NOISE & VIBRATION ASSOCIATES

REPORT

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MEASUREMENT AND ASSESSMENT OF NOISE LEVELS IN WAY OF PROPOSED RESIDENTIAL DEVELOPMENT SITE

at

WARK CRESCENT
FELLGATE
SOUTH TYNESIDE

for

South Tyneside Housing Ventures Trust Limited

Author: R.T.Morrow M Sc, MIOA
Date: 23 September 2015
NVA Report No: 734.1/1

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1.0 INTRODUCTION

1.1 At the request of CEAD Architects, and on behalf of South Tyneside Housing Ventures Trust Ltd, Noise and Vibration Associates (NVA) have carried out measurements of existing noise levels in way of a proposed residential development at vacant land to the north of the Metro line by Wark Crescent Fellgate South Tyneside. The development is to be new build apartments; see Figures 1.0 and 2.0.

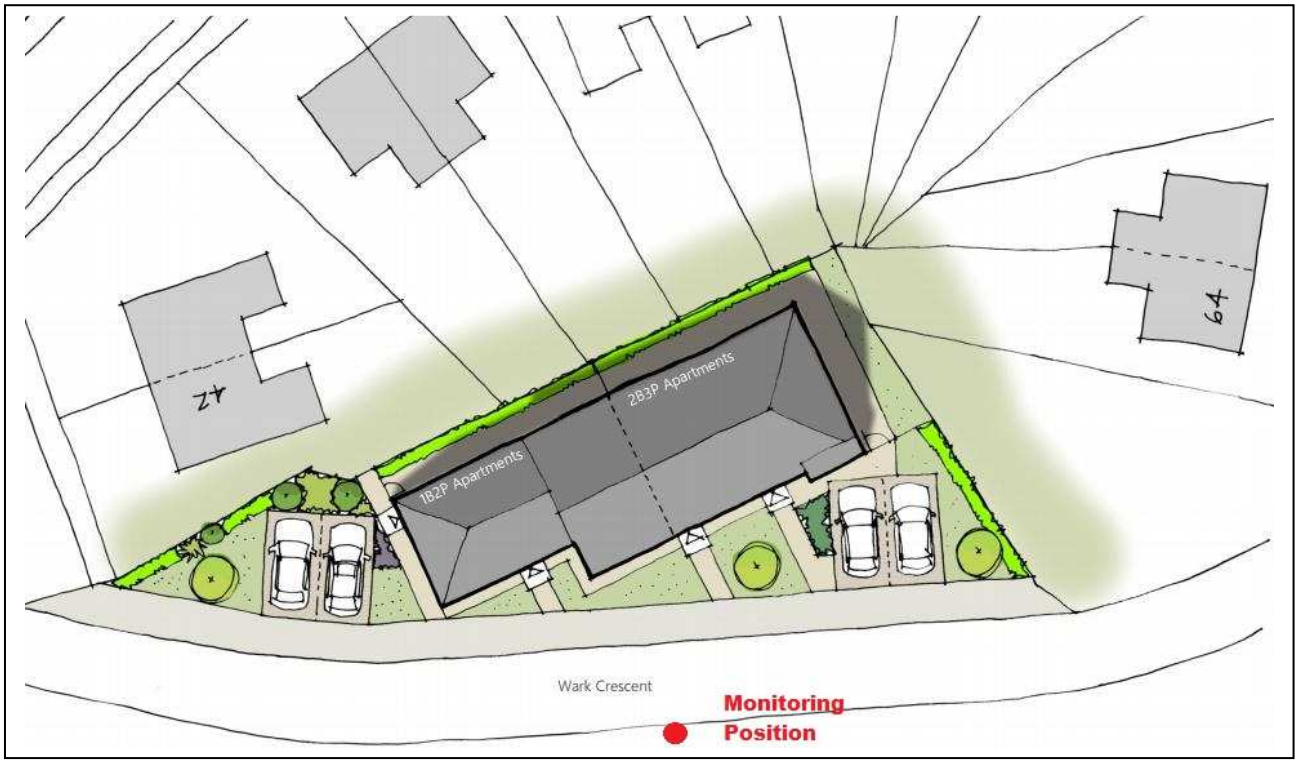
1.2 The purpose of the survey was to examine noise levels (passing Metro trains and (less frequent) mainline trains) and compare the results with guidance, as would generally be required by the Planning Authorities. **The Metro Line at this point also carries some mainline rail traffic.**

