09/00140/RBM DISCONS RM

Report No: **AAL/BS08112**

DEVELOPMENT SERVICES
26 FEB 2009
RECEIVED

Noise Mitigation
Outlands Drive

Acoustic Associates
LEICESTERSHIRE

Client: **S Parker**
Jelson Ltd
370 Loughborough Road
Leicester LE4 5PR

B N Smith BSc MSc CPhys MInstP MIOA

Date: **15 December 2008**

Acoustic Associates (Leicestershire), 19 St Johns Road, Leicester LE2 2BL 0116 2448828

Summary

A 2 m high noise barrier will be erected along the whole of the Normandy Way boundary. A standard vertical overlap wood fence (of at least 18 mm thick wood) with no gaps in it would suffice.

We recommend that 27 $R_{traffic}$ glazing should be fitted to all windows facing Normandy Way that are within 33 m of the kerb.

Contents

1. Introduction. 4

2. Noise measurements. 4

3. Noise assessment. 5

4. Noise mitigation. 7

Appendix 1. Measured noise levels. 9

Appendix 2. Calculated noise levels for mitigation effects. 10

Glossary. 12

1. Introduction

Acoustic Associates have been commissioned to advise on a noise mitigation scheme for Phase 3 & 4 Outlands Drive, Hinckley to meet planning condition 22 which states:

Prior to commencement of the phase of development incorporating dwellings to the western flank of the development adjacent to Normandy Way, a scheme for the protection of those properties incorporating a suitable noise barrier and specification for windows shall be submitted to and approved in writing by the Local Planning Authority.

All information presented is illustrative and intended to assist in the application for planning permission and it should not be used for design or any other purposes. This report is based on information supplied by the client and we are not responsible for any errors in that information.

2. Noise measurements

Noise levels were measured by a competent person for environmental and occupational noise monitoring, in accordance with BS 7445 (Description and measurement of environmental noise) and BS 4142:1997 (Method for rating industrial noise affecting mixed residential & industrial areas). Free field noise levels were measured at a height of 1.5 m above the ground using the following sound level meters with wind shields fitted:

Instrument	Serial No.	Calibrated	Measurement
Larson Davis 820	0709	Jan 08	11m from Normandy Way boundary

The equipment was operated according to the manufacturers instructions and calibrated before and after use with a Bruel & Kjaer Type 4230 acoustic calibrator (serial number 781674), and the calibration had not changed appreciably.

Weather conditions were satisfactory for monitoring noise, and noise level measurements were not affected by wind generated noise. Average wind speeds were less than 1m/s, and it was dry with sunny intervals.

The noise levels are given in Appendix 1, and the position of the NEC A region is calculated in Appendix 2 (with and without the barrier attenuation). There were no noise events at night exceeding 82 L_{Amax}.

3. Noise assessment

A noise survey was conducted in accordance with PPG 24, from 9th to 10th December, covering a 24 hour period of a typical weekday, the indications are that this was a typical day as far as we know. The noise was monitored in 1 hourly intervals.

PPG 24 introduced the concept of Noise Exposure Categories (NECs), ranging from A to D, to help local planning authorities in their consideration of applications for residential development near transport-related noise sources. Paragraph 8 of PPG 24 explains these categories as follows:

Category A represents the circumstances in which noise is unlikely to be a determining factor, while Category D relates to the situation in which development should normally be refused. Categories B and C deal with situations where noise mitigation measures may make development acceptable.

Paragraph 9 goes on to introduce Annex 1 which contains the range of noise levels for each NEC. Annex 1 of PPG 24 states that:

When assessing a proposal for residential development near a source of noise, local planning authorities should determine into which of the four noise exposure categories (NECs) the proposed site falls, taking account of both day and night-time noise levels. Local planning authorities should then have regard to the advice in the appropriate NEC, as below:

NEC	
A	*Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as a desirable level.*
B	*Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.*
C	*Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.*
D	*Planning permission should normally be refused.*

2. A recommended range of noise levels is given below for each of the NECs for dwellings exposed to noise from road, ... Paragraph 9 of the main text explains that in some cases local planning

authorities may be able to justify a range of NECs of up to 3 dB(A) above those recommended.

8. Values in the table below refer to noise levels measured on an open site at the position of the proposed dwellings, well away from any existing buildings, and 1.2m to 1.5m above the ground.

