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ACOUSTICS
Noise and Vibration Consultants

FINCHLEY BELL, 317 FINCHLEY ROAD, LONDON NW3 6EP

NOISE AND VIBRATION ASSESSMENT

On behalf of:

Caldecotte Consultants

Report No. 31392.2v1
December 2013

FINCHLEY BELL, 317 FINCHLEY ROAD, LONDON NW3 6EP

NOISE AND VIBRATION ASSESSMENT

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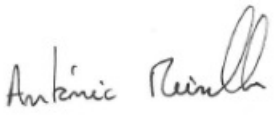

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CONTENTS

		Page
1.0	INTRODUCTION	1
2.0	DESCRIPTION OF SITE AND DEVELOPMENT PROPOSALS	2
3.0	ACOUSTIC CRITERIA	3
4.0	NOISE AND VIBRATION SURVEYS	6
5.0	ASSESSMENT AND RECOMMENDED MITIGATION MEASURES	11
6.0	SUMMARY AND CONCLUSIONS	14
Figure 1 – Site plan and approximate measurement locations		15
Appendix I – Noise Units and Indices		16
Appendix II – Results of Noise Surveys		18

1.0 INTRODUCTION

1.1 Hepworth Acoustics Limited has been commissioned by Caldecotte Consultants to carry out a noise and vibration assessment in relation to a proposed mixed residential and commercial development at the Finchley Bell, 317 Finchley Road, London NW3 6EP.

1.2 The assessment report has been commissioned in connection with the planning application for the proposed development.

1.3 The noise assessment has included:

i) A site inspection and review of proposed layout drawings;
ii) Daytime and night-time noise measurement surveys on the site;
iii) Daytime and night-time vibration measurement surveys on the site;
iv) Assessment of ambient noise and vibration impact on the proposed development; and
v) Outline recommendations of appropriate noise control measures for the proposed residences, where necessary.

1.4 The various noise indices referred to in this report are described in Appendix I. All noise levels mentioned in the text have been rounded to the nearest decibel, as fractions of decibels are imperceptible.

2.0 DESCRIPTION OF SITE AND DEVELOPMENT PROPOSALS

2.1 The proposed development site is currently occupied by a 4 storey building, which was previously occupied by the Finchley Bell pub premises and manager's residential flat at 3rd floor level. The pub is currently not in operation.

2.2 The main frontage is to Finchley Road whilst to the back the site faces over a railway line at Finchley Road and Frognal Station. The railway comprises two lines, which carry overground services as well as freight trains.

2.3 The proposal is to demolish the existing building and construct a new 6 storey building to receive retail at ground floor level and 10 residential flats on the upper floors.

2.4 The surrounding area is mainly residential and commercial in use.

2.5 The dominating noise sources at the site are road noise from Finchley Road and railway noise to the back of the site.

2.6 This assessment is based on the Wythe Holland Partnership drawings 1744-01 to 1774-08.

3.0 ACOUSTIC CRITERIA

3.1 The principles and policies regarding noise are set out in the Camden Development Policies 2010-2025, which is part of the Camden's Local Development Framework adopted in November 2010.

3.2 Policy DP28 on Noise and Vibration states that:

'The Council will seek to ensure that noise and vibration is controlled and managed and will not grant permission for:

a) Development likely to generate noise pollution; or

b) Development sensitive to noise in locations with noise pollution, unless appropriate attenuation measures are provided.

Development that exceeds Camden's Noise and Vibration Thresholds will not be permitted.

The Council will only grant permission for plant or machinery if it can be operated without cause harm to amenity and does not exceed our noise thresholds.

The Council will seek to minimise the impact on local amenity from the demolition and construction phases of development. Where these phases are likely to cause harm, conditions and planning obligations may be used to minimise the impact.'

3.3 In addition, London Borough of Camden Local Development Framework includes a series of Tables which establish the Council's thresholds. A copy of the relevant tables, i.e. Tables A to C and Table E, are presented in Tables 1 to 3 below.

Table 1 – Noise levels on residential sites adjoining railways and roads at which planning permission will not be granted

Noise description and location of measurement	Period	Time	Sites adjoining railway	Sites adjoining roads
Noise at 1 metre external to a sensitive façade	Day	0700-1900	74dB $L_{Aeq,12h}$	72dB $L_{Aeq,12h}$
Noise at 1 metre external to a sensitive façade	Evening	1900-2300	74dB $L_{Aeq,4h}$	72dB $L_{Aeq,4h}$
Noise at 1 metre external to a sensitive façade	Night	2300-0700	66dB $L_{Aeq,8h}$	66dB $L_{Aeq,8h}$

Table 2 – Noise levels on residential sites adjoining railways and roads at and above which attenuation measures will be required

Noise description and location of measurement	Period	Time	Sites adjoining railway	Sites adjoining roads
Noise at 1 metre external to a sensitive façade	Day	0700-1900	65dB $L_{Aeq,12h}$	62dB $L_{Aeq,12h}$
Noise at 1 metre external to a sensitive façade	Evening	1900-2300	60dB $L_{Aeq,4h}$	57dB $L_{Aeq,4h}$
Noise at 1 metre external to a sensitive façade	Night	2300-0700	55dB $L_{Aeq,1h}$	52dB $L_{Aeq,1h}$
Individual noise events several times an hour	Night	2300-0700	>82dB L_{Amax} (S time weighting)	>82dB L_{Amax} (S time weighting)

Table 3 – Vibration levels on residential sites adjoining railways and roads at which planning permission will not be granted

Vibration description and location of measurement	Period	Time	Vibration level
Vibration inside dwellings	Day and evening	0700-2300	0.2 to 0.4 VDV ms-1.75
Vibration inside dwellings	Night	2300-0700	0.13 VDV ms-1.75
Vibration inside offices	Day, evening and night	00:00-24:00	0.4 VDV ms-1.75

BS 8233: 1999

3.4 Further guidance on acoustic design goals for residential development is set out in British Standard 8233: 1999 'Sound insulation and noise reduction for buildings – Code of Practice'. The criteria are summarised in Table 4.

Table 4: BS 8233 Recommended Acoustic Design Criteria

Location	Internal Noise Levels
Living Rooms	Good Standard 30 dB L_{Aeq} Reasonable Standard 40 dB L_{Aeq}
Bedrooms	Good Standard 30 dB L_{Aeq} Reasonable Standard 35 dB L_{Aeq} (Night-time L_{Amax} should not normally exceed 45 dB)
Gardens and balconies	Upper limit of 55 dB L_{Aeq}

3.5 This assessment includes subsequent recommendations to ensure that $L_{Aeq,T}$ internal noise levels within residential habitable rooms do not exceed 35 dB inside living rooms and 30 dB inside bedrooms, whilst also ensuring the L_{Amax} noise level within bedrooms will not normally exceed 45 dB, with windows closed and trickle ventilation provided.

4.0 NOISE AND VIBRATION SURVEYS

Railway Noise Survey

4.1 Existing noise levels were measured on site on the flat roof of the existing building at a location representative of the nearest and most exposed proposed location to the railway. The approximate measurement location is shown as Location 1 in Figure 1.

4.2 Continuous noise monitoring was undertaken between 14:00 hours Monday 11 March 2013 and 23:00 hours on Friday 15 March 2013. Noise levels were measured over sequential fifteen minute periods for the entire duration of the survey.

4.3 The continuous noise monitoring was carried out using a Rion NL-31 Type 1 sound level meter (serial no. 01120844). The calibration level of the meter was checked before and after the survey with a Brüel & Kjaer Type 4203 sound calibrator (serial no. 1771163) with no variation in level observed. The measurement microphone was mounted at approximately 1.5m above roof level in free-field conditions.

4.4 Further daytime noise monitoring was undertaken between 13:30 hours and 15:46 hours on Monday 11 March 2013. Three 15-minute noise samples were recorded, including octave band data to assist with our subsequent recommendations for sound insulation specifications and noise control measures.

