SANDY BROWN

Consultants in Acoustics, Noise & Vibration

023549-R02-A

11 April 2024

10-16 Canfield Place

Plant noise assessment

London, Manchester, Edinburgh, Birmingham, Belfast, Leeds

post@sandybrown.com
www.sandybrown.com

Sandy Brown Ltd
Registered in England & Wales No. 13227735

Registered Office: 55 Charterhouse Street, London EC1M 6HA

Version	Date	Comments	Author	Reviewer
A	11 Apr 24		Aleksejs Apolskis	David Elliott

Summary

Sandy Brown has been appointed to provide acoustic advice in relation to the proposed development at 10-16 Canfield Place, Camden, London.

An environmental noise survey has been carried out by KP Acoustics in 2022 to determine the existing sound levels in the area. The noise survey was performed between 11:00 on 4 July 2022 and 11:00 on 6 July 2022.

Based on the requirements of the 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:

- Position 1 (South): $L_{Aeq,5min}$ 41 dB during the day, and $L_{Aeq,5min}$ 29 dB during the night.
- Position 2 (North): $L_{Aeq,5min}$ 37 dB during the day, and $L_{Aeq,5min}$ 25 dB during the night.

These limits are cumulative and apply with all plant operating under normal conditions. If plant items contain attention catching features, a 5 dB penalty based on the requirements of Camden Council will be applied.

The results of the assessment show facade levels at each noise sensitive receptor will be as follows:

- South receptors: $L_{Aeq,5min}$ 24 dB during the day, and $L_{Aeq,5min}$ 20 dB during the night.
- North receptors: $L_{Aeq,5min}$ 29 dB during the day, and $L_{Aeq,5min}$ 25 dB during the night.

Based on the criteria set above, this demonstrates that the plant noise limits will be achieved at all times whilst the plant is operational.

Contents

1 Introduction

Sandy Brown has been appointed to provide acoustic advice in relation to the proposed development at 10-16 Canfield Place, Camden, London.

At the initial planning application stage, an environmental noise survey was conducted KP Acoustics and is summarised in report 24427.NVA.01, issued in 2022 and reproduced in Appendix B for reference. This report established the existing background sound levels in the vicinity of nearby noise sensitive premises and sets appropriate limits for noise egress from building services plant.

This report presents an assessment of noise emissions from the heat rejection units which will be installed on the roof terraces of each house.

2 Site description

2.1 The site and its surrounding

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

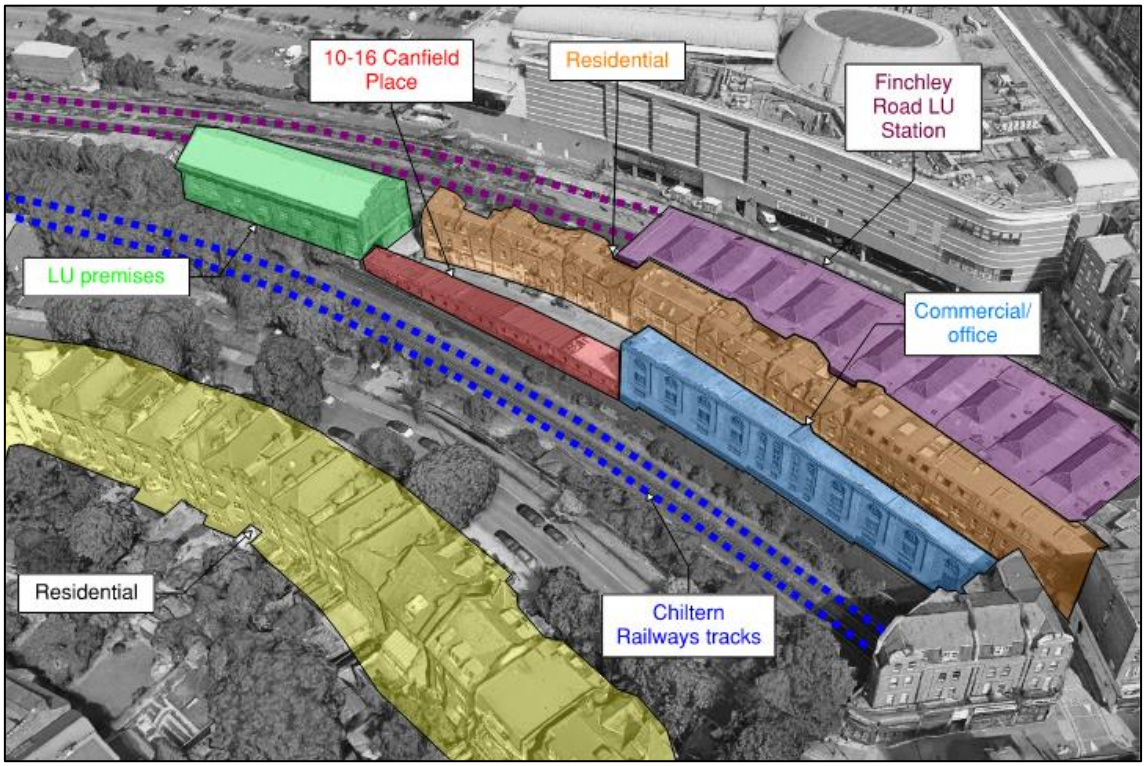

Figure 1 Aerial view of site (courtesy of Google Earth Pro) marked up to show site and surroundings

2.2 Adjacent premises

The neighbouring buildings on Canfield Place are of both residential and commercial use. The residential buildings are primarily located on the north side of the street, indicated in orange. To the east there are commercial offices which are of office use, shown in blue. To the west there is a building which is part of the London Underground Finchley Road Station premises.

The site overlooks external railway tracks which are used by Chiltern Railways for the service that runs to High Wycombe and Aylesbury. These are indicated in blue.

Further residential properties are situated across the railway tracks on Broadhurst Gardens, as shown in yellow.

3 Development proposals

This project involves the demolition of 18 existing garages located on the south of Canfield Place to make way for the construction of 8 new affordable residential townhouses.

The houses will be a mix of two and three bed properties, with a joint kitchen/living/dining space and rooftop terraces.

4 Building services noise egress criteria

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 nearby 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, a penalty, based on the type and impact of those features, is applied.

4.2 Local Authority criteria

The typical requirements of Camden Council, as stated in Camden Local Plan 2017 are summarised below.

4.2.1 Non-emergency plant noise

Non-emergency plant should be at least 10 dB below the existing background noise levels at 1 m from the facade and also in residential gardens (as a free-field level). Where the sound source has tonal characteristics, a further 5 dB penalty correction must be applied.

Moreover, the L_{AFmax} should not exceed 57 dB at bedroom windows during night time hours. The background noise level should be measured in accordance with BS4142:2014.

4.2.2 Emergency plant noise

Emergency plant should be no more than 10 dB above the background noise level ($L_{A90,15min}$) for short periods of operation. Extended standby periods should meet non-emergency plant noise limits.

5 Noise survey details

5.1 Methodology

The KP Acoustics survey was conducted in 2022 and included unattended and attended noise measurements. The measurement methods are detailed in the report's section 2.0 SITE SURVEYS, reproduced in in Appendix B.

5.2 Noise survey results

The ambient noise levels measured during the survey are presented in Table 1.

Table 1 Ambient noise levels measured during the survey

Date	Day (07:00 – 23:00) $L_{Aeq,16h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
Position 1 - South	75	69
Position 2 - North	59	52

The established representative background sound levels are presented in Table 2.

Table 2 Representative facade background sound levels measured during the survey

	Day (07:00 – 23:00) $L_{A90,5min}$ (dB)	Night (23:00 – 07:00) $L_{A90,5min}$ (dB)
Position 1 - South	48	36
Position 2 - North	44	32

5.3 Plant noise limits

The KP Acoustics report does not establish limits but does set out the representative free field background noise levels measured at both the north and south sides of the site. The appropriate plant noise limits have been derived based on the requirements of Camden Council, detailed in Section 4.2.

