

Former Remploy Site,
Railway Road
Wrexham
LL11 2DN



2688

Environmental Noise & Vibration Survey and Assessment



Client: Gower Homes
8 Temple Row
Wrexham
Clwyd
LL13 8LY

Our Ref: NHBC/5194-13/R01/JMN

Date: 08 October 2013

Prepared By: 
.....
Jonathan M North BSc AMIOA
Acoustic Consultant

Checked By: 
.....
Peter Turner MSc BSc (Hons) MIOA
Senior Acoustic Consultant



NHBC Testing Services
NHBC House, Davy Avenue, Knowlhill, Milton Keynes, Bucks MK5 8FP
Tel: 0844 633 1000 Fax: 0870 609 1228 www.nhbcbuilder.co.uk

1. BRIEF

A development of new residential homes is proposed at the Former Remploy Site Railway Road, Wrexham, LL11 2DN.

NHBC Acoustic Services (NHBCAS) were instructed to carry out an environmental noise and vibration survey on the site in order to:

- Determine average daytime and night time noise levels for the site in accordance with the requirements of Technical Advice Note 11:1997 (TAN11)¹
- Provide advice for suitable mitigation measures, such that suitable internal noise levels based on BS 8223² and WHO³ can be achieved.

A plan of the site is shown in Appendix 1.

This report details the measurements undertaken on site, equipment and personnel used, the time history of the results and an assessment of the daytime and night-time noise and vibration levels in accordance with TAN11¹, BS8233² and WHO³, along with glazing specifications such that suitable internal noise levels can be achieved.

2. SUMMARY

The existing environmental noise climate was measured in free field conditions at various locations around the site, indicated in the attached site plan, between 17h00 on Wednesday 31 July and 17h00 on Thursday 1 August 2013. The length of the survey ensured that the requirements of TAN11 and BS 8233 and WHO were met during a typical weekday during fair weather.

Two unattended meters (U1 & U2) were positioned in a secure location on the site. Position U1 was near the corner of Stansty Road and Railway Road at a distance of 7m from the kerb of Stansty Road. Position U2 was near the north east boundary of site facing the railway. These positions were chosen to obtain average day time (16hr) and night time (8hr) L_{Aeq} levels at the boundary of the site. In addition, 3-hour day time attended measurements (A1 & A2) were carried out in two other locations during day time.

A vibration meter was also placed in a location representative of the nearest proposed building to the railway tracks (Plot 9). Vibration measurements were carried out in accordance with BS6472:2008.

The average measured day time and night time noise levels measured at U1 ($L_{Aeq,16h}$, $L_{Aeq,8h}$) facing the roads were 63dB and 54dB respectively. At U2 facing the railway the levels were 59dB and 52dB respectively. In accordance with TAN11 this places the site into NEC Category B. Glazed facades which are screened from the railway by the 2m high noise barrier on the eastern boundary should be well within NEC Category B.

The highest L_{Max} levels during the night were significantly higher than average L_{Aeq} levels (75dB L_{Amax} at position U1, 78dB L_{Amax} at position U2) and therefore appropriate acoustic glazing is required to protect homeowners from excessive noise levels as the road and rail traffic pass during the night.

In accordance with BS8233 the average day time (07h00-23h00) and night time (23h00-07h00), for a good level of sound insulation, noise levels inside habitable rooms due to external sources should not elevate above 30dB L_{Aeq} in Living Rooms during the day and 30dB L_{Aeq} in bedrooms during the night. Furthermore, for a reasonable level of sound

insulation, a level of 45dB L_{Amax} should not be exceeded in bedrooms more than twice in any one hour during the night. Due to the large difference between L_{Amax} and L_{Aeq} levels, if L_{Amax} criteria can be achieved with appropriate glazing, then L_{Aeq} should be achieved with ease.

Based on plans provided by the architect, we have proposed glazing specifications, such that WHO and BS9233 criteria can be achieved throughout the development. It is understood that background ventilation will be provided through indirect mechanical means.

The calculated daytime (16h) and night time (8h) z-axis VDV measured at position V1 was $0.062 \text{ ms}^{-1.75}$ and $0.041 \text{ ms}^{-1.75}$. We assess this level as corresponding to a low probability of adverse comment.

3 PLANNING REQUIREMENTS

Technical Advice Note 11 (TAN11)

TAN11¹ deals with noise as a planning issue and it is the appropriate method of assessment for new residential development sites.

TAN 11 requires the existing noise environment at the site to be measured in terms of $L_{Aeq,T}$ and deals with two time periods that differentiate between day and night. These periods are 07h00 to 23h00 (daytime) and 23h00 to 07h00 (night-time).