1.3 This report presents the results of noise measurements taken on Wednesday 23 September 2015. An assessment of the results is also given in relation to the proposals and relevant guidance. Relevant noise amelioration measures are recommended where appropriate.

1.4 The Metro Line is on embankment some 7 metres above site level (see Photos).

Figure 1.0: Site, Proposed Development Area and Monitoring Position

Figure 2.0: Site Proposed and Monitoring Position



2.0 MEASUREMENTS

2.1 Noise Measurements

With reference to Figure 1.0, relevant noise measurements were taken at a single “worst case” monitoring position (see Figure 1.0) some 25 metres from the Metro boundary fence and 35 metres from the closest (eastbound) Metro line. The Metro Line is on embankment some 7 metres above site level (see Photo 1.0).

Photo 1.0: Monitoring Position

Methods

The sound level meter was set to record all statistical parameters in consecutive 1 second periods.

A “worst case” Metro Passage was also recorded in Audio and is available on request.

3.0 INSTRUMENTATION

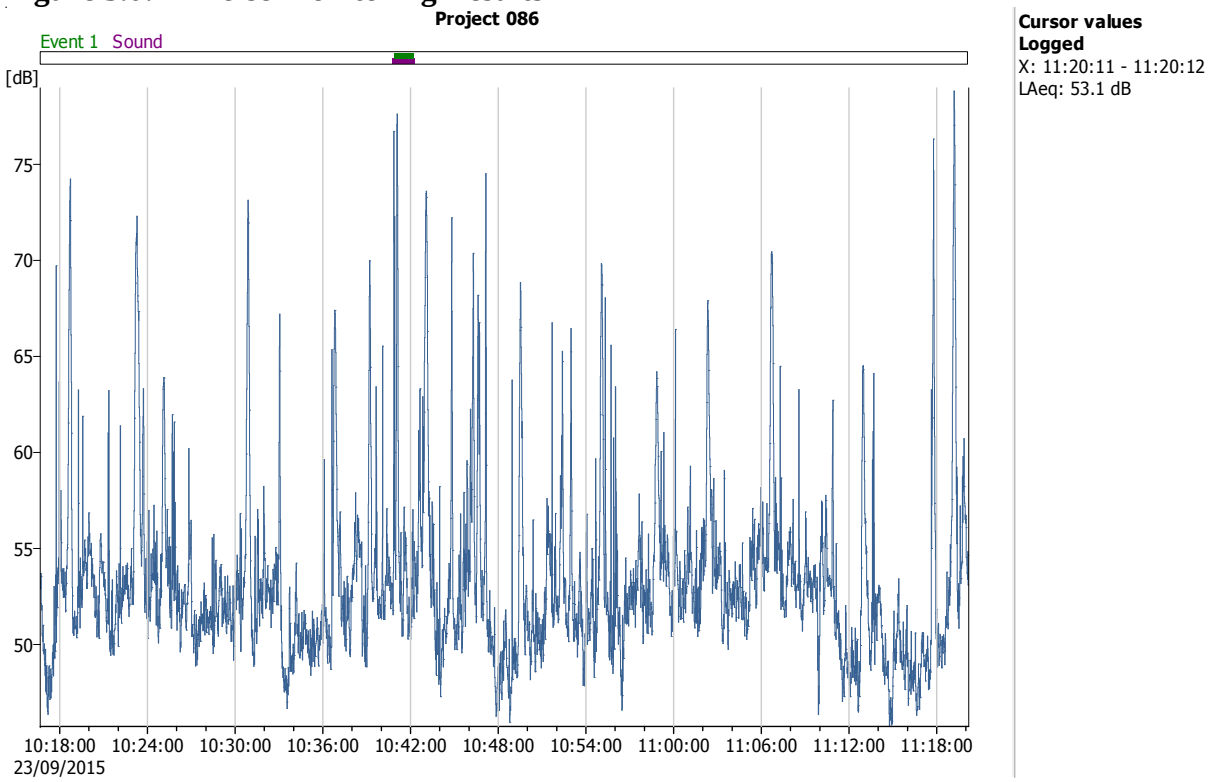
3.1 Noise

All recordings and direct measurements were obtained with "Precision Grade" (Type 1) Sound Level Meter/Microphone (see Appendix 1.0 for full details).

4.0 RESULTS

4.1 All monitored noise levels are summarised in Figure 3.0. Noise from train pass-by events may be clearly seen. (The monitoring period (1 hour) included 11 Metro Trains, 2 small Main Line Trains, a single Freight Train and a single Freight Locomotive).

Figure 3.0: Noise Monitoring Results



The calculated LA_{eq}(1 hour) is 59dB(A).

4.2 Summary of Expected Noise Exposure of Proposed Development

Noise exposure of the proposed housing units can be reliably estimated from measured noise levels at the monitoring position. The measurement position was 35metres from the closest rail track. The proposed development is 45 metres from the closest railtrack:

LA_{eq}(Typical Hour Incl Trains)	**=58 dB(A) @ 45m from railway track**
LA_{eq}(Typical Hour Excl Trains)	**~49-53 dB(A) @ 45m from railway track**
LAS_{Max}	**~70 - 75 dB(A) @ 45m from railway track**

As is usual in cases like this, the maxima associated with pass-by events will present the most onerous requirement for noise amelioration measures which should be designed accordingly.

These results allow the reliable estimation of noise levels at the proposed housing units and, hence, the required amelioration measures.

Night Time Noise Levels

Although passenger services do not operate throughout the night there may well be late trains after 23:00hrs and early trains before 07:00hrs and noise amelioration should ensure maximum noise levels within habitable rooms are adequately controlled.

