

LINDEN HOMES SOUTH

LAND EAST OF TYE LANE, WALBERTON

NOISE ASSESSMENT

REPORT REF: 183240-04

PROJECT NO: 183240

FEBRUARY 2019

**PROPOSED RESIDENTIAL DEVELOPMENT:
LAND EAST OF TYE LANE, WALBERTON**

NOISE ASSESSMENT

**Ardent Consulting Engineers
3rd Floor
The Hallmark Building
52-56 Leadenhall Street
London
EC2M 5JF**



**REPORT REFERENCE 183240-04
PROJECT NO. 183240
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DOCUMENT CONTROL SHEET

REV	ISSUE PURPOSE	AUTHOR	CHECKED	APPROVED	DATE
-	DRAFT	AS	LD	KM	30.01.19
-	FINAL	AS	LD	MNR	05.02.19

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1.0 INTRODUCTION

- 1.1 Ardent Consulting Engineers has been appointed by Linden Homes South to advise on noise aspect of the proposed residential development located to the north of Walberton, West Sussex.

Site Location

- 1.2 The site is circa 10.5ha and is located to the north of Walberton town centre, positioned to the west of Yapton Lane and to the east of Tye Lane. Walberton & Binsted C of E Primary School is located immediately to the south and to the north is Hilton Avisford Park hotel and golf course. Further away to the north is the A27, which runs in an approximate east to west direction.
- 1.3 The site is centred approximately at Ordnance Survey grid co-ordinates 497323E, 106231N comprising mainly of greenfield. The site location is shown on **Figure 1.1** below.



Figure 1.1: Site Location Plan

Development Proposals

- 1.4 It is proposed to redevelop the site to provide a residential scheme of 175 residential properties, together with associated parking and external amenity space. An extract of the indicative proposals plan is shown on in **Figure 1.2**.

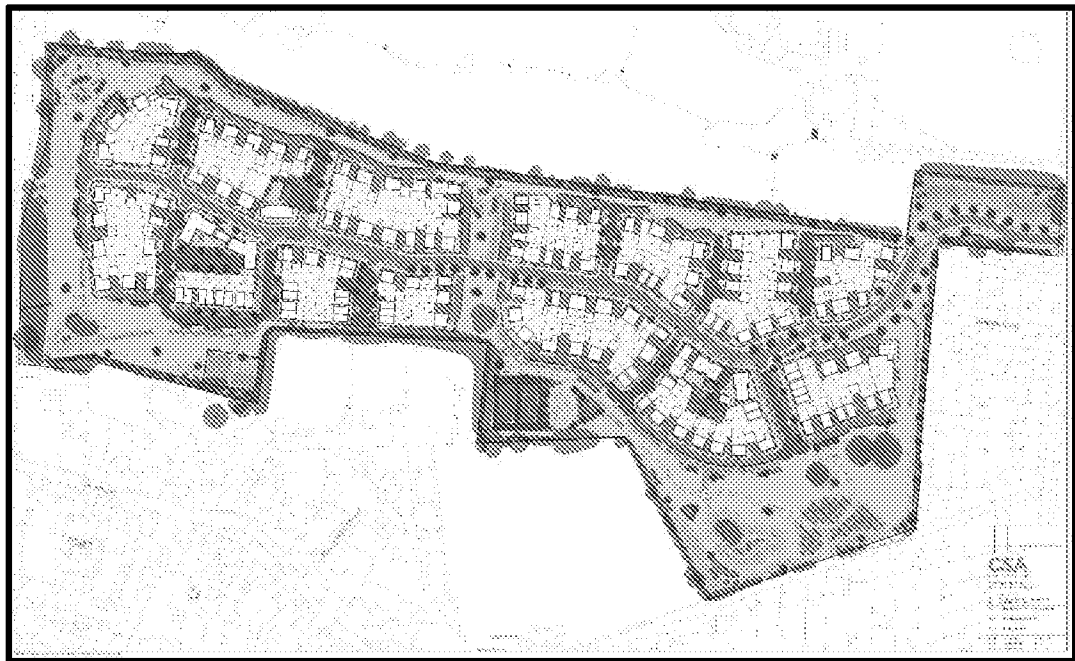


Figure 1.2: Indicative Development Proposals (Extract)