TAN 11 also categorises new residential sites in terms of the amount of noise to which they are exposed. These Noise Exposure Categories (NECs), ranging from A to D, have been defined in the table below.

TAN 11 Noise Exposure Categories

NEC	DEFINITION
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 more alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
D	Planning permission should normally be refused.

These NECs specify noise limits in terms of single $L_{Aeq,T}$ results for each time period. The noise environment at the site is both road and rail noise and so the NEC limits reproduced in the following table, relate to road and rail noise sources.

TAN 11 Noise Exposure Categories – Road Noise Sources

Category	A	B	C	D
07:00 – 23:00	< 55	55 – 63	63 – 72	> 72
23:00 – 07:00 ¹	< 45	45 – 57	57 – 66	>66

¹Night-time noise levels (23.00 – 07.00): sites where individual noise events regularly exceed 82 dB L_{Amax} (S time weighting) several times in any hour should be treated as being in NEC C, regardless of the $L_{Aeq,8h}$ (except where the $L_{Aeq,8h}$ already puts the site in NEC D).

TAN 11 Noise Exposure Categories – Rail Noise Sources

Category	A	B	C	D
07:00 – 23:00	< 55	55 – 66	66 – 74	> 74
23:00 – 07:00 ¹	< 45	45 – 59	59 – 66	>66

¹Night-time noise levels (23.00 – 07.00): sites where individual noise events regularly exceed 82 dB L_{Amax} (S time weighting) several times in any hour should be treated as being in NEC C, regardless of the $L_{Aeq,8h}$ (except where the $L_{Aeq,8h}$ already puts the site in NEC D).

The above limits have been used to establish the NEC of the site.

TAN 11¹ refers to BS 8233:1999² and the World Health Organisation (WHO)³ which gives guidance on internal noise levels.

WHO's report 'Guidelines for Community Noise' gives the following recommended noise criteria:

WHO Guideline Noise Levels

USAGE	DESIGN RANGE
Living Rooms (Day time)	35 dB $L_{Aeq,16hr}$
Bedrooms (Night time)	30 dB $L_{Aeq,8hr}$ 45 dB $L_{Amax}(Fast)$

These criteria are broadly similar to those recommended in BS 8233:1999 'Sound Insulation and Noise Reduction for Buildings - Code of Practice' as used for conditions relating to this development. BS 8233 gives the following recommended internal noise criteria:

USAGE	DESIGN RANGE	
	GOOD	REASONABLE
Living Rooms (Day time)	30 dB $L_{Aeq,16hr}$	40 dB $L_{Aeq,16hr}$
Bedrooms (Night time)	30 dB $L_{Aeq,8hr}$ 45 dB $L_{Amax(Fast)}$	35 dB $L_{Aeq,8hr}$ 45 dB $L_{Amax(Fast)}$

In this instance the criteria provided by WHO will be used to assess the noise survey results. This exceeds the “reasonable” design standard given in BS 8233.

4 SITE SURVEY

Continuous noise logging equipment was set up to measure the existing noise environment at two locations during the period 17h00 on 31 July and 17h00 on 1 August 2013.

Attended measurements were also undertaken between 10h00 and 13h00 on 1 August 2013. The purpose of the attended measurements was to determine typical road noise spectra for other locations at the site

All measurements were carried out by Jonathan North NHBC Acoustic Consultant (AMIOA). The weather conditions throughout the survey were warm, and dry, with light winds not exceeding 5m/s.

Unattended measurements were carried out using a Rion NL-52 Class 1 Sound Level meter with outdoor microphone. The microphone was calibrated before and after the survey using a Rion NC-74 Class 1 calibrator.

Attended measurements were carried out using a B&K 2260 Sound Level Meter fitted with a windshield. The microphone was calibrated before and after the survey using a B&K 4231 calibrator.

During the unattended survey, measurements of L_{Aeq} , L_{Amax} , L_{A90} and L_{eq} spectra were made over continuous 15-minute periods.

During the attended survey, measurements of L_{Aeq} , L_{Amax} , and L_{eq} octave-band spectra were obtained over 10-15-minute periods in each location.

Free-field measurement locations are shown on the attached site plan and are detailed as follows:

Position	Description	Representing Noise Levels at
U1	1.5m above local ground level, at the junction of Railway Road and Stansty Road, 7m from the kerb of Stansty Road.	South west façade of development
U2	1.5m above local ground level, 4m from the north east boundary wire fence, facing the railway.	East façade of development
A1	1.5m above local ground level, 50m from the junction of Railway Road and Stansty Road and 4m from the kerb of Railway Road.	West façade of development
A2	1.5m above local ground level, near to Stansty Road Bridge, 7m from the kerb of Stansty Road.	South façade of development

5 SURVEY RESULTS

The primary results of noise survey, is summarised in the tables below. Time history charts are shown in Appendix 2.