5.0 CURRENT GUIDANCE

5.1 Current Guidance – National Planning Policy Framework

National Planning Policy Framework (NPPF and the accompanying "Noise Policy Statement for England") has now replaced the revoked PPG24. The guidance of BS8223 (Reference 1) on internal noise levels within buildings is not replaced and the guidance therein is still current. It should be noted that NPPF generally refers to WHO Guidelines as regards noise limits and these, along with those of BS8233. Externally, amenity garden equivalent continuous noise levels less than 55dB(A) should be sought and, internally, habitable room equivalent continuous noise levels less than 30dB(A) and Maximum Noise Levels in habitable rooms not exceeding 45dB(A) should also be a design target.

5.2 The core strategies of NPPF are:

14. At the heart of the National Planning Policy Framework is a **presumption in favour of sustainable development**, which should be seen as a golden thread running through both plan-making and decision-taking.

For **plan-making** this means that:

- local planning authorities should positively seek opportunities to meet the development needs of their area;
- Local Plans should meet objectively assessed needs, with sufficient flexibility to adapt to rapid change, unless:
  - any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole; or
  - specific policies in this Framework indicate development should be restricted.

For **decision-taking** this means:

- approving development proposals that accord with the development plan without delay; and
- where the development plan is absent, silent or relevant policies are Out of date, granting permission unless:
  - any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole; or
  - specific policies in this Framework indicate development should be restricted.

The following are key recommendations of NPPF:

123. Planning policies and decisions should aim to:

- avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
- mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;
- recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established;

New development schemes should fulfill the requirement of the Noise Policy Statement for England that:

2.3 Furthermore, the broad aim of noise management has been to separate noise sources from sensitive noise receivers and to "minimise" noise. Of course, taken in isolation and to a literal extreme, noise minimisation would mean no noise at all. In reality, although it has not always been stated, the aim has tended to be to minimise noise "as far as reasonably practical". This concept can be found in the Environmental Protection Act 1990, where, in some circumstances, there is a defence of "best practicable means" in summary statutory nuisance proceedings.

