ARDENT CONSULTING ENGINEERS

HOMES FOR LAMBETH

PROPOSED RESIDENTIAL DEVELOPMENT: WOOTTON STREET, LAMBETH

NOISE AND VIBRATION ASSESSMENT

REPORT REF. 193860-01B
PROJECT NO. 193860
DECEMBER 2020

PROPOSED RESIDENTIAL-LED MIXED-USE DEVELOPMENT: WOOTTON STREET, LAMBETH

NOISE AND VIBRATION ASSESSMENT

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1.0 INTRODUCTION

1.1 Ardent Consulting Engineers were instructed by Homes for Lambeth Build Ltd to undertake a Noise and Vibration Assessment to assess the site suitability for a proposed residential-led mixed-use development.

Site Location

1.2 The existing site use houses the former Coral Day Nursery, a single storey building within the grounds of a 9-storey block of flats, Windmill House. The site is situated to the south of Waterloo East National Rail Station and to the west of Southwark London Underground Station. The site is bound by Wootton Street to the north, Greet Street to the east and Windmill Walk to the west. Beyond the access road to the south is a 5-storey residential block fronting onto Cons Street. The surrounding area and site boundary is shown in **Figure 1.1**.

1.3 The Jubilee underground line runs immediately to the south of the site in an approximate east to west direction. An indicative annotation of the positioning of the line is included in orange in **Figure 1.1.**

1.4 The site is centred approximately at Ordnance Survey grid co-ordinates 531421mE, 180022mN.

Figure 1.1: Site Location Plan – with indicative route of the Jubilee Line

Development Proposals

1.5 The proposals comprise a community centre use at ground floor level with a total of 36 residential units within a five, eight and ten storey development. An extract of the indicative proposals is shown in **Figure 1.2**.

Figure 1.2: Development Proposals – Proposed Site plan (Ground Level - Extract)

2.0 RELEVANT POLICY AND GUIDANCE

National Planning Policy Framework (NPPF) – February 2019

2.1 Under the NPPF: *paragraph 180 of Section 15*, with regard to environmental noise; Planning policies and decisions should aim to: -

- mitigate and reduce to a minimum, potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;
- identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

Noise Policy Statement for England (NPSE)

2.2 To avoid and mitigate adverse noise effects on health arising from and impacting on new development, the NPPF makes reference to NPSE. The NPSE was published in March 2010 and covers all forms of noise, other than occupational noise. For the purposes of this report, "Neighbourhood Noise" is most relevant as NPSE defined at paragraph 2.5:

"*neighbourhood noise which includes noise arising from within the community such as industrial and entertainment premises, trade and business premises, construction sites and noise in the street.* "

2.3 NPSE introduces three concepts to the assessment of noise in the UK:

- NOEL – No Observed Effect Level – This is the level below which no effect can be detected and below which there is no detectable effect on health and quality of life due to noise.
- LOAEL – Lowest Observable 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.

2.4 NPSE does not numerically define levels for the NOEL, LOAEL or SOAEL rather it makes it clear that the noise level is likely to vary depending upon the noise source, the receptor and the time of day/day of the week, etc.

National Planning Practice Guidance (2019)

2.5 The purpose of the guidance is to complement the NPPF and provide advice on how to deliver its policies.

2.6 The purpose of the guidance is to complement the NPPF and provide advice on how to deliver its policies.

2.7 The guidance includes a table (duplicated below) that summarises "the noise exposure hierarchy, based on the likely average response" and which offers "examples of outcomes" relevant to the NOEL, LOAEL and SOAEL effect levels described in the NPSE.

Perception	Examples of outcomes	Increasing effect level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, eg turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, eg avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, eg regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, eg auditory and non-auditory	Unacceptable Adverse Effect	Prevent

Table 2.1: Noise exposure hierarchy, based on the likely average response.

Calculation of Road Traffic Noise – 1988

2.8 For new developments, road traffic noise levels should be predicted in accordance with *CRTN*. This prediction method uses the traffic flow, vehicle speed, and percentage of heavy-duty vehicles (HDVs, over 3.5 tonnes), road gradient and other factors to calculate noise levels at receptor points.

Calculation of Railway Noise – 1995

2.9 Calculation of Railway Noise (CRN) outlines methods of calculation to determine noise levels generated by each train, considering train types and speeds, traction (whether diesel or electric locomotives), track ballast, the number of carriages/wagons in each train and the topography of the site.

Control of Pollution Act 1974

2.10 The local authority has powers under the Control of Pollution Act 1974 to control noise from construction sites. Section 60 of the Act allows a local authority to serve a notice of its requirements for the control of site noise. This notice may include specification of plant that is or is not to be used, hours during which the construction works can be carried out and levels of noise emission. Section 61 of the Act allows a contractor or developer to take the initiative and agree with the local authority the methods of construction, steps to minimise noise and hours of work.

The Environmental Protection Act 1990

2.11 Local authorities have a duty to deal with statutory nuisances under the Environmental Protection Act 1990. For noise to amount to a statutory nuisance, it must be "prejudicial to health or a nuisance" as outlined in Section 79 of the Act. Any proposed development should not result in a statutory nuisance being declared. Should the Local Authority declare a development to cause a statutory nuisance, an abatement notice can be served to the person responsible who has up to 21 days to appeal to Magistrates' Court, as detailed in Section 80 of the Act.

The Building Regulations 2010

2.12 Building Regulations approvals are required for most new buildings and for most types of works on existing buildings. Part 10 of The Building Regulations 2010 contains provisions, including power for local authorities to test building work, take samples, and provision to ensure compliance. Part E of the Regulation 'Resistance to the passage of sound' is expanded in Approved Document E, which provides robust details to control and mitigate noise within buildings. This Document is separated over four parts which include:

- E1: Protection against sound from other parts of the building and adjoining buildings;
- E2: Protection against sound within dwelling-house etc.;
- E3: Reverberation in the common internal parts of buildings containing flats or rooms for residential purposes;
- E4: Acoustic conditions in schools.

World Health Organisation

2.13 The WHO document *Guidance on Community Noise* specifies additional information for noise affecting noise sensitive receptors and forms the basis of many noise limitations and design ranges for internal and external ambient noise levels. It defines noise as *'a class of sounds that are considered unwanted'* (by the listener), *'that adversely affects, or may affect the physiological and psychological wellbeing of people.'* Much of the research around this study is based on transportation noise.

2.14 Further guidance on the recommended levels is given in the World Health Organisation (WHO) Guidelines for Community Noise. In this document it is stated that:

"*To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55 dB LAeq on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50 dB LAeq."*

2.15 WHO also states the following paragraph with regard to the effects of L_{Amax} events in a night-time period:

"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB L_{Amax} more than 10-15 times per night (Vallet & Vernet 1991)."

2.16 WHO guidance *'Night Noise Guidelines for Europe'* is concerned with the longer-term average noise levels that are covered by the EU Directive on Environmental Noise, although this does appear to suggest external maximum noise levels of around 57dBA outside bedrooms during the night to achieve internal maximum levels of 42dBA.

2.17 The World Health Organisation has recently published Environmental Noise Guidelines – for the European Region (2018) to provide recommendations for protecting human health from exposure to noise sources such as transportation (road traffic, railway and aircraft), wind turbine noise and leisure noise.

2.18 The guidance document defines the 'strength' of recommendation (for protecting against noise exposure) as either 'strong' or conditional', outlined below.

Strength of Recommendation

*"A **strong** recommendation can be adopted as policy in most situations. The guideline is based on the confidence that the desirable effects of adherence to the recommendation outweigh the undesirable consequences. The quality of evidence for a net benefit – combined with information about values, preference and resources – inform this recommendation, which should be implemented in most circumstances."*

*"A **conditional** recommendation requires a policy-making process with substantial debate and involvement of various stakeholders. There is less certainty of its efficacy owing to lower quality of evidence of a net benefit, opposing values and preferences of individuals and populations affected or the high resource implications of the recommendation, meaning there may be circumstances or settings in which it will not apply."*

Noise source	dB L_{den}	dB L_{night}	dB $L_{Aeq,\ 24hr}$ (yearly average)	Recommendation
Road Traffic	53	45	-	Strong
Railway	54	44	-	Strong
Aircraft	45	40	-	Strong
Wind Turbine	45	-	-	Conditional
Entertainment	-	-	70	Strong/Conditional

Table 2.2: Extract from Environmental Noise Guidelines for the European Region

2.19 External (free-field) recommendations included in the Environmental Noise Guidelines for the European Region are presented in **Table 2.1** for specific noise sources.

BS8233:2014 – Guidance on Sound Insulation and Noise Reduction for Buildings

2.20 Formerly a Code of Practice, the 2014 revision of BS8233 is now presented and intended as a guidance document. The standard is mainly concerned with building design from an acoustic standpoint. It does however, contain information relevant to environmental noise more specifically by stating guidance for desirable internal noise levels for dwellings and other buildings. An extract of Table 4 of the document relevant for residential development is reproduced in **Table 2.3**.

Activity	Location	07:00 to 23:00 dB LAeq, 16hour	23:00 to 07:00 LAeq, 8hour
Resting	Living room	35	-
Dining	Dining room / area	40	-
Sleeping (daytime resting)	Bedroom	35	30

Table 2.3: Extract from Table 4 – Indoor ambient noise levels in dwellings

2.21 The guidance of BS8233:2014 with regards to external amenity spaces is as follows:

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

BS6472-1:2008 – Guide to Evaluation of Human Exposure to Vibration in Buildings - Part 1: Vibration sources other than blasting.

2.22 This document offers guidance on how people inside buildings respond to building vibration: the judgement criteria are more stringent at higher frequencies than in the superseded standard due to changes in the vertical frequency weighting.

2.23 Assessment of building vibration with respect to human response: When the appropriately-weighted vibration measurements or predictions have been used to derive the VDV (Vibration Dose Value) for either 16hr (daytime) or 8h (night-time) at the relevant places of interest, their significance in terms of human response for people in those places can be derived from **Table 2.4** (below)

Vibration dose value ranges which might result in various probabilities of adverse comment within residential buildings

Place and time	Low probability of adverse comment $m \cdot s^{-1.75}$ 1)	Adverse comment possible $m \cdot s^{-1.75}$	Adverse comment probable $m \cdot s^{-1.75}$ 2)
Residential buildings 16 h day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8 h night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

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

Table 2.4: Vibration Dose Values from BS6472-1:2008

ProPG: Planning and Noise - May 2017

2.24 Guidance in ProPG Planning and Noise provides an approach which aims to inform developers, practitioners and local authorities on how potential residential sites should be assessed. The guidance also builds upon government planning policy that noise should not be treated in isolation and there should be a holistic approach to good acoustic design.