Planning Background

- 1.5 The site has an Outline Consent under application Reference WA/44/17/OUT. This report aims to satisfy the noise element of the following planning condition no.23:

"No development shall begin until an Air Quality Assessment and a Noise Impact Assessment have been submitted and approved in writing by the Local Planning Authority. Thereafter, the development shall be carried out in accordance with the approved schemes and any subsequent amendments shall be approved in writing by the Local Planning Authority."

2.0 RELEVANT POLICY AND GUIDANCE

National Planning Policy Framework (NPPF) – July 2018

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 areas of tranquillity 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.

Control of Pollution Act 1974

- 2.9 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

- 2.10 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

2.11 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

2.12 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.

2.13 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:

2.14 *"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."

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 2.2: Extract from Environmental Noise Guidelines for the European Region

- 2.19 External (free-field) recommendations included in the Environmental Noise Guidelines for the European Region are presented in **Table 2.1** for specific noise sources.

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 2.3**.

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 2.3: 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 LAeq,T, with an upper guideline value of 55 dB LAeq,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."

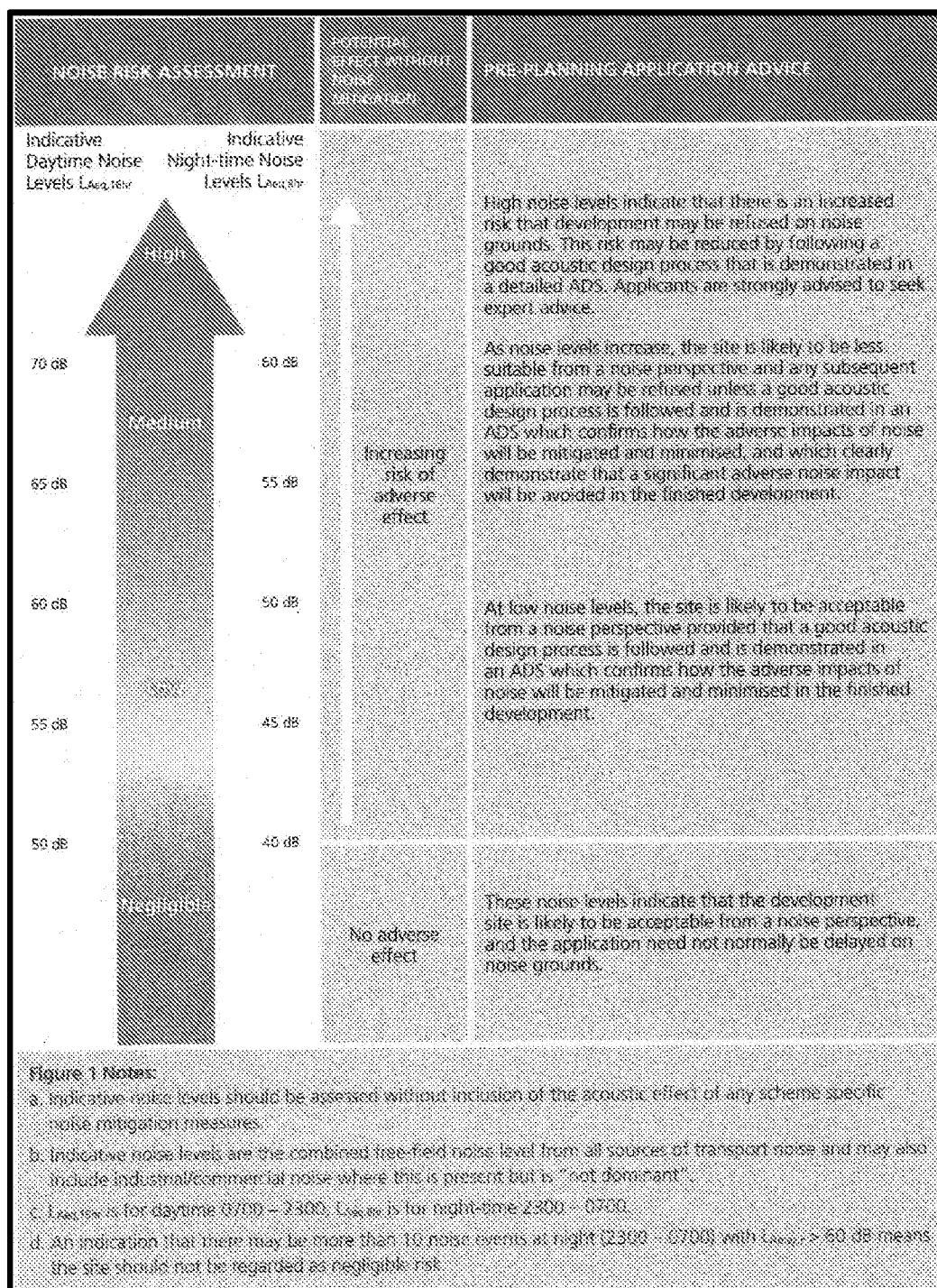


Figure 2.1: Extract from Figure 1 in ProPG – Initial Site Noise Risk Assessment

Local Authority Guidance

- 2.25 Discussions were held with Mr Christopher Davies, Environmental Health Officer of Arun District Council to agree on a suitable noise assessment methodology for the proposed development. Ardent proposed an assessment in line with the above guidance mentioned in this section of the report, which was accepted by the Local Authority.
- 2.26 Mr Davies noted that a Construction Noise Management Plan should be prepared and submitted to the Local Authority for approval. A Construction Management Plan has been produced by Ardent, report reference, 183240-06 which recommends noise control measures during the construction phase. Control measures can be implemented, however, it is noted that this is not a requirement of Condition 23.

3.0 ENVIRONMENTAL NOISE SURVEY

- 3.1 The environmental noise survey was undertaken between the 10th and 12th July 2018. Monitoring locations were chosen in order to obtain representative baseline levels due to the main observed noise sources within the vicinity of the development site.
- 3.2 Continuous automated monitoring was undertaken at 2 positions on site as shown in **Figure 3.1**. Position 1 is to the north of the school and position 2 is to the north east of the site, on the boundary near to the golf course. The locations were selected to represent exposed areas and in areas that equipment could be securely positioned.
- 3.3 Measurements were taken during school term-time to capture representative periods where noise levels may be elevated due to children are playing outdoors.

