SANDY BROWN

Consultants in Acoustics, Noise & Vibration

16327-R01-B

7 September 2016

75 Farringdon Road

Planning noise and vibration report

55 Charterhouse Street, London EC1M 6HA T: +44 (0)20 7549 3500
68 Sackville Street, Manchester M1 3NJ T: +44 (0)161 771 2020
2 Walker Street, Edinburgh EH3 7LA T: +44 (0)131 235 2020 **post@sandybrown.com**
35 St Paul's Square, Birmingham B3 1QX T: +44 (0)121 227 5020 **www.sandybrown.com**

Sandy Brown Associates LLP
Registered in England & Wales No. OC 307504 Registered Office: 55 Charterhouse Street, London EC1M 6HA

Version	Date	Comments	Author	Reviewer
A	24 Aug 16		Ben Southgate	Daniel Stringer
B	7 Sep 16	Incorporating Hanover Cube comments	Ben Southgate	Daniel Stringer

Summary

Sandy Brown (SB) has been commissioned by St James's Place Property Unit Trust to provide acoustic advice in relation to the proposed re-development of 75 Farringdon Road.

An environmental noise and vibration survey has been carried out at the site. The noise survey was performed between 11 August 2016 and 15 August 2016. The vibration survey was performed on 15 August 2016.

The lowest background sound levels measured during the survey were $L_{A90,15min}$ 54 dB during the daytime, $L_{A90,15min}$ 55 dB during the evening and $L_{A90,15min}$ 53 dB at night.

Based on the requirements of the London Borough of Camden and on the results of the noise survey, all plant must be designed such that the cumulative noise level at 1 m from the worst affected windows of the nearby noise sensitive premises does not exceed L_{Aeq} 49 dB during the daytime, L_{Aeq} 50 dB during the evening and L_{Aeq} 48 dB during the night.

The vibration survey indicated that tactile vibration and structure borne noise are not considered to be an issue at this site.

Contents

1 Introduction

Sandy Brown (SB) has been commissioned by St James's Place Property Unit Trust to provide acoustic advice in relation to the proposed re-development of 75 Farringdon Road.

An environmental noise survey has been carried out, the purpose of which was to establish the existing ambient and background sound levels in the vicinity of the site and nearby noise sensitive premises, as well as the vibration levels affecting the site.

The background sound levels measured during the survey are used as the basis for setting limits for noise emission from proposed building services plant. These limits are set in accordance with the requirements of the London Borough of Camden (LBC).

A vibration survey was performed with the objective of assessing the degree to which the proposed development will be affected by tactile vibration (with reference to BS 6472:2008 *Evaluation of Human Exposure to Vibration in Buildings – Part 1: Vibration from sources other than blasting*) and re-radiated noise from train movements along the nearby railway tracks that run parallel to the site.

This report presents the noise and vibration survey methods, the results of the surveys and a discussion of acceptable limits for noise emission from building services plant. An assessment of tactile vibration and ground-borne noise levels is also provided.

2 Site description

2.1 The site and its surroundings

The site location in relation to its surroundings is shown in Figure 1. The site is located on the corner of Farringdon Road and St. Cross Street and is approximately 40 m from the train lines into Farringdon station at its nearest.

Farringdon Road (to the east) is a busy road whilst St. Cross Street (to the south) is a quiet back street. The site is highlighted in red in Figure 1, with the nearby rail lines shown in green.