The limits are presented as facade levels in Table 3.

Table 3 KP 2022 survey – established plant noise limits at 1m from nearest neighbouring receptor (dBA)

Time of day	Plant noise limit at 1m from nearest noise sensitive receptor (dBA)	
	South	North
Daytime (07:00 – 23:00)	41	37
Night (23:00 – 07:00)	29	25

[1] The limits set out in Table 3 do not include any attention catching features.

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 3

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 both South and North locations.

6 Plant noise assessment

6.1 Proposed installations

A total of 7no. Viewssmann Vitocal air-source heat pump (ASHP) units will be installed on the roof terraces of each townhouse, as shown in blue in Figure 2.

In general, each unit is around 9-10 m from the closest receptors to the north and 46 m to the closes receptors to the south.

The units are expected to operate throughout daytime and night time hours.

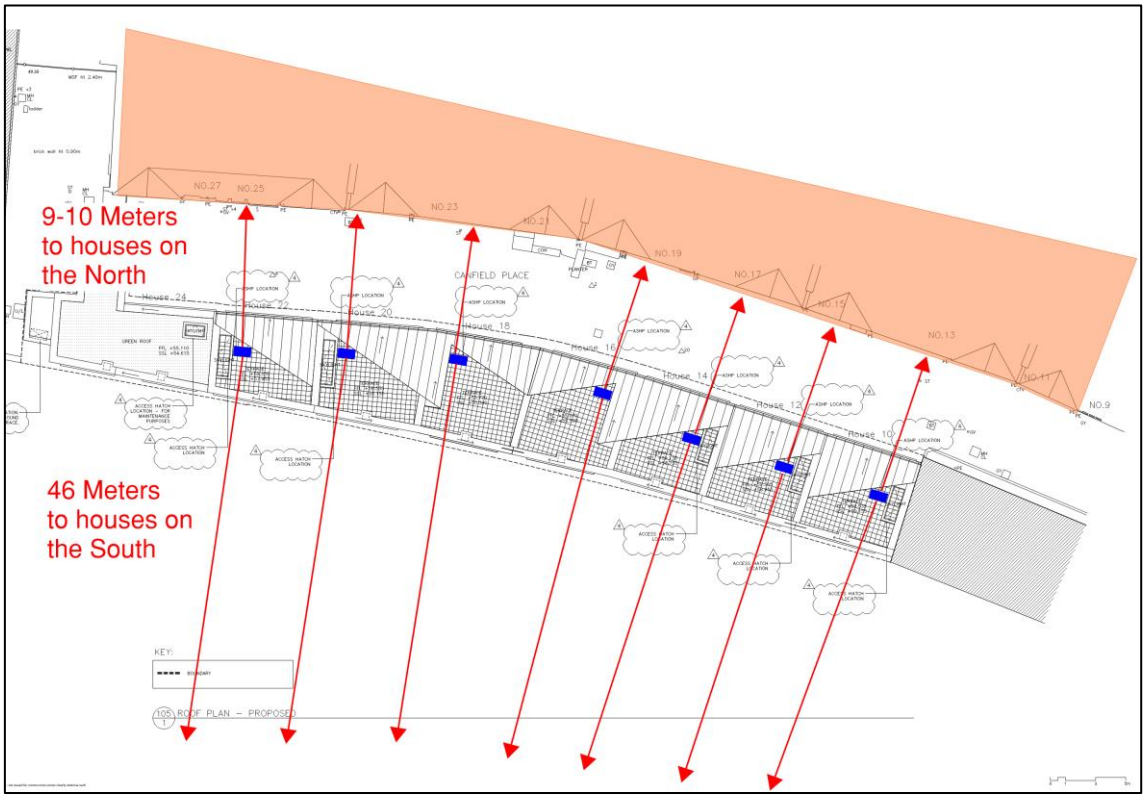

Figure 2 ASHPs locations (in blue) and North houses locations (in orange)

6.2 Manufacturer's noise data

The manufacturer's model number and quoted broadband sound power levels (at maximum and night-time set back operating duties) for the units are provided in Table 4.

For the purposes of this assessment, a nominal spectrum typical of an air-source heat pump of this size has been adopted and matched to the broadband sound power levels set out below.

Table 4 Manufacturers plant noise data (dB)

Unit	Duty	L_w(dBA)
Viessmann Vitocal 151-A	Maximum	56
	Night-time set back	52

6.3 Assessment

The cumulative noise levels from all units has been assessed to 1 m from the nearest windows of the houses to the north and the south.

The calculated cumulative level is provided in Table 5. The full calculation stages are provided in Appendix D.

The assessment includes corrections for distance attenuation, screening and facade reflection correction.

Table 5 Cumulative sound pressure levels at noise sensitive receptors on the South and North of site

Time of day	A-Weighted sound pressure level (dBA)	
	South	North
Daytime (07:00 – 23:00)	28	29
Night (23:00 – 07:00)	24	25

This demonstrates that the plant noise limits will be achieved at all times whilst the plant is operational.

7 Conclusion

The representative background sound levels established in the KP Acoustics planning noise report are:

- Position 1 (South) $L_{A90,5min}$ 48 dB during the day and $L_{A90,5min}$ 36 dB at night.
- Position 2 (North) $L_{A90,5min}$ 44 dB during the day and $L_{A90,5min}$ 32 dB at night.

Based on the requirements of the Local Authority, the relevant plant noise limits at the worst affected existing noise sensitive premises are:

- Position 1 (South): $L_{Aeq,5min}$ 41 dB during the day, and $L_{Aeq,5min}$ 29 dB during the night.
- Position 2 (North): $L_{Aeq,5min}$ 37 dB during the day, and $L_{Aeq,5min}$ 25 dB during the night.

These limits are cumulative and apply with all plant operating under normal conditions. If plant items contain attention catching features, a 5 dB penalty based on the requirements of Camden Council will be applied.

The results of the assessment show facade levels at each noise sensitive receptor will be as follows:

- South receptors: $L_{Aeq,5min}$ 24 dB during the day, and $L_{Aeq,5min}$ 20 dB during the night.
- North receptors: $L_{Aeq,5min}$ 29 dB during the day, and $L_{Aeq,5min}$ 25 dB during the night.

Based on the criteria set above, this demonstrates that the plant noise limits will be achieved at all times whilst the plant is operational.

Appendix A

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.
- $L_{A90,T}$ 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 BS 7445: Part 1: 2003 *Description and measurement of environmental noise, Part 1. Guide to quantities and procedures.*

Appendix B

KP Acoustics report (2022)

KP Acoustics Ltd.
info@kpacoustics.com
1 Galena Road, W6 0LT London, UK
+44 (0) 208 222 8778
www.kpacoustics.com

Canfield Place
London

Noise and Vibration Impact Assessment Report
Report 24427.NVA.01

Cowell Group
37-39 Maida Vale
London
W9 1TP

Report 24427.NVA.01 Revision History			
First Issue Date: 19/07/2022			
A		D	
B		E	
C		F	

Written by:	Checked by:	Approved by:
Billy Clark Acoustic Consultant	**Duncan Arkley MIOA** Senior Acoustic Consultant	**Kyriakos Papanagiotou MIOA** Managing Director

KP acoustics

Contents

List of Attachments

24427. TH1	Environmental Noise Time History
24427.VTH1	Vibration Time History
Appendix A	Glossary of Acoustics Terminology

SUMMARY

KP Acoustics Ltd has been commissioned to assess the suitability of the site at Canfield Place, London, NW6, for a residential development in accordance with the provisions of the National Planning Policy Framework and the Noise Policy Statement for England (NPSE).

An environmental noise survey has been undertaken on site in order to establish the current ambient noise levels, as shown in Table 3.1.

Sound reduction performance calculations have been undertaken in order to specify the minimum performance required from glazed elements in order to meet the requirements of BS8233:2014, taking into consideration the non-glazed external building fabric elements. The results of these calculations and the sound reduction performance requirements for the glazed elements are shown in Table 5.2.

