of BS8233 is now presented and intended as a guidance document. The standard is mainly concerned with building design from an acoustic standpoint. It does however, contain information relevant to environmental noise more specifically by stating guidance for desirable internal noise levels for dwellings and other buildings. An extract of Table 4 of the document relevant for residential development is reproduced in Table 2.4.

Activity	Location	07:00 to 23:00 dB LAeq, 16hour	23:00 to 07:00 LAeq, 8hour
Resting	Living room	35	-
Dining	Dining room / area	40	-
Sleeping (daytime resting)	Bedroom	35	30

Table 2.4: Extract from Table 4 - Indoor ambient noise levels in dwellings

2.21 The guidance of BS8233:2014 with regards to external amenity spaces is as follows:

`For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise 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 recognized that 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. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited._

ProPG: Planning and Noise - May 2017

2.22 Guidance in ProPG Planning and Noise provides an approach which aims to inform developers, practitioners and local authorities on how potential residential sites should be assessed. The guidance also builds upon government planning policy that noise should not be treated in isolation and there should be a holistic approach to good acoustic design.

2.23 ProPG sets out a 2-stage approach; the first of which is a risk assessment to identify the likelihood of significant adverse impact, then depending on the outcome of this risk assessment the extent of the acoustic design statement required. The graphic in Figure 2.1 is an extract from ProPG and indicates the level of risk associated with ranges of sound levels and provides some guidance on the likely extent of work associated with progressing a development exposed to these sound levels.

2.24 In relation to maximum noise levels, ProPG states that:

`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._

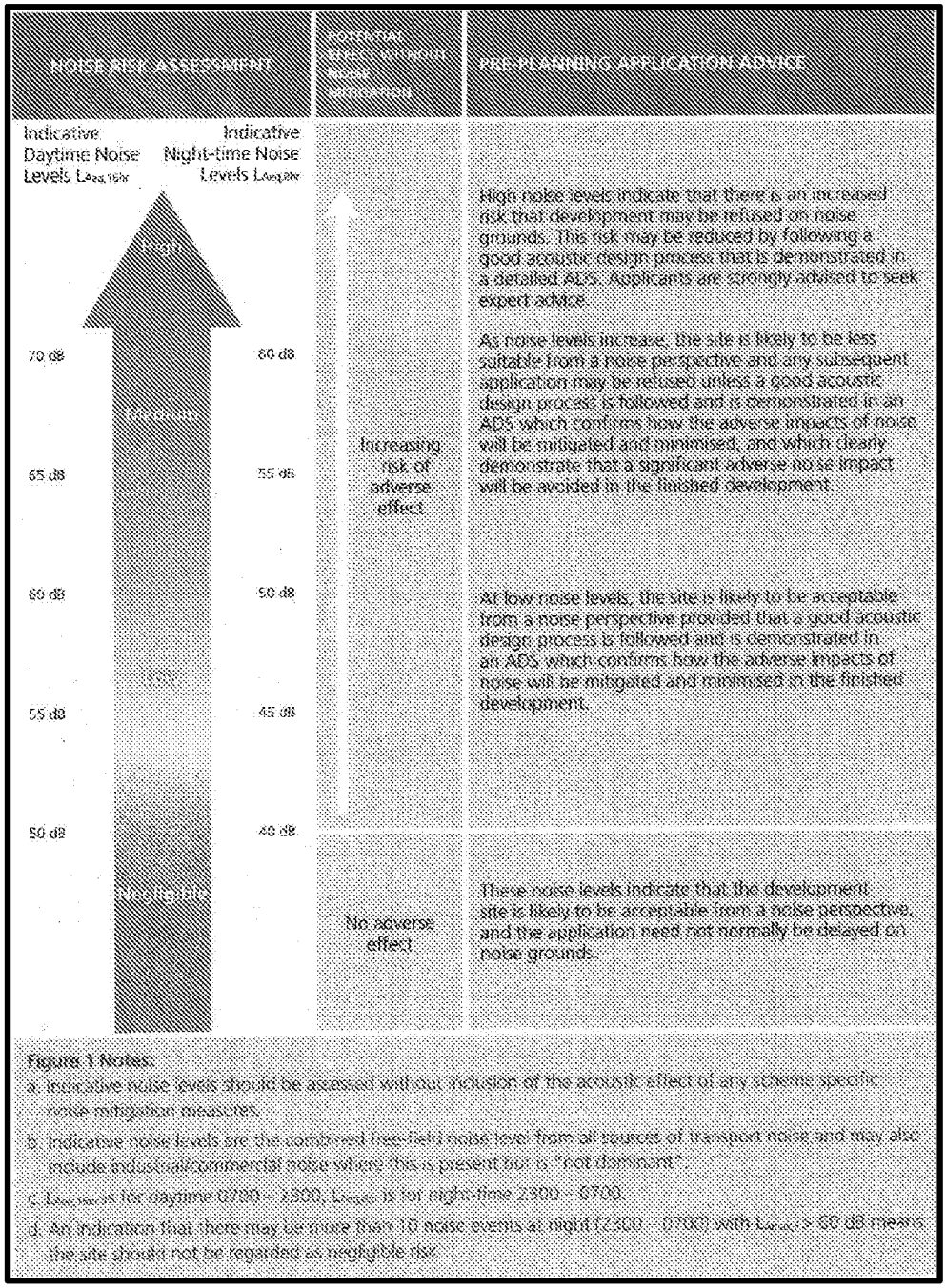


Figure 2.1: Extract from Figure 1 in ProPG - Initial Site Noise Risk Assessment

Acoustics Ventilation and Overheating - Residential Design Guide, January 2020

2.25 Acoustics Ventilation and Overheating (AVO) recommends an approach to acoustic assessments for new residential development taking consideration for acoustics, ventilation, and overheating.

2.26 Section 3 involves a two-level risk assessment approach to estimate the potential impact on occupants in the case of overheating.

The Level 1 site risk assessment is based on external free-field noise levels and the assumed scenario where a partially open window is used to mitigate overheating (Table 3-2 of the guidance).

2.27 The sound level reduction from outside to inside for a partially open window is 13dB in this instance. A Level 1 site risk assessment is considered adequate if the site falls within the :Negligible risk˘ category. A Level 2 assessment can optionally be undertaken to give more confidence in the case of Low or Medium risk sites, where appropriate. The Level 2 assessment is strongly recommended for :High˘risk sites.

The Level 2 assessment suggests that assessment of the adverse effect from noise exposure should include an estimate of how frequently and for what duration the overheating condition occurs (Table 3-3 of the guidance)