4.5 Individual noise samples were carried out using a Brüel & Kjær 2260 'Type 1' Sound Analyser (serial no. 2520468). The calibration level of the meter was checked before and after the survey with a Brüel & Kjaer Type 4203 sound calibrator (serial no. 1771163) with no variation in level observed. The measurement microphone was mounted at approximately 1.5m above roof level in free-field conditions.

4.6 The results of the continuous noise survey are detailed in Appendix II in graphical form. The L_{Aeq} and L_{Amax} levels for the 16 hour daytime and 8 hour night-time periods, at the location of the nearest proposed residential elevation to the railway, are as shown in Table 5:

Table 5: Overall Daytime, Evening and Night-time Noise Levels of Rail Traffic (dB)

Date		Daytime (0700-1900hrs)	Evening (1900-2300 hrs)	Night-time (2300-0700hrs)	
Daytime and evening	**Night-time**	$L_{Aeq,12\ hr}$	$L_{Aeq,4\ hr}$	$L_{Aeq,8hr}$	$L_{Amax,T}$
Monday 11 (part daytime)	Monday 11 – Tuesday 12	61	60	58	78
Tuesday 12	Tuesday12 – Wednesday 13	60	60	58	78
Wednesday 13	Wednesday 13 – Thursday 14	61	61	59	77
Thursday 14	Thursday 14 – Friday 15	59	58	59	77
Friday 15	-	61	61	-	-

4.7 The weather conditions throughout the noise survey were mainly dry with varying wind speeds, but consistently below 5m/s. A few light snow showers were noted on Monday 11 and Tuesday 12, but with no apparent effect on the measured noise levels.

Road Traffic Noise Survey

4.8 Noise levels were measured at a location representative of the most exposed residential facade, Locations 2 as shown in Figure 1. The measurement microphone was mounted at approximately 1.5m above ground level approximately 1m from the existing facade and therefore not in free-field conditions.

4.9 Daytime noise monitoring was undertaken between 13:00 and 15:15 hours on Monday 11 March 2013 whilst night-time noise monitoring was undertaken between 23:00 hours on Tuesday 12 March 2013 and 01:01 hours on Wednesday 13 March 2013. During the daytime survey 15-minute noise samples were recorded over three consecutive hours whereas during the night-time survey 5-minute noise samples were recorded, for the duration of the survey period.

4.10 Individual noise samples were carried out using a Brüel & Kjær 2260 'Type 1' Sound Analyser (serial no. 2520468). The calibration level of the meter was checked before and after the survey with a Brüel & Kjaer Type 4203 sound calibrator (serial no. 1771163) with no variation in level observed.

4.11 Daytime traffic noise levels have been measured in accordance with the shortened measurement method described in the Department of Transport document 'Calculation of Road Traffic Noise' (CRTN), 1988. The memorandum was prepared to enable entitlement under the Noise Insulation Regulations 1975 to be determined, but it is stated in the document, that the guidance is equally appropriate to the evaluation of traffic noise for land use planning purposes.

4.12 The CRTN shortened measurement method involves measuring traffic noise levels (L_{A10}) over representative time periods within any three consecutive hours between 10:00 hours and 17:00 hours. The measured L_{A10} values may be arithmetically averaged to determine the $L_{A10,3hr}$ value and then adjusted by -1dB to determine the $L_{A10,18hr}$ value.

4.13 In addition, Paragraph 9, Annex 1, of the former Planning Policy Guidance 24 (PPG24) 'Planning and Noise' HMSO, 1994 mentioned that $L_{A10,18hr}$ value may be adjusted by -2dB to determine the equivalent overall daytime (07:00-23:00 hours) $L_{Aeq,16hr}$ value. Note that although PPG24 has been withdrawn the proposed method has been considered to obtain the equivalent overall daytime $L_{Aeq,16hr}$ value.

4.14 The overall daytime (07:00-23:00 hours) $L_{Aeq,16hr}$ value has been considered to be representative of the daytime (07:00-19:00 hours) $L_{Aeq,12hr}$ value and evening (19:00-23:00 hours) $L_{Aeq,4hr}$ value in this assessment given that traffic on the Finchley Road was found not to vary significantly throughout the daytime period. Furthermore, it is considered that this represents a robust assessment.

4.15 The overall night-time (23:00-07:00 hours) $L_{Aeq,8hr}$ noise levels have been determined on the basis of the measured night-time $L_{Aeq,2hr}$ value, over the period 23:00-01:01 hours. In our experience. In our experience $L_{Aeq,\ 2hrs}$ (23:00-01:00 hours) is typically comparable to overall

(23:00-07:00 hours) $L_{Aeq,8hr}$ for sites adjacent to busy roads'

4.16 The following assessment is based on the calculated logarithmic average of the $L_{Amax,5min}$ night-time noise levels. This is in line with the 'ANC Guideline on Noise Measurements in Buildings Part 2: Noise from External Sources (e.g. traffic noise) within Building', which states that *'Normally, the L_{max} for the period of interest should be taken as the logarithmic average of the L_{max} noise levels that occurred or would occur in the period'.*

4.17 The full measured noise levels at Location 2 are shown in detail in Appendix II and summarised in Table 6 below. It is noted that due to site constraints measurement Location 2 was closer to Finchley Road than the nearest proposed residential facade. Therefore, a distance correction has been applied to the results shown in Table 6. The results shown in Appendix II are the measured levels and do not include any distance correction.

Table 6: Overall Daytime, Evening and Night-time Noise Levels of Road Traffic (dB)

Date		**Daytime (0700-1900hrs)**	**Evening (1900-2300 hrs)**	**Night-time (2300-0700hrs)**	
Daytime and evening	**Night-time**	**$L_{Aeq,12\ hr}$** (based on CRTN $L_{Aeq,16hrs}$)	**$L_{Aeq,4\ hr}$** (based on CRTN $L_{Aeq,16hrs}$)	**$L_{Aeq,8hr}$**	**$L_{Amax,T}$**
Monday 11	Monday 11-Tuesday 12	69	69	65	78

Vibration Survey

4.18 Vibration levels at the site were also measured at Location 1. Vibration levels were measured continuously during the entire duration of the continuous noise surveys.

4.19 Vibration measurements were carried out using a Vibrock V901-02 triaxial vibration recorder fitted with a Vibrock V901-VDV transducer.

4.20 The results of the measured levels are detailed in Appendix II. Estimated daytime VDVs for the partial daytime period on Monday 4 February 2013 and measured daytime and night-time VDVs

for the remainder of the survey are shown in Table 7.

Table 7: Overall Daytime, Evening and Night-time Vibration Dose Values in ms-1.75

Date	Period	Axis		
		X	Y	Z
Monday 11 March 2013	Part daytime and evening (10 hours)	0.026	0.035	0.081
Monday 11 – Tuesday 12 March 2013	Night-time	0.023	0.032	0.044
Tuesday 12 March 2013	Daytime and evening	0.026	0.033	0.050
Tuesday 12 – Wednesday 13 March 2013	Night-time	0.022	0.030	0.043
Wednesday 13 March 2013	Daytime and evening	0.026	0.033	0.048
Wednesday 13 – Thursday 14 March 2013	Night-time	0.022	0.033	0.043
Thursday 14 March 2013	Daytime and evening	0.026	0.033	0.048
Thursday 14 – Friday 15 March 2013	Night-time	0.022	0.028	0.043
Friday 15 March 2013	Daytime and evening	0.026	0.031	0.048

5.0 ASSESSMENT AND RECOMMENDED MITIGATION MEASURES

5.1 The overall results shown in Tables 5 and 6 demonstrate that noise levels measured at Location 1 are below the noise levels on residential sites adjoining railway and roads at which planning permission will not be granted and above the noise levels above which attenuation measures will be required by the London Borough of Camden.

5.2 It is considered that, subject to careful design, adequate sound insulation measures can be readily incorporated within the scheme to achieve acceptable noise levels in line with BS8233 at the site.

