100 Chalk Farm Road

Noise and Vibration Planning Report

Prepared by

Submitted on behalf of Regal Chalk Farm Ltd

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100 Chalk Farm Road, Camden

Noise and vibration planning report

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A	19 Dec 23		Daniel Shaw	Matthew Robinson
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Summary

This report has been prepared by Sandy Brown on behalf of Regal Chalk Farm Limited (the Applicant) in support of an application for full planning permission for the redevelopment of 100 and 100a Chalk Farm Road within London Borough of Camden (LBC).

An environmental noise and vibration survey has been carried out at the site. The noise survey was carried out between 21 October 2022 and 25 October 2022, with the vibration survey undertaken on 17 January 2024.

The representative background sound levels measured during the survey were:

- To the north on Chalk Farm Road:
    - $L_{A90,15min}$ 51 dB during the day,
    - $L_{A90,15min}$ 53 dB during the evening and
    - $L_{A90,15min}$ 44 dB at night
- To the south facing the train line:
    - $L_{A90,15min}$ 48 dB during the day
    - $L_{A90,15min}$ 44 dB at night.

The average ambient noise levels measured during the survey were $L_{Aeq,16h}$ 55-64 dB during the daytime and $L_{Aeq,8h}$ 54-61 dB at night, with night-time maxima not normally exceeded in the range of $L_{AFmax,15min}$ 79-83 dB. Based on the requirements of London Borough of Camden Council 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:

- To the north:
    - $L_{Aeq,15min}$ 41 dB during the day,
    - $L_{Aeq,15min}$ 43 dB during the evening
    - $L_{Aeq,15min}$ 34 dB at night
- To the south:
    - $L_{Aeq,15min}$ 38 dB during the day
    - $L_{Aeq,15min}$ 34 dB at night.

Operational noise limits have been set to control noise egress from commercial units to surrounding sensitive receptors. These are not expected to be overly restrictive on typical uses of the commercial spaces.

An initial assessment of the facade sound insulation required to meet internal noise limits has been carried out. The minimum facade sound insulation requirements vary between R'_w+C_{tr} 20-38 dB, and mechanical ventilation is expected to be required for background and overheating conditions.

An assessment of internal noise levels during overheating conditions has been carried out. Enhanced mechanical ventilation and heat recovery (MVHRs) will be required throughout the development to remove excess heat without relying on the use of openable windows, which would otherwise result in high internal noise levels. Openable windows under occupant control can be used for purge ventilation.

Tactile (feelable) vibration is not expected to be an issue at this site. Vertical vibration causing re-radiated noise is predicted to exceed the recommended re-radiated noise criterion of L_{ASmax} 35 dB by up to 1 dB on Level 1, though these levels are still below the London Underground Limited complaint threshold of L_{Amax} 40 dB.

Contents

1 Introduction

This report has been prepared by Sandy Brown on behalf of Regal Chalk Farm Limited (the Applicant) in support of an application for full planning permission for the redevelopment of 100 and 100a Chalk Farm Road within London Borough of Camden (LBC).

Environmental noise and vibration surveys have been carried out to establish:

- background sound levels around the site and by nearby noise sensitive premises
- ambient and maximum noise levels at the site
- 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 London Borough of Camden Council.

Ambient and maximum noise levels are used to assess indicative building envelope sound insulation requirements.

Vibration levels are used to provide an indicative assessment of the degree to which the proposed development will be affected by tactile vibration and re-radiated noise from the railway and the underground line adjacent to the site.

This report provides details of the noise and vibration surveys, including measurement results, and provides outline recommendations to ensure the proposed assessment criteria can be achieved.

2 Site description

2.1 The site and its surroundings

The site location in relation to its surroundings is shown in Figure 1, highlighted red, with survey positions also shown.

The site is located on the south-western side of Chalk Farm Road and border the mainline railway into Euston, with the Juniper Crescent Housing Estate to the south, which is the subject of further redevelopment proposals. It lies within the Regents Canal Conservation Area, to which the existing building on the site is a neutral contributor. To the west, the site is adjacent to the Grade 2* listed Roundhouse theatre and live music venue. Beyond that, to the north-west is Chalk Farm Underground Station. To the east is the former Petrol Filling Station site, which forms part of the Camden Goods Yard development and is currently in use as a temporary supermarket but has planning permission for a 6-storey building with replacement petrol filling station and ground floor retail with offices on upper floors.

The key sources of noise at the site include traffic and bars/restaurants on Chalk Farm Road, and trains on the railway to the south.

The key sources of vibration expected at the site are the Transport for London Northern Line running directly beneath the site (tunnels at Chalk Farm Station are 13 m below ground level), the existing mainline railway approaching London Euston station (tracks approximately 100 m south of the site), and the Transport for London Overground and freight line running between South Hampstead station and Camden Road station (tracks approximately 5 m south of site boundary).

The proposed High Speed 2 railway is planned to run east to west, approximately 140 m south of the site and 29 m below ground level in tunnels.

Figure 1 Aerial view of site (courtesy of Google Earth Pro)

2.2 Adjacent premises types

The site is within Camden town centre, and is generally surrounded by a mix of commercial and residential unts. The Roundhouse to the west is a major music venue, while the Camden Club and Camden Assembly on Chalk Farm Road are smaller music venues, all highlighted in

orange. These are existing businesses which should not have unreasonable restrictions placed upon them. This is discussed further in section 4.1.

The car park and proposed petrol station to the east is highlighted in pink. Across the train line are dedicated residential units, in blue. Mixed residential and commercial units are highlighted green.

The nearest residential receptors are 20 m from the boundary of the development both to the north and south.

3 Development proposals

The development will provide 265 student accommodation units, together with 824 m^2 of commercial space, 24 affordable residential units, with public realm improvements, new areas of landscaping, amenity and play space, and improved accessibility to the site. The description is as follows:

> *'Demolition of existing buildings and redevelopment of the site to provide two buildings ranging in height from 6 to 12 storeys containing purpose-built student accommodation (PBSA) with 265 rooms, associated amenity and ancillary space (Sui Generis), affordable residential homes (Class C3), ground floor commercial space (Class E) together with public realm, access, servicing, and other associated works.'*

Expectations for hours of operation or type of commercial unit would reflect the town centre location and be controlled by condition, but have not yet been defined. Consideration will need to be made for noise egress from building services plant at roof level or terminating at the facade, as well as operational noise within commercial units.

4 Assessment criteria

4.1 NPPF and NPSE

The National Planning Policy Framework, December 2023 (NPPF) sets out the UK government's planning policies for England. It 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 clause 191 states:

> *'Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*
>
> - *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 the 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.'*

and clause 193 states:

> *'Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.'*

and

> *'Planning policies and decisions should contribute to and enhance the natural and local environment by… preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution.'*

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, neither document sets out specific acoustic criteria for new residential developments, but they require consideration of the effect of existing noise on the new development and the effect of noise from the development on the surroundings.

4.2 ProPG

ProPG *Planning & Noise (Professional Practice Guidance on Planning & Noise), New Residential Development, 2017* provides guidance to the management of noise within the planning system in England. It is restricted to consideration of new residential developments that will be exposed predominantly to airborne noise from transport sources.

The two stages of the approach are given below

- Stage 1 – Initial noise risk assessment of the proposed development site
- Stage 2 – Systematic consideration of four key elements
    - Element 1 – Demonstrating a "Good Acoustic Design Process"
    - Element 2 – Observing internal "Noise Level Guidelines"
    - Element 3 – Undertaking an "External Amenity Area Noise Assessment"
    - Element 4 – Consideration of "Other Relevant Issues".

Following this approach, there are four possible recommendations, the choice of recommendation is as follows:

- Grant without conditions
- Grant with conditions
- Avoid
- Prevent.

Guidance provided in ProPG has been used to assess the proposed development site and recommend mitigation measures to reduce noise levels.

4.3 London Plan

With specific reference to noise, Policy 7.15 of the London Plan 2021 states:

> *'…the transport, spatial and design policies of this plan will be implemented in order to reduce noise and support the objectives of the Mayor's Ambient Noise Strategy',*

The London Plan goes on to note that development proposals should seek to reduce noise by:

- *'Minimising the existing and potential adverse impacts of noise on, from, within, or in the vicinity of, development proposals;*
- *Separating new noise sensitive development from major noise sources wherever practicable through the use of distance, screening, or internal layout in preference to sole reliance on sound insulation; and*
- *Promoting new technologies and improved practices to reduce noise at source.'*

It also states that London Boroughs and others with relevant responsibilities should have policies to:

- *'Manage the impact of noise through the spatial distribution of noise making and noise sensitive uses;*

- *Identify and nominate new quiet areas and protect existing quiet areas in line with the procedure in Defra's noise action plan for agglomerations.'*

4.4 Noise egress

4.4.1 Standard guidance

BS 4142:2014+A1:2019 *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 premises.

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 sound level, it is an indication of having a low impact. If the noise contains 'attention catching features' such as tones, bangs etc, the methodology applies a penalty based on the type and impact of those features, reducing the allowable noise egress.

4.4.2 Local Authority criteria – Industrial and commercial noise

Camden Local Plan 2017 requires noise egress to be assessed in line with BS 4142, with noise rating levels to be 10 dB below the typical background noise levels. Where tonality is present at the receptors, the limits should be reduced by 5 dB. Relevant section of the Local Plan are summarised below.

Appendix 3 Table C specifies target noise egress levels from industrial and commercial sources outside a development in relation 'effect levels' (NOEL: No Observed Effect Level, LOAEL: Lowest Observed Adverse Effect Level, SOAEL: Significant Observed Adverse Effect Level).

The target noise egress levels outside noise sensitive premises are summarised in Table 4 , where the 'Rating level' is determined using BS 4142.

Table 1 Summary of Camden Local Plan 2017 Appendix 3 Table C

Location	Period	LOAEL	LOAEL to SOAEL	SOAEL
Garden used for amenity and outside living, dining, bedroom window	Day	'Rating level' 10 dB[1] below background	'Rating level' between 9 dB below and 5 dB above background	'Rating level' greater than 5 dB above background
Outside bedroom window	Night	'Rating level' 10 dB[1] below background and no events exceeding L_{Amax} 57 dB	'Rating level' between 9 dB below and 5 dB above background or noise events between L_{Amax} 57-88 dB	'Rating level' greater than 5 dB above background and/or noise events exceeding L_{Amax} 88 dB

[1] 10 dB should be increased to 15 dB if the noise contains audible tonal elements (day and night).

4.4.3 Local authority criteria – Entertainment noise

Appendix 3 Table D specifies noise limits in internal spaces due to entertainment noise, which are summarised in Table 2. These limits are to be used when assessing transfer from commercial units within the development as well as egress to surrounding noise sensitive receptors.

Table 2 Summary of Camden Local Plan 2017 guidance on entertainment noise

Room	Period	Noise limit
Bedrooms	23:00-07:00	NR 25 ($L_{eq,15min}$) Approximately equivalent to L_{Aeq} 30 dB
All habitable rooms	07:00-23:00	NR 35 ($L_{eq,15min}$) Approximately equivalent to L_{Aeq} 40 dB

4.5 Noise ingress

4.5.1 British Standard guidance

Guidance on acceptable internal noise levels in residential dwellings is given in BS 8233:2014 *Sound insulation and noise reduction for buildings*. The guidance limits are shown below.

These internal levels are based on annual average data and do not have to be achieved in all circumstances. It is normal to exclude occasional events, such as fireworks night or New Year's Eve.

Table 3 Internal noise criteria for sleeping/resting

Internal space	Indoor ambient noise level, L_{Aeq} (dB)	
	Daytime (07:00 – 23:00)	Night (23:00 – 07:00)
Living rooms	35	-
Dining room	40	-
Bedrooms	35	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. For regular events, such as scheduled aircraft or passing trains, a guideline value may be set in terms of SEL or $L_{Amax,F}$. Sporadic noise events could require separate values.

The standard states that where development is considered necessary or desirable, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

For external amenity areas, such as gardens and patios, the standard states:

> *'it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$ with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.'*

4.5.2 Local Authority criteria

Within the Camden Local Plan 2017, Appendix 3 Table B specifies target noise levels outside a development, inside bedrooms and in outdoor living spaces (eg, balconies, terraces) in relation 'effect levels' (NOEL: No Observed Effect Level, LOAEL: Lowest Observed Adverse Effect Level, SOAEL: Significant Observed Adverse Effect Level).

The target noise levels inside bedrooms and in outdoor living spaces due the general environmental noise sources are summarised in Table 4.

Table 4 Summary of Camden Local Plan 2017 Appendix 3 Table B

Location	Period	LOAEL	LOAEL to SOAEL	SOAEL
Inside bedrooms	Day	< $L_{Aeq,16hr}$ 35 dB	$L_{Aeq,16hr}$ 35-45 dB	< $L_{Aeq,16hr}$ 45 dB
	Night	< $L_{Aeq,8hr}$ 30 dB	$L_{Aeq,8hr}$ 30-40 dB	< $L_{Aeq,8hr}$ 40 dB
		< L_{AFmax} 42 dB	L_{AFmax} 42-73 dB	< L_{AFmax} 73 dB
Outdoor living space (free-field)	Day	< $L_{Aeq,16hr}$ 50 dB	$L_{Aeq,16hr}$ 50-55 dB	< $L_{Aeq,16hr}$ 55 dB

The Camden Local Plan 2017 also specifies noise limits in internal spaces due to entertainment noise ingress, which are summarised in Table 2.

4.5.3 ProPG

Internal noise ingress criteria in ProPG are the same as in BS 8233:2014 but additional guidance is provided. In relation to regular individual noise events the following additional guidance is provided:

> *'In most circumstances in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events.'*

4.5.4 Approved Document O – Overheating

Approved Document O 2021 Edition (to the Building Regulations 2010) states the following in relation to noise ingress during overheating periods:

> *'In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (23:00-07:00 hours).*

Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

a. $L_{Aeq,T}$ *40 dB average over 8 hours (between 23:00-07:00)*
b. L_{AFmax} *55 dB more than 10 times a night (between 23:00-07:00).'*

The above applies to residential dwellings, institutional residential accommodation, and other types of residential accommodation, such as student accommodation.

4.5.5 Acoustics, ventilation and overheating

Guidance on external noise levels from transport noise sources and the assessment of risk in an overheating condition is given in the Association of Noise Consultants *Acoustics Ventilation and Overheating, Residential Design Guide* (AVO Guide). The guidance for night-time internal noise levels during an overheating condition set out in AVO Guide is superseded by the requirements set out in ADO2021 and therefore I provided for information only.

A Level 1 assessment comprises assessing the external free-field noise levels to guideline thresholds. External noise levels and the associated risk categories for a Level 1 assessment are adapted and summarised in Table 5, though consideration also has to be given the duration and frequency of any overheating periods.

