Noise Impact Assessment
June 2019
24 Acoustics

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NOISE AND VIBRATION IMPACT ASSESSMENT

Technical Report: R7699-1 Rev 2

Date: 30th May 2019

For: Demar Holdings (BVI) Ltd
c/o Protopapas Solicitors
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24 Acoustics Document Control Sheet

Project Title: 115-119 Camden High Street, London – Noise and Vibration Impact Assessment

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For and on behalf of 24 Acoustics Ltd				

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1.0 INTRODUCTION

1.1 24 Acoustics Ltd has been instructed by Demar Holdings (BVI) Ltd to undertake a noise and vibration impact assessment for the proposed redevelopment of 115-119 Camden High Street, for a hub hotel (by Premier Inn), 3 residential apartments and a retail unit.

1.2 The primary source of noise in the area is road traffic and the site is also affected by noise from nearby licensed premises and vibration from the underground northern line. The scheme will also include new building services plant and a retail unit. Accordingly, this noise and vibration impact assessment has included:

- Environmental noise and vibration monitoring;
- Consideration of noise arising from road traffic and licensed premises affecting the site;
- Assessment of internal noise levels within the proposed accommodation;
- External noise limits for new building services plant;
- Sound insulation requirements between residential and non-residential uses;
- Assessment of the impact of vibration on the site

1.3 This report presents the results of the assessment, following environmental noise and vibration measurements undertaken in January 2019.

1.4 All sound pressure levels quoted in this report are in dB relative to 20 µPa. A glossary of the acoustic terminology used in this report is provided in Appendix A.

2.0 SITE DESCRIPTION

2.1 The site is located at the junction of Camden High Street and Delancey Street in the London Borough of Camden. The site is currently occupied by a two-storey building (with part ancillary basement) used for retail. The site is bounded by existing commercial buildings to the north, Camden High Street to the east, Delancey Street to the south and Signmakers Yard to the west.

2.2 The neighbouring properties on Camden High Street and Delancey Street comprise a mixture of offices, retail units, food outlets and licensed premises, with some residential properties to the rear of the site on Delancey Street. The Blues Kitchen bar and restaurant, which hosts live music events, is located on the opposite side of Delancey Street. The northern underground line is understood to run underneath Camden High Street, in front of the site. An aerial view of the existing site is provided in Figure 1.

2.3 It is proposed to demolish the existing building and construct a new part four, part five storey development, with basement. The new building will comprise a Premier Inn Hub Hotel on the upper floors, with the hotel reception, lounge and back of house areas at ground and basement floors. A retail unit will be provided at ground floor fronting Camden High Street, with three residential apartments provided on the west side of the site, fronting Delancey Street.

2.4 The pedestrian entrances for the hotel and apartments will be from Delancey Street. The proposed site layout is shown in Figure 2.

3.0 STANDARDS AND GUIDANCE

National Planning Policy Framework and Noise Policy Statement for England

3.1 The National Planning Policy Framework (NPPF) [Reference 1], revised in February 2019, states (paragraph 180) in relation to noise that planning policies and decisions should aim to:

- Mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development - and avoid noise giving rise to significant adverse impacts on health and quality of life
- Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason

3.2 The NPPF states that where the operation of an existing business could have a significant adverse effect on new development in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.

3.3 The NPPF also refers to the Noise Policy Statement for England (NPSE) [Reference 2] which is intended to apply to all forms of noise, including environmental noise, neighbour noise and neighbourhood noise. The NPSE sets out the Government's long-term vision to 'promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development' which is supported by the following aims.

- Avoid significant adverse impacts on health and quality of life
- Mitigate and minimise adverse impacts on health and quality of life

3.4 The NPSE defines the concept of a 'significant observed adverse effect level' (SOAEL) as 'the level above which significant adverse effects on health and quality of life occur'. The following guidance is provided within the NPSE:

> *"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."*

3.5 The Planning Practice Guidance (NPPG) [Reference 3] is written to support the NPPF with more specific planning guidance. The PPG reflects the NPSE and states that noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment. It also states that opportunities should be taken, where practicable, to achieve improvements to the acoustic environment. The PPG states that noise can over-ride other planning concerns but should not be considered in isolation from the other economic, social and environmental dimensions of the proposed development.

3.6 The NPPG expands upon the concept of SOAEL (together with Lowest Observable Adverse Effect Level, LOAEL and No Observed Effect Level, NOEL) as introduced in the NPSE and provides a table of noise exposure hierarchy for use in noise impact assessments in the planning system.

3.7 The NPPF, NPSE and NPPG documents do not refer to specific noise criteria. For residential developments 24 Acoustics considers that the spirit of the requirements of the NPPF and NPSE will be complied with if criteria from British Standard 8233: 2014 and guidance from the World Health Organisation are adopted for road traffic noise levels within dwellings. This guidance and criteria for other sources of noise are discussed in the following sections.

<u>Professional Practice Guidance on Planning & Noise (ProPG)</u>

3.8 The Professional Practice Guidance on Planning and Noise (ProPG) [Reference 4] was published jointly by the Association of Noise Consultants, Institute of Acoustics and Chartered Institute of Environmental Health in May 2017. The guidance relates to the consideration of existing sources of transportation noise upon proposed new residential development and strives to:

- Advocate full consideration of the acoustic environment from the earliest possible stage of the development control process
- Encourage the process of good acoustic design in and around new residential developments
- Outline what should be taken into account in deciding planning applications for new noise-sensitive developments0
- Improve understanding of how to determine the extent of potential noise impact and effect, and
- Assist the delivery of sustainable development.

3.9 The guidance describes a recommended approach for new residential development, which includes four key elements of the assessment process, identified below:

(i) Good acoustic design process;
(ii) Internal noise level guidelines;
(iii) External amenity area noise assessment;
(iv) Assessment of other relevant issues.

3.10 It is important to note that the guidance in ProPG does not constitute an official government code of practice and neither replaces nor provides an authoritative interpretation of the law or government policy. It is provided for guidance only and has no formal place within planning legislation.

Local Authority Policy – London Borough of Camden

3.11 Appendix 3 of the Camden Local Plan 2017 [Reference 5] provides threshold criteria for noise and vibration in connection with new developments. For assessing noise from proposed plant and machinery, the Local Plan states the following:

"Where appropriate and within the scope of the document it is expected that British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' (BS 4142) will be used. For such cases a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion)."

3.12 For new developments affected by noise from entertainment and/or plant, the Local Plan recommends the following criteria for internal noise levels:

NR 25 (Leq,15min) within Bedrooms (23:00 – 07:00 hours)
NR 35 (Leq,15min) within All habitable rooms (07:00 – 23:00 hours)

3.13 Table A from the Camden Local Plan states the following criteria for *"vibration levels from uses such as railways, roads, leisure and entertainment premises and/or plant or machinery at which planning permission will not normally be granted"*:

Location	Time	Vibration Dose Value, $m/s^{1.75}$
Dwellings	Day and evening (07:00 – 23:00)	0.2 to 0.4
	Night (23:00 – 07:00)	0.13
Offices	Day, evening and night (00:00 - 24:00)	0.4

Table 1: Camden Local Plan Criteria - Vibration Dose Values and Subjective Response

Premier Inn Specification – Acoustics

3.14 Premier Inn have provided a turnkey specification for the proposed hub hotel [Reference 6], with acoustic performance requirements detailed in Section 2.13 of the document. The relevant performance requirements for external noise intrusion are summarised in Table 2 below.

Time	Noise Level
Daytime (07:00 – 23:00 hrs)	$L_{Aeq,1hour}$ 35 dB
Night-time (23:00 – 07:00 hrs)	$L_{Aeq,1hour}$ 30 dB L_{AFmax} 42 dB (*)

Table 2: Premier Inn – Internal Noise Level Requirements

(*) The maximum criterion applies to all vehicle and railway train passbys and all aircraft flyovers. It also applies to the noise from all street activities including those associated with patrons attending and leaving adjacent, neighbouring or connected entertainment venues; noise associated with commercial and industrial neighbouring premises including delivery activities and process equipment; seagulls and church bells. Genuinely infrequent and unpredictable sources of noise such as car alarms occurring no more than twice a night are excluded.