The noise implications of the ventilation strategy have been considered, with options being provided to ensure that the ventilation requirements of Approved Document F are achieved.

No further mitigation measures should be required in order to protect the proposed habitable spaces from external noise intrusion.

Further reviews on vibration induced noise ingress are currently being undertaken, and will follow in an addendum to this report.

1.0 INTRODUCTION

KP Acoustics Ltd has been commissioned by Cowell Group, 37-39 Maida Vale, London W9 1TP, to assess the suitability of the site at Canfield Place, London, NW6, for a residential development in accordance with the provisions of the National Planning Policy Framework and the Noise Policy Statement for England (NPSE).

This report presents the results of the environmental survey undertaken in order to measure prevailing background noise and vibration levels and outlines any necessary mitigation measures.

2.0 SITE SURVEYS

2.1 Site Description

The site is bounded by Canfield Place and mixed commercial and residential properties to the north and a London underground railway line to the south. Entrance to the site is located via Canfield Place. At the time of the survey, the background noise climate was dominated by rail traffic noise from the adjacent railway line.

2.2 Environmental Noise Survey Procedure

A noise survey was undertaken on the proposed site as shown in Figure 2.1. The location was chosen in order to collect data representative of the worst-case levels expected on the site due to all nearby sources.

Continuous automated monitoring was undertaken for the duration of the survey between 11:00 on 04/07/2022 and 11:00 on 06/07/2022.

Weather conditions were generally dry with light winds and therefore suitable for the measurement of environmental noise. The measurement procedure complied with ISO 1996-2:2017 Acoustics '*Description, measurement and assessment of environmental noise - Part 2: Determination of environmental noise levels*'.

2.3 Vibration Survey Procedure

Continuous automated vibration monitoring was undertaken in conjunction with the noise survey between 11:00 on 04/07/2022 and 11:00 on 06/07/2022 at the position shown in Figure 2.1. Measurements were made of vertical (z-axis) and horizontal (x - y axes) vibration dose value levels.

This survey addressed rail traffic vibration from the nearby vibration source. The character of the vibration would be considered to be intermittent.

The vibration monitoring position was chosen in order to capture worst case expected levels of vibration as stated within BS6472-1:2008 *''Guide to evaluation of human exposure to vibration in buildings''.*

2.4 Measurement Locations

Measurement positions are as described within Table 2.1 and shown within Figure 2.1.

Icon	Descriptor	Location Description
	Noise Measurement Position 1	The microphone was installed on a window on the ground floor of the south façade of the existing garages, as shown in Figure 2.1. A correction of 3dB has been applied to account for non-free field conditions
	Noise Measurement Position 2	Manual noise measurements were undertaken adjacent to the north façade of the existing garages, as shown in Figure 2.1
	Vibration Measurement Position	The accelerometer was installed at a distance of 1m from the façade adjoining the nearby railway tracks on a steel cube and attached with manufacturer issued mounting wax

Table 2.1 Measurement positions and descriptions

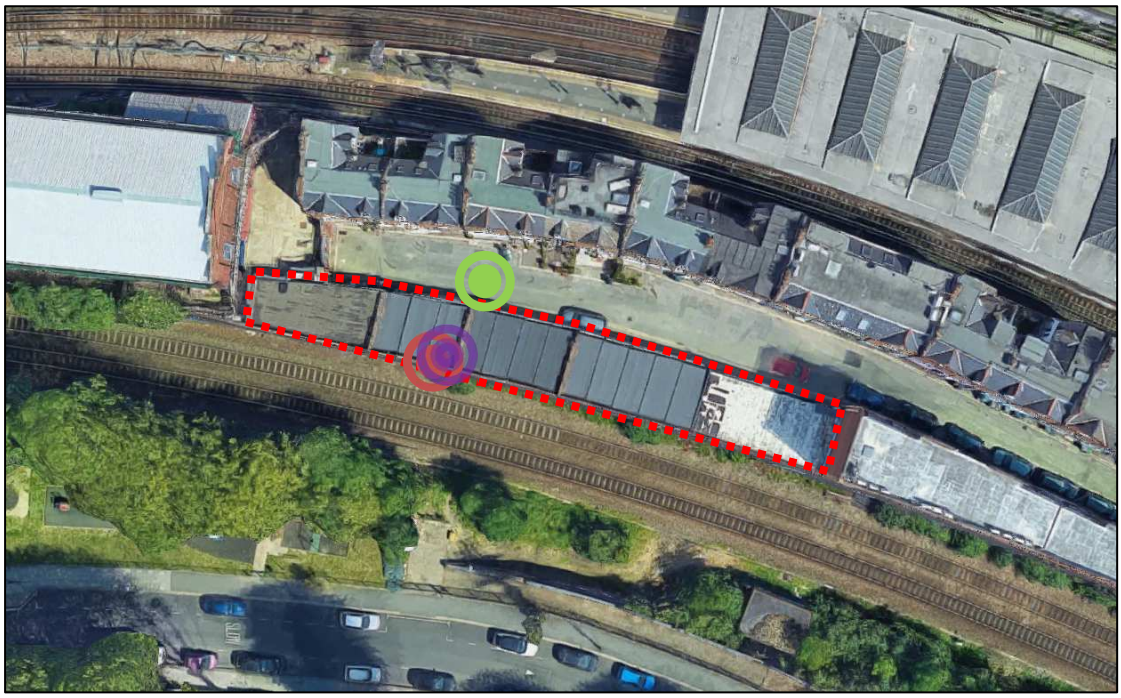

Figure 2.1 Site measurement positions (Image Source: Google Maps)

2.5 Equipment

The equipment calibration was verified before and after use and no abnormalities were observed. The equipment used is described within Table 2.2.

Measurement instrumentation		Serial no.	Date	Cert no.
Noise & Vibration Kit 1	Svantek Type 958A Class 1 Sound & Vibration Level Meter	34580	10/03/2022	1502001-2a
	Free-field microphone PCB 377B02	169019		
	Preamp PCB 426M07	041446		
	Svantek External windshield	-	-	-
	Svantek Type 958A Class 1 Sound & Vibration Level Meter	34580	10/03/2022	1502001-2b
	Accelerometer PCB 356B18	LW254496		
B&K Type 4231 Class 1 Calibrator		2147411	24/05/2022	UCRT22/1581

Table 2.2 Measurement instrumentation

3.0 RESULTS

3.1 Noise Survey

The $L_{Aeq:\,5min}$, $L_{Amax:\,5min}$, $L_{A10:\,5min}$ and $L_{A90:\,5min}$ acoustic parameters were measured throughout the duration of the survey. Measured levels are shown as a time history in Figure 24427.TH1. Average daytime and night time noise levels are shown in Table 4.1.

Measured noise levels are representative of noise exposure levels expected to be experienced by all facades of the proposed development, and are shown in Table 3.1.

Time Period	Noise Measurement Position 1 (Measured Noise level – dBA)	Noise Measurement Position 2 (Derived Noise level – dBA)
Daytime $L_{Aeq,16hour}$	75	59
Night-time $L_{Aeq,8hour}$	69	52

Table 3.1 Site average noise levels for daytime and night time

3.2 Vibration Survey

The results of the vibration measurements captured during the automated survey period are shown as a time history in Figure 24427.VTH1 as VDV levels over the full survey period. It should be noted that vibration was not subjectively felt on site during the equipment installation and collection periods.

4.0 NOISE AND VIBRATION ASSESSMENT GUIDANCE

4.1 Noise Policy Statement For England 2021

The National Planning Policy Framework (NPPF) has superseded and replaces Planning Policy Guidance Note 24 (PPG24), which previously covered issues relating to noise and planning in England. Paragraph 174 of NPPF 2021 states that planning policies and decisions should aim to:

- 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 or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans

In addition, Paragraph 185 of the NPPF states that '*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

The Noise Policy Statement for England (NPSE) was developed by DEFRA and published in March 2010 with the aim to 'Promote good health and good quality of life through the effective management of noise within the context of Government policy on sustainable development.'