5.3 The principal method of noise mitigation will be appropriately specified glazing and ventilation systems. The specification of the surrounding external building fabric (new built) is not known at this stage, however this must provide a sufficient level of sound insulation to maintain the overall performance of the façade. This will be readily achievable using a variety of standard building materials and constructions, however the detailed proposals should be checked by an acoustic consultant to ensure that the internal noise criteria will be met.

5.4 Recommended internal noise levels in bedrooms overlooking the railway will be achieved with double glazing providing the minimum Sound Reduction Indices (SRIs) set out in Table 8, typically achievable using a system comprising one 4mm glass pane and a laminated 6.4mm glass pane on a minimum 12mm air gap (i.e. minimum 4-12-$6.4_{laminated}$) and an acoustically treated ventilation system with minimum acoustic rating $D_{n,e,w}$ 45dB;

Table 8: Minimum Glazing SRIs

	Hz Octave Band Centre Frequency					
	125	**250**	**500**	**1k**	**2k**	**4k**
dB SRI	24	22	29	40	44	46

5.5 Recommended internal noise levels in the remaining habitable areas overlooking the railway will be achieved with double glazing providing the minimum Sound Reduction Indices (SRIs) set out in Table 9, typically achievable using a Standard thermal double glazing (i.e. 4mm

glass/12mm cavity/4mm glass) with standard non-acoustic trickle vents at the elevation overlooking the railway and acoustically treated ventilation system with minimum acoustic rating $D_{n,e,w}$ 35dB at the elevation overlooking Finchley Road;

Table 9: Minimum Glazing SRIs

	Hz Octave Band Centre Frequency					
	125	**250**	**500**	**1k**	**2k**	**4k**
dB SRI	20	20	25	35	38	35

5.6 Recommended internal noise levels in remaining habitable rooms overlooking Finchley Road will be achieved with double glazing providing the minimum Sound Reduction Indices (SRIs) set out in Table 10, typically achievable using a system comprising one 6mm glass pane and a laminated 8.4mm glass pane on a minimum 12mm air gap (i.e. minimum 6-12-$8.4_{laminated}$) and an acoustically treated ventilation system with minimum acoustic rating $D_{n,e,w}$ 50dB;

Table 10: Minimum Glazing SRIs

	Hz Octave Band Centre Frequency					
	125	**250**	**500**	**1k**	**2k**	**4k**
dB SRI	25	25	33	44	44	45

5.7 Recommended internal noise levels in remaining habitable rooms overlooking Finchley Road will be achieved with double glazing providing the minimum Sound Reduction Indices (SRIs) set out in Table 11, typically achievable using a system comprising one 6mm glass pane and a laminated 6.4mm glass pane on a minimum 12mm air gap (i.e. minimum 6-12-$6.4_{laminated}$) and an acoustically treated ventilation system with minimum acoustic rating $D_{n,e,w}$ 50dB;

Table 11: Minimum Glazing SRIs

	Hz Octave Band Centre Frequency					
	125	**250**	**500**	**1k**	**2k**	**4k**
dB SRI	24	25	31	42	44	46

5.8 Options for acoustic vents are available from Greenwood (www.greenwood.co.uk), Caice (www.caice.co.uk) and Rytons (www.vents.co.uk).

Balconies

5.9 Proposed balconies overlooking Finchley Road will be exposed to daytime noise levels above the recommended upper limit of 55 dB $L_{Aeq,16hrs}$. However, it is understood that planning permission for other residential development including balconies overlooking Finchley Road has been granted at adjoining sites.

5.10 It is understood that the proposed balconies include for the provision of 900mm high solid balustrades, which will reduce noise intrusion to these spaces, especially for a seated position. It is recommended that the balustrades are of minimum mass per unit area of 10 kg/m^2, with no holes or gaps in its construction and may be typically constructed from masonry, glazing or metal cladding.

Private gardens

5.11 The proposed communal space to the back of the site directly overlooking the railway will be exposed to daytime noise levels above the recommended upper limit of 55 dB L_{Aeq}. To reduce noise levels within this space, it is recommended that imperforate acoustic screens are installed at the site boundary to the railway. To function as effective acoustic screens, such fences would need to be of overall mass not less than 10kg/m^2 and nominal thickness not less than 20mm (e.g. close boarded timber), and should extend to a height not less than 2.0m. The construction should be imperforate with no holes or gaps and should be sealed at the base.

Vibration

5.12 The vibration dose values levels presented in Table 7 are well below the threshold levels above which planning permission will not be granted. It is expected that any amplification of vibration from transfer functions (e.g. by proposed building or furniture supporting a person) will not be significant.

6.0 SUMMARY AND CONCLUSIONS

6.1 A noise assessment has been carried out in connection with a planning application for proposed mixed residential and commercial development at the Finchley Bell, 317 Finchley Road, London NW3 6EP.

6.2 Noise and vibration surveys have been undertaken at the site and daytime, evening and night-time noise levels have been determined.

6.3 Appropriate noise mitigation measures have been recommended for the proposed residences which will ensure that internal and external noise levels will meet the recommended acoustic criteria based on the guidelines set out in BS 8233: 1999.

6.4 It has been demonstrated that vibration levels at the most exposed parts of the proposed development will be below the threshold levels above which London Borough of Camden will not grant planning permission.

