ACOUSTIC DESIGN TECHNOLOGY
Noise and Vibration Consultants

ADT 2457

7 October 2016

Welland Homes Ltd
c/o South Holland District Council
Council Offices
Priory Road
SPALDING
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PARKSIDE CRESCENT PHASE 1

ENVIRONMENTAL NOISE AND VIBRATION IMPACT ASSESSMENT

ACOUSTIC CONSULTANCY REPORT ADT 2457/ENIA

Revision	Date	Issued By	Revision Notes
-	7 October 2016	Chris Middleton	first issue

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1.0 SUMMARY

Outline planning permission has been granted for residential development of the site, and Condition 8 requires the submission of an acoustic report with the reserved matters application.

Acoustic Design Technology Limited have undertaken an environmental noise and vibration survey to determine the typical levels of noise and vibration generated by the nearby railway.

Based on the survey data, preliminary analysis indicates that compliance with the BS 8233:2014 indoor ambient noise criteria should generally be achievable with standard thermal double glazing and trickle vents, and with acoustic vents to the rooms most exposed to the railway noise.

Noise levels in outdoor amenity areas should be within the BS 8233:2014 recommended limits.

Measured vibration levels are generally within or below the lowest range defined as 'low probability of adverse comment' in BS 6472-1:2008, except in the vertical direction during the night, where the standard indicates 'adverse comment possible'.

This marginal conclusion can be set against the fact that the site is located in a well established residential context, and the vibration of individual trains passing was not noticeably significant during the survey. Furthermore, the risk of adverse comment can be minimised with appropriate building design.

The site should therefore be acoustically suitable for residential development, with appropriate acoustic control measures.

2.0 BASIS OF ASSESSMENT

2.1 Site Location

The site is located on Parkside Crescent, Spalding and is currently occupied by residential garages backing onto an area of scrubland. The surrounding area is largely residential to the north, west and south, while to the east beyond the railway are commercial and retail units.

The railway forms the eastern site boundary, with Spalding station located approximately 250 metres away to the south.

2.2 Proposed Development

The proposal is to redevelop the site to create 10 no. houses as shown on the planning application drawings.

2.3 Assessment Criteria

Suitable indoor ambient noise criteria for residential developments are provided in Section 7.7.2 of BS 8233:2014, as follows:

Activity	Location	Day (07:00 - 23:00)	Night (23:00 - 07:00)
Resting	Living room	35 dB $L_{Aeq, 16hour}$	-
Dining	Dining room / area	40 dB $L_{Aeq, 16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16hour}$	30 dB $L_{Aeq, 16hour}$

Section 7.7.3.2 of the same document recommends that the external noise levels in outdoor amenity spaces such as gardens and patios do not exceed $L_{Aeq,\ T}$ 50 - 55 dB, where practical.

In terms of vibration, BS 6472-1:2008 sets the following vibration dose values (VDV) for residential buildings:

	Low probability of adverse comment	VDV ($m/s^{1.75}$) x, y or z axes Adverse comment possible	Adverse comment probable
Day 07:00 - 23:00	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Night 23:00 - 07:00	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

2.4 Strategy for Noise and Vibration Impact Assessment

Based on the information in Sections 2.1 to 2.3 above, the strategy for the assessment has been broken down into the following stages:

i. undertake an environmental noise and vibration survey, as described in Section 3.0 below

ii. assess the noise levels across the site with reference to the BS 8233 criteria and provide preliminary guidance on the scope of noise control measures that may be required, as described in Section 4.0 below.

iii. assess the vibration levels against the BS 6472 criteria, as described in Section 5.0 below.

3.0 ENVIRONMENTAL NOISE AND VIBRATION SURVEY

3.1 Introduction

An environmental noise and vibration survey was undertaken between 04:00 hours and 10:00 hours on Wednesday 14 September 2016, that being a sample of typical railway operations. The sample period was discussed and agreed with South Holland District Council environmental health department beforehand.

3.2 Instrumentation

The survey was conducted using the instrumentation detailed in Appendix A of this report.

The sound level meter and analyser were calibrated at the beginning of the survey period, and the calibrations checked at the end. No significant drifts occurred.

3.3 Procedure

Measurement positions were selected at a single position at the proposed building line nearest the railway, as indicated on the attached site plan 2457/SP1:

The microphone was mounted on a tripod approximately 1.2 metres above the ground and least 3.5 metres from any other acoustically reflective surface.