2.28 Figure 2.2 explains the two-level noise assessment procedure for overheating conditions.

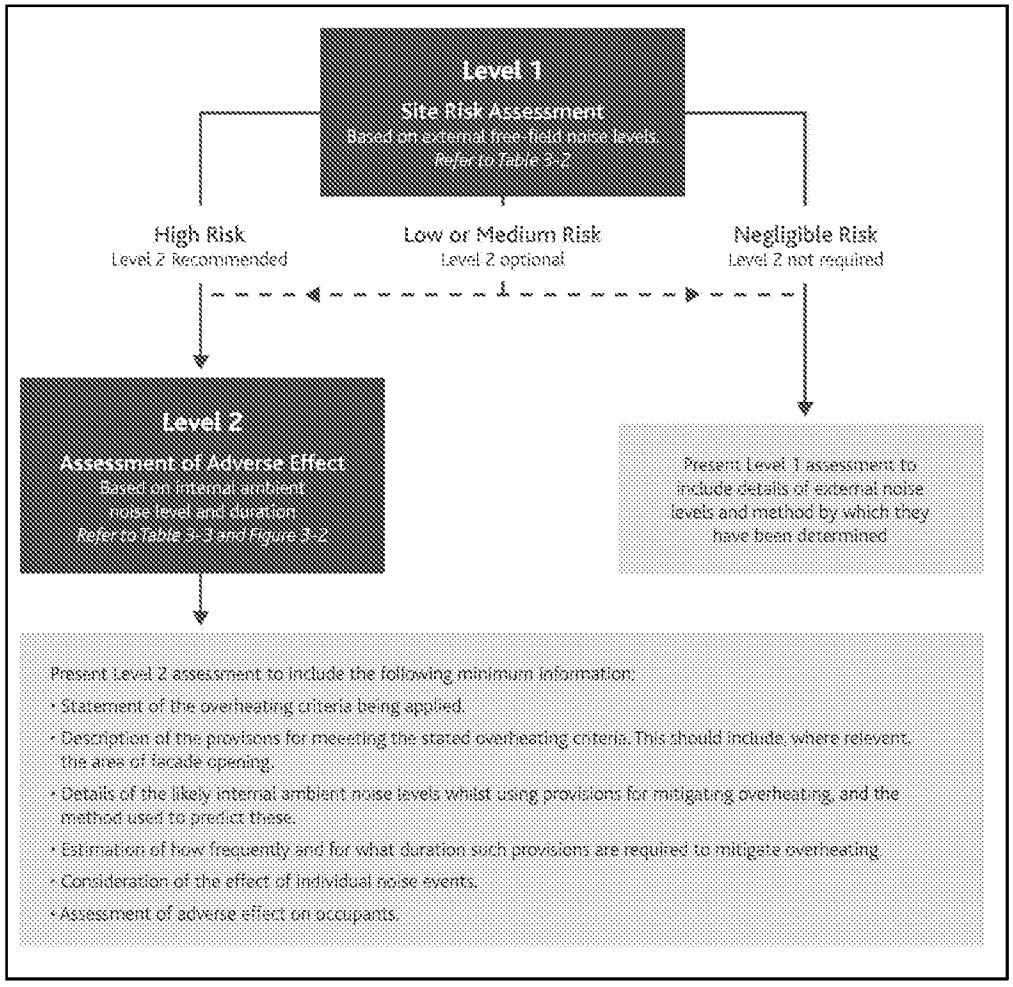
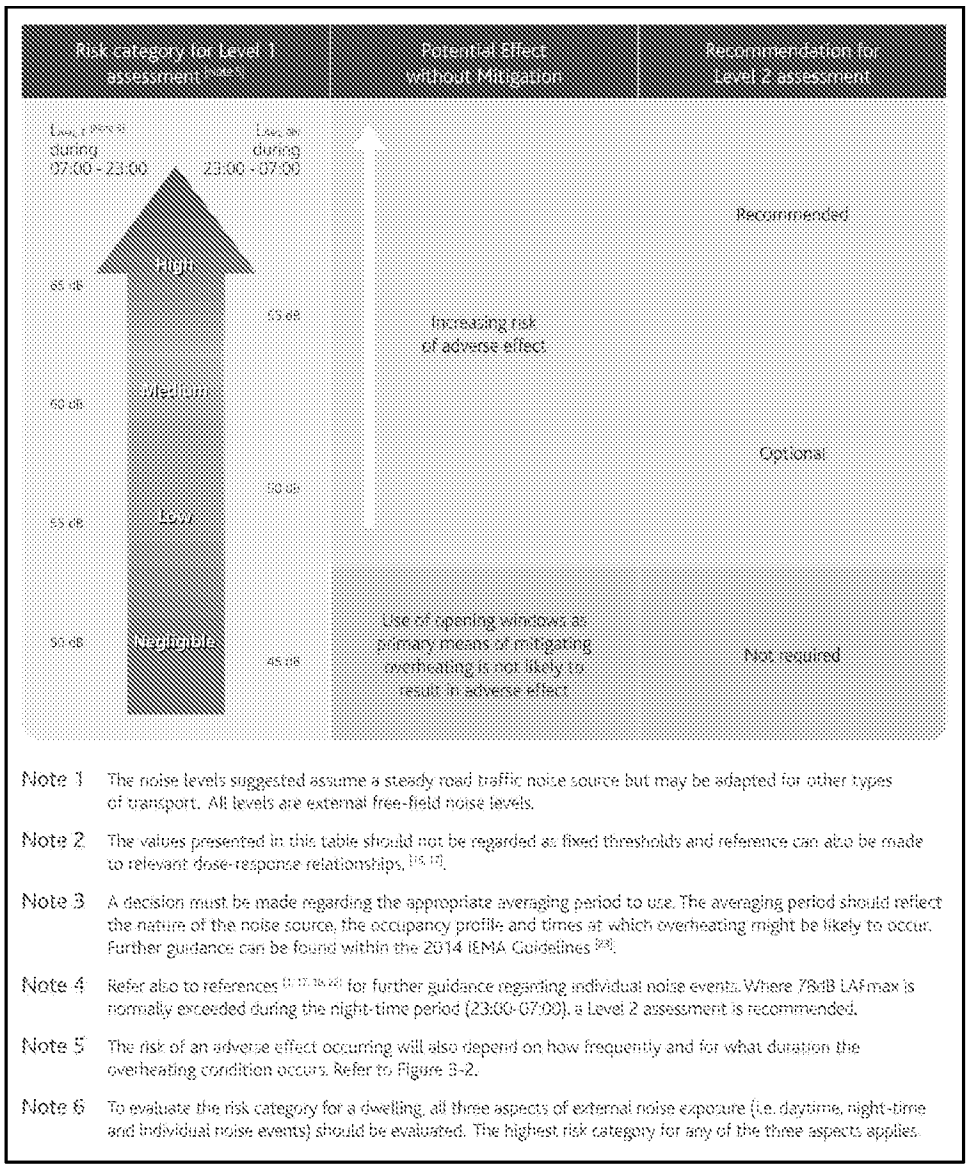


Figure 2.2 Two-level Assessment Procedure (Figure 3.1 of AVO Guidance)

2.29 Figure 2.3 shows the Level 1 site risk assessment of noise, relating to overheating conditions.



Note 1 The noise levels suggested assume a steady road traffic noise source but may be adapted for other types of transport. All levels are external free-field noise levels.

Note 2 The values presented in this table should not be regarded as fixed thresholds and reference can also be made to relevant dose-response relationships. [16, 17].

Note 3 A decision must be made regarding the appropriate averaging period to use. The averaging period should reflect the nature of the noise source, the occupancy profile and times at which overheating might be likely to occur. Further guidance can be found within the 2014 IEMA Guidelines [23].

Note 4 Refer also to references [1, 17, 18, 22] for further guidance regarding individual noise events. Where 78dB LAFmax is normally exceeded during the night-time period (23:00-07:00), a Level 2 assessment is recommended.

Note 5 The risk of an adverse effect occurring will also depend on how frequently and for what duration the overheating condition occurs. Refer to Figure 3-2.

Note 6 To evaluate the risk category for a dwelling, all three aspects of external noise exposure (i.e. daytime, night-time and individual noise events) should be evaluated. The highest risk category for any of the three aspects applies.

