NOISE & VIBRATION ASSOCIATES

REPORT

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MEASUREMENT AND ASSESSMENT OF NOISE AMELIORATION MEASURES

in way of

PROPOSED RESIDENTIAL DEVELOPMENT

at

CELL F
NEWCASTLE GREAT PARK

for

Newcastle Great Park

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1.0 INTRODUCTION

1.1 At the instruction of Newcastle Great Park, Noise and Vibration Associates (NVA) have carried out measurement and assessment of noise affecting the proposed residential development site within Newcastle Great Park Cell F (see Figure 1.0, overleaf).

1.2 The purpose of the survey was to examine noise levels and compare the results with relevant guidance (Reference 1), as would generally be required by the Planning Authorities.

1.3 This report presents the results of noise measurements taken on Tuesday (04/09/2007). An assessment of the results is also given in relation to relevant guidance:

Ref 1: Department of the Environment Planning Policy Guidance: Sept 1994 "Planning and Noise". (PPG24)

1.4 The assessment also makes preliminary suggestion of noise amelioration relevant to gardens and building envelope such that the appropriate noise levels due to external sources may be achieved.

2.0 MEASUREMENTS

2.1 Noise is predominantly due to road traffic on the A1(M) Western Bypass as it passes to the east of the proposed development site.

2.2 Noise was examined at 7 measurement positions at the location of proposed housing units that will be most exposed to noise from the A1(M) (see Figure 1.0 and Photos, below):

Figure 1.0: Proposed Development and Measurement Positions

Photo 1: Position 6

Photo 2: Position 2

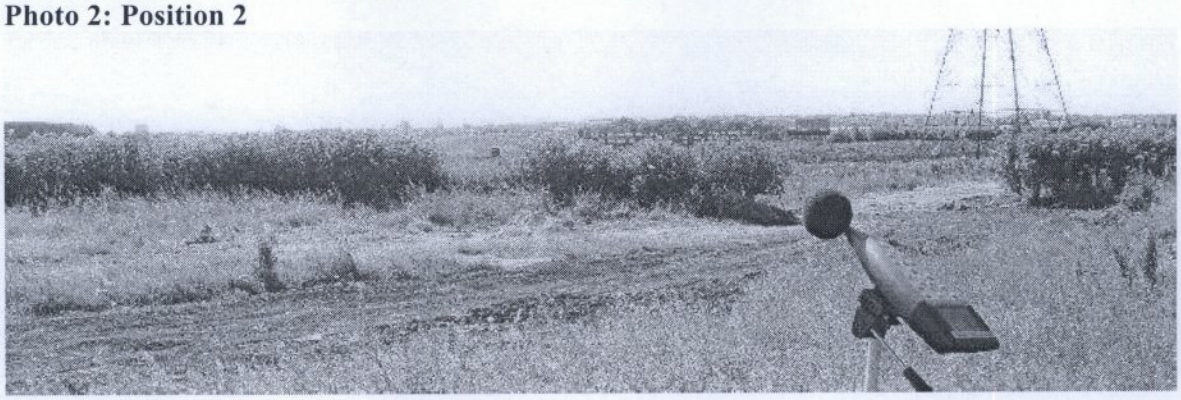

Photo 2: Position 5

Various statistical noise measurements, including A-weighted Equivalent Continuous Noise Levels and A-weighted Percentile Noise Levels (Appendix 3.0), were taken on Tuesday 4 September 2007, in 3 consecutive hours between 10:00hrs and 14:00hrs.

The above procedure is sufficient to reliably determine 3 consecutive hourly values of LA_{10}, in accordance with the "shortened measurement procedure" as described in Calculation of Road Traffic Noise (Ref 3, para 43). As noise at the measurement positions was dominated by noise from the busy A1(M), a sampling time of 5 minutes in each hour was deemed sufficient (Ref 3, para 41.2).

All the statistical analysis was directly carried out within the Sound Level Meter (Type 1 Precision Grade, see Appendix 1) to yield Equivalent Continuous Noise Levels (L_{eq}), Percentile Noise Levels (L_{10},L_{90}) and maximum/minimum (MAXL, MINL) noise levels during the measurement periods (see Appendix 3.0).