Noise Policy Statement England (NPSE) noise policy 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*

The Noise Policy Statement England (NPSE) outlines observed effect levels relating to the above, as follows:

- NOEL – No Observed Effect Level
    - This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.
- LOAEL – Lowest Observed Adverse Effect Level
    - This is the level above which adverse effects on health and quality of life can be detected.
- SOAEL – Significant Observed Adverse Effect Level
    - This is the level above which significant adverse effects on health and quality of life occur.

As stated in The Noise Policy Statement England (NPSE), it is not currently possible to have a single objective based measure that defines SOAEL that is applicable to all sources of noise in all situations. Specific noise levels are not stated within the guidance for this reason, and allow flexibility in the policy until further guidance is available.

4.2 The London Plan: Policy D12 Agent of Change

The London Plan states the following with regards to existing noise generating sources and new residential developments:

A. *The Agent of Change principle places the responsibility for mitigating impacts from existing noise-generating activities or uses on the proposed new noise-sensitive development.*

B. *Boroughs should ensure that planning decisions reflect the Agent of Change principle and take account of existing noise-generating uses in a sensitive manner when new development, particularly residential, is proposed nearby.*

C. Development proposals should manage noise and other potential nuisances by:

- *Ensuring good acoustic design to mitigate and minimise existing and potential impacts of noise generated by existing uses located in the area*
- *Exploring mitigation measures early in the design stage, with necessary and appropriate provisions secured through planning obligations*
- *Separating new noise-sensitive development where possible from existing noise-generating businesses through distance, screening, internal layout, sound-proofing and insulation, and other acoustic design measures.*

D. Development should be designed to ensure that established noise-generating venues remain viable and can continue or grow without unreasonable restrictions being placed on them.

E. New noise-generating development, such as industrial uses, music venues, pubs, rail infrastructure, schools and sporting venues proposed close to residential and other noise-sensitive development should put in place measures such as soundproofing to mitigate and manage any noise impacts for neighbouring residents and businesses.

F. Boroughs should refuse development proposals that have not clearly demonstrated how noise impacts will be mitigated and managed.'

4.3 ProPG: Planning and Noise

As outlined above, the National Planning Policy Framework encourages improved standards of design, although it provides no specific noise levels which should be achieved on site for varying standards of acoustic acceptability, or a prescriptive method for the assessment of noise.

ProPG: Planning and Noise was published in May 2017 in order to encourage better acoustic design for new residential schemes in order to protect future residents from the harmful effects of noise. This guidance can be seen as the missing link between the current NPPF and its predecessor, PPG24 (Planning Policy Guidance 24: Planning and Noise), which provided a prescriptive method for assessing sites for residential development, but without the nuance of 'good acoustic design' as outlined in ProPG.

ProPG allows the assessor to take a holistic approach to consider the site's suitability, taking into consideration numerous design factors which previously may not have been considered

alongside the noise level measured on site, for example the orientation of the building in relation to the main source of noise incident upon it.

It should be noted this document is not an official government code of practice, and neither replaces nor provides an authoritative interpretation of the law or government policy, and therefore should be seen as a good practice document only.

4.4 BS8233:2014

BS8233:2014 *'Sound insulation and noise reduction for buildings'* describes recommended internal noise levels for residential spaces. These levels are shown in Table 4.1.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Rooms	35 dB(A)	-
Dining	Dining Room/area	40 dB(A)	-
Sleeping (daytime resting)	Bedrooms	35 dB(A)	30 dB(A)

Table 4.1 BS8233 recommended internal background noise levels

It should be noted that the recommended internal noise levels outlined above are not applicable under "purge ventilation" conditions as defined by Approved Document F of the Building Regulations, as this should only occur occasionally (E.G. to remove odour from painting or burnt food). However, the levels above should be achieved whilst providing sufficient background ventilation, either via passive or mechanical methods.

The external building fabric would need to be carefully designed to achieve these recommended internal levels.

4.5 WHO Guidelines for Community Noise (1999)

WHO Guidelines for Community Noise (1999) recommends that internal noise levels for individual events should not exceed 45dB L_{Amax} more than 10-15 times per night.

It should be noted that this impact is increasingly being regarded as 'LOAEL' for this number of exceedances, as described in Section 4.1.

The external building fabric would need to be carefully designed to ensure that the above guidance is achieved.

4.6 ANC Residential Design Guide to Acoustics, Ventilation and Overheating

The ANC guide to acoustics, ventilation and overheating provides an integrated approach to achieving good acoustic design with the ventilation requirements of Approved Document F of the Building Regulations and consideration for overheating control. This good practice document recognises the interdependence of ventilation and overheating when assessing

noise, and provides a methodology for assessing the noise implications surrounding ventilation and overheating control.

Ventilation

The ANC Guide to Acoustics, Ventilation and Overheating states the following with regards to ventilation:

'It is important to differentiate between the need to provide 'purge ventilation' as required occasionally under Part F, which applies to all building types, in all locations and throughout the year; against the need to provide ventilation for the 'overheating condition' which is influenced by the location, orientation, type and design of the building and may be required for sustained periods of time, or not at all, depending on the overheating risk…

Approved Document F outlines the three main types of ventilation as whole house ventilation (continuous ventilation of rooms or spaces at a relatively low rate to dilute and remove pollutants and water vapour), extract ventilation (typically for kitchens or bathrooms), and purge ventilation (manually controlled ventilation of rooms or spaces at a relatively high rate to rapidly dilute pollutants and / or water vapour, provided by natural or mechanical means).

It also provides four template systems which can be adopted to demonstrate compliance with the Building Regulations, which are outlined in Table 4.2 below.

Ventilation System	Provision with ADF System / Purpose		
	Whole Dwelling Ventilation	**Extract Ventilation**	**Purge Ventilation**
System 1 – Trickle vents & intermittent extract fans	Trickle vents	Intermittent extract fans	Typically provided by opening windows
System 2 – Passive stack	Trickle vents and passive stack ventilation	Continuous via passive stack	Typically provided by opening windows
System 3 – Cont. mechanical extract (MEV)	Continuous mechanical extract – min. low rate Trickle vents for inlet air	Continuous mechanical extract – min. high rate Trickle vents for inlet air	Typically provided by opening windows
System 4 – Cont. mechanical supply & extract with heat recovery (MEV)	Continuous mechanical supply and extract – min. low rate	Continuous mechanical supply and extract – min. high rate	Typically provided by opening windows

Table 4.2 ADF template systems

4.7 BS6472-1-2008 - Vibration Assessment

BS 6472 provides guidance on predicting human response to vibration in buildings over the frequency range 0.5 Hz to 80 Hz. The vibration dose value is used to estimate the probability of adverse comment which might be expected from human beings experiencing vibration in buildings. Consideration is given to the time of day and use made of occupied space in buildings, whether residential, office or workshop.

Table 4.4 shows the different likelihoods of adverse comment from nearby vibration sources on residential occupants.

Place and time	Low probability of adverse comment $m.s^{-1.75}$	Adverse comment possible $m.s^{-1.75}$	Adverse comment probable $m.s^{-1.75}$
Residential buildings 16h day	0.2-0.4	0.4-0.8	0.8-1.6
Residential buildings 8h night	0.1-0.2	0.2-0.4	0.4-0.8

Table 4.4 Likelihood of comment on vibration perceived within residential dwellings

It should be noted that the vibration levels outlined in Table 4.4 are at the point of entry into the human body, and not the point of entry of vibration into the structure itself. In the cases where the proposed structure is not yet built and vibration measurements cannot be taken inside the building, losses should be accounted for due to the transfer function between the ground and building structure and its foundations. As ground conditions, foundation types, building construction, and floor construction and loading are all variables in terms of transfer function and losses, this report will assume piled foundations in rock and a negligible loss as a worst-case scenario.