Table 5 Guidance for Level 1 assessment of noise from transport sources relating to overheating condition

Risk category for Level 1 assessment	External free-field noise level	
	Daytime (07:00 – 23:00)	Night (23:00 – 07:00)
Negligible	$L_{Aeq} \leq 52$ dB	$L_{Aeq} \leq 47$ dB
Low	$L_{Aeq} > 52$ dB and $L_{Aeq} \leq 57$ dB	$L_{Aeq} > 47$ dB and $L_{Aeq} \leq 52$ dB
Medium	$L_{Aeq} > 57$ dB and $L_{Aeq} \leq 62$ dB	$L_{Aeq} > 52$ dB and $L_{Aeq} \leq 55$ dB
High	$L_{Aeq} > 62$ dB	$L_{Aeq} > 55$ dB

If a Level 1 assessment finds that the development falls into a 'Medium' or 'High' risk category a Level 2 assessment should be carried out, assessing the expected internal noise levels for an overheating condition and the associated risk of adverse effect.

The Level 2 assessment would consider the following:

- Duration of period where additional ventilative cooling is required (to be assessed by others, typically part of a CIBSE TM59 assessment)
- How wide the external windows would need to be open to control overheating (to be assessed by others, typically part of a CIBSE TM59 assessment).

4.6 Tactile vibration criteria

4.6.1 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 (VDV). This relates the level and duration of vibration.

The BS 6472-1:2008 assessment criteria are presented in Table 6.

Table 6 BS 6472-1: 2008 tactile vibration assessment criteria

VDV ($m/s^{1.75}$) above which might result in various probabilities of adverse comment within residential buildings (including student accommodation)			
Place	Low probability of adverse comment	Adverse comment possible	Adverse comment probable
Residential buildings 16 hr day	0.2 – 0.4	0.4 – 0.8	0.8 – 1.6
Residential building 8 hr night	0.1 – 0.2	0.2 – 0.4	0.4 – 0.8

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.

4.6.2 Local Authority criteria

The Camden Local Plan 2017 sets out the following vibration limits in Appendix 3.

Table 7 Camden Local Plan 2017 vibration limits

Place	Limiting vibration levels, VDV ($m/s^{1.75}$)
Residential buildings 16 hr day	0.2 – 0.4
Residential building 8 hr night	0.13
Offices 24 hour day	0.4

4.7 Re-radiated noise criteria

4.7.1 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 L_{Amax} 40 dB.
- 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 L_{AFmax} 35 dB.

In all 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.

5 Survey method

5.1 Noise survey method

The survey included unattended and attended noise measurements.

5.1.1 Unattended measurements

Unattended noise monitoring was undertaken at the site over five days.

Details of the equipment used and the noise indices measured are provided in Appendix A.

The unattended measurements were taken over 15 minute periods between 17:00 on 21 October 2022 and 14:00 on 25 October 2022.

Performances at the Roundhouse were on 21, 22, 23 and 24 October 2023.

The measurement positions used during the survey are indicated in Figure 1, denoted by the letters 'L', 'M' and 'N'. Photographs showing the measurement location overlooking the Roundhouse are provided in Figure 2 to Figure 4. These locations were chosen to be reasonably representative of noise levels at the site and outside the nearest noise sensitive premises.

All microphones were located 0.5 m from the facade of the existing office building, on the uppermost floors.

Figure 2 Photograph of measurement position L overlooking the Roundhouse

Figure 3 Photograph of measurements position M overlooking the railway

Figure 4 Photograph of measurement position N overlooking the road

5.1.2 Attended measurements

Attended sample measurements were taken at three locations around the site. These are indicated in Figure 1 as positions A to C. The evening and night-time attended measurements were carried out on 21 October 2022, while the daytime measurements were carried out on 25 October 2022, with both sets of measurements over five-minute periods.

At each position the microphone was mounted on a tripod approximately 1.5 m above the ground level and at least 3 m from any other reflective surface. Details of the equipment used and the noise indices measured are provided in Appendix A.

Dominant noise sources occurring during the measurements were noted.

Photographs of the measurement positions are provided below in Figure 5 to Figure 7.

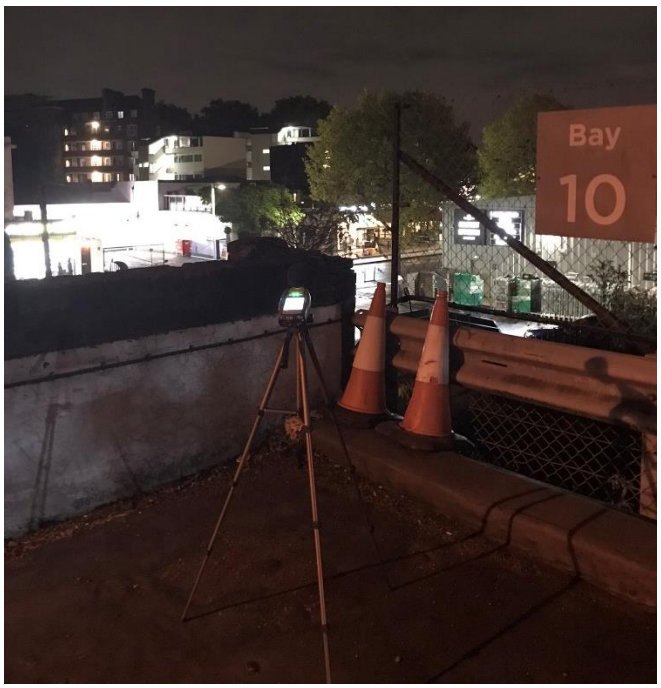


Figure 5 Photograph of measurement position A

Figure 6 Photograph of measurement position B

Figure 7 Photographs of measurement position C

5.2 Vibration survey method

Vibration measurements were taken at two locations around the site to determine the vibration levels resulting from the passage of trains on the railway tracks and underground line adjacent to the site. The vibration measurement locations are indicated in Figure 1 as positions V and W.

The measurements were taken on 17 January 2024 throughout the afternoon. Measurement periods containing multiple train events were obtained during the survey, and are considered to be representative of events throughout the full 24-hour period.

Vibration time histories were recorded using a tri-axial accelerometer and data recorder. The accelerometers were arranged on a mounting block that was connected to either a ground-bearing concrete slab or the external made ground.

The vibration 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.

Details of the equipment used and the noise indices measured are provided in Appendix A.

Measurements at V were inside the existing building, on the lower ground floor slab. These were to primarily measure ground-borne vibration from the underground trains. Measurements at W were outside, on the made ground of the car park, and were primarily to measure ground-borne vibration from the train line adjacent to the site.

The vibration measurements taken at location V and W are considered to be reasonably representative of the vibration levels to be experienced by the proposed development.

Figure 8 Internal vibration measurement position V

Figure 9 External vibration measurement position W

5.3 Weather conditions

Weather conditions during the survey are described in Appendix A. High wind speeds were noted on the night of 21 October, though the weather for the rest of the period are expected to be representative.

6 Measurement results

6.1 Observations

6.1.1 Noise

The dominant noise sources observed at the site during the survey were from road traffic and pedestrians.

Less significant noise sources included occasional freight trains.

Music noise egress from performances at the Roundhouse was not observed during installation at the unattended measurement positions, or during attended measurements around the site. This is understood to be because the Roundhouse building envelope is suitable controlling noise egress to the surrounding environment.*Vibration*

Subjectively there was perceptual vibration at the measurement location, with train events also audible at position V.

6.2 Noise measurement results

6.2.1 Unattended measurement results – Position L

Graphs showing the results of the unattended measurements are provided in Appendix B.

Day and night-time ambient noise levels measured during the unattended survey are presented in Table 8. All measurements are in facade conditions, 0.5 m from the facade of the existing office building.

Table 8 Ambient noise levels measured during the unattended survey – position L, facing Roundhouse

Date	Day (07:00-19:00) $L_{Aeq,12hr}$ (dB)	Evening (19:00-23:00) $L_{Aeq,4hr}$ (dB)	Night (23:00-07:00) $L_{Aeq,8hr}$ (dB)
Friday 21 October 2022	63 [1]	64	61
Saturday 22 October 2022	62	63	61
Sunday 23 October 2022	63	65	61
Monday 24 October 2022	63	64	60
Tuesday 25 October 2022	63 [1]	-	-
Average	63	64	61

[1] Measurement not made over full period due to monitoring start and end time (the measurement on 21 October 2022 was over 2 hours, and on 25 October 2022 over 6 hours); not included in the average.

Analysis of night-time maximum noise levels indicates that the night-time maximum noise level 'not normally exceeded' 10 times a night is $L_{AFmax,2min}$ 81 dB.

In line with BS 4142:2014+A1:2019, representative background sound levels have been determined using statistical analysis of the continuous measurements.

Day, evening and night-time statistical analysis of representative values for the site are given in the figures below.

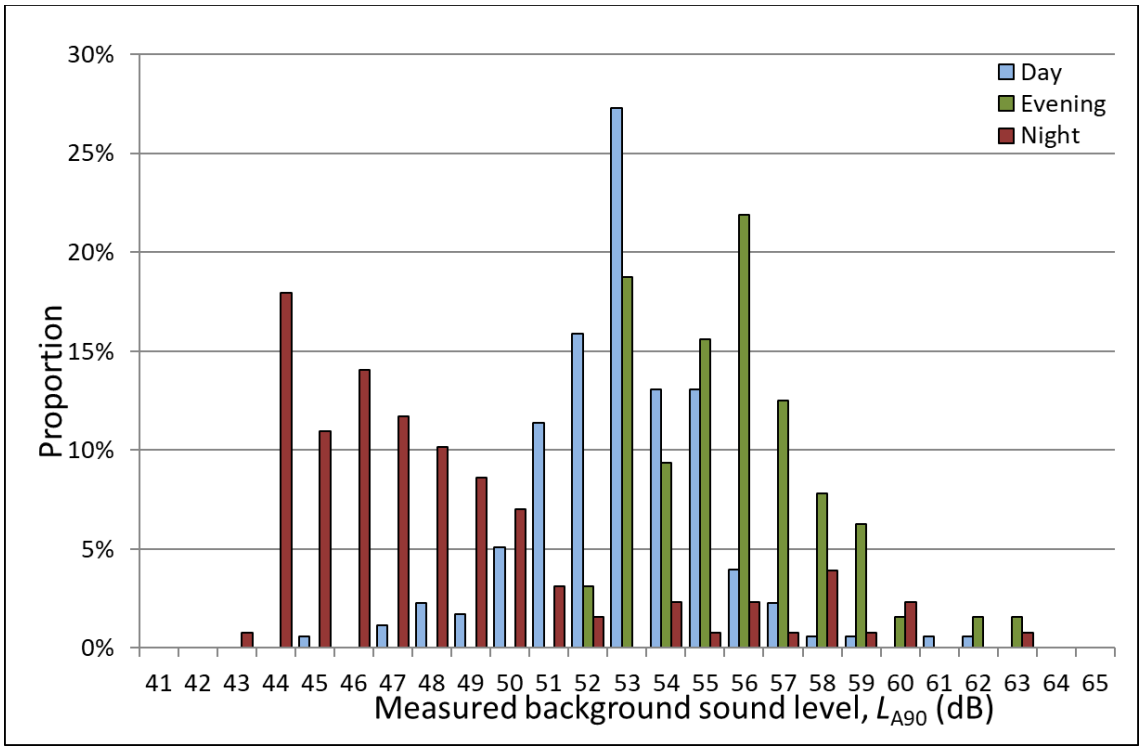


Figure 10 Histogram of background noise levels at Position L – facing Roundhouse

From this analysis, the representative background sound levels measured during the survey were $L_{A90,15min}$ 51 dB during the daytime, $L_{A90,15min}$ 53 dB during the evening, and $L_{A90,15min}$ 44 dB at night.

6.2.2 Unattended measurement results – Position M

Graphs showing the results of the unattended measurements are provided in Appendix B.

Day and night-time ambient noise levels measured during the unattended survey are presented in Table 9. All measurements are in facade conditions, located 0.5 m from the facade of the existing office building.

Table 9 Ambient noise levels measured during the unattended survey – position M, facing railway

Date	Day (07:00-19:00) $L_{Aeq,12hr}$ (dB)	Evening (19:00-23:00) $L_{Aeq,4hr}$ (dB)	Night (23:00-07:00) $L_{Aeq,8hr}$ (dB)
Friday 21 October 2022	58 [1]	61	50
Saturday 22 October 2022	51	51	49
Sunday 23 October 2022	54	53	53
Monday 24 October 2022	60	65	63
Tuesday 25 October 2022	57[1]	-	-
Average	56	58	54

[1] Measurement not made over full period due to monitoring start and end time (the measurement on 21 October 2022 was over 2 hours, and on 25 October 2022 over 6 hours); not included in the average.

Analysis of night-time maximum noise levels indicates that the night-time maximum noise level not normally exceeded 10 times a night is $L_{AFmax,2min}$ 83 dB.

In line with BS 4142:2014+A1:2019, representative background sound levels have been determined using statistical analysis of the continuous measurements.

Day, evening and night-time statistical analysis of representative values for the site are given in the figures below.

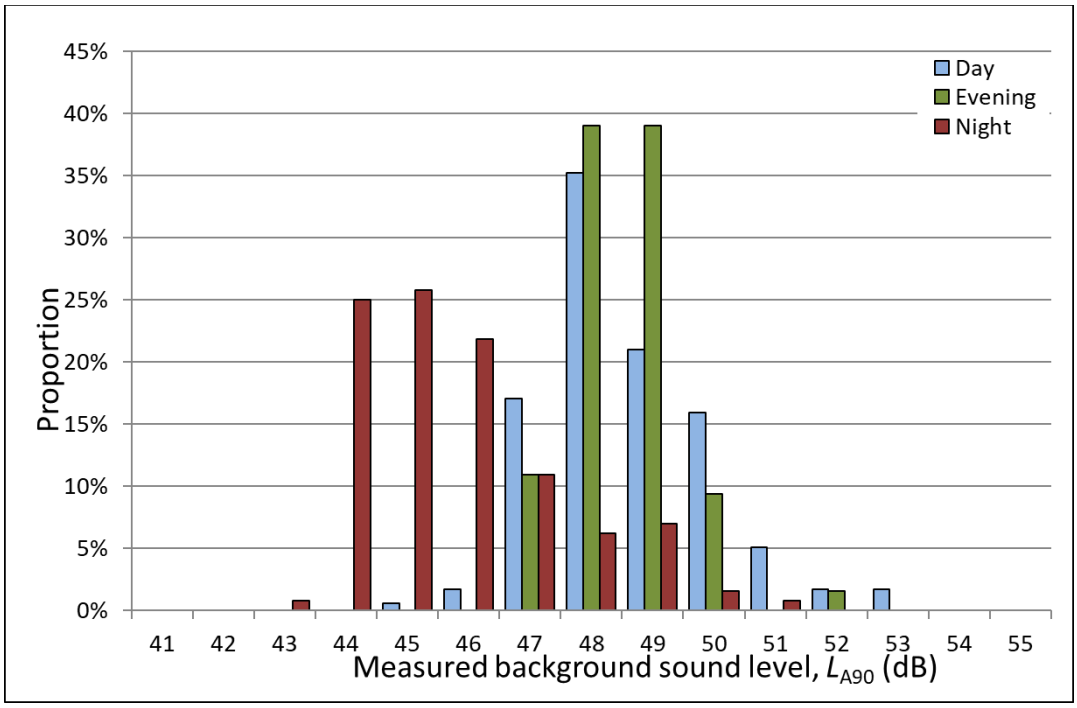


Figure 11 Histogram of background noise levels at Position M – facing railway

From this analysis, the representative background sound levels measured during the survey were $L_{A90,15min}$ 48 dB during the daytime and evening, and $L_{A90,15min}$ 44 dB at night.