2.25 ProPG sets out a 2-stage approach; the first of which is a risk assessment to identify the likelihood of significant adverse impact, then depending on the outcome of this risk assessment the extent of the acoustic design statement required. The graphic in Figure 2.1 is an extract from ProPG and indicates the level of risk associated with ranges of sound levels and provides some guidance on the likely extent of work associated with progressing a development exposed to these sound levels.

2.26 In relation to maximum noise levels, ProPG states that:

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

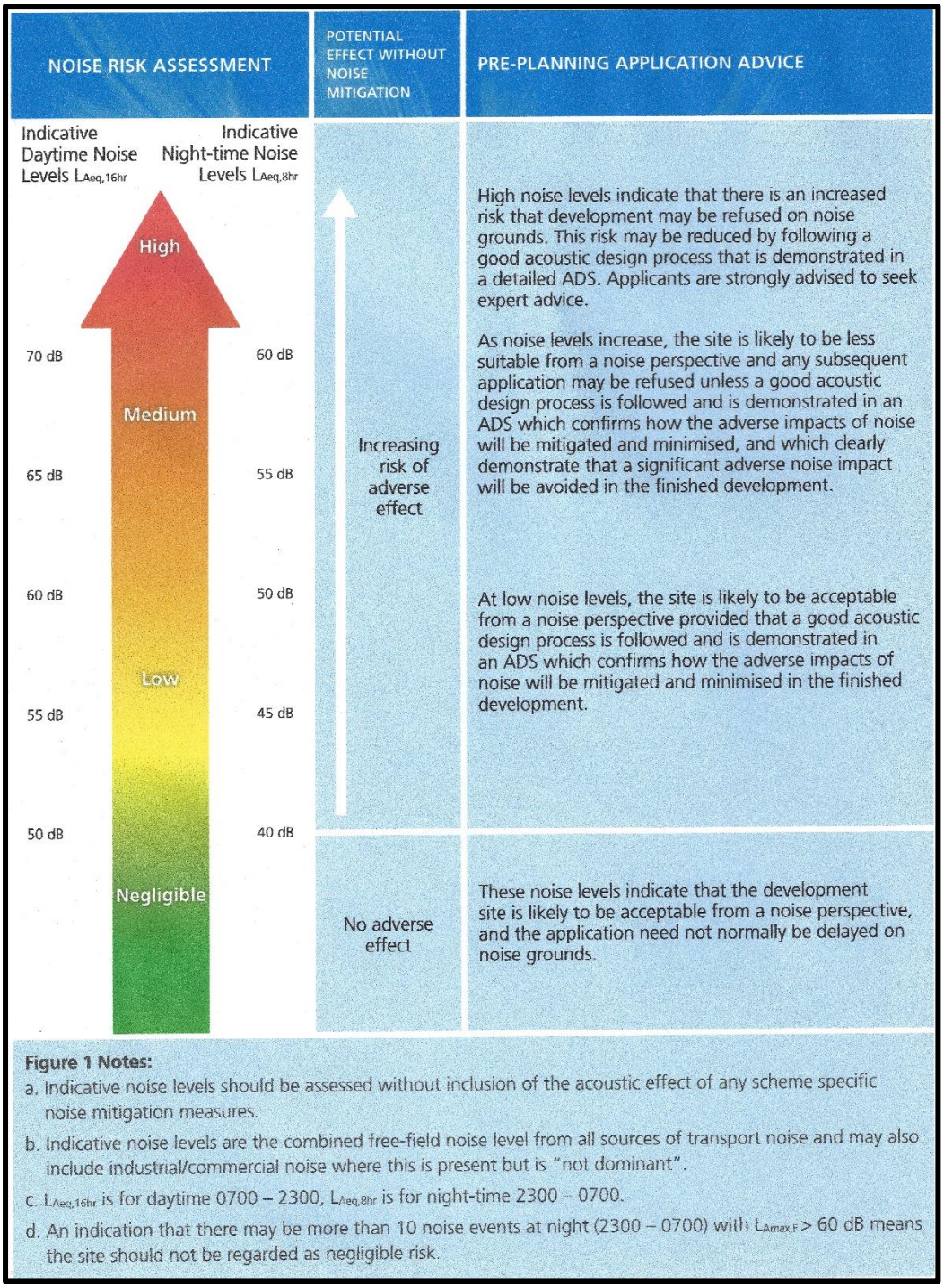


Figure 2.1: Extract from Figure 1 in ProPG – Initial Site Noise Risk Assessment

Acoustics Ventilation and Overheating - Residential Design Guide, January 2020

2.27 Acoustics Ventilation and Overheating (AVO) recommends an approach to acoustic assessments for new residential development taking consideration for acoustics, ventilation, and overheating.

2.28 Section 3 involves a two-level risk assessment approach to estimate the potential impact on occupants in the case of overheating.

The Level 1 site risk assessment is based on external free-field noise levels and the assumed scenario where a partially open window is used to mitigate overheating. (Table 3-2 of the guidance).

2.29 The sound level reduction from outside to inside for a partially open window is 13dB in this instance. A Level 1 site risk assessment is considered adequate if the site falls within the negligible risk category. A Level 2 assessment can optionally be undertaken to give more confidence in the case of low or medium risk sites, where appropriate. The Level 2 assessment is strongly recommended for high risk sites.

The Level 2 assessment suggests that assessment of the adverse effect from noise exposure should include an estimate of how frequently and for what duration the overheating condition occurs (Table 3-3 of the guidance).

2.30 **Figure 2.2** explains the two-level noise assessment procedure for overheating conditions.

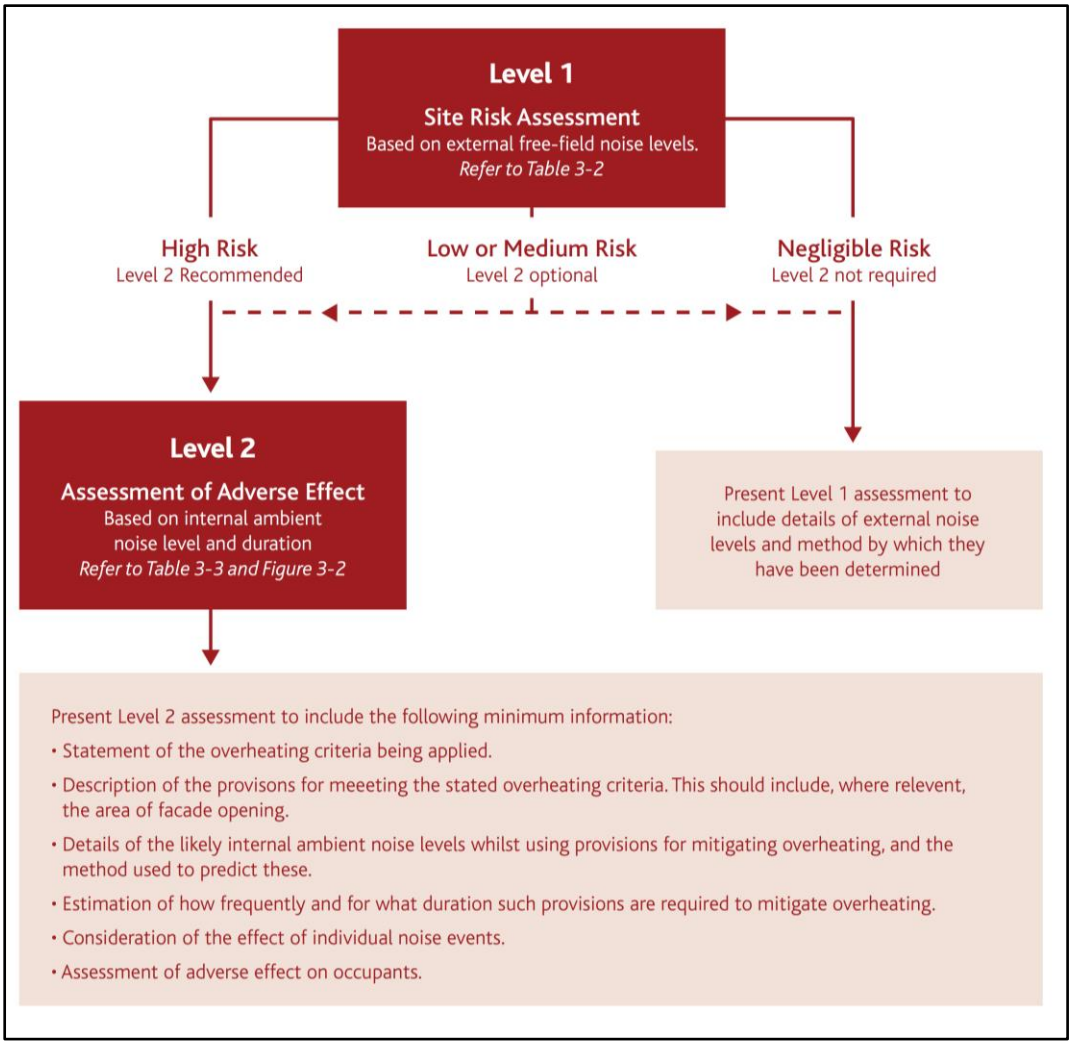


Figure 2.2 Two-level Assessment Procedure (Figure 3.1 of AVO Guidance)

2.31 **Figure 2.3** shows the Level 1 site risk assessment of noise, relating to overheating conditions.