Current guidance on noise affecting new development is from National Planning Policy Framework (NPPF). Paragraph 123 and Footnote 27 (see Section 4.4) should be key.

Planning policies and decisions should also aim to:

- *avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
- *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established*
- *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.*

As for guidance on "noise limits", NPPF defers to WHO Guidelines.

6.0 DISCUSSION AND ASSESSMENT

6.1 Summary of Expected Noise Exposure of Proposed Development

Noise exposure of the proposed housing units can be reliably estimated from measured noise levels at the monitoring position. The measurement position was 35metres from the closest rail track. The proposed development is 45 metres from the closest railtrack:

LA_{eq}(Typical Hour Incl Trains)	**=58 dB(A) @ 45m from railway track**
LA_{eq}(Typical Hour Excl Trains)	**~49-53 dB(A) @ 45m from railway track**
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As is usual in cases like this, the maxima associated with pass-by events will present the most onerous requirement for noise amelioration measures which should be designed accordingly.

These results allow the reliable estimation of noise levels at the proposed housing units and, hence, the required amelioration measures.

Night Time Noise Levels

Although passenger services do not operate throughout the night there may well be late trains after 23:00hrs and early trains before 07:00hrs and noise amelioration should ensure maximum noise levels within habitable rooms are adequately controlled.

6.2 Noise Amelioration Measures

Discussions and assessments below relate to the proposed layout of residential apartments as shown in Figure 4.0. Figure 4.0 shows estimated LAS_{Max} Noise Levels at facades (allowing for a 3dB(A) increase due to façade reflections).

Figure 4.0: Site Proposed – Maximum Façade Noise Levels

National Planning Policy Framework (NPPF – Reference 1 and the accompanying "Noise Policy Statement for England) has now replaced the revoked PPG24. The guidance of BS8223 on internal noise levels within buildings is not replaced, although it is updated (2014) and the guidance therein is still current. It should be noted that NPPF generally refers to WHO Guidelines as regards noise limits and these, along with those of BS8233, are appropriate. Externally, amenity garden equivalent continuous noise levels less than 55dB(A) should be sought and, internally, habitable room Equivalent Continuous Noise levels less than 30dB(A) (resting rooms), less than 35dB(A) (living rooms) and Maximum Noise Levels in all habitable rooms not exceeding 45dB(A) should also be a design target. NVA would note that the latter limit on maxima is further qualified according to BS8233:2014 as Maxima regularly occurring with a definition of "regularly occurring" being 10-15 times per night (WHO Guidelines). The following are working design criteria for this proposed development:

1) Resting Rooms - LA_{eq}(16hr Daytime) less than 30dB(A)
2) Living Rooms - LA_{eq}(16hr Daytime) less than 35dB(A)
3) Amenity Gardens - LA_{eq}(16hr Daytime) less than 55dB(A)
4) Maxima - LA_{Max}(Night Time) not generally exceeding 45dB(A)

Noting the results of the noise survey, ensuring these criteria are met will require attention to noise amelioration measures at building envelopes (enhanced sound insulation). Noting that "façade" noise levels will be some 3dB(A) higher than free-field values (reflection effects), façade maximum noise levels in the range 73 to 78dB(A) may be expected at the most exposed facades. NVA would recommend providing for the appropriate enhancements to building envelope sound insulation accordingly. Suitable measures are discussed below.

6.2.1 Enhancements to Building Envelope Sound Insulation

Glazing

The weakest part of a building façade in terms of sound insulation is often the glazed areas. NVA would suggest, therefore, that the insulation of various glazing configurations may be assessed by reference to the full calculation methods of BS8233:1999 (which takes account of an increased low frequency content usually associated with road traffic) (Ref 1, Sect 6,7).

Guide calculations are carried out for habitable rooms with an assumption of $2.5M^2$ glazed area and a room volume of $40M^3$ and "reverberation time" around 0.7 seconds.