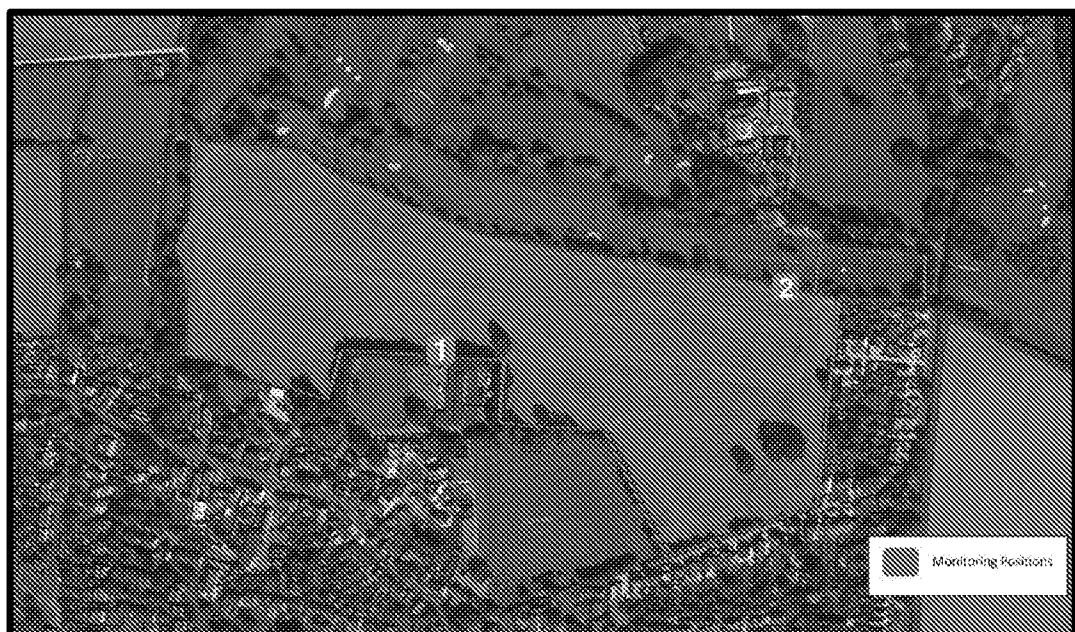


Figure 3.1: Monitoring Positions

- 3.4 Noise measurements presented as time histories can be found in **Appendix A** and are summarised in the following paragraphs.

Measurement Procedures

- 3.5 Staff involved with the measurements and observations are fully competent with regard to the requirements of environmental noise measurement. Measurement procedures used within this assessment conformed to relevant guidance within *BS 7445* and *CRTN* where appropriate.

Instrumentation

- 3.6 The equipment used was as follows:
- 2 x No Norsonic NOR140 Sound Level Meters
 - B&K 4231 Class 1 Calibrator
- 3.7 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

- 3.8 The main noise sources observed on site were distant and local road, rail traffic, children playing in the school playground during the day, bird song – particular dawn chorus, which was the cause of the elevated sound levels in the early morning, and foliage movement.
- 3.9 All measurements used within the calculations, mitigation recommendations and conclusions were taken during times of appropriate weather and representative traffic conditions.

Results

3.10 The L_{Aeq} , L_{Amax} , and L_{A90} acoustic parameters were measured throughout the duration of the survey. Measured levels are shown as time histories in **Appendix A**.

3.11 **Table 3.1** provides a summary of the measured noise levels.

Monitoring location	Ambient Noise Level dB $L_{Aeq, T}$		Representative night-time L_{Amax} dB(A)
	Daytime [07:00 - 23:00]	Night-time [23:00 - 07:00]	
Position 1 (School)	50 - 59	43	54
Position 2 (Golf Course)	47 - 49	41	59

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

3.12 The representative L_{Amax} level is the value which has been exceeded less 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.

3.13 Average sound levels are around $47dB_{LAeq,16hour}$ to $59dB_{LAeq,16hour}$ during the day and $41dB_{LAeq,8hour}$ to $43dB_{LAeq,8hour}$ at night. This would be considered a 'low risk' development site for residential use 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."

3.14 Good acoustic design processes will be followed to reduce sound levels to as low as practical across the site.

3.15 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} :16hr (day)	53	54	47	49	52	50	43	37
	L _{Aeq} :8hr (night)	44	40	37	40	40	31	28	23
	L _{Amax} :T (night)	59	56	51	55	50	47	44	46
P2	L _{Aeq} :16hr (day)	54	51	55	41	40	35	33	34
	L _{Aeq} :8hr (night)	46	40	37	39	37	29	32	23
	L _{Amax} :T (night)	65	57	55	59	50	51	54	48

Table 3.2: Octave band data for noise monitoring locations

4.0 MITIGATION RECOMMENDATIONS

4.1 The measured results and indicative layout were used to undertake calculations, presented in **Appendix B**, for suitable façade treatments. Mitigation recommendations are outlined in the following paragraphs.

4.2 Careful design of internal layout can be beneficial to achieve suitable internal sound levels; for example, positioning non-sensitive rooms such as kitchens and bathrooms on the more exposed façades and sensitive rooms such as bedrooms and living areas on more the sheltered elevations, which have been considered in the design.