3.15 The Premier Inn specification also states the following in relation to noise and vibration from other sources:

"Music and patron noise intrusion from inside or outside any adjacent, neighbouring or connected gym, bar/restaurant or nightclub demises, into the guest bedrooms shall be controlled such that this source of noise intrusion is inaudible."

"Internal noise levels in bedrooms from underground railway train movements and re-radiated noise from railway trains not visible from the bedroom window when measured at the bedhead shall not exceed 30 dB LAFmax."

"Noise from any other building services plant serving neighbouring, adjacent or connected demises shall not cause noise levels to exceed NR 20 Leq,5min within any bedroom"

"Vibration within guest bedrooms shall be imperceptible. Guidance on levels of vibration considered being imperceptible to seated standing and resting persons can be found in BS 6472."

3.16 For external noise emissions from building services plant, the Premier Inn specification has the following requirement:

"Noise emission from all plant associated with the hotel shall be designed so as to be at least 5dB below the lowest measured background noise level at night with all plant operating simultaneously at full duty, when measured at the nearest noise sensitive property."

BS 8233:2014 and WHO Guidelines

3.17 BS 8233:2014 [Reference 7] provides design guidance for dwelling houses, flats, rooms in residential use and hotels. For dwellings, the standard recommends that internal noise levels do not exceed 35 dB $L_{Aeq,16\ hour}$ in living rooms and bedrooms during the day, 40 dB $L_{Aeq,\ 16\ hour}$ in dining rooms during the day and 30 dB $L_{Aeq,\ 8\ hour}$ in bedrooms at night.

3.18 For hotels, BS 8233: 2014 recommends that internal noise levels in hotel bedrooms do not exceed 30 to 40 dB $L_{Aeq,\ 1\ hour}$ during the day (07:00 to 23:00), 25 to 35 dB $L_{Aeq,\ 1\ hour}$ at night and also not exceed 45 to 55 dB L_{Amax} at night.

3.19 The standard states that the above limits apply to steady external noise sources without specific character, and also states the following:

"Noise has a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate."

3.20 Additionally, when considering entertainment noise affecting hotel accommodation, the standard states:

> *"Music and patron noise intrusion from inside any adjacent, neighbouring or connected bar/restaurant or nightclub into the guest bedrooms is to be controlled such that it is unlikely to cause disturbance."*

3.21 BS 8233:2014 also notes that "Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night."

3.22 Although the guidelines have no formal standing, the World Health Organisation (WHO) provides guidance on desirable internal noise levels to minimise the risk of sleep disturbance. The WHO 2000 guidelines [Reference 8] suggest internal night-time noise levels not regularly (10 – 15 times per night) exceeding 45 dB $L_{Amax,f}$ for 'a good night's sleep'.

Entertainment Noise

3.23 There is no official guidance for managing noise from entertainment. The Institute of Acoustics' document Good Practice Guide on the Control of Noise from Pubs and Clubs considers the audibility of noise and refers to the Code of Practice on Environmental Noise Control at Concerts. The code considers suitable music noise levels for up to 30 events per year, which is not applicable to this site given the regular events that take place at The Blues Kitchen.

3.24 It is recommended that noise from entertainment sources, as determined inside habitable rooms of the proposed development, be controlled to a maximum of 45 dB $L_{eq\ 63Hz,\ 1\ min}$ and 28 dB $L_{eq\ 125Hz,\ 1\ min}$.

3.25 On the basis that these criteria are achieved, the resulting entertainment noise levels within the proposed development would be controlled to a level unlikely to cause unreasonable disturbance.

BS 4142:2014 Methods for Rating Industrial and Commercial Sound

3.26 BS 4142:2014 [Reference 9] provides a method for rating the effects of industrial and commercial sound on residential areas.

3.27 The standard advocates a comparison between the typical measured L_{A90} background noise level and L_{Aeq} noise level from the source being considered. For rating purposes if the noise source is tonal, intermittent, or otherwise distinctive in character, a rating correction should be applied.

3.28 The standard states that a difference between the rating level and the background level of around +10 dB is an indication of a significant adverse impact, depending on the context and a difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context. Where the rating level does not exceed the background noise level, this is an indication of the specific sound source having a low impact (depending upon the context).

3.29 BS 4142 requires the noise impact to be assessed depending on the context. In relation to situations where background noise levels are low, the standard states *"Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night."*

BS 6472-1: 2008 Guide to Evaluation of Human Exposure to Vibration in Buildings

3.30 The assessment of human response to vibration within buildings is currently guided by BS 6472-1 [Reference 10]. The relevant criteria are summarised below.

3.31 Where vibration occurs as a series of events, as in the case of train pass-bys, BS 6472 indicates that Vibration Dose Values (VDVs) should be used. Human response to vibration in buildings is assessed in terms of VDVs defined over daytime and night-time periods.

3.32 The human body is most sensitive to vibration in the vertical direction (head to foot). The standard defines values of VDV which are likely to cause varying degrees of adverse comment and these are summarised in Table 3.

Place and Time	Vibration Dose Value, $m/s^{1.75}$		
	Low Probability of Adverse Comment	**Adverse Comment Possible**	**Adverse Comment Probable**
Residential 16-hour day (07:00 to 23:00)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential 8-hour night (23:00 to 07:00)	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Table 3: BS 6472 - Vibration Dose Values and Subjective Response

Summary

3.33 Based on the above review of relevant standards, local authority requirements and the Premier Inn specification, the impact of noise and vibration has been assessed using the following criteria:

- Road traffic noise
  - Within apartments, an upper internal daytime level of 35 dB $L_{Aeq, 16\ hour}$, night-time levels of 30 dB $L_{Aeq, 8\ hour}$ and 45 dB $L_{Amax, fast}$ (for regular events).
  - Within hotel bedrooms, an upper internal daytime level of 35 dB $L_{Aeq, 1\ hour}$, night-time levels of 30 dB $L_{Aeq, 1\ hour}$ and 42 dB $L_{Amax, fast}$ as per the Premier Inn specification.
- Entertainment noise
  - Maximum night-time internal levels of 45 dB $L_{eq\ 1\ min,\ 63Hz}$ and 28 dB $L_{eq\ 1\ min,\ 125Hz}$ should apply for typical activity, assessed in hotel bedrooms and habitable rooms.
- External noise from new building services plant
  - Assessed using the guidance of BS 4142, targeting a cumulative noise level 10 dB lower than the background noise level at the nearest noise sensitive properties, as per LB Camden's requirements.
- Vibration from underground trains
  - Assessed using the guidance of BS 6472, vibration should not exceed the 'low probability of adverse comment' range when assessed in habitable rooms and hotel bedrooms, commensurate with LB Camden's requirements.
  - Re-radiated noise from underground trains should not exceed 30 dB $L_{Amax, fast}$ when assessed in hotel bedrooms, as per the Premier Inn specification.

4.0 ENVIRONMENTAL NOISE AND VIBRATION SURVEYS

Noise Survey Procedure

4.1 Environmental noise surveys were undertaken between 24th and 28th January 2019 to determine the prevailing noise levels around the site. Measurements were undertaken using the following equipment:

- 2 x Rion precision sound level meter Type NL-52
- 1 x Rion precision sound level meter Type NL-32
- Brüel & Kjær acoustic calibrator Type 4231

4.2 The noise survey locations are described below and are shown in Figure 1:

- Location 1 (long-term) – On the roof of the existing building, overlooking Camden High Street, at a height of approximately 8m above local ground level;
- Location 2 (long-term) - On the roof of the existing building at the rear of the site, overlooking Signmakers Yard, at a height of approximately 8m above local ground level;
- Location 3 (short-term) – On the pavement of Camden High Street, adjacent to the façade of the existing building, at a height of approximately 1.5m above local ground level;
- Location 4 (short-term) - On the pavement of Delancey Street, adjacent to the façade of the existing building, at a height of approximately 1.5m above local ground level;

4.3 Noise measurements were undertaken in samples of 1 minute in terms of the octave-band and free-field A-weighted L_{eq}, L_{90} and $L_{max,f}$ parameters. Measurements were made in accordance with BS 7445:1991 "Description and measurement of environmental noise Part 2 - Acquisition of data pertinent to land use" [Reference 11]. Audio was recorded during the survey in order to help identify noise sources.