Figure 2.3 Level 1 Risk Assessment (Figure 3.2 of AVO guidance)

2.30 Figure 2.4 shows the Level 2 site risk assessment of noise, relating to overheating conditions.

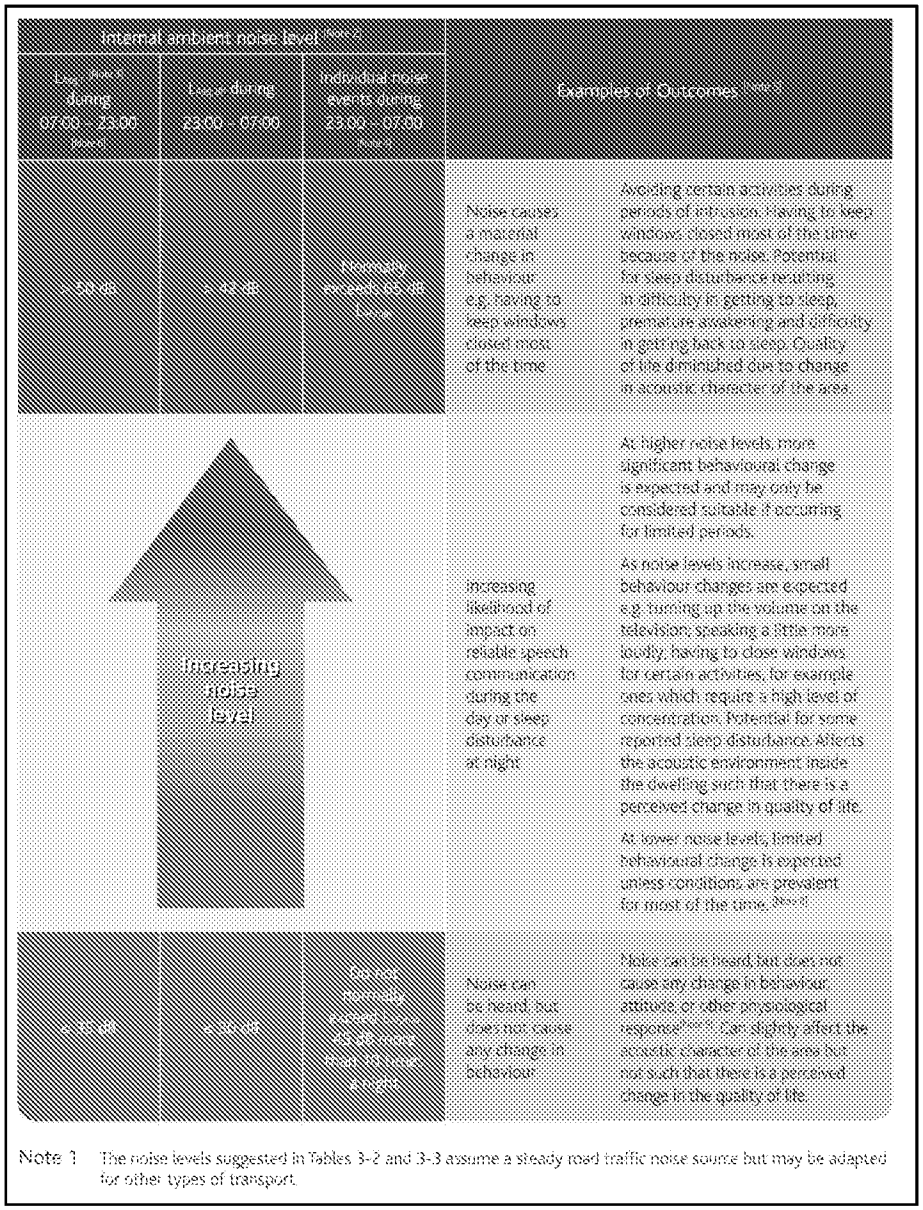


Figure 2.4 Level 2 Risk Assessment (Figure 3.3 of AVO guidance)

2.31 The noise levels suggested in Figure 2.3 and Figure 2.4 assume a steady road traffic noise source but may be adapted for other types of transport by taking account of the differing responses to different transport sources.

Arun District Council

2.32 Arun District Council follow the guidance in Planning and Noise Advice Document: Sussex issued March 2013 in addition to national policy and guidance. The guidance is in accordance with documents previously mentioned in this section.

3.0 ENVIRONMENTAL NOISE SURVEY

3.1 The environmental noise survey was undertaken at two positions across the site as shown in Figure 3.1. Noise measurement positions were selected in order to obtain representative baseline noise levels due to the main observed noise sources around the site at the closest proposed approach for future properties to the surrounding roads.

3.2 Continuous automated monitoring was undertaken at two positions for the duration of the survey between 14th and 16th October 2020. Measurements are shown graphically in Appendix A.

Figure 3.1: Monitoring Positions

Measurement Procedures

3.3 Staff involved with the measurements and observations are fully competent with regard to the requirements of environmental noise measurement.

Instrumentation

3.4 The equipment used was as follows:

- ¿ 1 x Svan 957 and 1 x Svan 977 Sound Level Meters
- ¿ Rion NC-74 Calibrator

3.5 All equipment used has been professionally calibrated. Field calibration of the sound level meters was undertaken before and after measurement to ensure no drifting of the calibration signal. Calibration certificates are available on request.

Observations

3.6 The main noise sources at the time of the survey were local and distant road traffic. Dominant noise source is the traffic noise from Ford Road.

3.7 All measurements used within the calculations, mitigation recommendations and conclusions were taken during times of appropriate weather and representative traffic conditions.

Results

3.8 The $L_{Aeq,}$ and $L_{Amax,}$ acoustic parameters were measured throughout the duration of the survey. Measured levels are shown as time histories in Appendix A.

3.9 Table 3.1 provides a summary of the measured noise levels.

Monitoring positions	Ambient Noise Level dB $L_{Aeq,T}$		Representative night-time L_{Amax} dB(A)
	Daytime	Night-time	
Position 1	51	44	66
Position 2	48	39	54

Table 3.1: Site average noise levels for daytime and night-time

3.10 The representative L_{Amax} level is the value which has been exceeded fewer than 10 times in the 8-hour night-time period, i.e. one which can be considered to be :not normally exceeded˘ as per the WHO guidelines.

3.11 Average sound levels are around 48dB$L_{Aeq,T}$ to 51dB$L_{Aeq,T}$ during the day and 39dB$L_{Aeq,T}$ to 44dB$L_{Aeq,T}$ at night. This would be considered a :negligible to low risk˘ development site for residential use during day and :negligible˘ at night-time when compared with Figure 1 included in Section 2 of ProPG, as shown in Figure 2.1 of this report. A low-risk site is summarised as:

`At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development._

3.12 This would not prohibit the development as good acoustic design processes will be followed to reduce sound levels to as low as practical across the site.

3.13 Ambient noise levels are relatively low across the whole site and with the exception of those facades facing Ford Road where sound levels

are marginally above external sound levels to achieve the guidance criteria inside properties with partially open windows.

3.14 Properties in theis area of the site are set back from Ford Road to maximise the separation distance attenuation in accordance with the guidance. The excess over the criteria is very slight and unlikely to lead to a significant impact. Nevertheless, the first row of properties facing Ford road can incorporate suitable trickle ventilation to allow the windows on the east fa´ade to remain closed whilst maintaining adequate ventilation to accord with the Building Regulations.

3.15 Windows are not sealed shut and residents will have a choice to open windows for ventilation whilst accepting slightly higher internal sound levels.

3.16 Representative octave band levels are provided in Table 3.2. These are used in glazing calculations to ensure a robust calculation of internal noise levels.

		Octave band centre frequency dB							
		63	125	250	500	1k	2k	4k	8k
P1	$L_{Aeq,T}$ (day)	59	50	46	46	49	43	36	33
	$L_{Aeq,T}$ (night)	54	43	39	40	42	35	25	23
	$L_{Amax,T}$ (night)	80	65	59	68	59	53	46	40
P2	$L_{Aeq,T}$ (day)	57	51	45	44	44	39	35	33
	$L_{Aeq,T}$ (night)	46	39	35	36	35	28	25	23
	$L_{Amax,T}$ (night)	59	55	55	52	49	45	42	38

Table 3.2: Octave band data for noise monitoring locations

4.0 CONSTRUCTION PHASE

4.1 Given the proximity of proposed construction to neighbouring noise sensitive properties such as residential areas, it is possible that site clearance, preparation and construction noise may impact nearby receptors.