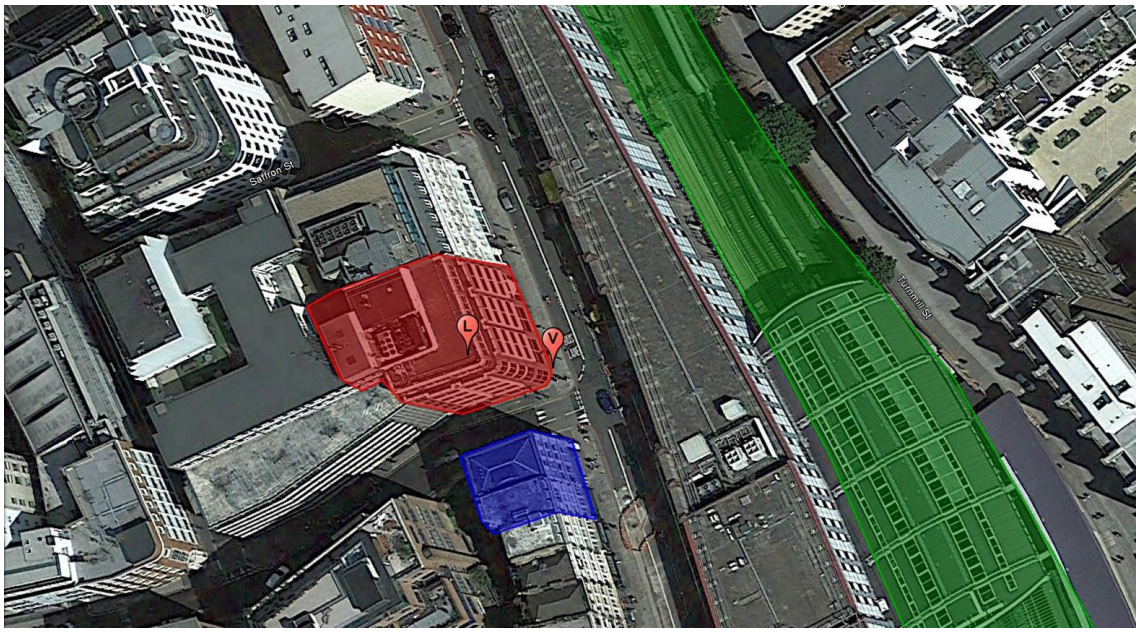


Figure 1 The site in relation to its surroundings (courtesy of Google Earth Pro)

2.2 Adjacent premises

The site is adjoined to 77 Farringdon Road to the north which consists of a restaurant and offices, whilst the adjoining building to the west is a multi-storey car park along St. Cross Street with offices above.

The nearest noise sensitive receiver is considered to be the fourth floor flat at 73 Farringdon Road (highlighted blue in Figure 1).

3 Method

Details of the equipment used, the noise indices and the weather conditions during the survey are provided in Appendix A. Further information on the specific survey method is provided in this section.

3.1 Unattended noise survey method

Unattended noise monitoring was undertaken at the site over 5 days to determine the existing background sound levels in the vicinity of nearby noise sensitive premises.

The unattended measurements were performed over 15 minute periods between 15:53 on 11 August 2016 and 16:08 on 15 August 2016. The equipment was installed by Ben Southgate and Rob Conetta and collected by Ben Southgate.

The measurement position used during the survey is indicated in Figure 1, denoted by the letter 'L'. A photograph showing the measurement location is provided in Figure 2. This location was chosen to be reasonably representative of the noise levels experienced by the nearest noise sensitive premises, and also of night maximum noise levels experienced at the site.

Figure 2 Photograph of unattended measurement position

3.2 Vibration survey method

Vibration measurements were performed at the lower ground level of the building in order to determine the maximum vibration levels from the passage of trains on the railway tracks near to the site. The vibration measurement location is indicated in Figure 1 with the letter 'V'.

For the vibration measurements, tri-axial accelerometers were set up, to measure vibration dose values (VDV) and 1/3 octave band slow weighted RMS acceleration in three axes. The VDV measurements were taken to establish levels of tactile vibration while the 1/3 octave band slow weighted RMS acceleration measurements were used for purposes of the re-radiated L_{ASmax} prediction.

These measurements were performed in the mid-afternoon period of 15 August 2016. Notes on the number and timings of train pass-bys were made at Farringdon station at the same time as the measurements were taken in order to correlate the levels of the measurements with the train activities.