In addition to potential losses as vibration passes from unloaded ground into the structure, amplification of vibration can occur as the vibration propagates across a suspended floor, such as in upper floors of the proposed building. As this is fully dependent on the input frequency of vibration and the natural frequency of the receiving structure, VDV levels would only be considered on the ground floor of the proposed development within this assessment.

4.8 BS4142: 2014 '*Methods for rating and assessing industrial and commercial sound*'

British Standard BS4142:2014 '*Methods for rating and assessing industrial and commercial sound*' describes a method for rating and assessing sound of an industrial and/or commercial nature, which includes:

- Sound from industrial and manufacturing processes

- Sound from fixed installations which comprise mechanical and electrical plant and equipment
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises, and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes.

This Standard compares the Rating Level due to the noise source/s under assessment for a one-hour period during the daytime (07:00 – 23:00 hours) and a fifteen-minute period during the night-time (23:00 – 07:00 hours) with the existing background noise level in terms of an L_{A90} when the noise source is not operating.

It should be noted that the Rating Level is the Specific Sound Level in question ($L_{Aeq,\ Tr}$), including any relevant acoustic feature corrections, as follows:

- **Tonality** – '*For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0dB and +6dB for tonality. Subjectively, this can be converted to a penalty of 2dB for a tone which is just perceptible at the noise receptor, 4dB where it is clearly perceptible, and 6dB where it is highly perceptible*'
- **Impulsivity** – '*A correction of up to +9dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3dB for impulsivity which is just perceptible at the noise receptor, 6dB where it is clearly perceptible, and 9dB where it is highly perceptible*'
- **Intermittency** – '*If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3dB can be applied*'
- **Other sound characteristics** – '*Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3dB can be applied*'

Once the Rating Level has been obtained, the representative background sound level is subtracted from the Rating Level to obtain an initial estimate of the impact, as follows:

- Typically, the greater this difference, the greater the magnitude of the impact
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context

- A difference of around +5 dB could be an indication of an adverse impact, depending on the context
- The lower the rating level is relative to the measured background sound level, the less likely it is that there will be an adverse impact or significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound having a low impact, depending on the context

NOTE: Adverse impacts may include but not be limited to annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

The initial estimate of the impact may then be modified by taking consideration of the context in which the sound occurs.

5.0 EXTERNAL BUILDING FABRIC SPECIFICATION

Sound reduction performance calculations have been undertaken in order to specify the minimum performance required from glazed and non-glazed elements in order to achieve the recommended internal noise levels shown in Table 4.1, taking into account average and maximum noise levels monitored during the environmental noise survey.

Typical sized bedrooms with a high ratio of glazing to masonry have been used for all calculations in order to specify glazing.

As a more robust assessment, L_{Amax} spectrum values of night-time peaks have also been considered and incorporated into the glazing calculation in order to cater for the interior limit of 45 dB L_{Amax} for individual events, as recommended in WHO Guidelines.

Please note that the glazed and non-glazed element calculations would need to be finalised once all design proposals are finalised.

5.1 Non-Glazed Elements

At this project stage, the exact construction of the non-glazed external building fabric is not yet defined, however, it is understood that it would be based upon the construction proposed in Table 5.1 and would be expected to provide the minimum figures shown above when tested in accordance with BS EN ISO, 140-3:1995.

For this purpose, the originally proposed external building fabric has been increased in mass via a cementitious board between SFS frames, and has been modelled as follows:

Element	Octave band centre frequency SRI, dB					
	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz
75mm Outer cladding zone 200mm stud frame w/ Rockwool Duo Slab 18mm Cementitious board 100mm stud frame w/ Rockwool slab 2x15mm SoundBloc board (or similar)	46	55	60	63	61	70

Table 5.1 Sound reduction performance for non-glazed elements

5.2 Glazed Elements

Minimum octave band sound reduction index (SRI) values required for all glazed elements to be installed are shown in Table 5.2.The performance is specified for the whole window unit, including the frame and other design features such as the inclusion of trickle vents. Sole glass performance data would not demonstrate compliance with this specification.

Glazing performance calculations have been based both on average measured night-time noise levels as well as verified against the L_{Amax} spectrum of individual events in order to comply with a maximum internal noise level of 45dB(A) in bedrooms as recommended by World Health Organisation Guidelines. The combined most robust results of these calculations are shown in Table 5.2.

Elevation	Octave band centre frequency SRI, dB						R_w ($C;C_{tr}$), dB
	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	
South Elevations	32	37	45	46	46	57	46 (-2;-4)
North Elevations	23	23	30	39	36	43	34 (-1;-4)

Table 5.2 Required glazing performance

The nominated glazing supplier should verify that their proposed window system meets the attenuation figures shown at each centre frequency band as shown in Table 5.2.

All major building elements should be tested in accordance with BS EN ISO 140-3:1995.

Independent testing at a UKAS accredited laboratory will be required in order to confirm the performance of the chosen system for an actual configuration.

6.0 VENTILATION

6.1 Ventilation Strategy

Based on the noise levels measured on site, appropriate ventilation systems are outlined in Table 6.1 below in order to ensure the internal noise environment is not compromised.

Ventilation System	South Elevations Ventilation	North Elevations Ventilation	Extract Ventilation
ADF System 1	n/a	Trickle vents providing a minimum performance of 35dB $D_{,n,e,w}$	Intermittent extract fans
ADF System 3	n/a	Continuous mechanical extract (low rate) and trickle vents for supply providing a minimum performance of 35dB $D_{,n,e,w}$	Continuous mechanical extract (high rate) with trickle vents providing inlet air
ADF System 4	Continuous mechanical supply and extract (low rate)	Continuous mechanical supply and extract (low rate)	Continuous mechanical supply and extract (high rate)

Table 6.1 Ventilation systems

In the case of mechanical ventilation, systems should be designed to meet the internal noise levels as defined in CIBSE Guide A (2015), as shown in Table 6.2.

Room Type	L_{Aeq}, dB	NR
Bedrooms	30	25
Living Rooms	35	30
Kitchen	45-50	40-45

Table 6.2 CIBSE Guide A 2015 guidance levels for mechanical building services

In all cases, purge ventilation would be provided by openable windows. As outlined in Section 4.5, the internal noise level requirement would not be applicable during purge conditions as this would only occur occasionally.

7.0 VIBRATION ASSESSMENT

The measured results of the 24 hour survey have been aggregated to produce the VDV over the 16 hour daytime and 8 hour night time period. Table 7.1 compares the measured levels on site against VDV ranges outlined in Table 4.4 and BS6472-1 2008 '*Guide to evaluation of human exposure to vibration in buildings*'.

Axis	Vibration Measurement	Measured VDV Level $m/s^{1.75}$	Likelihood of Comment
x	$VDV_{d,day}$	0.04	Adverse comment is not expected
	$VDV_{d,night}$	0.04	Adverse comment is not expected
y	$VDV_{d,day}$	0.02	Adverse comment is not expected
	$VDV_{d,night}$	0.02	Adverse comment is not expected
z	$VDV_{b,day}$	0.08	Adverse comment is not expected
	$VDV_{b,night}$	0.04	Adverse comment is not expected

Table 7.1 Daytime and night-time VDV levels and likelihood of comment in accordance with BS6472

As shown in Table 7.1, the most dominant axis of vibration is the z-axis with a $VDV_{d,day}$ of $0.08m/s^{1.75}$ and $VDV_{d,night}$ $0.04m/s^{1.75}$, which correlates with adverse comment not being expected from future occupiers within the development.

8.0 PRELIMINARY PLANT NOISE IMPACT ASSESSMENT

8.1 Plant Noise Survey Results

The $L_{Aeq:\ 5min}$, $L_{Amax:\ 5min}$, $L_{A10:\ 5min}$ and $L_{A90:\ 5min}$ acoustic parameters were measured throughout the duration of the manual survey.

Representative background noise levels are shown in Table 7.1 for daytime and night-time.