External Building Fabric - Non-Glazed Elements

4.3 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 4.1** 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 4.1: Non-glazed elements assumed sound reduction performance

4.4 This would contribute towards a significant reduction of ambient noise levels in combination with a good quality double-glazed window configuration, as shown in **Table 4.2**.

External Building Fabric - Specification of Glazed Units

- 4.5 Sound reduction performance calculations have been undertaken to specify the minimum performance required from glazed elements in order to achieve recommended internal noise levels shown in **Table 2.3** of **Chapter 2**.
- 4.6 Calculations have been based on habitable rooms with relatively higher ratios of glazing to masonry, in order to present a more onerous assessment. This specification therefore presents a robust assessment, for BS8233:2014 criteria for internal noise levels in all affected facades.
- 4.7 The detailed layout of the buildings on site is not known at this stage. Assumptions have been made regarding room sizes in the calculation sheets.
- 4.8 Glazing calculations have been performed using the L_{Aeq} and L_{Amax} values (as appropriate) as detailed in **Table 3.1**, together with the octave band levels as shown in **Table 3.2**.
- 4.9 The required glazing performance is shown in **Table 4.2**. The performance is specified for the whole window unit, including the frame.

Glazing Type reference, description and typical dimensions(mm)	Sound Reduction Index R_w	Octave band centre frequency (Hz) SRI (dB)					
		125	250	500	1k	2k	4k
Standard Thermal double (6/16/6mm)	32	20	21	30	35	32	37

Table 4.2: Minimum glazing specification

External Building Fabric - Specification of Vents

- 4.10 It should be noted that there may be additional considerations for glazing requirements such as security and thermal performance, therefore the above specified glazing is merely guidance for how the acoustic criteria can be achieved. Alternative glazing could be used in place of the above specified units, assuming the minimum acoustic performance is met.
- 4.11 In addition, where non-sensitive rooms and sensitive rooms form part of an open plan area, for example a dining and kitchen area, the glazing specification for the more sensitive room should be used across all windows in this area.
- 4.12 Properties fronting onto the school playground are subject to slightly higher sound levels during the day when the school is open. If windows are open during this period, this may result in levels that are above what is considered suitable in authoritative guidance. However, during the evenings when residents are most likely to be resting in their homes, suitable internal sound levels can be achieved with partially opened windows.

- 4.13 Acoustic trickle ventilation will be provided for the properties fronting onto the school grounds to offer a choice to ventilate properties during the daytime in lieu of partially open windows.

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

Table 4.3: Required minimum attenuation values for ventilation

- 4.14 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.

External amenity space

- 4.15 Gardens and external amenity spaces should aim to meet desirable ambient noise levels defined in WHO Guidelines and BS 8233. However, guidelines recognise that external levels of 55dBA is not always achievable and that a decision should be balanced against the other criteria for developing a site. In general, however, the lowest practicable levels should be achieved through good acoustic design.
- 4.16 External sound levels are generally suitable across the site and meet the criteria set out in the guidance. Gardens fronting onto the school playground will be subject to slightly higher sound levels during the day, however when the school is closed, suitable external levels can be achieved.
- 4.17 Careful orientation of gardens to the more sheltered side of dwellings or screening of gardens with close boarded fences or walls can reduce sound levels by around 5dBA to 10dBA.

- 4.18 Following these principles of good acoustic design, the vast majority of gardens areas can achieve suitable external sound levels as set out in the guidance.

