John Waring
Acoustic Consultant

Report

Noise Assessment

Proposed Residential Development on land adjacent to Pinsley Mill, Leominster

Design of noise reduction measures to reduce noise breaking into proposed dwellings at Pinsley Mill, Pinsley Road, Leominster

Assessment dates: 6-7 April 2004

Prepared for Marcus Tomkins

This report dated: 13 June 2012

This report assesses the noise environment of a site close to the disused Pinsley Mill works at Leominster on which, it is proposed, dwellings would be erected. The site is exposed to road traffic noise from the A49 Leominster by-pass & is immediately adjacent to a railway line..

The sound levels were measured at the site over a 24 hour period at a location immediately to the north of the site in April 2004 & the results were interpreted to arrive at the appropriate choice of glazing to the façade facing the railway line & road to bring the unscreened noise down to acceptable levels with the windows closed. Advice has also been given for mechanical ventilation to the dwellings so that it is not essential to open the windows for ventilation.

As a separate additional measure a recommendation has also been made for a noise screen (possibly comprising a high fence) along the perimeter of the site with the railway.

Although the measurements & assessments were made over eight years ago, the recommendations are still relevant in this report issued in 2012.

John Waring
Acoustic Consultant

Contents

Figures

Appendices

1 Introduction

This report has been commissioned to identify into which noise exposure category falls the site of a residential development which, it is proposed, should be erected on land adjacent to Pinsley Mill, Pinsley Road, Leominster. The concern is that a mixture of road & railway traffic noise might be a potential problem.

2 Results

The sound level meter was set up overnight for the night & day of 6-7 April 2004 in the position shown on the plan of the environs on page 3.

The meter was set to take readings over a 24 hour period, measuring 24 results of the $L_{A,eq,1\,hr}$ noise environment.

The following results were obtained:

Period	Sound level $L_{A,eq,1\,hr}$
1500 hr - 1600 hr	64.6 dB
1600 hr - 1700 hr	68.4 dB
1700 hr - 1800 hr	58.8 dB
1800 hr - 1900 hr	60.5 dB
1900 hr - 2000 hr	61.4 dB
2000 hr - 2100 hr	65.0 dB
2100 hr - 2200 hr	66.0 dB
2200 hr - 2300 hr	57.0 dB
2300 hr - 0000 hr	63.0 dB
0000 hr - 0100 hr	50.1 dB
0100 hr - 0200 hr	64.2 dB
0200 hr - 0300 hr	40.7 dB
0300 hr - 0400 hr	60.3 dB
0400 hr - 0500 hr	45.3 dB
0500 hr - 0600 hr	62.3 dB
0600 hr - 0700 hr	58.4 dB
0700 hr - 0800 hr	55.9 dB
0800 hr - 0900 hr	62.7 dB
0900 hr - 1000 hr	58.2 dB
1000 hr - 1100 hr	57.2 dB
1100 hr - 1200 hr	66.0 dB
1200 hr - 1300 hr	62.4 dB
1300 hr - 1400 hr	65.1 dB
1400 hr - 1500 hr	63.6 dB

These may be summarised, by logarithmic averaging (see Appendix I). The sixteen results between 0700 hr & 2300 hr are averaged to give the day time noise level & the eight results between 2300 hr & 0700 hr are averaged to give the night time noise level.

Times of measurement	Noise level
23.00 - 07.00	$L_{A,eq,8\,hr}$ = 60 dB
07.00 - 23.00	$L_{A,eq,16\,hr}$ = 64 dB

3 Noise control using a screen

Reference to BS 5228-1:2009 "Code of practice for noise & vibration control on construction & open sites - Part 1: Noise" gives guidance for the prediction of the influence of screens. Paragraph F.2.2.2.1 (page 129) states *In the absence of spectral data, as a working approximation, if there is a barrier or other topographic feature between the source & the receiving position, assume an approximate attenuation of 5 dB when the top of the plant is just visible to the receiver over the noise barrier, & 10 dB when the noise screen completely hides the source from the receiver.*

Assuming that a noise screen will be erected such that the screen completely hides the noise source a sound reduction of 10 dB will be assumed. The dominant noise from the fast moving traffic is tyre noise & so the tyres of the road traffic should not be visible from the upstairs windows of the dwellings' façades. The dominant noise from the railway traffic would be the sound of the wheels running along the rails & so the railway wheels running along the rails & so the railway track should not be visible from the upstairs windows of the dwellings' façades.