4.2 A detailed construction programme; specific plant data and operations are not available at this stage of the project. Therefore, it is not possible to undertake a detailed assessment of likely impact at this time.

4.3 Reasonable construction noise limits can be derived using the Example Method 1 (the ABC Method) of BS 5228, within section E.3.2. Table E.1 from the standard is reproduced below in Table 4.1:

Table E.1 Example threshold of significant effect at dwellings

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A [A]	Category B [B]	Category C [C]
Night-time (23.00–07.00)	45	50	55
Evenings and weekends [D]	55	60	65
Daytime (07.00–19.00) and Saturdays (07.00–13.00)	65	70	75

NOTE 1 A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level.

NOTE 2 If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L_{Aeq} noise level for the period increases by more than 3 dB due to construction activity.

NOTE 3 Applied to residential receptors only.

A Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

B Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.

C Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

D 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

Table 4.1: Table E.1 from BS 5228: Part 1

4.4 Existing ambient noise levels across much of the site will place the site and surroundings within Category A of Table E.1. Therefore, the following noise ambient noise levels (as a result of construction activities) should be considered as reasonable limits to adhere to during construction works.

Time Period	Construction Noise Limits L_{Aeq} (dB)
Saturday 08:00 - 13:00	55
Weekdays 08:00 - 18:00	65

Table 4.2 - Construction Noise Limits

4.5 A noise and vibration management plan can be produced to control the works if appropriate.

5.0 MITIGATION RECOMMENDATIONS

5.1 The measured results and indicative layout were used to undertake calculations, presented in Appendix C, for suitable fa´ade treatments, as outlined in the following paragraphs.

5.2 Sound levels across the majority of the site are low and should not be challenging to provide suitable internal noise levels to protect amenity with open window ventilation. Properties on the eastern boundary of the development will be exposed to sound levels that are very slightly above the guidance criteria. In these properties there should be alternative ventilation provided to allow windows to remain closed to ensure suitable internal sound levels.

External Building Fabric - Non-Glazed Elements

5.3 It is assumed that the non-glazed external building fabric elements of the proposed development comprise masonry cavity walls. This would typically provide a sound reduction performance of at least the figures shown in Table 5.1 when tested in accordance with BS EN ISO 10140-2:2010 (figures derived from: Representative Values of Airborne SRI for Some Common Structures: Appendix B of Flakt Woods :Guide to Noise Control).

Element	Octave band centre frequency SRI, dB					
	125	250	500	1k	2k	4k
Masonry Cavity Wall	34	43	55	66	77	85

Table 5.1: Non-glazed elements assumed sound reduction performance

5.4 This would contribute towards a significant reduction of ambient noise levels in combination with a good quality double-glazed window configuration.

External Building Fabric - Specification of Glazed Units

5.5 Sound reduction performance calculations have been undertaken to specify the minimum glazing and ventilation performance. Calculations are presented in Appendix C.

5.6 Standard thermal double glazing and standard ventilation is suitable, in order to achieve recommended internal noise levels shown in Table 2.4 of Chapter 2.

5.7 Calculations are based on habitable rooms with relatively higher ratios of glazing to masonry. This specification therefore presents a robust assessment, for BS8233:2014 criteria for internal noise levels in all affected facades.

5.8 Glazing calculations have been performed using the average (L_{Aeq}) and short duration (L_{Amax} values) as detailed in Table 3.1, together with the octave band levels as shown in Table 3.2.

5.9 The required glazing performance is shown in Table 5.2. The performance is specified for the whole window unit, including the frame.

Glazing Type	Sound Reduction Index R_W	Octave band centre frequency (Hz) SRI (dB)					
		125	250	500	1k	2k	4k
Standard Thermal Double	32	20	21	30	35	32	37

Table 5.2: Minimum glazing specification

External Building Fabric - Specification of Vents

5.10 Table 5.3 provides a minimum acoustic performance for any ventilation used in lieu of open windows to demonstrate how suitable internal sound levels can be achieved.

Element	Octave band centre frequency SRI, dB						Overall
	125	250	500	1k	2k	4k	Dn,e,w
Standard Ventilation	36	34	31	34	38	38	35

Table 5.3: Required minimum attenuation values for ventilation

5.11 It should be noted that there may be additional considerations for glazing and ventilation requirements such as overheating, security, thermal performance and air quality, Alternative glazing and ventilation could be used assuming the minimum acoustic performance is met.

5.12 All major building elements should be tested in accordance with BS EN ISO 10140-2:2010. Sole glass performance data would not necessarily demonstrate compliance with this specification. No further mitigation measures would be required to achieve the recommended internal noise levels.

Overheating

5.13 Measurements taken during the day indicate a negligible to low-risk of noise impact, relating to overheating conditions. During the night, measured average sound levels would also indicate a negligible risk of noise impact under overheating condition. Therefore, a Level 1 assessment is considered adequate for all elevations.

5.14 To achieve suitable internal amenity sound levels, sensitive windows on the eastern facades of those properties on the eastern boundary of the development can remain closed and an alternative means of ventilation provided. Consideration has been given to the potential for adverse noise impact during overheating conditions; where residents may open windows to control temperature. The site is determined to have a negligible to low risk of noise impact under overheating condition in accordance with AVO guidance.

External amenity space

5.15 External sound levels are within the criteria set out in the guidance and no specific noise control measures are considered necessary in relation to external amenity spaces.

Construction Phase

5.16 In accordance with local policy, construction activities should only take place between the hours of 08:00 and 18:00 on weekdays and between 08:00 - 13:00 on Saturdays. No construction activity should be carried out during the night, on Sundays or on bank holiday's without additional consideration to controlling noise and with the prior approval of the LPA.

5.17 During construction, the contractor will employ best practicable means to control noise from construction operations.

5.18 Temporary screening in the form of solid timber hoarding can be used where operations are adjacent to sensitive receptors. Consideration will be given to neighbouring residential properties when locating the temporary site compounds and material stockpiles.

5.19 Stationary equipment and plant such as generators will be placed as far as practicable from noise sensitive properties, and preferably in

areas benefiting from existing or purpose-built attenuation such as bunding or behind non-sensitive buildings.

5.20 Delivery of materials and removal of waste from the site will be planned to minimise disturbance to neighbouring properties. Idling of plant, machinery and delivery vehicles should be prohibited when not in use.

5.21 If required noise levels can be monitored regularly in accordance with BS 5228 to ensure the above set limits are not exceeded. In addition to the above all other guidance within BS 5228-1 will be followed at all times.

6.0 CONCLUSIONS

6.1 A detailed noise survey has been undertaken and measured levels have been used to calculate and assess suitable glazing and ventilation specification.

6.2 This is considered a :negligible to low risk˘ site in accordance with guidance in ProPG. Expert Acoustics advice has been sought and good acoustic design processes have been followed to reduce sound levels where appropriate.

6.3 Closed but not sealed windows will be provided to control internal amenity sound levels on eastern facades of properties on the eastern boundary of the development. Alternative ventilation will be selected to meet the acoustic specification and the requirements of Building Regulations Part F ¯ Ventilation in lieu of open windows. At all other properties, the internal sound level criteria can be achieved with open window ventilation. No further noise control measures are considered necessary.

6.4 The site risk of noise impact under overheating conditions in properties has been considered in accordance with AVO Guidance. The assessment results in a negligible to low risk of noise impact during the day and negligible risk at night.