The vibration measurements performed are considered to be a worst case and representative of the vibration levels to be experienced in the re-developed office spaces. A photograph of the measurement location is given in Figure 3.

Figure 3 Photograph of vibration measurement equipment set up

The accelerometers were fixed to a tri-axial block which was in turn fixed the floor using beeswax, away from the boundaries of the room.

The measurements were conducted in three axes as follows:

- X axis - Horizontal vibration approximately parallel to the railway tracks;
- Y axis - Horizontal vibration approximately perpendicular to the railway tracks;
- Z axis - Vertical vibration.

4 Measurement results

4.1 Observations

The dominant noise sources observed at the site during the survey consisted of road traffic noise, railway noise and plant noise from roof-top building services plant.

Less significant noise sources included construction noise.

4.2 Noise measurement results

The results of the unattended noise measurements are summarised in the following tables. A graph showing the results of the unattended measurements is provided in Appendix B.

The day and night time ambient noise levels measured during the unattended survey are presented in Table 1. These measurements were considered to be free-field.

Table 1 Ambient noise levels measured during the survey

Date	Daytime (07:00 – 19:00) $L_{Aeq,12h}$ (dB)	Evening (19:00 – 23:00) $L_{Aeq,4h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
Thursday 11 August 2016	-	60	59
Friday 12 August 2016	63	62	59
Saturday 13 August 2016	60	58	58
Sunday 14 August 2016	59	59	59
Average	61	60	59

The minimum background sound levels measured during the unattended survey are given in Table 2.

Table 2 Minimum background sound levels measured during the survey

Date	Daytime (07:00 – 19:00) $L_{A90,15min}$ (dB)	Evening (19:00 – 23:00) $L_{A90,15min}$ (dB)	Night (23:00 – 07:00) $L_{A90,15min}$ (dB)
Thursday 11 August 2016	59 *	56	54
Friday 12 August 2016	58	56	54
Saturday 13 August 2016	54	55	54
Sunday 14 August 2016	54	55	53
Monday 15 August 2016	57 *	-	-

* Measurement not made over full period due to monitoring start and end time

The lowest background sound levels measured during the survey were $L_{A90,15min}$ 54 dB during the daytime, $L_{A90,15min}$ 55 dB during the evening and $L_{A90,15min}$ 53 dB at night.

4.3 Vibration measurement results

4.3.1 Tactile vibration measurements

A time history of the consecutive 1 minute vibration dose values in the worst case Z axis measured on the lower ground level of the site is shown in Figure 4. These measurements were performed between 15:24 and 16:01 on 15 August 2016 and are considered representative of the vibration levels to be experienced by the proposed re-development. Based on the time history seen, the worst case level measured was VDV_b 0.007 $m/s^{1.75}$.

