Appendix: Noise and Vibration

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Annex 1 Legislation and Planning Policy Context

Control of Pollution Act 1974

Powers are given to Local Planning Authorities (LPAs) under the Control of Pollution Act 1974 (COPA) for the control of noise from construction sites. Sections 60 and 61 of COPA 1974 allow LPAs to serve notices imposing conditions on the way in which construction work is conducted. It is a criminal offence to contravene such a notice without a reasonable excuse, which can be avoided provided the work is carried out under a consent issued under Section 61 of the Act. Such consents may be applied for in advance of construction work being carried out.

LPAs can produce Regulations to control noise from plant or machinery under Section 68 of COPA 1974, but the preference is generally to use codes of practice issued under Section 71 to minimise noise. Although breach of a code of practice is not a criminal offence, these may be taken into account in legal proceedings.

The Environmental Noise (England) Regulations 2006 (as amended 2008, 2009 2010 and 2018)

The Environmental Noise (England) Regulations 2006 implement the Assessment and Management of Environmental Noise Directive 2002/49/EC (END). The END requires:

- The use of harmonised noise indicators and computational measures so that data can be collected and compared in a standardised way
- Common protocols for noise mapping
- The drawing up of noise maps
- Making information available to the public
- The drawing up of local action plans
- Collection of data by the Commission to inform future Community policy.

Noise mapping of the UK has been under way for some years, with the majority of urban areas being covered.

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National Planning Policy

National Planning Policy Framework, 2021

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

The NPPF states:

'Planning policies and decisions should 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 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…'*

In addition, the following is noted:

'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.'

National Planning Practice Guidance, 2016

The National Planning Practice Guidance (NPPG) provides further context to the NPPF and the two documents should be read together. The document provides guidance on how to recognise when noise could be a concern and the factors that influence this, along with outline guidance on noise mitigation through engineering and design, etc.

Noise Policy Statement for England, 2010

The Noise Policy Statement for England (NPSE) sets out the long-term vision of Government noise policy. 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."*

The NPSE adopts established concepts from toxicology that can be applied to noise impacts. The concept details noise levels, at which the effects of an exposure may be classified into a specific category. The classification categories as detailed within the NPSE are as follows:

- No Observed Effect Level (NOEL) - the level below which no effect can be detected. Below this level no detectable effect on health and quality of life due to noise can be established;
- Lowest Observable Adverse Effect Level (LOAEL) - the level above which adverse effects on health and quality of life can be detected; and
- Significant Observed Adverse Effect Level (SOAEL) - the level above which significant adverse effects on health and quality of life occur.

The SOAEL does not have a single objective noise level that is applicable to all sources of noise in all situations and therefore, the SOAEL is likely to be different for different sources, different receptors and at different times of the day.

The first aim of the NPSE is to avoid significant adverse effects on health and quality of life, taking into account the guiding principles of sustainable development. The second aim considers situations where impacts are established between the LOAEL and SOAEL. In such circumstances, all reasonable steps should be taken to mitigate and minimise the effects. However, this does not mean that such adverse effects cannot occur. The third aim seeks to improve health and quality of life, where possible, through the pro-active management of noise, whilst also taking account of the guiding principles of sustainable development.

DEFRA have led a study to identify the SOAEL and LOAEL for a limited range of noise sources. The study was understood to have ended in 2012. However, no guidance from this research has been issued at the time of writing (February 2021).

ProPG: for planning and noise, 2017

The Professional Practice Guidance on Planning and Noise (ProPG) is a recently introduced document that provides guidance on the management of noise within the planning system in England.

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The document emphasises that good acoustic design should avoid 'unreasonable' acoustic conditions and prevent 'unacceptable' acoustic conditions both internally (inside noise-sensitive parts within buildings), and externally in spaces intended for amenity purposes. The document highlights that care should be taken not to over-design mitigation, and states that:

"Good acoustic design should provide an integrated solution whereby the optimum acoustic outcome is achieved, without design compromises that will adversely affect living conditions and the quality of life of the inhabitants or other sustainable design objectives and requirements."

This typically involves careful consideration of:

- Checking the feasibility of relocating or reducing noise levels from relevant sources.
- Consider options for planning the site or building layout.
- Consider the orientation of proposed building(s).
- Select construction types and methods for meeting building performance requirements.
- Examine the effects of noise control measures on ventilation, fire regulation, health and safety cost, CDM etc.
- Assess the viability of alternative solutions.

Regional Planning Policy

The London Plan – Spatial Development Strategy for Greater London, 2016

With specific reference to noise, Policy 7.15 of the London Plan 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"*.

London Plan, 2021

Policy D14 of the London Plan refers specifically to noise. The content is mainly the same as the draft versions, with the notable addition of policy used to specifically protect existing noise-generating uses from the development of noise sensitive buildings within their vicinity, reflecting the Agent of Change principle (Policy D13).

Other policies consider noise (C4, D3, CEW3, S19 and S22), though relate back to the positions and objectives outlined in HIC3, H1 and H3.

The Mayor's Ambient Noise Strategy, 2004

The Mayor's Ambient Noise Strategy 'Sounder City' is the first city-wide strategy focusing on controlling ambient noise. This primarily concerns noise from transport and industry and states that:

- *"This strategy sets out the main steps that need to be taken, including quieter road surfaces, smoother traffic flow, rail infrastructure improvements, aircraft noise measures, and improved design for new developments.*
- *The aim of the Mayor's ambient noise strategy is a practical one – to minimise the adverse impacts of noise on people living and working in, and visiting London using the best available practices and technology within a sustainable development framework".*

Sustainable Design and Construction – Supplementary Planning Guidance

The Sustainable Design and Construction Supplementary Planning Guidance (SPG) provides guidance on what measures can be included in the design of buildings to achieve targets set for reductions in environmental emissions and consumption of natural resources in order to achieve sustainable developments.