6.5 Control measures will be implemented to manage potential impacts from construction noise.

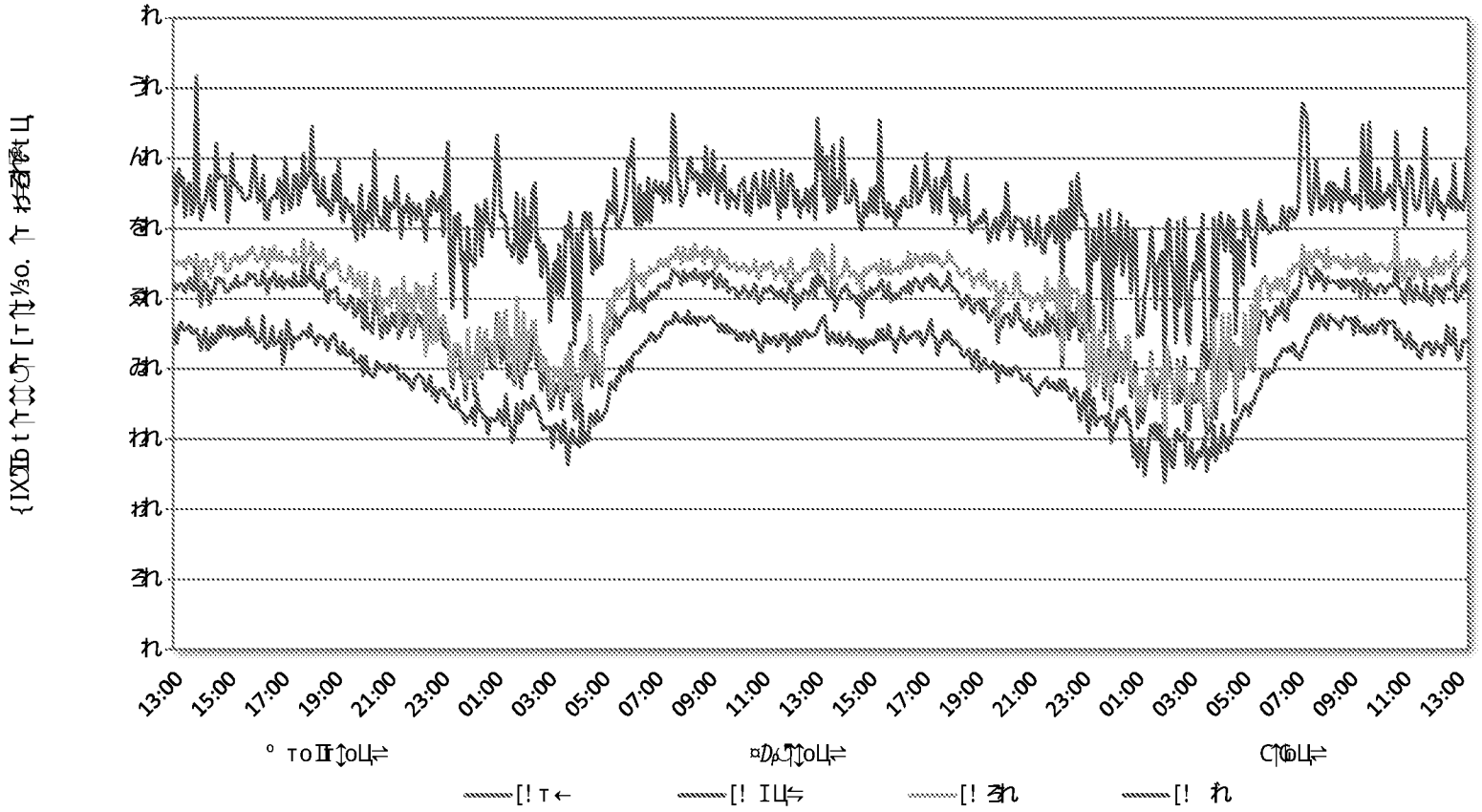
6.6 This assessment demonstrates that the site is suitable for residential development subject to the recommendations included in this report.

APPENDIX A

ARDENT CONSULTING ENGINEERS

Ford Road Arundel - Position 1

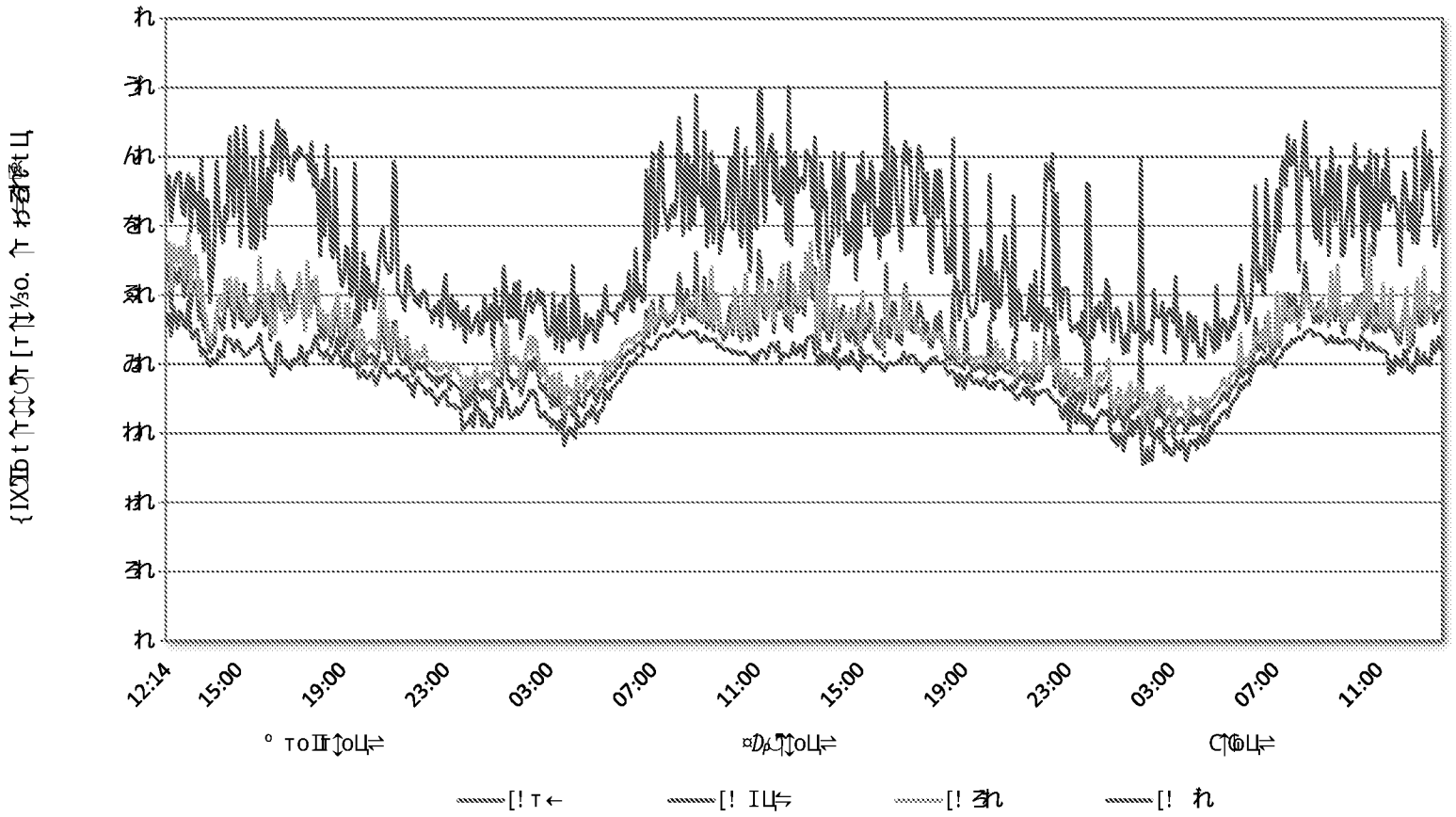
Environmental Noise Time History
14 October 2020 to 16 October 2020