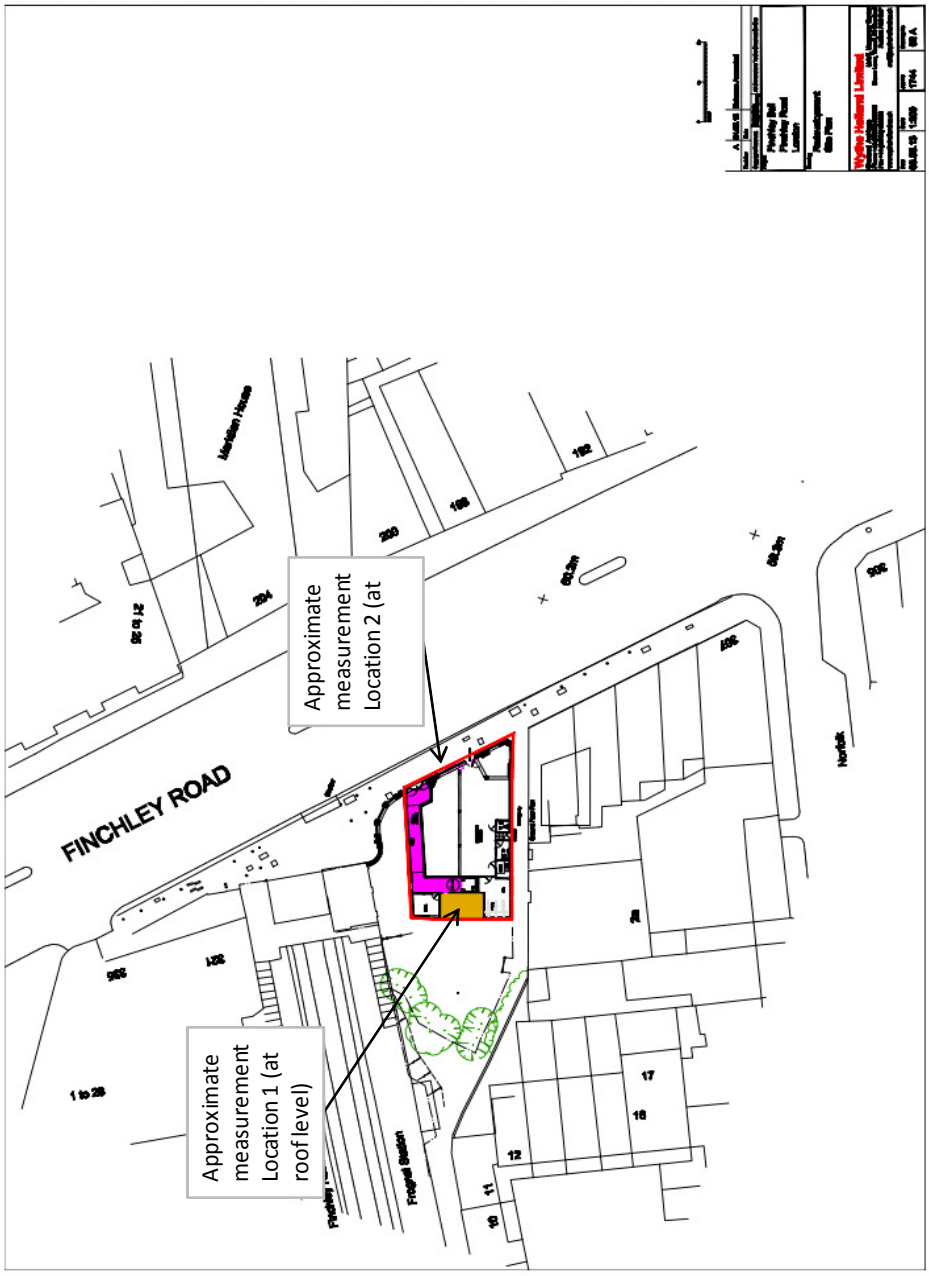

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Figure 1 - Site plan and approximate measurement locations

Appendix I – Noise Units and Indices

a) Sound Pressure Level and the decibel (dB)

A sound wave is a small fluctuation of atmospheric pressure. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the values into manageable numbers. Although it might seem unusual to use a logarithmic scale to measure a physical phenomenon, it has been found that human hearing also responds to sound in an approximately logarithmic fashion. The dB (decibel) is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120 dB (threshold of pain).

b) Frequency and hertz (Hz)

As well as the loudness of a sound, the frequency content of a sound is also very important. Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or hertz (Hz). Sometimes large frequency values are written as kilohertz (kHz), where 1 kHz = 1000 Hz.

Young people with normal hearing can hear frequencies in the range 20 Hz to 20,000 Hz. However, the upper frequency limit gradually reduces as a person gets older.

c) Glossary of Terms

When a noise level is constant and does not fluctuate over time, it can be described adequately by measuring the dB(A) level. However, when the noise level varies with time, the measured dB(A) level will vary as well. In this case it is therefore not possible to represent the noise climate with a simple dB(A) value. In order to describe noise where the level is continuously varying, a number of other indices, including statistical parameters, are used. The indices used in this report are described below.

L_{Aeq} This is the A-weighted 'equivalent continuous noise level' which is an average of the total sound energy measured over a specified time period. In other words, L_{Aeq} is the

level of a continuous noise which has the same total (A-weighted) energy as the real fluctuating noise, measured over the same time period. It is increasingly being used as the preferred parameter for all forms of environmental noise.

L_{Amax} This is the maximum A-weighted noise level that was recorded during the monitoring period.

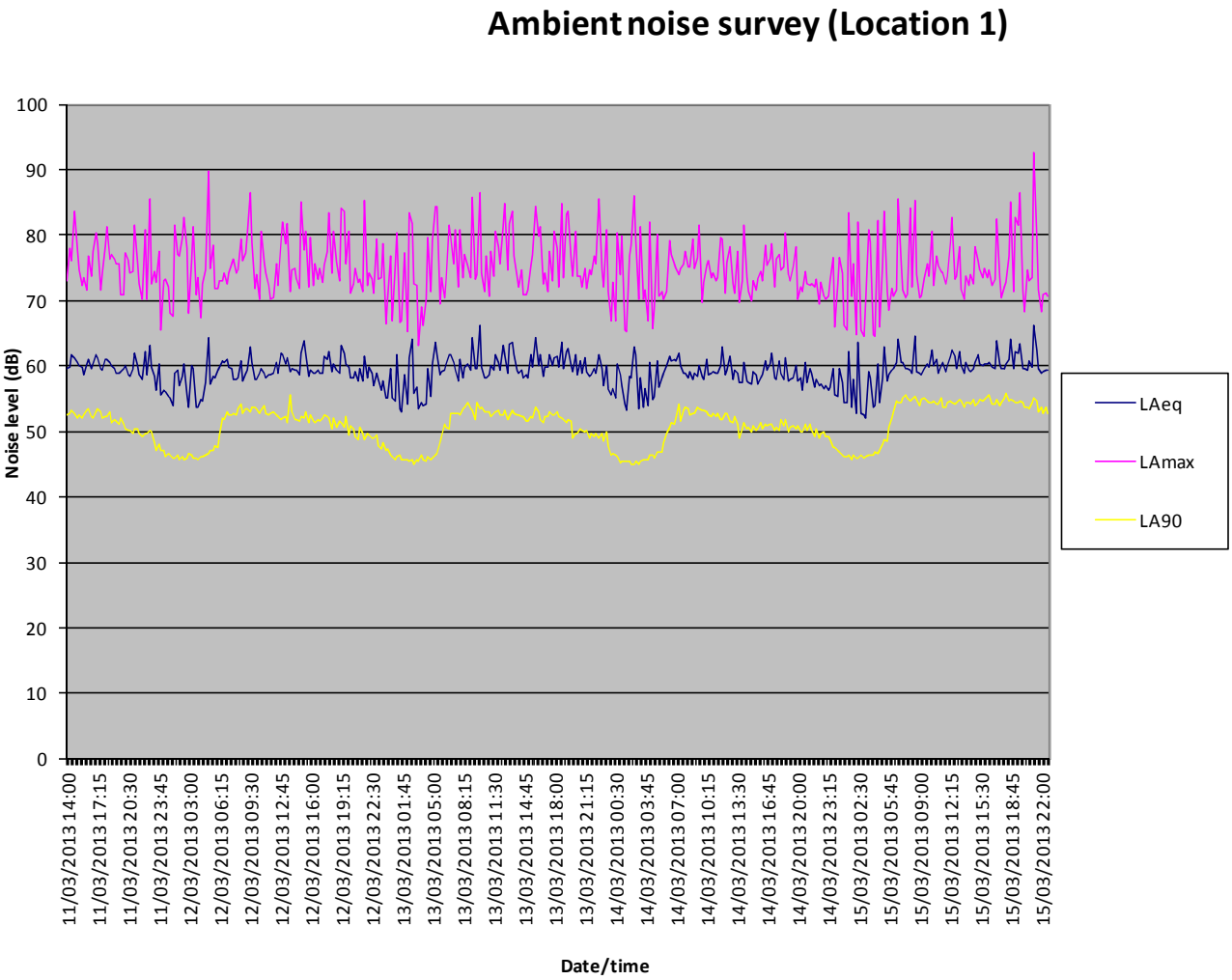
L_{A10} This the A-weighted noise level exceeded for 10% of the time period. L_{A10} is used as a measure of traffic noise.

L_{A90} This is the A-weighted noise level exceeded for 90% of the time period. L_{A90} is used as a measure of background noise.

Appendix II – Results of Noise Surveys

Dates:	Monday 11 to Friday 15 March 2013
Equipment:	Rion NL-31 Type 1 integrating sound level meter
Weather:	Mainly dry with some light snow shower on Monday 11 and Tuesday 12 March 2013. Wind speeds below 5 m/s.