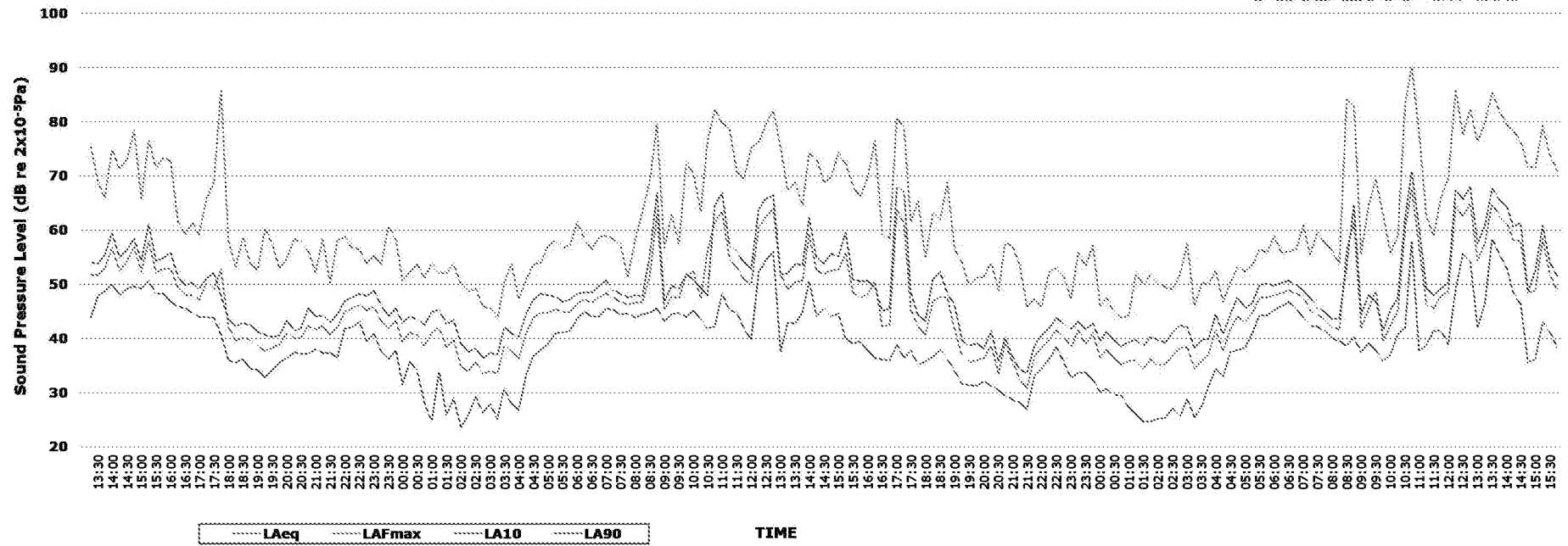
5.0 CONCLUSIONS

- 5.1 Noise levels have been measured at two locations across the site. Measured levels have been used to calculate and assess suitable glazing specification.
- 5.2 This is considered a 'low risk' site when considered in accordance with guidance in ProPG. Expert Acoustics advice has been sought and good acoustic design processes should be followed to reduce sound levels across the site.
- 5.3 External levels are suitable across the majority of the site. Properties near to the school playground may be subject to slightly higher sound levels during the day, sound levels will be reduced to as low a level as practicable in accordance with the principles of good acoustic design.
- 5.4 This assessment demonstrates that the site is suitable for residential development subject to the mitigation recommendations included in this report, and as such, Condition 23 of planning reference WA/44/17/OUT can be satisfied.

APPENDIX A

Walberton - Position 1 - School

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Walberton - Position 2 - Golf Club

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APPENDIX B

ARDENT CONSULTING ENGINEERS
Noise Break-in Calculation - Position 1

Description	
Ardent CE Project No.	183240
Property Address	Walberton
Room Type	Bedroom
Parameter	LAeq, 16h

Room Dimensions and Areas	
Room volume	17.0m³
Total Surface area	55.9m²
Wall fa'ade area	10.00
Roof fa'ade area	17.00
Glazing area	17.00
Dne Ref Area, A0	17.00
Total fa'ade area	34.00

Based on typical size

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	
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	

