SANDY BROWN

Consultants in Acoustics, Noise & Vibration

18095-R01-B

26 July 2018

7ABC Bayham Street

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**
87 Caroline Street, Birmingham B3 1UP 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	22 June 18		Artem Khodov	Robert Burrell
B	26 July 18		Artem Khodov	Robert Burrell

Summary

Sandy Brown has been commissioned by Camden Lifestyle (UK) Ltd to provide acoustic advice in relation to the proposed development at 7ABC Bayham St.

This report is a part of a Full Planning Application for the demolition of existing buildings (B1a Use Class) and erection of a part 3, part 4, part 5 storey building (with two basement levels), comprising co-working office floorspace (B1a Use Class), hotel accommodation (C1 Use Class) and an ancillary café/bar and fitness facilities; works to the existing access and associated works.

An environmental noise and vibration survey has been carried out at the site. The noise survey was performed between 17 May 2018 and 24 May 2018. The vibration survey was performed on 06 April 2018.

The representative background noise levels measured during the survey were $L_{A90,15\ min}$ 46 dB during the daytime and $L_{A90,15\ min}$ 41 dB at night.

Based on the requirements of 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} 36 dB during the daytime and L_{Aeq} 31 dB during the night.

The average ambient noise levels measured during the survey were $L_{Aeq,16h}$ 58 dB during the daytime and $L_{Aeq,8h}$ 53 dB at night.

An initial facade sound insulation assessment has been carried out to determine the required acoustic performance of the facade and provide guidance on the ventilation strategy. The required facade performances range from R'_w+C_{tr} 32 dB to 38 dB for different facades.

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. Standard plant noise criteria could be included as a planning condition to protect the surrounding residences.

The vibration survey indicated that tactile vibration and re radiated nose are not considered to be an issue at this site. Vibration isolation is not required.

Contents

1 Introduction

Sandy Brown has been commissioned by Camden Lifestyle (UK) Ltd to provide acoustic advice in relation to the proposed development at 7ABC Bayham Street, London, NW1 0EY.

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

The background noise 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 London Borough of Camden.

The ambient noise levels measured during the survey are used to determine the necessary facade sound insulation performance required to achieve appropriate internal noise levels in accordance with BS 8233:2014 *Sound insulation and noise reduction for buildings*, World Health Organisation and London Borough of Camden guidelines.

A vibration survey was performed with 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 London Underground lines passing close to the site.

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

2 Site description

2.1 Proposed development

The proposal consists the demolition of existing buildings (B1a Use Class) and erection of a part 3, part 4, part 5 storey building (with two basement levels), comprising co-working office floorspace (B1a Use Class), hotel accommodation (C1 Use Class) and an ancillary café/bar and fitness facilities; works to the existing access and associated works.

2.2 The site and its surroundings

The site location in relation to its surroundings is shown in Figure 1. The site is highlighted in red.

The site is bound by Bayham street to the east, Kings Terrace to north west and Bayham place to the south. Camden High Street is nearby to the west.

Figure 1 Site map (courtesy of Google Earth Pro)

2.3 Adjacent premises

The site is located in a predominantly residential area, with residential premises highlighted in yellow. South of the site there is a live music venue – KOKO, and a public house marked up in orange and green respectively. All the commercial premises in the area are highlighted in blue.

Nearest noise sensitive premises are dwellings directly north and south of the site.

3 Noise and vibration survey

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 Noise survey method

3.1.1 Unattended measurements

Unattended noise monitoring was undertaken at the site over seven 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 12:15 on 17 May 2018 and 10:00 on 24 May 2018. The equipment was installed and collected by Artem Khodov.

The measurement position used during the survey is indicated and denoted by the letter 'L' in Figure 1. A photograph showing the measurement location is provided in Figure 2. At this location background noise levels are considered to be reasonably representative of those experienced by the nearest noise sensitive premises.

Figure 2 Noise monitor on site

3.1.2 Attended measurements

Attended sample measurements were performed by Artem Khodov at several locations around the site. The attended measurements were carried out on 6 April 2018 and 17 May 2018 over 5-minute periods, with the purpose of determining the existing noise levels from road traffic, pedestrians and other significant noise sources in the area.