3.0 INSTRUMENTATION

3.1 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 Measured noise levels at all positions are given in Table 1.0. Equivalent Continuous Noise Levels (LA_{eq}), Percentile Noise Levels (L_{10}, L_{90}) and Maximum/Minimum noise levels during the measurement periods are noted.

Table 1.0: General Noise Parameters - All Positions

Position	Start Time	Elapsed Time	Statistical Noise Parameter dB(A)					
			LAFMax	LASMax	LAF10	LAF90	LAFMin	LAeq
Position 1	11:32:06	00:05:03	65.2	62.9	53.7	47.8	45.9	52.2
	12:15:22	00:05:04	60.7	54.6	51.3	48.4	47.1	50.1
	12:00:12	00:05:17	54.3	53.3	50.6	47.2	45.6	49.1
	13:29:19	00:05:09	56.2	55.4	52.0	47.8	46.3	50.1
Position 2	11:38:56	00:05:21	60.3	56.0	53.7	48.8	47.2	51.5
	12:21:48	00:05:27	61.5	58.9	53.3	48.2	46.6	51.2
	13:22:29	00:05:34	62.2	60.2	57.3	49.4	45.9	54.3
Position 3	11:45:11	00:06:26	65.3	61.6	58.2	52.8	49.6	56.0
	12:27:32	00:05:14	61.3	59.2	56.4	49.6	47.2	53.8
	13:15:45	00:05:53	68.7	64.7	58.5	53.1	50.7	56.3
Position 4	11:52:28	00:05:07	61.3	59.6	57.1	51.5	48.1	54.9
	12:34:21	00:05:02	58.7	56.4	53.4	48.4	46.4	51.2
	13:09:32	00:05:04	63.2	62.0	58.8	51.9	49.0	55.9
Position 5	11:57:08	00:05:08	61.0	57.6	54.5	49.9	47.4	52.8
	12:39:47	00:05:10	59.1	56.6	51.5	47.8	46.6	49.7
Position 6	12:04:08	00:05:01	62.2	55.8	51.1	47.1	45.2	49.6
	12:47:47	00:05:07	53.5	52.3	50.1	47.2	46.2	48.6
	13:02:49	00:05:11	57.0	53.2	50.5	47.2	45.6	48.9
Position 7	12:54:53	00:05:04	59.4	54.5	52.1	46.7	45.5	49.8

For noise categorisation according to PPG24 (Ref 1), the above data may be averaged into relevant single figure representations (according to the methods of Ref 1, Annex 1 and Reference 2, Para 43) for standard "Open Site" (or "Free Field") positions at proposed building façade locations. Position 3 is "worst case":

Position 3:

Hourly LA_{10}(Free Field)	Average (58.2, 56.4, 58.5)	=	57.7 dB(A)
LA_{10}(18 hour, Free Field) =	57.7 – 1.0 (Ref 2, para 43)	=	56.7 dB(A)
LA_{eq}(16 hour, Free Field) =	56.7 – 2.0 (Ref 1, Annex 1)	=	54.7 dB(A)
LA_{eq}(16 hour, Free Field @ closest building facades)		=	54.7 dB(A)
LA_{eq}(16 hour, Free Field) @ Closest Façade		~	**55 dB(A)**

Noise Exposure Categorisation

The above assessment, on the basis of a "worst case" position of a proposed building facade, **places the development site at the boundary of Noise Exposure Categories A and B (55 dB(A)$L_{eq(16\ hour)}$ Daytime).**

5.0 DISCUSSION AND ASSESSMENT

5.1 Noise Exposure Summary

The site is predominantly affected by road traffic noise due to traffic on the A1(M)-Western ByPass. Worst case LA_{eq}(16hr – Daytime) Free Field Noise Levels at the location of closest proposed facades are 55dB(A) close to Positions 2, 3 and 4. **This currently places the development site at the boundary of Noise Exposure Categories A and B (55 dB(A)$L_{eq(16\ hour)}$ Daytime).** With traffic growth noise levels are expected to increase and advance this area into Noise Exposure Category B.

Noise from A1(M) is constant and subjectively appears to be concentrated from the south where the road is clearly visible at grade and can be seen running southwards to Fawdon. NVA would note that this section of the A1(M) is clearly visible and noticeable visually as well as audibly (see Photos above).