6.2.3 Unattended measurement results – Position N

Graphs showing the results of the unattended measurements are provided in Appendix B.

Day and night-time ambient noise levels measured during the unattended survey are presented in Table 10.

All measurements are in facade conditions, 0.5 m from the facade of the existing office building.

Table 10 Ambient noise levels measured during the unattended survey – position N, facing Chalk Farm Road

Date	Day (07:00-19:00) $L_{Aeq,12hr}$ (dB)	Evening (19:00-23:00) $L_{Aeq,4hr}$ (dB)	Night (23:00-07:00) $L_{Aeq,8hr}$ (dB)
Friday 21 October 2022	63 [1]	64	62
Saturday 22 October 2022	63	63	60
Sunday 23 October 2022	64	65	61
Monday 24 October 2022	66	64	61
Tuesday 25 October 2022	65 [1]	-	-
Average	64	64	61

[1] Measurement not made over full period due to monitoring start and end time (the measurement on 21 October 2022 was over 2 hours, and on 25 October 2022 over 6 hours); not included in the average.

Analysis of night-time maximum noise levels indicates that the night-time maximum noise level not normally exceeded 10 times a night is $L_{AFmax,2min}$ 84 dB.

In line with BS 4142:2014+A1:2019, representative background sound levels have been determined using statistical analysis of the continuous measurements.

Day, evening and night-time statistical analysis of representative values for the site are given in the figures below.

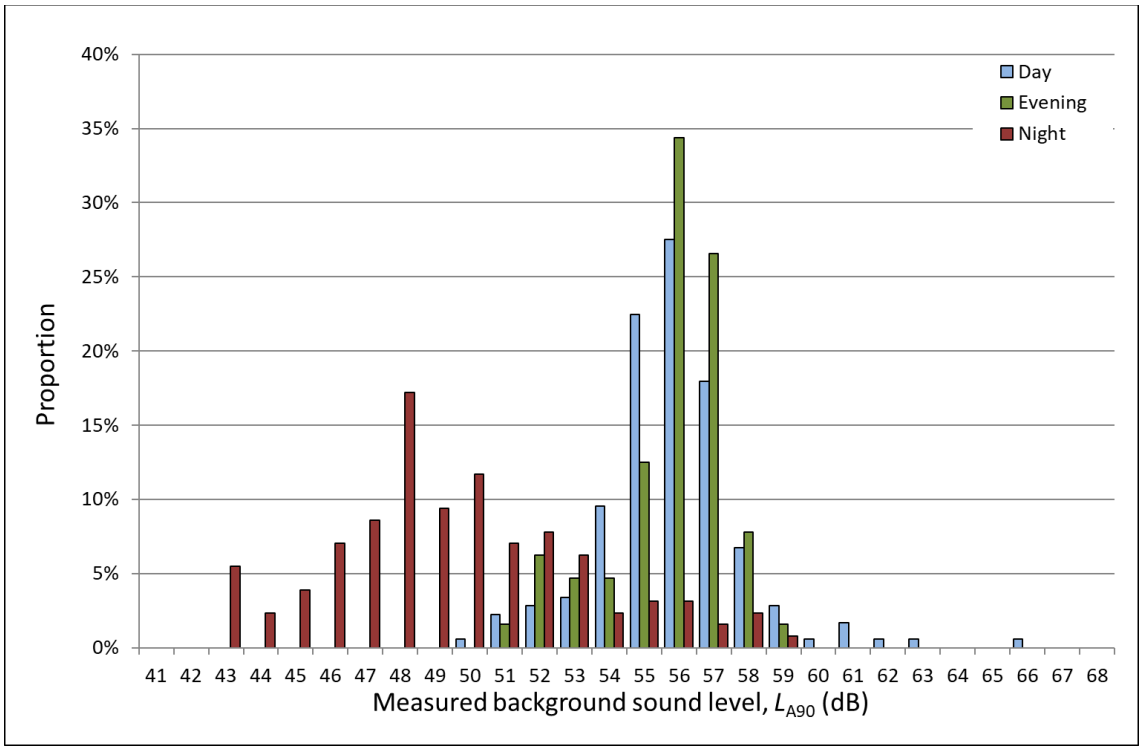


Figure 12 Histogram of background noise levels at Position N – facing Chalk Farm Road

From this analysis, the representative background sound levels measured during the survey were $L_{A90,15min}$ 55 dB during the daytime and evening, and $L_{A90,15min}$ 48 dB at night.

6.2.4 Attended measurement results

Noise levels and key sources recorded during the attended measurements are summarised in the tables below. All measurements are in the free field.

Table 11 Noise levels and key noise sources from attended measurements – Daytime (25 October 2022)

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,5min}$	$L_{aFmax,5min}$	$L_{A90,5min}$	
A	10:57	60	75	50	Road traffic, trains, pedestrians, Morrisons car park, street cleaner 11:02
	11:02	62	72	53	
	11:12	70	90	50	
B	11:23	67	78	56	Road traffic including lorries and buses, trains, pedestrians, street cleaner 11:35
	11:29	72	91	60	
	11:35	72	82	63	
C	11:41	69	84	60	Road traffic including lorries and buses, trains, pedestrians
	11:47	66	79	55	
	11:52	68	82	55	
A	12:07	64	83	53	General road traffic, fewer trains, plane overhead 12:07
	12:12	55	66	52	
	12:18	56	66	52	
B	12:28	65	75	57	Road traffic, pedestrians, HGVs and buses
	12:33	70	82	57	
	12:38	67	83	56	
C	12:46	67	81	55	Road traffic including bikes and scooters, pedestrians, HGVs and buses
	12:53	67	81	60	
	12:59	67	79	56	

Table 12 Noise levels and key noise sources from attended measurements – Evening (21 October 2022)

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,5min}$	$L_{aFmax,5min}$	$L_{A90,5min}$	
A	19:11	57	71	51	Freight train, road traffic, pedestrians
	19:16	63	84	50	
	19:21	55	62	50	
B	19:31	68	80	56	Road traffic, pedestrians
	19:36	71	92	59	
	19:43	69	84	59	
C	19:49	69	80	61	Road traffic, pedestrians
	19:55	67	79	58	
	20:00	67	79	59	
A	21:26	65	74	50	Freight train, road traffic, pedestrians
	21:31	54	65	50	
	21:36	54	60	50	
B	21:45	67	79	58	Road traffic, pedestrians
	21:50	68	88	58	
	21:56	75	94	61	
C	22:01	65	76	58	Road traffic, pedestrians
	22:06	68	81	58	
	22:12	69	95	57	

Table 13 Noise levels and key noise sources from attended measurements – Night (21 October 2022)

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,5min}$	$L_{aFmax,5min}$	$L_{A90,5min}$	
A	22:59	58	74	50	Freight train, road traffic, pedestrians
	23:05	57	77	50	
	23:10	53	66	49	

6.3 Vibration measurement results

VDV measurements at locations V and W are presented in Table 14 and Table 15 respectively. All measurements are over a 1-minute duration, and cover a single event. The maximum values measured for each of the directions are highlighted in red. RMS acceleration measurements over the full period are set out in Appendix C.

Table 14 VDV measured at location V

Start time	Measured VDV, $m/s^{1.75}$		
	Z-axis	Y-axis	X-axis
14:00	0.00159	0.00123	0.00125
14:01	0.00171	0.00039	0.00044
14:02	0.01697	0.00070	0.00130
14:03	0.00123	0.00023	0.00029
14:04	0.00133	0.00022	0.00029
14:05	0.00748	0.00041	0.00051
14:06	0.00105	0.00025	0.00032
14:07	0.01817	0.00071	0.00134
14:08	0.00130	0.00035	0.00041
14:09	0.01684	0.00071	0.00125
14:10	0.00708	0.00043	0.00054
14:11	0.00351	0.00053	0.00054
14:12	0.01798	0.00085	0.00131
14:13	0.00775	0.00050	0.00058
14:14	0.00120	0.00034	0.00039

Start time	Measured VDV, $m/s^{1.75}$		
	Z-axis	Y-axis	X-axis
14:15	0.01821	0.00075	0.00135
14:16	0.00168	0.00031	0.00044
14:17	0.01696	0.00074	0.00125
14:18	0.00682	0.00041	0.00053
14:19	0.00348	0.00041	0.00051
14:20	0.01678	0.00073	0.00129
14:21	0.00260	0.00033	0.00040
14:22	0.00774	0.00052	0.00069
14:23	0.01824	0.00071	0.00132
14:24	0.00750	0.00042	0.00052
14:25	0.00154	0.00037	0.00037
14:26	0.01834	0.00081	0.00138
14:27	0.00694	0.00042	0.00054
14:28	0.01810	0.00074	0.00135
14:29	0.00141	0.00029	0.00035
14:30	0.00691	0.00063	0.00080
14:31	0.00291	0.00067	0.00079
14:32	0.01794	0.00085	0.00144
14:33	0.00271	0.00048	0.00047
14:34	0.01841	0.00087	0.00136
14:35	0.00188	0.00057	0.00072
14:36	0.01734	0.00078	0.00129
14:37	0.00680	0.00051	0.00069
14:38	0.01806	0.00071	0.00132
14:39	0.00756	0.00047	0.00056
14:40	0.00246	0.00058	0.00057
14:41	0.01804	0.00081	0.00132

Start time	Measured VDV, $m/s^{1.75}$		
	Z-axis	Y-axis	X-axis
14:42	0.00777	0.00055	0.00063
14:43	0.00155	0.00037	0.00048
14:44	0.01778	0.00077	0.00133
14:45	0.00725	0.00045	0.00055
14:46	0.00346	0.00039	0.00043
14:47	0.01703	0.00073	0.00126
14:48	0.00762	0.00050	0.00060
14:49	0.00117	0.00035	0.00040
14:50	0.00134	0.00039	0.00045
14:51	0.00712	0.00045	0.00058
14:52	0.00209	0.00039	0.00042
14:53	0.01778	0.00072	0.00127
14:54	0.00134	0.00041	0.00049
14:55	0.00097	0.00024	0.00030
14:56	0.00250	0.00043	0.00060
14:57	0.00493	0.00028	0.00036
14:58	0.00651	0.00038	0.00048
14:59	0.01718	0.00068	0.00124

Table 15 VDV measured at location W

Start time	Measured VDV, $m/s^{1.75}$		
	X-axis	Y-axis	Z-axis
20:01	0.00150	0.00067	0.02544
20:02	0.00123	0.00056	0.01980
20:27	0.00081	0.00038	0.01497
20:28	0.00175	0.00075	0.02972
20:34	0.00115	0.00045	0.01871
20:35	0.00145	0.00059	0.02267

7 Plant noise egress

7.1 Limits

7.1.1 Normally operating plant

Based on the above criteria and the measurement results, the cumulative noise level from the operation of all new plant should not exceed the limits set out in Table 16. The limits apply at 1 m from the worst affected windows of the nearest noise sensitive premises and are presented as facade levels. In this case these limits would apply at all surrounding sensitive receptors.

Table 16 Normally operating 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)	
	Northern receptors	Southern receptors
Daytime (07:00 – 19:00)	41	38
Evening (19:00-23:00)	43	38
Night-time (23:00 – 07:00)	34	34

[1] The limits set out in Table 16 do not include any attention catching features. LBCC requires tonal plant to meet limits 5 dB lower than those listed above.

7.1.2 Emergency plant

Based on the measurement results, and the typical requirements of the London Borough of Camden (LBC) the recommended cumulative external noise egress limits for proposed emergency plant items are set out in Table 17. These are based on emergency plant items operating for a short period and would need to be agreed with LBC. The limits apply at 1 m from the worst affected windows of the nearest noise sensitive premises and are presented as facade levels.

Table 17 Emergency 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)	
	Northern receptors	Southern receptors
Daytime (07:00 – 19:00)	61	58
Evening (19:00-23:00)	63	58
Night-time (23:00 – 07:00)	54	54

7.2 Assessment

All building services plant will be designed to achieve the noise limits set out above, including any corrections for attention catching features. At this stage, the proposed plant is understood to be largely located at roof level, with some atmospheric terminations at the facade on lower levels.

8 Operational noise egress

8.1 Noise egress to nearby sensitive premises

Based on the above criteria and the measurement results, the cumulative noise level from the operation of the commercial units should not exceed the limits set out in Table 18.

The limits apply at 1 m from the worst affected windows of the nearest noise sensitive premises and are presented as facade levels.

Table 18 Operational noise limits at 1 m from the nearest noise sensitive premises

Location	Operational noise egress limit at 1 m from noise sensitive premises, $L_{eq,\ 5min}$ (dB)							
		Octave-band centre frequency (Hz)						
	L_{Aeq}	63	125	250	500	1000	2000	4000
North (07:00-23:00)	41	45	41	37	38	36	32	26
South (07:00-23:00)	38	46	47	39	34	33	28	20

8.2 Noise transfer to proposed dwellings

Operational noise limits will be set based on the constructions proposed to ensure that internal noise criteria set out in Section 4.4.3 are met. If higher levels are desired to the commercial units, enhancement to the sound insulation performance of these areas would be required as part of fit-out works (eg, provision of sound insulating ceiling).

To control noise transfer from the commercial units to the student accommodation above and allow internal operational noise limits to be set, it is recommended (as a guide) that the separating floor provides a minimum sound insulation performance at least 10 dB above the minimum standard required in Building Regulations Approved Document E 2003 between individual dwellings ie, $D_{nT,w}+C_{tr}$ 55 dB.

8.3 Operational noise limits

Operational noise limits within the commercial units and commercial units will be set as the design progresses to control noise transfer to both the proposed dwellings and nearby noise sensitive premises. For typical double glazed facades, the limits would be in the region of L_{Aeq} 90 dB. This will be refined as the design is developed.

9 Facade sound insulation – noise ingress

This section describes an assessment of facade sound insulation to control noise ingress. The required facade specification largely depends on the external noise levels and the internal noise criteria.

The following assessment is based on achieving the internal noise levels recommended in BS 8233:2014, which are set out in Section 4.5.

9.1 Measured external noise levels

External noise levels measured at the facades of the existing development are shown in Table 19. These were generally dominated by road and rail noise – anonymous sources. There was some contribution from bars and restaurants on Chalk Farm Road, which was largely non-anonymous. Music noise egress from The Roundhouse was generally not audible during the survey.

Table 19 Measured facade noise levels

Facade	Average ambient noise level, L_{Aeq} (dB)			Night-time maximum noise level not normally exceeded, $L_{AFmax,2min}$ (dB)
	Day	Evening	Night	
Facing the Roundhouse Level 4	63	64	61	81
Facing the railway Level 2	55	58	54	83
Facing Chalk Farm Road Level 4 [1]	64	64	61	84

[1] Expected to be representative of the north and east facades.

9.2 Predicted external noise levels

A 3D environmental noise model of the site and its surroundings has been generated using CadnaA (version 2023) software by DataKustik. This allows for a more accurate assessment of noise ingress by incorporating the screening that the proposed building will provide when it is completed.