The locations of the measurements are indicated in Figure 1 as positions 1 to 5. In each case the microphone was mounted on a tripod approximately 1.5 m above the ground level and at least 1 m from any other reflective surface. Measurements were taken at the facade. The photographs of various measurement positions are shown in Figure 3.

Figure 3 Attended noise measurements

3.2 Vibration survey method

Vibration measurements were performed by Artem Khodov at one location at the site to determine the maximum vibration levels from the passage of underground trains on London Underground Northern line close to the site. The vibration measurement locations are indicated in Figure 1 as position 'V'. The measurements were taken outside, on the existing slab between two existing buildings.

For the vibration measurements, one tri-axial accelerometer was set up to measure vibration dose values (VDV) and 1/3 octave band slow weighted RMS acceleration. 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 on 6 April 2018.

The vibration levels measured at this location are are considered to be reasonably representative of those that will experienced by the ground floor level of the proposed development.

The accelerometers were fixed to the floor using beeswax, away from the building boundaries.

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.

3.3 Observations

The dominant noise sources observed at the site during the survey consisted of traffic on Bayham St. Less significant noise sources included distant noise from Camden High street and construction noise from 48-56 Bayham Pl directly south of the site.

3.4 Results

3.4.1 Unattended 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.

Table 1 Ambient noise levels measured during the survey

Date	Daytime (07:00 – 23:00) $L_{Aeq,16h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
Thursday 17 May 2018	*	53
Friday 18 May 2018	59	55
Saturday 19 May 2018	69**	54
Sunday 20 May 2018	57	53
Monday 21 May 2018	59	52
Tuesday 22 May 2018	59	53
Wednesday 23 May 2018	58	54
Thursday 24 May 2018	*	N/A
Average	58	53

* Measurement not made over full period due to monitoring start and end time (the measurement on 17 May 18 was over 11 hours, and on 24 May 18 over 3 hours); not included in the average

** Data excluded from the average, due to unusually high noise levels and non-typical measured spectrum between 9:00 and 13:00. This coincides with time of the royal wedding, which is not a recurring event.

To establishing representative background noise levels, day and night time typical levels have been quantified using statistical analysis, in line with BS 4142:2014, from the continuous logging measurements.

Daytime and night time statistical analysis of representative values for the site are given in Figure 4 and Figure 5.

From this analysis, the representative background noise levels measured during the survey were $L_{A90,15min}$ 46 dB during the daytime and $L_{A90,15min}$ 41 dB at night.