Glazing configurations and the acoustic insulation rating of such are specified in terms of dB(R_W).

Ventilation

Enhanced glazing must be closed to provide the required benefit and it is consequently necessary to provide the required ventilation by suitably sound attenuated means.

The acoustic rating of such ventilators, when assessed as a façade element, is specified in terms of dB($D_{ne,W}$).

Roof Construction

In high noise level situations it is also necessary to ensure that roof/ceiling constructions also provide sufficient sound insulation in way of top floor habitable rooms.

Typical pitch roof constructions are categorised in guide calculations as 4 alternatives:

1 single ceiling boarding no mineral wool
2 single ceiling boarding with 100mm mineral wool
3 double ceiling boarding with 100mm mineral wool
4 double ceiling boarding with 100mm mineral wool solid layer (19mm ply) under tiles/felt.

Other roof constructions (e.g. flat roof) may be included in guide calculations according to their estimated or specified performance levels **dB(R_W)**.

Walls

Walls, usually masonry, provide good sound insulation such that they need not be considered in relation to the above.

However, for lightweight walling construction methods (e.g. curtain walling) due attention must be given to design for appropriate sound insulation. These may be included in guide calculations according to their estimated or specified performance levels **dB(R_W).**

6.2.2 Building Envelope Sound Insulation Enhancements

Building envelope enhancements that may be required at this proposed development will typically be within the following range (Table 1.0).

Table 1.0: Building Envelope Enhanced Insulation Options (Reference to Fig 4.0)

External Noise Level Max - dB(A)	Glazing Config Glass/Cavity/Glass	Glazing dB(Rw)	Ventilator dB(Dnew)	Ceiling Roof (*)	External Internal Noise Reduction dB(A)	Internal Noise Level dB(A)
78	10mm/12mm/6.4mm PVB	40	45	3	35.7	**42**
78	10mm/12mm/6mm	38	43	3	34.4	**44**

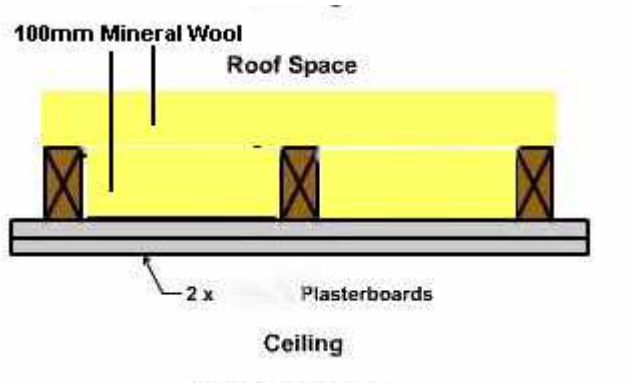
(PVB) Standard Laminated Glass (or equivalent)
(*) Roof/Ceiling Type as described above

Different glazing options may be used to achieve the same insulation performance (dB(R_W)).

In general, for small cavity glazing (~12mm) reduction to 10mm cavity, to accommodate frame rebate sizes, would not be significant in terms of noise reduction.
Other glazing configurations giving equivalent performance would be acceptable.
In all cases windows may be openable but should be well sealed when closed. Ventilation systems should allow the appropriate air change capability (other than "purge ventilation" which may be achieved by opening windows) without resort to open (or partially open) windows.

Roof/Ceilings – Explanatory Notes

Assuming pitch roof construction, roof types 3 and 4 require double boarded ceilings of overlapped plasterboarding taped, skimmed and sealed. The felt layer should be well sealed at all edges such that there are no air paths to noisy external areas. The loft cavity should contain at a 200mm layer of sound absorbent material such as mineral wool or fibre glass.



However, if there are to be any "attic" type rooms, roof/ceiling structures would need to be sound insulated with system to provide of the order of 55dB(R_w). This would typically require incorporation of solid boarding (plywood or otherwise) under tiles/felt and double boarding on resilient bars under rafters. The cavity between boarding should contain sound absorbent material. NVA would recommend the incorporation of suitable a proprietary system from British Gypsum or Sheffield Insulation or similar companies and note that extreme care is required at installation to ensure the required level of insulation is not compromised. The effectiveness of the resilient bars is usually crucial. It will also be necessary to design for adequate ventilation of the roof and incorporation of thermal building regulations without significantly compromising sound insulation.