Section 4.4 of the SPG relates specifically to the control of noise and makes references the London Plan policy 7.15. The guidance provided on noise includes consideration of the sources of noise that are generated by developments, engineering measures on the control of noise and vibration, consideration of the building layout, administrative measures and design measures that are to be considered in developments. The Sustainable Design and Construction SPG does not contain any specific assessment criteria.

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Local Planning Policy

London Borough of Southwark – Core Strategy (2011)

The Core Strategy contains the following relevant local policy, namely SP1 – *Sustainable Development*, and SP13 *High environmental standards*.

SP1 states:

> *Development will improve the places we live and work in and enable a better quality of life for Southwark's diverse population. It will help meet the needs of a growing population in a way that respect these limits of the planet's resources and protects the environment.*

SP13 states:

> *Development will help us live and work in a way that respect the limits of the planet's natural resources, reduces pollution and dame to the environment and helps us adapt to climate change.*

The policy aims to achieve this commitment by:

> *Setting high standards and supporting measures for reducing air, land, water, noise and light pollution and avoiding amenity and environmental problems that affect how we enjoy the environment in which we live and work.*

London Borough of Southwark – Draft Local Plan

The Core Strategy will be replaced with a Local Plan. The Local Plan is a set of borough-wide planning policy documents that contain:

- The regeneration strategy for the borough
- Policies that used to make decisions on planning applications
- Key development sites with land use and urban design requirements
- Visions for the each of the borough's unique neighbourhoods.

Policy 67: *Reducing noise pollution and enhancing soundscapes*, specifically references noise, and states the following:

> *Development must:*
>
> *1.1 Avoid significant adverse impacts on health and quality of life; and*
>
> *1.2 Mitigate any adverse impacts caused by noise on health and quality of life; and*
>
> *1.3 Mitigate and manage noise by separating noise sensitive developments from major noise sources by distance, screening or internal layout, in preference to sound insulation.*

2 Large scale major development will be required to demonstrate how the noise pollution impacts created during the construction process will be reduced, mitigated and managed appropriately to minimise harm to present occupiers of the site and adjoining neighbours.

3 Major development adjacent to, or within:

i. Designated open space; and

ii. Designated open water space; and

iii. Hard landscaped civic spaces with public amenity value; and

iv. Street markets Should be designed to protect and enhance positive aspects of the acoustic environment identified through a public soundscape assessment. New spaces proposed as part of development should also assess the potential to enhance a place's character and identity through the acoustic environment and positive public soundscape.

London Borough of Southwark – Technical Guidance for Noise (2017)

The London Borough of Southwark provides a guide for how they require noise and vibration to be assessed for their planning application. The guide covers all areas of development and sets out the criteria and assessment methodologies that are to be adopted within planning applications.

The criteria and assessments follow those included in the relevant British Standards.

London Borough of Southwark – Technical Guidance for Demolition and Construction

The technical guidance on Demolition and Construction has been written as a guide for contractors, developers and related professionals.

The guidance provides many practical considerations for the principle contractor/developer to consider that relate to good management of the site. In addition, there is listed the method of managing noise and vibration using triggers and action alert levels.

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British standards and guidance

The following paragraphs summarise the outline assessment British Standards and guidance documents used to set target criteria for the identification of noise and vibration impacts:

Construction noise and vibration

Estimation of noise and vibration generated during each principal phase of the construction works and an assessment of the likely significant effects on surrounding sensitive receptors using the methodology set out in British Standard BS 5228:2009+A1 2014 Code of Practice for Noise and Vibration on Construction and Open Sites (Part 1: Noise, Part 2: Vibration).

Road traffic noise

For the assessment of noise associated with road traffic, reference will be made to the Calculation of Road Traffic Noise (CRTN). Further advice is also given in the Design Manual for Roads and Bridges (DMRB) for road traffic noise assessments. Each of these documents offer a means of predicting noise levels and changes in noise level and assessment of the impact of the changes. Guidance on the impact assessment of traffic noise is provided within the Institute of Environmental Management and Assessment (IEMA) Guidance Note No. 1 Guidelines for the Environmental Assessment of Road Traffic.

Building services noise egress

For the assessment of building services noise egress, reference will be made to BS 4142:2014+A1 2019: Methods for Rating and Assessing Industrial and Commercial Sound. The standard provides a method of measuring background noise levels and assessing the likelihood of complaint regarding external noise levels. The noise level resulting from plant operation is measured or predicted at a distance of one metre from the facade of the nearest noise sensitive premises. The plant noise level is compared to the existing background noise level in the area, as determined by a noise survey, over the proposed operational hours.

Human response to vibration

British Standard BS 6472-1: Guide to Evaluation of Human Exposure to Vibration in Buildings. Part 1: Vibration Sources other than Blasting. BS 6472-1 provides guidance on the measurement and assessment of vibration levels affecting humans in buildings resulting from sources such as road and rail traffic or building services systems. The probability of adverse comment is assessed by considering the vibration dose value (VDV), which quantifies the total exposure to vibration over a specified period.

IEMA Guidelines for Environmental Noise Impact Assessment, 2014

IEMA Guidelines for Environmental Noise Impact Assessment 2014. The IEMA guidelines set out guidance on significance criteria for noise impact based on the changes in noise levels.