The software carries out calculations using a ray tracing technique. This takes account of the effects of topography, reflections, screening and distance attenuation for noise sources to predict noise levels in three dimensions. Calculations are carried out in accordance with ISO 9613 *Attenuation of sound during propagation outdoors.*

The noise levels across the site have been used to calibrate the model to establish the levels at each facade as well as noise levels across the site. Images of the environmental noise model are provided in Figure 13 to Figure 16.

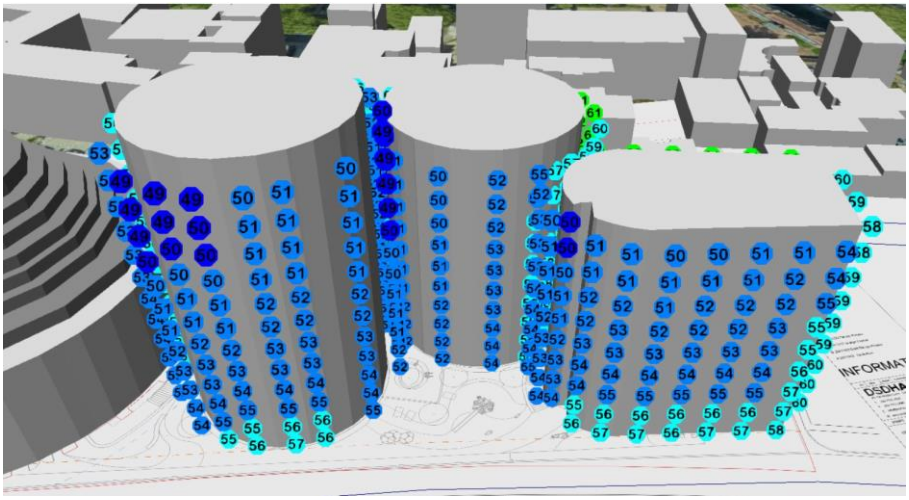


Figure 13 Screenshot of 3D environmental noise model – Predicted facade noise levels, L_{Aeq} (dB), south elevation

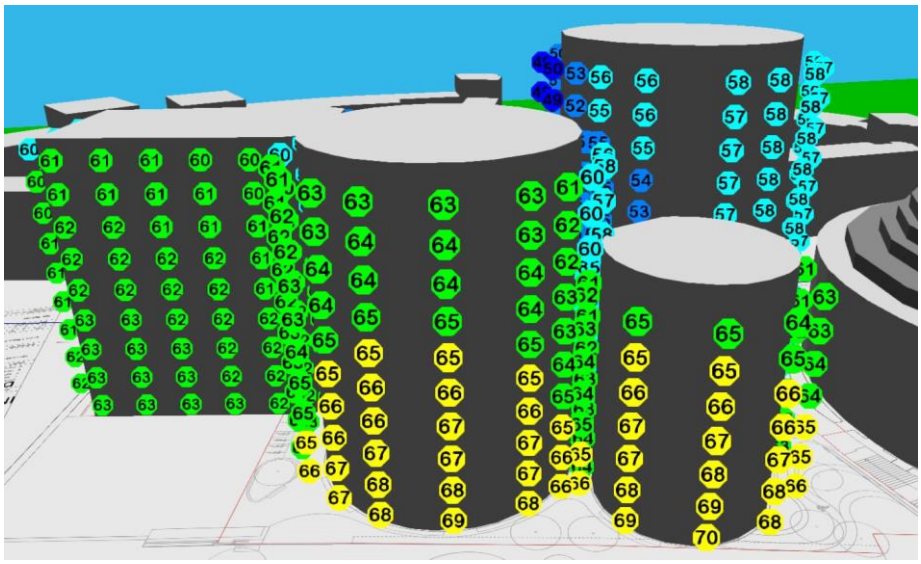


Figure 14 Screenshot of 3D environmental noise model – Predicted facade noise levels, L_{Aeq} (dB), north elevation

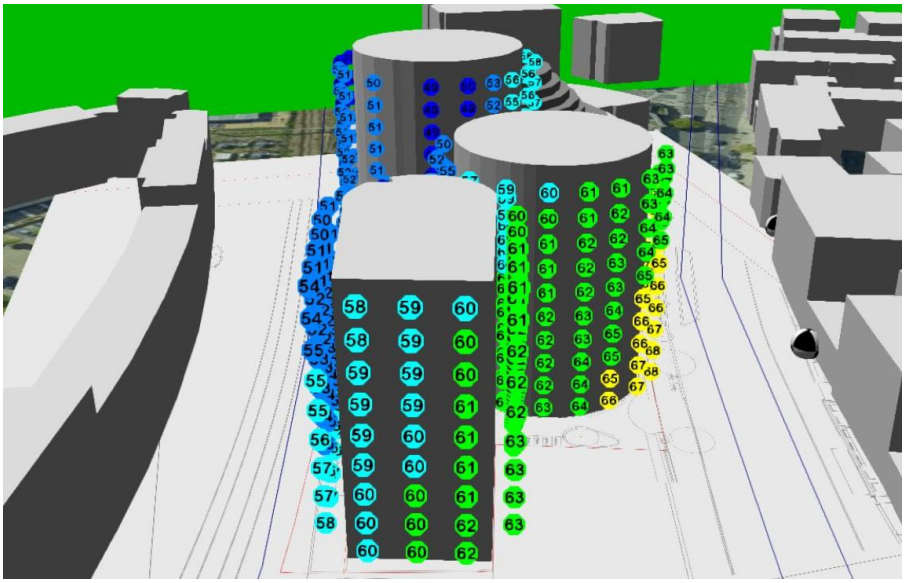


Figure 15 Screenshot of 3D environmental noise model – Predicted facade noise levels, L_{Aeq} (dB), east elevation

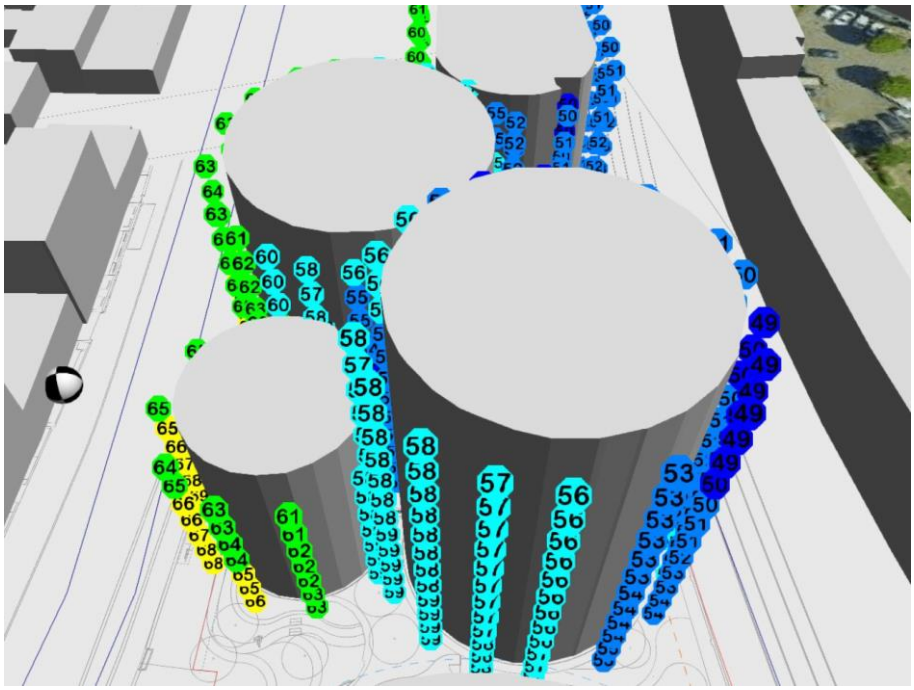


Figure 16 Screenshot of 3D environmental noise model – Predicted facade noise levels, L_{Aeq} (dB), west elevation

Facade zone markups are provided in Appendix D.

Table 20 Predicted facade noise levels

Facade zone	Average facade noise level, L_{Aeq} (dB)	Maximum facade noise level, L_{AFmax} (dB)
A	65-70	80-85
B	60-65	75-80
C	55-60	70-75
D	≤ 55	≤ 70

Typical maximum facade noise levels not normally exceeded are L_{AFmax} 85 dB at Level 1 on the worst-case facades.

Noise levels on the rooftop terraces are expected to be in the region of L_{Aeq} 55-60 dB. While this marginally exceeds the BS8233 target values for external amenity spaces, policy is clear that schemes should not be rejected on the basis of noise levels in amenity spaces.

9.3 Facade sound insulation

Minimum overall facade sound insulation requirements for the facades, under the background ventilation condition are given in Table 20.

These have been determined to achieve the internal noise criteria for bedrooms and living areas using the predicted external noise levels at the facades. The facade specification has been determined to ensure that $L_{AFmax,2min}$ criteria is exceeded on no more than 10 occasions based on the worst affected night during the survey.

At this site, the facade performance requirements are largely driven by the night-time maximum noise levels.

Table 21 Minimum overall facade sound insulation requirements

Facade zone	Facade noise level, L_{Aeq} (dB)	Maximum facade noise level, L_{AFmax} (dB)	Overall minimum sound insulation performance R'_w+C_{tr} (dB)	
			Living rooms	Bedrooms/ Student Studios
A	65-70	80-85	35	38
B	60-65	75-80	30	33
C	55-60	70-75	25	28
D	50-55	≤ 70	20	23

9.3.1 Guidance on facade construction, glazing and ventilation strategy

The solid facades should ideally provide a performance at least 10 dB greater than that of the external glazing.

Table 22 sets out some examples of glazing configurations and ventilation strategies that could achieve the required sound insulation performances.

Table 22 Example glazing configurations and ventilation strategies for overall facade sound insulation

Overall facade sound insulation, R'_w+C_{tr} (dB)	Example glazing configuration	Ventilation strategy
20-27	6 mm glass/16 mm cavity/6 mm glass	Acoustically attenuated passive ventilation (eg, trickle vents)
30-32	8.8 mm acoustic laminate glass/16 mm cavity/6 mm glass	Acoustically attenuated passive ventilation (eg, trickle vents)
36-38	8.8 mm acoustic laminate glass/16 mm cavity/10 mm glass	Mechanical ventilation (eg, whole house ventilation)

The performance required by each element will depend on the relative areas of glazed and non-glazed elements, and the ventilation strategy. As a guide, for a mechanically ventilated room with a 50% glazed facade, the glazing sound insulation requirement would typically be 3 dB lower than the overall facade sound insulation requirement. This is provided the non-glazed external wall elements provide at least 10 dB more sound insulation than the glazed elements.

Each room will likely need to have independent mechanical ventilation with heat recovery unit (MVHR) by supply and extract heat recovery equipment in accordance with Approved Document F, Table 5.16.

Air supply and extract will need to be ducted through the facade for each apartment and student room. This avoids use of facade trickle ventilators and optimises the sound insulation provided by the facade.

Noise break-in via the ductwork will also need to be controlled. This would be achieved by the use of sound insulating ceilings and in-duct attenuators.

Openable windows can be provided under occupant control to allow purge ventilation, such as for removal of odours.

10 Acoustics, ventilation and overheating

Approved Document O 2021 relates to overheating and sets out requirements for internal noise levels in bedrooms during the night, and therefore takes precedence over *Acoustics Ventilation and Overheating, Residential Design Guide* (AVO guide). For occupied spaces during the day, the AVO guide will be used to inform the advice provided.

10.1 Approved Document O 2021 (during the night)

Although demonstrating compliance with ADO2021 is not strictly a requirement of planning, achieving the requirements will likely have implications on the building's design. This may include impacts on the appearance of the facade and requirements for additional building services plant (eg, external heat rejection plant, mechanical ventilation with/without cooling units within apartments).

The results of noise survey and acoustic modelling have been used to assess internal noise levels within bedrooms at night, assuming windows are open and based on inputs associated with the 'simplified method' as described in ADO2021. The results indicate that noise in bedrooms will be such that windows will likely need to be closed overnight.

The ANC *Guide to demonstrating compliance with noise requirements of Approved Document O* suggests the noise attenuation from free field noise levels provided by an open window would be approximately 4 dB in high-risk areas with an openable free area greater than 13%.

This site, being in London, is understood to be in a high-risk area, as such, 7 dB from facade values has been used to assess noise ingress (ie 4 dB from free field values corrected by 3 dB). ADO suggests that windows are likely to be closed during sleeping hours if noise within bedrooms exceeds L_{Aeq} 40 dB average over 8 hours, or $L_{AFmax,2min}$ 55 dB more than 10 times a night.

The ADO assessment indicates that openable windows to control overheating during the night would only be acceptable for maximum noise levels below $L_{AFmax,2min}$ 62 dB, which does not occur at any point across the site.

Open windows in bedrooms at night can likely not be relied upon as a method to remove excess heat, and the 'dynamic thermal modelling method' will need to be used to demonstrate compliance with the requirements of ADO 2021.

MVHR units with additional cooling modules (or similar) are recommended as a method of controlling overheating without the use of openable windows or attenuated vents.

10.2 Acoustics, ventilation and overheating assessment (during the day)

Predicted external noise levels are within the 'Medium' or 'High' categories across the site. As such, a Level 2 AVO assessment should be carried out to assess noise levels during the day.

Appendix C of the AVO guide provides the following alternative information for the attenuation from open windows based on a field study in Switzerland:

> *They measured (free-field) outside-to-inside level differences of 10.0 ± 2.9dB for open windows and 15.8 Open ± 2.7dB for tilted windows. A value of 13dB is consistent with a situation between 'open' and 'tilted'.*

Calculated internal noise levels shown in Table 23 are based on a free-field outside to inside level difference insulation of 13 dB. A variation of ±3 dB has been considered to allow for adjustment of window openings – ie, a worst-case reduction from free field levels of 10 dB.

Table 23 Predicted daytime internal noise levels with openable windows assessed under AVO

Facade zone	Predicted daytime internal noise level with open window, L_{Aeq} (dB)
A	55-60
B	50-55
C	45-50
D	40-45
E	≤40

The predicted levels with windows open are higher than the daytime upper limits of $L_{Aeq,16hrs}$ 50 dB in most locations exposed to the road and railway. As such, MVHRs with additional cooling modules (or similar) are likely required to control overheating without the use of openable windows.

Although for more screened locations the internal level is below the upper limit, the need to control maxima during the night would require the use of MVHRs with additional cooling modules (or similar) to control overheating throughout.

11 Vibration assessment

The key sources of vibration expected at the site are the Transport for London Northern Line running directly beneath the site (tunnels at Chalk Farm Station are 13 m below ground level), the existing mainline railway approaching London Euston station (tracks approximately 100 m south of the site), and the Transport for London Overground and freight line running between South Hampstead station and Camden Road station (tracks approximately 5 m south of site boundary).

The proposed High Speed 2 railway is planned to run east to west, approximately 140 m south of the site and 29 m below ground level in tunnels. The railway is proposed to be designed to control re-radiated ground-borne noise to a LOAEL of L_{ASmax} 35 dB and a SOAEL of L_{ASmax} 45 dB at existing residential premises. As there are existing residential premises directly above tunnels, it is expected that the criteria would be achieved at the proposed development site. As such adverse impact from ground borne vibration from High Speed 2 is considered low risk.