In paragraph B.4 of BS 5228 "Noise Control on construction & open sites" Part 1: 1997 the minimum weight of the screen is recommended as to be about 7 kg/m² with no gaps at the joints. This may therefore be achieved by the erection of a close boarded heavy fence or by a brick wall.

4 Design target noise levels within the dwellings

Internal noise criteria for dwellings are stated in B.R.E. Digest No. 266 "Thermal Visual & Acoustic requirements in buildings" 1979 (also given in BS 8233: 1987 "British Standard Code of practice for Sound insulation & noise reduction for buildings", Section three, paragraph 8.1) gives design criteria in the form of recommended maxima for steady intrusive noise as :

(a) bedrooms: 30 dB to 40 dB $L_{\mathrm{Aeq}T}$
(b) living areas (for conversation & listening to radio & television): 40 dB to 45 dB $L_{\mathrm{Aeq}T}$

When BS 8233 was reissued in 1999, the above guidance was withdrawn. BS 8233: 1999 "British Standard Code of practice for Sound insulation & noise reduction for buildings", Table 5 gives indoor ambient noise levels:

(a) bedrooms 30 dB to 35 dB $L_{\mathrm{Aeq}T}$
(b) living areas: 30 dB to 40 dB $L_{\mathrm{Aeq}T}$

A publication by the Building Research Establishment & Construction Industry Research & Information Centre "Sound control for homes" shows the design criteria in their Table 10 which is summarised here:

Suggested design background noise level arising from external noise sources

Room classification	Noise levels $L_{\mathrm{Aeq}T}$	
	dB	T
Sensitive rooms		
Bedroom	< 35	8 h
Living room	< 40	16 h
Dining room	< 40	16 h
Less sensitive areas	< 50	16 h

The time period, T, is 23:00 hr - 07.00 hr for bedrooms & 07.00 hr - 23.00 hr for all other areas.

This document also states that where "good standards are required, 5 dB should be subtracted from the values".

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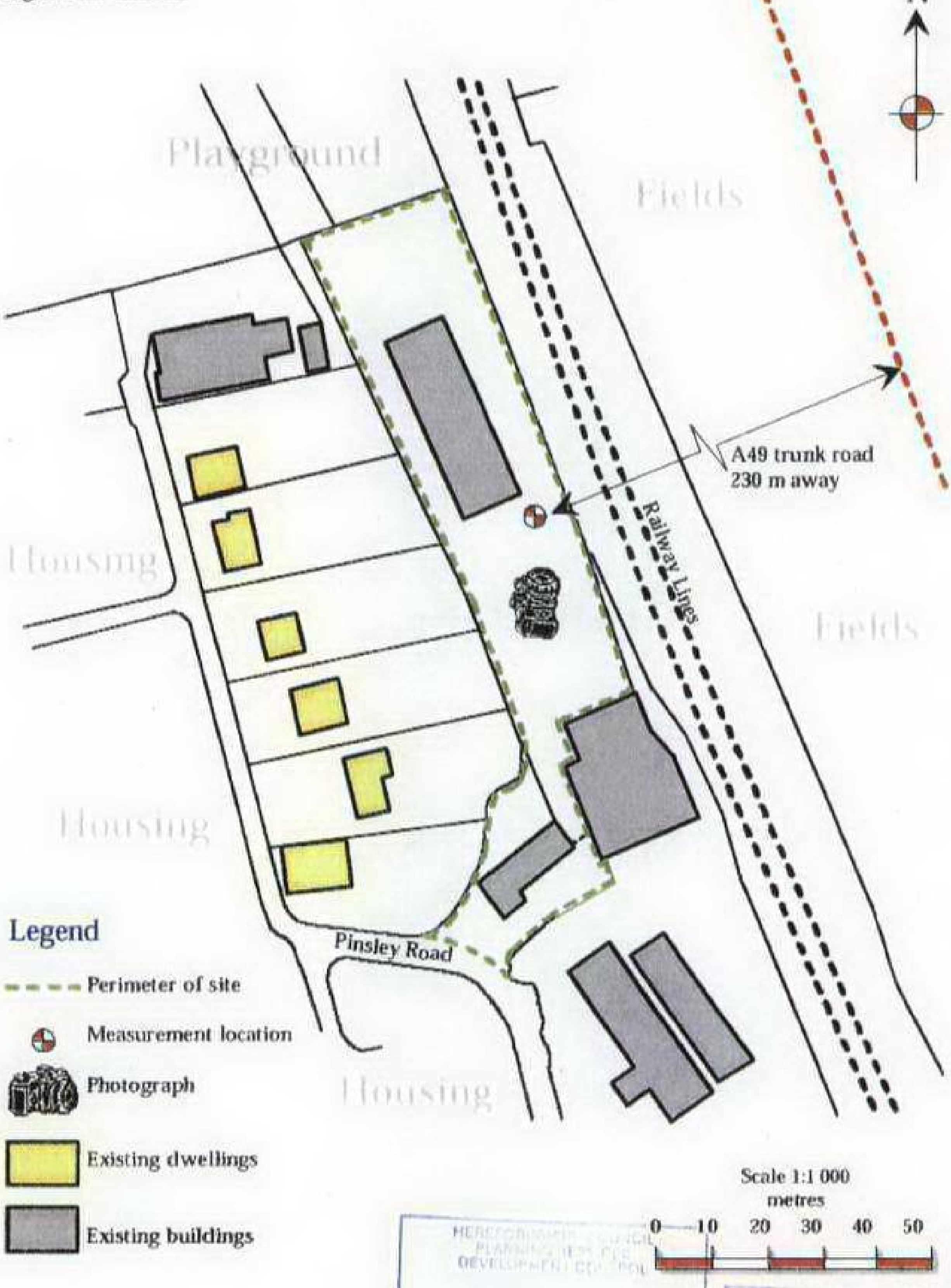
NC08/0440/0