4.4 The instruments' calibration was verified before and after the surveys in accordance with the manufacturer's instructions and no significant drift in calibration was recorded. Calibration of 24 Acoustics' equipment is traceable to National Standards.

4.5 All instrumentation was fitted with environmental weather shields during the surveys. Weather conditions during the surveys were fine and dry with wind speeds lower than 5 m/s. Measurement results are therefore not considered to have been affected by weather.

Noise Survey Results

4.6 The results of the noise measurements at Locations 1 and 2 are shown graphically in Appendix B and summarised in Tables 4, 5, 6 and 7, respectively.

Date	**Daytime Level (07:00 - 23:00)**		
	dB $L_{Aeq, 16\ hour}$	**Highest dB $L_{Aeq, 1\ hour}$**	**Typical dB L_{A90}**
Thurs 17th Jan	70	73	59
Fri 18th Jan	69	72	59
Sat 19th Jan	69	72	58
Sun 20th Jan	69	73	57
Mon 21st Jan	70	72	59
Tues 22nd Jan	70	72	59
Overall Level	**69**	**72**	**58**

Table 4: Daytime Measured Noise Levels at Location 1 – Camden High Street

Date	**Night Time Level (23:00 – 07:00)**			
	dB $L_{Aeq, 8\ hour}$	**Highest dB $L_{Aeq, 1\ hour}$**	**Typical dB $L_{Amax, f}$**	**Typical dB L_{A90}**
Weds 16th Jan	68	69	88 - 93	55
Thurs 17th Jan	67	70	83 - 91	55
Fri 18th Jan	69	70	90 - 94	58
Sat 19th Jan	70	72	90 - 98	58
Sun 20th Jan	66	68	82 – 85	53
Mon 21st Jan	67	69	83 – 91	55
Tues 22nd Jan	67	71	83 - 92	53
Overall Level	**68**	**70**	**86 - 93**	**55**

Table 5: Night-time Measured Noise Levels at Location 1 – Camden High Street

Date	Daytime Level (07:00 - 23:00)		
	dB $L_{Aeq, 16\ hour}$	Highest dB $L_{Aeq, 1\ hour}$	Typical dB L_{A90}
Thurs 17th Jan	66	69	53
Fri 18th Jan	65	68	53
Sat 19th Jan	63	67	52
Sun 20th Jan	63	66	50
Mon 21st Jan	65	68	53
Tues 22nd Jan	66	67	53
Overall Level	**65**	**68**	**52**

Table 6: Daytime Measured Noise Levels at Location 2 – Rear of Site

Date	Night Time Level (23:00 – 07:00)			
	dB $L_{Aeq, 8\ hour}$	Highest dB $L_{Aeq, 1\ hour}$	Typical dB $L_{Amax, f}$	Typical dB L_{A90}
Weds 16th Jan	61	65	81 – 85	48
Thurs 17th Jan	62	67	81 – 86	47
Fri 18th Jan	61	63	81 – 89	50
Sat 19th Jan	61	63	80 – 85	50
Sun 20th Jan	61	65	81 – 84	47
Mon 21st Jan	61	64	81 – 84	49
Tues 22nd Jan	61	65	82 -84	48
Overall Level	**61**	**65**	**81 - 85**	**49**

Table 7: Night-time Measured Noise Levels at Location 2 – Rear of Site

4.7 24 Acoustics determines the typical $L_{Amax,f}$ maximum noise event to be the tenth highest value during the measurement period, which presented in Tables 5 and 7 as the lower values, to be used for the design of the residential apartments.

4.8 The upper $L_{Amax,f}$ values presented are the third highest value, in accordance with the requirements of the Premier Inn specification (i.e. exclude events that occur no more than twice a night).

4.9 The typical background noise level is determined as the average minus standard deviation, over the relevant measurement period.

4.10 Noise from road traffic using Camden High Street was the primary source of ambient noise at measurement location 1. Evening and night-time noise levels at location 1 were also affected by noise from music and patrons at The Blues Kitchen.

4.11 The prevailing noise levels at Location 2 were noted to be affected by general ambient noise, including from road traffic using Delancey Street and Camden High Street.

4.12 The results of short-term noise measurements at Locations 3 and 4 and observations are summarised in Table 8.

Location	**Measured Noise Level dB L_{Aeq}**	**Observations**
3 Camden High Street façade	69	Road traffic, pedestrians
4 Delancey Street façade	73	Road traffic

Table 8: Daytime Measured Noise Levels, 23rd January 2019 – Locations 3 and 4

Entertainment Noise

4.13 Noise levels at Location 1 were affected by music noise associated with The Blues Kitchen. According to The Blues Kitchen's website, the venue is open 7 days a week, with live music and DJ events most evenings from around 21:45 hours until closing. The venue's opening hours are as follows:

- Monday 12:00 to 00:00 hours
- Tuesday 12:00 to 00:00 hours
- Wednesday 12:00 to 01:00 hours
- Thursday 12:00 to 01:00 hours
- Friday 12:00 to 02:30 hours
- Saturday 10:00 to 03:00 hours
- Sunday 10:00 to 01:00 hours

4.14 The operation of The Blues Kitchen is permitted under the existing premises license (ref PREM-LIC\1807) which includes conditions (26, 27 and 28) relating to the control of noise emanating from the premises.

4.15 From a review of audio recordings at Location 1, during the evening and night-time opening hours the measured noise levels were dominated by road traffic and pedestrian activity. Noise levels during the early hours of Saturday 19th January and Sunday 20th January, from approximately 00:00 to 03:00 hours, were affected by noise from music and patrons at The Blues Kitchen.

4.16 Table 9 describes the representative ambient noise levels (overall L_{Aeq} and L_{eq} at 63Hz and 125Hz) measured at Location 1 during the early hours (00:00 to 03:00 hours).

Date (January 2019)	Typical Low Frequency Sound Pressure Level (00:00 to 03:00 hours) dB, $L_{eq,1\ min,}$		Overall Sound Pressure Level dB, $L_{Aeq,1\ min,}$
	63 Hz	125 Hz	
Thursday 17th	67	63	**66**
Friday 18th	67	63	**66**
Saturday 19th	70	65	**68**
Sunday 20th	71	65	**69**
Monday 21st	65	62	**64**
Tuesday 22nd	66	62	**67**
Wednesday 23rd	66	62	**66**

Table 9: Measured Noise Levels (00:00 to 03:00 hours) at Location 1

4.17 The results have been used to determine the following worst-case entertainment noise levels outside the proposed development during evening and night time opening hours (21:30 to 03:00 hours):

- Low frequency noise levels of 71 dB $L_{eq(63Hz),\ 1\ min}$ and 65 dB $L_{eq(125Hz),\ 1\ min}$

Vibration Survey Procedure

4.18 A vibration survey was undertaken from 24th and 28th January 2019 to determine the existing vibration levels at the site. Vibration levels were measured using following equipment:

- 1 x Svantek 958 real-time analyser and Dynatron 3233A tri-axial accelerometer
- 1 x Svantek 958 real-time analyser and Svantek SV84 tri-axial accelerometer

4.19 Vibration monitoring equipment was installed within the basement of the existing building, at the locations described below and shown in Figure 2:

- Location A – At the front end of the basement closest to Camden High Street.
- Location B – Towards the rear of the basement.

4.20 Vibration measurements were undertaken in each of the three orthogonal axes of motion in samples of 1 minute in terms of the frequency weighted Vibration Dose Value (using the W_d frequency weighting in the horizontal axes and the W_b weighting in the vertical axis in accordance with the requirements of BS 6472). The accelerometers were levelled and mounted directly on the basement floor slab via a mounting plate. The accelerometer was well coupled with the ground in free field conditions.