Unattended Survey Results

Position	$L_{Aeq,16hr}$ 07h00-23h00	$L_{Aeq,8hr}$ 23h00-07h00	$L_{Amax,8hr}$ 23h00-07h00
U1	63.0	53.6	75.4
U2	59.4	52.2	78.4

The highest L_{Amax} event over the entire night time period was 89.6dB, occurring at 06h30 at Location U2 beside the railway. As this was a single one-off event and L_{Amax} did not exceed 78.4dB more than twice in any one hour, we have taken 78.4dB L_{Amax} to be a reasonable L_{Amax} limit for our glazing specifications.

A summary of the results of the attended noise survey at locations A1 and A2 are shown below.

Survey Results – Attended position A1

Time	L_{Aeq}	L_{Amax}
10h00-11h00	51.5	69.8
11h00-12h00	53.1	73.7
12h00-13h00	52.2	68.3
AVERAGE	52.3	

Survey Results – Attended position A2

Time	L _{Aeq}	L _{Amax}
10h00-11h00	67.5	76.9
11h00-12h00	67.0	75.3
12h00-13h00	67.9	77.0
AVERAGE	67.5	-

We have applied the spectral results of the survey for our glazing assessment.

6 GLAZING ASSESSMENT

Mitigation measures in the form of acoustic specifications for glazing have been selected based on architect's drawings and a 2m high acoustic close boarded fence on the eastern boundary of the site. Calculation sheets are available on request.

Internal noise levels with windows/doors closed have been considered for daytime and night-time periods for the proposed development using the noise data obtained from the survey. An assessment has been made on the basis that adequate background ventilation is provided by indirect means.

Based on the survey data and internal layout of the proposed development, the following minimum installed glazing specification should be applied in order to achieve target noise levels detailed in WHO guidance. The supplier should be able to demonstrate through certified test results that these results are achievable in each octave band, usually through tests carried out in an acoustic laboratory, in accordance with BS EN ISO 140-3:1995.

GLAZING SPECIFICATION

FAÇADE	Installed Sound Reduction Index (R) at Octave Band Centre Frequency (Hz), dB						
		125	250	500	1000	2000	4000
i. Façades coloured Red		29	25	36	46	45	52
ii. Façade coloured Green		26	27	34	40	39	46
iii. Façade coloured Blue		23	23	30	39	36	43
iv. Façade coloured Yellow		20	19	29	38	36	43

The performance figures are for the installed system as a whole, including glass, frames, mullions, seals, any integrated ventilation etc. (this list is not exhaustive).

Specifications i & ii can be achieved using acoustically laminated double glazing (our specifications are based on 39dB 8.8/12/6 and 37dB 10/12/6 glazing respectively. Specification iii is based on 34dB 8/12/6 glazing. Specification iv is typically achieved using

32dB R_w 4/16/4 thermal double glazing. However, it is important to ensure that all the above values are achieved.

7 Vibration Survey

Vibration measurements were carried out using a tri-axial vibration meter and accelerometer (pressed firmly onto the ground by a weight) and assessed in accordance with BS6472-1: Guide to Evaluation of human exposure to vibration in buildings. This standard assesses the human response to vibration and is stated in TAN11, for cases where a residential development is located close to vibration sources such as railways. Table 1 of the document gives Vibration Dose Values (VDV), in order to determine whether adverse comments due to vibration are probable. This is summarized in the table below:

Place and time	Low Probability of adverse comment $\text{m}\cdot\text{s}^{-1.75}$	Adverse comment possible $\text{m}\cdot\text{s}^{-1.75}$	Adverse comment probable $\text{m}\cdot\text{s}^{-1.75}$
<i>Residential Buildings 16h day</i>	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
<i>Residential Buildings 8h night</i>	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Vibration is measured along three axes (vertical (z) and two horizontal (x,y)) and spectrally weighted according to human response to vibrations along these axes. The VDV calculation is heavily weighted towards vibrations of highest magnitude, therefore one can be confident that the results present responses to worst case vibrations. During our survey we identified the Z (vertical) axis as having the greatest displacement and this is reported here.

The daytime (16h) and night time (8h) z-axis VDV measured at position V1 at ground level was $0.062 \text{ m}\cdot\text{s}^{-1.75}$ and $0.041 \text{ m}\cdot\text{s}^{-1.75}$. Using the above table, we assess of VDV level not exceeding $0.1 \text{ m}\cdot\text{s}^{-1.75}$ during the day and night, thereby corresponding to a low probability of adverse comment.