Figure: Plan of the site



page 3

Less sensitive areas are considered to be the kitchen, bathroom, utility room, W.C., internal & communal circulation areas.

The time period, T, is 23:00 hr - 07.00 hr for bedrooms & 07.00 hr - 23.00 hr for all other areas.

The W.H.O. Guidelines for Community Noise - Executive summary state, in table 1 (page 11):

Room classification	Maximum noise levels L_{AeqT}	
	dB	T
Inside bedroom	30	8 h
Outside bedrooms	45	8 h
General day time & evening	35	16 h

Accordingly, in the light of the above advice, the following design maximum noise levels would appear to be reasonable.

(a) bedrooms 30 dB $L_{Aeq\ (8\ hours)}$
(b) living areas: 35 dB $L_{Aeq\ (16\ hours)}$

5 Prediction of noise levels at the façades of the proposed dwellings

5.1 Correction for façade reflections

The meter was sited well away from any buildings however the noise outside the windows of the proposed dwellings will be increased by 3 dB due to façade reflections.

5.2 Correction for the height of the first floor bedroom windows

BS 8233 recommends that the measured ground level sound level be increased by a nominal 1 dB. (See appendix I).

5.3 Calculation of the design exterior noise levels

	Ground floor glazing (living rooms)	First & second floor glazing (bedrooms)
Measured noise level	64 dB $L_{Aeq\ (16\ hours)}$	60 dB $L_{Aeq\ (8\ hours)}$
Plus façade reflection	+ 3 dB	+ 3 dB
Height of glazing		+ 1 dB
Total exterior design noise levels	67 dB $L_{Aeq\ (16\ hours)}$	64 dB $L_{Aeq\ (8\ hours)}$

The following highest exterior design noise levels will be taken as the worst case for the purpose of design of the building envelope:

2300 - 0700: 66 dB $L_{Aeq\ (8\ hours)}$
0700 - 2300: 58 dB $L_{Aeq\ (16\ hours)}$

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6 Calculation of the sound level within the rooms of the nearest dwelling

6.1 Calculation of the performance of the glazing when open

Consider first the sound levels in the dwelling with the windows open.
A partially open window provides a noise reduction from outside to inside of 10-15 dB R_w (BS 8233: 1999 Table 10). The sound level at ground level outside the proposed dwelling at night is 64 dB $L_{Aeq(8\ hour)}$.
The sound level at ground level outside the proposed dwelling during the day is 67 dB $L_{Aeq(16\ hour)}$.

