KP Acoustics Ltd
Britannia House
11 Glenthorne Road
London
W6 0LH

Tel: +44(0)208 222 8778
Fax: +44(0)208 222 8575
Email: info@kpacoustics.com
www.kpacoustics.com

23 RAVENSHAW STREET, LONDON

NOISE AND VIBRATION ASSESSMENT

Report 12132.NVA.01

Prepared on 19th January 2015

For:

Chris Taylor

23 Ravenshaw Street

London

NW6 1NP

Registered in England Company No. 7947892
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1.0 INTRODUCTION

KP Acoustics has been commissioned by Chris Taylor, 23 Ravenshaw Street, London, NW6 1NP, to assess the suitability of the site at 23 Ravenshaw Street, London, NW6 1NP, for a residential development in accordance with the provisions of the National Planning Policy Framework and the Noise Policy Statement for England (NPSE).

This report presents the results of the environmental survey undertaken in order to measure prevailing background noise and vibration levels and outlines any necessary mitigation measures.

2.0 ENVIRONMENTAL NOISE SURVEY

2.1 Procedure

A noise survey was undertaken on the proposed site as shown in Figure 12132.SP1. The location was chosen in order to collect data representative of the worst-case levels expected on the site due to all nearby sources.

Continuous automated monitoring was undertaken for the duration of the survey between 15:30 on 29th January and 15:00 on 30th January 2015.

Weather conditions were generally dry with light winds and therefore suitable for the measurement of environmental noise.

The measurement procedure complied with ISO 1996-2:2007 Acoustics "*Description, measurement and assessment of environmental noise - Part 2: Determination of environmental noise levels*".

In addition to the noise survey, an assessment of vibration was carried out. This survey addressed rail traffic from the railway line to the rear of the site. Background vibration measurements were also conducted during the course of the noise survey as described above.

The vibration monitoring position is indicated on the site plan 12132.SP1. Measurements were made of vertical (z-axis) and horizontal (x - y axes) vibration levels from a number of trains passing in each direction.

2.2 Equipment

The equipment calibration was verified before and after use and no abnormalities were observed. The equipment used was as follows:

- 1 No. Svantek Type 958 Class 1 Sound Level Meter
- 1 No. Svantek Type 957 Class 1 Sound Level Meter
- B&K Type 4231 Class 1 Calibrator
- Dytran accelerometer, Model 3100D24

3.0 RESULTS

3.1 Noise Survey

The $L_{Aeq: 5min}$, $L_{Amax: 5min}$, $L_{A10: 5min}$ and $L_{A90: 5min}$ acoustic parameters were measured throughout the duration of the survey. Measured levels are shown as time histories in Figures 12132.TH1-2. Average daytime and night time noise levels are shown in Table 4.1.

3.2 Vibration Survey

The results of the background and rail traffic vibration measurements are shown in Figures 12132.VS1-3 as acceleration levels over the 1Hz to 80Hz frequency range.

4.0 DISCUSSION

The site bounded by Ravenshaw Street to the East, a railway line to the West, and existing residential properties to the North and South. At the time of the survey, the background noise climate was dominated by road traffic noise from Ravenshaw Street to the front façade, and rail noise from the adjacent railway line to the rear façade.

Measured noise levels are representative of noise exposure levels expected to be experienced by the front and rear façades of the proposed development, and are shown in Table 4.1.

	Level dB(A)
POSITION 1 – REAR FAÇADE	
Daytime $L_{Aeq,16hour}$	65
Night-time $L_{Aeq,8hour}$	58
POSITION 1 – FRONT FAÇADE	
Daytime $L_{Aeq,16hour}$	56
Night-time $L_{Aeq,8hour}$	50

Table 4.1 Site average noise levels for daytime and night time

Provided adequate mitigation measures are put in place during the design and construction phase of a development, Good internal noise levels may still be achieved. Mitigation measures are described in Sections 5 and 6 of this report.