Continuous Noise Measurements at Location 1



Dates: Monday 11, Tuesday 12 and Wednesday 13 March 2013

Equipment: Bruel & Kjaer 2260 Type 1 integrating sound level meter

Weather: Dry with wind speed below 5m/s

Table A1: Attended noise measurements – Location 1

Measurement Period	Date	Time start	Time end	$L_{Amax,F}$	$L_{Amax,S}$	L_{A10}	L_{Aeq}	L_{A90}
Daytime	11/03/2013	13:30	13:45	74.0	70.5	62.4	59.7	52.0
		14:30	14:45	74.9	73.4	61.8	59.7	53.0
		15:30	15:46	83.3	81.6	62.4	62.1	51.8

Table A2: Attended noise measurements – Location 2

Measurement Period	Date	Time start	Time end	$L_{Amax,F}$	$L_{Amax,S}$	L_{A10}	L_{Aeq}	L_{A90}
Daytime	11/03/2013	13:00	13:15	86.8	84.7	79.4	75.9	65.2
		14:00	14:15	96.0	91.6	79.6	77.2	66.0
		15:00	15:15	94.5	93.2	79.0	76.6	67.0
Night-time	12/03/2013	23:00	23:05	84.3	82.3	77.0	73.0	57.2
		23:05	23:10	87.3	83.5	78.4	75.3	60.4
		23:10	23:15	83.2	82.2	77.6	73.6	53.4
		23:15	23:20	83.8	82.2	77.8	73.4	55.8
		23:20	23:25	84.2	81.9	77.6	73.1	56.4
		23:25	23:30	85.0	83.5	78.0	73.9	57.2
		23:30	23:35	82.5	81.1	78.0	72.	50.8
		23:35	23:40	87.9	85.1	78.2	74.1	54.0
		23:40	23:46	82.5	81.4	76.4	72.6	57.0
		23:46	23:51	82.9	81.0	77.4	73.0	56.4
		23:51	23:56	84.7	82.2	77.6	73.4	58.8
		23:56	00:01	85.2	82.5	78.2	73.7	53.8
Night-time	13/03/2013	00:01	00:06	83.7	81.6	77.2	72.8	56.6

Measurement Period	Date	Time start	Time end	$L_{Amax,F}$	$L_{Amax,S}$	L_{A10}	L_{Aeq}	L_{A90}
Night-time	13/03/2013	00:06	00:11	82.8	80.8	75.8	71.1	50.6
		00:11	00:16	92.7	88.4	78.6	74.8	52.6
		00:16	00:21	82.1	80.8	77.2	72.5	54.0
		00:21	00:26	85.9	81.8	76.4	72.7	54.4
		00:26	00:31	82.6	81.1	77.2	72.3	53.2
		00:31	00:36	83.5	80.3	76.2	71.2	51.0
		00:36	00:41	85.1	83.3	77.6	73.6	52.2
		00:41	00:46	82.6	81.3	75.8	70.9	50.0
		00:46	00:51	87.8	85.3	76.8	72.6	55.6
		00:51	00:56	86.5	84.1	77.2	72.6	51.6
		00:56	01:01	83.2	81.4	77.0	72.1	52.2