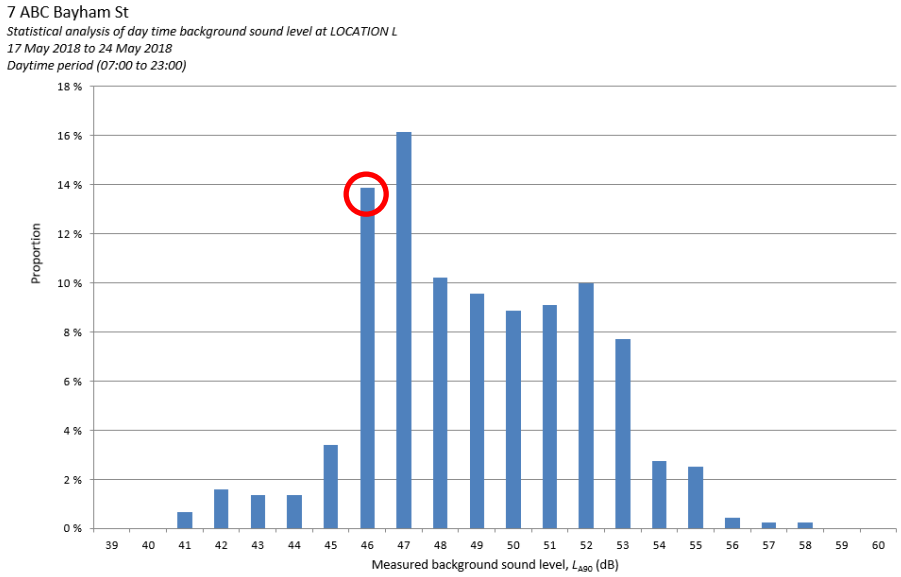


Figure 4 Statistical analysis of daytime background noise

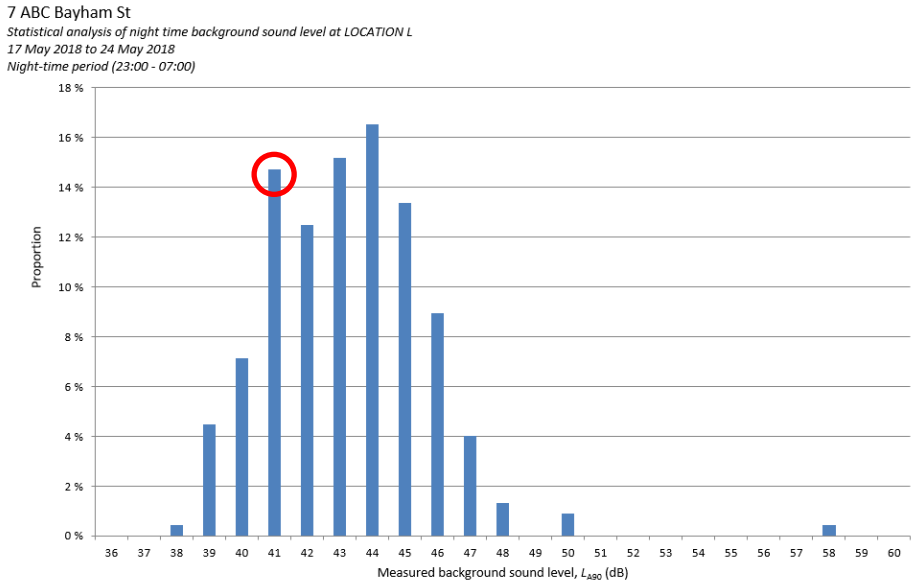


Figure 5 Statistical analysis of night time background noise

3.4.2 Attended measurement results

The sound pressure levels recorded during the attended measurements on 6 April are summarised in Table 2. The dominant noise sources noted during the measurements are also described in Table 2. All the attended measurements were performed over 5-minute periods.

Measurements were taken at the facade.

Table 2 Sound pressure levels from attended measurements

Pos.	Start date and time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,5min}$	$L_{AFmax,5min}$	$L_{A90,5min}$	
1	06/04; 15:36	64	77	51	Traffic, pedestrians
1	06/04; 15:42	65	85	50	Traffic, pedestrians
2	06/04; 15:48	65	80	51	Traffic, pedestrians
2	06/04; 15:53	63	77	52	Traffic, pedestrians, construction
3	06/04; 15:59	65	80	55	Traffic, pedestrians, construction
4	06/04; 16:07	66	78	57	Traffic, pedestrians, construction
2	17/05; 12:45	66	77	54	Traffic, pedestrians
2	17/05; 12:50	61	73	56	Traffic, pedestrians
2	17/05; 12:55	63	76	52	Traffic, pedestrians
3	17/05; 13:01	64	77	54	Traffic, pedestrians
3	17/05; 13:06	64	75	57	Traffic, pedestrians
3	17/05; 13:12	66	85	54	Traffic, pedestrians, motorcyclist
4	17/05; 13:28	65	79	55	Traffic, distant music
5	17/05; 13:34	61	80	53	Construction, external plant

3.4.3 Tactile vibration measurements

Measurements of 29 underground train events were taken. The maximum event VDV measured was 0.00565 $m/s^{1.75}$.

3.4.4 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.

The maximum predicted re-radiated noise level, from the vibration measurements at location 'V' is presented in terms of L_{ASmax} as required by BS 6472 and is discussed in Chapter 7.2.

4 Assessment criteria

4.1 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.

4.2 External noise levels – noise egress

4.2.1 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 noise level, it is likely to be an indication of a significant adverse impact. If the level is 5 dB above the existing background noise 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.

4.2.2 Local Authority criteria

In relation to noise egress from industrial and commercial noise sources, London Borough of Camden's local plan (June 2017) states:

"*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 (15 dB if tonal components are present) should be considered as design criterion."*

Based on the extract from Camden Local Plan, all external plan must be such that the cumulative noise 1 m away from the windows of the nearest noise sensitive receptors is 10 dB below the representative measured background level ($L_{A90,\ 15\ min)}$).