Comment:
Typical Bedroom RT

Fa'ade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	53.4	54.0	47.4	49.1	52.4	49.8	43.3	37.1	55.9
Fa'ade to free field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Angle of view	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Screening (Maekewa)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Distance correction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Noise level at fa'ade (Leq)	53	54	47	49	52	50	43	37	56

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	18	20	21	30	35	32	37	44	32
Transmission Coefficient	0.015849	0.010000	0.007943	0.001000	0.000316	0.000631	0.000200	0.000040	
Wall SRI	34	41	45	48	56	65	69	72	54
Transmission Coefficient	0.000398	0.000079	0.000032	0.000016	0.000003	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
Transmission Coefficient	0.000251	0.000251	0.000398	0.000794	0.000398	0.000158	0.000158	0.000158	
Average Transmission Coeff	0.004673	0.002890	0.002419	0.000860	0.000378	0.000284	0.000169	0.000127	
Average SRI	23	25	26	31	34	35	38	39	34

Thermal 6/16/6

Typical masonry cavity wall (300mm - 380kg/m2)

Standard Trickle Vent

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A
Lp (Reverberant), line source	31.0	29.4	22.1	19.3	19.0	15.2	6.5	-1.0	23.4
Lp (Direct)	30.1	28.6	21.2	18.4	18.2	14.3	5.6	-1.8	22.5
Lp (Rev & Direct)	34	32	25	22	22	18	9	2	26
BS 8233	33	31	24	21	21	17	8	1	25

Criteria

#35

#35

Noise Break-in Calculation - Position 1

Description	
Ardent CE Project No.	183240
Property Address	Walberton
Room Type	Bedroom
Parameter	LAeq, 8h

Room Dimensions and Areas	
Room volume	16.1m³
Total Surface area	56.0m²
Wall fa'ade area	10.00
Roof fa'ade area	16.1m²
Glazing area	1.0m²
Dne Ref Area, A0	3.0m²
Total fa'ade area	27.1m²

Based on typical size

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	
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	

Comment:
Typical Bedroom RT

Fa'ade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	43.7	39.6	36.7	40.2	40.3	30.8	27.8	23.1	42.8
Fa'ade to free field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Angle of view	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Screening (Maekewa)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Distance correction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Noise level at fa'ade (Leq)	44	40	37	40	40	31	28	23	43

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	18	20	21	30	35	32	37	44	32
Transmission Coefficient	0.015849	0.010000	0.007943	0.001000	0.000316	0.000631	0.000200	0.000040	
Wall SRI	34	41	45	48	56	65	69	72	54
Transmission Coefficient	0.000398	0.000079	0.000032	0.000016	0.000003	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
Transmission Coefficient	0.000251	0.000251	0.000398	0.000794	0.000398	0.000158	0.000158	0.000158	
Average Transmission Coeff	0.004673	0.002890	0.002419	0.000860	0.000378	0.000284	0.000169	0.000127	
Average SRI	23	25	26	31	34	35	38	39	34

Thermal 6/16/6

Typical masonry cavity wall (300mm - 380kg/m2)

Standard Trickle Vent

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A
Lp (Reverberant), line source	21.2	15.0	11.4	10.3	7.0	-3.8	-9.1	-15.0	11.4
Lp (Direct)	20.3	14.2	10.5	9.5	6.1	-4.7	-9.9	-15.8	10.6
Lp (Rev & Direct)	24	18	14	13	10	-1	-6	-12	14
BS8233	23	17	13	12	9	-2	-7	-13	13

Criteria

H30

H30

Noise Break-in Calculation - Position 1

Description	
Ardent CE Project No.	183240
Property Address	Walberton
Room Type	Bedroom
Parameter	Lamax

Room Dimensions and Areas	
Room volume	16.1
Total Surface area	56.1
Wall fa'ade area	10.00
Roof fa'ade area	16.1
Glazing area	16.1
Dne Ref Area, A0	36.1
Total fa'ade area	36.1

Based on typical size

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	
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	