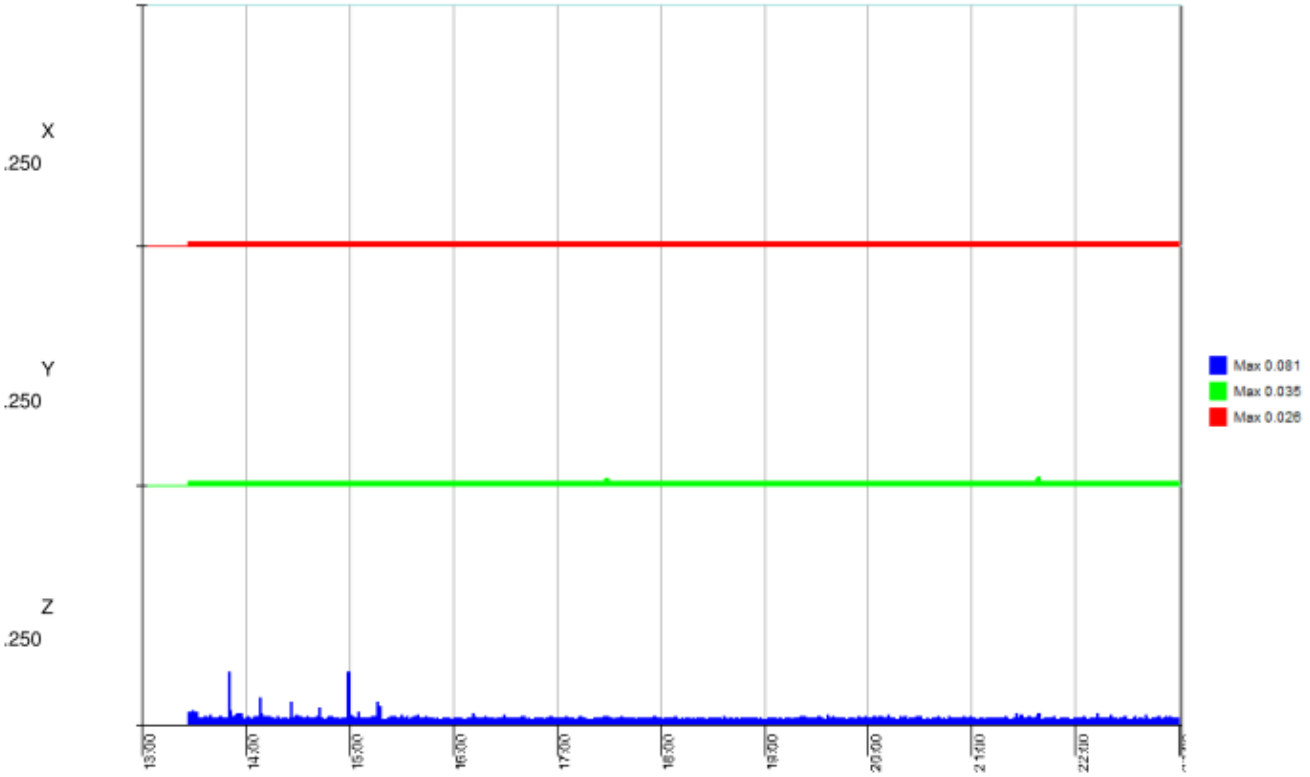
Vibration Measurements

Dates: Between 1330-2300 hours on Monday 11 March 2013

Equipment: Vibrock V901-02 Triaxial vibration recorder

Vibrock V901-VDV transsducer

Table A3: Continuous vibration measurement



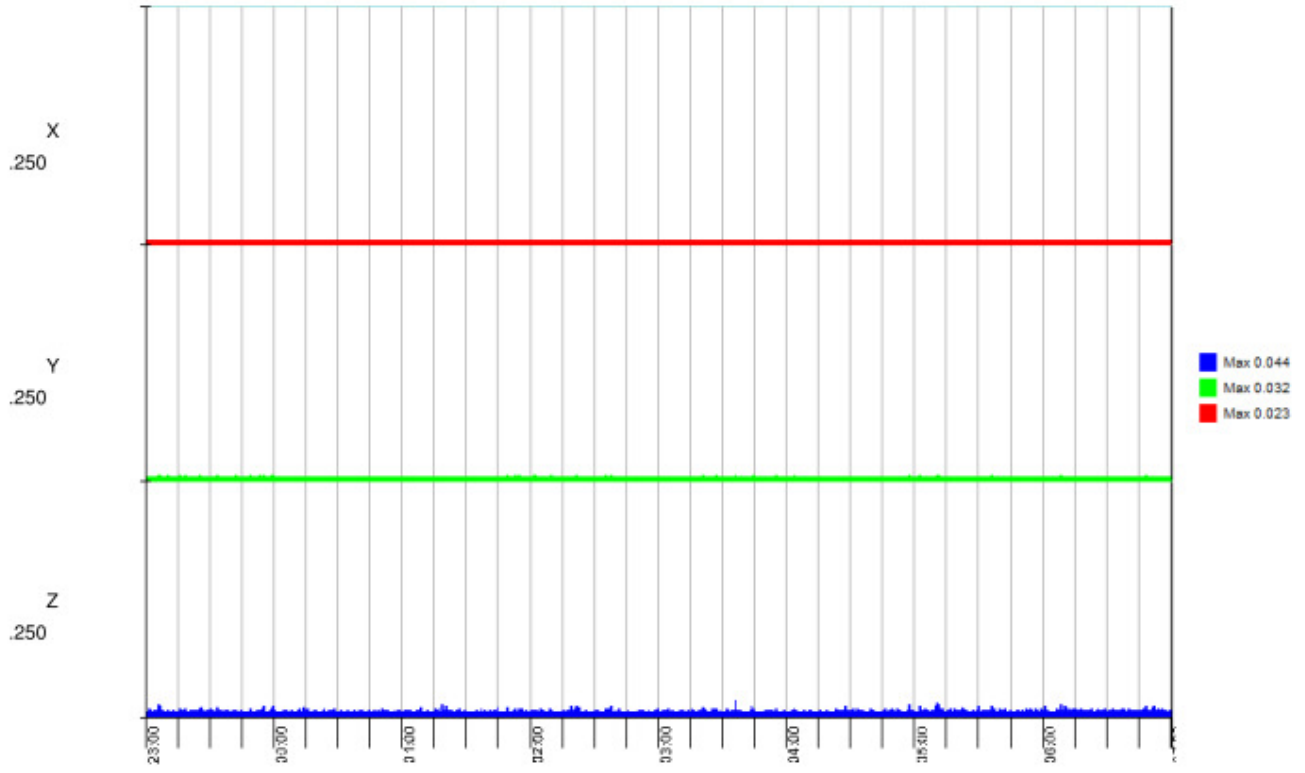
Event 000	X	Y	Z	X	Y	Z
		16 Hour				
	.026	.035	.081			
		1 Hour			Total	
Hour 1	.013	.014	.066	.011	.012	.057
Hour 2	.013	.015	.058	.014	.017	.068
Hour 3	.013	.016	.032	.016	.019	.069
Hour 4	.013	.017	.025	.018	.022	.070
Hour 5	.013	.017	.024	.019	.024	.070
Hour 6	.013	.017	.023	.020	.025	.070
Hour 7	.013	.018	.024	.021	.027	.070
Hour 8	.013	.018	.024	.022	.028	.071
Hour 9	.013	.019	.025	.023	.030	.071
Hour 10	.013	.019	.025	.023	.031	.071

Dates: Between 2300 hours on Monday 11 and 0700 hours on Tuesday 12 March 2013

Equipment: Vibrock V901-02 Triaxial vibration recorder

Vibrock V901-VDV transducer

Table A4: Continuous vibration measurement



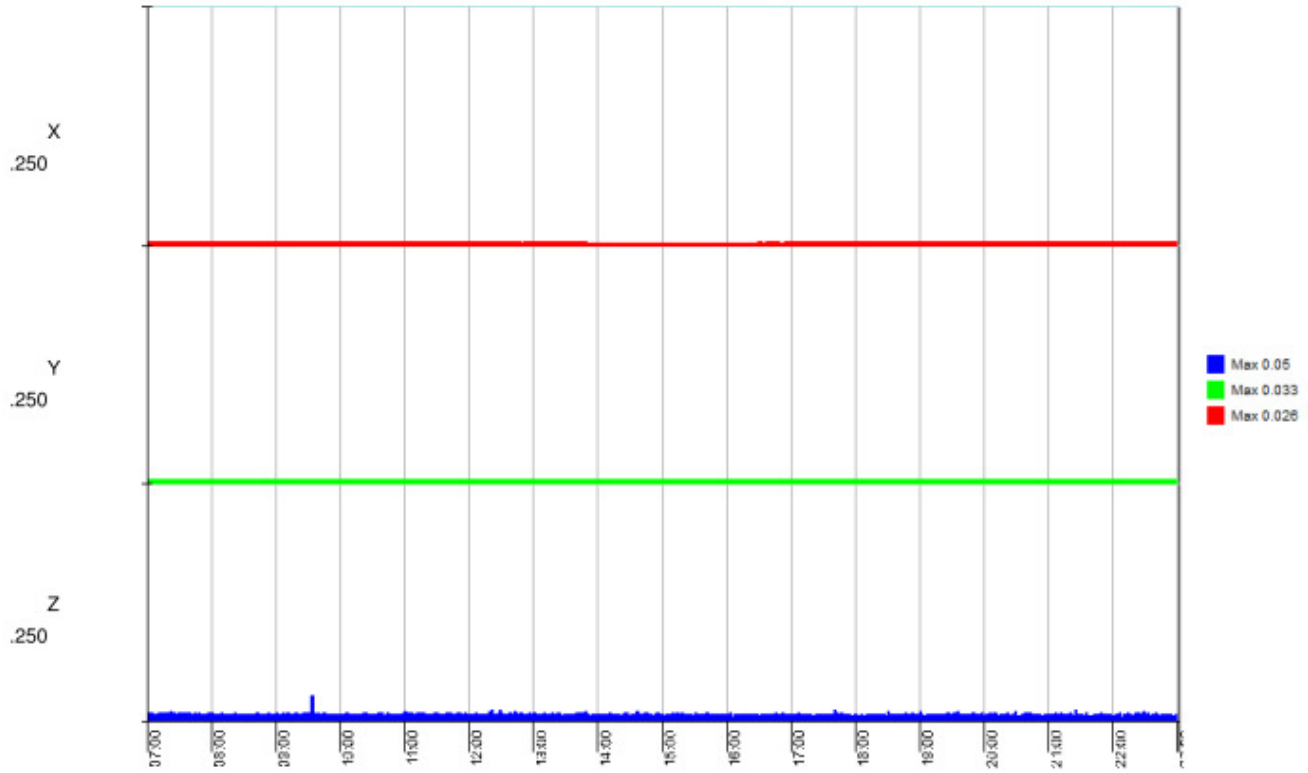
Event 001	X	Y	Z	X	Y	Z
		8 Hour				
	.023	.032	.044			
		1 Hour			Total	
Hour 1	.013	.019	.026	.013	.019	.026
Hour 2	.013	.019	.023	.016	.022	.029
Hour 3	.013	.019	.025	.018	.025	.033
Hour 4	.013	.019	.025	.019	.027	.035
Hour 5	.013	.019	.026	.020	.028	.038
Hour 6	.013	.019	.024	.021	.030	.039
Hour 7	.013	.019	.027	.022	.031	.042
Hour 8	.013	.019	.028	.023	.032	.044

Dates: Between 0700-2300 hours on Tuesday 12 March 2013

Equipment: Vibrock V901-02 Triaxial vibration recorder

Vibrock V901-VDV transducer

Table A5: Continuous vibration measurement



Event 002	X	Y	Z	X	Y	Z
		16 Hour				
	.026	.033	.050			
		1 Hour			Total	
Hour 1	.013	.019	.027	.013	.019	.027
Hour 2	.013	.018	.024	.016	.022	.031
Hour 3	.013	.018	.032	.017	.024	.037
Hour 4	.013	.017	.024	.019	.026	.039
Hour 5	.013	.016	.025	.020	.026	.041
Hour 6	.013	.015	.026	.021	.027	.042
Hour 7	.013	.015	.024	.021	.028	.043
Hour 8	.012	.014	.024	.022	.028	.044
Hour 9	.012	.014	.023	.022	.029	.045
Hour 10	.013	.015	.023	.023	.029	.046
Hour 11	.013	.015	.023	.024	.030	.047
Hour 12	.013	.015	.022	.024	.030	.047
Hour 13	.013	.016	.024	.025	.031	.048
Hour 14	.013	.016	.023	.025	.031	.049
Hour 15	.013	.016	.023	.026	.032	.049
Hour 16	.013	.016	.023	.026	.033	.050

Dates: Between 2300 hours on Tuesday 12 and 0700 hours on Wednesday 13 March 2013