4.2.3 Plant noise criteria

Based on the above criteria 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:

- $L_{Aeq,15min}$ 36 dB during the daytime (07:00-23:00)
- $L_{Aeq,15min}$ 31 dB at night (23:00-07:00)

The limits do not include any attention catching features. The penalties for attention catching features will need to be considered as the building services design progresses.

4.3 Internal noise level – noise ingress

4.3.1 Standard guidance

Guidance on acceptable internal noise levels in residential dwellings is given in BS 8233:2014 *Sound insulation and noise reduction for buildings* and is also provided by the World Health Organisation. The guidance given by BS 8233 and WHO is shown in Table 3.

Table 3 Internal noise criteria for sleeping/resting

Internal space	Indoor ambient noise level L_{Aeq} (dB)		
	BS 8233 (07:00 to 23:00)	BS 8233 (23:00 to 07:00)	WHO
Bedrooms	35	30[1]	30[1]

[1] BS 8233 notes that individual noise events can cause sleep disturbance, and that a guideline value may be set depending on the character and number of events per night, although no specific limit is provided. Section 3.4 of the WHO guidelines for community noise suggests that good sleep will not generally be affected if internal levels of L_{Amax} 45 dB are not exceeded more than 10-15 times per night.

BS 8233 recommends that the internal noise level criteria for residential dwellings is applicable for Hotel guestrooms.

4.3.2 Local Authority requirements

Camden Local Plan sets out noise thresholds in terms of 'effect levels' described in the NPPF and PPG:

- NOEL – No Observed Effect Level
- LOAEL – Lowest Observed Adverse Effect Level
- SOAEL – Significant Observed Adverse Effect Level

According to Camdel Local Plan, three design criteria have been set for proposed development, as below:

- Green – where noise is considered to be at acceptable level
- Amber – where noise is observed to have an adverse effect level, but which may be considered acceptable when assessed in the context of other merits of the development
- Red – where noise is observed to have a significant adverse effect

Bedroom internal criteria, set out in Camden Local Plan in accordance with three design criteria, is duplicated in Table 4.

Table 4 Noise thresholds in accordance with Camden Local Plan

Design period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAEL (Red)
Day	$L_{Aeq\ 16\ hr}$<35 dB	$L_{Aeq\ 16\ hr}$ 35-45 dB	$L_{Aeq\ 16\ hr}$>45 dB
Night	$L_{Aeq\ 8\ hr}$<30 dB	$L_{Aeq\ 8\ hr}$ 30-40 dB	$L_{Aeq\ 8\ hr}$>40 dB
	L_{AFmax} 42 dB	L_{AFmax} 40-73 dB	L_{AFmax} >73 dB

The Camden Local Plan does not specify specific criteria for NOEL category.

The proposed development will be designed to achieve the criteria set out in BS 8233 and WHO which is in general agreement with the Camden LOAEL (Green) criteria.

4.4 Tactile vibration criteria

4.4.1 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 5 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
Residential buildings 16 hr day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential building 8 hr night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Note that offices and workshops, multiplying factors of 2 and 4 respectively should be applied to the above vibration dose value ranges for a 16 hr day.

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.

4.4.2 Local Authority requirements

Highest VDV values accepted by London Borough of Camden are indicated in Camden Local Plan and are duplicated in Table 6.

Table 6 Maximum VDV values (from Camden Local Plan)

Measurement location	Period	Time	VDV ($m/s^{1.75}$)
Inside dwellings	Day and evening	07:00-23:00	0.2 to 0.4
Inside dwellings	Night	23:00-07:00	0.13
Inside offices	Day, evening and night	00:00-24:00	0.4

4.5 Re-radiated noise criteria

4.5.1 Standard guidance

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 a building. The Association of Noise Consultants (ANC) guidelines '*Measurement and assessment of ground-borne noise and vibration*', 2nd edition published in 2012, is generally used as the basis of assessments such as this.

This document also provides discussion on the relevant research that has been carried out, and a summary of typically adopted criteria.