11.1 Tactile vibration

11.1.1 Basement underground vibration (position V)

The VDV for the worst-case measurement in the worst-case axis is 0.018 m/s$^{1.75}$. Assuming the same vibration level once a minute for a full 16 hour day would give an overall VDV of 0.09 m/s$^{1.75}$ which is acceptable for both BS 8233 and Camden requirements. Additionally, as seen above, not all measurements were of a similar level, and there is likely to be attenuation of vibration with height up the building.

The predicted night-time VDV is heavily dependent on the number of tube services. Based on services stopping between around 01:00 and 05:30, the VDV would be in the region of 0.05 m/s$^{1.75}$, which is acceptable for both BS 6472 and London Borough of Camden requirements. Again, this is expected to reduce with height up the building and when accounting for events with lower vibration levels.

11.1.2 External train vibration (position W)

The VDV for the worst-case measurement in the worst-case axis is 0.03 m/s$^{1.75}$. Assuming the same vibration level four times per hour for a full 16-hour day would give an overall VDV of 0.08 m/s$^{1.75}$, with the true full day value likely to be lower than this as discussed above.

Assuming the same worst-case vibration level for a typical 15 events per full 8-hour night would give an overall VDV of 0.07 m/s$^{1.75}$, with the true full night value likely to be lower than this as discussed above.

These values are acceptable for both BS 6472 and London Borough of Camden requirements.

11.2 Re-radiated noise

An assessment of ground borne vibration a re-radiated noise has been carried out and is based on the following:

- The buildings use a concrete frame structure.
- There a no significant changes to rolling stock for trains using the nearby mainline railway tracks or the London Underground Northern line.
- The buildings are arranged as follows: basement level, ground floor, Level 1 (first level of residential/student accommodation), Level 2, etc.

11.2.1 Basement underground vibration (position V)

The assessment indicates the following for the underground level London Underground Northern line:

- From vibration measurements at basement level, the predicted internal re-radiated noise levels in the student accommodation and residential apartments from most of the train passes would be borderline with the criterion of L_{ASmax} 35 dB on Level 1.

- Re-radiated noise would be expected to reduce on upper floors.
- Re-radiated noise from London Underground trains would not be expected to reduce at any location on the site, as the London Underground northern line runs directly beneath Chalk Farm Road.

11.2.2 External train vibration (position W)

The assessment indicates the following for the surface level railway tracks:

- From vibration measurements at ground level the internal re-radiated noise criterion is expected to be marginally exceeded by most of the train passes in the student accommodation and residential apartments on Level 1.
- The recommended re-radiated noise criterion of L_{ASmax} 35 dB is predicted to be exceeded by around 1 dB on Level 1 though these levels are still below the London Underground Limited complaint threshold of L_{Amax} 40 dB.
- Re-radiated noise from surface level trains would be expected to reduce the further away from the track the building is, ie, in the northern student accommodation building.

Re-radiated noise would be expected to reduce on upper floors.

12 ProPG Acoustic Design Statement

12.1 Stage 1 assessment

The measured external ambient noise levels, as detailed in Section 6, indicate that the site would be exposed to a medium to high risk of adverse noise effects.

12.2 Stage 2 assessment

This section discusses the assessed external noise levels at the facades of the proposed development and the good acoustic design processes adopted so that appropriate conditions for a residential development (internal noise levels and external noise levels in amenity areas) are provided.

12.2.1 External noise level evaluation

The existing environmental noise sources in the vicinity of the proposed development comprise:

- Road traffic on Chalk Farm Road to the north
- Trains on the railway to the south

- Activity noise from bars and clubs along Chalk Farm Road (these are existing businesses producing non-anonymous noise and as such should not have unreasonable restrictions placed on them per the Agent of Change principle)

Music noise egress from the Roundhouse is not a dominant or an observable non-anonymous noise source, and does not contribute to the noise climate.

12.2.2 Noise levels in the vicinity of the residential development

Measured external levels are in the region of L_{Aeq} 55 dB to L_{Aeq} 70 dB, and from L_{AFmax} 65 dB to L_{AFmax} 85 dB.

12.2.3 Element 1 – Good Acoustic Design

External amenity spaces are located at roof level with screening parapets to reduce levels.

The majority of facades are faced away from Chalk Farm Road, either inwards towards the centre of the site, or to the quieter railway facade.

12.2.4 Element 2 – Internal noise levels

Internal noise criteria are presented in Table 3. Based on the measured and predicted external noise levels, the facade sound insulation requirements have been determined to meet the internal criteria. This meets the requirements for Element 2.

12.2.5 Element 3 – External amenity area noise levels

Based on the measured and assessed external noise levels and external amenity area noise criteria presented in Section 4.5.1, the external noise levels are minimised as much a practicable without significantly reducing the building footprint or omitting external balconies/terraces. BS 8233:2014 states that the development should be '*designed to achieve the lowest practicable levels … but should not be prohibited*', which infers that permission should not be refused on this basis.

12.2.6 Element 4 – Assessment of other relevant issues

Overheating assessments are presented in Section 10. An enhanced standard of sound insulation has been recommended to control noise transfer from commercial units to residences above. This is set out in Section 8.2.

12.2.7 Recommendation to the decision maker

When considering the good acoustic design process that has been followed and demonstrated within this statement, it is recommended that consent be granted with conditions associated with noise ingress to the proposed residences.

13 Conclusion

The representative background sound levels measured during the survey were:

- To the north:
    - $L_{A90,15min}$ 51 dB during the day,
    - $L_{A90,15min}$ 53 dB during the evening
    - $L_{A90,15min}$ 44 dB at night
- To the south:
    - $L_{A90,15min}$ 48 dB during the day
    - $L_{A90,15min}$ 44 dB at night to the south.

Based on the requirements of London Borough of Camden Council 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:

- To the north:
    - $L_{Aeq,15min}$ 41 dB during the day,
    - $L_{Aeq,15min}$ 43 dB during the evening
    - $L_{Aeq,15min}$ 34 dB at night
- To the south:
    - $L_{Aeq,15min}$ 38 dB during the day
    - $L_{Aeq,15min}$ 34 dB at 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.

Operational noise limits have been set for egress to surrounding sensitive receptors. These are not expected to be overly restrictive on typical uses of the commercial spaces.

An initial assessment of the required facade sound insulation has been carried out and the minimum facade sound insulation requirements between R'_w+C_{tr} 20-38 dB, and mechanical ventilation is expected to be required for background and overheating conditions. Openable windows would still be provided to allow for purge ventilation.

An assessment of internal noise levels during overheating conditions has been carried out. Enhanced MVHRs will be required throughout the development to remove excess heat without relying on the use of openable windows.

Tactile (feelable) vibration is not expected to be an issue at this site. Vertical vibration causing re-radiated noise is predicted to exceed the recommended re-radiated noise criterion of L_{ASmax} 35 dB by up to 1 dB on Level 1, though these levels are still below the London Underground Limited complaint threshold of L_{Amax} 40 dB.

Appendix A

Survey details

Equipment

The unattended and attended noise measurements were taken using Rion NL-52 sound level meters and a B&K 2250 sound level meter, respectively.

The 1/3 octave band RMS acceleration measurements were carried out using a Rion VM-56 vibration level meter.

Calibration details for the equipment used during the survey are provided in Table A1. Calibration of the meters used for the measurements is traceable to national standards. Calibration certificates for the sound and vibration level meters used in this survey are available upon request.

Calibration checks were carried out on the meters and their measurement chains at the beginning and end of the survey. No significant calibration deviation occurred.

Table A1 Equipment calibration data

Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
Sound level meter	2250/3011096	Brüel & Kjær	12 Mar 23	UCRT21/1348, UTRC21/1352
Microphone	4189/3060575	Brüel & Kjær	12 Mar 23	UCRT21/1348, UTRC21/1352
Pre-amp	ZC0032/25430	Brüel & Kjær	12 Mar 23	UCRT21/1348, UTRC21/1352
Calibrator	4231/3017675	Brüel & Kjær	11 Mar 23	UCRT21/1345
Sound level meter	NL-52/00320633	Rion	9 Jun 24	TCRT22/1368
Microphone	UC-59/12576	Rion	9 Jun 24	TCRT22/1368
Pre-amp	NH-25/10641	Rion	9 Jun 24	TCRT22/1368
Calibrator	NC-74/34125430	Rion	8 Jun 24	TCRT22/1361
Sound level meter	NL-52/00264531	Rion	5 Jul 24	TCRT22/1430
Microphone	UC-59/09678	Rion	5 Jul 24	TCRT22/1430
Pre-amp	NH-25/64656	Rion	5 Jul 24	TCRT22/1430
Calibrator	NC-75/35013664	Rion	5 Jul 24	TCRT22/1427
Sound level meter	NL-52/00375679	Rion	19 Jul 23	TCRT21/1501

Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
Microphone	UC-59/11168	Rion	19 Jul 23	TCRT21/1501
Pre-amp	NH-25/65806	Rion	19 Jul 23	TCRT21/1501
Calibrator	SV30A/10576	Svan	16 Jul 23	TCRT21/1500
Data recorder	VM-56 / 34310135	Rion	27 Oct 25	TCRT23/1782
Accelerometer	PV-83D / 90136	Rion	27 Oct 25	TCRT23/1782

Noise indices

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.

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

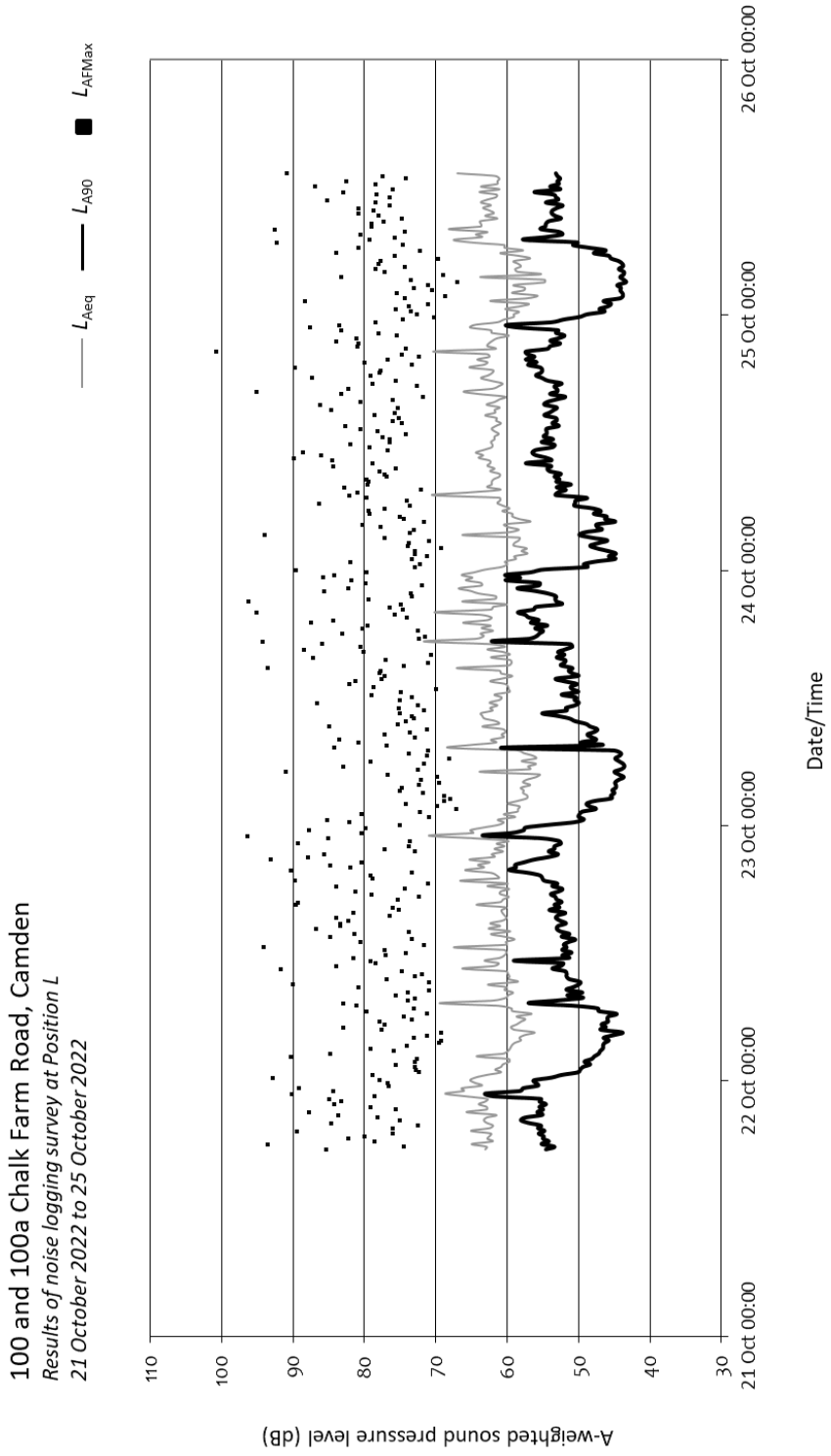
During the attended noise measurements, the weather was generally overcast with intermittent light rain. Measurements were stopped before rain became heavier. Wind speeds at each position varied between 4 m/s and 5 m/s.