Equipment: Vibrock V901-02 Triaxial vibration recorder

Vibrock V901-VDV transducer

Table A6: Continuous vibration measurement

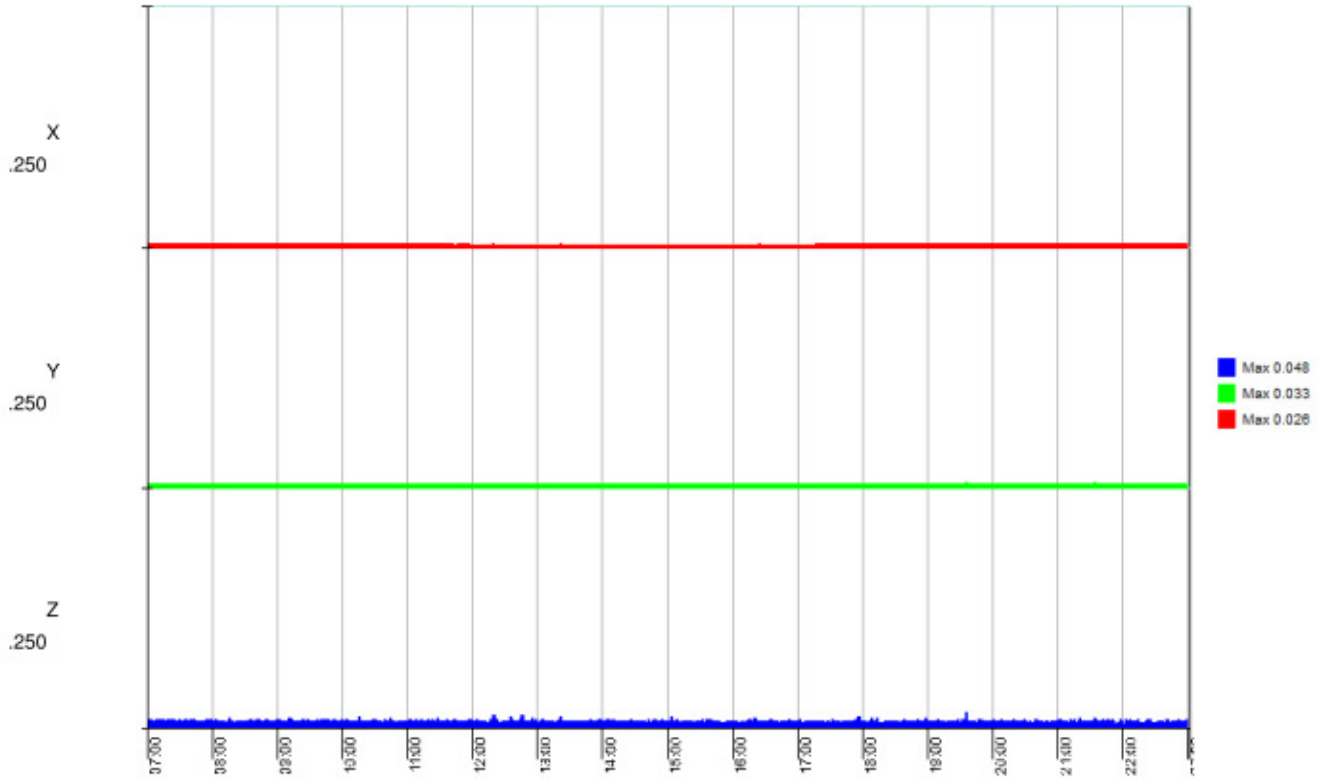
Event 003	X	Y	Z	X	Y	Z
		8 Hour				
	.022	.030	.043			
		1 Hour			Total	
Hour 1	.013	.017	.022	.013	.017	.022
Hour 2	.013	.017	.023	.015	.020	.027
Hour 3	.013	.017	.029	.017	.022	.033
Hour 4	.013	.017	.026	.019	.024	.036
Hour 5	.013	.018	.023	.020	.026	.037
Hour 6	.013	.018	.024	.021	.028	.039
Hour 7	.013	.019	.028	.021	.029	.042
Hour 8	.013	.019	.027	.022	.030	.043

Dates: Between 0700-2300 hours on Wednesday 13 March 2013

Equipment: Vibrock V901-02 Triaxial vibration recorder

Vibrock V901-VDV transducer

Table A7: Continuous vibration measurement



Event 004	X	Y	Z	X	Y	Z
		16 Hour				
	.026	.033	.048			
		1 Hour			Total	
Hour 1	.013	.018	.026	.013	.018	.026
Hour 2	.013	.017	.024	.016	.021	.030
Hour 3	.013	.017	.025	.017	.023	.033
Hour 4	.013	.016	.024	.019	.025	.035
Hour 5	.013	.015	.024	.020	.025	.037
Hour 6	.012	.015	.026	.020	.026	.039
Hour 7	.012	.014	.024	.021	.027	.041
Hour 8	.012	.015	.023	.022	.027	.042
Hour 9	.011	.014	.023	.022	.028	.043
Hour 10	.012	.015	.023	.023	.028	.044
Hour 11	.013	.015	.022	.023	.029	.044
Hour 12	.013	.016	.023	.024	.030	.045
Hour 13	.013	.017	.025	.024	.030	.046
Hour 14	.013	.017	.023	.025	.031	.047
Hour 15	.013	.017	.024	.025	.032	.048
Hour 16	.013	.017	.023	.026	.033	.048

Dates: Between 2300 hours on Wednesday 13 and 0700 hours on Thursday 14 March 2013

Equipment: Vibrock V901-02 Triaxial vibration recorder

Vibrock V901-VDV transducer

Table A8: Continuous vibration measurement

Event 005	X	Y	Z	X	Y	Z
		8 Hour				
	.022	.033	.043			
		1 Hour			Total	
Hour 1	.013	.018	.025	.013	.018	.025
Hour 2	.013	.019	.023	.016	.022	.029
Hour 3	.013	.019	.023	.017	.025	.032
Hour 4	.013	.019	.028	.019	.027	.036
Hour 5	.013	.019	.023	.020	.028	.037
Hour 6	.013	.020	.024	.021	.030	.039
Hour 7	.013	.020	.026	.022	.031	.041
Hour 8	.013	.020	.028	.022	.033	.043