It should be noted that the representative background noise level has been derived from the most commonly occurring $L_{A90,5\ min}$ levels measured during the environmental noise survey undertaken on site.

Time Period	Representative background noise level L_{A90} dB(A)	
	Noise Measurement Position 1 (Measured Noise level – dBA)	Noise Measurement Position 2 (Derived Noise level – dBA)
Daytime $L_{Aeq,16hour}$	48	44
Night-time $L_{Aeq,8hour}$	36	32

Table 7.1 Representative background noise levels

8.2 Local Authority Guidance

The guidance provided by The London Borough of Camden for noise emissions of new plant in this instance is as follows:

The noise criteria, as per the Local Plan 2017 of London Borough of Camden, British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' should be considered as the main reference document for the assessment. The resultant 'Rating Level' would be considered as follows:

Period	Assessment Location	Rating Level Acceptability Range		
		Green: noise is considered to be at an acceptable level	**Amber:** 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:** noise is observed to have a significant adverse effect.
Daytime (7:00-23:00)	Garden used for main amenity (free field) and Outside living or dining or Bedroom window (façade)	10dB below background	9 dB below and 5dB above background	5dB above background
Night-time (23:00-7:00)	Outside bedroom window (façade)	10dB below background and no events exceeding 57dB L_{Amax}	9db below and 5dB above background or noise events between 57dB and 88dB L_{Amax}	5dB above background and/or events exceeding 88dB L_{Amax}

Table 4.1 Camden noise criteria for plant and machinery

8.3 Proposed Plant Installations

Currently, the exact details of the proposed units are unknown. Once all M&E proposals have been finalised, this report will be revised to include calculations which demonstrate compliance to the criterion set in Table 4.1.

9.0 CONCLUSION

An environmental noise and vibration survey has been undertaken at Canfield Place, London, NW6, allowing the assessment of daytime and night-time levels likely to be experienced by the proposed development.

Measured noise levels allowed a robust glazing specification to be proposed which would provide internal noise levels for all residential environments of the development commensurate to the design range of BS8233.

No further mitigation measures should be required in order to protect the proposed habitable spaces from external noise intrusion.

Measurement of the London underground rail train activity indicates that vibration levels are below the unlikely to cause adverse comment in accordance with BS6472: 2008.

A maximum noise emissions criterion has also been determined for the proposed plant unit installations and has been set based on the requirements of the London Borough of Camden for new plant unit installations.

Further calculations would need to be undertaken once all M&E proposals are finalised in order to demonstrate compliance.

Canfield Place, London
Environmental Noise Time History
From 04 July 2022 To 06 July 2022