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Annex 2 Glossary of Terms

Decibel (dB)	A logarithmic unit used for many acoustic values to indicate the level with respect to a reference level
Sound pressure level	A logarithmic measure of the effective sound pressure of a sound relative to a reference value, measured in decibels, dB. Sound pressure levels are dependent on the conditions under which they are measured.
Sound power level	A logarithmic measure of the sound power in comparison to specified reference level, measured in decibels, dB. Unlike sound pressure, sound power is not room or distance dependent.
'A' weighting	Frequency weighting based on the frequency response of the human ear which has been found to correlate well with the subjective response to sound.
Hz	Hertz (Hz) is the unit of frequency (see also 'Frequency')
Frequency	The number of cycles per second. The unit of frequency is the Hertz (Hz). Frequency gives a sound its distinctive tone.
Octave band	A frequency band in which the upper limit of the band is twice the frequency of the lower limit.
One-third octave band	A frequency band in which the upper limit of the band is the cube root of two times the lower limit of the band or more simply one third of an octave band.
$L_{A90,T}$	The A-weighted sound pressure level exceeded 90% of the measurement period (T) over which a noise is measured (ie, the quietest 10% of the period). When not weighted it is denoted L90,T. This parameter is generally considered to be representative of a constant noise source, or background noise level.
$L_{Aeq,T}$	Equivalent A-weighted sound pressure level of a steady noise that has the same acoustic energy as a fluctuating noise over the measurement period (T). When not weighted it is denoted $L_{eq,T}$.

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$L_{AFmax,T}$	The highest A-weighted sound pressure level measured in the period (T) with either fast (L_{AFmax}) or slow (L_{ASmax}) time weightings. When not weighted it is denoted L_{Fmax} or L_{Smax} .
PPV	Peak Particle Velocity (PPV), a measure of vibration in mm/s, used to assess likelihood of damage and perceptibility of vibration.
VDV	Vibration Dose Value, a measure of vibration in $m/s^{1.75}$. The VDV defines a relationship that yields a consistent assessment of continuous, intermittent, occasional and impulsive vibration and correlates well with subjective response.
Free-field noise level	A noise level measured at least 3 m from the building façade and does not contain reflected sound.
Facade noise level	A noise level measured close to (1-2 m) from the façade of a building, which contains a reflection of sound from the building. Façade noise levels are 3 dB higher than the equivalent free-field noise level measured

Appendix: Noise and Vibration

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18362-R01-A

21 November 2018

Vinegar Yard, London

Environmental noise and vibration survey report

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Version	Date	Comments	Author	Reviewer
A	21 Nov 18		Alexander Green	Philip Owen

Summary

Sandy Brown has been commissioned to provide acoustic advice in relation to the proposed development at Vinegar Yard, London.

An environmental noise and vibration survey has been carried out at the site. The noise survey was performed between 1 November 2018 and 6 November 2018. The vibration survey was performed on 1 November 2018.

The lowest background sound levels measured during the survey at were $L_{A90,5min}$ 44 dB during the daytime, $L_{A90,5min}$ 45 dB during the evening and $L_{A90,5min}$ 44 dB at night.

The representative background sound levels measured during the survey were $L_{A90,5min}$ 53 dB during the daytime, $L_{A90,5min}$ 54 dB during the evening and $L_{A90,5min}$ 47 dB at night.

The average ambient noise levels measured during the survey were $L_{Aeq,12h}$ 59 dB during the daytime, $L_{Aeq,4h}$ 61 dB and $L_{Aeq,8h}$ 55 dB at night.

The highest equivalent vibration dose values measured was 0.0026 $m/s^{-1.75}$, a negligible level of vibration.

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Contents

1 Introduction

Sandy Brown has been commissioned to provide acoustic advice in relation to the proposed development at Vinegar Yard, London.

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

This report presents the noise and vibration survey methods and the results of the surveys.

2 Site description

2.1 The site and its surroundings

The site location in relation to its surroundings is highlighted in yellow in Figure 1. The site is surrounded by St Thomas Street to the north, Fenning Street to the west and Melior Street to the south. London Bridge train station highlighted in green is located to the north of the site.

Figure 1 Site map (courtesy of Google Earth Pro)

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2.2 Adjacent premises

The surrounding premises are a mixture of commercial and residential properties. The Horseshoe Inn (highlighted in purple) is located directly to the south of the site. The nearest residential receptors (highlighted in blue) are located on Melior Street and Melior Place. There is a restaurant in the bottom floor of the apartments located at 8 Melior Street. Our Lady of La Salette and Saint Joseph Catholic church (highlighted in orange) is located at 14 Melior Street.

3 Method

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

3.1 Noise survey method

3.1.1 Unattended measurements

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

The unattended measurements were performed over 5 minute periods between 10:47 on 1 November 2018 and 11:47 on 6 November 2018. The equipment was installed by Dilan Neumann and Richard Deane and was collected by Dilan Neumann and Mollie Mitchell.

The measurement positions used during the survey are indicated in Figure 1, denoted by the letters ‘A’ and ‘B’. Photographs showing the measurement locations are provided in Figure 2 and Figure 3. These locations were chosen to be reasonably representative of the noise levels experienced by the nearest noise sensitive premises, noise levels experienced at the site.

Figure 2 location of unattended measurement position 'A'

Figure 3 location of unattended measurement position 'B'

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Both locations were roughly 4 m above the ground, position A was approximately 3 .5 m away from any reflective surface and position B was approximately 1 m away from any reflective surface.