5.0 NOISE ASSESSMENT

Internal noise requirements are normally based on BS8233:2014 '*Guidance on sound insulation and noise reduction for buildings'*. This standard recommends internal noise levels for good or reasonable resting conditions during daytime (07:00-23:00 hours) and night-time (23:00-07:00). These levels are shown in Table 5.1.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Rooms	35 dB(A)	-
Dining	Dining Room/area	40 dB(A)	-
Sleeping (daytime resting)	Bedrooms	35 dB(A)	30 dB(A)

Table 5.1 BS8233 recommended internal background noise levels

The external building fabric would need to be carefully designed to achieve these recommended internal levels. It is currently assumed that the non-glazed external building fabric elements of the proposed development would be comprised of blockwork. This would contribute towards a significant reduction of ambient noise levels in combination with a good quality double-glazed window configuration, as shown in Section 6.

5.1 Vibration Assessment

BS6472-1:2008 '*Guide to evaluation of human exposure to vibration in buildings*' defines the vibration magnitudes at which complaints are likely to occur. These are defined by a series of standardised curves against which measured vibration values are compared.

Curve 1 may be considered as the threshold of human perception of vibration, so any levels below Curve 1 would not be tactile. In dwellings, the minimum vibration thresholds equating to a "low probability of complaints" is Curve 1.4 during night-time and Curve 2 for daytime.

Figures 12132.VS1-3 compare vibration acceleration magnitudes for rail traffic pass-bys to the BS6472 curve family. The z-axis vibration level, which is the most important when annoyance is considered, is below the threshold of perception and would, consequently, not constitute a significant concern for this development.

With regards to structural or cosmetic damage to the building, this is considered significant in the frequency range above 4Hz. The small increase at the very low frequency end which is seen in the attached Figures would not be considered to present any danger to the shell of the building.

6.0 EXTERNAL BUILDING FABRIC SPECIFICATION

Sound reduction performance calculations have been undertaken in order to specify the minimum performance required from glazed and non-glazed elements in order to achieve ‘good’ internal noise levels shown in Table 5.1. Taking into account average and maximum noise levels monitored during the environmental noise survey.

Typical bedrooms with a high ratio of glazing to masonry have been used for all calculations in order to specify glazing.

As a more robust assessment, L_{Amax} spectrum values of night-time peaks have also been considered and incorporated into the glazing calculation in order to cater for the interior limit of 45 dB L_{Amax} for individual events, as specified in BS8233:1999.

6.1 Non-Glazed Elements

All non-glazed elements of the building façade have been assumed to provide a sound reduction performance of at least the figures shown in Table 6.1 when tested in accordance with BS EN ISO, 140-3:1995.

Element	Octave band centre frequency SRI, dB					
	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz
Non glazed element SRI	41	43	48	50	55	55

Table 6.1 Assumed sound reduction performance for non-glazed elements

6.2 Glazed Elements

Minimum octave band sound reduction index (SRI) values required for all glazed elements to be installed are shown in Table 6.2.The performance is specified for the whole window unit, including the frame and other design features such as the inclusion of trickle vents. Sole glass performance data would not demonstrate compliance with this specification.

Glazing performance calculations have been based both on average measured night-time noise levels as well as verified against the L_{Amax} spectrum of individual events in order to comply with a maximum internal noise level of 45dB(A) in bedrooms as recommended by BS8233. The combined most robust results of these calculations are shown in Table 6.2.

Glazing Type	Octave band centre frequency SRI, dB					
	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz
Front Elevation	20	22	26	32	30	20
Rear Elevation	19	27	35	42	43	36

Table 6.2 Required glazing performance

With regards to the introduction of acoustic trickle vents, we would recommend any system with a rated acoustic performance of 39-42 dB, $D_{n,e,w}$, for the rear façade, and a rated acoustic performance of 37-39 dB, $D_{n,e,w}$ for the front façade, should natural ventilation be required.

All major building elements should be tested in accordance with BS EN ISO 140-3:1995.