The most relevant items are set out below:

- The American Public Transit Association (APTA) guidelines recommend criteria of between 30 and 40 dB(A) depending on the density and type of residential properties. They do not define where within a building these apply, or the time response that should be used.
- The Federal Transit Administration (FTA) of the US Department of Transportation, recommends limits for maximum pass-by levels of 35 dB(A) for frequent events (more than 70 events per day) and 43 dB(A) for infrequent events.
- London Underground Limited has studied the relationship between ground-borne noise levels and complaint thresholds. This was used to define a complaint threshold of 40 dB L_{Amax}.
- The ANC guidelines also note that Local Authority guidelines for ground-borne noise were published in London and the South East, and state a limit of 35 dB L_{Amax}.

In all of the above examples, the time constant is not defined, with the exception of the Local Authority guidelines in London and the South East, which is defined as having a fast time weighting.

It should be noted that most of this research relates to residential accommodation, and is aimed at providing good sleeping / resting conditions.

4.5.2 Local Authority requirements

London Borough of Camden does not have any specific re-radiated noise criteria. Criteria indicated in section 4.5.1 shall be used for this development.

5 Facade sound insulation – noise ingress

This section discusses internal noise level criteria and assesses the required facade sound insulation performance. In principle, the required facade specification depends on two factors – the external noise levels at the site, and the internal noise criteria.

The following assessment is based on achieving the internal noise levels recommended in BS 8233 and by London Borough of Camden, which are set out in Section 4.3.

5.1 External noise levels

To allow an assessment of the worst-case scenario, the highest noise levels provided in Table 2 have been used to assess noise ingress.

On this basis, the predicted external noise levels at the various facades of the proposed development are estimated to be L_{Aeq} 66 dB during the daytime.

Data from the unattended measurement potions shows a reduction in noise level of 5 dB from the daytime average noise levels to the night time average noise levels. On this basis a night time noise level of L_{Aeq} 61 dB has been used for the purpose of the assessment.

Maximum noise levels of around L_{AFmax} 80 dB were measured along the existing facades of Bayham Street. These levels coincide with buss pass-bys, which occur throughout the night. This level has been used for the purpose of the assessment.

5.2 Facade sound insulation

To achieve the internal noise criteria in given in section 4.3 for guestrooms, minimum facade sound insulation requirements have been determined, based on the external noise levels at each facade stated above.

The maximum sound insulation performance for the facades is R'_w+C_{tr} 35 dB.

5.3 Guidance on facade construction, glazing, and ventilation strategy

It is assumed that a centralised ventilation system (e.g. AHUs) will provide the necessary air flow requirements.

A performance of R'_w+C_{tr} 35 dB can be achieved by double and triple glazed systems.

The performance required by each element will depend on the construction of the solid elements, the glazing specification, the relative areas of the solid and glazed elements, and the ventilation strategy.

As the design progresses, a more detailed facade sound insulation assessment will need to be performed, considering the factors listed above, to ensure that the overall performance requirements will be met.

6 Plant noise egress

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.

The standard plant noise criteria could be included as a planning condition to protect the surrounding residences.

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 measurement location V, the highest vibration dose value was measured on the vertical axis.

Published timetables indicate that approximately 84 underground trains pass by the site per hour during the peak hours. This will result in approximately 1344 trains passing on the tracks between 07:00 – 23:00. At night, between 23:00 – 07:00, the number of trains operating along this line is expected to be approximately 256 trains.

Based on the maximum vibration values measured and on the number of trains passing on the tracks between 07:00 – 23:00 and 23:00 – 07:00, the equivalent vibration dose values over a 16 hour day and an 8 hour night are given in the following table.

Table 7 Equivalent vibration dose values

Location	Maximum VDV measured ($m/s^{1.75}$)	Equivalent VDV ($m/s^{1.75}$)	
		Daytime (07:00 – 23:00)	Night time (23:00 – 07:00)
V	0.00565	0.03	0.02

By comparing the calculated day and night time vibration dose values above with the assessment table given in section 0 of this report, it can be seen that the predicted vibration dose values during the daytime and night periods are lower than the threshold of the ‘low probability of adverse comment’ category.