The target sound levels inside the ground floor living rooms will be 35 dB L_{AeqT} during the night & inside the first floor bedrooms 30 dB L_{AeqT} at night. The external noise level outside the bedrooms on the first floor will be about 1 dB higher than the level outside the rooms on the ground floor.

To reduce the noise exposure inside the house, attention should be given to the sound insulation of both the roof and façade. A traditional pitched roof with concrete tiles and a 9 mm plasterboard ceiling, covered in mineral fibre thermal insulting material, will have an insulation of about 43 dB R_w (see Table 11 of BS 8233). The windows, and any trickle ventilators, will normally be the weakest part of a brick and block façade. If the windows are intended to be opened to provide rapid ventilation and summer cooling, the insulation will reduce to about 10-15 dB R_w.

The sound level within the dwelling with an open window is the external sound level minus the sound reduction index of an open window (for the derivation of this formula see the appendices).

External noise level during the day at ground level L_{AeqT} = ...	67	dB
Deduct the sound reduction index of an open window R_w = ...	-10	dB
Noise level inside ground floor rooms during the day L_{AeqT} = ...	57	dB

As the noise level inside the ground floor living rooms exceeds the target noise level of L_{AeqT} = 35 dB, mechanical ventilation for rapid ventilation should be considered.

The sound level within the dwelling with an open window is the external sound level minus the sound reduction index of an open window (for the derivation of this formula see the appendices).

External noise level during the night at ground level L_{AeqT} = ...	64	dB
Add 1 dB	1	dB
External noise level during the night at first floor level L_{AeqT} = ...	65	dB
Deduct the sound reduction index of an open window R_w = ...	-10	dB
Noise level inside first floor bedrooms during the night L_{AeqT} =	55	dB

As the noise level inside the first floor bedrooms exceeds the target noise level of L_{AeqT} = 30 dB, mechanical ventilation for rapid ventilation should be considered.

Strictly, the insulation here relate to a pink noise spectrum, and actual values achieved will be lower for traffic noise. Furthermore, the method does not take account of the absorption (e.g. furnishings) in the room. However, the R_w values will suffice for a rough calculation, although it is likely to underestimate the level in the room by up to 5 dB.

6.2 Calculation of the performance of the glazing when closed

The following equation will be used to identify the minimum sound reduction index required of the glazing.

$SRI = L_2 - L_1$ dB

Where, for road traffic:

SRI is the sound reduction index of the façade which is R_{TRA}.

R_{TRA} takes into account the particular characteristics of the spectrum of the dominant noise outside the building which in this case is of urban road traffic

L_1 is the design reverberant noise level in the building

L_2 is the noise level immediately outside (1.0 m)

This equation is defined in the appendices.

NC08/1824/60

L_1 is the design reverberant noise level in the building (Bedrooms) ..	30	dB
L_1 is the design reverberant noise level in the building (Living areas)	35	dB
L_2 is the noise level immediately outside (Bedrooms)	64	dB
L_2 is the noise level immediately outside (Living areas)	67	dB

Bedrooms

L_1 is the design reverberant noise level in the building	30	dB
L_2 is the noise level immediately outside (1.0 m)	64	dB
R_{TRA} for traffic noise reduction ...	34	dB

Living areas

L_1 is the design reverberant noise level in the building	35	dB
L_2 is the noise level immediately outside (1.0 m)	67	dB
R_{TRA} for traffic noise reduction ...	32	dB

Summary

Glazing to bedrooms R_{TRA}=	34	dB
Glazing to living rooms R_{TRA}= ...	32	dB

For railway traffic:

SRI is the sound reduction index of the façade which is R_{RAIL}. These indices are found in Pilkington Glass literature who have tested their glazing & have sound reduction data. $R_{RAIL} = R_{TRA} + 3$.

R_{RAIL} takes into account the particular characteristics of the spectrum of the dominant noise outside the building which in this case is of railway traffic

L_1 is the design reverberant noise level in the building

L_2 is the noise level immediately outside (1.0 m)

This equation is defined in the appendices.