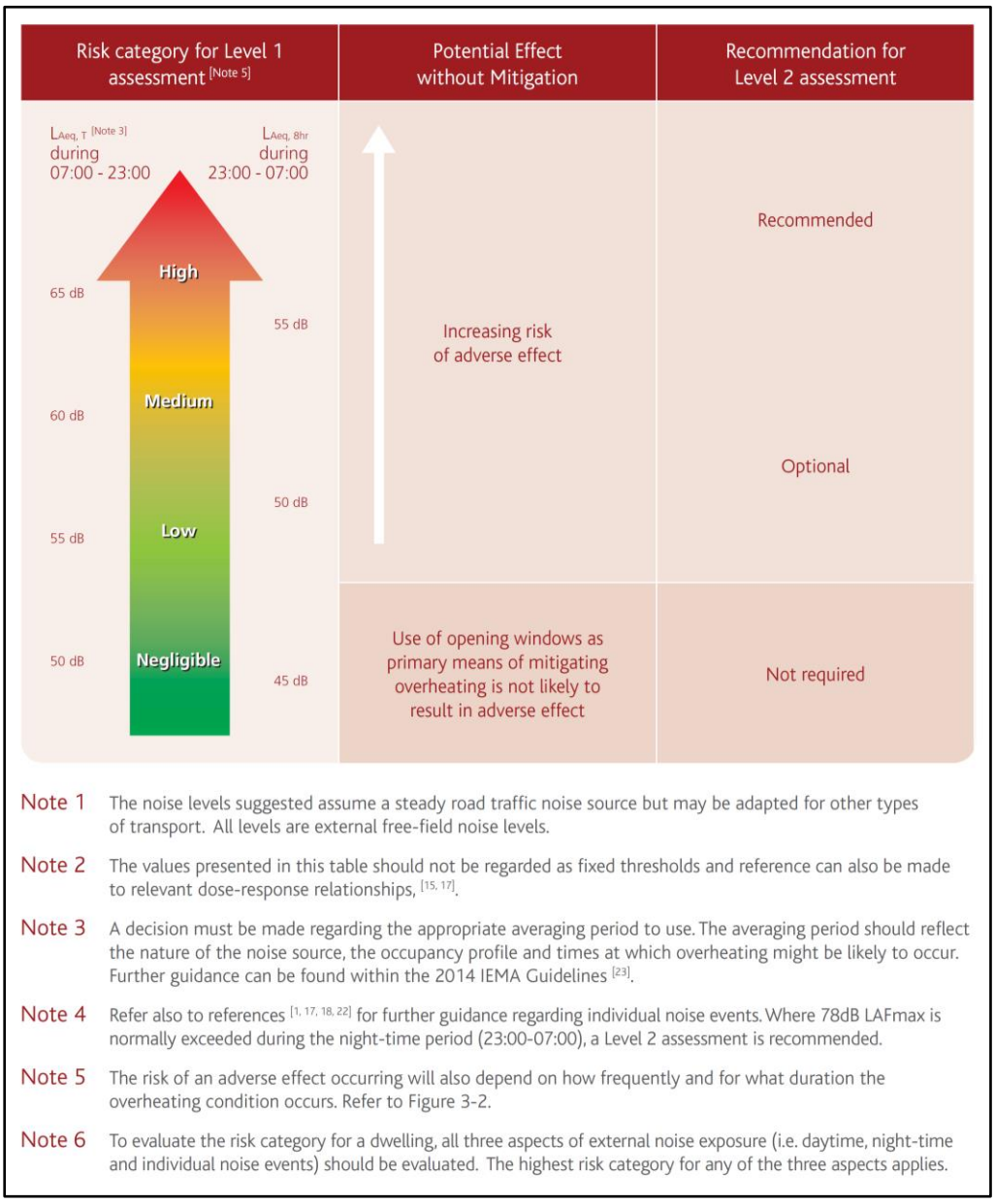


Figure 2.3 Level 1 Risk Assessment (Figure 3.2 of AVO guidance)

2.32 **Figure 2.4** shows the Level 2 site risk assessment of noise, relating to overheating conditions.

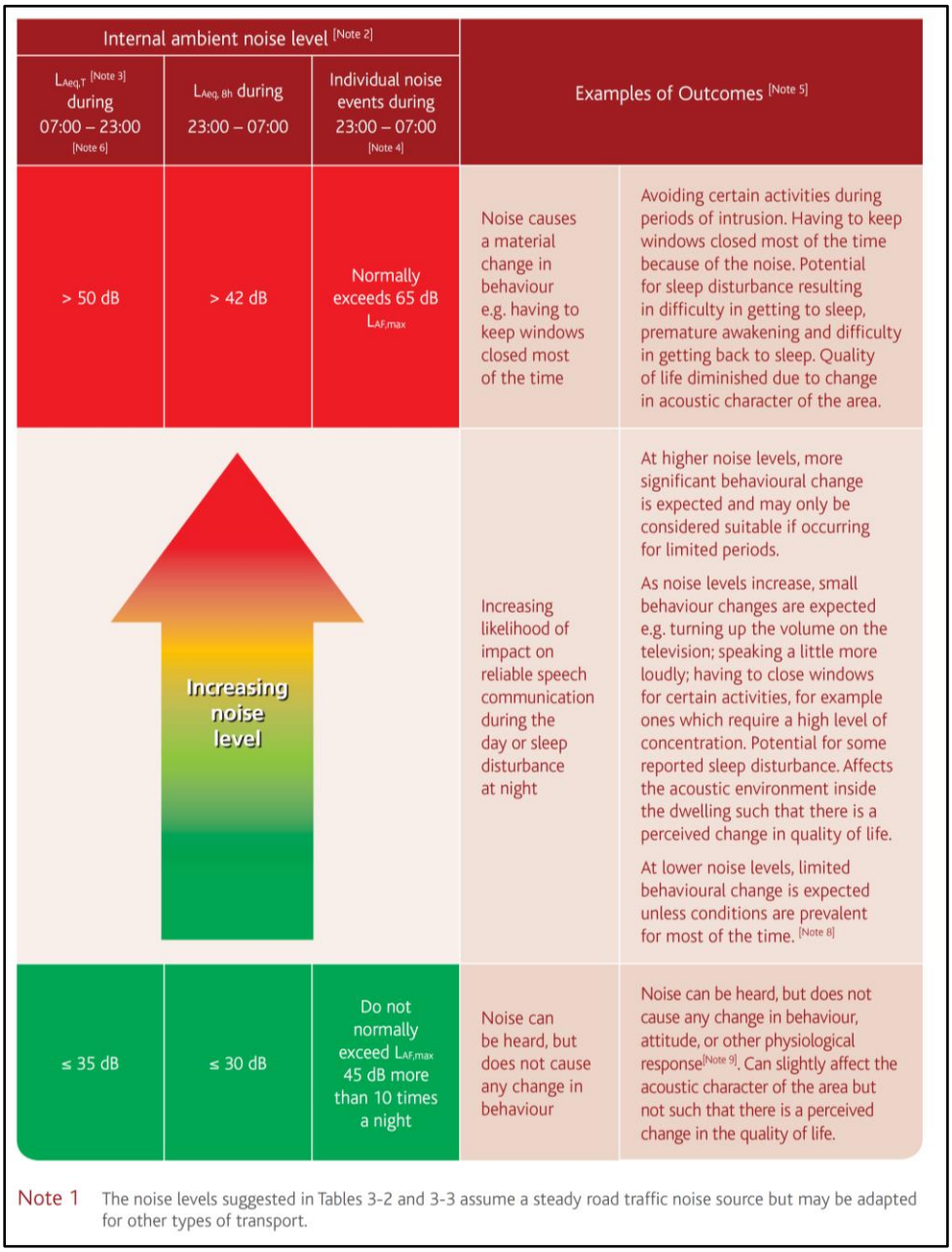


Figure 2.4 Level 2 Risk Assessment (Figure 3.3 of AVO guidance)

London Borough of Lambeth Council Discussions

2.33 Discussions were held with Dr Ali Peyvandi, Public Protection Officer of the Borough of Lambeth Council to agree on a suitable assessment methodology.

2.34 Ardent proposed an assessment in line with the guidance mentioned in this section of the report, which was accepted by the Local Authority.

2.35 Ardent also requested to receive a copy of the council's typical planning conditions relating to noise, to ensure the assessments are in accordance with local planning policy.

2.36 Dr Peyyandi advised that they do not have a typical planning condition for noise and that each application is individually assessed in line with relevant British Standards and guidance.

3.0 ENVIRONMENTAL NOISE AND VIBRATION SURVEY

3.1 The environmental noise and vibration survey was undertaken between the 4th to 9th December 2019. Locations were chosen in order to obtain representative baseline noise and vibration levels due to the main observed noise sources within the vicinity of the development site.

3.2 Continuous automated sound level monitoring was undertaken at two positions across the site (green markers) with two continuous vibration positions (red markers). A further attended vibration position was also undertaken further to the north of the site boundary (blue marker), as shown in **Figure 3.1**. The locations were selected to represent exposed areas and in areas that equipment could be securely positioned.

3.3 Sound level measurements were taken at a height of 1.5m, resulting in line of sight acoustic screening from passing rail to the north. There will be a direct line of sight to the railway line above second storey level. Therefore, a correction of +5dB has been applied to the calculations using then measurements taken at Position 1 to assist in mitigation design on properties above second floor level.

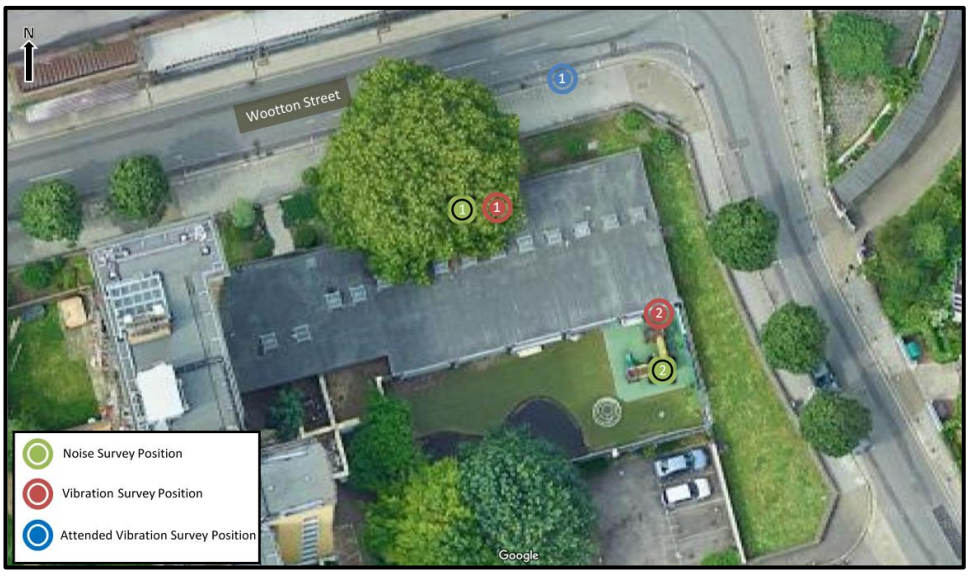


Figure 3.1: Monitoring Positions

3.4 Measurements presented as time histories can be found in **Appendix A** and are summarised in the following paragraphs.

Measurement Procedures

3.5 Staff involved with the measurements and observations are fully competent with regard to the requirements of environmental noise measurement.

Instrumentation

3.6 The equipment used was as follows:

- 2 x SVAN 958 Sound Level Meters
- 1 x SVAN 977 Sound Level Meter
- Rion NC-74 Class 1 Calibrator
- Rion VM-56 Tri-Axial Vibration Meter
- Rion PV-87 Accelerometer

3.7 All equipment used has been professionally calibrated. Field calibration of the sound level meters was undertaken before and after measurement to ensure no drifting of the calibration signal. Calibration certificates are available on request.

Observations

3.8 The main noise sources at the time of the survey were local and distant road traffic and occasional aircraft. Other sources comprised railway movements including horns and breaking noise. Vibration from rail and the Jubilee underground line was considered imperceptible.

3.9 All measurements used within the calculations, mitigation recommendations and conclusions were taken during times of appropriate weather and representative traffic conditions.