Independent testing at a UKAS accredited laboratory will be required in order to confirm the performance of the chosen system for an “actual” configuration.

No further mitigation measures would be required to achieve good internal noise levels.

7.0 CONCLUSION

An environmental noise and vibration survey has been undertaken at 23 Ravenshaw Street, London, NW6 1NP, allowing the assessment of daytime and night-time levels likely to be experienced by the proposed development.

Measured noise levels allowed a robust glazing specification to be proposed which would provide internal noise levels for all residential environments of the development commensurate to “Good” in the design range of BS8233.

No further mitigation measures should be required in order to protect the proposed habitable spaces from external noise intrusion.

Measurement of vibration from train activity indicates that vibration levels are below the threshold of human perception in the z-axis, in accordance with BS6472: 2008.

Report by

Dan Green TechIOA

KP Acoustics Ltd

Checked by

Kyriakos Papanagiotou MIOA

KP Acoustics Ltd

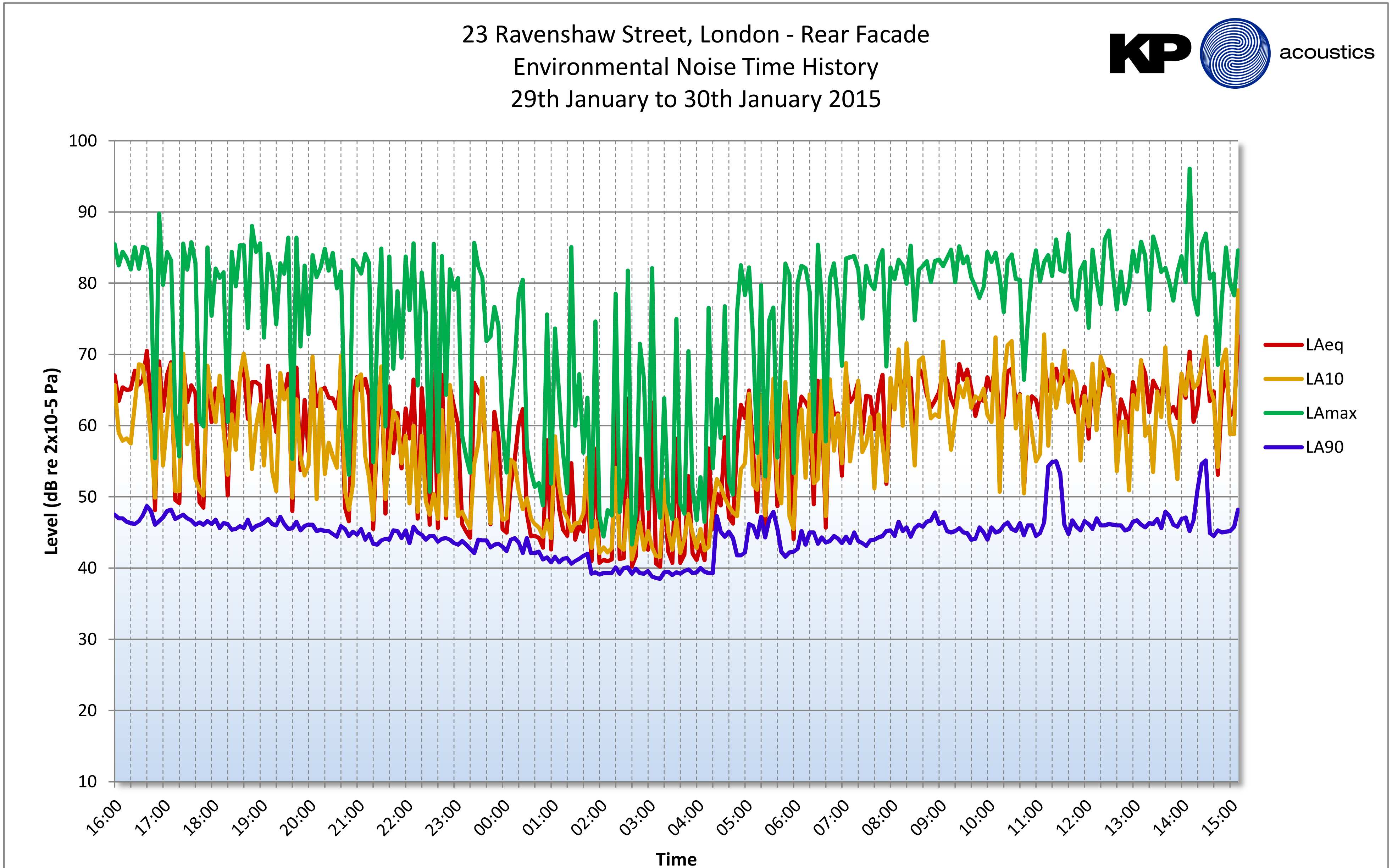

Figure 12132.TH1

23 Ravenshaw Street, London - Front Facade
Environmental Noise Time History
29th January to 30th January 2015

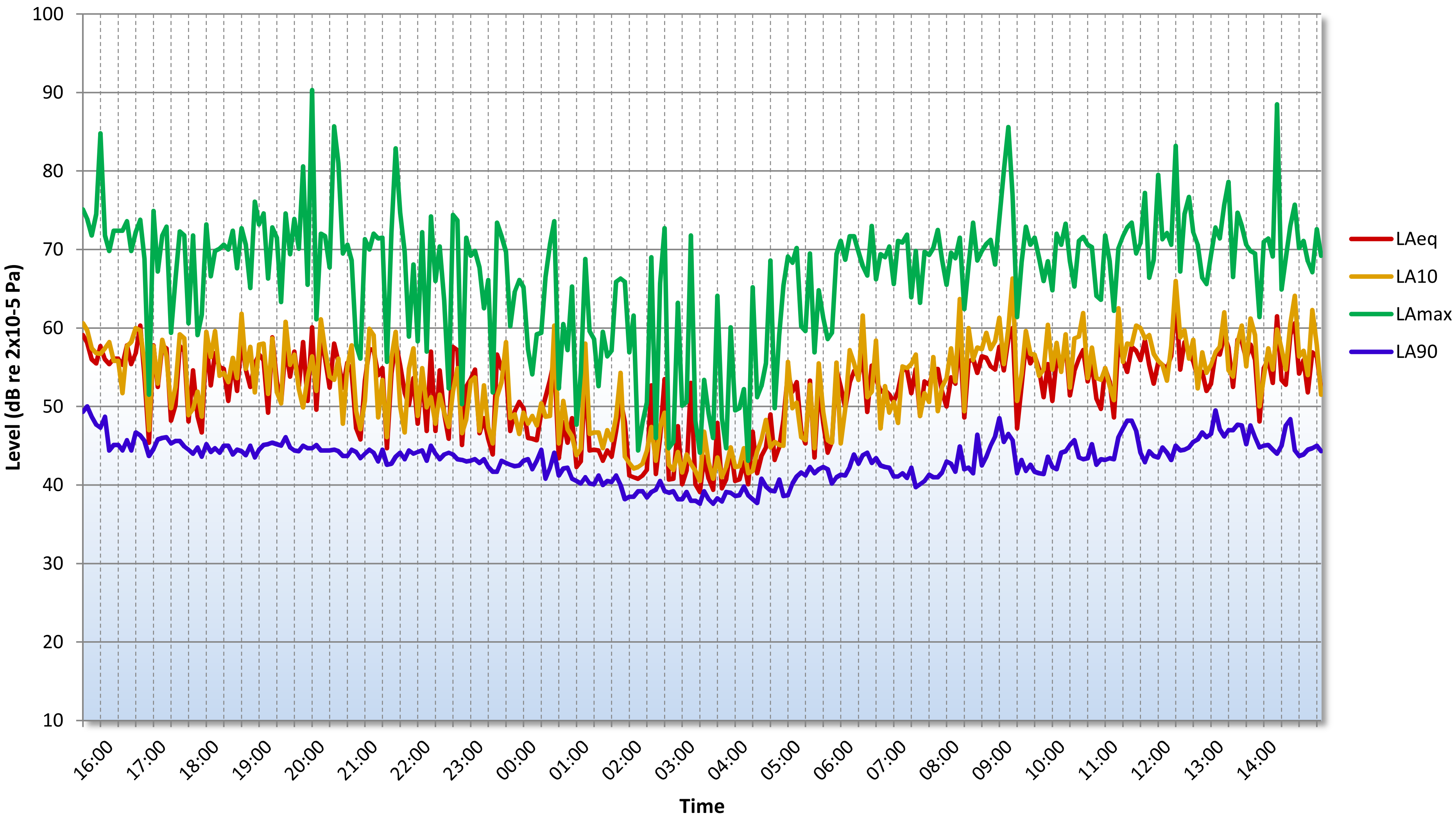

Figure 12132.TH2

23 RAVENSHAW STREET, LONDON

MAXIMUM HORIZONTAL VIBRATION LEVELS

X-AXIS

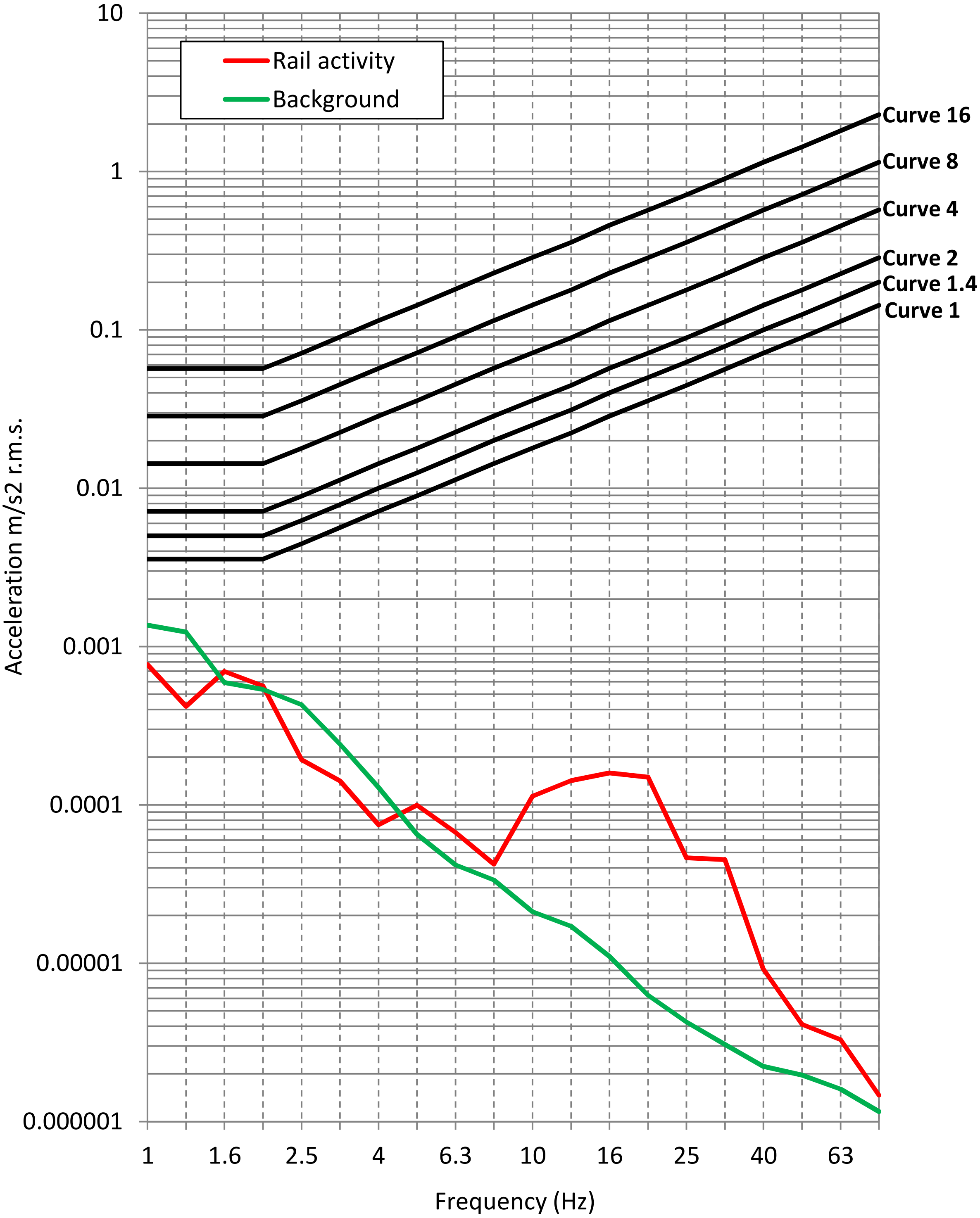

Figure 12132.VS1

23 RAVENSHAW STREET, LONDON

MAXIMUM HORIZONTAL VIBRATION LEVELS

Y-AXIS

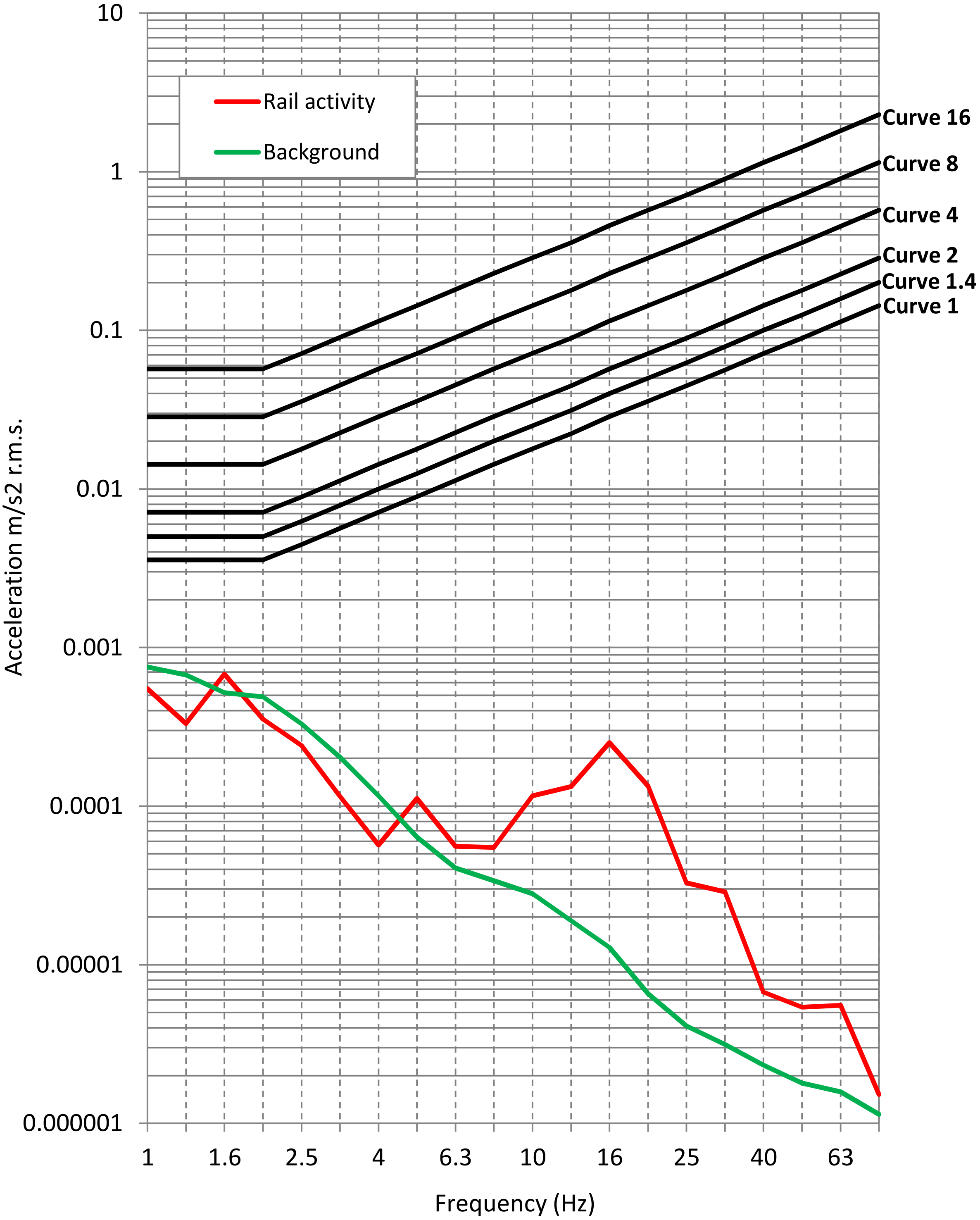

Figure 12132.VS2

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23 RAVENSHAW STREET, LONDON

MAXIMUM VERTICAL VIBRATION LEVELS

Z-AXIS

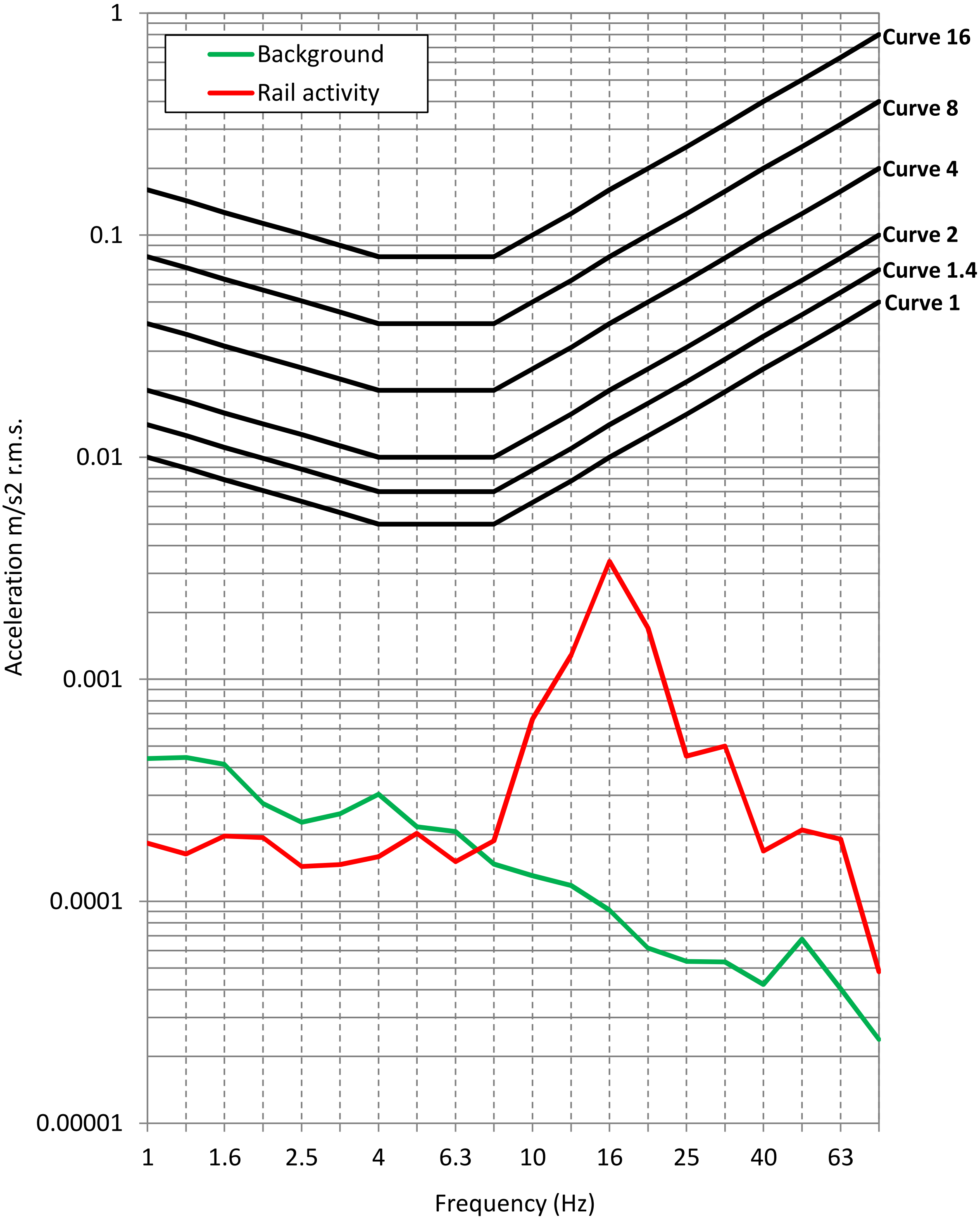