Vibration Survey Results

4.21 Vibration measurement results from Locations A and B are shown graphically in Appendix C. High peaks in vibration levels were due to local activity near the equipment sensors, and have been omitted from the analysis.

4.22 Calculations have been undertaken using the measured vibration data to determine the 16-hour daytime and 8-hour night time Vibration Dose Values in accordance with the requirements of BS 6472, as presented in Table 10.

Location	**Vibration Dose Values ($m/s^{1.75}$)**					
	Daytime (07:00 – 23:00)			**Night-time (23:00 – 07:00)**		
	X-axis	**Y-axis**	**Z-axis**	**X-axis**	**Y-axis**	**Z-axis**
A – Front of Basement	0.010	0.018	0.111	0.004	0.006	0.088
B – Rear of Basement	0.014	0.004	0.053	0.007	0.003	0.035

Table 10: Summary of Vibration Dosage Values at Locations A and B

4.23 Vibration was not perceptible at Locations A and B during underground train pass-by events, however, re-radiated noise from underground train pass-bys was observed to be audible at Location A.

5.0 NOISE IMPACT ASSESSMENT

Internal Noise Levels Assessment

5.1 The following assessment has been undertaken to determine internal noise levels in the proposed hotel bedrooms and apartments during daytime and night-time periods.

5.2 For calculation purposes, it has been assumed that the external wall (non-glazed) constructions would achieve a minimum sound insulation performance of 58 dB R_w, which should be confirmed during detailed design.

5.3 It is assumed that the hotel bedrooms will be provided with mechanical ventilation, with no trickle ventilators or passive ventilation openings in the façade.

5.4 The calculations are based on the proposed floorplans and elevation drawings provided by Morris + Company Architects in April 2019. Should there be any changes to the room sizes or window areas, these calculations should be revised accordingly.

5.5 Calculations have been undertaken to determine the acoustic requirements for glazing and ventilation to the proposed hotel bedrooms and apartments, which will ensure that the internal noise levels meet the criteria set out in section 3.33 for road traffic noise and entertainment noise.

5.6 The acoustic zones A and B are described on the proposed plan in Figure 3. The recommended glazing types and ventilation specifications for hotel bedrooms and habitable rooms within each zone are described in Table 11.

Zone	Noise Sources	Rooms	Glazing Type	Ventilation Type
A	Road Traffic, Entertainment Noise	Hotel Bedrooms	GL1	Mechanical, e.g. centralised system or MVHR (no trickle vents)
B	Road Traffic	Hotel Bedrooms	GL2	Mechanical, e.g. centralised system or MVHR (no trickle vents)
		Apartment Bedrooms and Living Rooms	GL2	Attenuated trickle vents or mechanical (e.g. MVHR)

Table 11: Glazing and Ventilation Zones

Glazing

5.7 The sound insulation performance requirements for each glazing type are described in Table 12.

Glazing Type	Minimum Octave Band (Hz) Sound Reduction Index, dB						
	63	125	250	500	1k	2k	4k
GL1	Secondary Glazing Required (see below)						
GL2	23	28	30	39	44	49	56

Table 12: Glazing Sound Insulation Specifications

5.8 In making a comparison with the values in Table 12, it is important that the glazing figures used are the result of tests in accordance with ISO 10140, Part 2: 2010. The quoted minimum sound reduction specifications must be achieved by the entire glazing system as a whole, including frames, seals, any insulated panels and not just the glass. The requirements also apply to any external doors to habitable rooms, e.g. to balcony areas.

5.9 For guidance, the following glazing configurations are considered capable of achieving the required sound reduction performance if installed properly (ie, with appropriate frames and seals, etc.):

Glazing Type GL1:

- 6mm laminated glass
- Minimum 150 mm cavity with absorbent reveal (Class B absorption)
- Double glazed outer leaf e.g. 6mm glass/ 12mm cavity/ 12mm glass

Glazing Type GL2 (minimum 42 dB R_w):

- 10 mm glass / 12 mm cavity / 8.4 mm Stadip Silence glass (or equivalent)

5.10 The above glazing configurations are provided only for guidance at the planning stage and should be reviewed during detailed design. The low frequency performance of the secondary glazing system is critical in order to mitigate entertainment noise, and therefore must be considered further during detailed design.

Ventilation – Hotel Bedrooms

5.11 It is understood that a mechanical ventilation system will be provided to all of the proposed hotel bedrooms. The relevant requirements from the Premier Inn specification, for internal noise from mechanical services, are reproduced below:

> *"The background noise level in any hotel bedroom as a result of comfort cooling room units serving the bedroom shall not exceed NR25 Leq when the systems are operating at their design duty. Comfort cooling systems serving bedrooms should also have the facility to be operated at quieter duties and be switched off by room occupants."*
>
> *"The background noise level in any hotel bedroom as a result of constant minimum fresh air ventilation systems serving the guestroom or other parts of the development shall be between NR15 and NR20 Leq when the systems are operating at their design duty."*
>
> *"The background noise level in any hotel bedroom as a result of any other building services systems serving the bedroom or any other parts of the development shall not exceed NR20 Leq within the bedroom."*

Ventilation – Apartments

5.12 The acoustic performance requirements for background ventilators to the apartments are shown in Table 13.

Rooms	**Minimum Acoustic Performance D,n,e (dB) per Octave Band Centre Frequency (Hz)**					
	125	**250**	**500**	**1k**	**2k**	**4k**
Apartments (Habitable rooms)	42	40	37	45	53	55

Table 13: Ventilation Acoustic Performance – Apartments

5.13 In order to assist with the selection process, the following ventilator, if installed properly, would be capable of achieving the required sound reduction performances:

- Sound attenuated trickle ventilator or through-wall ventilator, minimum 44 dB $D_{n,e,w}$

5.14 In making a comparison with the specifications in Table 13, it is important that the figures used are the result of laboratory tests with the vent in the open position. Note that the stated minimum performance values assume one ventilator per habitable room. Alternatively, a whole-house ventilation system (e.g. MVHR) may be acceptable.

Limiting Plant Noise Criteria

5.15 A plant area is proposed on the roof of the new building. It is understood that the roof plant is likely to comprise the following:

- AHU to serve the hotel floors 1-4
- Kitchen extract fan
- 4 x condensers to serve floors 1-4
- 1 x condenser to serve the ground and basement
- 1 x condenser to serve the AHU
- 1 x ASHP for the DHW pre-heat
- Allowance for a future condenser to be installed to serve the retail unit

5.16 As set out in paragraph 3.33, rating noise levels from any new building services plant should be controlled to 10 dBA below the typical background level in order to comply with LB Camden's requirements

5.17 The limits set out in Table 14 are for the cumulative rating noise level from all plant associated with the development, as assessed by BS 4142 (taking account of corrections for tonality etc.) at the nearest noise sensitive receptors.

Noise Sensitive Properties	**Noise Rating Level, dB**	
	Daytime (07:00 – 23:00) $L_{Aeq,\ 1\ hour}$	**Night-time (23:00 - 07:00)** $L_{Aeq,\ 15\ min}$
Camden High Street, to the East	48	45
Delancey Street, to the South and West	42	39

Table 14: External Plant Noise Limits at Existing Noise Sensitive Properties

5.18 Plant noise mitigation measures (e.g. plant attenuation, correct selection of equipment, screening), should be incorporated into the design in order to achieve the external plant noise limits.

Sound Insulation between Residential Accommodation and Other Uses

5.19 In accordance with the proposed plans, the first floor hotel bedrooms will be situated above other hotel areas (e.g. reception, lounge) and the proposed retail unit on the ground floor.

5.20 In accordance with the Premier Inn specification, the separating floor construction between ground and first floors should be designed to achieve an airborne sound insulation performance of up to 65 dB $D_{nT,w}$. Sound insulation criteria for each specific adjacency will be specified during the detailed design stages. The overall sound insulation performance of the separating constructions will be subject to detailed design.