3.1.2 Attended measurements

Attended sample measurements were performed by Dilan Neumann at a single location, indicated in Figure 1 as position 1. The attended measurements were carried out on 6 November 2018, over 5 minute periods, with the purpose of determining the existing noise levels from road traffic, pedestrians and other significant noise sources in the area.

The locations of the measurements are indicated in Figure 4. The microphone was mounted on a tripod approximately 1.5 m above the ground level and 1 m from any other reflective surface.

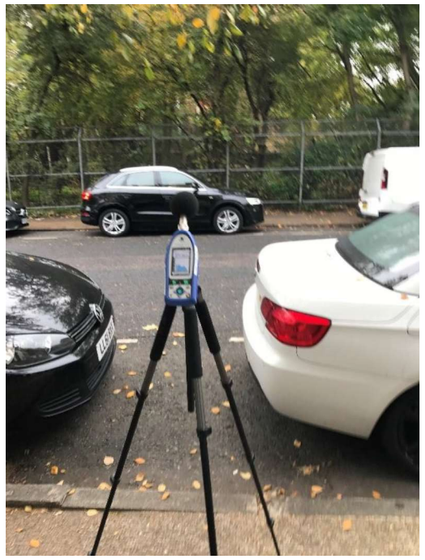

Figure 4 location of attended measurement position

3.2 Vibration survey method

Vibration measurements were performed on the ground floor of the existing building in order to determine the maximum vibration levels from the passage of trains on the railway tracks near to the site.

For the vibration measurements, three accelerometers were set up, to measure vibration dose values (VDV). The VDV measurements were taken to establish levels of tactile vibration.

These measurements were performed on 1 November 2018.

The vibration measurements are considered to be reasonably representative of the vibration levels to be experienced in the proposed development.

The accelerometers were fixed to the existing ground floor concrete slab using beeswax, away from the boundaries of the room.

The VDV measurements were conducted in three axes as follows:

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

4 Measurement results

4.1 Observations

The dominant noise sources observed at the site during the survey consisted of traffic on St Thomas Street, plant from the restaurant on Melior Street and construction at London Bridge Station.

Less significant noise sources included announcements from London Bridge Station, pedestrians, planes, cars on Melior Street and a delivery.

4.2 Noise measurement results

4.2.1 Unattended measurement results

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

The day and night time ambient noise levels measured during the unattended survey at positions ‘A’ and ‘B’ are presented in . Position B are facade measurements.

Table 1 and Table 2 respectively.

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Position A measurements were conducted within the free-field. Position B are facade measurements.

Table 1 Ambient noise levels measured during the survey at position ‘A’

Date	Daytime (07:00 – 19:00) $L_{Aeq,12h}$ (dB)	Evening (19:00 – 23:00) $L_{Aeq,4h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
1 Nov 2018	-	58	56
2 Nov 2018	62	59	56
3 Nov 2018	60	62	55
4 Nov 2018	57	59	50
5 Nov 2018	62	65	56
Average	60	61	55

Table 2 Ambient noise levels measured during the survey at position ‘B’

Date	Daytime (07:00 – 19:00) $L_{Aeq,12h}$ (dB)	Evening (19:00 – 23:00) $L_{Aeq,4h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
1 Nov 2018	-	65	56
2 Nov 2018	66	71	60
3 Nov 2018	60	63	54
4 Nov 2018	56	60	48
5 Nov 2018	63	65	56
Average	61	65	55

The minimum background sound levels measured during the unattended survey are given in Table 3 and Table 4.

Table 3 Minimum background sound levels measured during the survey at position A

Date	Daytime (07:00 – 19:00)	Evening (19:00 – 23:00)	Night (23:00 – 07:00)
	$L_{A90,5min}$ (dB)	$L_{A90,5min}$ (dB)	$L_{A90,5min}$ (dB)
1 Nov 2018	51*	51	47
2 Nov 2018	50	54	46
3 Nov 2018	49	50	45
4 Nov 2018	45	47	45
5 Nov 2018	49	50	46
6 Nov 2018	49*	-	-

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

Table 4 Minimum background sound levels measured during the survey at position B

Date	Daytime (07:00 – 19:00)	Evening (19:00 – 23:00)	Night (23:00 – 07:00)
	$L_{A90,5min}$ (dB)	$L_{A90,5min}$ (dB)	$L_{A90,5min}$ (dB)
1 Nov 2018	54 *	55	53
2 Nov 2018	54	60	44
3 Nov 2018	47	49	44
4 Nov 2018	44	45	44
5 Nov 2018	48	54	53
6 Nov 2018	54 *	-	-

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

The lowest background sound levels measured during the survey were $L_{A90,5min}$ 44 dB during the daytime, $L_{A90,5min}$ 45 dB during the evening and $L_{A90,5min}$ 44 dB at night.

In line with BS 4142:2014, for the purpose of analysis and establishing representative background sound levels, day and night time typical levels have been quantified using statistical analysis from the continuous logging measurements.

Daytime, evening and night time statistical analysis of representative values for both positions at the site are given in Figure 5 to Figure 10.