Results

3.10 The L_{Aeq}, L_{AMax}, and L_{A90} acoustic parameters were measured throughout the duration of the survey. Vibration levels in the form of Vibration Dose Value (VDV) were measured. Measured levels are shown as time histories in **Appendix A.**

3.11 **Table 3.1** provides a summary of the measured noise levels.

Monitoring location	Ambient Level dB L_{Aeq}		Representative night-time dB L_{AMax}	Background Level dB L_{A90}	
	Daytime	Night-time		Daytime	Night-time
Position 1	58	51	70	52	44
Position 2	58	49	66	52	43

Table 3.1: Measured levels for daytime and night-time

3.12 The representative L_{Amax} level is the value which has been exceeded less than 10 times in the 8-hour night-time period, i.e. one which can be considered to be 'not normally exceeded' as per the WHO guidelines.

3.13 Average sound levels are around 58dB$L_{Aeq,16hour}$ during the day and 49dB$L_{Aeq,8hour}$ to 51dB$L_{Aeq,8hour}$ at night.

3.14 This would be considered a 'low to medium risk' development site for residential use when compared with Figure 1 included in Section 2 of ProPG, as shown in **Figure 2.1** of this report. A low-risk site is summarised as:

"At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development."

3.15 This would not prohibit the development as good acoustic design processes will be followed to reduce sound levels to as low as practical across the site.

3.16 Measurements taken indicate a medium risk assessment of noise, relating to overheating conditions during the day and low to medium at night, in accordance with AVO guidance. Therefore, a Level 1 assessment is considered adequate for all elevations, as shown in **Appendix D.**

3.17 Representative octave band levels are provided in **Table 3.2**. These are used in glazing calculations to ensure a robust calculation of internal noise levels.

		Octave band centre frequency dB							
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
P1	$L_{Aeq,16hr}$ (day)	67	60	58	56	53	49	44	38
	$L_{Aeq,8hr}$ (night)	58	54	50	47	45	43	38	33
	$L_{Amax,T}$ (night)	77	71	68	66	66	64	56	47
P2	$L_{Aeq,16hr}$ (day)	64	59	57	56	53	50	45	38
	$L_{Aeq,8hr}$ (night)	54	51	48	46	44	40	36	30
	$L_{Amax,T}$ (night)	68	65	63	63	61	58	53	46

Table 3.2: Octave band data for noise monitoring locations

Vibration Survey

3.18 The VDV X, Y and Z vibration axis parameters were measured throughout the duration of the survey. Measured levels are summarised below in **Table 3.3** at ground level.

3.19 V1 and V2 correspond to the continuous measurements undertaken whilst A1 is the attended short-duration measurement, closer to the railway line, shown in **Figure 3.1**.

3.20 As previously noted, the Jubilee underground line runs almost immediately to the south of the site. A subjective assessment was undertaken and vibration levels were considered imperceptible.

		VDV (X)	VDV (Y)	VDV (Z)	BS6472 (low probability of adverse comment)
V1	**Daytime 16hr** [07:00 - 23:00]	0.002	0.002	0.001	0.2 - 0.4
	Night-time 8hr [23:00 - 07:00]	0.001	0.002	0.010	0.1 - 0.2
V2	**Daytime 16hr** [07:00 - 23:00]	0.007	0.007	0.026	0.2 - 0.4
	Night-time 8hr [23:00 - 07:00]	0.006	0.008	0.023	0.1 - 0.2
A1	**Daytime** [14:40 - 15:00]	0.001	0.001	0.008	0.2 - 0.4

Table 3.3: Measured Vibration Dose Values

3.21 The measured vibration levels are significantly below the lowest category in BS6472 (low probability of adverse comment).

4.0 CONSTRUCTION PHASE

4.1 Given the proximity of proposed construction to neighbouring noise sensitive properties such as residential areas, it is possible that site clearance, preparation and construction noise may impact nearby receptors.

4.2 A detailed construction programme; specific plant data and operations are not available at this stage of the project. Therefore, it is not possible to undertake a detailed assessment of likely impact at this stage.

4.3 Reasonable construction noise limits can be derived using the Example Method 1 (the ABC Method) of BS 5228, within section E.3.2. Table E.1 from the standard is reproduced below in **Table 4.1:**

Table E.1 **Example threshold of significant effect at dwellings**

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A [A]	Category B [B]	Category C [C]
Night-time (23.00–07.00)	45	50	55
Evenings and weekends [D]	55	60	65
Daytime (07.00–19.00) and Saturdays (07.00–13.00)	65	70	75

NOTE 1 A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level.

NOTE 2 If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L_{Aeq} noise level for the period increases by more than 3 dB due to construction activity.

NOTE 3 Applied to residential receptors only.

[A] Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

[B] Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.

[C] Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

[D] 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

Table 4.1: Table E.1 from BS 5228: Part 1

4.4 Existing ambient noise levels across much of the site will place the site and surroundings within Category A of Table E.1. Therefore, the following noise ambient noise levels (as a result of construction activities) should be considered as reasonable limits to adhere to during construction works.

Time Period	Construction Noise Limits L_{Aeq} (dB)
Saturday 08:00 – 13:00	55
Weekdays 08:00 – 18:00	65

Table 4.2 - Construction Noise Limits

5.0 COMMERCIAL NOISE

Operations at the Redeveloped Community Centre

5.1 There is likely to be some operational plant serving the proposed community centre when redeveloped.

5.2 At this stage, it is not possible to establish actual rating levels, as specific noise generating sources or any proposed external fixed plant is unknown. Therefore, in order to protect residential amenity, a cumulative rating level limit has been set at the closest receptors.

5.3 The measured residual sound level is relatively high therefore it would be prudent to design and select plant so as not to increase the existing residual sound level.

5.4 The representative residual sound level across all measurement positions during the day and night was 58dBL_{Aeq} and 51dBL_{Aeq} respectively.

5.5 Noise associated with the commercial use of the community centre, such as operational fixed plant and equipment, should not exceed a cumulative rating level of **48dBL_{Aeq}** during the day and **41dBL_{Aeq}** at night, in order to protect the amenity of residents. This is below the measured background sound level during the day and night and would result in a low impact when assessed in line with BS4142:2014.

5.6 It is often most efficient to select appropriate plant that complies with the criteria, however where this is not possible suitable attenuation can be specified to reduce levels and protect residential amenity.

5.7 A detailed assessment will be undertaken once plant has been selected in order to assess the likely impact and advise any mitigation requirements.

6.0 MITIGATION RECOMMENDATIONS

6.1 The measured results and indicative layout were used to undertake calculations, presented in **Appendix B**, for suitable façade treatments, as outlined in the following paragraphs.

External Building Fabric - Non-Glazed Elements

6.2 It is assumed that the non-glazed external building fabric elements of the proposed development comprise masonry cavity walls. This would typically provide a sound reduction performance of at least the figures shown in **Table 6.1** when tested in accordance with BS EN ISO 10140-2:2010 (figures derived from: *Representative Values of Airborne SRI for Some Common Structures:* Appendix B of Flakt Woods 'Guide to Noise Control').

Element	Octave band centre frequency SRI, dB					
	125	250	500	1k	2k	4k
Masonry Cavity Wall	34	43	55	66	77	85

Table 6.1: Non-glazed elements assumed sound reduction performance

6.3 This would contribute towards a significant reduction of ambient noise levels in combination with a good quality double-glazed window configuration, as shown in **Table 6.2.**

External Building Fabric - Specification of Glazed Units

6.4 Sound reduction performance calculations have been undertaken to specify the minimum glazing and ventilation performance.

6.5 Standard thermal double glazing and standard ventilation is suitable across the site, with the exception of properties positioned to the far north, above second floor level with line of sight to rail, which will require slightly uprated glazing. A mitigation plan is presented in **Appendix C.**

6.6 Calculations have been based on habitable rooms with relatively higher ratios of glazing to masonry, in order to present a more onerous assessment. This specification therefore presents a robust assessment, for compliance with the BS8233:2014 criteria for internal noise levels and the protection of residential amenity across the development.

6.7 Where non-sensitive rooms and sensitive rooms form part of an open plan area, for example a dining and kitchen area, the glazing and ventilation specification for the more sensitive room should be used across the combined area.

6.8 Glazing calculations have been performed using the L_{Aeq} and L_{Amax} values (as appropriate) as detailed in **Table 3.1**, together with the octave band levels as shown in **Table 3.2**.

6.9 The required glazing performance is shown in **Table 6.2**. The performance is specified for the whole window unit, including the frame.

Glazing Type reference, description	Sound Reduction Index R_W	Octave band centre frequency (Hz) SRI (dB)					
		125	250	500	1k	2k	4k
Standard double glazing	32	20	21	30	35	32	37
Uprated double glazing	39	27	29	36	41	42	52

Table 6.2: Minimum glazing specification

External Building Fabric - Specification of Vents

6.10 To achieve the suitable internal criteria, it is necessary that windows remain closed and alternative means of ventilation is provided across the site. Windows are not sealed and residents may choose to open the windows whilst accepting that internal sound levels may not meet the internal performance criteria. This means of mitigation is typical for a development in such an area that is affected by nearby road traffic and where external levels are elevated.

6.11 **Table 6.3** provides a minimum acoustic performance for any ventilation used in lieu of openable windows to demonstrate how suitable internal sound levels can be achieved.

Element	Octave band centre frequency SRI, dB						Overall
	125	250	500	1k	2k	4k	Dn,e,w
Ventilation	36	34	31	34	38	38	35

Table 6.3: Required minimum attenuation values for ventilation

6.12 It should be noted that there may be additional considerations for glazing and ventilation requirements such as overheating, security, thermal performance and air quality, therefore the specified glazing and ventilation is merely guidance for how the acoustic criteria can be achieved. Alternative glazing and ventilation could be used in place of the specified units, assuming the minimum acoustic performance is met.

6.13 All major building elements should be tested in accordance with BS EN ISO 10140-2:2010. Sole glass performance data would not necessarily demonstrate compliance with this specification. No further mitigation measures would be required to achieve the recommended internal noise levels.

Overheating

6.14 To achieve suitable internal amenity sound levels in accordance with BS8233:2014, windows must remain closed and an alternative means of ventilation provided. Consideration has been given to the potential for adverse impact during overheating conditions; where residents may open windows to control temperature and accept slightly higher internal sound levels. **Appendix D** identifies the Overheating Risk Categories for each building elevation.

External amenity space

6.15 External sound levels are marginally above those set out in relevant authoritative guidance. The guidance in BS8233:2014 notes that a compromise between elevated noise levels and factors, including other planning requirements should be considered.

6.16 Sound levels will be suitable in the communal garden, as this location will benefit from screening from ambient noise sources provided by the intervening structure of the proposed development therefore

residents will have a choice of available amenity space including their private balconies and the shared amenity spaces across the development.