Measurements were taken continuously, with the Svantek 958 analyser set to store the octave band and A-weighted 100ms short-term L_{eq} levels, along with triaxial ground vibration for subsequent post processing.

3.4 Results

The logged data has been post processed to determine $L_{Aeq,5\ mins}$, and these are plotted on the attached time history graph 2457/TH1. Train pass-bys generated up to L_{Amax} 75 dB.

Octave band $L_{eq,\ 15\ mins}$ averaged over the survey period are listed in the attached table 2457/T2.

Please refer to Appendix B for an explanation of the noise units and the A-weighting term used in this report.

Vibration survey results for the survey period are listed in the following table:

	VDV ($m/s^{1.75}$)		
	x-axis	y-axis	z-axis
VDV, $_{3\ hour}$ (04:00 - 07:00)	0.014	0.016	0.301
VDV, $_{3\ hour}$ (07:00 - 10:00)	0.005	0.006	0.08

3.5 Weather Conditions

For the duration of the survey the weather conditions were dry and still, and had no effect on the measured levels.

3.6 Description of Existing Acoustic Environment

Aside from minor local traffic on Park Road, the most significant noise affecting the site was trains.

Trains were observed at 04:39, 05:01, 05:21 (all freight), 08:54 (x2, one of which was freight), 09:00, 09:11 and 09:57. Railway noise was more noticeable during the night, from the freight trains. Significant vibration was not perceptible.

4.0 NOISE IMPACT ASSESSMENT

4.1 Introduction

The guidance in the following sections is intended to demonstrate how suitable noise levels could be achieved inside dwellings and in outdoor living areas, for the purposes of the planning application. It is not intended to provide definitive acoustic performance specifications for the building envelope.

4.2 Site Noise Levels

When assessing external noise intrusion into new dwellings and noise levels in gardens it must be borne in mind that the noise climate may change in the future. The following discussion is by necessity based on the results of the environmental noise survey described in Section 3.0 above.

The data from measurement position 1 represents the noise climate in the area most exposed to the railway noise, although the proposed layout of the site provides screening and reduced angles of views to some properties, so that the noise levels will not be not the same at all building elevations.

Analysis has been undertaken to determine the effects of screening and reduced angles of view, and the proposed building elevations have then been classified into three noise exposure zones as illustrated on the attached site plan 2457/SP2, with the predicted incident noise levels from the railway outlined in the following table:

	Day $L_{Aeq,\ 16\ hour*}$	Night $L_{Aeq,\ 8\ hour*}$
Zone 1: Elevations fully exposed to railway noise (east elevation and gable ends of east block)	51 dB	54 dB
Zone 2: North and south elevations of west block	40 dB	43 dB
Zone 3: Elevations facing fully away from railway	< 35 dB	< 40 dB

* Note:- based on measurements over a portion of the full day / night periods.

4.3 Noise Design Criteria

BS 8233:2014 noise criteria for indoor and outdoor living areas are provided in Section 2.3 above and repeated below for quick reference:

Activity	Location	Day (07:00 - 23:00)	Night (23:00 - 07:00)
Resting	Living room	35 dB $L_{Aeq,\ 16hour}$	-
Dining	Dining room / area	40 dB $L_{Aeq,\ 16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,\ 16hour}$	30 dB $L_{Aeq,\ 16hour}$
-	Outdoor living areas	50 - 55 dB $L_{Aeq,\ 16hour}$	-

4.4 Noise Levels Within Dwellings

Based on the incident noise levels set out in Section 4.2 above, noise reduction requirements for compliance with the indoor ambient noise criteria in Section 4.3 above are as follows:

Location	Noise reduction required by parameter dB	
	Day $L_{Aeq,\ 16\ hour}$	Night $L_{Aeq,\ 8\ hour}$
Zone 1: Elevations fully exposed to railway noise (east elevation and gable ends of east block)	11 - 16	24
Zone 2: North and south elevations of west block	0 - 5	13
Zone 3: Elevations facing fully away from railway	0	< 10

A typical building facade with windows open for ventilation generally provides up to around 15 dB noise reduction. It should be apparent from the above table that this level would be sufficient for the houses set back from the railway (Zone 2) and the elevations facing directly away from the railway (Zone 3), but not the elevations fully exposed to the railway noise (Zone 1).