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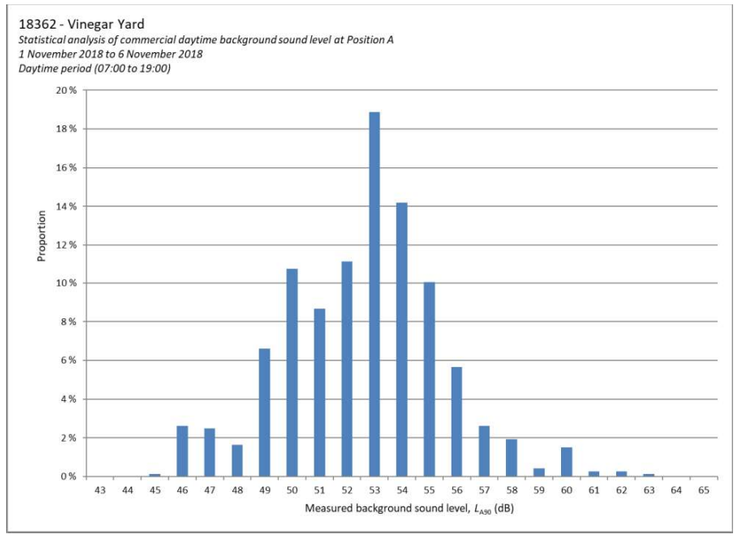

Figure 5 statistical analysis of background sound level during the day on St Thomas Street.

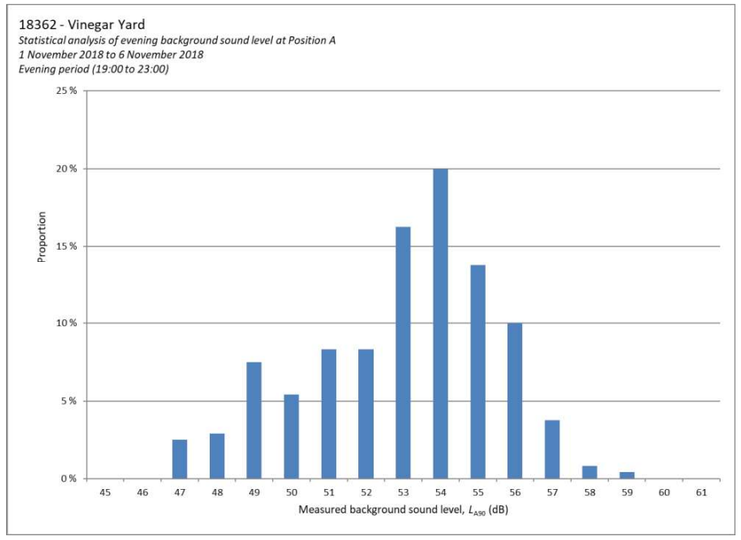

Figure 6 statistical analysis of background sound level during the evening on St Thomas Street.

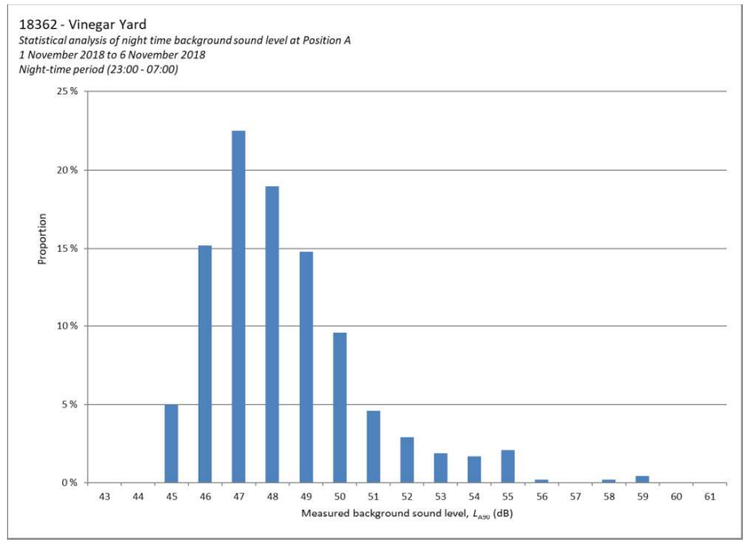

Figure 7 statistical analysis of background sound level during the night on St Thomas Street.

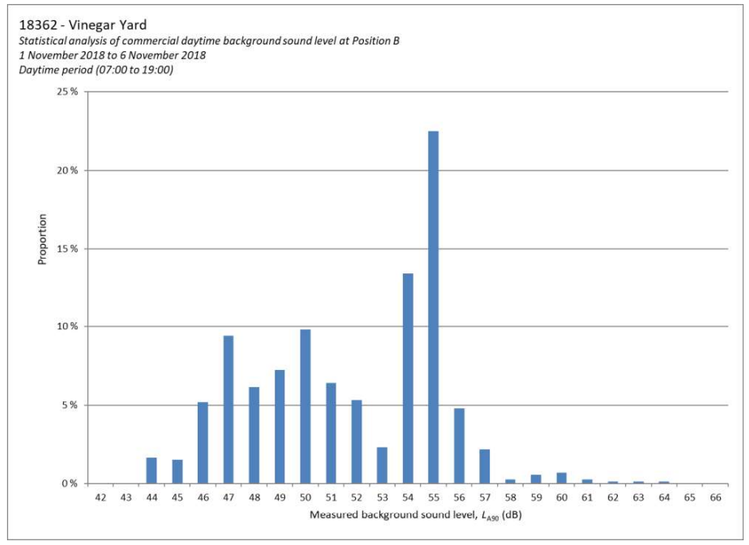

Figure 8 statistical analysis of background sound level during the day on Melior Street.