ARDENT CONSULTING ENGINEERS

Ford Road, Arundel - Position 2

Environmental Noise Time History
14 October 2020 to 16 October 2020



APPENDIX B

ARDENT CONSULTING ENGINEERS

Noise Break-in Calculation - Point 1

Description	
Ardent CE Project No.	173483
Property Address	Land at Tortington, Arundel
Room Type	Living Room
Parameter	LAeq, 16h

Room Dimensions and Areas		
Room volume	[illegible]	- Based on typical size
Total Surface area	[illegible]	
Wall fa´ade area	[illegible]	
Roof fa´ade area	[illegible]	
Glazing area	[illegible]	
Dne Ref Area, A0	[illegible]	

Total fa´ade area	[illegible]

Room Absorption Calculation	63	125	250	500	1000	2000	4000	8000		
Estimated Reverberation time	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4		- Typical RT
Alpha bar	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22		
Total Absorption	14.09	14.09	14.09	14.09	14.09	14.09	14.09	14.09		
10Log S/A	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15		

Fa´ade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	58.6	50.3	46.0	45.7	48.7	42.7	36.1	33.2	51.2
Fa´ade to free field	0	0	0	0	0	0	0	0	
Angle of view	0	0	0	0	0	0	0	0	
Screening (Maekewa)	0	0	0	0	0	0	0	0	
Distance correction	0	0	0	0	0	0	0	0	
Other	0	0	0	0	0	0	0	0	
Noise level at fa´ade (Leq)	59	50	46	46	49	43	36	33	51

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw	
Glazing SRI	18	20	21	30	35	32	37	44	32	Thermal 6/16/6
Transmission Coefficient	0.015849	0.010000	0.007943	0.001000	0.000316	0.000631	0.000200	0.000040		
Wall SRI	28	34	43	55	66	77	85	85	88.6	Typical masonry cavity wall (300mm - 380kg/m2)
Transmission Coefficient	0.001585	0.000398	0.000050	0.000003	0.000000	0.000000	0.000000	0.000000		
Roof SRI	23	26	43	52	60	65	65	65	51	
Transmission Coefficient	0.005012	0.002512	0.000050	0.000006	0.000001	0.000000	0.000000	0.000000		
Ventilation, Dne	36	36	34	31	34	38	38	38	35	Standard Trickle Vent
Transmission Coefficient	0.000251	0.000251	0.000398	0.000794	0.000398	0.000158	0.000158	0.000158		
Average Transmission Coeff	0.005545	0.003124	0.002432	0.000851	0.000377	0.000284	0.000169	0.000127		
Average SRI	23	25	26	31	34	35	38	39	34	

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	36.9	26.1	20.7	15.8	15.3	8.1	-0.8	-4.9	20	
Lp (Direct)	36.0	25.2	19.9	15.0	14.5	7.2	-1.6	-5.8	19.2	Criteria
Lp (Rev & Direct)	40	29	23	19	18	11	2	-2	22.6	H35
BS8233	39	28	23	18	17	10	1	-3	22	H35

ARDENT CONSULTING ENGINEERS

Noise Break-in Calculation Point 1

Description	
Ardent CE Project No.	173483
Property Address	Land at Tortington, Arundel
Room Type	Bedroom
Parameter	LAeq, 8h

Room Dimensions and Areas		
Room volume	[illegible]	- Based on typical size
Total Surface area	[illegible]	
Wall fa´ade area	10.00	
Roof fa´ade area	[illegible]	
Glazing area	[illegible]	
Dne Ref Area, A0	[illegible]	

Total fa´ade area	[illegible]

Room Absorption Calculation	63	125	250	500	1000	2000	4000	8000		
Estimated Reverberation time	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4		- Typical Bedroom RT
Alpha bar	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22		
Total Absorption	14.09	14.09	14.09	14.09	14.09	14.09	14.09	14.09		
10Log S/A	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15		

Fa´ade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	54.0	42.8	39.4	40.1	41.8	34.9	25.1	23.0	44.3
Fa´ade to free field	0	0	0	0	0	0	0	0	
Angle of view	0	0	0	0	0	0	0	0	
Screening (Maekewa)	0	0	0	0	0	0	0	0	
Distance correction	0	0	0	0	0	0	0	0	
Other	0	0	0	0	0	0	0	0	
Noise level at fa´ade (Leq)	54	43	39	40	42	35	25	23	44

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw	
Glazing SRI	18	20	21	30	35	32	37	44	32	Thermal 6/16/6
Transmission Coefficient	0.015849	0.010000	0.007943	0.001000	0.000316	0.000631	0.000200	0.000040		
Wall SRI	28	34	43	55	66	77	85	85	55	Typical masonry cavity wall (300mm - 380kg/m2)
Transmission Coefficient	0.001585	0.000398	0.000050	0.000003	0.000000	0.000000	0.000000	0.000000		
Roof SRI	23	26	43	52	60	65	65	65	51	
Transmission Coefficient	0.005012	0.002512	0.000050	0.000006	0.000001	0.000000	0.000000	0.000000		
Ventilation, Dne	36	36	34	31	34	38	38	38	35	Standard Trickle Vent
Transmission Coefficient	0.000251	0.000251	0.000398	0.000794	0.000398	0.000158	0.000158	0.000158		
Average Transmission Coeff	0.005545	0.003124	0.002432	0.000851	0.000377	0.000284	0.000169	0.000127		
Average SRI	23	25	26	31	34	35	38	39	34	

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	32.3	18.6	14.1	10.2	8.4	0.3	-11.8	-15.1	13.6	
Lp (Direct)	31.4	17.7	13.3	9.4	7.6	-0.6	-12.6	-16.0	12.8	Criteria
Lp (Rev & Direct)	35	21	17	13	11	3	-9	-13	16	H30
BS8233	34	21	16	12	10	2	-10	-13	16	H30

ARDENT CONSULTING ENGINEERS

Noise Break-in Calculation Point 1

Description	
Ardent CE Project No.	173483
Property Address	Land at Tortington, Arundel
Room Type	Bedroom
Parameter	LAmax

Room Dimensions and Areas		
Room volume	[illegible]	- Based on typical size
Total Surface area	[illegible]	
Wall fa´ade area	10.00	
Roof fa´ade area	[illegible]	
Glazing area	[illegible]	
Dne Ref Area, A0	[illegible]	

Total fa´ade area	[illegible]

Room Absorption Calculation	63	125	250	500	1000	2000	4000	8000	
Estimated Reverberation time	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	- Typical Bedroom RT
Alpha bar	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	
Total Absorption	14.09	14.09	14.09	14.09	14.09	14.09	14.09	14.09	
10Log S/A	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	

Fa´ade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	80	65	59	68	59	53	46	40	66.4
Fa´ade to free field	0	0	0	0	0	0	0	0	
Angle of view	0	0	0	0	0	0	0	0	
Screening (Maekewa)	0	0	0	0	0	0	0	0	
Distance correction	0	0	0	0	0	0	0	0	
Other	0	0	0	0	0	0	0	0	
Noise level at fa´ade (Leq)	80	65	59	68	59	53	46	40	66

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw	
Glazing SRI	18	20	21	30	35	32	37	44	32	Thermal 6/16/6
Transmission Coefficient	0.015849	0.010000	0.007943	0.001000	0.000316	0.000631	0.000200	0.000040		
Wall SRI	28	34	43	55	66	77	85	85	55	Typical masonry cavity wall (300mm - 380kg/m2)
Transmission Coefficient	0.001585	0.000398	0.000050	0.000003	0.000000	0.000000	0.000000	0.000000		
Roof SRI	23	26	43	52	60	65	65	65	51	
Transmission Coefficient	0.005012	0.002512	0.000050	0.000006	0.000001	0.000000	0.000000	0.000000		
Ventilation, Dne	36	36	34	31	34	38	38	38	35	Standard Trickle Vent
Transmission Coefficient	0.000251	0.000251	0.000398	0.000794	0.000398	0.000158	0.000158	0.000158		
Average Transmission Coeff	0.005545	0.003124	0.002432	0.000851	0.000377	0.000284	0.000169	0.000127		
Average SRI	23	25	26	31	34	35	38	39	34	