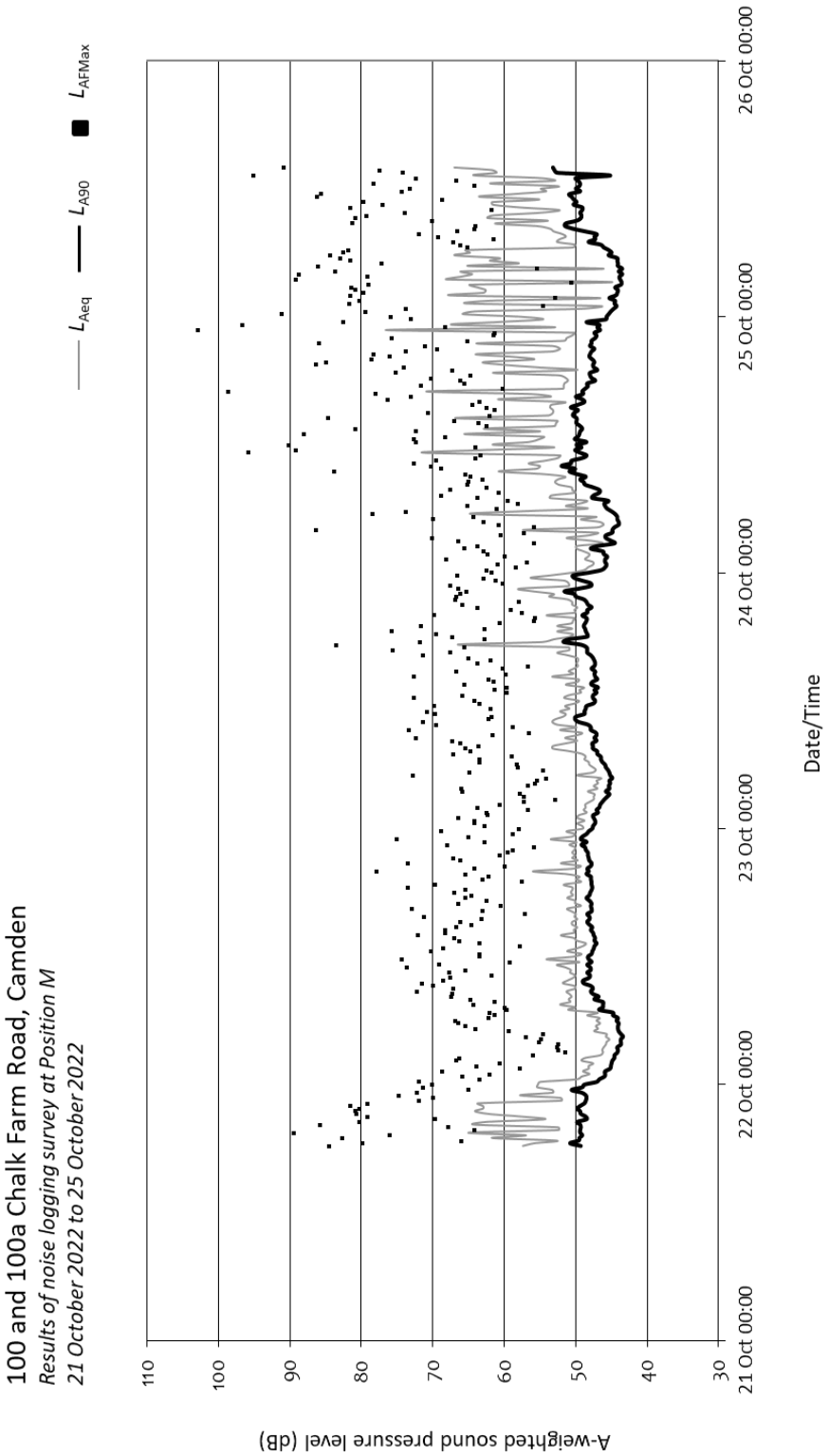
During the unattended noise measurements, weather reports for the area indicated that temperatures varied between 9°C at night and 19°C during the day, and the wind speed was generally less than 5 m/s, with occasional gusts up to 11 m/s.

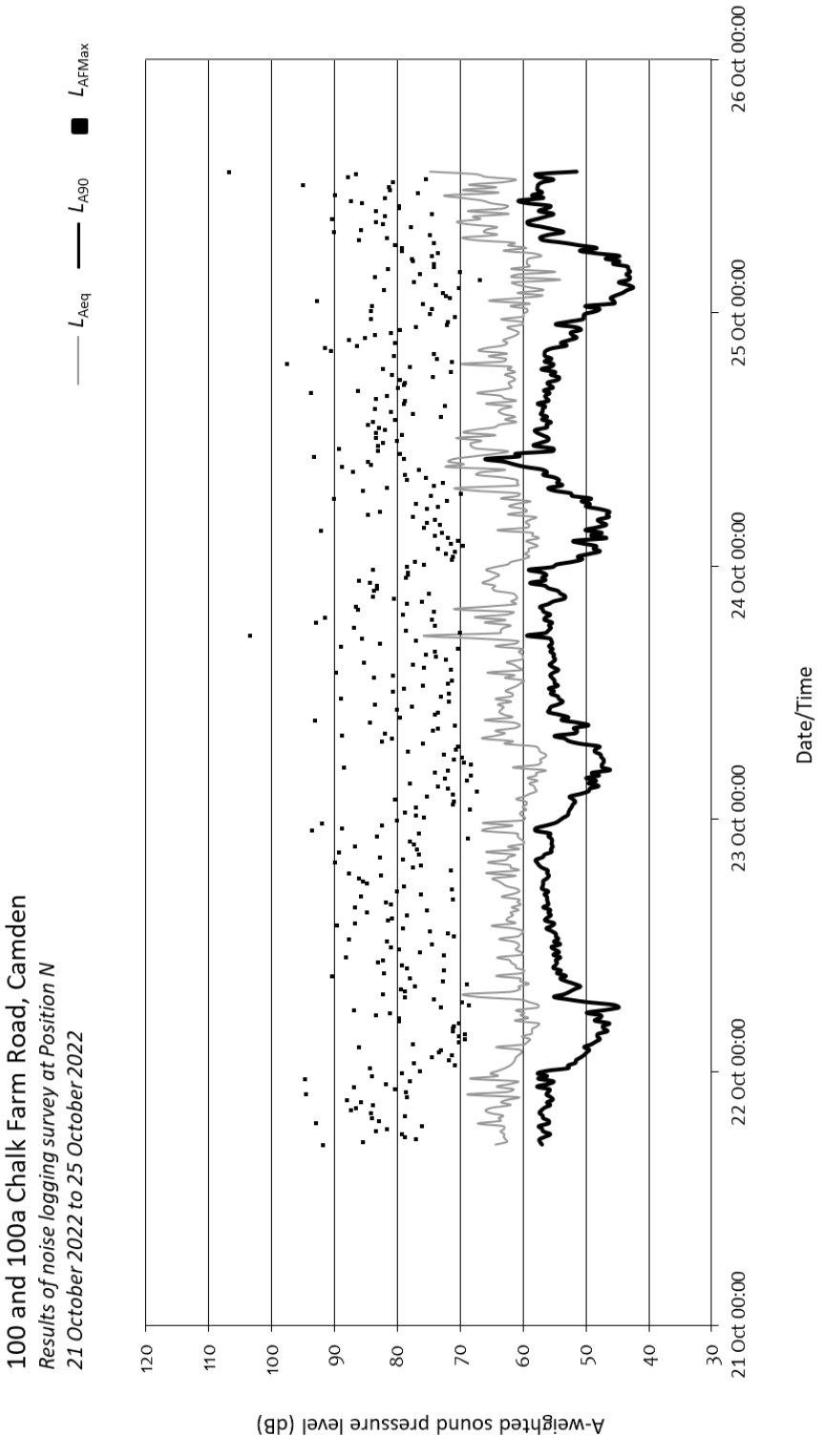
These weather conditions are generally considered suitable for obtaining representative measurements.

Appendix B

Results of unattended measurements

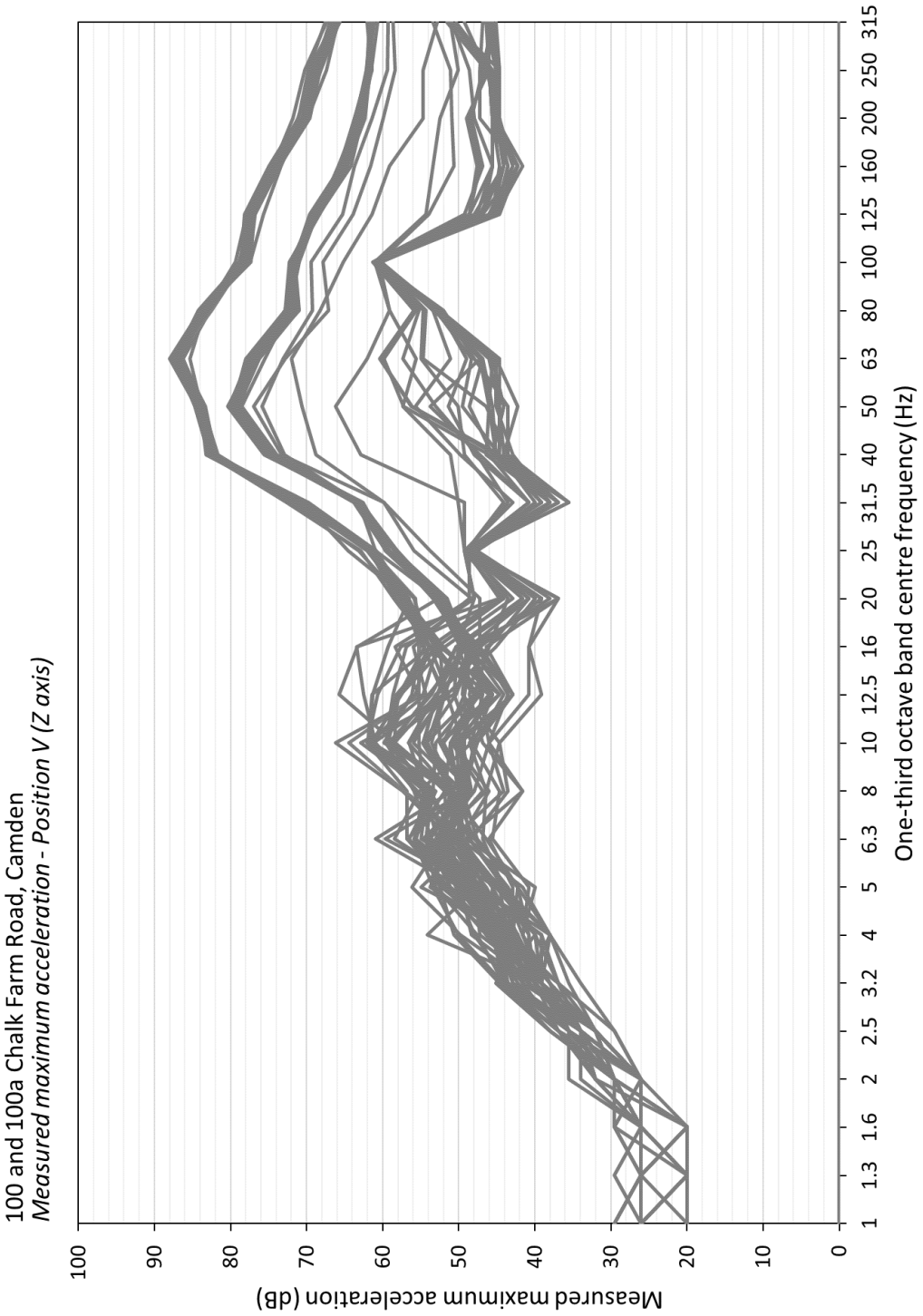

100 and 100a Chalk Farm Road, Camden
Results of noise logging survey at Position L
21 October 2022 to 25 October 2022
L_{Aeq}
L_{A90}
L_{AFMax}
A-weighted sound pressure level (dB)
110
100
90
80
70
60
50
40
30
21 Oct 00:00
22 Oct 00:00
23 Oct 00:00
24 Oct 00:00
25 Oct 00:00
26 Oct 00:00
Date/Time

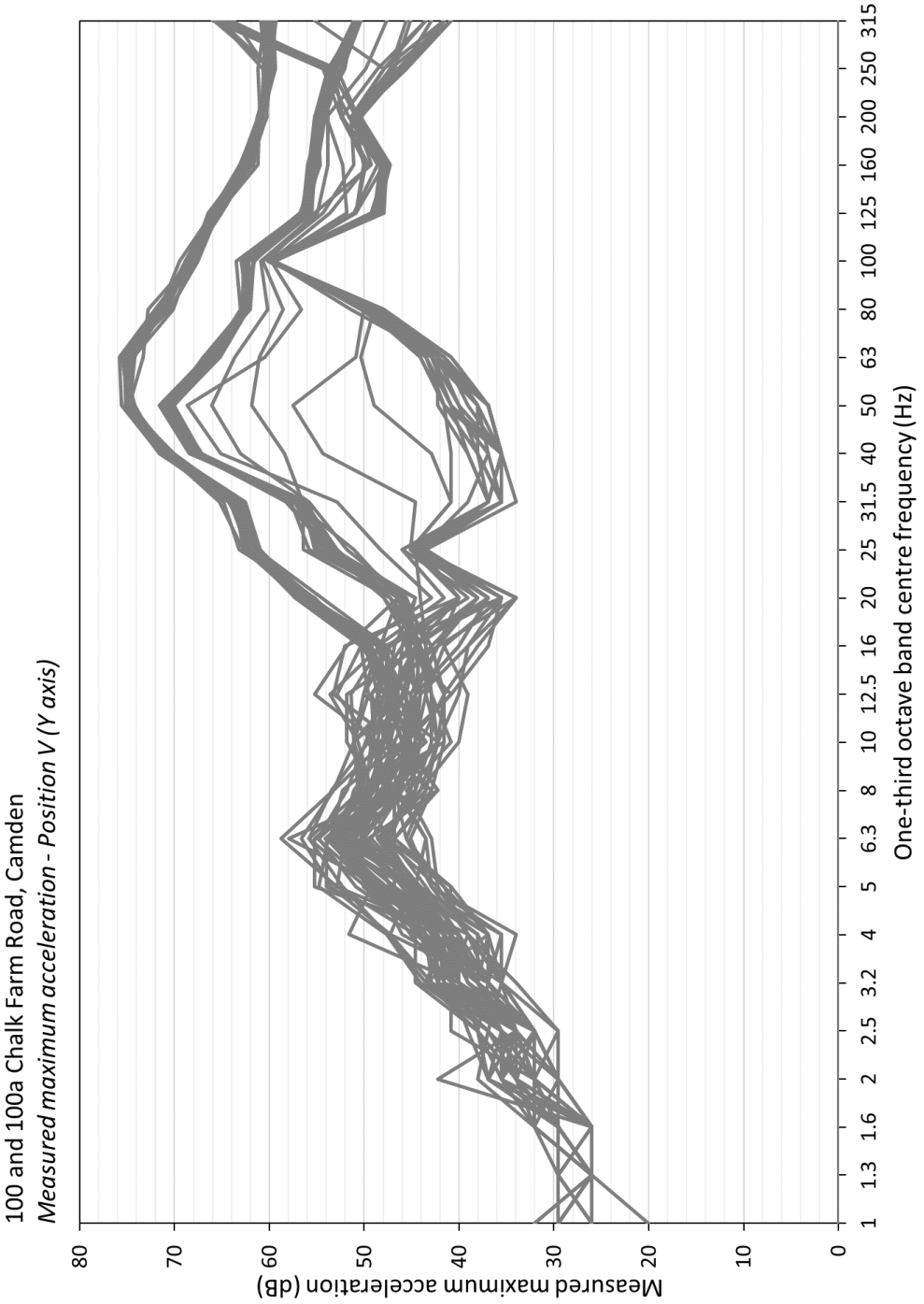

100 and 100a Chalk Farm Road, Camden
Results of noise logging survey at Position M
21 October 2022 to 25 October 2022
L_{Aeq}
L_{A90}
L_{AFMax}
A-weighted sound pressure level (dB)
110
100
90
80
70
60
50
40
30
21 Oct 00:00
22 Oct 00:00
23 Oct 00:00
24 Oct 00:00
25 Oct 00:00
26 Oct 00:00
Date/Time