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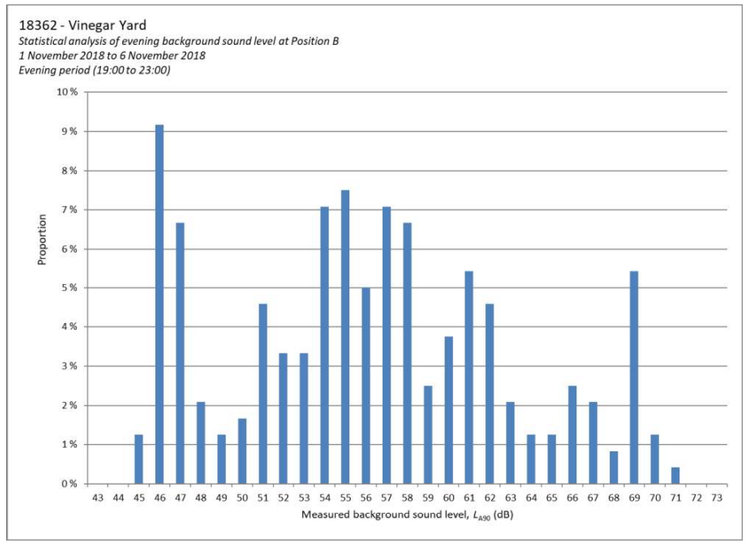

Figure 9 statistical analysis of background sound level during the evening on Melior Street.

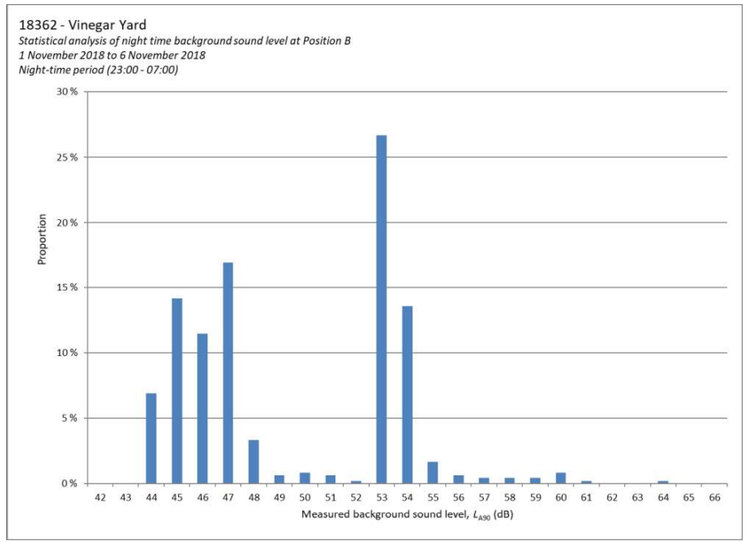

Figure 10 statistical analysis of background sound level during the night on Melior Street.

From this analysis, the representative background sound levels measured during the survey at position A (on St Thomas Street) were $L_{A90,5min}$ 53 dB during the daytime, $L_{A90,5min}$ 54 dB during the evening and $L_{A90,5min}$ 47 dB at night.

The statistical data at position B (on Melior Street) is erratic and does not follow a common pattern so a representative background sound level cannot be given.

4.2.2 Attended measurement results

The sound pressure levels recorded during the attended measurements are summarised in Table 5. The dominant noise sources noted during the measurements are also described in Table 5. All the attended measurements were performed over 5 minute periods 1 m from the facades.

Table 5 Sound pressure levels from attended measurements

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,5min}$	$L_{AFmax,5min}$	$L_{A90,5min}$	
1	10:17	64	89	53	Pedestrians, primary school children, plane, idling car, motor bike, traffic, construction.
	10:22	60	83	54	
	10:27	60	76	55	
	11:11	58	73	54	

4.3 Vibration measurement results

4.3.1 Tactile vibration measurements

The following table presents the vibration dose values measured in the ground floor of the existing building. These measurements were performed on 1 November 2018 and are considered representative of the vibration levels to be experienced by the proposed development. The maximum vibration dose values measured for each of the directions are highlighted in red.

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Table 6 Vibration dose values measured in the ground floor of the existing building

Start time	Duration (min)	VDV (m/s$^{1.75}$)		
		X	Y	Z
11:04	5:00	0.0016	0.0009	0.0021
11:10	5:02	0.0013	0.0007	0.0018
11:15	5:00	0.0009	0.0006	0.0020
11:20	0:29	0.0005	0.0004	0.0009
11:20	5:01	0.0009	0.0006	0.0016
11:26	5:00	0.0007	0.0005	0.0016
11:31	5:14	0.0007	0.0006	0.0026
11:37	0:12	0.0003	0.0003	0.0015
11:39	0:11	0.0002	0.0003	0.0010

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

BS 6472-1:2008 states that VDVs below 0.4 m/s$^{-1.75}$ in offices are not expected to result in adverse comment. All the measurements are significantly below the range for adverse comment which indicates that only negligible vibration is present on the site.

5 Conclusion

A noise and vibration survey was undertaken between 1 November 2018 and 6 November 2018.

The lowest background sound levels measured during the survey at were $L_{A90,5min}$ 44 dB during the daytime, $L_{A90,5min}$ 45 dB during the evening and $L_{A90,5min}$ 44 dB at night.

The representative background sound levels measured during the survey were $L_{A90,5min}$ 53 dB during the daytime, $L_{A90,5min}$ 54 dB during the evening and $L_{A90,5min}$ 47 dB at night.