L_1 is the design reverberant noise level in the building (Bedrooms) ..	30	dB
L_1 is the design reverberant noise level in the building (Living areas)	35	dB
L_2 is the noise level immediately outside (Bedrooms)	64	dB
L_2 is the noise level immediately outside (Living areas)	67	dB

Bedrooms

L_1 is the design reverberant noise level in the building	30	dB
L_2 is the noise level immediately outside (1.0 m)	64	dB
R_{RAIL} for railway noise reduction .	34	dB

Living areas

L_1 is the design reverberant noise level in the building	35	dB
L_2 is the noise level immediately outside (1.0 m)	67	dB
R_{RAIL} for railway noise reduction .	32	dB

Summary

Glazing to bedrooms R_{RAIL}=	34	dB
Glazing to living rooms R_{RAIL}= ...	32	dB

7 Sound reduction indices of glazing

Although the laminated pane of glass (including a PVB (polyvinyl butyral) interlayer) is normally used as the inside pane for safety reasons the sound reduction is the same no matter which are the inner or outer panes. The following is a summary of the sound reduction indices of Pilkington's glazing:

For road traffic:

Conventional Pilkington Insulight double glazing

Outer Pane	Cavity	Inner Pane	Urban road traffic sound reduction index R_{TRA}
10 mm	12 mm	4 mm	29 dB
10 mm	12 mm	6 mm	32 dB
10 mm	12 mm	6.4 mm*	34 dB

*This pane includes a PVB (polyvinyl butyral) interlayer.

Pilkington Acoustic Laminate double glazing

Outer Pane	Cavity	Inner Pane	Urban road traffic sound reduction index R_{TRA}
6 mm	12 mm	7 mm	31 dB
6 mm	12 mm	11 mm	33 dB
10 mm	12 mm	16 mm	37 dB

For railway traffic:

Conventional Pilkington Insulight double glazing

Outer Pane	Cavity	Inner Pane	Railway traffic sound reduction index $R_{RAIL} = R_{TRA} + 3$
10 mm	12 mm	4 mm	32 dB
10 mm	12 mm	6 mm	35 dB
10 mm	12 mm	6.4 mm*	37 dB

*This pane includes a PVB (polyvinyl butyral) interlayer.

Pilkington Acoustic Laminate double glazing

Outer Pane	Cavity	Inner Pane	Railway traffic sound reduction index $R_{RAIL} = R_{TRA} + 3$
6 mm	12 mm	7 mm	34 dB
6 mm	12 mm	11 mm	36 dB
16 mm	12 mm	16 mm	44 dB

8 Choice of Glazing

After inspection of the above table, the following glazing exceeds the minimum sound insulation performance required:

8.1 Glazing to bedrooms

The glazing to the bedrooms' windows should comprise double glazing of Pilkington "Insulite Phon":

10 mm outer pane of Pilkington Insulight glass
12 mm cavity
6.4* mm outer pane of Pilkington Insulight glass

*This pane includes a PVB (polyvinyl butyral) interlayer.

The sound reduction index of this construction is:

34 dB R_{TRA}
37 dB R_{RAIL}

This equals or exceeds the minimum sound reduction index required which has been calculated as:

34 dB R_{TRA}
34 dB R_{RAIL}

8.2 Glazing to living areas

The glazing to the living areas' windows should comprise double glazing of Pilkington "Insulite Phon":

NC08/0440/0
NC08/1824/0

10 mm outer pane of Pilkington Insulight glass
12 mm cavity
6.4* mm outer pane of Pilkington Insulight glass

*This pane includes a PVB (polyvinyl butyral) interlayer.

The sound reduction index of this construction is:

34 dB R_{TRA}
37 dB R_{RAIL}

This exceeds the minimum sound reduction index required which has been calculated as:

32 dB R_{TRA}
32 dB R_{RAIL}

9 Manufacturers of glass

Pilkington Glass Limited
Prescot Road
St Helens
WA10 3TT

telephone: (01744) 692000
fax: (01744) 692880

Mr Twiss
pilkington@respond.uk.com

www.pilkington.co.uk

10 Mechanical ventilation

A publication by the Building Research Establishment & Construction Industry Research & Information Centre "Sound control for homes" shows the design criteria in their Table 11 which is summarized here:

Suggested design background noise level arising from mechanical services

Room classification	Noise levels L_{Aeq}
	dB
Sensitive rooms	
Bedroom	< 30
Living room	< 35
Dining room	< 35
Less sensitive areas	< 45

Accordingly, in the light of the above advice, the following design maximum noise levels arising from mechanical services would appear to be reasonable.