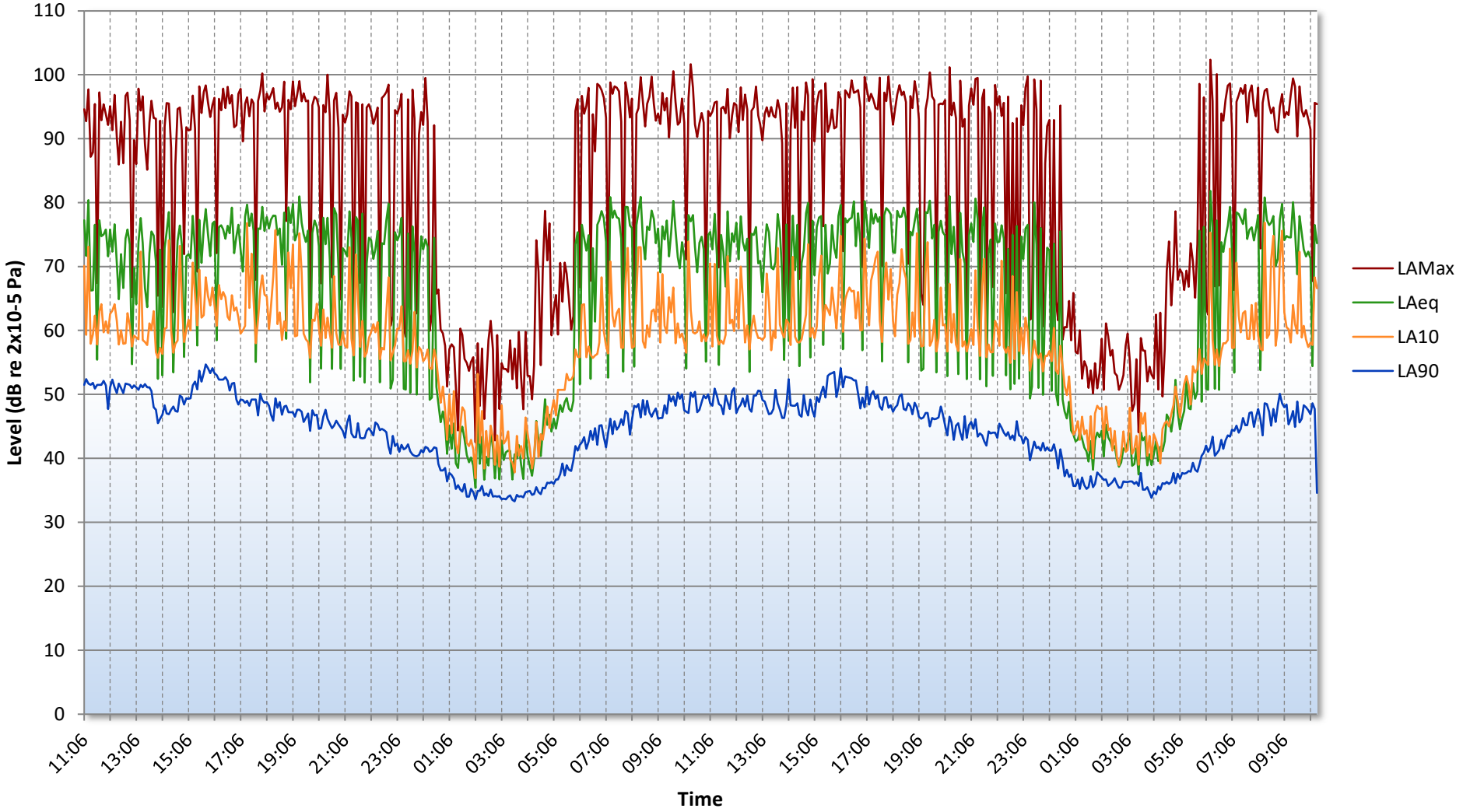

Figure 24427.TH1

Canfield Place, London
VDV Time History
From 04 July 2022 To 06 July 2022

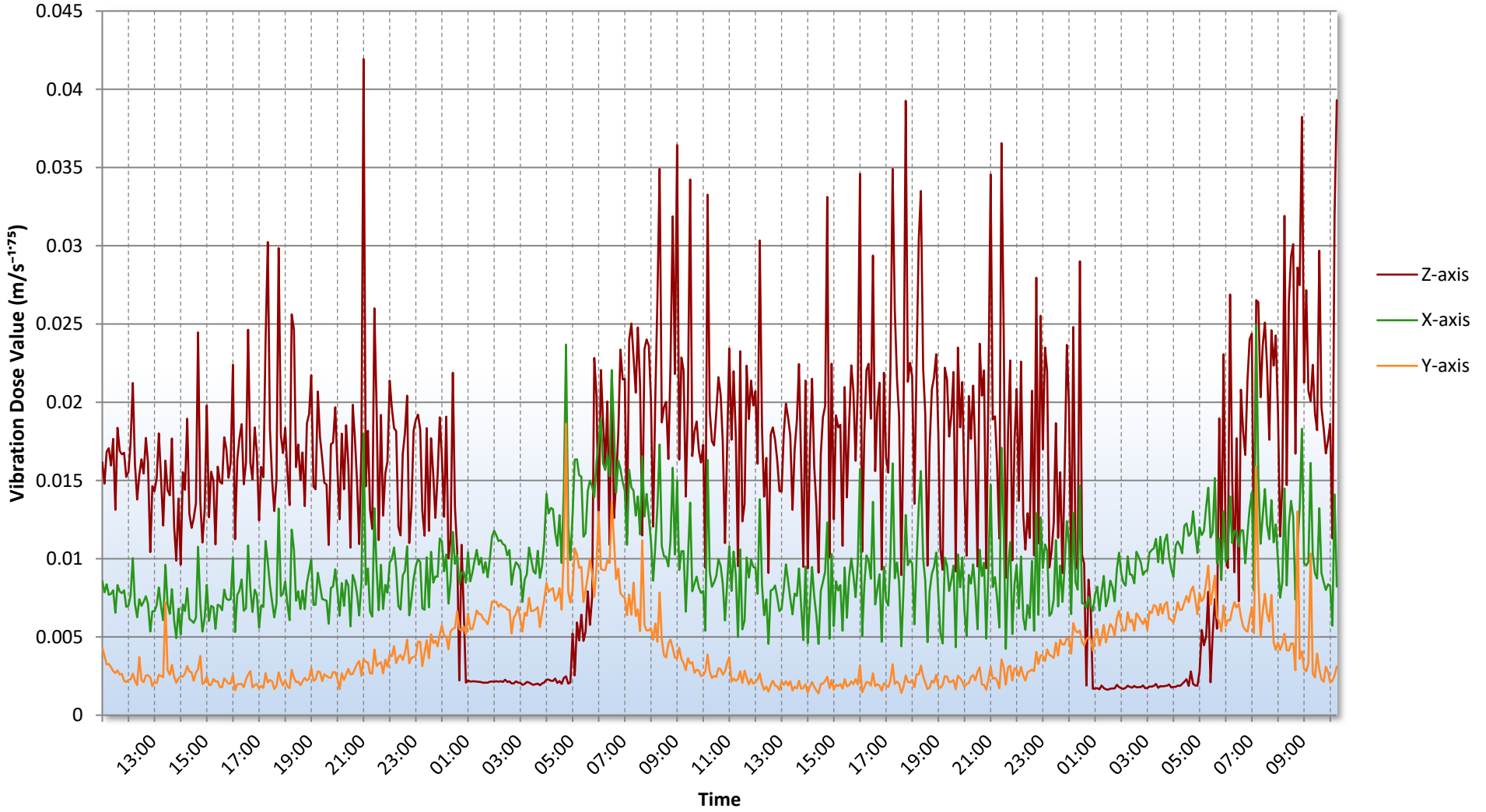

Figure 24427.VTH1

APPENDIX A

GENERAL ACOUSTIC TERMINOLOGY

Decibel scale - dB

In practice, when sound intensity or sound pressure is measured, a logarithmic scale is used in which the unit is the 'decibel', dB. This is derived from the human auditory system, where the dynamic range of human hearing is so large, in the order of 10^{13} units, that only a logarithmic scale is the sensible solution for displaying such a range.

Decibel scale, 'A' weighted - dB(A)

The human ear is less sensitive at frequency extremes, below 125Hz and above 16Khz. A sound level meter models the ears variable sensitivity to sound at different frequencies. This is achieved by building a filter into the Sound Level Meter with a similar frequency response to that of the ear, an A-weighted filter where the unit is dB(A).

L_{eq}

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level L_{eq}. The L_{eq} is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

L_{10}

This is the level exceeded for no more than 10% of the time. This parameter is often used as a "not to exceed" criterion for noise.

L_{90}

This is the level exceeded for no more than 90% of the time. This parameter is often used as a descriptor of "background noise" for environmental impact studies.

L_{max}

This is the maximum sound pressure level that has been measured over a period.

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 11 such octave bands whose centre frequencies are defined in accordance with international standards. These centre frequencies are: 16, 31.5, 63, 125, 250, 500, 1000, 2000, 4000, 8000 and 16000 Hertz.

Environmental noise terms are defined in BS7445, *Description and Measurement of Environmental Noise*.

APPENDIX A

APPLIED ACOUSTIC TERMINOLOGY

Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than a single source and 4 sources produce a 6dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Hearing perception is highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a guide to explain increases or decreases in sound levels for many scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud

Transmission path(s)

The transmission path is the path the sound takes from the source to the receiver. Where multiple paths exist in parallel, the reduction in each path should be calculated and summed at the receiving point. Outdoor barriers can block transmission paths, for example traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and construction.

Ground-borne vibration

In addition to airborne noise levels caused by transportation, construction, and industrial sources there is also the generation of ground-borne vibration to consider. This can lead to structure-borne noise, perceptible vibration, or in rare cases, building damage.

Sound insulation - Absorption within porous materials

Upon encountering a porous material, sound energy is absorbed. Porous materials which are intended to absorb sound are known as absorbents, and usually absorb 50 to 90% of the energy and are frequency dependent. Some are designed to absorb low frequencies, some for high frequencies and more exotic designs being able to absorb very wide ranges of frequencies. The energy is converted into both mechanical movement and heat within the material; both the stiffness and mass of panels affect the sound insulation performance.

Appendix C

BS 4142 corrections for attention catching features

The following applies where plant noise is assessed in accordance with BS 4142:2014+A1:2019.

If the proposed plant noise contains attention catching features (such as tonal elements, whines, whistles, bangs etc), penalty corrections should be applied based on the type and impact of the features.

If appropriate, a subjective assessment of the plant features can be adopted. Where the plant noise contains tonal elements, the following corrections can be made depending on how perceptible the tone is at the noise receptor:

- 0 dB where the tone is not perceptible
- 2 dB where the tone is just perceptible
- 4 dB where the tone is clearly perceptible
- 6 dB where the tone is highly perceptible.

Where the plant noise is impulsive, the following corrections can be made depending on how perceptible the impulsivity is at the noise receptor:

- 0 dB where the impulse is not perceptible
- 3 dB where the impulse is just perceptible
- 6 dB where the impulse is clearly perceptible
- 9 dB where the impulse is highly perceptible.

For noise which is equally both impulsive and tonal, then both features can be accounted for by linearly summing the corrections for both characteristics.

If the plant has other distinctive characteristics, such as intermittency, then a 3 dB correction can be made.

If a subjective assessment of tonality is not appropriate, an objective assessment can be made by analysis of time-averaged, third-octave band sound pressure levels. A noise source is deemed to be tonal if the level in a third-octave band exceeds the level in adjacent third-octave bands by the level differences given below:

- 15 dB in the low frequency third-octave bands (25 Hz to 125 Hz)
- 8 dB in the mid frequency third-octave bands (160 Hz to 400 Hz)
- 5 dB in the high frequency third-octave bands (500 Hz to 10000 Hz).

If an objective assessment identifies the plant noise to be tonal then a 6 dB correction must be made.