5.21 For retail unit(s) to be let out, it is also recommended to impose a tenancy condition with a restriction on maximum noise levels within the tenants' demise. Additional sound mitigation measures should be implemented by the tenant, if necessary, to mitigate higher noise levels. Example wording for the lease can be provided by 24 Acoustics, if required.

6.0 VIBRATION IMPACT ASSESSMENT

6.1 The measured free-field vibration levels at Locations A and B within the existing building generated Vibration Dose Values (VDVs) which were lower than the 'low probability of adverse comment' semantic of BS 6472. In practice, however, the vibration level inside the proposed new building may not be the same as that measured within the existing building.

6.2 The levels of vibration generated within the proposed building will depend upon the nature of the construction, the materials used and mass and stiffness of individual building elements. Because of this it is difficult to reliably predict the likely internal vibration levels from existing measurements without using a detailed vibration model. In practice, however, it is most often the case that lower vibration levels are transmitted into the building than those measured in the ground, however, in some circumstances, vibration levels can be amplified (which occurs if the natural frequency of any building elements coincides with the driving frequency from the railway activity).

6.3 Measured vibration levels at both locations were of low magnitude, with overall vibration dose values (VDV) below the range for low probability of adverse comment under BS 6472. This is commensurate with observations made on site that vibration caused by passing trains was not subjectively perceptible. Although re-radiated noise from underground train pass-bys was audible within the basement of the existing building, there is a low risk of re-radiated noise occurring within habitable rooms of the proposed development.

7.0 CONCLUSIONS

7.1 24 Acoustics Ltd has been instructed by Demar Holdings (BVI) Ltd to undertake a noise and vibration impact assessment for the proposed redevelopment of 115-119 Camden High Street, for a hub hotel (by Premier Inn), 3 residential apartments and a retail unit. This report has addressed the impact of noise from road traffic and entertainment noise and the impact of vibration on the proposed development.

7.2 Suitable noise and vibration criteria have been established based on local authority requirements, the hotel specification and relevant standards and guidance.

7.3 Environmental noise and vibration measurements have been undertaken at the site to determine existing noise and vibration levels during daytime and night-time periods.

7.4 Preliminary recommendations have been provided for acoustically rated glazing and alternative means of ventilation to the proposed hotel bedrooms and apartments.

7.5 Maximum external noise levels for building services plant serving the development have been established, applicable at the nearest noise sensitive properties.

7.6 A target performance specification has been provided for party floors between residential and other uses.

7.7 Measured vibration levels (Vibration Dose Values) were found to be acceptable in the context of BS 6472. The risk of re-radiated noise, from underground trains, occurring within the proposed habitable rooms is considered low.

7.8 On the basis of the above, it is concluded that noise and vibration levels at the development will be acceptable for future occupiers of the scheme.

REFERENCES

1. Department for Communities and Local Government. National Planning Policy Framework (NPPF), February 2019.

2. DEFRA. Noise Policy Statement for England, 2010.

3. Department of Communities and Local Government. Planning Practice Guidance, March 2014.

4. Professional Practice Guidance on Planning & Noise (ProPG), 2017.

5. London Borough of Camden, Adopted Local Plan, June 2017.

6. Hub by Premier Inn, Camden High St Specification for a Turnkey Development, Rev D July 2018

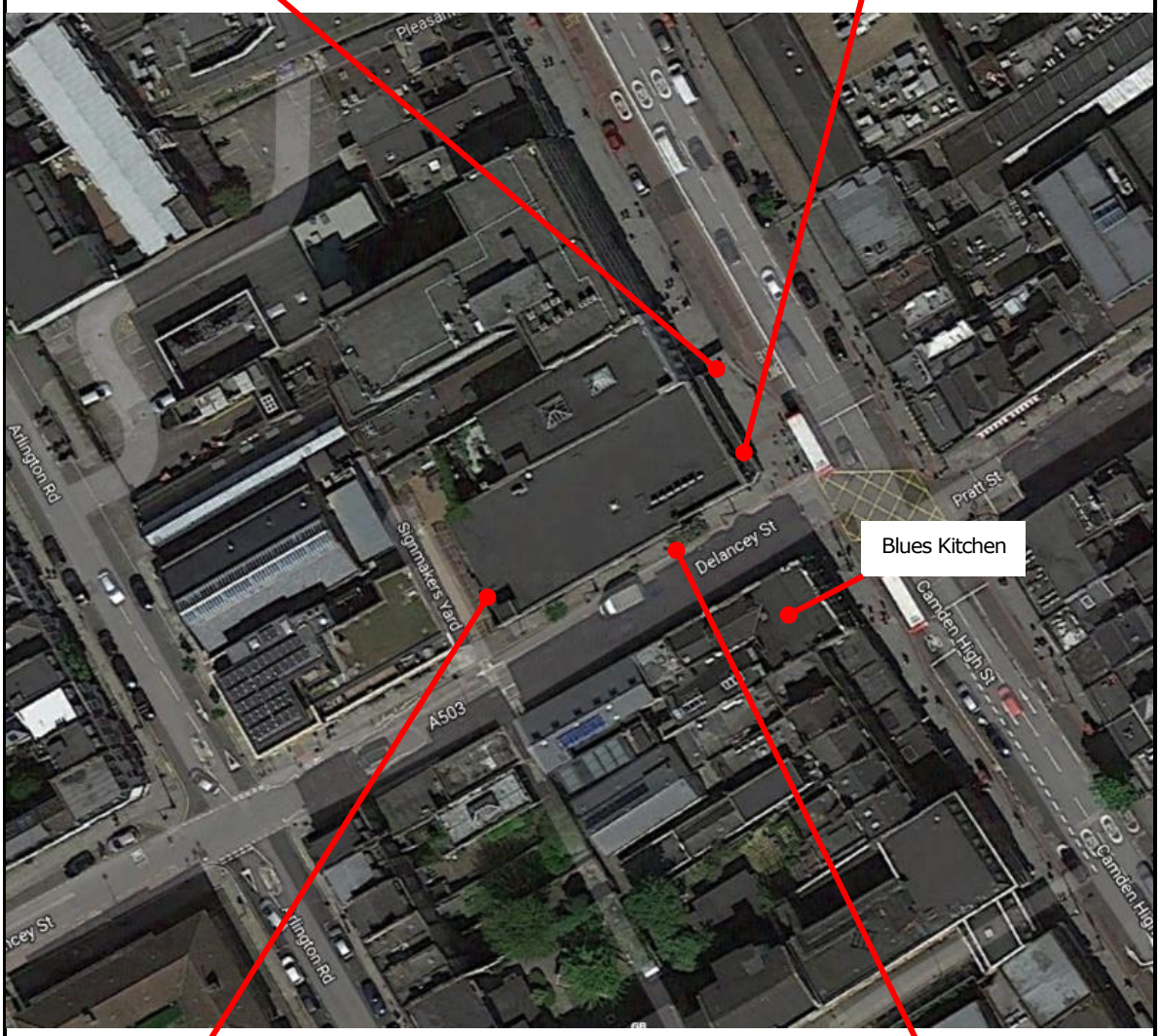
7. British Standards Institution. British Standard 8233:2014 Guidance on sound insulation and noise reduction for buildings, 2014.