Construction Phase

6.17 In accordance with local policy, construction activities should only take place between the hours of 08:00 and 18:00 on weekdays and between 08:00 – 13:00 on Saturdays. No construction activity should be carried out during the night, on Sundays or on bank holiday's without additional consideration to controlling noise and with the prior approval of the LPA.

6.18 During construction, the contractor will employ best practicable means to control noise from construction operations.

6.19 Temporary screening in the form of solid timber hoarding can be used where operations are adjacent to sensitive receptors. Consideration will be given to neighbouring residential properties when locating the temporary site compounds and material stockpiles.

6.20 Stationary equipment and plant such as generators will be placed as far as practicable from noise sensitive properties, and preferably in areas benefiting from existing or purpose-built attenuation such as bunding or behind non-sensitive buildings.

6.21 Delivery of materials and removal of waste from the site will be planned to minimise disturbance to neighbouring properties. Idling of plant, machinery and delivery vehicles should be prohibited when not in use.

6.22 If required noise levels can be monitored regularly in accordance with BS 5228 to ensure the above set limits are not exceeded. In addition to the above all other guidance within BS 5228–1 will be followed at all times.

7.0 CONCLUSIONS

7.1 Ambient vibration levels have been measured and are negligible at ground floor. Further assessment will take place as part of the detailed structural design for vibration above ground floor.

7.2 Noise levels have been measured at two locations across the site. Measured levels have been used to calculate and assess suitable glazing specification.

7.3 This is considered a 'low to medium risk' site when considered in accordance with guidance in ProPG. Expert Acoustics advice has been sought and good acoustic design processes should be followed to reduce sound levels across the site.

7.4 The site risk of overheating conditions within properties has been considered in accordance with AVO Guidance. The buildings are designed to achieve high standards of thermal performance through passive design. The assessment results in a medium risk of noise impact under overheating conditions during the day and low to medium at night where windows may be opened to control overheating.

7.5 Control measures should be implemented to manage potential impacts from construction noise.

7.6 Noise associated with the proposed community use, such as fixed plant and equipment will not exceed cumulative rating levels at the closest receptor of 48dBL_{Aeq} during the day and 41dBL_{Aeq} at night If appropriate acoustic mitigation will be designed into the plant to ensure the criteria are achieved and residential amenity is properly protected. An appropriately worded condition to this effect could be imposed if necessary.

7.7 External sound levels will be reduced to as low a level as practicable in accordance with the principles of good acoustic design.

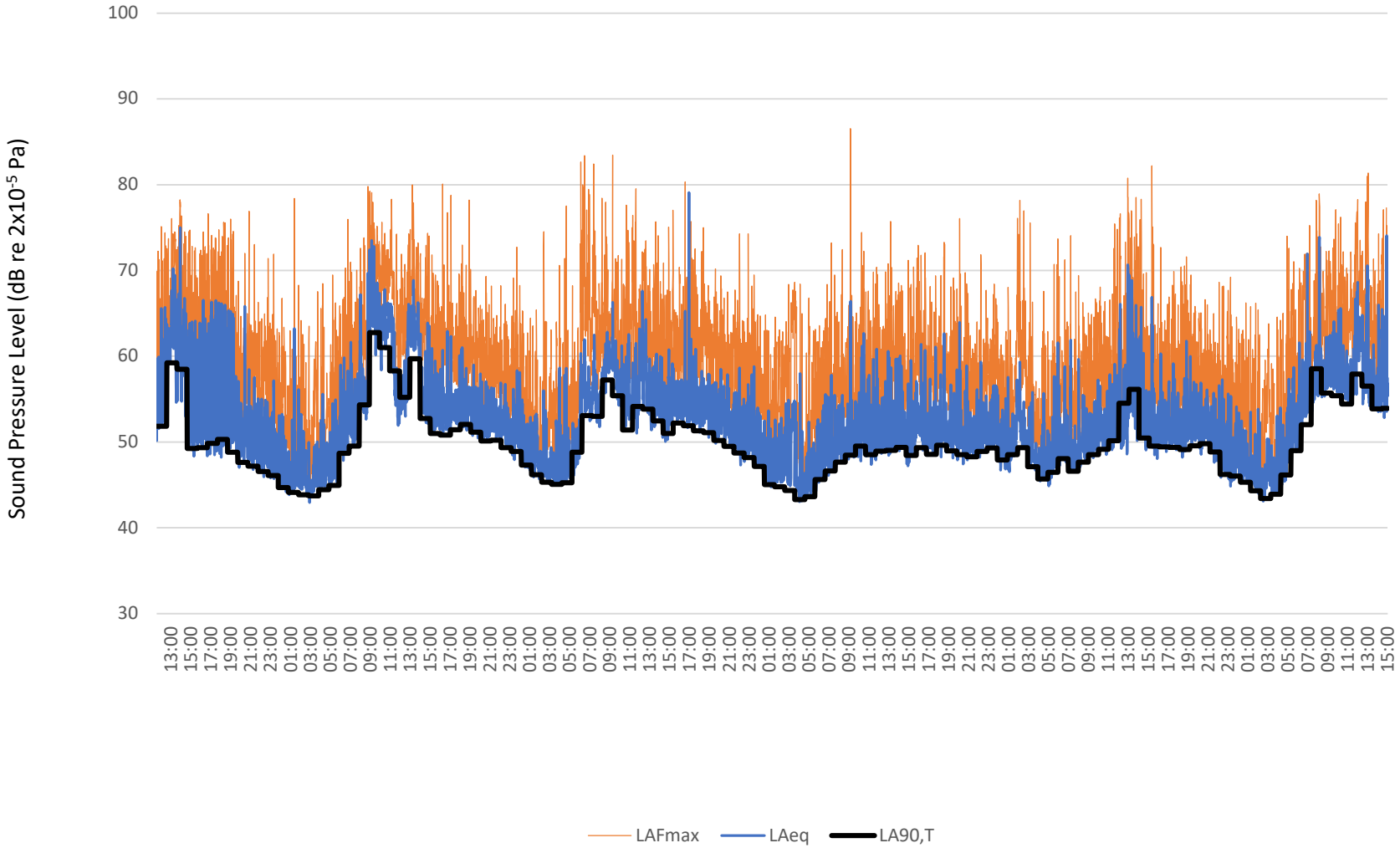
7.8 This assessment demonstrates that the site is suitable for development subject to the recommendations included in this report.

APPENDIX A

ARDENT
CONSULTING ENGINEERS

Wootton Street, Lambeth

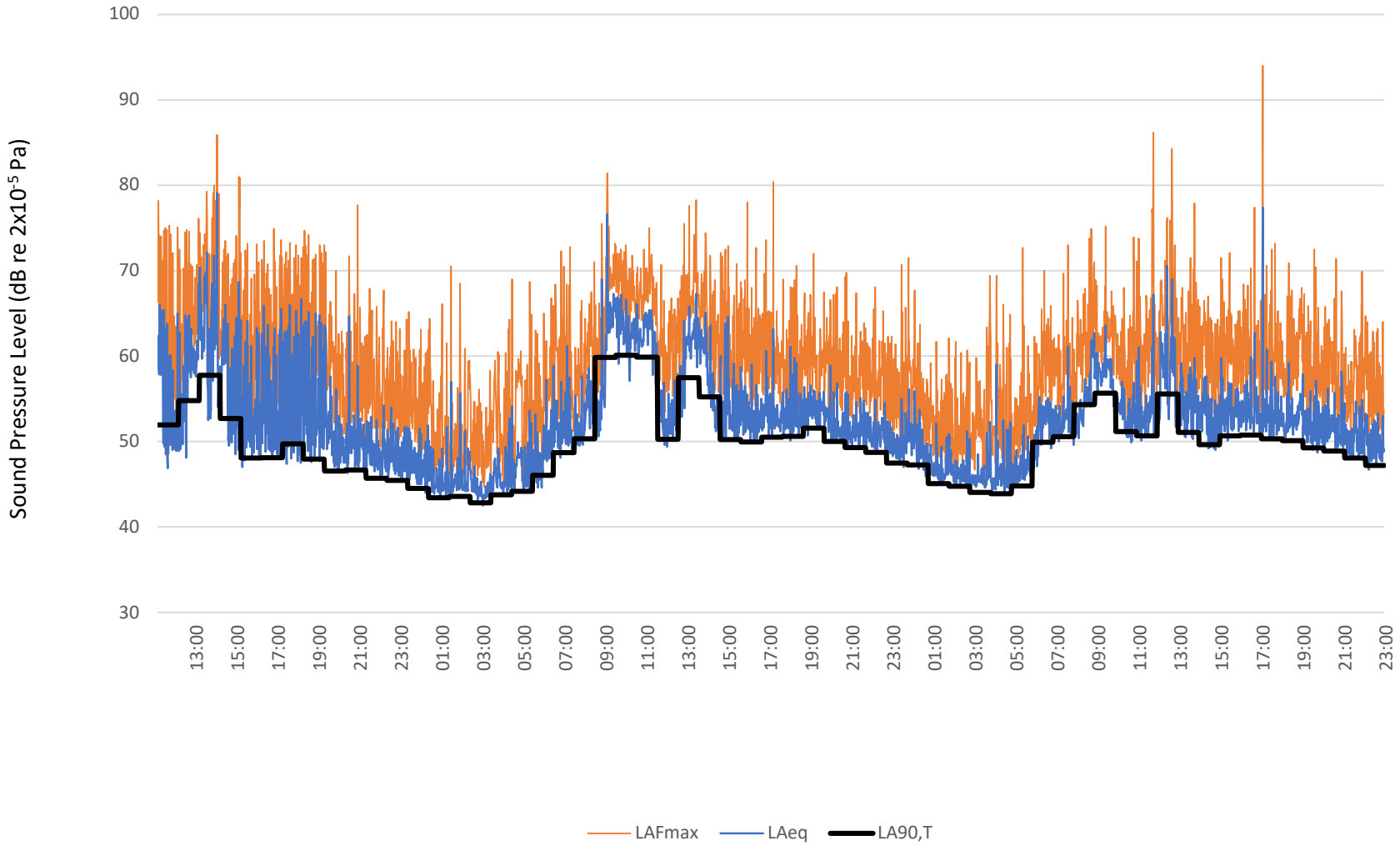
Position 1 - 4th to 9th December 2019



ARDENT
CONSULTING ENGINEERS

Wootton Road, Lambeth

Position 2 - 4th to 6th December 2019



APPENDIX B

ARDENT CONSULTING ENGINEERS

Noise Break-in Calculation - Position 1

Description	
Ardent CE Project No.	**193860**
Property Address	**Wootton Street, Lambeth**
Room Type	**Bedroom**
Parameter	**LAeq, 16h**