Noise levels corresponding to the noise exposure categories for new dwellings $L_{Aeq,T}$ dB				
	Noise exposure category			
Noise source	***A***	***B***	***C***	***D***
road traffic				
07:00-23:00	*<55*	*55 - 63*	*63 - 72*	*>72*
23:00-07:00	*<45*	*45 - 57*	*57 - 66*	*>66*

Notes

[0]Noise levels: the noise levels ($L_{Aeq,T}$) used when deciding the NEC of a site should be representative of typical conditions.

[1]Night time noise levels (23:00 - 07:00): sites where individual noise events regularly exceed 82 dBL_{Amax} (S time weighting) several times in any hour should be treated as being in NEC C

Noise from road traffic

1. For established roads it will normally be sufficient to base assessments on the current measured noise level (para 8 of Annex 1 refers).

The World Health Organisation Guidelines for Community Noise (1999) state

To protect the majority of people from being seriously annoyed during the day time the out door sound level from steady, continuous noise should not exceed 55 L_{Aeq}. To protect the majority of people from being moderately annoyed during the day time, the out door sound level from steady, continuous noise should not exceed 50 L_{Aeq}. If negative effects on sleep are to be avoided the equivalent sound pressure level should not exceed 30 dBA ***indoors*** *for continuous noise. If the noise is not continuous, sleep disturbance correlates best with L_{Amax} and effects have been observed at 45 dB or less. For a good night's sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times per night. It should be noted that it should be possible to sleep with a bedroom window slightly open (a reduction from outside to inside of 15 dB). At night, sound pressure levels at the outside façades of the living spaces should not exceed 45dB LAeq and 60 dB LAmax, so that people may sleep with bedroom windows*

open. These values have been obtained by assuming that the noise reduction from outside to inside with the window partly open is 15 dB.

BS 8233:1999 Code of practice for sound insulation and noise reduction for buildings gives design criteria for dwellings, it states:

7.6.1.2 For dwellings the main criteria are reasonable resting/sleeping conditions in bedrooms and good listening conditions in other rooms. It also gives design ranges for external noise experienced within rooms:

BS 8233: 1999 Table 5		*Design range $L_{Aeq,T}$*	
		good	*reasonable*
Reasonable resting/sleeping conditions	*Living rooms*	*30*	*40*
	Bedrooms	*30*	*35*

For a reasonable standard in bedrooms at night individual noise events should not normally exceed 45 L_{Amax}

External noise levels could be 15 dBA higher than this if the windows are open, so 45 L_{Aeq} externally would be considered "good", which parallels the WHO night time criterion.

4. Noise mitigation

A 2 m high noise barrier will be erected along the whole of the Normandy Way boundary. It would normally provide a 10 dBA reduction in noise (at ear height, for a ground level receiver). A standard vertical overlap wood fence (of at least 18 mm thick wood) with no gaps in it would suffice. As can be seen from the calculations in Appendix 2 this will reduce noise to NEC A (for which no further mitigation would be necessary) at distances of 3 m from the boundary fence to Normandy Way at ground floor level. All houses are at least this far from the fence so no more mitigation is required to ground floors. However the barrier effect is lower for first floor windows close to Normandy Way.

For windows less than 33 m from the kerb (Table 4) there may be a direct line of sight to the traffic source position so the barrier attenuation is no more than 5 dBA and for those nearest Normandy Way it may be negligible. Based on the Dec 2008 layout, drawing number 788.6 rev B, the most affected houses would be plot 190/191 (plots 183 and 189 are closer but they are gable end on so provided there are no windows in the gable ends plot 190 is the most affected plot). This is 8 m from the fence so noise levels there would be 57.5 $L_{Aeq,8hr}$. We therefore recommend that 27 $R_{traffic}$ glazing should be fitted to all windows facing Normandy Way that are within 33 m of the kerb. Appendix 2 gives an example of 10/12/4 double glazing units which achieve this attenuation (it gives 29 $R_{traffic}$ and 36 R_w).