8. World Health Organisation. Guidelines for Community Noise, 2000.

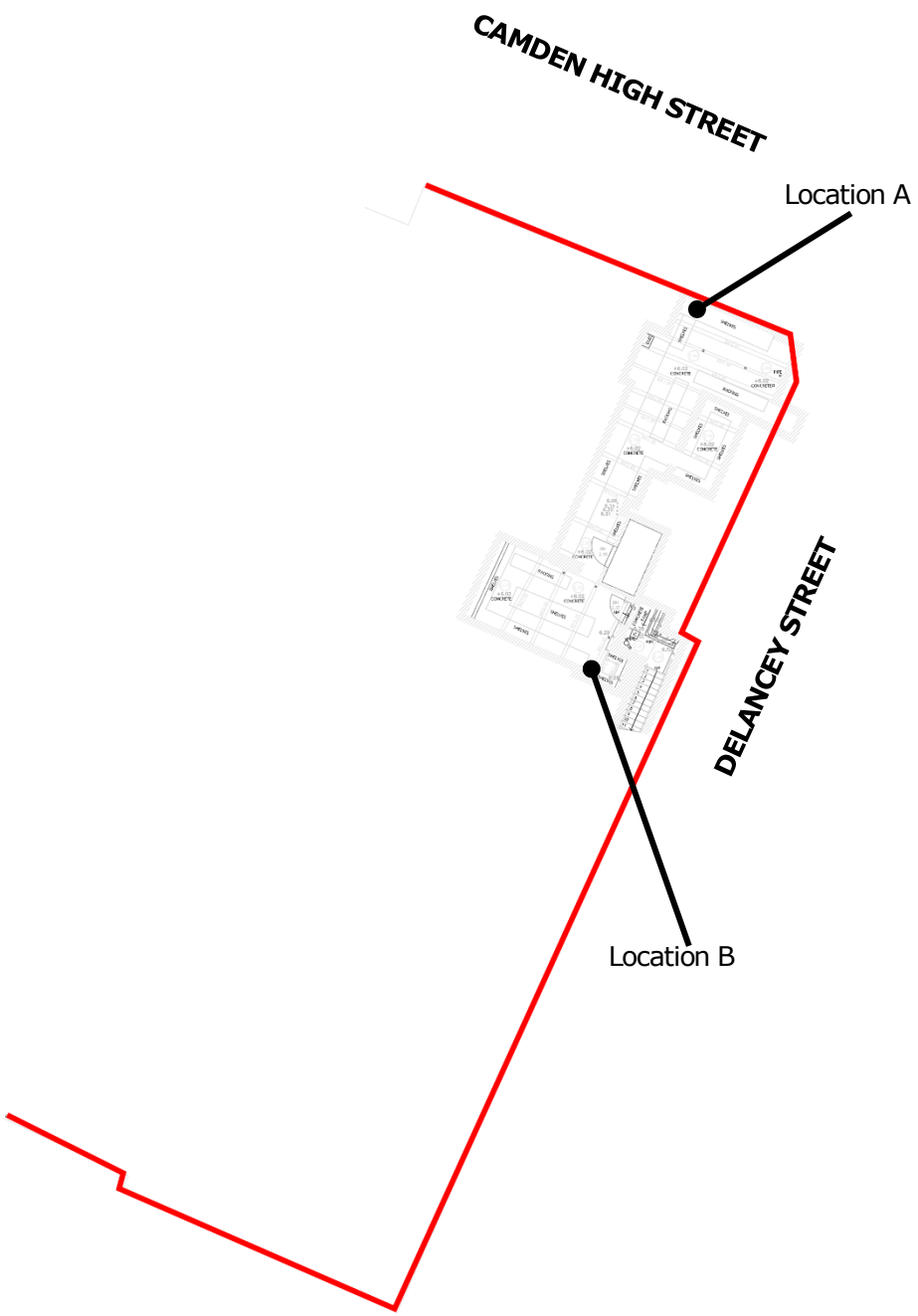
9. British Standards Institution. British Standard 4142. Methods for Rating Industrial and Commercial Sound, 2014.

10. British Standards Institution. British Standard 6472: Guide to Evaluation of Human Exposure to Vibration in Buildings, Part 1: Vibration Sources Other than Blasting: 2008.

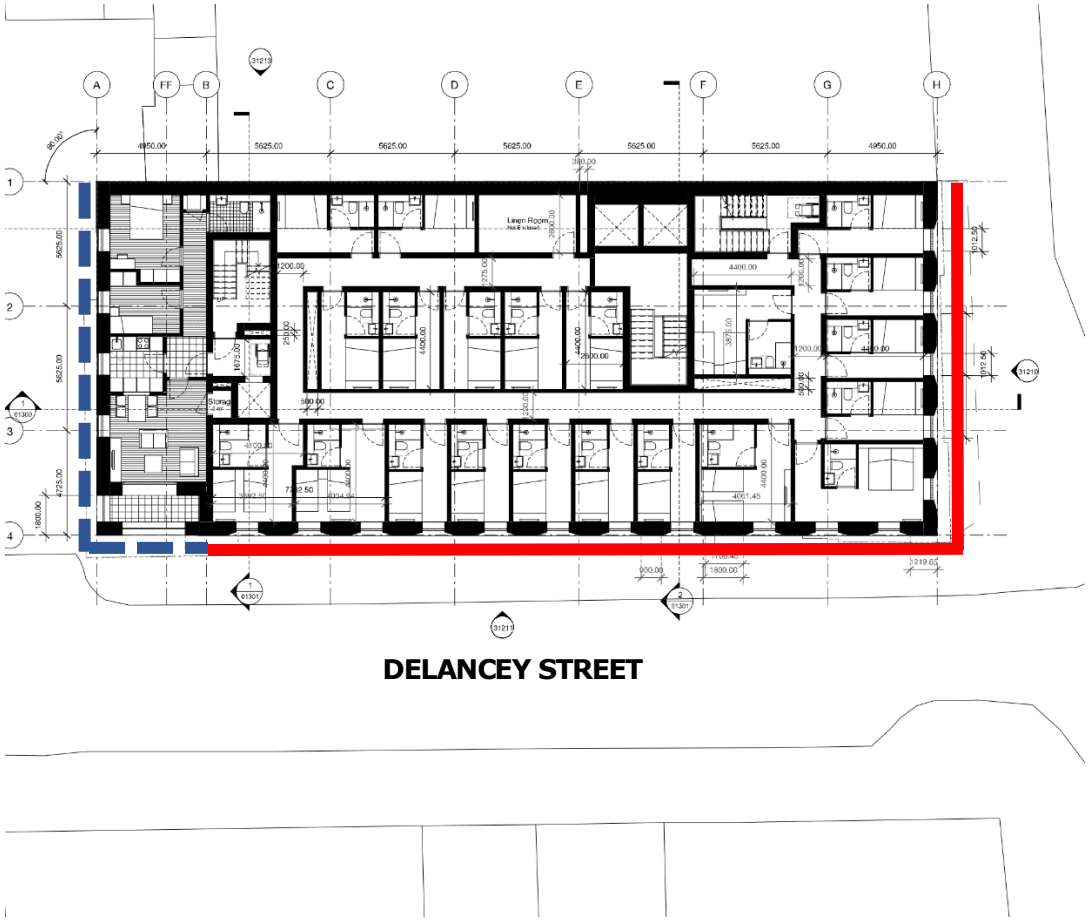
11. British Standards Institution. British Standard 7445:1991 Description and measurement of environmental noise Part 2 - Acquisition of data pertinent to land use, 1991.



Project: Camden High Street Hub Hotel	**Title:** Aerial View and Noise Measurement Locations	
DWG No: Figure 1	**Scale:** N.T.S.	**Rev**: -
Date: April 2019	**Drawn By:** CM	**Job No**: 7699



Project: Camden High Street Hub Hotel	**Title:** Existing Basement and Vibration Measurement Locations	
DWG No: Figure 2	**Scale:** N.T.S.	**Rev**: -
Date: April 2019	**Drawn By:** CM	**Job No**: 7699



Project: Camden High Street Hub Hotel	**Title:** Acoustic Zones	
DWG No: Figure 3	**Scale:** N.T.S.	**Rev**: -
Date: April 2019	**Drawn By:** CM	**Job No**: 7699

APPENDIX A – ACOUSTIC TERMINOLOGY

Noise is defined as unwanted sound. The range of audible sound is from 0 to 140 dB. The frequency response of the ear is usually taken to be around 18 Hz (number of oscillations per second) to 18000 Hz. The ear does not respond equally to different frequencies at the same level. It is more sensitive in the mid-frequency range than the lower and higher frequencies and because of this, the low and high frequency components of a sound are reduced in importance by applying a weighting (filtering) circuit to the noise measuring instrument. The weighting which is most widely used and which correlates best with subjective response to noise is the dBA weighting. This is an internationally accepted standard for noise measurements.