Ventilation (For Units Affected By High External Noise) – Explanatory Notes

For habitable rooms with windows in facades subject to the noise levels identified in Figure 4.0 and Table 1.0, ventilation systems enabling adequate ventilation without recourse to open windows to noisy facades should be incorporated. Suppliers should be informed of the overall reduction required (Table 1.0, Column 6). The reductions will typically require ventilation units to provide a sound reduction of 43 - 45 dB($D_{ne,W}$) or better (as identified in Column 4) (See Appendix 3.0 for supplier list).

Table 1.0 is recommended for guidance and suppliers may offer alternative solutions based on the noise data provided within this report. At the higher ratings it may be necessary to ventilate by ducted means.

NVA are not qualified to make recommendations for the specification of ventilators in relation to The Building Regulations (Ventilation – Approved Document F). It is our understanding that whatever ventilators are used they should provide the above level of acoustic insulation whilst still providing the basic ventilation requirements (i.e non-purge situations) for each habitable room for which they are required. It is our understanding that a passive ventilation unit will provide for sufficient ventilation in circumstances such as these. Should a purge ventilation requirement arise then windows may be opened in the normal manner. Reputable suppliers will usually provide a free design service to satisfy both acoustic and ventilation requirements **(NVA would draw attention to Appendices 3.0 & 4.0)**. The noise levels detailed in this report should enable them to configure and recommend appropriate ventilation solutions.

7.0 CONCLUSIONS

7.1 Prevailing noise levels (distant traffic and pass-by Metro events) have been measured and assessed according to representative "worst case" conditions. The measured data presented allows the full and appropriate assessment of noise over the proposed layout.

7.2 Assessment of appropriate noise amelioration measures are given in section 6.2 above. These comprise of additional sound insulation measures in the building envelopes of those proposed units affected by metro noise. Subject to final definition and the subsequent provision of noise amelioration measures, as discussed above, the residents of the proposed dwellings will be provided with acceptable internal noise environments.

7.3 The planning authority should be informed of the final specific proposals for inclusion of noise amelioration measures from the recommendations of Section 6.2 or equivalent alternatives.

REFERENCES

1) Sound Insulation and Noise Reduction for Buildings: BS8233:2014

APPENDIX 1.0: EQUIPMENT LIST

Noise measurement and analysis was carried out using the following equipment:

Sound Level Meter:	Bruel and Kjaer Type:	2260
	Serial No:	2274779
	(Calibration Certificate available upon request)	
Microphone:	Bruel and Kjaer Type:	4189
	Serial No:	2237664
Calibrator:	Bruel and Kjaer Type:	4231
	Serial No:	1730932

Calibration was carried out before and after each measurement exercise using the "Charge Injection" facility within the Type 2260 Meter, enabling reference to previous calibrations of the instrument and providing warning of any significant change of sensitivity of the whole measurement chain (microphone and electronics) since the initial calibration. Full reference to all instrumentation is given above. Instrumentation was also checked with the above Calibrator.

APPENDIX 2.0: ACOUSTIC UNITS

Noise in these situations is generally measured and assessed in terms of the following parameters:

"A" weighted Sound Pressure Level (SPL) - dB(A).

This represents an "average" sound level measured over selected time periods of either 1 second ("slow response") or 0.125 seconds ("fast response"), taking account of the entire audible frequency range (with an applied "weighting" according to human auditory response). The "A" weighted decibel is the commonly accepted measure of noise level in relation to regulations and the effects of noise on man. With many noise sources (e.g. traffic noise) there is a general variation of level from second to second; it is not possible to directly read off a representative noise level and statistical averaging of a suitable form has to be utilised. The various statistical measures that may be considered are described below:

Sound Exposure Level (SEL) - dB or DB(A).