Figure 12132.VS3

Title:
Indicative site plan showing noise and vibration monitoring positions

Date: 4 February 2015

FIGURE 12132.SP1

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APPENDIX A

GENERAL ACOUSTIC TERMINOLOGY

Decibel scale - dB

In practice, when sound intensity or sound pressure is measured, a logarithmic scale is used in which the unit is the 'decibel', dB. This is derived from the human auditory system, where the dynamic range of human hearing is so large, in the order of 10^{13} units, that only a logarithmic scale is the sensible solution for displaying such a range.

Decibel scale, 'A' weighted - dB(A)

The human ear is less sensitive at frequency extremes, below 125Hz and above 16Khz. A sound level meter models the ears variable sensitivity to sound at different frequencies. This is achieved by building a filter into the Sound Level Meter with a similar frequency response to that of the ear, an A-weighted filter where the unit is dB(A).

L_{eq}

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level L_{eq}. The L_{eq} is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

L_{10}

This is the level exceeded for no more than 10% of the time. This parameter is often used as a "not to exceed" criterion for noise.

L_{90}

This is the level exceeded for no more than 90% of the time. This parameter is often used as a descriptor of "background noise" for environmental impact studies.

L_{max}

This is the maximum sound pressure level that has been measured over a period.

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 11 such octave bands whose centre frequencies are defined in accordance with international standards. These centre frequencies are: 16, 31.5, 63, 125, 250, 500, 1000, 2000, 4000, 8000 and 16000 Hertz.

Environmental noise terms are defined in BS7445, *Description and Measurement of Environmental Noise*.

APPENDIX A

APPLIED ACOUSTIC TERMINOLOGY

Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than a single source and 4 sources produce a 6dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Hearing perception is highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a guide to explain increases or decreases in sound levels for many scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud

Transmission path(s)

The transmission path is the path the sound takes from the source to the receiver. Where multiple paths exist in parallel, the reduction in each path should be calculated and summed at the receiving point. Outdoor barriers can block transmission paths, for example traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and construction.

Ground-borne vibration

In addition to airborne noise levels caused by transportation, construction, and industrial sources there is also the generation of ground-borne vibration to consider. This can lead to structure-borne noise, perceptible vibration, or in rare cases, building damage.

Sound insulation - Absorption within porous materials

Upon encountering a porous material, sound energy is absorbed. Porous materials which are intended to absorb sound are known as absorbents, and usually absorb 50 to 90% of the energy and are frequency dependent. Some are designed to absorb low frequencies, some for high frequencies and more exotic designs being able to absorb very wide ranges of frequencies. The energy is converted into both mechanical movement and heat within the material; both the stiffness and mass of panels affect the sound insulation performance.