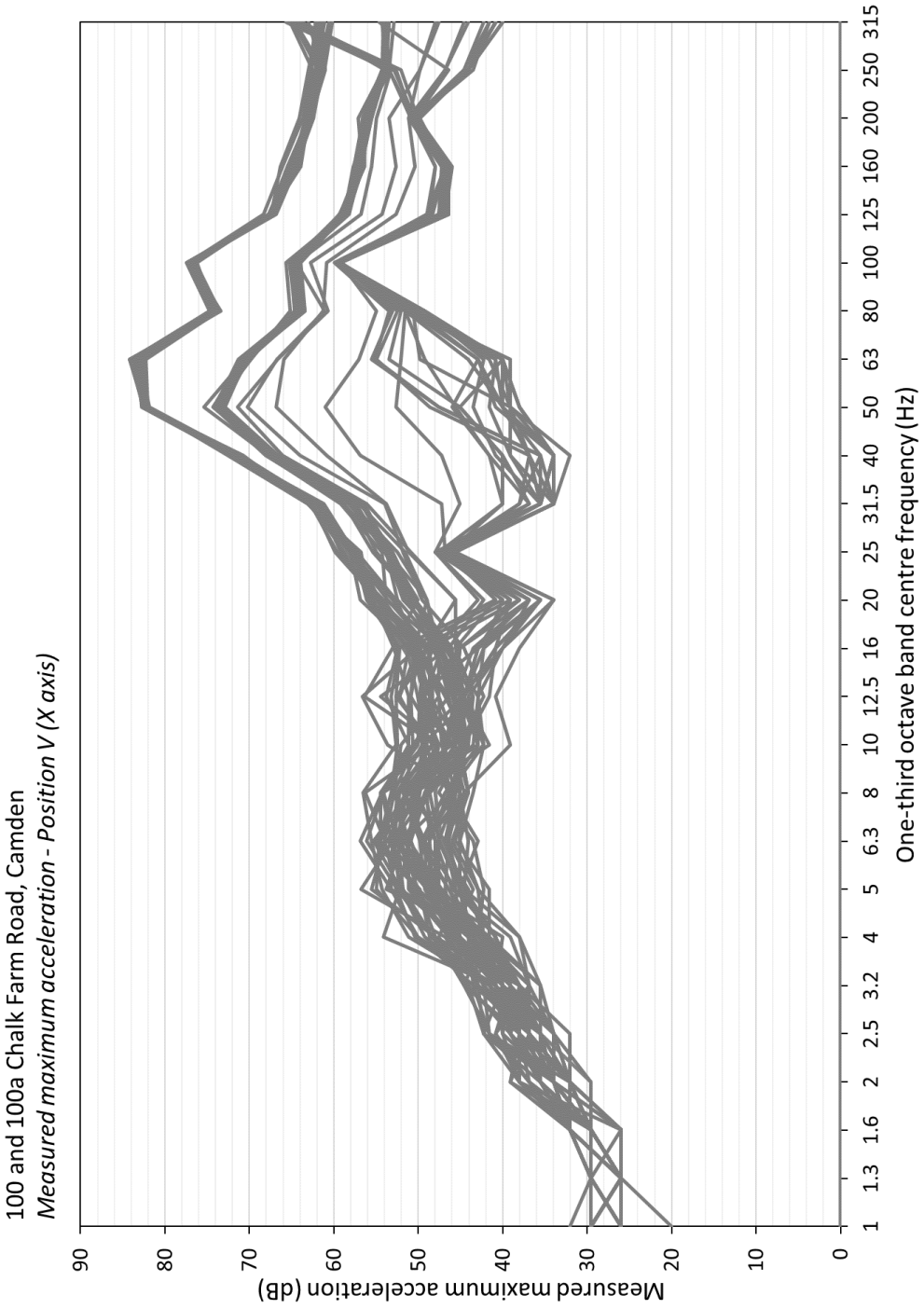

100 and 100a Chalk Farm Road, Camden
Results of noise logging survey at Position N
21 October 2022 to 25 October 2022
L_{Aeq}
L_{A90}
L_{AFMax}
A-weighted sound pressure level (dB)
120
110
100
90
80
70
60
50
40
30
21 Oct 00:00
22 Oct 00:00
23 Oct 00:00
24 Oct 00:00
25 Oct 00:00
26 Oct 00:00
Date/Time

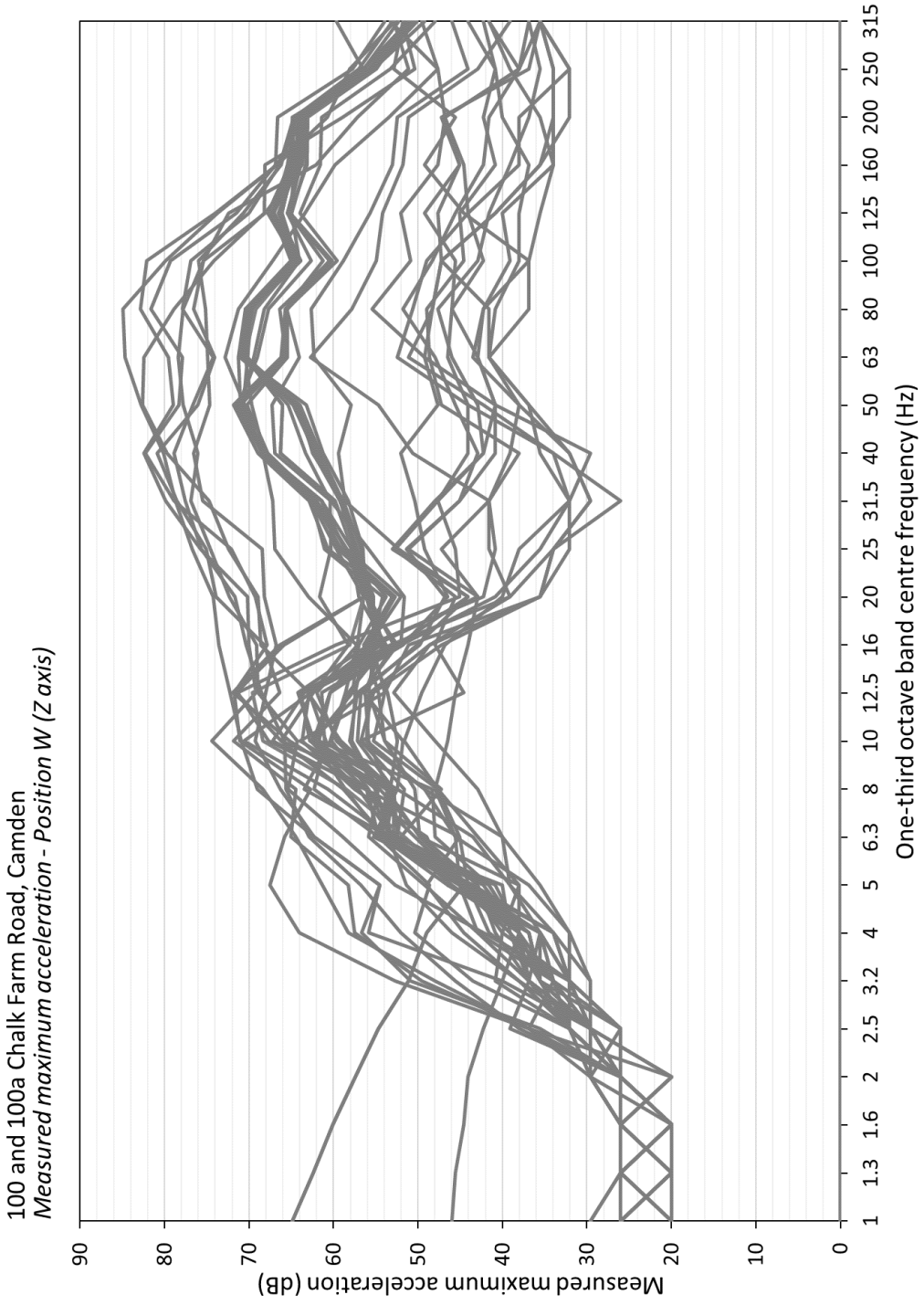
Appendix C

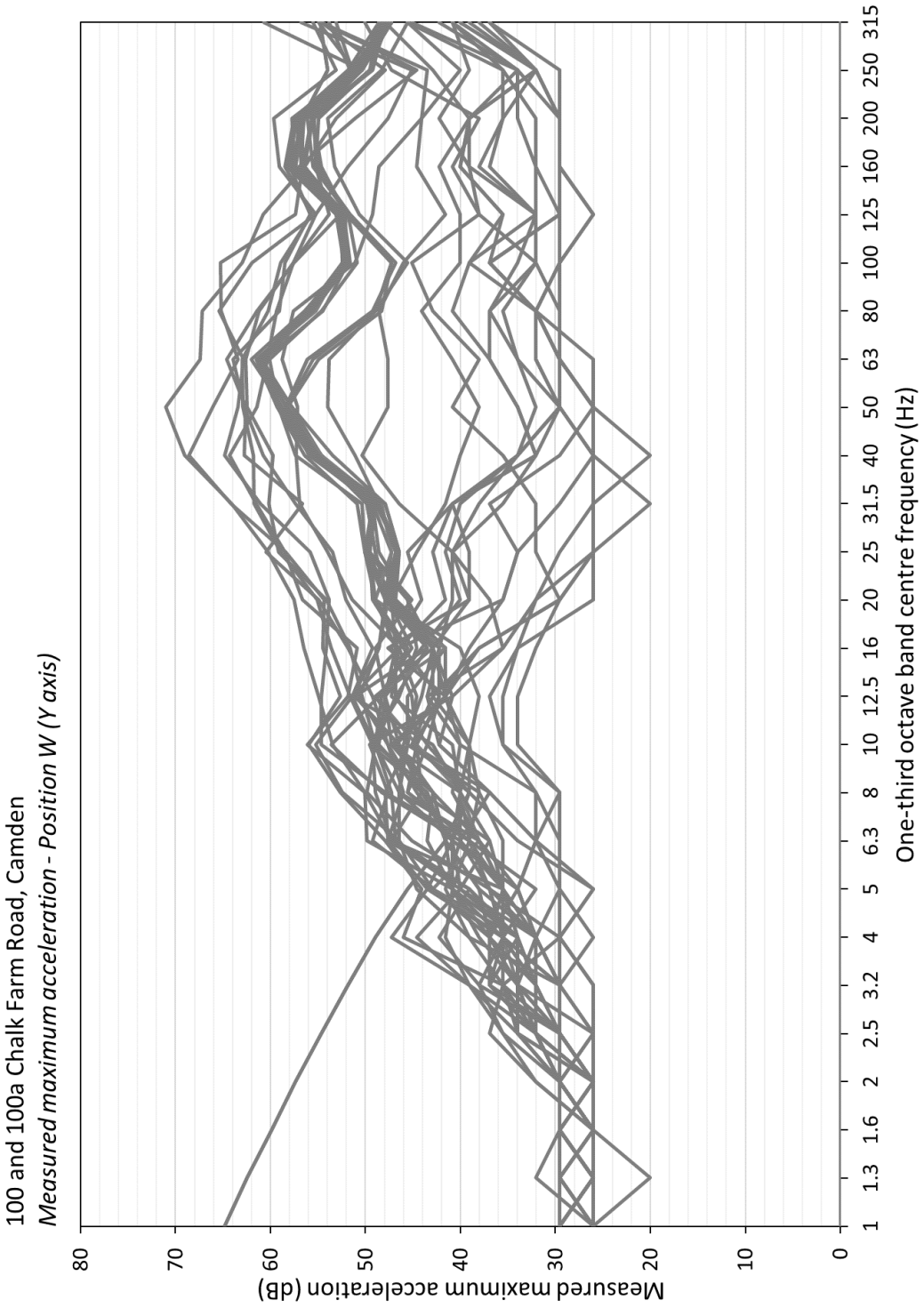
Measured RMS acceleration results

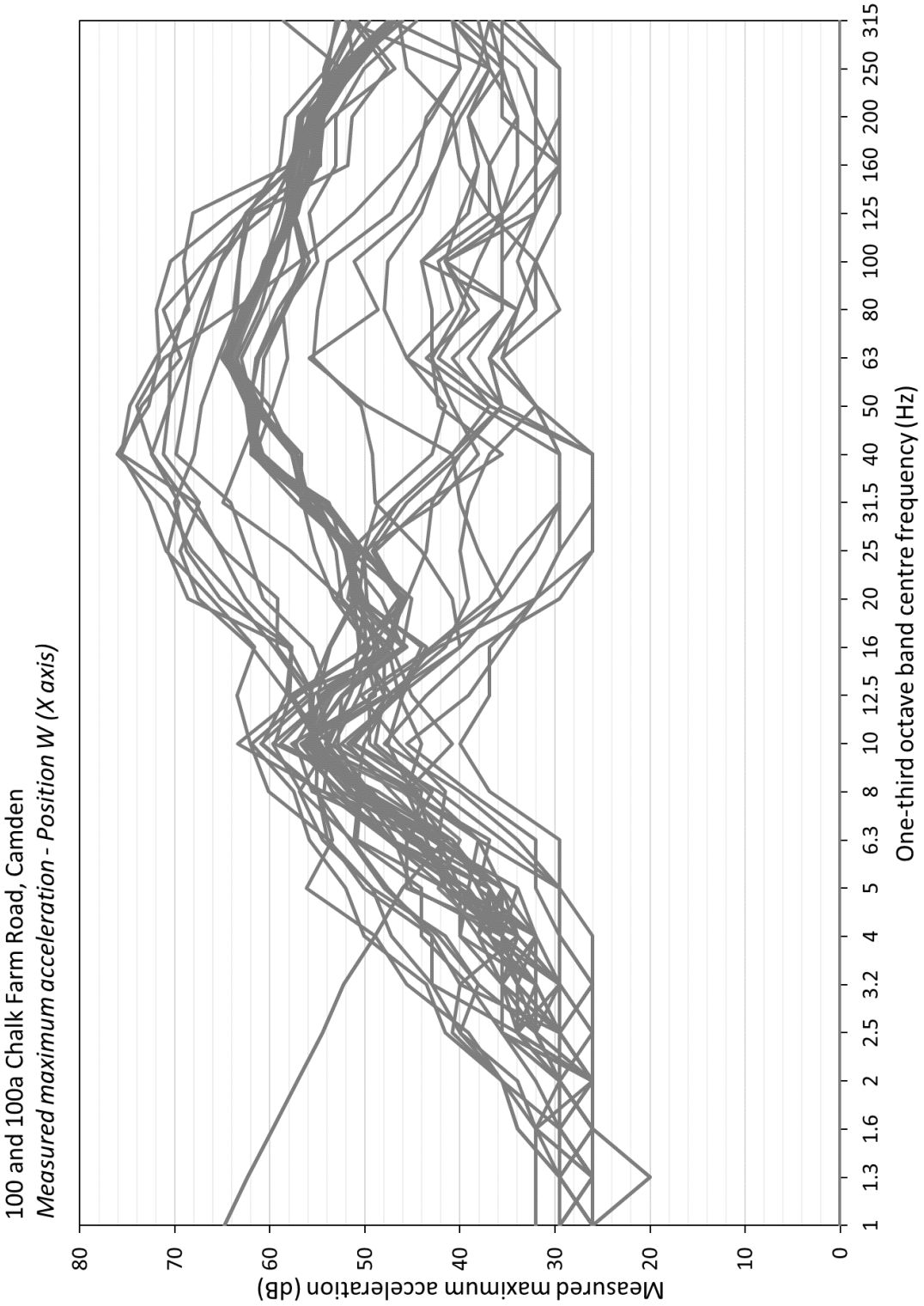

100 and 100a Chalk Farm Road, Camden
Measured maximum acceleration - Position V (Z axis)
Measured maximum acceleration (dB)
100
90
80
70
60
50
40
30
20
10
0
1
1.3
1.6
2
2.5
3.2
4
5
6.3
8
10
12.5
16
20
25
31.5
40
50
63
80
100
125
160
200
250
315
One-third octave band centre frequency (Hz)