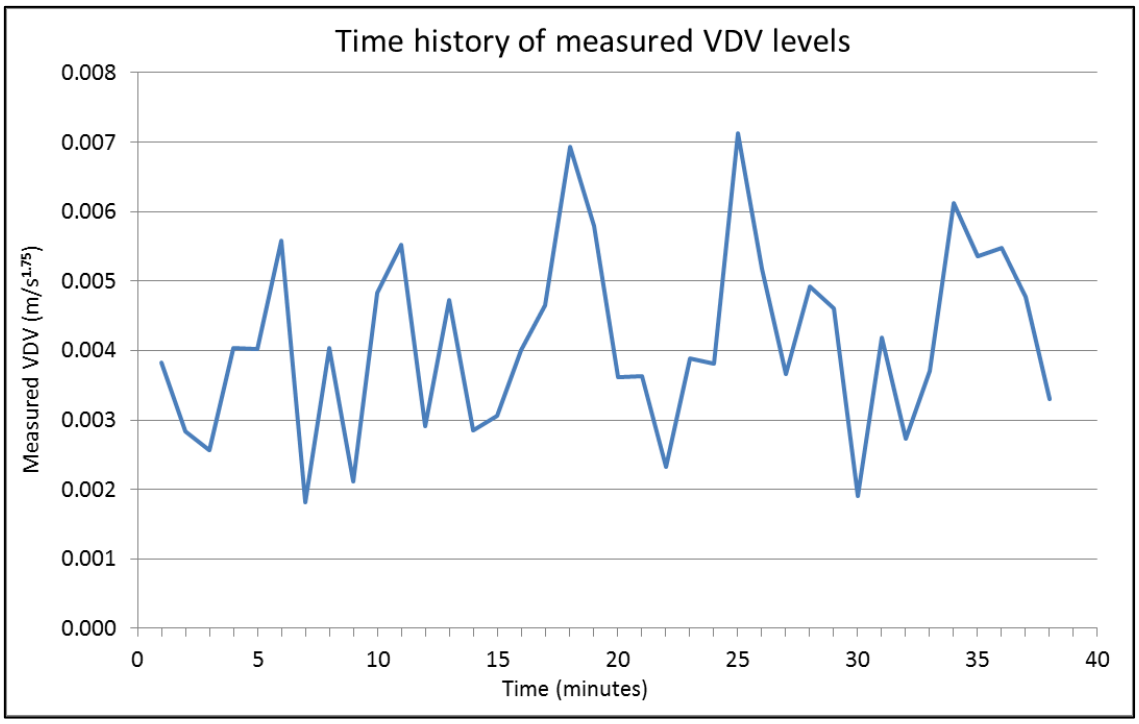


Figure 4 Time history of measured VDV levels

4.3.2 Re-radiated noise measurements

Ground-borne noise within the proposed development was predicted using an empirical formula described in '*Guidelines for the Measurement & Assessment of Groundborne Noise and Vibration (2nd Edition)*' published by the Association of Noise Consultants in 2012.

A time history of the predicted re-radiated noise in each consecutive 1 minute measurement interval throughout the measurement period is shown in Figure 5. It is considered that levels below L_{Amax} 22 dB do not include a train event within the measurement interval. A re-radiated noise range of L_{Amax} 22-32 dB can therefore be considered typical.