The average ambient noise levels measured during the survey were $L_{Aeq,12h}$ 59 dB during the daytime, $L_{Aeq,4h}$ 61 dB and $L_{Aeq,8h}$ 55 dB at night.

The highest equivalent vibration dose values measured was 0.0026 m/s$^{-1.75}$, a negligible level of vibration.

Appendix A

Survey details

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Equipment

The unattended and attended noise measurements were performed using three Rion NL-52 sound level meters.

The VDV measurements were carried out using a Rion DA-20 vibration level meter.

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

Table A1 Equipment calibration data

Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
Sound level meter	NL-52/00264531	Rion	25 Jun 20	TCRT18/1553
Microphone	UC-59/09678	Rion	25 Jun 20	TCRT18/1553
Pre-amp	NH-25/64656	Rion	25 Jun 20	TCRT18/1553
Calibrator	NC-74/34367630	Rion	25 Jun 20	TCRT18/1551
Sound level meter	NL-52/00242702	Rion	9 Jun 19	TCRT17/1341
Microphone	UC-59/06185	Rion	9 Jun 19	TCRT17/1341
Pre-amp	NH-25/32730	Rion	9 Jun 19	TCRT17/1341
Calibrator	CAL200/4499	Larson Davis	9 Jun 19	TCRT17/1339
Sound level meter	NL-52/00375679	Rion	6 Jul 19	TCRT17/1440
Microphone	UC-59/11168	Rion	6 Jul 19	TCRT17/1440
Pre-amp	NH-25/65806	Rion	6 Jul 19	TCRT17/1440
Calibrator	SV30A/10576	Svan	3 Jul 19	TCRT17/1418
Data Recorder	DA-20/10870889	Rion	8 Sep 19	TCRT17/1581
Accelerometer	PV-87/33827	Rion	8 Sep 19	TCRT17/1593
Accelerometer	PV-87/74274	Rion	5 Dec 19	TCRT17/1808
Accelerometer	PV-87/33829	Rion	8 Sep 19	TCRT17/1594
Vibration Calibrator	AT01/3015	AP Technology	8 Sep 19	TCRT17/1595

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

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

Noise indices

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

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

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

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

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

Vibration indices

For each measurement period a number of parameters were recorded. The most relevant of these are described below:

- The vibration dose value (VDV) in each of three axes with the appropriate frequency weightings (as defined in BS 6472-1:2008).

Weather conditions

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

During the unattended noise measurements between 1 November 2018 and 6 November 2018, weather reports for the area indicated that temperatures varied between 0 °C at night and 16 °C during the day, and the wind speed was less than 6 m/s.

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These weather conditions are considered suitable for obtaining representative measurements.

Appendix B

Results of unattended measurements at Location A

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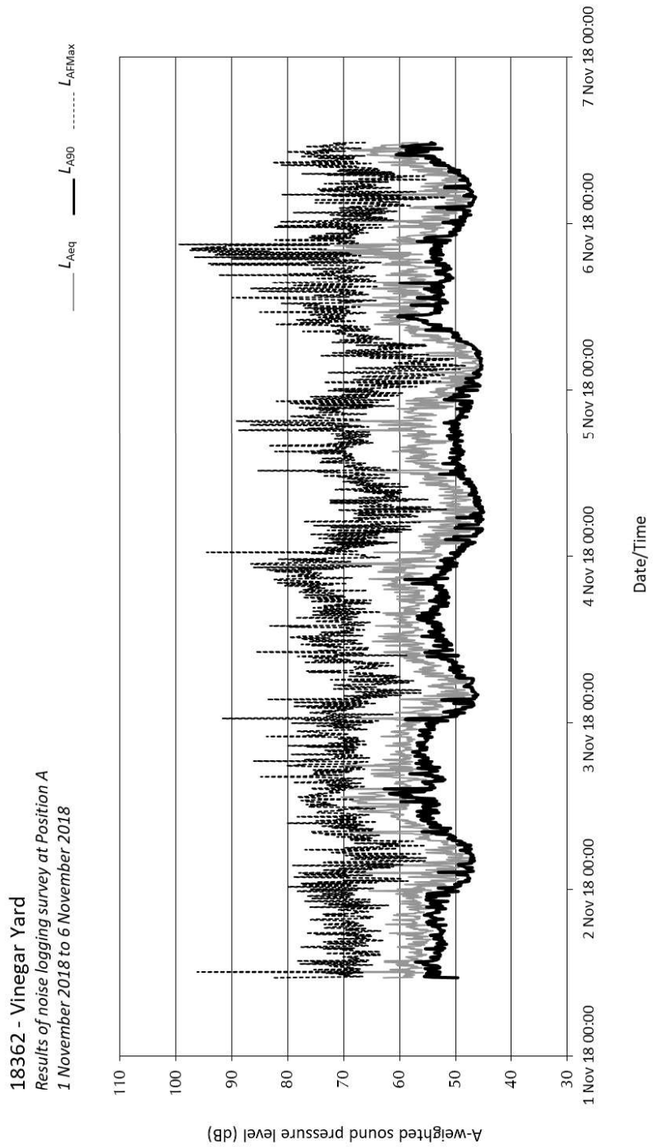