100 and 100a Chalk Farm Road, Camden
Measured maximum acceleration - Position V (Y axis)
Measured maximum acceleration (dB)
0
10
20
30
40
50
60
70
80
One-third octave band centre frequency (Hz)
1
1.3
1.6
2
2.5
3.2
4
5
6.3
8
10
12.5
16
20
25
31.5
40
50
63
80
100
125
160
200
250
315


100 and 100a Chalk Farm Road, Camden
Measured maximum acceleration - Position V (X axis)
Measured maximum acceleration (dB)
0
10
20
30
40
50
60
70
80
90
One-third octave band centre frequency (Hz)
1
1.3
1.6
2
2.5
3.2
4
5
6.3
8
10
12.5
16
20
25
31.5
40
50
63
80
100
125
160
200
250
315


100 and 100a Chalk Farm Road, Camden
Measured maximum acceleration - Position W (Z axis)
Measured maximum acceleration (dB)
0
10
20
30
40
50
60
70
80
90
One-third octave band centre frequency (Hz)
1
1.3
1.6
2
2.5
3.2
4
5
6.3
8
10
12.5
16
20
25
31.5
40
50
63
80
100
125
160
200
250
315


100 and 100a Chalk Farm Road, Camden
Measured maximum acceleration - Position W (Y axis)
Measured maximum acceleration (dB)
0
10
20
30
40
50
60
70
80
One-third octave band centre frequency (Hz)
1
1.3
1.6
2
2.5
3.2
4
5
6.3
8
10
12.5
16
20
25
31.5
40
50
63
80
100
125
160
200
250
315


100 and 100a Chalk Farm Road, Camden
Measured maximum acceleration - Position W (X axis)
Measured maximum acceleration (dB)
0
10
20
30
40
50
60
70
80
One-third octave band centre frequency (Hz)
1
1.3
1.6
2
2.5
3.2
4
5
6.3
8
10
12.5
16
20
25
31.5
40
50
63
80
100
125
160
200
250
315

Appendix D

Predicted facade noise levels

Title	Predicted facade noise levels
Project	100 Chalk Farm Road, Camden
Project no.	22483
Version	A
Marked-up by	Jack Parrott
Reviewed by	Matthew Robinson
Date	19 December 2023

Mark-up key	Night	Day/Night
	A - L_{AFmax} 80 - 85 dB	L_{Aeq} 65- 70 dB
	B - L_{AFmax} 75 - 80 dB	L_{Aeq} 60-65 dB
	C - L_{AFmax} 70 - 75 dB	L_{Aeq} 55-60 dB
	D - L_{AFmax} ≤ 70 dB	L_{Aeq} ≤ 55 dB

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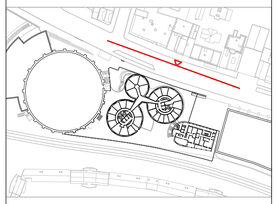
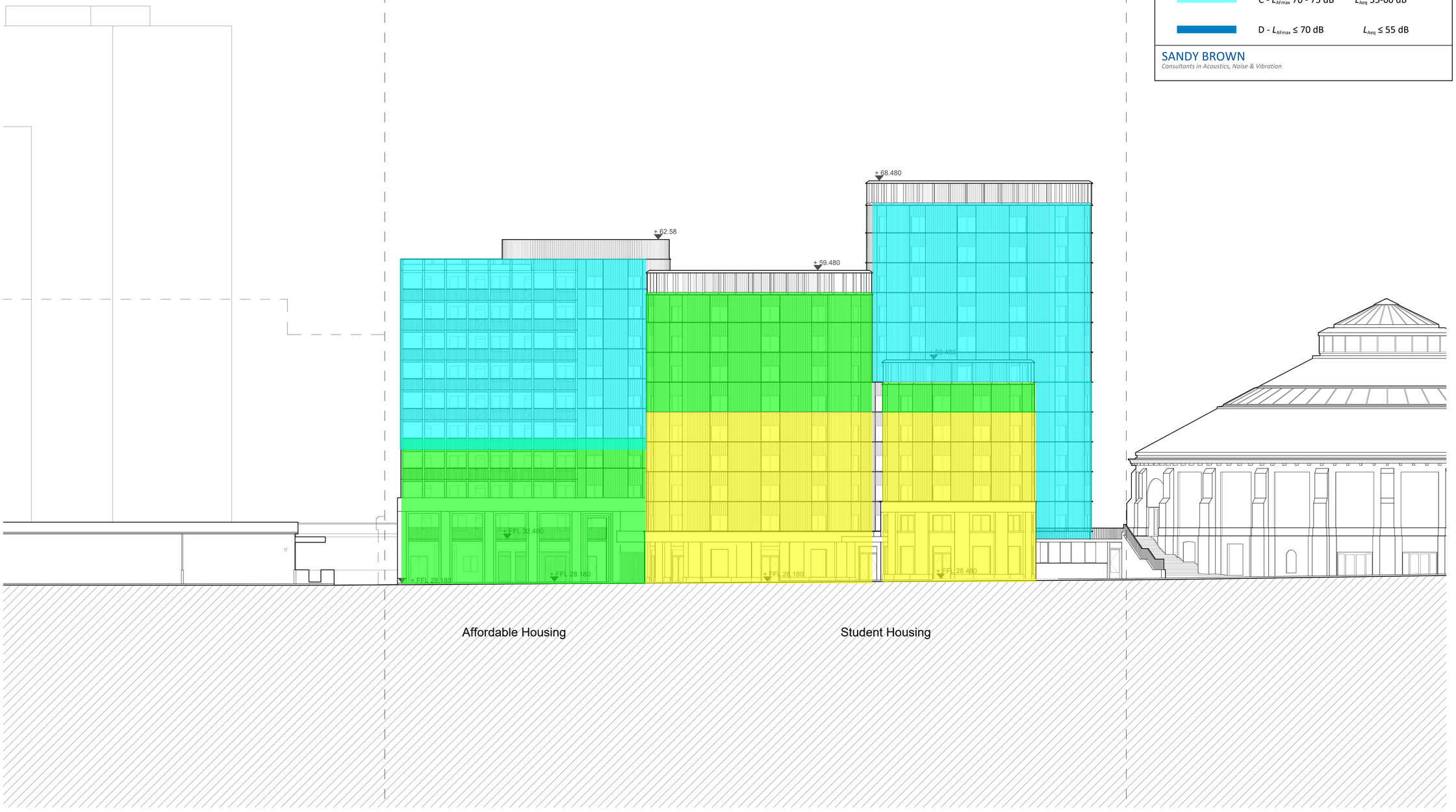
NOTES





1 5 10 20

100 Chalk Farm Road

D_23/11/22 Design Freeze

C_23/11/17 Design Freeze

B_23/11/09 Draft Design Freeze

A 23/11/03 Draft

INFORMATION

rev	date	check	comments

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W www.dsdha.co.uk

project

100 Chalk Farm Road

drawing title

North Elevation

drawn	size	date	scale
FI	A1	23/11/17	1:200

drawing number	revision
356_P30.120	D

Title	Predicted facade noise levels
Project	100 Chalk Farm Road, Camden
Project no.	22483
Version	A
Marked-up by	Jack Parrott
Reviewed by	Matthew Robinson
Date	19 December 2023

Mark-up key	Night	Day/Night
	A - L_{AFmax} 80 - 85 dB	L_{Aeq} 65- 70 dB
	B - L_{AFmax} 75 - 80 dB	L_{Aeq} 60-65 dB
	C - L_{AFmax} 70 - 75 dB	L_{Aeq} 55-60 dB
	D - L_{AFmax} ≤ 70 dB	L_{Aeq} ≤ 55 dB

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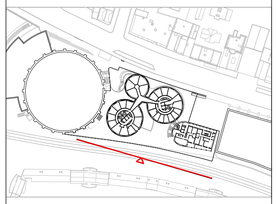
100 Chalk Farm Road

NOTES



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C_23/11/17 Design Freeze

B_23/11/09 Draft Design Freeze

A 23/11/03 Draft

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100 Chalk Farm Road

drawing title

South Elevation

drawn	size	date	scale
FI	A1	23/11/17	1:200

drawing number	revision
356_P30.121	D

Title	Predicted facade noise levels
Project	100 Chalk Farm Road, Camden
Project no.	22483
Version	A
Marked-up by	Jack Parrott
Reviewed by	Matthew Robinson
Date	19 December 2023

Mark-up key	Night	Day/Night
	A - L_{AFmax} 80 - 85 dB	L_{Aeq} 65- 70 dB
	B - L_{AFmax} 75 - 80 dB	L_{Aeq} 60-65 dB
	C - L_{AFmax} 70 - 75 dB	L_{Aeq} 55-60 dB
	D - L_{AFmax} ≤ 70 dB	L_{Aeq} ≤ 55 dB

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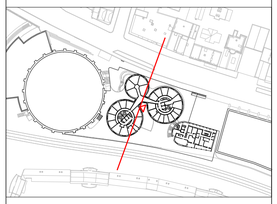
NOTES



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100 Chalk Farm Road

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C_23/11/17 Design Freeze

B_23/11/09 Draft Design Freeze

A 23/11/03 Draft

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project

100 Chalk Farm Road

drawing title

Site Section CC

drawn	size	date	scale
FI	A1	23/11/17	1:200

drawing number: 356_P40.003

revision: D

Title	Predicted facade noise levels
Project	100 Chalk Farm Road, Camden
Project no.	22483
Version	A
Marked-up by	Jack Parrott
Reviewed by	Matthew Robinson
Date	19 December 2023

Mark-up key	Night	Day/Night
	A - L_{AFmax} 80 - 85 dB	L_{Aeq} 65- 70 dB
	B - L_{AFmax} 75 - 80 dB	L_{Aeq} 60-65 dB
	C - L_{AFmax} 70 - 75 dB	L_{Aeq} 55-60 dB
	D - L_{AFmax} ≤ 70 dB	L_{Aeq} ≤ 55 dB

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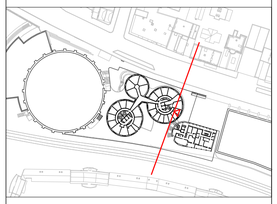
NOTES



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100 Chalk Farm Road

D_23/11/22 Design Freeze

C_23/11/17 Design Freeze

B_23/11/09 Draft Design Freeze

A 23/11/03 Draft

INFORMATION

rev	date	check	comments

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project

100 Chalk Farm Road

drawing title

Site Section DD

drawn	size	date	scale
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drawing number	revision
356_P40.004	D

Title	Predicted facade noise levels
Project	100 Chalk Farm Road, Camden
Project no.	22483
Version	A
Marked-up by	Jack Parrott
Reviewed by	Matthew Robinson
Date	19 December 2023

Mark-up key	Night	Day/Night
	A - L_{AFmax} 80 - 85 dB	L_{Aeq} 65- 70 dB
	B - L_{AFmax} 75 - 80 dB	L_{Aeq} 60-65 dB
	C - L_{AFmax} 70 - 75 dB	L_{Aeq} 55-60 dB
	D - L_{AFmax} ≤ 70 dB	L_{Aeq} ≤ 55 dB

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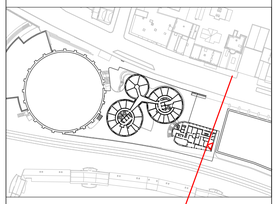
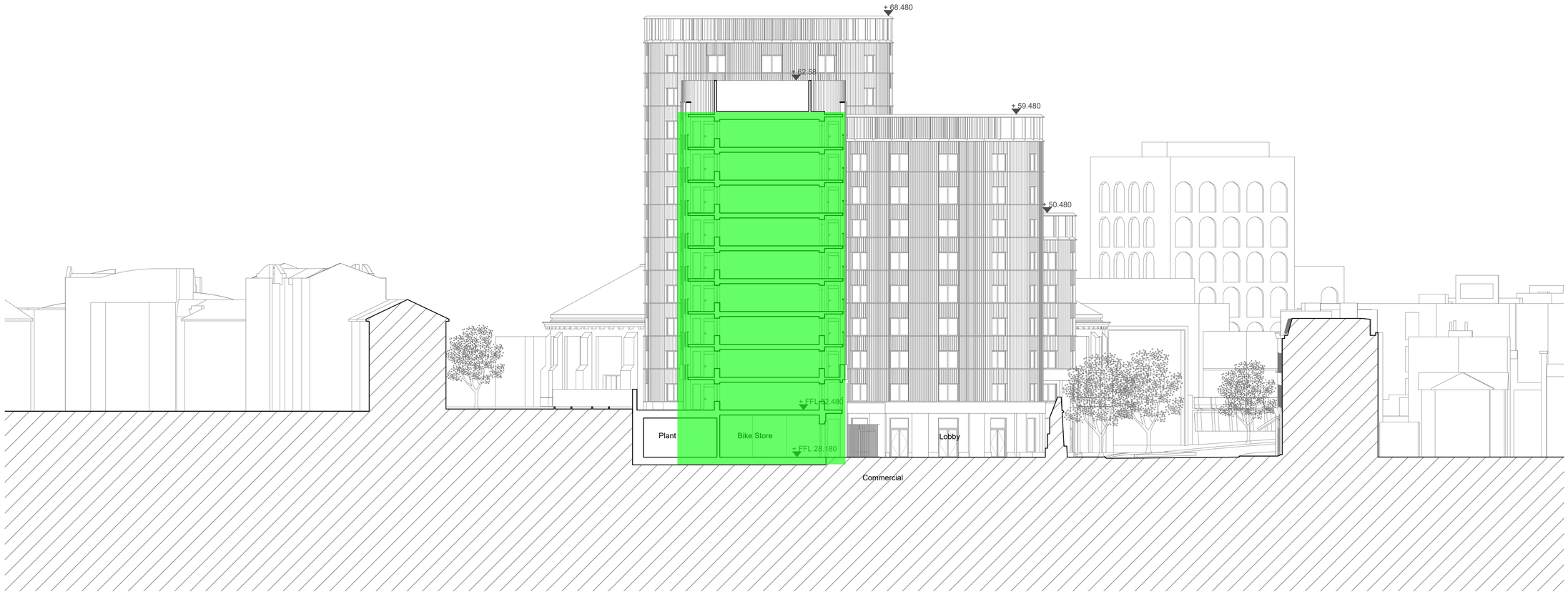
Consultants in Acoustics, Noise & Vibration

NOTES





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100 Chalk Farm Road

D_23/11/22 Design Freeze

C_23/11/17 Design Freeze

B_23/11/09 Draft Design Freeze

A 23/11/03 Draft

INFORMATION

rev	date	check	comments

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W www.dsdha.co.uk

project

100 Chalk Farm Road

drawing title

Site Section EE

drawn	size	date	scale
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drawing number: 356_P40.005

revision: D