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	58.2	40.9	33.3	38.0	25.2	18.2	8.9	1.9	37.5	
Lp (Direct)	57.3	40.1	32.5	37.1	24.3	17.3	8.1	1.0	36.6	Criteria
Lp (Rev & Direct)	61	44	36	41	28	21	12	5	40	H45
BS8233	60	43	35	40	27	20	11	4	40	H45

ARDENT CONSULTING ENGINEERS

Noise Break-in Calculation - Point 2

Description	
Ardent CE Project No.	173483
Property Address	Land at Tortington, Arundel
Room Type	Living Room
Parameter	LAeq, 16h

Room Dimensions and Areas		
Room volume	[illegible]	- Based on typical size
Total Surface area	[illegible]	
Wall fa´ade area	[illegible]	
Roof fa´ade area	[illegible]	
Glazing area	[illegible]	
Dne Ref Area, A0	[illegible]	

Total fa´ade area	[illegible]

Room Absorption Calculation	63	125	250	500	1000	2000	4000	8000		
Estimated Reverberation time	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4		- Typical RT
Alpha bar	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22		
Total Absorption	14.09	14.09	14.09	14.09	14.09	14.09	14.09	14.09		
10Log S/A	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15		

Fa´ade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	56.5	50.7	45.3	44.0	44.1	38.7	34.8	32.9	47.9
Fa´ade to free field	0	0	0	0	0	0	0	0	
Angle of view	0	0	0	0	0	0	0	0	
Screening (Maekewa)	0	0	0	0	0	0	0	0	
Distance correction	0	0	0	0	0	0	0	0	
Other	0	0	0	0	0	0	0	0	
Noise level at fa´ade (Leq)	57	51	45	44	44	39	35	33	48

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw	
Glazing SRI	18	20	21	30	35	32	37	44	32	Thermal 6/16/6
Transmission Coefficient	0.015849	0.010000	0.007943	0.001000	0.000316	0.000631	0.000200	0.000040		
Wall SRI	28	34	43	55	66	77	85	85	88.6	Typical masonry cavity wall (300mm - 380kg/m2)
Transmission Coefficient	0.001585	0.000398	0.000050	0.000003	0.000000	0.000000	0.000000	0.000000		
Roof SRI	23	26	43	52	60	65	65	65	51	
Transmission Coefficient	0.005012	0.002512	0.000050	0.000006	0.000001	0.000000	0.000000	0.000000		
Ventilation, Dne	36	36	34	31	34	38	38	38	35	Standard Trickle Vent
Transmission Coefficient	0.000251	0.000251	0.000398	0.000794	0.000398	0.000158	0.000158	0.000158		
Average Transmission Coeff	0.005545	0.003124	0.002432	0.000851	0.000377	0.000284	0.000169	0.000127		
Average SRI	23	25	26	31	34	35	38	39	34	

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	34.8	26.5	20.0	14.1	10.7	4.1	-2.1	-5.2	17.8	
Lp (Direct)	33.9	25.6	19.2	13.3	9.9	3.2	-2.9	-6.1	17	Criteria
Lp (Rev & Direct)	37	29	23	17	13	7	1	-3	20.4	H35
BS8233	37	28	22	16	13	6	0	-3	20	H35

ARDENT CONSULTING ENGINEERS

Noise Break-in Calculation - Point 2

Description	
Ardent CE Project No.	173483
Property Address	Land at Tortington, Arundel
Room Type	Bedroom
Parameter	LAeq, 8h

Room Dimensions and Areas		
Room volume	[illegible]	- Based on typical size
Total Surface area	[illegible]	
Wall fa´ade area	10.00	
Roof fa´ade area	[illegible]	
Glazing area	[illegible]	
Dne Ref Area, A0	[illegible]	

Total fa´ade area	[illegible]

Room Absorption Calculation	63	125	250	500	1000	2000	4000	8000	
Estimated Reverberation time	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	- Typical Bedroom RT
Alpha bar	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	
Total Absorption	14.09	14.09	14.09	14.09	14.09	14.09	14.09	14.09	
10Log S/A	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	

Fa´ade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	45.7	38.7	35.2	35.7	35.3	28.2	25.0	23.0	38.6
Fa´ade to free field	0	0	0	0	0	0	0	0	
Angle of view	0	0	0	0	0	0	0	0	
Screening (Maekewa)	0	0	0	0	0	0	0	0	
Distance correction	0	0	0	0	0	0	0	0	
Other	0	0	0	0	0	0	0	0	
Noise level at fa´ade (Leq)	46	39	35	36	35	28	25	23	39

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw	
Glazing SRI	18	20	21	30	35	32	37	44	32	Thermal 6/16/6
Transmission Coefficient	0.015849	0.010000	0.007943	0.001000	0.000316	0.000631	0.000200	0.000040		
Wall SRI	28	34	43	55	66	77	85	85	55	Typical masonry cavity wall (300mm - 380kg/m2)
Transmission Coefficient	0.001585	0.000398	0.000050	0.000003	0.000000	0.000000	0.000000	0.000000		
Roof SRI	23	26	43	52	60	65	65	65	51	
Transmission Coefficient	0.005012	0.002512	0.000050	0.000006	0.000001	0.000000	0.000000	0.000000		
Ventilation, Dne	36	36	34	31	34	38	38	38	35	Standard Trickle Vent
Transmission Coefficient	0.000251	0.000251	0.000398	0.000794	0.000398	0.000158	0.000158	0.000158		
Average Transmission Coeff	0.005545	0.003124	0.002432	0.000851	0.000377	0.000284	0.000169	0.000127		
Average SRI	23	25	26	31	34	35	38	39	34	

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	24.0	14.5	9.9	5.8	1.9	-6.4	-11.9	-15.1	8.1	
Lp (Direct)	23.1	13.6	9.1	5.0	1.1	-7.3	-12.7	-16.0	7.2	Criteria
Lp (Rev & Direct)	27	17	13	9	5	-4	-9	-13	11	H30
BS8233	26	16	12	8	4	-4	-10	-13	10	H30

ARDENT CONSULTING ENGINEERS

Noise Break-in Calculation - Point 2

Description	
Ardent CE Project No.	173483
Property Address	Land at Tortington, Arundel
Room Type	Bedroom
Parameter	LAmax

Room Dimensions and Areas		
Room volume	[illegible]	- Based on typical size
Total Surface area	[illegible]	
Wall fa´ade area	10.00	
Roof fa´ade area	[illegible]	
Glazing area	[illegible]	
Dne Ref Area, A0	[illegible]	

Total fa´ade area	[illegible]