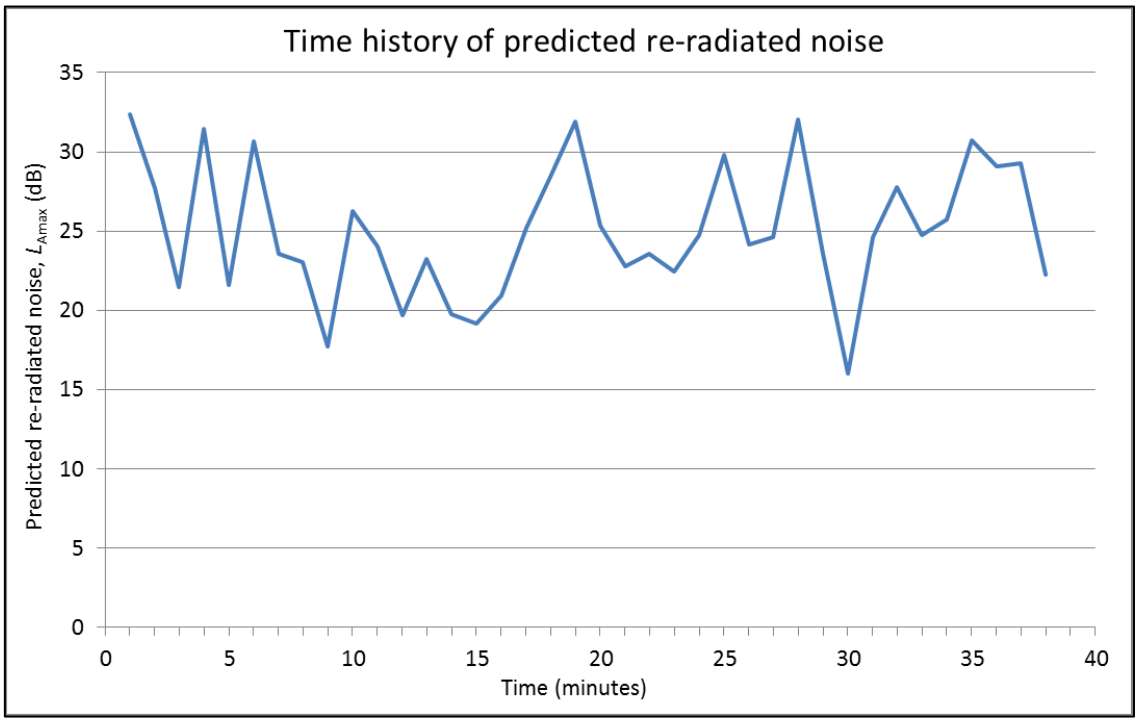


Figure 5 Time history of predicted re-radiated noise

5 Assessment criteria

5.1 NPPF and NPSE

The National Planning Policy Framework (NPPF) sets out the government planning requirements, and supersedes previous guidance notes such as PPG24. No specific noise criteria are set out in the NPPF, or in the Noise Policy Statement for England (NPSE) to which it refers.

The NPPF states:

'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; and*
- *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.'*

The NPSE states that its aims are as follows:

'Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvement of health and quality of life.'*

As such, although neither of these documents sets out specific acoustic criteria for new residential development, the requirement to control both the effect of existing noise on the new development and the effect of noise from the development on the surroundings needs to be considered.

5.2 External noise levels – noise egress

5.2.1 Standard guidance

Guidance for noise emission from proposed new items of building services plant is given in BS 4142: 2014 '*Methods for rating and assessing industrial and commercial sound*'.

BS 4142 provides a method for assessing noise from items such as building services plant against the existing background sound levels at the nearest noise sensitive.

BS 4142 suggests that if the noise level is 10 dB or more higher than the existing background sound level, it is likely to be an indication of a significant adverse impact. If the level is 5 dB above the existing background sound level, it is likely to be an indication of an adverse impact. If the level does not exceed the background level, it is an indication of having a low impact.

If the noise contains 'attention catching features' such as tones, bangs etc, a penalty, based on the type and impact of those features, is applied.

5.2.2 Local Authority criteria

The requirements specified by LBC are set out in Table 3.

Table 3 Requirements of LBC

Noise description and location of measurement	Period	Time	Noise level
Noise at 1 metre external to a sensitive facade	Day, evening and night	0000-2400	5 dBA < L_{A90}
Noise that has a distinguishable note (whine, hiss, screech, hum) at 1 metre external to a sensitive facade	Day, evening and night	0000-2400	10 dBA < L_{A90}
Noise that has a distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive facade	Day, evening and night	0000-2400	10 dBA < L_{A90}
Noise at 1 metre external to a sensitive facade where L_{A90} > 60 dB	Day, evening and night	0000-2400	L_{Aeq} 55 dB

5.3 Tactile vibration criteria

5.3.1 Standard guidance

Tactile vibration is that which is perceived as mechanical motion. BS 6472-1: 2008 *Guide to Evaluation of Human Exposure to Vibration in Buildings Part 1: Vibration Sources Other Than Blasting* provides procedures for assessing the potential human response to vibration.

Vibration is assessed in terms of the equivalent 'vibration dose value'. This relates the level and duration of vibration.