In that area, the required overall 24 dB noise reduction should be readily achievable with standard thermal double glazed units (R_w 30 dB) and acoustic trickle ventilation ($D_{ne,w}$ 35 dB), with windows closed.

The L_{Amax} parameter is not quantified in the current (2014) BS 8233, although an indoor ambient level of 45 dB is still commonly used. With an incident level of L_{Amax} 75 dB in the worst affected area, 30 dB reduction would be required, and again this is within the capabilities of standard glazing with acoustic vents.

4.5 Noise Levels in Outdoor Amenity Areas

Day time noise levels in gardens should be within the recommended range of $L_{Aeq,T}$ 50 - 55 dB.

5.0 VIBRATION ASSESSMENT

5.1 BS 6472 Criteria

BS 6472-1:2008 sets the following vibration dose values (VDV) for residential buildings:

	VDV ($m/s^{1.75}$) x, y or z axes		
	Low probability of adverse comment	Adverse comment possible	Adverse comment probable
Day 07:00 - 23:00	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Night 23:00 - 07:00	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

5.2 Assessment of Measured Vibration

It is reasonable to assume that traffic on the line adjoining the site can run throughout the night. The measured $VDV_{,\ 3\ hour}$ have therefore been factored up to VDV for the day time and night time in accordance with the methods in BS 6472-1:2008, as follows:

$$VDV_{day} = (16 \text{ hours} / 3 \text{ hours})^{0.25} \times VDV_{,\ 3\ hour}$$

$$VDV_{night} = (8 \text{ hours} / 3 \text{ hours})^{0.25} \times VDV_{,\ 3\ hour}$$

Day time and night time VDV determined from the measured $VDV_{,\ 3\ hour}$ in Section 3.3 above are therefore as follows:

	VDV ($m/s^{1.75}$)		
	x-axis	y-axis	z-axis
$VDV_{,\ day}$	0.01	0.01	0.12
$VDV_{,\ night}$	0.02	0.02	0.38

A comparison of the VDV in the above table with the BS 6472 criteria in Section 5.1 above shows that the vibration levels are within or below the lowest range defined as 'low probability of adverse comment', except for night time vibration in the vertical (z) axis, which would be classified as 'adverse comment possible', but below the level of 'adverse comment probable'.

Section 5.2.3 of BS 6472 states that an allowance should be made for the transfer function between the measurement point and the point of entry to the body. In this case the vibration was measured on the bare ground, while the point of entry would be the ground or upper floor of the dwelling, depending on where the bedrooms are located.

The transfer function from the measurement position to the point of entry will depend on a number of factors:

i. the foundations of the new dwellings, i.e. pad foundations or piles
ii. the form of superstructure, i.e. traditional masonry construction or timber frame. Heavyweight constructions tend to provide a better transfer function.
iii. insulation of the floors e.g. insulated floor screeds

All of the above would contribute towards the transfer function and therefore reduce the actual VDV at the point of entry from that measured on the bare ground.

It is also possible to provide vibration attenuation using an open or filled trench, although these are not commonly used in the UK, particularly for small residential sites.

Finally, the BS 6472 conclusion of 'adverse comment possible' needs to be weighed up against the fact that the site is located in a residential area, with existing dwellings on both sides in similar proximity to the railway. Some of the houses on Britannia Gardens to the south are actually closer to the tracks.

In summary, it would be reasonable to conclude that the site should be suitable for residential development, as the risk of adverse comment is only 'possible' not 'probable', the vibration was not perceptibly significant during the survey, and the site is in an established residential context and the surrounding. The risk of adverse comment will be minimised by using heavyweight constructions rather than timber frame, and providing acoustic isolation (e.g. neoprene / rubber mat) below floor screeds.