For isolated “noise events”, such as the passage of various types of train, it is useful to determine the “total noise energy” associated with a “pass-by” event. If the number of such events, over an assessment time period, are known it is possible to accurately calculate noise data (see Reference 3), such as “Equivalent Continuous Noise Level” (see below) that may be compared to relevant guidance for planning and insulation purposes (eg Reference 2).

Equivalent Continuous Noise Levels (L_{eq}) - dB or dB(A).

When noise levels generally vary with time, as is the case with passing traffic noise, it is convenient to relate measurements to the average noise energy per second received during the measurement period. The unit utilised for this purpose is the Equivalent Continuous Noise Level (L_{eq}) which is defined as:

> *"That level of continuous steady noise that contains the same amount of noise energy as the variable noise under consideration".*

The usual "A" weighting may be applied (resultant units of dB(A)), to give an overall assessment of the "noise energy" corrected for the sensitivity of the human hearing mechanism. Note that, if noise was completely steady, then the Equivalent Continuous Noise Level (L_{eq}) would exactly equal the Sound Pressure Level; in cases where noise is non-steady, L_{eq} may be thought of as an average noise level.

Percentile Noise Levels - dB or dB(A).

Where noise levels vary with time, as may be the case with traffic noise, it is often convenient to determine levels of noise that are exceeded for a certain percentage of the measurement period. These levels are signified as L_n, where L is the noise level exceeded for $_n$% of the measurement period (for instance, L_{10} would signify that level of noise that has been exceeded for 10% of the whole measurement period). Traffic noise and environmental impact noise surveys may be meaningfully assessed with this type of unit; an L_{90} would typically represent a "Background Noise Level" and L_{10} will relate to subjective annoyance by intermittent noise.

The "A" weighting may again be applied (resultant units of dB(A)), to give an overall assessment of the noise corrected for the sensitivity of the human hearing mechanism.

Traffic noise is assessed in terms of the "L_{10}(18 hour)", defined as that level of A-weighted noise exceeded for 10% of the 18 hours between 0600hrs and 2400hrs. This may be approximated by a 3 hour shortened measurement, as defined in Reference 1.

Decibel Scale.

The decibel is a logarithmic measure defined in the form of a ratio to a specified "reference level"; in the case of noise levels the decibel scale is based upon a reference level of 0.00002 Newtons/square metre as follows:

$$SPL = 10 \log_{10} \left[\frac{\overline{p^2}}{(0.00002)^2} \right]$$

"A-weighting".

As mentioned above, the "A-weighting" associates different importance to the noise in relation to the frequency content; work has shown that the human hearing mechanism is more sensitive (and susceptible to damage) to noise in certain frequency ranges. Modern measuring equipment enables the different sensitivity to be assessed electronically, the resultant unit being the A-weighted decibel defined as:

$$SPL(A) = 10 \log_{10} \left[\frac{\overline{p_A^2}}{(2 \, x \, 10^{-5})^2} \right]$$

APPENDIX 3.0 SUPPLIERS OF ACOUSTIC VENTILATION SYSTEMS

Rytons Building Products Ltd (see also Appendix 4.0)
Design House
Kettering Business Park
Kettering
Northants
NN15 6NL Tel: 01536 511874
Contact: Mr Anthony Irwin

Airflow Developments Limited
Aidelle House
Lancaster Road
Cressex Business Park
High Wycombe
Bucks
HP12 3QP Tel: 01494 525252
Local Contact: Mr Ian Thompson (07825 668782)

Passivent
Brooklands Road
Sale
Cheshire
M33 3SS Tel: 0161 962 7113

Air Domestique Installations Ltd
31, Berkely Road
London
N15 6HH Tel: 0181-880-2426