For information, the BS 6472-1: 2008 assessment table is reproduced below:

Table 4 BS 6472-1: 2008 tactile vibration assessment criteria

Vibration dose values ($m/s^{1.75}$) above which might result in various degrees of adverse comment within residential buildings.			
Place	Low probability of adverse comment	Adverse comment possible	Adverse comment probable
Office buildings 16 hr day	0.4 to 0.8	0.8 to 1.6	1.6 to 3.2

It is important to note that people exhibit wide variations of vibration tolerance. Specific values are dependent upon social and cultural factors, psychological attitudes and expected degree of intrusion.

5.3.2 Local Authority requirements

LBC gives vibration levels on sites adjoining railways and roads at which planning permission will not be granted (taken from BS 6472: 1992). For offices, this level is 0.4 $m/s^{1.75}$ during the day, evening or night, relating to a 'low probability of adverse comment' as seen in Table 4.

5.4 Re-radiated noise criteria

The British Council of Offices (BCO) Guide to Specification 2014 provides guidance in relation to vibration transfer from intermittent sources such as underground trains. It states that re-radiated noise levels in occupied cellular offices and meeting rooms should not exceed L_{AFmax} 45 dB, and should not exceed L_{AFmax} 50 dB in open plan offices.

There is currently no international or British Standard which provides guidance on assessing the impact of ground-borne noise from railways on the occupants of commercial buildings.

6 Plant noise limits – noise egress

6.1 Basic limits

Based on the LBC criteria set out in section 5.2.2 and the measurement results, the cumulative noise level resulting from the operation of all new plant at 1 m from the worst affected windows of the nearest noise sensitive premises should not exceed the limits set out in Table 5.

Table 5 Plant noise limits at 1 m from the nearest noise sensitive premises

Time of day	Maximum sound pressure level at 1 m from noise sensitive premises ($L_{Aeq,15min}$ dB)
Daytime (07:00-19:00)	49
Evening (19:00-23:00)	50
Night-time (23:00-07:00)	48

The limits set out in Table 5 do include any corrections for any attention catching features. As detailed by LBC, these limits will be 5 dBA more stringent if the plant contains attention-catching features.

Emergency plant should meet limits no more than 15 dBA above those set out in Table 5. However, this should only be operational in the case of an emergency or during testing, which should take place during daytime hours.

6.2 Assessment

At this stage, no information is available in relation to the proposed installation of building services plant, and this will need to be assessed in detail as the design progresses. However, all plant items will be designed to achieve the plant noise limits set out above, including any corrections for attention catching features.

7 Vibration assessment

7.1 Tactile vibration

BS 6472 states that the assessment should be based on the axis along which the highest vibration dose value (VDV) is measured. At the measurement location, the highest vibration dose value was measured on the Z axis.

Based on the worst-case measured 1 minute vibration value presented in section 4.3 (VDV 0.007 $m/s^{1.75}$) and on the total daytime period of 07:00 – 23:00, the equivalent vibration dose value over a 16 hour is VDV 0.04 $m/s^{1.75}$.

By comparing this value above with the LBC criterion set out in section 5.3.2 based on BS 6472 guidance, it is clear that tactile vibration is well below the threshold category of 'low probability of adverse comment'.

Levels experienced may vary depending on the type of train however, as the measured vibration levels are below the lowest BS 6472 threshold, a significant increase in the number of trains would be required for the threshold to be exceeded. Tactile vibration due to trains is therefore not considered to be problematic at this site.

7.2 Re-radiated noise

The highest predicted L_{Amax} level was 32 dB which is well below the BCO guidance as presented in section 5.4.

On this basis, ground-borne noise in the proposed re-development is unlikely to result in adverse comment. As the predicted values are for worst case lower ground floor conditions, noise levels from this source are expected to be even lower at upper floor levels.

8 Conclusion

The minimum measured background sound levels were $L_{A90,15min}$ 54 dB during the day, $L_{A90,15min}$ 55 dB during the evening and $L_{A90,15min}$ 53 dB during the night.