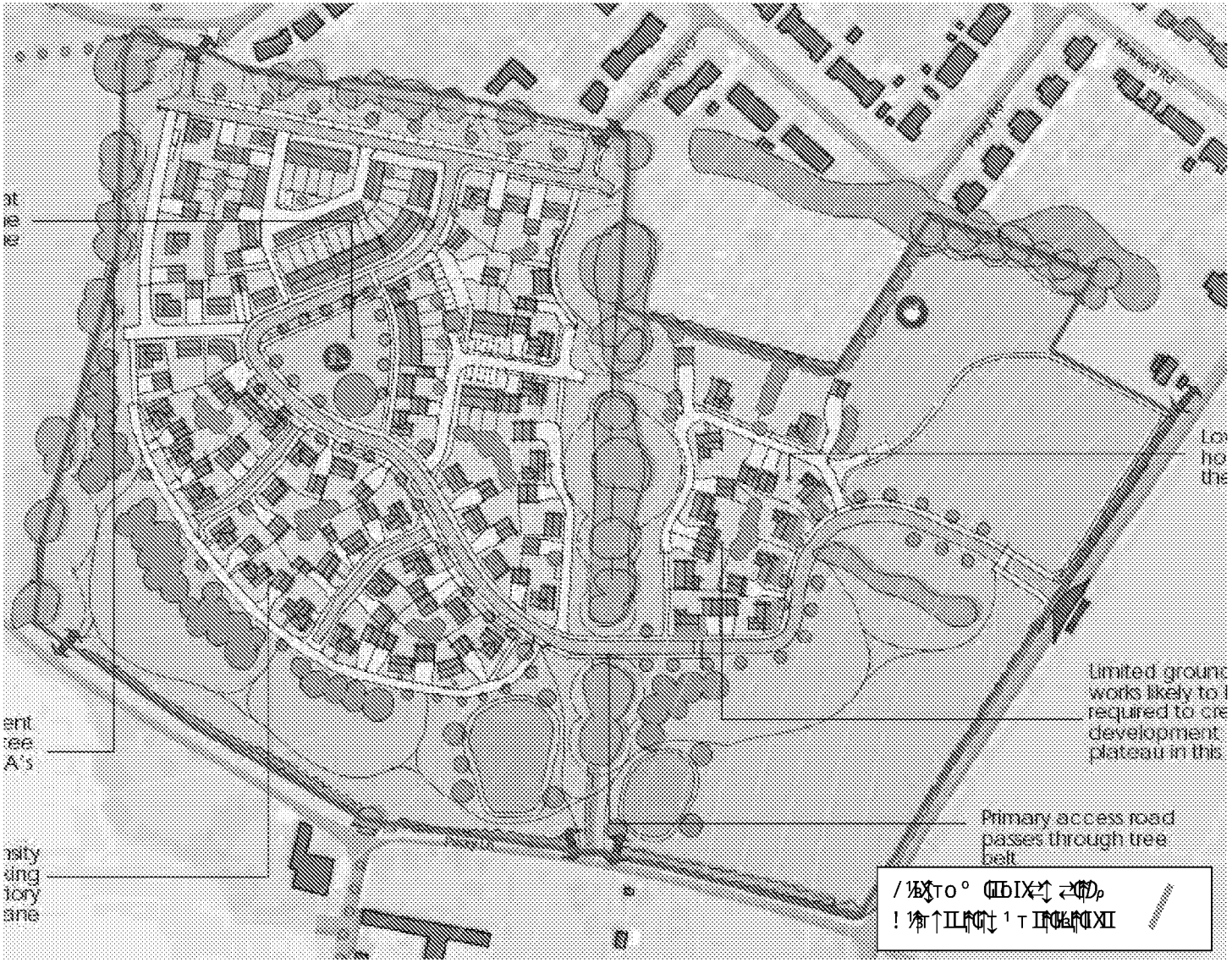
Room Absorption Calculation	63	125	250	500	1000	2000	4000	8000	
Estimated Reverberation time	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	- Typical Bedroom RT
Alpha bar	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	
Total Absorption	14.09	14.09	14.09	14.09	14.09	14.09	14.09	14.09	
10Log S/A	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	

Fa´ade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	58.9	54.8	54.8	51.8	49.3	44.6	41.7	37.8	54.3
Fa´ade to free field	0	0	0	0	0	0	0	0	
Angle of view	0	0	0	0	0	0	0	0	
Screening (Maekewa)	0	0	0	0	0	0	0	0	
Distance correction	0	0	0	0	0	0	0	0	
Other	0	0	0	0	0	0	0	0	
Noise level at fa´ade (Leq)	59	55	55	52	49	45	42	38	54

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw	
Glazing SRI	18	20	21	30	35	32	37	44	32	Thermal 6/16/6
Transmission Coefficient	0.015849	0.010000	0.007943	0.001000	0.000316	0.000631	0.000200	0.000040		
Wall SRI	28	34	43	55	66	77	85	85	55	Typical masonry cavity wall (300mm - 380kg/m2)
Transmission Coefficient	0.001585	0.000398	0.000050	0.000003	0.000000	0.000000	0.000000	0.000000		
Roof SRI	23	26	43	52	60	65	65	65	51	
Transmission Coefficient	0.005012	0.002512	0.000050	0.000006	0.000001	0.000000	0.000000	0.000000		
Ventilation, Dne	36	36	34	31	34	38	38	38	35	Standard Trickle Vent
Transmission Coefficient	0.000251	0.000251	0.000398	0.000794	0.000398	0.000158	0.000158	0.000158		
Average Transmission Coeff	0.005545	0.003124	0.002432	0.000851	0.000377	0.000284	0.000169	0.000127		
Average SRI	23	25	26	31	34	35	38	39	34	

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	37.2	30.6	29.5	21.9	16.0	10.0	4.9	-0.4	24.7	
Lp (Direct)	36.3	29.7	28.6	21.1	15.1	9.2	4.0	-1.2	23.8	Criteria
Lp (Rev & Direct)	40	33	32	25	19	13	8	2	27	H45
BS8233	39	33	31	24	18	12	7	2	27	H45

APPENDIX C


Limited ground
works likely to
required to cre
development
plateau in this
Primary access road
passes through tree
belt

APPENDIX D

ACOUSTIC TERMINOLOGY

The effects of noise on human beings may be expressed in terms of physiological damage and annoyance. It is, however, only the annoyance impacts that need to be considered in detail when addressing environmental noise impacts. Annoyance also includes the immediate effects of activity interference, for example sleep disturbance and speech interference.

The practice has become to measure sound levels in decibels (dB). The decibel scale is logarithmic rather than linear and it is useful to bear in mind that a noise level change of 3dB would be equivalent to doubling the energy level (for example doubling the volume of traffic) and that an increase of 10 dB is perceived, subjectively, as a doubling of loudness. The human ear responds differently to sounds of different frequency. The ear perceives high frequency sound of a given sound pressure level more loudly than a low frequency sound at the same level. The A-weighted sound level, dB(A), takes this response into consideration and is commonly used for measurement of environmental noise in UK. It thus indicates the subjective human response to sound.

Environmental noise levels vary continuously from second to second, it is clearly impractical to specify the sound level continuously and thus time averaging is required. In practice human response has been related to various units which include allowance for the fluctuating nature of sound with time. For the purpose of this report these include:

LAeq,T : the equivalent A-weighted continuous sound level.

This unit relates to the equivalent level of continuous sound for a specific time period T, for example 16 hours for daytime noise. It contains all the sound energy of the varying sound levels over the same time period and expresses it as a continuous sound level over that period. The unit is used for assessing traffic and industrial noise for planning purposes and in particular for PPG24.

LA10,T : the A-weighted level of sound exceeded for 10% of the time period T.

This unit is used for traffic noise measurement and is the preferred unit for prediction of traffic noise in the publication, 'Calculation of Road Traffic Noise'.

LA90,T : the A-weighted level of sound exceeded for 90% of the time period T.

This unit is commonly used to represent the background noise and is used in assessing the effects of industrial noise in UK.

LAmax : the maximum A-weighted level of sound over a period of measurement.

LAr,T : the rating level.

The specific Noise plus any adjustments for the characteristic features of the noise. Used for comparison between background levels with the noise source off.

SEL : the Sound Exposure Level.

Sound exposure level abbreviated as SEL and LAE, is the total noise energy produced from a single noise event condensed into a 1 second time period.

Rw : weighted sound reduction index.

A laboratory-measured value as defined in ISO717 Part 1.

DnTw :

The equivalent of Rw, but measured onsite as oppose to in a laboratory