Appendix 1. Measured noise levels

Table 1. 11m from the fence to Normandy Way

Date	Time	L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}
09 Dec 2008	19:00:00	62.8	70.2	65.5	57.6
09 Dec 2008	20:00:00	61.8	73.9	64.9	51.2
09 Dec 2008	21:00:00	61	71.5	64.4	48.1
09 Dec 2008	22:00:00	60.7	70.7	64.5	43.7
09 Dec 2008	23:00:00	57.8	70.5	62.3	35.6
10 Dec 2008	00:00:00	55.6	70.5	60.2	33.3
10 Dec 2008	01:00:00	52.1	71.4	57.2	31.3
10 Dec 2008	02:00:00	52.1	66.7	56.7	31.8
10 Dec 2008	03:00:00	53.1	69.5	57.8	32.7
10 Dec 2008	04:00:00	54.2	66.9	59.2	32.8
10 Dec 2008	05:00:00	59.2	72	63.2	37.2
10 Dec 2008	06:00:00	61.6	72.4	64.7	52.2
10 Dec 2008	07:00:00	63.3	71.4	65.5	59.7
10 Dec 2008	08:00:00	63.7	73.9	65.7	60.7
10 Dec 2008	09:00:00	63.7	82.5	65.9	59.2
10 Dec 2008	10:00:00	63.3	75.5	65.9	58.1
10 Dec 2008	11:00:00	63.6	73.7	66	58.8
10 Dec 2008	12:00:00	63.8	71.4	66	60
10 Dec 2008	13:00:00	64	76.9	66.2	59.7
10 Dec 2008	14:00:00	64.4	71.7	66.7	60.3
10 Dec 2008	15:00:00	64.2	69.9	66.4	60.7
10 Dec 2008	16:00:00	64.2	71.7	66.2	61.1
10 Dec 2008	17:00:00	64.4	74	66	61.8
10 Dec 2008	18:00:00	63.5	75	66.5	59.2

57.0 8 hr night time $L_{Aeq,8hr}$
63.4 16 hr day time $L_{Aeq,16hr}$

Appendix 2. Calculated noise levels for mitigation effects

Distances to NEC boundaries are estimated based upon noise from a line source (3 dB attenuation per doubling of distance) with the source position as stipulated in CRTN at 3.5m from the kerb.

Table 2. Calculation of NEC A/B position (day - at 55 dBA for road), no barrier

Monitored noise level	63.4	$L_{Aeq,16hr}$
distance from fence	11	m
distance of fence from kerb	12	m
distance from source	26.5	m
NEC A/B level	55	$L_{Aeq,16hr}$
difference in noise level	8.40	dB
distance from source of NEC A/B	183.5	m
distance from fence to NEC A/B	168.0	m
distance from kerb to NEC A/B	180.0	m

Table 3. Calculation of NEC A/B position (day - at 55 dBA for road) with barrier erected

Monitored noise level less barrier attenuation	53.4	$L_{Aeq,16hr}$
distance from fence	11	m
distance of fence from kerb	12	m
distance from source	26.5	m
NEC A/B level	55	$L_{Aeq,16hr}$
difference in noise level	-1.60	dB
distance from source of NEC A/B	18.3	m
distance from fence to NEC A/B	2.8	m
distance from kerb to NEC A/B	14.8	m

Table 4. Barrier effect range

window above source	3.5	b_1
fence above source	1.5	b_2
fence to source	15.5	a_2
source to window	36.2	a_1
kerb to window	32.7	

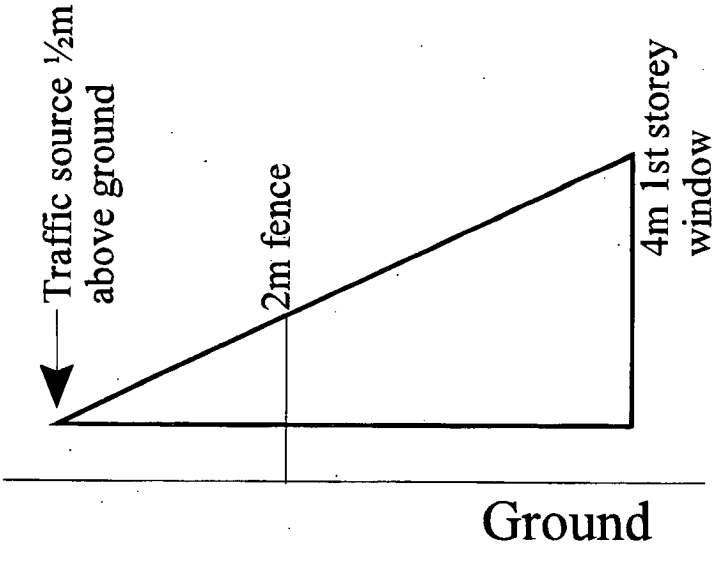


Figure 1 $a_1/b_1=a_2/b_2$ so $a_1 b_2=a_2 b_1$ so $a_1=a_2b_1/b_2$

Table 5. Calculations of internal noise levels to BS 8233 paragraph 6.7.1.