5.2 Noise Amelioration Measures

With reference to BS8233:1999 (Reference 2, Table 5), Internal Equivalent Continuous Noise Levels of 30 dB(A) or less would be classed as "good" for "habitable" rooms (i.e. Living Rooms and Bedrooms), whilst "reasonable" conditions are classified as 35dB(A) for bedrooms and 40dB(A) for Living Rooms.

PPG24 (Reference 1) also identifies World Health Organisation guidance that "general daytime outdoor noise levels of less than 55 dB(A) L_{eq} are desirable to prevent any significant community annoyance".

The above criteria for noise levels will require some attention to noise amelioration (screening, glazing, roofs and ventilation) in way of those proposed units closest to the A1(M) in order to provide the appropriate protection against traffic noise.

At the most exposed of the proposed housing units (eastern edge, facing A1(M)), façade noise levels of up to 60dB(A) may be expected (allowing 3dB(A) for façade reflection and 2dB(A) for reduced screening at 1st Floor Levels or higher) and insulation properties of building envelopes to provide of the order of 30dB(A) are recommended.

Gardens at the eastern edges of Cell F may also be expected to experience noise levels at around 55dB(A), possibly exceeding this (average) level during certain busy periods (see Table 1.0). consequently the provision of additional screening in the form of earthworks and bunding to screen the visible sections of the A1(M) (see Photos 1.0 – 3.0) are recommended.

5.2.1 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 Traffic Noise Insulation Index (R_{Tra}) (which takes account of an increased low frequency content usually associated with road traffic) enabling estimation of the A-weighted reduction according to the following formula (based on that given in Ref 2, Sect 6,7):

$$\mathbf{LAeq(Inside) = LAeq(Outside, Façade) - R_{Tra} + 10\ Log\{S_W/A\}} \quad \mathbf{(1)}$$

Where S_W is the glazed area and A is the total acoustic absorption within the room

With an assumption of $2.5M^2$ glazed area and a room volume of $40M^3$ and "reverberation time" around 0.7 seconds, (1) becomes:

$$\mathbf{LAeq(Inside) \sim LAeq(Outside, Façade) - (R_{Tra} + 5)} \quad \mathbf{(2)}$$

Noting the above a good design target would be to limit Daytime Noise Levels to 30dB(A) in all habitable rooms. This would generally be considered to be representative of a "good" internal noise environment. Glazing configurations (or equivalent) from within the following range (Table 2.0) are recommended as appropriate to habitable rooms with windows in any "worst case" façade at the eastern edge of the development and facing the A1(M):

Table 2.0: Glazing Options For Habitable Rooms Facing A1(M):

Façade Noise Level dB(A)	Glazing Configuration (Glass/Cavity/Glass)	Noise Reduction Range dB(A)	Resultant Internal Noise Level dB(A)
60	10mm/12mm/4mm	~34	~26 Good Internal Noise
	6mm/12mm/6.4mm(PVB)	~32	~28 Good Internal Noise
	6mm/12mm/6mm	~31	~29 Good/Reasonable Internal Noise
	6mm/12mm/4mm	~30	~30 Good/Reasonable Internal Noise

(K) - Pilkington "K" Glass or equivalent
(PVB) - Pilkington Standard Laminated Glass (or equivalent)
(OPT) - Pilkington Optilam

NVA would recommend that consideration is given to using the better options, particularly where window sizes are relatively large.
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.

These requirements may possibly be relaxed dependent upon the screening ultimately provided to further restrict noise from the A1(M).

5.2.2 Roof/Ceiling

Assuming development buildings to be of Pitch Roof construction, NVA would recommend tiles on felt and a plasterboarded ceiling of GYPROC SOUNDBLOC (15mm thickness and 12.5 kg/m^2 superficial density), or equivalent, to top floor habitable rooms of those units on the eastern perimeter (facing A1(M)). The loft cavities should contain at least a 100mm layer of sound absorbent material such as mineral wool or fibre glass.

5.2.3 Ventilation

For all units at eastern perimeters (facing A1(M)), passive wall or window mounted ventilators should be incorporated to enable adequate ventilation without recourse to open windows to noisy facades. Suppliers should be informed that an overall sound reduction of up to 30dB(A) between external and internal is required (See Appendix 4.0 for supplier list). This will typically require ventilation units to provide a sound reduction of 38 dB($D_{ne,W}$) or better.