(a) bedrooms 30 dB $L_{Aeq\,(8\,hours)}$
(b) living areas: 35 dB $L_{Aeq\,(16\,hours)}$

It should be noted that, were the noise from the mechanical services equal to the noise intruding into the room from outside the total would be 3 dB greater than the target. To this end it would therefore be prudent for the mechanical ventilation engineer to aim lower than the above target values in his design.

Standards for ventilation in dwellings are given in approved document F of the Building Regulations. Mechanical ventilation may be provided either as room ventilator units, or a ducted ventilation system. Noise attenuated ventilator units have been specified extensively under the Noise Insulation Regulations & airport authority grant schemes. They usually comprise a unit having a variable speed air
supply unit which is designed to be used in the façade of noise exposed rooms, & a permanent air outlet duct.

The Noise Insulation Regulations give detailed performance specifications which include the following:

Air flow: at least two specified settings.

NC08/1824/0
NC08/0440/0

Self noise: high setting less than 40 dB(A) & low setting less than 35 dB(A).

Sound insulation against external sources.

Manufacturers must obtain an Agrément Certificate showing that their units comply with the above requirements before they can be specified under the Noise Insulation Regulations.

Manufacturers of ventilation units

Willan Building Services Ltd
2 Brooklands Road
Sale
Cheshire
M33 3SS

telephone number: 0161-962 7113 ("Sales")
fax: 0161-905 2085

In addition to the through the wall units, Willans offer a ventilation system called the "Passivent Whole House Ventilation Systems". This comprises ducts to a roof extract. The air is either naturally drawn out of the roof extract by convection or may be fan assisted.

Silavent Ltd
60 High Street
Sandhurst
Berkshire
GU47 8DY

telephone number: (01252) 878282
fax: (01252) 871212
www.silavent.co.uk

The Silavent product, to comply with the regulations, is called the "Freshflo SM2/C combined mechanical & permanent ventilator". This company offers a supply & fit service for both the ventilators & windows if required.

Air Domestique Ltd
9 Southern Road
East Finchley
London
N2 9LH

telephone number: 020 8883 9229
fax: 020 8374 2818

Bob Robinson (Managing Director)

Their product, complying with the regulations, is called the "Freeway Mark II Gemini combined mechanical & permanent ventilator". An installation service is offered.

Titon Hardware Limited
International House
Peartree Road
Stanway
Colchester
CO3 0JL

Telephone number: (01206) 713800
Fax: (01206) 543126
Email: enquiries@titon.co.uk
www.titon.com

Nick Howlett, Product Development Director

Titon distribute the "Innosource" range of ventilation products that reduce the nuisance of external noise whilst helping to improve indoor air quality. The "Sonair" is a compact system which ventilates, recirculates & cleans the air in individual rooms. The "Air Comfort Control" is a whole house system, which centrally controls the ventilation requirements for the living area.

11 Conclusion

The results of the noise survey, when calculated using data for double glazing comprising double glazing of Pilkington "Insulite Phon" incorporating Pilkington "K Glass":

10 mm outer pane of Pilkington Insulight glass
12 mm cavity
6.4 mm outer pane of Pilkington Insulight glass

show that this glazing would be sufficient to bring the noise levels within the dwellings to below the maximum design noise levels, provided that the specialist ventilation units are used.

12 References

BS 5228-1: 2009 "Code of practice for noise & vibration control on construction & open sites - Part 1: Noise".

B.R.E. Information paper IP6/94. "The sound insulation provided by windows".

R.H. Warring: "Handbook of Noise & Vibration Control".

World Health Authority Guidelines for Community Noise 1999.

Noise Policy Statement for England (NPSE) March 2010. Published by defra (Department for Environment, Food & Rural Affairs).

National Planning Policy Framework March 2012. Published by the Department for Communities & Local Government.

NC08/0440/0

Appendix I: Derivation of the equation for calculation of the sound reduction index of the glazing

In most cases the area of the façade having the lowest sound reduction index will be the glazing; the walls being of brickwork & concrete blockwork having relatively good sound insulation properties & may be discounted. To achieve the noise criteria, given the level of external noise, the sound reduction index of the glazing may be chosen using the following formula:

$L_2 = L_1 - SRI + 10 \log S - 6$ dB

where

L_1 is the design reverberant noise level in the building

L_2 is the noise level immediately outside (1.0 m)

SRI is the sound reduction index of the façade

S is the area of the window

6 is a correction made for the fact that the sound energy incident inside on the exterior wall of the building is diffuse, whereas outside the building it is not.