8 ACOUSTIC FENCE

A boundary fence between the railway and site should have a minimum height of 2m and be close boarded with a minimum mass of $12\text{kg}/\text{m}^2$. No gaps should remain in any location. One example of a suitable fence is shown here:

<http://www.premieracousticfencing.co.uk/12kg.html>

9 CONCLUSIONS

A 24-hour environmental noise survey has been conducted at the proposed Former Remploy Site Railway Road, Wrexham, LL11 2DN

Average daytime and night time noise levels have been established for the site.

Glazing, ventilation and fence specifications have been proposed in order to meet design targets given in WHO "Guidelines for Community Noise" and BS8233.

10 REFERENCES

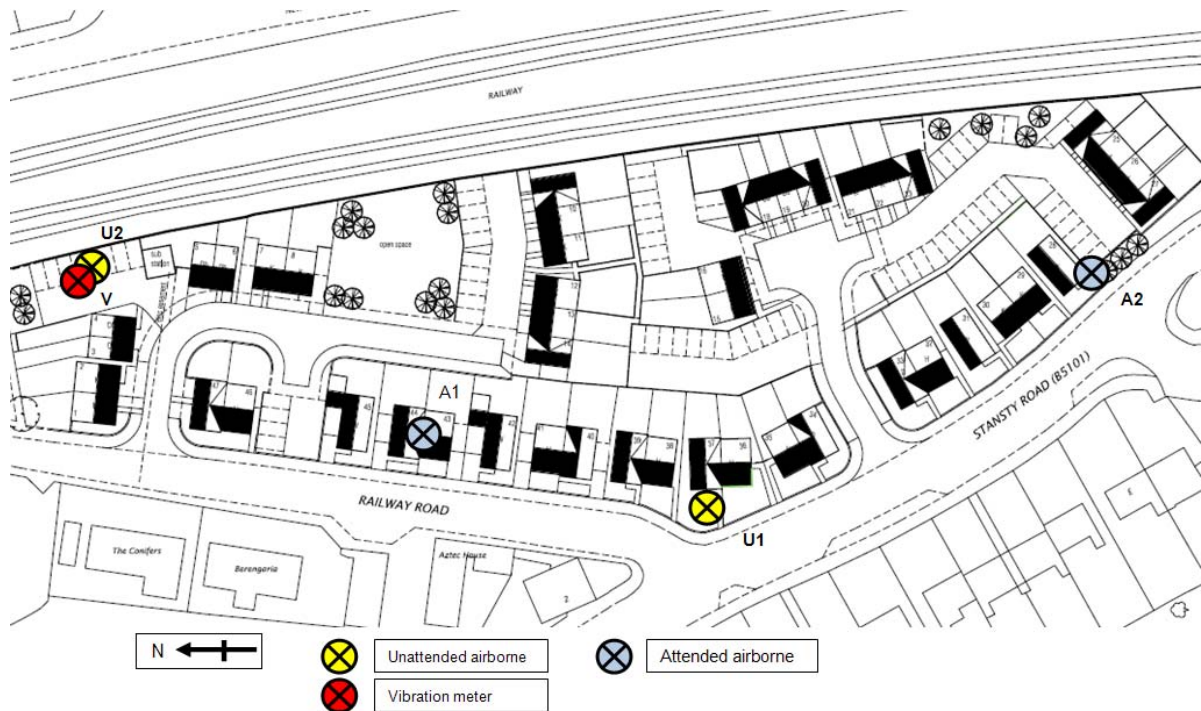
- 1) Planning Guidance (Wales) Technical Advice Note 11, October 1997.
- 2) BS 8233 : 1999 'Sound Insulation and Noise Reduction for Buildings - Code of Practice'
- 3) 'Guidelines for Community Noise' - The World Health Organisation Published 2000

11 GLOSSARY

A-Weighting	A frequency dependant correction applied to a measured noise level proven to correlate well with the varying sensitivity of the ear to sound for different frequencies.
$L_{Aeq,T}$	The A-weighted equivalent, continuous sound pressure level of a fluctuating noise, of duration T.
L_{Amax}	A-Weighted maximum sound pressure level measured, over a specified time period.
L_{A10}	A-Weighted sound pressure level exceeded for 10% of the time, measured over a specified time period.
L_{A90}	A-Weighted sound pressure level exceeded for 90% of the time, measured over a specified time period.

Appendix 1: Site Plan and Glazing Specifications

SITE PLAN AND MEASUREMENT POSITIONS



GROUND FLOOR GLAZING SPECIFICATION



Ground floor

FIRST FLOOR GLAZING SPECIFICATION



First floor

Appendix 2: Measurements at unattended positions U1 and U2