Comment:
Typical Bedroom RT

Fa'ade level		63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level		59.0	55.8	51.3	55.1	50.1	47.4	44.4	45.9	54.3
Fa'ade to free field		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Angle of view		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Screening (Maekewa)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Distance correction		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Other		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Noise level at fa'ade (Leq)		59	56	51	55	50	47	44	46	56.3

Composite SRI		63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI		18	20	21	30	35	32	37	44	32
Transmission Coefficient		0.015849	0.010000	0.007943	0.001000	0.000316	0.000631	0.000200	0.000040	
Wall SRI		34	41	45	48	56	65	69	72	54
Transmission Coefficient		0.000398	0.000079	0.000032	0.000016	0.000003	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
Transmission Coefficient		0.000251	0.000251	0.000398	0.000794	0.000398	0.000158	0.000158	0.000158	
Average Transmission Coeff		0.004673	0.002890	0.002419	0.000860	0.000378	0.000284	0.000169	0.000127	
Average SRI		23.3	25.4	26.2	30.7	34.2	35.5	37.7	39.0	34

Thermal 6/16/6

Typical masonry cavity wall (300mm - 380kg/m2)

Standard Trickle Vent

Calculated Internal Noise Level, dB		63	125	250	500	1000	2000	4000	8000	A
Lp (Reverberant), line source		36.5	31.2	26.0	25.3	16.7	12.8	7.6	7.8	25.3
Lp (Direct)		35.7	30.4	25.1	24.4	15.9	11.9	6.7	7.0	24.5
Lp (Rev & Direct)		39	34	29	28	19	15	10	10	28
BS8233		39	33	28	27	19	15	10	10	27

Criteria

H45

H45

ARDENT CONSULTING ENGINEERS
Noise Break-in Calculation - Position 2

Description	
Ardent CE Project No.	183240
Property Address	Walberton
Room Type	Bedroom
Parameter	LAeq, 16h

Room Dimensions and Areas	
Room volume	15.1m³
Total Surface area	55.0m²
Wall fa'ade area	10.00
Roof fa'ade area	11.1m²
Glazing area	1.2m²
Dne Ref Area, A0	3.1m²
Total fa'ade area	30.3m²

Based on typical size

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	
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	

Comment:
Typical Bedroom RT

Fa'ade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	54.2	50.6	44.2	41.1	40.1	35.4	33.1	34.2	47.7
Fa'ade to free field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Angle of view	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Screening (Maekewa)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Distance correction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Noise level at fa'ade (Leq)	54	51	44	41	40	35	33	34	45

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	18	20	21	30	35	32	37	44	32
Transmission Coefficient	0.015849	0.010000	0.007943	0.001000	0.000316	0.000631	0.000200	0.000040	
Wall SRI	34	41	45	48	56	65	69	72	54
Transmission Coefficient	0.000398	0.000079	0.000032	0.000016	0.000003	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
Transmission Coefficient	0.000251	0.000251	0.000398	0.000794	0.000398	0.000158	0.000158	0.000158	
Average Transmission Coeff	0.004673	0.002890	0.002419	0.000860	0.000378	0.000284	0.000169	0.000127	
Average SRI	23	25	26	31	34	35	38	39	34

Thermal 6/16/6

Typical masonry cavity wall (300mm - 380kg/m2)

Standard Trickle Vent

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A
Lp (Reverberant), line source	31.7	26.1	18.9	11.3	6.7	0.8	-3.7	-3.9	15.8
Lp (Direct)	30.9	25.2	18.0	10.4	5.9	-0.1	-4.6	-4.8	14.9
Lp (Rev & Direct)	34	29	22	14	9	3	-1	-1	18
BS8233	34	28	21	13	9	3	-2	-2	18

Criteria

H35

H35

APPENDIX C

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:

$L_{Aeq,T}$ 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.

$L_{A10,T}$: 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',

$L_{A90,T}$: 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.

L_{Amax} : the maximum A-weighted level of sound over a period of measurement.

$L_{Ar,T}$ 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.

S_{EL} 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