Room Dimensions and Areas	
Room volume	35.00
Total Surface area	65.50
Wall façade area	10.00
Roof façade area	0.00
Glazing area	3.60
Dne Ref Area, A0	10.00

- Based on typical size

Total façade area	13.60

Room Absorption Calcuation	63	125	250	500	1000	2000	4000	8000	
Estimated Reverberation time	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
Alpha bar	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	
Total Absorption	14.09	14.09	14.09	14.09	14.09	14.09	14.09	14.09	
10Log S/A	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	

- Typical Bedroom RT

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	66.6	59.9	58.0	56.0	52.7	48.9	44.4	38.0	58.1
Façade to free field	0	0	0	0	0	0	0	0	
Angle of view	0	0	0	0	0	0	0	0	
Screening (Maekewa)	0	0	0	0	0	0	0	0	
Distance correction	0	0	0	0	0	0	0	0	
Other	0	0	0	0	0	0	0	0	
Noise level at façade (Leq)	67	60	58	56	53	49	44	38	58

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw	
Glazing SRI	18	20	21	30	35	32	37	44	32	
Transmission Coefficient	0.015849	0.010000	0.007943	0.001000	0.000316	0.000631	0.000200	0.000040		
Wall SRI	28	34	43	55	66	77	85	85	55	**Typical masonry cavity wall (300mm - 380kg/m2)**
Transmission Coefficient	0.001585	0.000398	0.000050	0.000003	0.000000	0.000000	0.000000	0.000000		
Roof SRI	23	26	43	52	60	65	65	65	51	
Transmission Coefficient	0.005012	0.002512	0.000050	0.000006	0.000001	0.000000	0.000000	0.000000		
Ventilation, Dne	36	36	34	31	34	38	38	38	35	
Transmission Coefficient	0.000251	0.000251	0.000398	0.000794	0.000398	0.000158	0.000158	0.000158		
Average Transmission Coeff	0.005545	0.003124	0.002432	0.000851	0.000377	0.000284	0.000169	0.000127		
Average SRI	23	25	26	31	34	35	38	39	34	

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	44.9	35.7	32.7	26.1	19.3	14.3	7.5	-0.1	28.7	
Lp (Direct)	44.0	34.8	31.9	25.3	18.5	13.4	6.7	-1.0	27.9	**Criteria**
Lp (Rev & Direct)	48	38	35	29	22	17	10	3	31.4	**≤ 35**
BS8233	47	38	35	28	21	16	10	2	31	**≤ 35**

ARDENT CONSULTING ENGINEERS

Noise Break-in Calculation - Position 1

Description	
Ardent CE Project No.	**193860**
Property Address	**Wootton Street, Lambeth**
Room Type	**Bedroom**
Parameter	**LAeq, 8h**

Room Dimensions and Areas	
Room volume	35.00
Total Surface area	65.50
Wall façade area	10.00
Roof façade area	0.00
Glazing area	3.60
Dne Ref Area, A0	10.00

- Based on typical size

Total façade area	13.60

Room Absorption Calcuation	63	125	250	500	1000	2000	4000	8000	
Estimated Reverberation time	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
Alpha bar	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	
Total Absorption	14.09	14.09	14.09	14.09	14.09	14.09	14.09	14.09	
10Log S/A	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	

- Typical Bedroom RT

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	57.6	53.9	50.0	46.8	45.4	42.5	37.9	33.4	50.5
Façade to free field	0	0	0	0	0	0	0	0	
Angle of view	0	0	0	0	0	0	0	0	
Screening (Maekewa)	0	0	0	0	0	0	0	0	
Distance correction	0	0	0	0	0	0	0	0	
Other	0	0	0	0	0	0	0	0	
Noise level at façade (Leq)	58	54	50	47	45	43	38	33	51

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	18	20	21	30	35	32	37	44	32
Transmission Coefficient	0.015849	0.010000	0.007943	0.001000	0.000316	0.000631	0.000200	0.000040	
Wall SRI	28	34	43	55	66	77	85	85	55
Transmission Coefficient	0.001585	0.000398	0.000050	0.000003	0.000000	0.000000	0.000000	0.000000	
Roof SRI	23	26	43	52	60	65	65	65	51
Transmission Coefficient	0.005012	0.002512	0.000050	0.000006	0.000001	0.000000	0.000000	0.000000	
Ventilation, Dne	36	36	34	31	34	38	38	38	35
Transmission Coefficient	0.000251	0.000251	0.000398	0.000794	0.000398	0.000158	0.000158	0.000158	
Average Transmission Coeff	0.005545	0.003124	0.002432	0.000851	0.000377	0.000284	0.000169	0.000127	
Average SRI	23	25	26	31	34	35	38	39	34

Typical masonry cavity wall (300mm - 380kg/m2)

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	35.9	29.7	24.7	16.9	12.0	7.9	1.0	-4.7	20.9	
Lp (Direct)	35.0	28.8	23.9	16.1	11.2	7.0	0.2	-5.6	20	**Criteria**
Lp (Rev & Direct)	39	32	27	20	15	11	4	-2	24	**≤ 30**
BS8233	38	32	27	19	14	10	3	-3	23	**≤ 30**

ARDENT CONSULTING ENGINEERS

Noise Break-in Calculation - Position 1

Description	
Ardent CE Project No.	**193860**
Property Address	**Wootton Street, Lambeth**
Room Type	**Bedroom**
Parameter	**LAmax**

Room Dimensions and Areas	
Room volume	35.00
Total Surface area	65.50
Wall façade area	10.00
Roof façade area	0.00
Glazing area	3.60
Dne Ref Area, A0	10.00

- Based on typical size

Total façade area	13.60

Room Absorption Calcuation	63	125	250	500	1000	2000	4000	8000	
Estimated Reverberation time	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
Alpha bar	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	
Total Absorption	14.09	14.09	14.09	14.09	14.09	14.09	14.09	14.09	
10Log S/A	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	

- Typical Bedroom RT

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	77.2	70.6	67.7	65.6	65.8	63.8	56.2	46.9	70.2
Façade to free field	0	0	0	0	0	0	0	0	
Angle of view	0	0	0	0	0	0	0	0	
Screening (Maekewa)	0	0	0	0	0	0	0	0	
Distance correction	0	0	0	0	0	0	0	0	
Other	0	0	0	0	0	0	0	0	
Noise level at façade (Leq)	77	71	68	66	66	64	56	47	70

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw	
Glazing SRI	18	20	21	30	35	32	37	44	32	
Transmission Coefficient	0.015849	0.010000	0.007943	0.001000	0.000316	0.000631	0.000200	0.000040		
Wall SRI	28	34	43	55	66	77	85	85	55	**Typical masonry cavity wall (300mm - 380kg/m2)**
Transmission Coefficient	0.001585	0.000398	0.000050	0.000003	0.000000	0.000000	0.000000	0.000000		
Roof SRI	23	26	43	52	60	65	65	65	51	
Transmission Coefficient	0.005012	0.002512	0.000050	0.000006	0.000001	0.000000	0.000000	0.000000		
Ventilation, Dne	36	36	34	31	34	38	38	38	35	
Transmission Coefficient	0.000251	0.000251	0.000398	0.000794	0.000398	0.000158	0.000158	0.000158		
Average Transmission Coeff	0.005545	0.003124	0.002432	0.000851	0.000377	0.000284	0.000169	0.000127		
Average SRI	23	25	26	31	34	35	38	39	34	

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	55.5	46.4	42.5	35.8	32.4	29.1	19.3	8.8	39.6	
Lp (Direct)	54.7	45.6	41.6	34.9	31.5	28.3	18.5	8.0	38.7	**Criteria**
Lp (Rev & Direct)	58	49	45	38	35	32	22	11	42	**≤ 45**
BS8233	58	48	44	38	34	31	21	11	42	**≤ 45**

ARDENT CONSULTING ENGINEERS

Noise Break-in Calculation - Position 1a (above 2nd floor)

Description	
Ardent CE Project No.	**193860**
Property Address	**Wootton Street, Lambeth**
Room Type	**Bedroom**
Parameter	**LAeq, 16h**

Room Dimensions and Areas		
Room volume	35.00	**- Based on typical size**
Total Surface area	65.50	
Wall façade area	10.00	
Roof façade area	0.00	
Glazing area	3.60	
Dne Ref Area, A0	10.00	

Total façade area	13.60

Room Absorption Calcuation	63	125	250	500	1000	2000	4000	8000		
Estimated Reverberation time	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4		**- Typical Bedroom RT**
Alpha bar	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22		
Total Absorption	14.09	14.09	14.09	14.09	14.09	14.09	14.09	14.09		
10Log S/A	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15		

Façade level	63	125	250	500	1000	2000	4000	8000	A	
Measured Noise Level	66.6	59.9	58.0	56.0	52.7	48.9	44.4	38.0	58.1	
Façade to free field	0	0	0	0	0	0	0	0		
Angle of view	0	0	0	0	0	0	0	0		
Screening (Maekewa)	5	5	5	5	5	5	5	5		**Line of sight to rail**
Distance correction	0	0	0	0	0	0	0	0		
Other	0	0	0	0	0	0	0	0		
Noise level at façade (Leq)	72	65	63	61	58	54	49	43	63	

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw	
Glazing SRI	20	27	29	36	41	42	52	60	39	
Transmission Coefficient	0.010000	0.001995	0.001259	0.000251	0.000079	0.000063	0.000006	0.000001		
Wall SRI	28	34	43	55	66	77	85	85	55	**Typical masonry cavity wall (300mm - 380kg/m2)**
Transmission Coefficient	0.001585	0.000398	0.000050	0.000003	0.000000	0.000000	0.000000	0.000000		
Roof SRI	23	26	43	52	60	65	65	65	51	
Transmission Coefficient	0.005012	0.002512	0.000050	0.000006	0.000001	0.000000	0.000000	0.000000		
Ventilation, Dne	36	36	34	31	34	38	38	38	35	
Transmission Coefficient	0.000251	0.000251	0.000398	0.000794	0.000398	0.000158	0.000158	0.000158		
Average Transmission Coeff	0.003997	0.001006	0.000663	0.000653	0.000314	0.000133	0.000118	0.000117		
Average SRI	24	30	32	32	35	39	39	39	36	

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	48.5	35.8	32.1	30.0	23.5	16.0	11.0	4.5	31	
Lp (Direct)	47.6	34.9	31.2	29.1	22.7	15.1	10.1	3.7	30.1	**Criteria**
Lp (Rev & Direct)	51	38	35	33	26	19	14	7	33.6	**≤ 35**
BS8233	50	38	34	32	26	18	13	7	33	**≤ 35**

ARDENT CONSULTING ENGINEERS

Noise Break-in Calculation - Position 1a (above 2nd floor)