Appendix D

Calculation stages

SANDY BROWN

Consultants in Acoustics, Noise & Vibration

Project number	023549	**Project name**	Canfield Pl		
Calculation revision	A				
Calculation by	AA			**Date created**	10/04/2024
Checked by	DE			**Date checked**	10/04/2024
Calculation description	North receptors - daytime operation (max duty)				

Comments	**Octave band centre frequency (Hz)**								
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dBA**
units 18,16									
Sound power level (indicative spectrum)	60	57	57	55	51	44	34	28	56
Correction for 2 units	3	3	3	3	3	3	3	3	
Additional source directivity; Q = 8	9	9	9	9	9	9	9	9	
Total sound power level	72	69	69	67	63	56	46	40	68
Losses									
Distance attenuation - Point source, r=10m	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	
Screening loss - Path difference = 0.299m	6.7	8.0	10.0	12.5	15.4	18.4	21.4	24.0	
Total losses	*38*	*39*	*41*	*44*	*46*	*49*	*52*	*55*	
Sound pressure level after losses	34	30	28	24	17	7	-6	-15	24
Facade correction	3	3	3	3	3	3	3	3	
Total facade sound pressure level at receptor	37	33	31	27	20	10	-3	-12	27
Units 22, 20									
Sound power level	60	57	57	55	51	44	34	28	56
Correction for 2 units	3	3	3	3	3	3	3	3	
Additional source directivity; Q = 8	9	9	9	9	9	9	9	9	
Total sound power level	72	69	69	67	63	56	46	40	68
Losses									
Distance attenuation - Point source, r=17m	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	
Screening loss - Path difference = 0.434m	7.4	9.0	11.3	14.1	17.0	20.0	23.0	24.0	
Total losses	*43*	*45*	*47*	*50*	*53*	*56*	*59*	*60*	
Sound pressure level after losses	29	24	22	17	10	0	-13	-20	18
Facade correction	3	3	3	3	3	3	3	3	
Total facade sound pressure level at receptor	32	27	25	20	13	3	-10	-17	21
units 10, 12, 14									
Sound power level	60	57	57	55	51	44	34	28	56
Correction for 3 units	5	5	5	5	5	5	5	5	
Additional source directivity; Q = 8	9	9	9	9	9	9	9	9	
Total sound power level	74	71	71	69	65	58	48	42	70
Losses									
Distance attenuation - Point source, r=20m	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	
Screening loss - Path difference = 0.428m	7.3	9.0	11.3	14.0	17.0	20.0	23.0	24.0	
Total losses	*44*	*46*	*48*	*51*	*54*	*57*	*60*	*61*	
Sound pressure level after losses	29	25	22	18	11	1	-12	-19	19
Facade correction	3	3	3	3	3	3	3	3	
Total facade sound pressure level at receptor	32	28	25	21	14	4	-9	-16	22
Cumulative level									
Total facade sound pressure level at receptor	39	35	33	28	21	11	-2	-10	**29**
	39	*35*	*33*	*28*	*21*	*11*	*-2*	*-10*	*29*
Criteria									
Criteria - Daytime									37
Difference									-8

SANDY BROWN

Consultants in Acoustics, Noise & Vibration

Project number	023549	**Project name**	Canfield Pl		
Calculation revision	A				
Calculation by	AA			**Date created**	10/04/2024
Checked by	DE			**Date checked**	10/04/2024
Calculation description	North receptors - Night time operation (night time setback mode)				

Comments	**Octave band centre frequency (Hz)**								
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dBA**
units 18,16									
Sound power level (indicative spectrum)	60	57	57	55	51	44	34	28	56
Adjustment to spectrum to be 52dBA	-4	-4	-4	-4	-4	-4	-4	-4	
Correction for 2 units	3	3	3	3	3	3	3	3	
Additional source directivity; Q = 8	9	9	9	9	9	9	9	9	
Total sound power level	68	65	65	63	59	52	42	36	64
Losses									
Distance attenuation - Point source, r=10m	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	
Screening loss - Path difference = 0.299m	6.7	8.0	10.0	12.5	15.4	18.4	21.4	24.0	
Total losses	*38*	*39*	*41*	*44*	*46*	*49*	*52*	*55*	
Sound pressure level after losses	30	26	24	20	13	3	-10	-19	20
Facade correction	3	3	3	3	3	3	3	3	
Total facade sound pressure level at receptor	33	29	27	23	16	6	-7	-16	23
Units 22, 20									
Sound power level (indicative spectrum)	60	57	57	55	51	44	34	28	56
Adjustment to spectrum to be 52dBA	-4	-4	-4	-4	-4	-4	-4	-4	
Correction for 2 units	3	3	3	3	3	3	3	3	
Additional source directivity; Q = 8	9	9	9	9	9	9	9	9	
Total sound power level	68	65	65	63	59	52	42	36	64
Losses									
Distance attenuation - Point source, r=17m	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	
Screening loss - Path difference = 0.434m	7.4	9.0	11.3	14.1	17.0	20.0	23.0	24.0	
Total losses	*43*	*45*	*47*	*50*	*53*	*56*	*59*	*60*	
Sound pressure level after losses	25	20	18	13	6	-4	-17	-24	14
Facade correction	3	3	3	3	3	3	3	3	
Total facade sound pressure level at receptor	28	23	21	16	9	-1	-14	-21	17
units 10, 12, 14									
Sound power level (indicative spectrum)	60	57	57	55	51	44	34	28	56
Adjustment to spectrum to be 52dBA	-4	-4	-4	-4	-4	-4	-4	-4	
Correction for 3 units	5	5	5	5	5	5	5	5	
Additional source directivity; Q = 8	9	9	9	9	9	9	9	9	
Total sound power level	70	67	67	65	61	54	44	38	66
Losses									
Distance attenuation - Point source, r=20m	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	
Screening loss - Path difference = 0.428m	7.3	9.0	11.3	14.0	17.0	20.0	23.0	24.0	
Total losses	*44*	*46*	*48*	*51*	*54*	*57*	*60*	*61*	
Sound pressure level after losses	25	21	18	14	7	-3	-16	-23	15
Facade correction	3	3	3	3	3	3	3	3	
Total facade sound pressure level at receptor	28	24	21	17	10	0	-13	-20	18
Cumulative level									
Total facade sound pressure level at receptor	35	31	29	24	17	7	-6	-14	**25**
	35	*31*	*29*	*24*	*17*	*7*	*-6*	*-14*	*25*
Criteria									
Criteria - Daytime									25
Difference									0

SANDY BROWN

Consultants in Acoustics, Noise & Vibration

Project number	023549	**Project name**	Canfield Pl		
Calculation revision	A				
Calculation by	AA			**Date created**	10/04/2024
Checked by	DE			**Date checked**	10/04/2024
Calculation description	South receptors - daytime operation (max duty)				

Comments	**Octave band centre frequency (Hz)**								
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dBA**
All units									
Sound power level (indicative spectrum)	60	57	57	55	51	44	34	28	56
Correction for 7 units	8	8	8	8	8	8	8	8	
Additional source directivity; Q = 8	9	9	9	9	9	9	9	9	
Total sound power level	77	74	74	72	68	61	51	45	73
Losses									
Distance attenuation - Point source, r=46m	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.3	
Screening loss - Path difference = 0.055m	5.4	5.7	6.3	7.4	9.1	11.4	14.1	17.1	
Total losses	*50*	*50*	*51*	*52*	*53*	*56*	*58*	*61*	
Sound pressure level after losses	28	25	24	21	15	6	-7	-16	21
Facade correction	3	3	3	3	3	3	3	3	
Total facade sound pressure level at receptor	31	28	27	24	18	9	-4	-13	24
Criteria									
Criteria - Daytime									41
Difference									-17

SANDY BROWN

Consultants in Acoustics, Noise & Vibration

Project number	023549	**Project name**	Canfield Pl		
Calculation revision	A				
Calculation by	AA			**Date created**	10/04/2024
Checked by	DE			**Date checked**	10/04/2024
Calculation description	South receptors - night time operation (night time setback mode)				

Comments	**Octave band centre frequency (Hz)**								
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dBA**
All units									
Sound power level (indicative spectrum)	60	57	57	55	51	44	34	28	56
Adjustment to spectrum to be 52dBA	-4	-4	-4	-4	-4	-4	-4	-4	
Correction for 7 units	8	8	8	8	8	8	8	8	
Additional source directivity; Q = 8	9	9	9	9	9	9	9	9	
Total sound power level	73	70	70	68	64	57	47	41	69
Losses									
Distance attenuation - Point source, r=46m	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.3	
Screening loss - Path difference = 0.055m	5.4	5.7	6.3	7.4	9.1	11.4	14.1	17.1	
Total losses	*50*	*50*	*51*	*52*	*53*	*56*	*58*	*61*	
Sound pressure level after losses	24	21	20	17	11	2	-11	-20	17
Facade correction	3	3	3	3	3	3	3	3	
Total facade sound pressure level at receptor	27	24	23	20	14	5	-8	-17	20
Criteria									
Criteria - Night time									29
Difference									-9