For variable sources, such as traffic, a difference of 3 dB is just distinguishable. In addition, a doubling of traffic flow will increase the overall noise by 3 dB. The 'loudness' of a noise is a purely subjective parameter, but it is generally accepted that an increase/ decrease of 10 dB corresponds to a doubling/ halving in perceived loudness.

External noise levels are rarely steady, but rise and fall according to activities within an area. In attempt to produce a figure that relates this variable noise level to subjective response, a number of noise indices have been developed. These include:

i) The L_{Amax} noise level

This is the maximum noise level recorded over the measurement period.

ii) The L_{Aeq} noise level

This is "equivalent continuous A-weighted sound pressure level, in decibels" and is defined in British Standard BS 7445 as the "value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time internal, T, has the same mean square sound pressure as a sound under consideration whose level varies with time".

It is a unit commonly used to describe construction noise and noise from industrial premises and is the most suitable unit for the description of other forms of environmental noise. In more straightforward terms, it is a measure of energy within the varying noise.

iii) The L_{A10} noise level

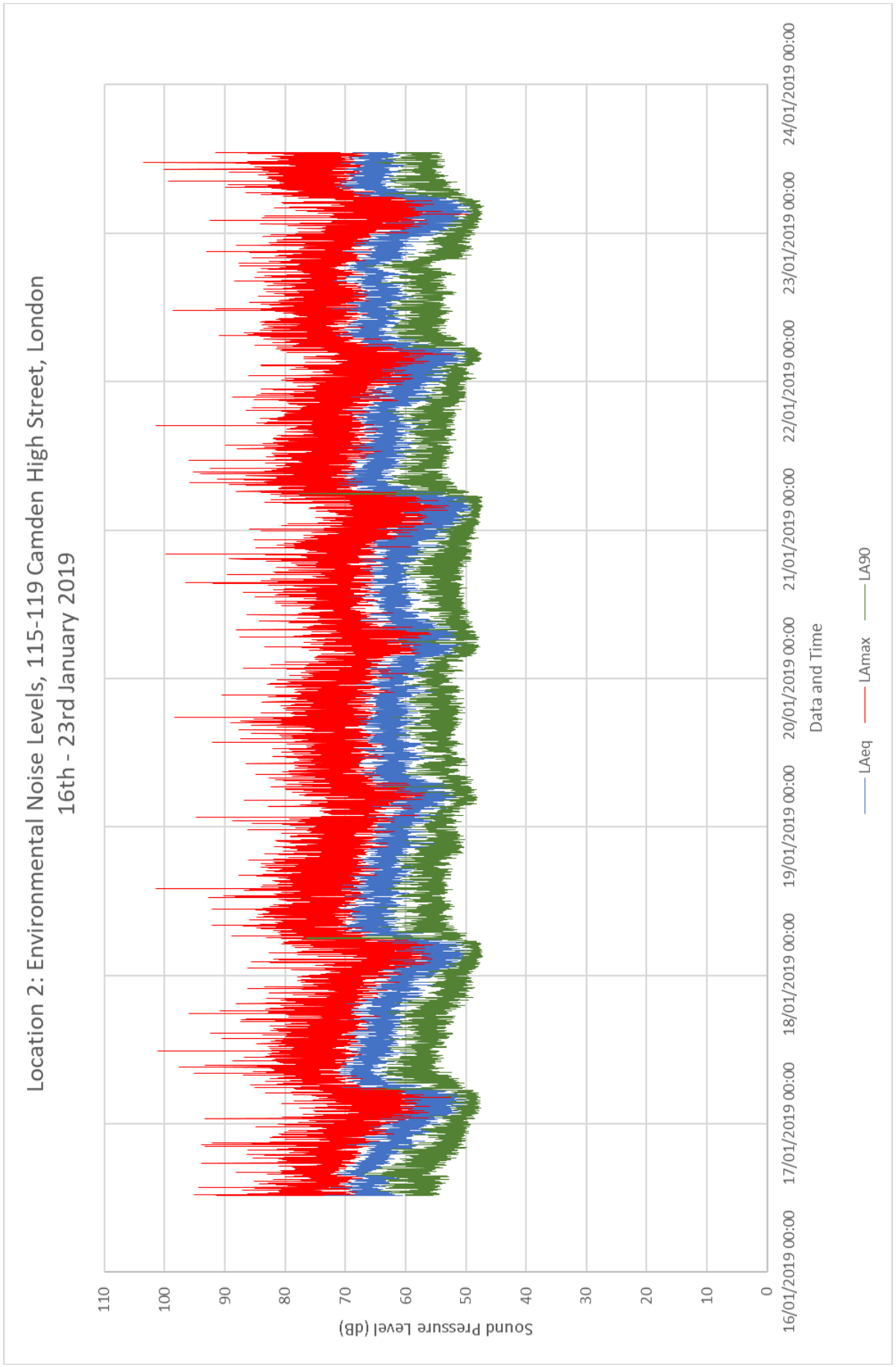
This is the noise level that is exceeded for 10% of the measurement period and gives an indication of the noisier levels. It is a unit that has been used over many years for the measurement and assessment of road traffic noise.

iv) The L_{A90} noise level

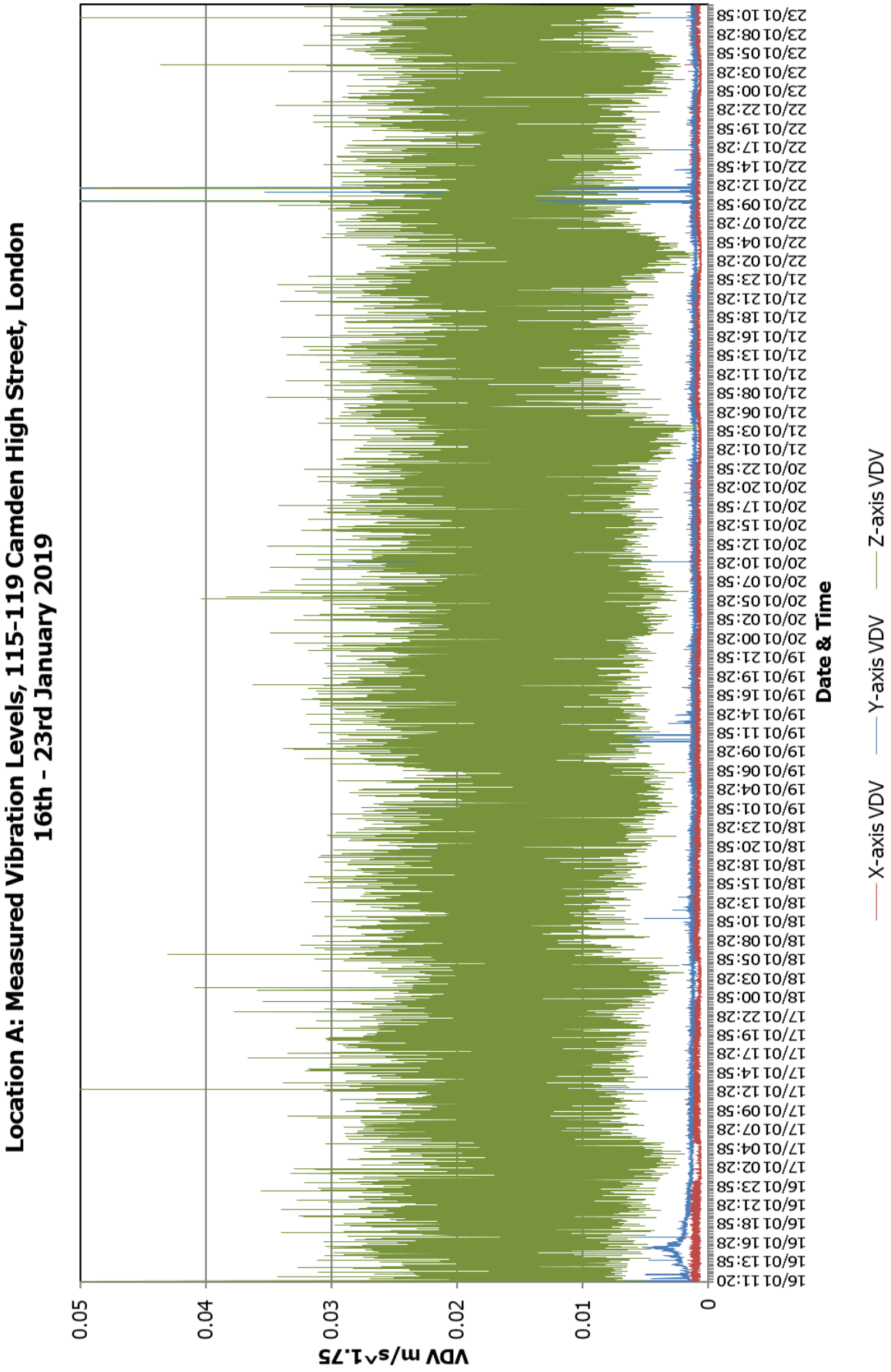
This is the noise level that is exceeded for 90% of the measurement period and gives an indication of the noise level during the quieter periods. It is often referred to as the background noise level and is used in the assessment of disturbance from industrial noise.