Assuming a typical window opening of $S = 4\ m^2$, this equation simplifies to:

$L_2 = L_1 - SRI + 10 \log 4 - 6$ dB

$L_2 = L_1 - SRI$ dB

$SRI = L_2 - L_1$

The document, published by the Building Research Establishment & Construction Industry Research & *Information Centre "Sound control for homes", on* page 30, arrives at an identical simplified equation.

In practice, doubling or halving the window area produces a noise level change of only 3 dB or - 3dB. The height of the window above ground level can also be considered irrelevant even for high rise dwellings as, the higher the window, so, (although further from the noise source in question) particularly in built up areas, the greater the noise sources that can be seen (& therefore heard). BS 8233 recommends that the measured ground level sound level be increased by a nominal 1 dB.

Appendix II: Calculation of the average $L_{eq,T}$

The average level is defined mathematically by:

$$L_{eq} = 10 \log \frac{t_1 \text{antilog} \frac{L_1}{10} + t_2 \text{antilog} \frac{L_2}{10} + \dots t_n \text{antilog} \frac{L_n}{10}}{t_1 + t_2 + \dots t_n}$$

Where

t_1 is the duration of noise level L_1
t_2 is the duration of noise level L_2
t_n is the duration of noise level L_n

In this case each of the time scales is 1 hour, so

t_1 = 1 hour
t_2 = 1 hour
t_n = 1 hour

For an eight hour measurement period

$$L_{eq\ (8\ hours)} = 10 \log \frac{\text{antilog} \frac{L_1}{10} + \text{antilog} \frac{L_2}{10} + \dots \text{antilog} \frac{L_8}{10}}{8}$$

& for an sixteen hour measurement period

$$L_{eq\ (16\ hours)} = 10 \log \frac{\text{antilog} \frac{L_1}{10} + \text{antilog} \frac{L_2}{10} + \dots \text{antilog} \frac{L_{16}}{10}}{16}$$

Appendix III: Measurement equipment

The ambient noise levels were measured using a Norsonic Nor-116 (conforming to class 1 of BS EN 61672-1:2003 *Electroacoustics. Sound Level Meters. Specifications* & type 1 of the former standard BS EN 60804) real time sound analyser, complete with a GRAS-41AL-S weather protected microphone. The meter was calibrated before & after usage using a type 1 Norsonic Nor-1251 Acoustic calibrator.

This conforms with the specification for equipment set out in paragraph 4.2 of BS 4142. All levels are measured by the meter accurate to one decimal place of a decibel, however, as recommended in BS 4142, they have been reported to the nearest decibel.

Appendix IV: The author & acoustic consultant

John Waring, Acoustic Consultant

Qualifications of the Acoustic Consultant

B.Sc. in Civil Engineering.
M.Sc. in Acoustics, Vibration & Noise Control.
MIOA full member of the Institute of Acoustics.

Brief Curriculum Vitae of the Acoustic Consultant

The acoustic consultant has been practising since 1989 following a career in the building industry. John Waring was a civil engineer with Gallifords, a technical adviser at Torvale Woodcemair Ltd., & was the technical manager at Kingspan Insulation Ltd.

He currently is, or has been, the acoustic consultant for Gala Coral Group bingo halls & casinos, Westons Cider, Tyrrells Potato Chips, Jaguar LandRover, Bentley Motor Cars, Dixons Stores Group, West Midlands Safari Park, GlaxoSmithKline, Ladbrokes, A.D.A.S., Hyder Industrial Limited (now United Green Energy), ThyssenKrupp GmbH, Wiggin Special Metals (Hereford), Interserve, Beacon Radio, Harper Builders, South Shropshire District Council, South Shropshire Housing Association, Wrekin Construction, Somerfield stores, Mowlem Midlands, Costains, Pubmaster, Marston plc brewers, Kendrick Construction, Ladbrokes, Perkins Engines & William Hill bookmakers amongst others.

He has made television appearances as a consultant for both BBC & ITV.

In his late fifties, he is a sole trader operating from Ludlow, covering the entire country.

John Waring

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