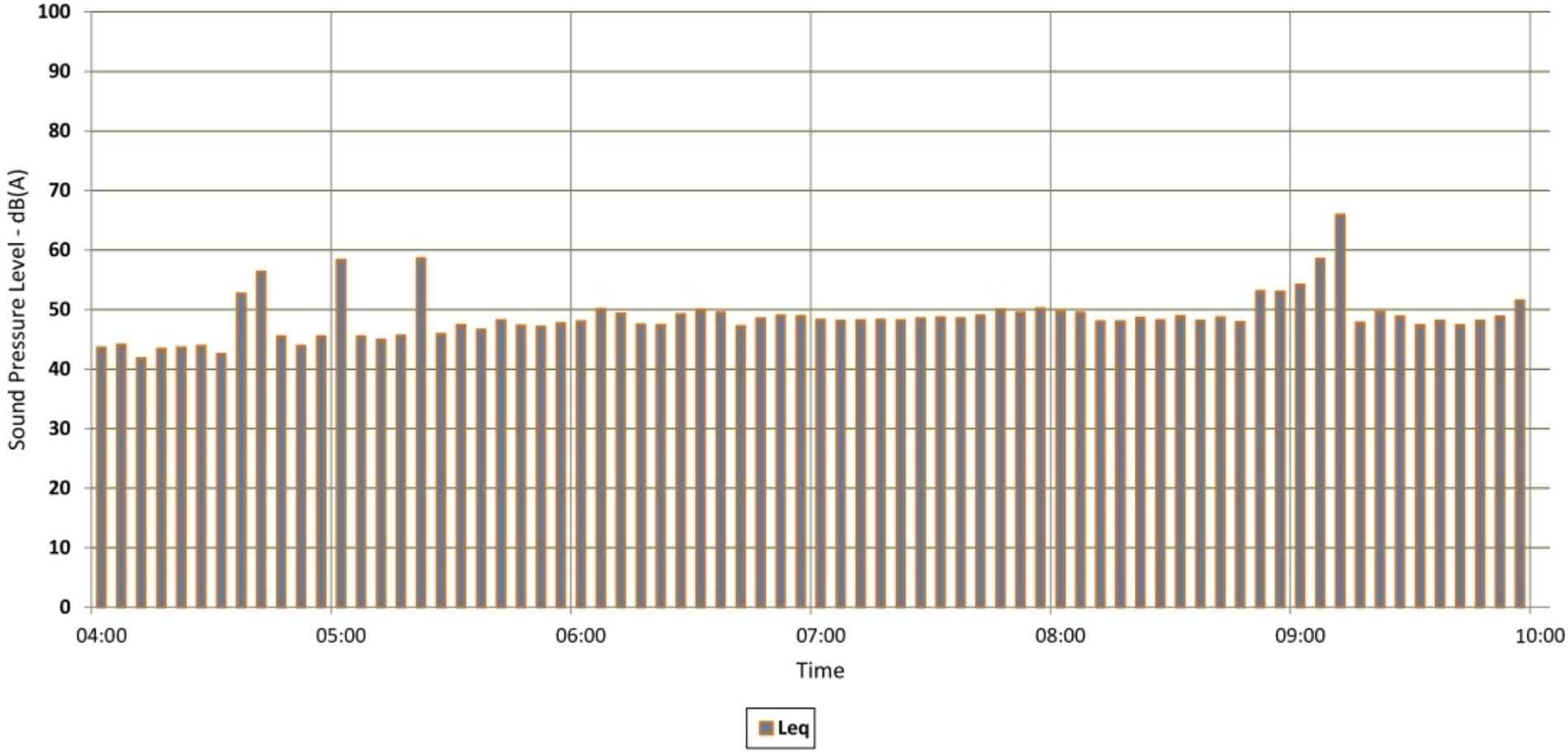
FOR ACOUSTIC DESIGN TECHNOLOGY



10 Unit Option with rear gardens in railway easement

Notes	**Description** Site Plan Showing Noise Monitoring Locations	
	Project Parkside Crescent Phase 1	
	Survey Date 14 September 2016	**Drawing No.** 2457/SP1