Levels experienced may vary depending on the type of train and position of the future buildings. However, it the measured vibration levels are below the lowest BS 6472 threshold, and it 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

During the ground-borne noise measurements, 29 individual train events were observed. To ensure a conservative assessment, coupling losses have not been accounted for.

The predicted noise level based on the worst event is L_{ASmax} 30 dB. This is the level predicted for ground floor level. At the guestrooms at level 2 and above, the levels of ground-borne noise will be even lower.

Of the train passes captured during the survey period, all the predicted levels were lower than the criteria adopted by the recent UK rail projects discussed in Section 4.5. On this basis, ground-borne noise in is unlikely to result in adverse comment and there is no requirement for building isolation.

8 Conclusion

The representative measured background noise levels were $L_{A90,15min}$ 46 dB during the day, and $L_{A90,15min}$ 41 dB during the night. Based on the requirements of the London Borough of Camden, the relevant plant noise limits at the worst affected existing noise sensitive premises would be L_{Aeq} 36 dB during the day, and L_{Aeq} 31 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 more stringent than those set out above.

An initial facade sound insulation assessment has been carried out to determine the required acoustic performance of the facade and provide guidance on the ventilation strategy. The maximum sound insulation performance for the facades is R'_w+C_{tr} 35 dB, which can be achieve by double and triple glazed systems.

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. Standard plant noise criteria could be included as a planning condition to protect the surrounding residences.

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

Appendix A - Survey details

Equipment

The unattended measurements were performed using a Rion NL-52 sound level meter

The attended noise measurements were performed using a Rion NL-52 sound level meter and a Bruel&Kjear 2250 sound level meter

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

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	Cal. expiry	Calibration certification number
Sound level meter	2250/3009283	Brüel & Kjær	14 Jun 18	CDK1603872, 09295
Microphone	4189/3005042	Brüel & Kjær	14 Jun 18	CDK1603872, 09295
Pre-amp	ZC0032/23792	Brüel & Kjær	14 Jun 18	CDK1603872, 09295
Calibrator	4231/3016124	Brüel & Kjær	10 Jun 18	CDK1603872
Sound level meter	NL-52/00242702	Rion	9 Jun 19	TCRT17/1341
Microphone	UC-59/06185	Rion	9 Jun 19	TCRT17/1341
Pre-amp	NH-25/32730	Rion	9 Jun 19	TCRT17/1341
Calibrator	CAL200/4499	Larson Davis	9 Jun 19	TCRT17/1339
Sound level meter	NL-52/00264550	Rion	14 Jul 18	09293
Microphone	UC-59/09698	Rion	14 Jul 18	09293
Pre-amp	NH-25/64675	Rion	14 Jul 18	09293
Calibrator	NC-74/34367631	Rion	14 Jul 18	09288
Data Recorder	DA-20/10870889	Rion	8 Sep 19	TCRT17/1581
Accelerometer	PV-87/33827	Rion	8 Sep 19	TCRT17/1593
Accelerometer	PV-87/74274	Rion	5 Dec 19	TCRT17/1808
Accelerometer	PV-87/33829	Rion	8 Sep 19	TCRT17/1594
Vibration Calibrator	AT01/3015	AP Technology	8 Sep 19	TCRT17/1595

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 are described below:

- The vibration dose value (VDV) in each of three axes with the appropriate frequency weightings (as defined in BS 6472-1:2008).
- The maximum RMS acceleration levels in each of three axes in one-third-octave bands, measured using the 'slow response' exponential time weighting.