Description	
Ardent CE Project No.	**193860**
Property Address	**Wootton Street, Lambeth**
Room Type	**Bedroom**
Parameter	**LAeq, 8h**

Room Dimensions and Areas		
Room volume	35.00	**- Based on typical size**
Total Surface area	65.50	
Wall façade area	10.00	
Roof façade area	0.00	
Glazing area	3.60	
Dne Ref Area, A0	10.00	

Total façade area	13.60

Room Absorption Calcuation	63	125	250	500	1000	2000	4000	8000		
Estimated Reverberation time	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4		**- Typical Bedroom RT**
Alpha bar	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22		
Total Absorption	14.09	14.09	14.09	14.09	14.09	14.09	14.09	14.09		
10Log S/A	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15		

Façade level	63	125	250	500	1000	2000	4000	8000	A	
Measured Noise Level	57.6	53.9	50.0	46.8	45.4	42.5	37.9	33.4	50.5	
Façade to free field	0	0	0	0	0	0	0	0		
Angle of view	0	0	0	0	0	0	0	0		
Screening (Maekewa)	5	5	5	5	5	5	5	5		**Line of sight to rail**
Distance correction	0	0	0	0	0	0	0	0		
Other	0	0	0	0	0	0	0	0		
Noise level at façade (Leq)	63	59	55	52	50	48	43	38	56	

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw	
Glazing SRI	20	27	29	36	41	42	52	60	39	
Transmission Coefficient	0.010000	0.001995	0.001259	0.000251	0.000079	0.000063	0.000006	0.000001		
Wall SRI	28	34	43	55	66	77	85	85	55	**Typical masonry cavity wall (300mm - 380kg/m2)**
Transmission Coefficient	0.001585	0.000398	0.000050	0.000003	0.000000	0.000000	0.000000	0.000000		
Roof SRI	23	26	43	52	60	65	65	65	51	
Transmission Coefficient	0.005012	0.002512	0.000050	0.000006	0.000001	0.000000	0.000000	0.000000		
Ventilation, Dne	36	36	34	31	34	38	38	38	35	
Transmission Coefficient	0.000251	0.000251	0.000398	0.000794	0.000398	0.000158	0.000158	0.000158		
Average Transmission Coeff	0.003997	0.001006	0.000663	0.000653	0.000314	0.000133	0.000118	0.000117		
Average SRI	24	30	32	32	35	39	39	39	36	

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	39.5	29.8	24.1	20.8	16.2	9.6	4.5	-0.1	22.9	
Lp (Direct)	38.6	28.9	23.2	19.9	15.4	8.7	3.6	-0.9	22.1	**Criteria**
Lp (Rev & Direct)	42	32	27	23	19	12	7	3	26	**≤ 30**
BS8233	41	32	26	23	18	12	6	2	25	**≤ 30**

ARDENT CONSULTING ENGINEERS

Noise Break-in Calculation - Position 1a (above 2nd floor)

Description	
Ardent CE Project No.	**193860**
Property Address	**Wootton Street, Lambeth**
Room Type	**Bedroom**
Parameter	**LAmax**

Room Dimensions and Areas		
Room volume	35.00	**- Based on typical size**
Total Surface area	65.50	
Wall façade area	10.00	
Roof façade area	0.00	
Glazing area	3.60	
Dne Ref Area, A0	10.00	

Total façade area	13.60

Room Absorption Calcuation	63	125	250	500	1000	2000	4000	8000		
Estimated Reverberation time	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4		**- Typical Bedroom RT**
Alpha bar	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22		
Total Absorption	14.09	14.09	14.09	14.09	14.09	14.09	14.09	14.09		
10Log S/A	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15		

Façade level	63	125	250	500	1000	2000	4000	8000	A	
Measured Noise Level	77.2	70.6	67.7	65.6	65.8	63.8	56.2	46.9	70.2	
Façade to free field	0	0	0	0	0	0	0	0		
Angle of view	0	0	0	0	0	0	0	0		
Screening (Maekewa)	5	5	5	5	5	5	5	5		**Line of sight to rail**
Distance correction	0	0	0	0	0	0	0	0		
Other	0	0	0	0	0	0	0	0		
Noise level at façade (Leq)	82	76	73	71	71	69	61	52	75	

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw	
Glazing SRI	20	27	29	36	41	42	52	60	39	
Transmission Coefficient	0.010000	0.001995	0.001259	0.000251	0.000079	0.000063	0.000006	0.000001		
Wall SRI	28	34	43	55	66	77	85	85	55	**Typical masonry cavity wall (300mm - 380kg/m2)**
Transmission Coefficient	0.001585	0.000398	0.000050	0.000003	0.000000	0.000000	0.000000	0.000000		
Roof SRI	23	26	43	52	60	65	65	65	51	
Transmission Coefficient	0.005012	0.002512	0.000050	0.000006	0.000001	0.000000	0.000000	0.000000		
Ventilation, Dne	36	36	34	31	34	38	38	38	35	
Transmission Coefficient	0.000251	0.000251	0.000398	0.000794	0.000398	0.000158	0.000158	0.000158		
Average Transmission Coeff	0.003997	0.001006	0.000663	0.000653	0.000314	0.000133	0.000118	0.000117		
Average SRI	24	30	32	32	35	39	39	39	36	

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	59.1	46.5	41.8	39.6	36.6	30.9	22.8	13.4	42	
Lp (Direct)	58.3	45.7	41.0	38.8	35.8	30.0	21.9	12.6	41.2	**Criteria**
Lp (Rev & Direct)	62	49	44	42	39	34	25	16	45	**≤ 45**
BS8233	61	49	44	42	39	33	25	15	44	**≤ 45**

ARDENT CONSULTING ENGINEERS

Noise Break-in Calculation - Position 2

Description	
Ardent CE Project No.	**193860**
Property Address	**Wootton Street, Lambeth**
Room Type	**Bedroom**
Parameter	**LAeq, 16h**

Room Dimensions and Areas	
Room volume	35.00
Total Surface area	65.50
Wall façade area	10.00
Roof façade area	0.00
Glazing area	3.60
Dne Ref Area, A0	10.00

- Based on typical size

Total façade area	13.60

Room Absorption Calcuation	63	125	250	500	1000	2000	4000	8000	
Estimated Reverberation time	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
Alpha bar	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	
Total Absorption	14.09	14.09	14.09	14.09	14.09	14.09	14.09	14.09	
10Log S/A	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	

- Typical Bedroom RT

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	64.4	58.6	56.9	56.2	53.3	49.7	45.3	37.6	58.3
Façade to free field	0	0	0	0	0	0	0	0	
Angle of view	0	0	0	0	0	0	0	0	
Screening (Maekewa)	0	0	0	0	0	0	0	0	
Distance correction	0	0	0	0	0	0	0	0	
Other	0	0	0	0	0	0	0	0	
Noise level at façade (Leq)	64	59	57	56	53	50	45	38	58

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw	
Glazing SRI	18	20	21	30	35	32	37	44	32	
Transmission Coefficient	0.015849	0.010000	0.007943	0.001000	0.000316	0.000631	0.000200	0.000040		
Wall SRI	28	34	43	55	66	77	85	85	55	**Typical masonry cavity wall (300mm - 380kg/m2)**
Transmission Coefficient	0.001585	0.000398	0.000050	0.000003	0.000000	0.000000	0.000000	0.000000		
Roof SRI	23	26	43	52	60	65	65	65	51	
Transmission Coefficient	0.005012	0.002512	0.000050	0.000006	0.000001	0.000000	0.000000	0.000000		
Ventilation, Dne	36	36	34	31	34	38	38	38	35	
Transmission Coefficient	0.000251	0.000251	0.000398	0.000794	0.000398	0.000158	0.000158	0.000158		
Average Transmission Coeff	0.005545	0.003124	0.002432	0.000851	0.000377	0.000284	0.000169	0.000127		
Average SRI	23	25	26	31	34	35	38	39	34	

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	42.7	34.4	31.6	26.3	19.9	15.1	8.4	-0.5	28.2	
Lp (Direct)	41.8	33.5	30.8	25.5	19.1	14.2	7.6	-1.4	27.4	**Criteria**
Lp (Rev & Direct)	45	37	34	29	23	18	11	2	30.9	**≤ 35**
BS8233	45	36	34	28	22	17	10	1	30	**≤ 35**

ARDENT CONSULTING ENGINEERS

Noise Break-in Calculation - Position 2

Description	
Ardent CE Project No.	**193860**
Property Address	**Wootton Street, Lambeth**
Room Type	**Bedroom**
Parameter	**LAeq, 8h**

Room Dimensions and Areas	
Room volume	35.00
Total Surface area	65.50
Wall façade area	10.00
Roof façade area	0.00
Glazing area	3.60
Dne Ref Area, A0	10.00

- Based on typical size

Total façade area	13.60

Room Absorption Calcuation	63	125	250	500	1000	2000	4000	8000	
Estimated Reverberation time	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
Alpha bar	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	
Total Absorption	14.09	14.09	14.09	14.09	14.09	14.09	14.09	14.09	
10Log S/A	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	

- Typical Bedroom RT

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	53.8	51.2	48.4	46.0	43.7	39.9	35.7	29.8	48.7
Façade to free field	0	0	0	0	0	0	0	0	
Angle of view	0	0	0	0	0	0	0	0	
Screening (Maekewa)	0	0	0	0	0	0	0	0	
Distance correction	0	0	0	0	0	0	0	0	
Other	0	0	0	0	0	0	0	0	
Noise level at façade (Leq)	54	51	48	46	44	40	36	30	49

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	18	20	21	30	35	32	37	44	32
Transmission Coefficient	0.015849	0.010000	0.007943	0.001000	0.000316	0.000631	0.000200	0.000040	
Wall SRI	28	34	43	55	66	77	85	85	55
Transmission Coefficient	0.001585	0.000398	0.000050	0.000003	0.000000	0.000000	0.000000	0.000000	
Roof SRI	23	26	43	52	60	65	65	65	51
Transmission Coefficient	0.005012	0.002512	0.000050	0.000006	0.000001	0.000000	0.000000	0.000000	
Ventilation, Dne	36	36	34	31	34	38	38	38	35
Transmission Coefficient	0.000251	0.000251	0.000398	0.000794	0.000398	0.000158	0.000158	0.000158	
Average Transmission Coeff	0.005545	0.003124	0.002432	0.000851	0.000377	0.000284	0.000169	0.000127	
Average SRI	23	25	26	31	34	35	38	39	34

Typical masonry cavity wall (300mm - 380kg/m2)

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	32.1	27.0	23.1	16.1	10.3	5.3	-1.2	-8.3	19.1	
Lp (Direct)	31.2	26.1	22.3	15.3	9.5	4.4	-2.0	-9.2	18.2	**Criteria**
Lp (Rev & Direct)	35	30	26	19	13	8	1	-6	22	**≤ 30**
BS8233	34	29	25	18	12	7	1	-6	21	**≤ 30**