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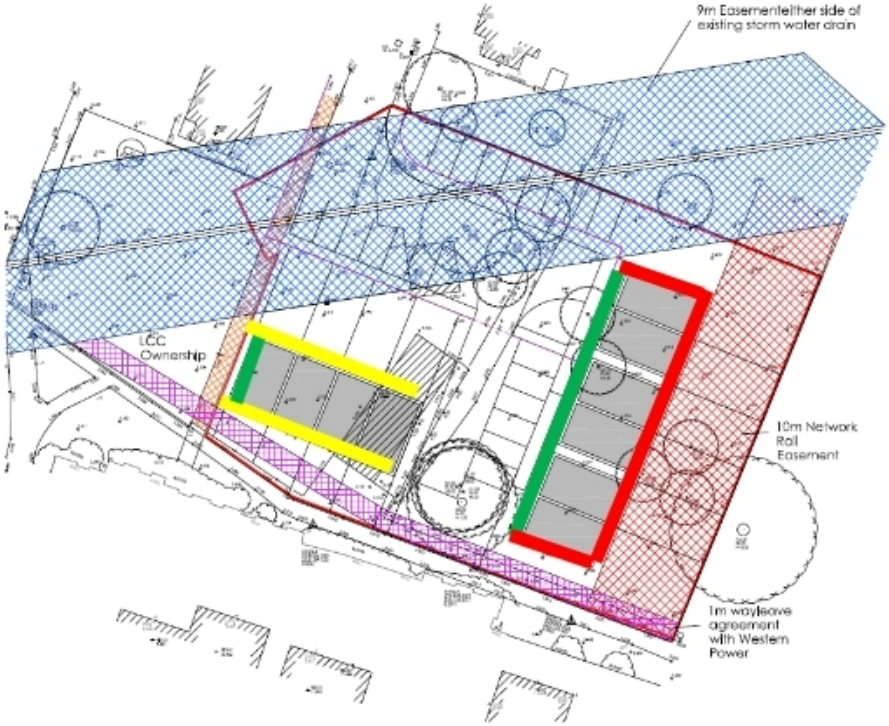
Notes	Description	
	Time History Graph for measurement position 1 - $L_{Aeq,\ 5\ mins}$	
	Project	
	Parkside Crescent Phase 1	
	Survey Date	**Drawing No.**
	9 and 14 September 2016	2457/TH1

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AVERAGED OCTAVE BAND LEQ,T

Period	$L_{eq,T}$ (dB) Octave band centre frequency (Hz)								$L_{Aeq,T}$ (dB)
	63	125	250	500	1k	2k	4k	8k	
Night 04:00 - 07:00	63	59	49	51	49	44	40	33	**54**
Day 07:00 - 10:00	62	56	52	47	47	42	38	35	**51**

Table 2457/T1



10 Unit Option with rear gardens in railway easement

Notes

	Zone 1 $L_{Aeq,T}$ 54 dB
	Zone 2 $L_{Aeq,T}$ 43 dB
	Zone 3 $L_{Aeq,T}$ < 40 dB

Description
Noise zones

Project
Parkside Crescent Phase 1

Survey Date
14 September 2016

Drawing No.
2457/SP2

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APPENDIX A - INSTRUMENTATION

Manufacturer	Type and / or Model	Serial Number	Last Calibrated
Svantek	SVAN 971 Class 1 Sound Level Meter SV 7052E ½ inch Microphone	34392 54655	October 2015
	Svan 958 4 Channel Sound and Vibration Analyser	23430	August 2014
Norsonic	Nor1251 Microphone Calibrator	34220	January 2016

APPENDIX B

Acoustic Terminology

The annoyance produced by noise is dependent upon many complex interrelated factors such as 'loudness', its frequency (or pitch) and any variations in its level. In order to have some objective measure of the annoyance, scales have been derived to allow for these subjective factors.

A-weighting — The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the A-weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average person. It is also possible to calculate the A-weighted noise level by applying certain corrections to an un-weighted spectrum.

When the noise being measured has variable amplitude, such as traffic noise, it is necessary to qualify the basic dB unit. This may be done using a statistical index L_n dB, where n is any value between 0 and 100, and is the percentage of the sample time for which the stated level is exceeded. In defining the use of the index, both the value of n and the length of the sample period must be stated.

L_{10} — L_{10}, being the level exceeded for 10% of the time, has been shown to be a good indicator for traffic noise intrusion, and is used in assessing the effect of traffic noise on residential or commercial premises.

L_{90} — L_{90} is the level exceeded for 90% of the time, and is used as a measure of background noise level, as it excludes the effects of occasional transient levels, such as individual passing cars or aircraft.

In addition to the statistical noise indices defined above, the following noise units are also used to define variable amplitude noise sources:

$L_{eq,T}$ — $L_{eq,T}$ is defined as the notional steady sound pressure level which, over a stated period of time, would contain the same amount of acoustical energy as the actual fluctuating sound measured over the same period. In other words, it is a measure of the "average" noise level

L_{max} — L_{max} is the maximum time-weighted sound pressure level recorded over the stated time period