On the basis of the requirements of LBC, the relevant plant noise limits at the worst affected existing noise sensitive premises would be L_{Aeq} 49 dB during the day, L_{Aeq} 50 dB during the evening and L_{Aeq} 48 dB during the night. These limits are cumulative, and apply with all plant operating under normal conditions. If plant items contain tonal or attention catching features, the limits will be 5 dBA more stringent than those set out above.

Tactile vibration and structure borne noise are not considered to be an issue at this site.

Appendix A - Survey details

Equipment

The unattended noise measurements were performed using a Svantek 957 sound level meter.

The VDV and 1/3 octave band RMS acceleration measurements were carried out using a Rion DA-20 data recorder.

The calibration details for the equipment used during the survey are provided in Table A1.

Table A1 Equipment calibration data

Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
Sound level meter	SVAN957/12327	Svantek	2 Nov 17	1511575
Microphone	ACO7052H/43273	Svantek	2 Nov 17	1511575
Pre-amp	SV12L/13569	Svantek	2 Nov 17	1511575
Calibrator	SV30A/7451	Svantek	30 Oct 17	1510572
Data Recorder	DA-20/10870889	Rion	7 Sep 17	TCRT15/1252
Accelerometer	PV-87/33827	Rion	8 Sep 17	1509496
Accelerometer	PV-87/33828	Rion	8 Sep 17	1509497
Accelerometer	PV-87/33829	Rion	8 Sep 17	1509498
Vibration calibrator	AT01/3015	AP Technology	8 Sep 17	1509495

Calibration of the meters used for the tests is traceable to national standards. The calibration certificates for the sound level meters used in this survey are available upon request.

The sound and vibration level meters and the respective measurement chains were calibrated at the beginning and end of the measurements using their respective sound level calibrators. No significant calibration deviation occurred.

Noise indices

The equipment was set to record a continuous series of broadband sound pressure levels. Noise indices recorded included the following:

- $L_{Aeq,T}$ The A-weighted equivalent continuous sound pressure level over a period of time, T.
- $L_{AFmax,T}$ The A-weighted maximum sound pressure level that occurred during a given period, T, with a fast time weighting.
- $L_{ASmax,T}$ The A-weighted maximum sound pressure level that occurred during a given period, T, with a slow time weighting.
- $L_{A90,T}$ The A-weighted sound pressure level exceeded for 90% of the measurement period. Indicative of the background sound level.

The L_{A90} is considered most representative of the background sound level for the purposes of complying with any local authority requirements.

Sound pressure level measurements are normally taken with an A-weighting (denoted by a subscript 'A', eg L_{A90}) to approximate the frequency response of the human ear.

A more detailed explanation of these quantities can be found in BS7445: Part 1: 2003 *Description and measurement of environmental noise, Part 1. Guide to quantities and procedures.*