	Night L_{Aeq}	Night L_{Amax}	
A. External noise level	57.5	71.4	dBA
B. Roof-ceiling insulation	43	43	R_w
C. 10/12/4 double glazing units	29	29	$R_{traffic}$
Internal noise level, A-C	28.5	42.4	dBA
BS8233 classification	good	acceptable	

Glossary

Ambient noise	The whole noise climate that exists at present, excluding the Specific Noise (the noise under consideration). The all pervasive noise associated with a given environment. It would normally be measured as an L_{Aeq}.
A-weighting	The human ear responds to sound in a frequency dependent manner. Low frequencies (bass tones) and very high frequencies (eg a dog whistle) are not heard as well as intermediate frequencies. The sound level is A-weighted (electronically) to get the sound level meter to respond in a similar way as a human ear.
Background	The "typical lowest" noise level when the specific noise being considered is not contributing to the noise. It is measured in terms of the L_{A90}.
Barrier	A wall or fence which blocks the path of noise. For it to be effective it must be air tight and of sufficient mass, and must be sufficiently wide and tall.
Competent person	A person with sufficient experience and qualification to assess noise, for example a Member of the Institute of Acoustics (an MIOA or FIOA) or someone with a degree in acoustics.
dB	The decibel, the unit of measurement of sound pressure level. It is a logarithmic scale so doubling it's value does NOT mean twice as much sound. It is calculated from the reference level, p_0, = 2 x 10^{-5}N/m^2, so that 0dB is the threshold of hearing. $$Noise\ \ level,\ dB = 20\log\frac{p}{p_0}$$ A 3dB increase indicates a doubling of the **energy** of the sound. A 10 dB increase in noise level will produce a perception of about a doubling of the **loudness**. Note that it is a ratio and so both sound pressure and sound power are measured in dB, although they are not the same physical quantity.
dB(A)	The sound pressure level after it has been A-weighted.
Free field	An environment where there are no reflective surfaces other than the ground or floor, in the middle of a field for instance. Noise decays at 6 dB per doubling of distance.
Facade noise level	Noise level 1 m in front of a reflective surface (usually a building). It is usually about 3 dB higher than the equivalent free field noise level.
Intermittent	An intermittent noise is one that **because of its nature** fluctuates in noise level (not one that is switched on and off), for example a dust filter with a self cleaning pneumatic mechanism (with a periodic blowback.)
L_{Aeq}	Equivalent continuous A-weighted sound pressure level. It indicates the average noise level over the measurement period.
$L_{A\,N}$, L_{A90}	N is an integer. The noise level that is exceeded for N% of the time; eg L_{A90} (the background) is the noise level that is exceeded for 90% of the time.

L_a	Machine declared Noise Level at the operators ear
Noise level	The same as sound pressure level.
Noise sensitive area	Any location where there may be people (animals may also be included in some circumstances) who could be adversely affected by noise, such as dwellings, schools, hospitals, auditoria, law courts and chambers, laboratories, libraries, museums, art galleries, inhabited buildings, open areas used by the public or recreational areas. Usually factories and industrial sites would not be noise sensitive.
Octave bands	Specific frequency ranges (each octave is adjacent to, but does not overlap, its neighbouring bands). The nominal centre frequencies have been internationally agreed and increase by a factor of 2. They include 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1kHz, 2kHz, 4kHz etc
Representative property	A property considered to be an example of the surrounding properties. For each group it should be the property of the group exposed to the most noise from the site.
Rw	Weighted sound reduction index defined in ISO 140-3:1995. it is the noise reduction provided by a building element.
Sound power	see SWL
Sound pressure	see SPL
Specific Noise	The noise under consideration, such as from a factory or new development.
SEL	Single event level, the noise level over a one second period that has the same energy as the noise event (usually lasting much longer than 1 second) being measured.
SPL	Sound Pressure Level, not to be confused with sound power level. The noise level indicated by a sound level meter in dB. It will vary from place to place (cf the temperature produced by an electric heater).
SWL	Sound Power Level, should not be confused with sound pressure level although both are measured in dB. Also called the noise level. The sound emission from a machine (cf the power rating of an electric fire). It is **not** dependent on the measurement position.
Statutory nuisance	A noise which is considered in law to amount to a nuisance, it depends upon the interpretation of a judge. There is no defined noise level at which this occurs, but British Standards (eg BS 4142 or BS 5228) and governmental advice (eg Noise Insulation Regs, PPG 24) would probably be quoted to indicate whether a nuisance had been caused.
Tonal	Noise which is predominantly at one (or a few) particular frequencies, noise that has a noticeable pitch. For instance it may be described as a hum, whistle, high (or low) pitched noise. Examples of tonal noise would be noise from some fans or reversing alarms.
Working pattern	How a job is performed, for how long each machine operates in a given time period, and where on the site the job is done (or the path taken by mobile plant).