NVA would note that reputable suppliers will usually provide a free design service to satisfy PPG24 requirements. The measured noise levels contained in this report should enable them to configure and recommend appropriate ventilation solutions.

Again, these requirements may possibly be relaxed dependent upon the screening ultimately provided to further restrict noise from the A1(M).

6.0 CONCLUSIONS

6.1 The required noise survey has been carried out to determine representative noise levels affecting the proposed development of Newcastle Great Park Cell F.

6.2 Results and assessment of average daytime noise levels indicate that the **most exposed facades facing the A1(M) are at the boundary of Noise Exposure Categories A and B.** Increasing traffic growth will advance the site into Noise Exposure Category B.

6.3 Preliminary recommendations for noise amelioration measures to ensure good/acceptable internal noise environments within all habitable rooms under daytime conditions are given in 5.2 above. NVA would recommend incorporation of earthworks/screening to remove existing sight lines to the A1(M) and hence ensure garden and outdoor amenity area noise levels remain below 55dB(A) for the foreseeable future.

REFERENCES

1)	Department of the Environment Planning Policy Guidance: "Planning and Noise".	PPG24: 1994
2)	Sound Insulation and Noise Reduction for Buildings:	BS8233:1999
3)	Department of Transport "Calculation of Road Traffic Noise"	HMSO

APPENDIX 1.0 EQUIPMENT LIST

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

Noise Analysis:

Sound Level Meter:	Bruel and Kjaer Type:	2260
	Serial No:	2274779
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 GUIDANCE

A2.1 General guidance with regard to absolute noise levels in relation to proposed residential development is given by PPG 24 (Reference 1 and 5.2 below). This guidance considers absolute noise levels and is applicable to those sites affected by any combination of road, rail, air and industrial noise. Assessment of noise affecting the proposed development may therefore be formally assessed by the methods of PPG24. .

A2.2 **Department of the Environment Planning Policy Guidance PPG24 (Reference 2): Planning and Noise, 1994 (superseding Planning Circular 10/73, 1973).**

This planning guidance document outlines considerations to be taken into account in determining planning applications for noise sensitive developments in areas where noise levels are significant. The guidance predominantly relates to transportation noise (road, rail and air).

This document defines 4 "Noise Exposure Categories (NEC)" to assist local planning authorities in relation to the assessment of proposed residential developments. Categories are defined according to Daytime and Night Time Equivalent Continuous Noise Levels:

Category A:
Road Noise: **< 55 dB(A)$L_{eq(16\ hour)}$ Daytime and < 45 dB(A)$L_{eq(8\ hour)}$ Night Time**
Rail Noise: **< 55 dB(A)$L_{eq(16\ hour)}$ Daytime and < 45 dB(A)$L_{eq(8\ hour)}$ Night Time**

"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 considered as a desirable level".

Category B:
Road Noise: **< 63 dB(A)$L_{eq(16\ hour)}$ Daytime and < 57 dB(A)$L_{eq(8\ hour)}$ Night Time**
Rail Noise: **< 66 dB(A)$L_{eq(16\ hour)}$ Daytime and < 59 dB(A)$L_{eq(8\ hour)}$ Night Time**

"Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise".

Category C:
Road Noise: **< 72 dB(A)$L_{eq(16\ hour)}$ Daytime and < 66 dB(A)$L_{eq(8\ hour)}$ Night Time**
Rail Noise: **< 74 dB(A)$L_{eq(16\ hour)}$ Daytime and < 66 dB(A)$L_{eq(8\ hour)}$ Night Time**

"Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quiet sites available, conditions should be imposed to ensure a commensurate level of protection against noise".

Category D:
Road Noise: **> 72 dB(A)$L_{eq(16\ hour)}$ Daytime and > 66 dB(A)$L_{eq(8\ hour)}$ Night Time**
Rail Noise: **> 74 dB(A)$L_{eq(16\ hour)}$ Daytime and > 66 dB(A)$L_{eq(8\ hour)}$ Night Time**

"Planning permission should normally be refused".

APPENDIX 3.0: 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:

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

APPENDIX 4.0 SUPPLIERS OF SOUND ATTENUATED VENTILATORS

Rytons Building Products Ltd
Design House
Kettering Business Park
Kettering
Northants
NN15 6NL Tel: 01536 511874

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