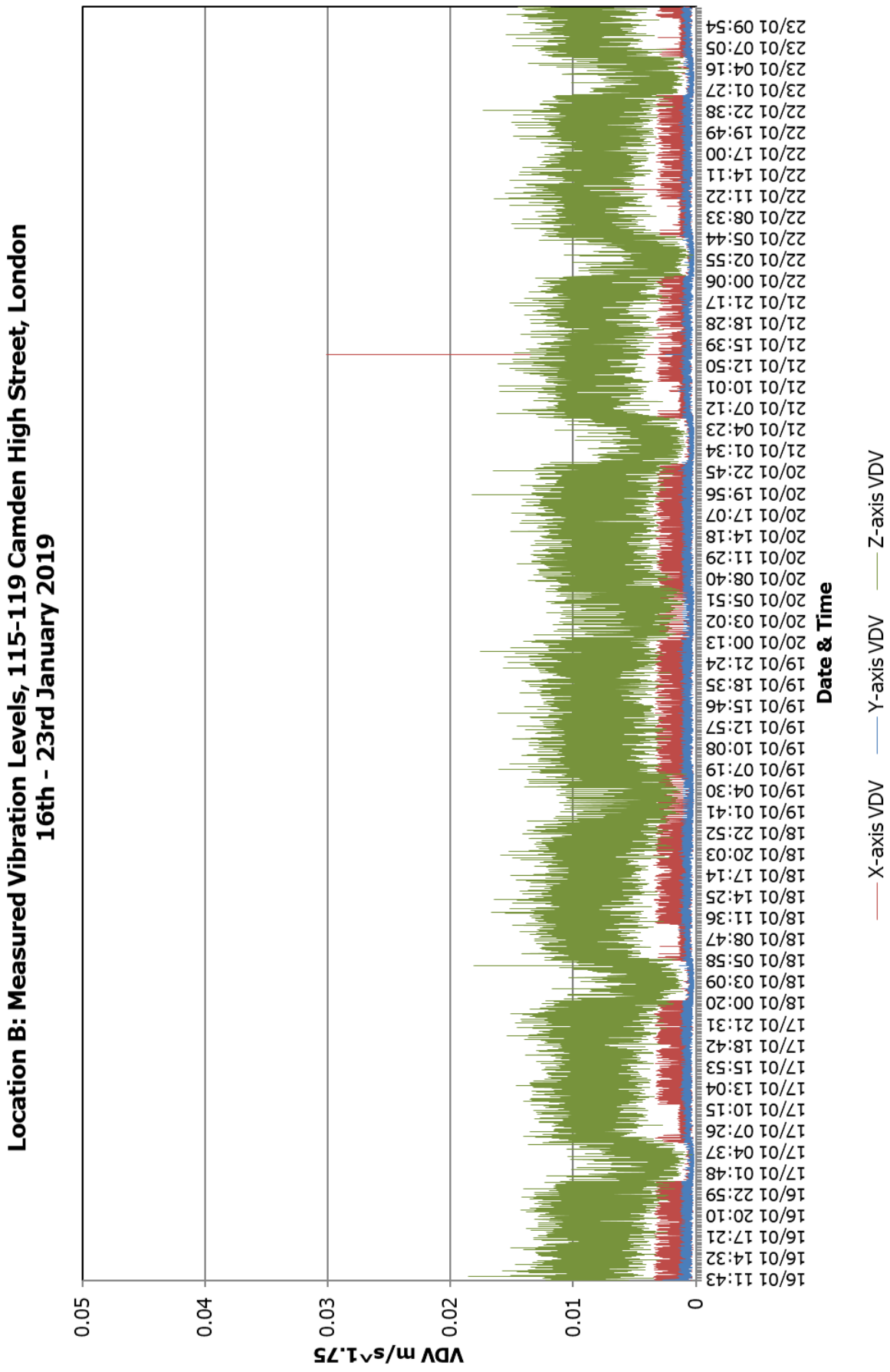
APPENDIX B – ENVIRONMENTAL NOISE MEASUREMENTS


Location 1: Environmental Noise Levels, 115-119 Camden High Street, London
16th - 23rd January 2019
Sound Pressure Level (dB)
110
100
90
80
70
60
50
40
30
20
10
0
16/01/2019 00:00
17/01/2019 00:00
18/01/2019 00:00
19/01/2019 00:00
20/01/2019 00:00
21/01/2019 00:00
22/01/2019 00:00
23/01/2019 00:00
24/01/2019 00:00
Date & Time
LAeq
LAmax
LA90


Location 2: Environmental Noise Levels, 115-119 Camden High Street, London
16th - 23rd January 2019
Sound Pressure Level (dB)
110
100
90
80
70
60
50
40
30
20
10
0
16/01/2019 00:00
17/01/2019 00:00
18/01/2019 00:00
19/01/2019 00:00
20/01/2019 00:00
21/01/2019 00:00
22/01/2019 00:00
23/01/2019 00:00
24/01/2019 00:00
Data and Time
LAeq
LAmax
LA90

APPENDIX C – VIBRATION MEASUREMENTS


Location A: Measured Vibration Levels, 115-119 Camden High Street, London
16th - 23rd January 2019
VDV m/s^1.75
0.05
0.04
0.03
0.02
0.01
0
Date & Time
X-axis VDV
Y-axis VDV
Z-axis VDV


Location B: Measured Vibration Levels, 115-119 Camden High Street, London
16th - 23rd January 2019
VDV m/s^1.75
0.05
0.04
0.03
0.02
0.01
0
Date & Time
16/01 11:43
16/01 14:32
16/01 17:21
16/01 20:10
16/01 22:59
17/01 01:48
17/01 04:37
17/01 07:26
17/01 10:15
17/01 13:04
17/01 15:53
17/01 18:42
17/01 21:31
18/01 00:20
18/01 03:09
18/01 05:58
18/01 08:47
18/01 11:36
18/01 14:25
18/01 17:14
18/01 20:03
18/01 22:52
19/01 01:41
19/01 04:30
19/01 07:19
19/01 10:08
19/01 12:57
19/01 15:46
19/01 18:35
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20/01 05:51
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20/01 17:07
20/01 19:56
20/01 22:45
21/01 01:34
21/01 04:23
21/01 07:12
21/01 10:01
21/01 12:50
21/01 15:39
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22/01 02:55
22/01 05:44
22/01 08:33
22/01 11:22
22/01 14:11
22/01 17:00
22/01 19:49
22/01 22:38
23/01 01:27
23/01 04:16
23/01 07:05
23/01 09:54
X-axis VDV
Y-axis VDV
Z-axis VDV