Results of unattended measurements at Location B

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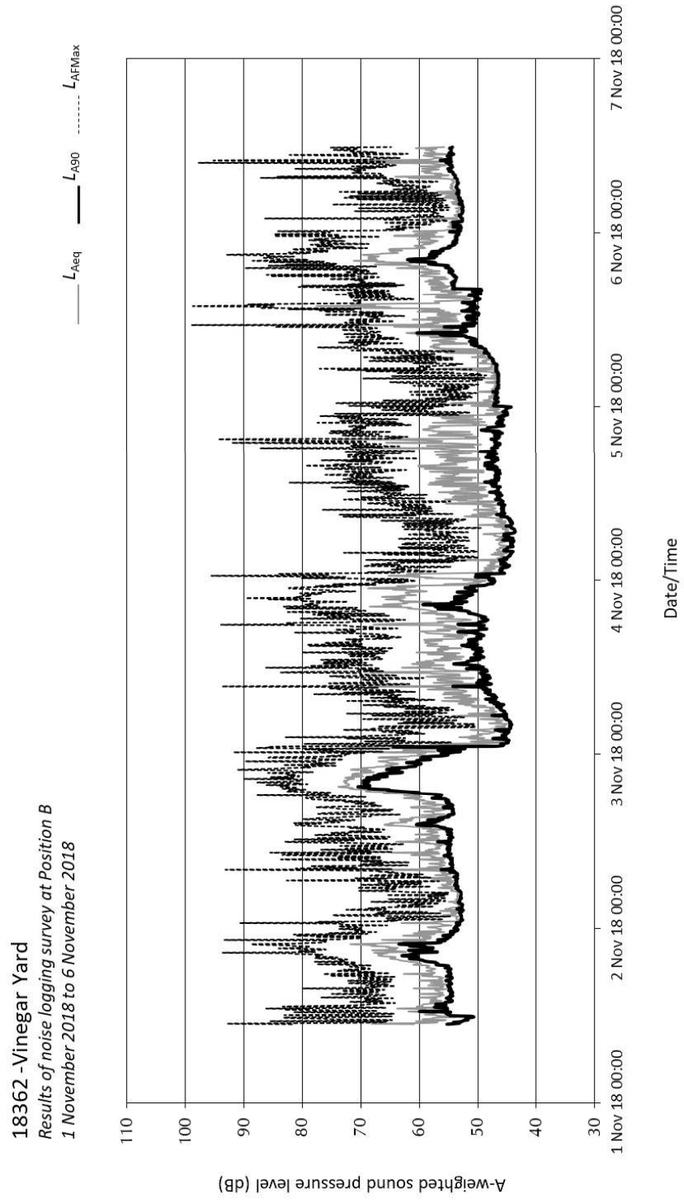

Appendix: Noise and Vibration

Annex 1: Legislation, Planning Policy and Other Relevant Standard and Guidance
Annex 2: Glossary of Terms
Annex 3: Environmental Noise and Vibration Survey Report
Annex 4: Construction Plant Assumptions

Annex 4 Construction Plant Assumptions

The Construction Methodology for the Proposed Development has been reviewed by Sandy Brown to assess the potential noise and vibration affects associated with the construction phases of the project.

Further to this review, five workstreams of the demolition and construction programme have been assessed in the noise and vibration chapter for the Environmental Statement, namely:

- Demolition
- Substructure (excavation and piling)
- Superstructure.

These phases represent the worst case for potential noise impacts on the nearby noise sensitive receptors. Details of the different construction plant, number, the percentage of time they will be operational and their associated sound pressure level, as set in BS 5228:2009, are provided.

The assessments do not include the use of hand-held tools, or other construction activities that cannot be easily accounted for within calculations.

Most plant has been modelled at ground floor height except for the tower cranes, which are modelled at 25 m above ground.

Demolition

Demolition activities are programmed to last a total of six weeks. Following the soft strip-out, the structure will be taken down to ground level using a grabber and excavator. The bricks and concrete will be crushed on-site.

The details included in the construction noise and vibration assessment of the demolition works are set out in Table 1.

Table 1 Demolition plant assumptions

Construction plant	Number	% activity	BS5228-1 reference	L_{Aeq} at 10 m (dB)
Mobile cranes	1	40	C.4-50	71
Tracked excavators with breakers	1	20	C.1-9	90
Concrete crushers	1	20	C.1-14	86

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Substructure

The substructure work will comprise excavation (12 weeks) and piling works (36 weeks). Each of these work streams have been assessed separately.

Excavation

The site will be excavated to basement levels as part of the substructure work. The details included in the construction noise and vibration assessment for the excavation works are set out in Table 2.

Table 2 Excavation construction plant assumptions

Construction plant	Number	% activity	BS5228-1 reference	L_{Aeq} at 10 m (dB)
Tracked excavators	2	40	C.2-2	77
Tracked excavators with breakers	2	20	C.1-9	90
Concrete crusher	1	20	C.1-14	86
Mobile cranes	2	50	C.4-50	71

Piling

The details included in the construction noise and vibration assessment of the piling of the office are set out in Table 3.

Table 3 Substructure – phase 1 construction plant assumptions

Construction plant	Number	% activity	BS5228-1 reference	L_{Aeq} at 10 m (dB)
Mobile cranes	2	50	C.4-50	71
Continuous Flight Auger – Crawler mounted rig	2	40	C.3-21	79
Tower Cranes	2	40	C.4-47	76

Superstructure

The details included in the construction noise and vibration assessment of the superstructure works are set out in Table 4.

Table 4 Superstructure construction plant assumptions

Construction plant	Number	% activity	BS5228-1 reference	L_{Aeq} at 10 m (dB)
Mobile cranes	2	50	C.4-50	71
Concrete pump and concrete mixer truck	1	50	C.4-28	75
Tower Cranes	2	50	C.4-47	76
Deliveries	1	10	D7-121	70