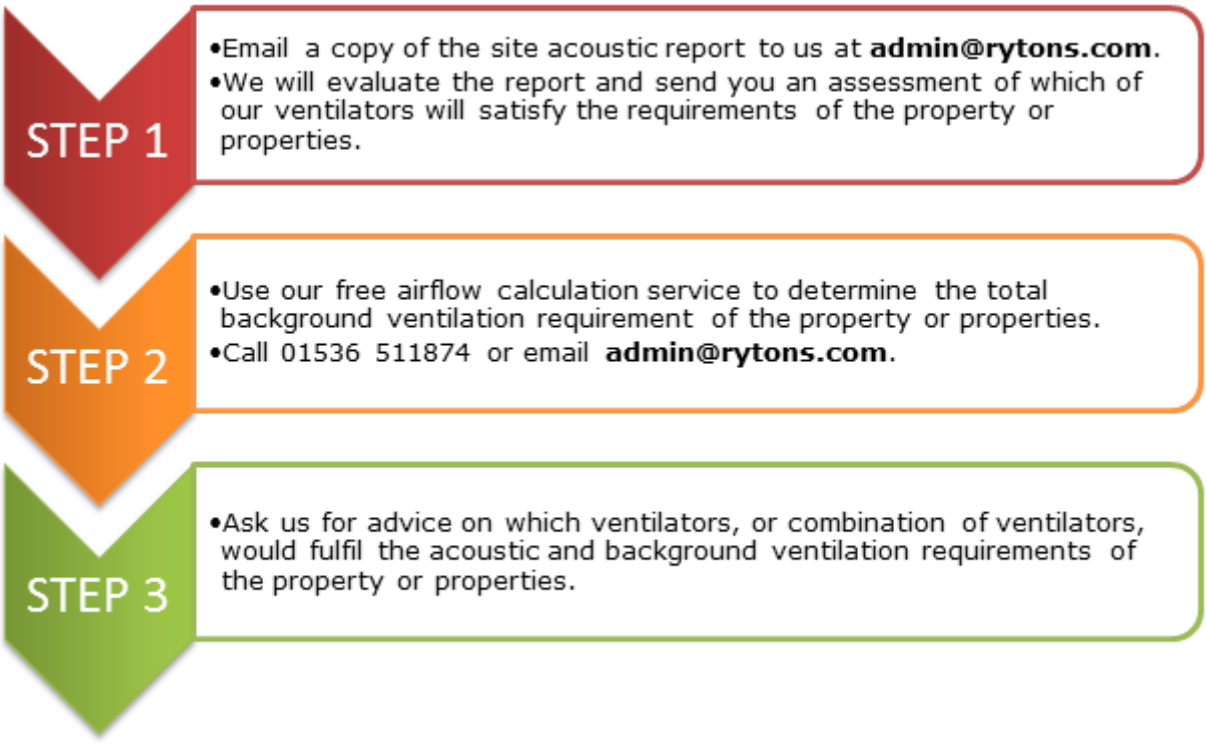
Greenwood Air Management
Brookside Industrial Estate
Rustington
West Sussex
BN16 3LH Tel: 01903-771021

APPENDIX 4.0 EXAMPLE OF ACOUSTIC VENTILATION SYSTEM ADVICE

Free acoustic ventilation evaluation service from Rytons

Working out the background ventilation requirements of properties with acoustic issues can be a juggling act between satisfying the acoustic requirements and providing sufficient ventilation to the Building Regulations.

To simplify this task we have a simple 3 step plan which will take you from acoustic report to product detailing quickly and easily.



Good to know:

- All Rytons Acoustic Background Ventilators provide in excess of the 5000mm² equivalent area threshold required by Part F, which allows the number of units used in a property to be kept to a minimum.
- All Rytons Acoustic Background Ventilators feature a fully adjustable vent on the inside allowing the occupier to regulate the airflow in each habitable room.
- All Rytons Acoustic Background Ventilators are independently tested by the BRE for both acoustic performance and equivalent area; your assurance that the figures are accurate and verifiable.
- Background ventilators are efficient and low cost to buy. With zero running and maintenance expenses for the occupants they are also less likely to be tampered with.
- NBS Plus specifications are available to cut and paste straight into your documentation from the product pages of our website at www.vents.co.uk