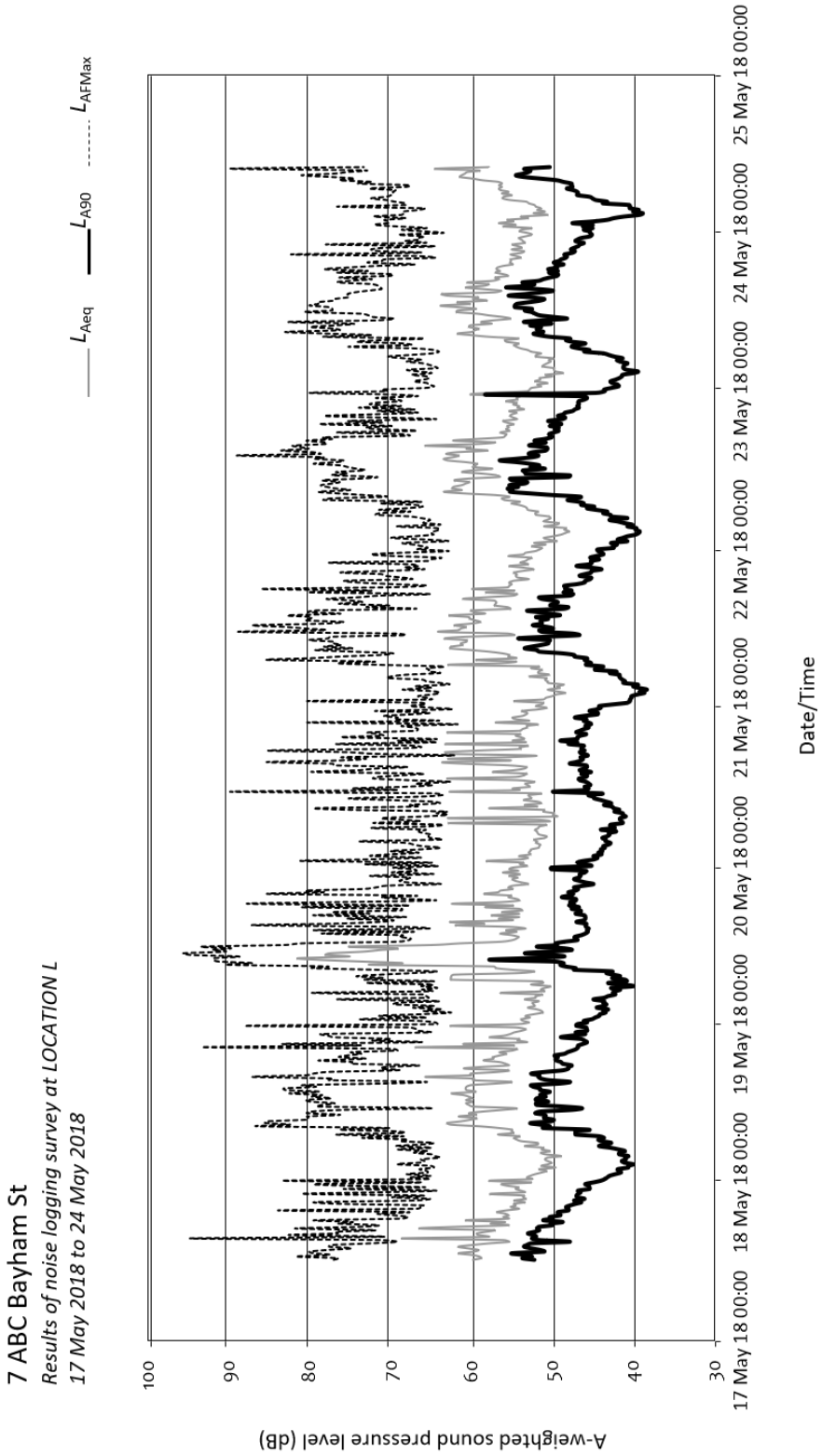
Weather conditions

During the attended measurements carried out on 6 April 2018 and 17 May 2018, the weather was generally clear and dry and no rain occurred. Wind speeds were measured at each position and varied between 0 m/s and 3 m/s.

During the unattended noise measurements between 17 May 2018 and 24 May 2018, weather reports for the area indicated that temperatures varied between 7°C at night and 24°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 at Location L


7 ABC Bayham St
Results of noise logging survey at LOCATION L
17 May 2018 to 24 May 2018
L_{Aeq}
L_{A90}
L_{AFMax}
A-weighted sound pressure level (dB)
100
90
80
70
60
50
40
30
17 May 18 00:00
18 May 18 00:00
19 May 18 00:00
20 May 18 00:00
21 May 18 00:00
22 May 18 00:00
23 May 18 00:00
24 May 18 00:00
25 May 18 00:00
Date/Time