Dates: Between 0700-2300 hours on Thursday 14 March 2013

Equipment: Vibrock V901-02 Triaxial vibration recorder

Vibrock V901-VDV transducer

Table A9: Continuous vibration measurement

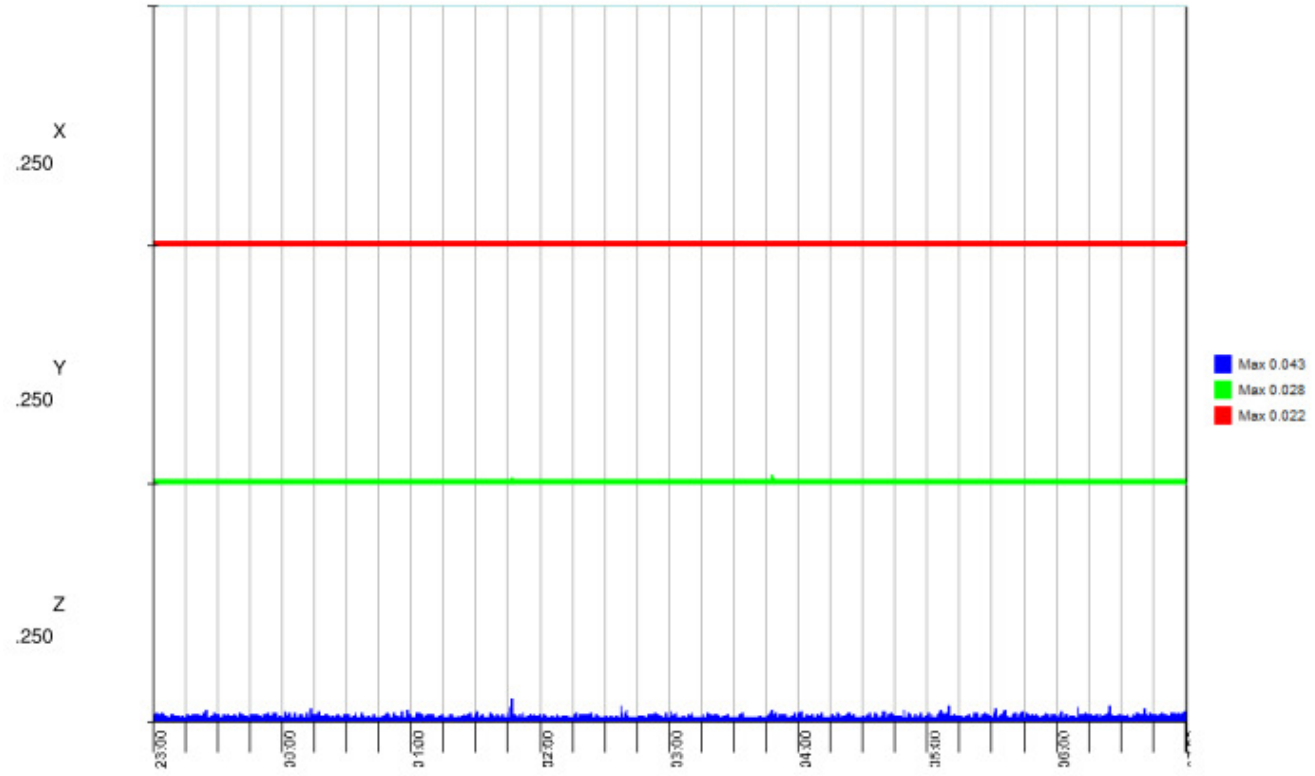
Event 006	X	Y	Z	X	Y	Z
		16 Hour				
	.026	.033	.048			
		1 Hour			Total	
Hour 1	.013	.020	.027	.013	.020	.027
Hour 2	.013	.019	.025	.016	.023	.031
Hour 3	.013	.018	.025	.017	.025	.034
Hour 4	.013	.017	.024	.019	.026	.036
Hour 5	.013	.016	.023	.020	.027	.037
Hour 6	.013	.015	.025	.021	.028	.039
Hour 7	.012	.015	.024	.021	.029	.041
Hour 8	.011	.014	.023	.022	.029	.042
Hour 9	.011	.013	.023	.022	.029	.043
Hour 10	.011	.014	.024	.023	.030	.044
Hour 11	.012	.016	.024	.023	.030	.045
Hour 12	.013	.015	.023	.024	.031	.045
Hour 13	.013	.015	.023	.024	.031	.046
Hour 14	.013	.015	.023	.025	.032	.047
Hour 15	.013	.015	.023	.025	.032	.048
Hour 16	.013	.015	.023	.026	.033	.048

Dates: Between 2300 hours on Thursday 14 and 0700 hours on Friday 15 March 2013

Equipment: Vibrock V901-02 Triaxial vibration recorder

Vibrock V901-VDV transducer

Table A10: Continuous vibration measurement



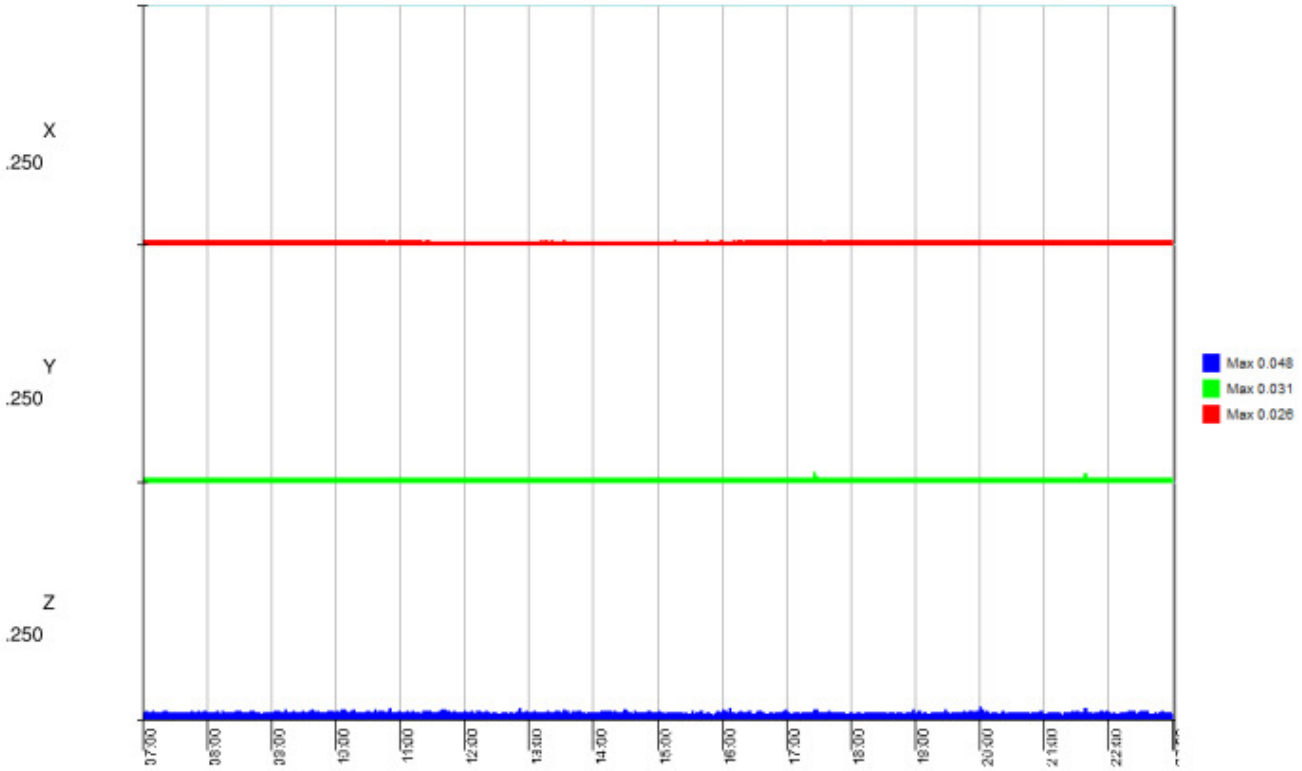
Event 007	X	Y	Z	X	Y	Z
		8 Hour				
	.022	.028	.043			
		1 Hour			Total	
Hour 1	.013	.016	.023	.013	.016	.023
Hour 2	.013	.016	.024	.015	.019	.028
Hour 3	.013	.016	.029	.017	.022	.034
Hour 4	.013	.017	.024	.018	.023	.036
Hour 5	.013	.017	.022	.020	.025	.037
Hour 6	.013	.017	.023	.021	.026	.039
Hour 7	.013	.017	.026	.021	.027	.041
Hour 8	.013	.017	.027	.022	.028	.043

Dates: Between 0700-2300 hours Friday 15 March 2013

Equipment: Vibrock V901-02 Triaxial vibration recorder

Vibrock V901-VDV transducer

Table A11: Continuous vibration measurement



Event 008	X	Y	Z	X	Y	Z
		16 Hour				
	.026	.031	.048			
		1 Hour			Total	
Hour 1	.013	.016	.024	.013	.016	.024
Hour 2	.013	.016	.023	.015	.019	.028
Hour 3	.013	.015	.025	.017	.021	.032
Hour 4	.013	.015	.026	.018	.022	.035
Hour 5	.013	.015	.025	.019	.023	.037
Hour 6	.012	.015	.024	.020	.024	.039
Hour 7	.012	.015	.024	.021	.025	.040
Hour 8	.012	.015	.024	.022	.026	.041
Hour 9	.012	.015	.022	.022	.027	.042
Hour 10	.013	.015	.024	.023	.027	.043
Hour 11	.013	.016	.023	.023	.028	.044
Hour 12	.013	.015	.022	.024	.029	.045
Hour 13	.013	.015	.023	.025	.029	.046
Hour 14	.013	.015	.024	.025	.030	.046
Hour 15	.013	.016	.023	.026	.031	.047
Hour 16	.013	.015	.023	.026	.031	.048