Vibration indices

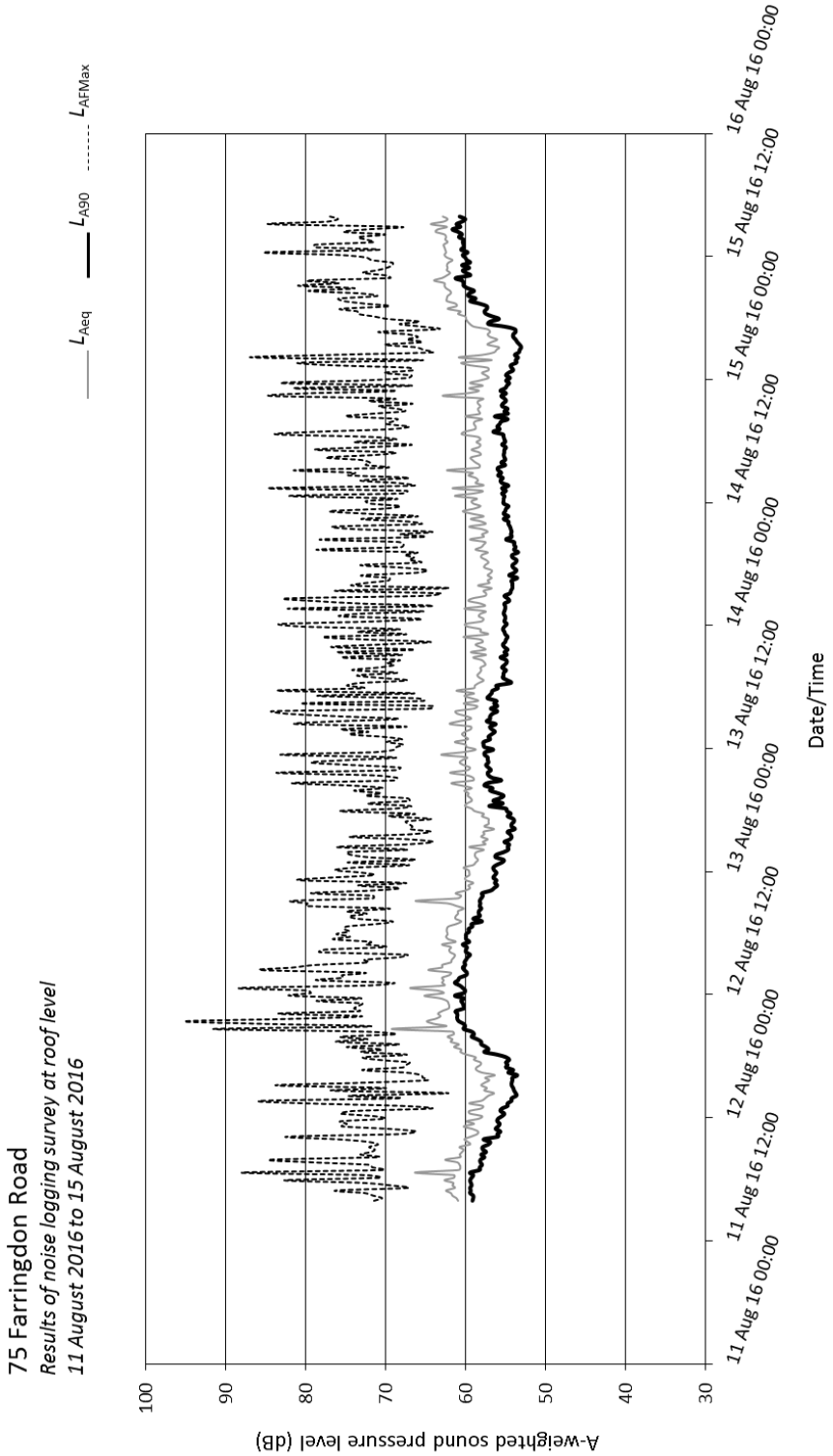
For each measurement period a number of parameters were recorded. The most relevant of these included the vibration dose value (VDV) in each of three axes with the appropriate frequency weightings (as defined in BS 6472-1:2008).

Weather conditions

During the unattended noise measurements between 11 August 2016 and 15 August 2016, weather reports for the area indicated that temperatures varied between 15 °C at night and 28 °C during the day, and the wind speed was less than 5 m/s.

These weather conditions are considered suitable for obtaining representative measurements.

Appendix B - Results of unattended measurements


75 Farringdon Road
Results of noise logging survey at roof level
11 August 2016 to 15 August 2016
L_{Aeq}
L_{A90}
L_{AFMax}
A-weighted sound pressure level (dB)
100
90
80
70
60
50
40
30
11 Aug 16 00:00
11 Aug 16 12:00
12 Aug 16 00:00
12 Aug 16 12:00
13 Aug 16 00:00
13 Aug 16 12:00
14 Aug 16 00:00
14 Aug 16 12:00
15 Aug 16 00:00
15 Aug 16 12:00
16 Aug 16 00:00
Date/Time