ARDENT CONSULTING ENGINEERS

Noise Break-in Calculation - Position 2

Description	
Ardent CE Project No.	**193860**
Property Address	**Wootton Street, Lambeth**
Room Type	**Bedroom**
Parameter	**LAmax**

Room Dimensions and Areas	
Room volume	35.00
Total Surface area	65.50
Wall façade area	10.00
Roof façade area	0.00
Glazing area	3.60
Dne Ref Area, A0	10.00

- Based on typical size

Total façade area	13.60

Room Absorption Calcuation	63	125	250	500	1000	2000	4000	8000	
Estimated Reverberation time	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
Alpha bar	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	
Total Absorption	14.09	14.09	14.09	14.09	14.09	14.09	14.09	14.09	
10Log S/A	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	

- Typical Bedroom RT

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	68.1	64.8	62.7	63.5	60.5	58.2	53.2	46.1	65.7
Façade to free field	0	0	0	0	0	0	0	0	
Angle of view	0	0	0	0	0	0	0	0	
Screening (Maekewa)	0	0	0	0	0	0	0	0	
Distance correction	0	0	0	0	0	0	0	0	
Other	0	0	0	0	0	0	0	0	
Noise level at façade (Leq)	68	65	63	63	61	58	53	46	66

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw	
Glazing SRI	18	20	21	30	35	32	37	44	32	
Transmission Coefficient	0.015849	0.010000	0.007943	0.001000	0.000316	0.000631	0.000200	0.000040		
Wall SRI	28	34	43	55	66	77	85	85	55	**Typical masonry cavity wall (300mm - 380kg/m2)**
Transmission Coefficient	0.001585	0.000398	0.000050	0.000003	0.000000	0.000000	0.000000	0.000000		
Roof SRI	23	26	43	52	60	65	65	65	51	
Transmission Coefficient	0.005012	0.002512	0.000050	0.000006	0.000001	0.000000	0.000000	0.000000		
Ventilation, Dne	36	36	34	31	34	38	38	38	35	
Transmission Coefficient	0.000251	0.000251	0.000398	0.000794	0.000398	0.000158	0.000158	0.000158		
Average Transmission Coeff	0.005545	0.003124	0.002432	0.000851	0.000377	0.000284	0.000169	0.000127		
Average SRI	23	25	26	31	34	35	38	39	34	

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	46.4	40.6	37.4	33.6	27.1	23.6	16.4	8.0	34.9	
Lp (Direct)	45.6	39.7	36.6	32.8	26.3	22.8	15.5	7.2	34.1	**Criteria**
Lp (Rev & Direct)	49	43	40	36	30	26	19	11	38	**≤ 45**
BS8233	48	43	39	36	29	26	18	10	37	**≤ 45**

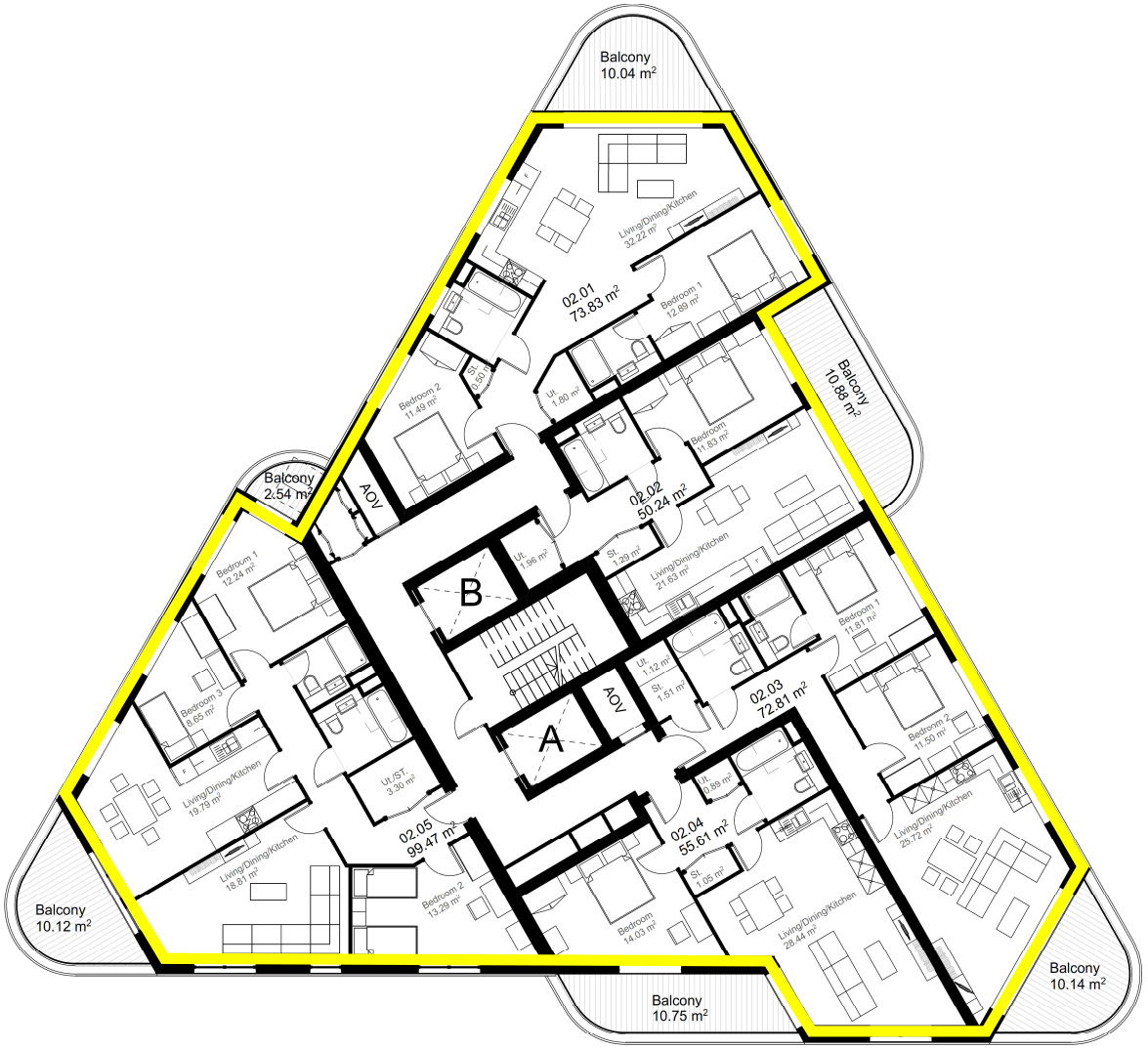
APPENDIX C

Noise Mitigation Plan

Uprated Glazing

APPENDIX D

Noise Impact Overheating Risk Categories – Daytime

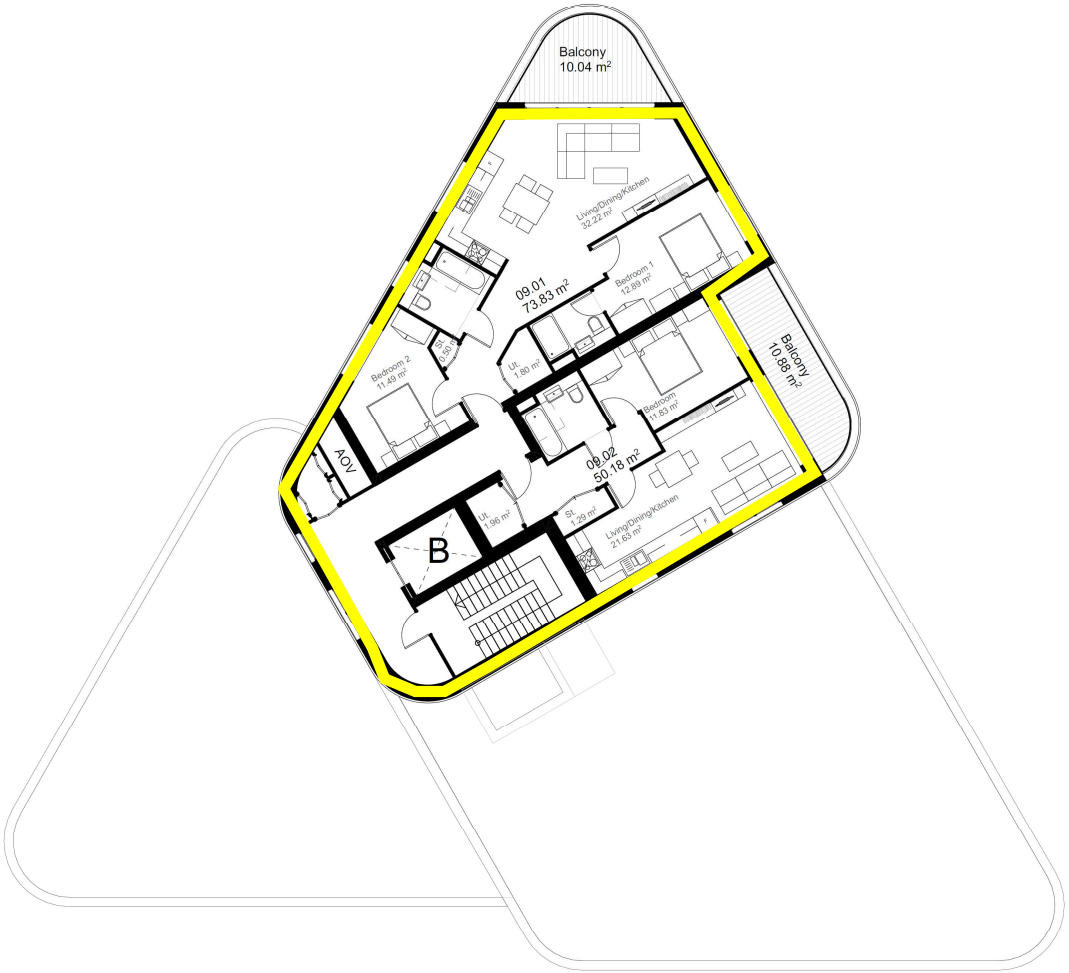


Risk Category for Level 1 Assessment according to: *Table 3-2 Acoustics, Ventilation and Overheating: Residential Design Guide*	
	High
	Medium
	Low
	Negligible

Noi se Impact Overheating Risk Categories – Daytime

Risk Category for Level 1 Assessment according to: *Table 3-2 Acoustics, Ventilation and Overheating: Residential Design Guide*	
	High
	Medium
	Low
	Negligible

Noise Impact Overheating Risk Categories – Daytime



Risk Category for Level 1 Assessment according to: *Table 3-2 Acoustics, Ventilation and Overheating: Residential Design Guide*	
	High
	Medium
	Low
	Negligible

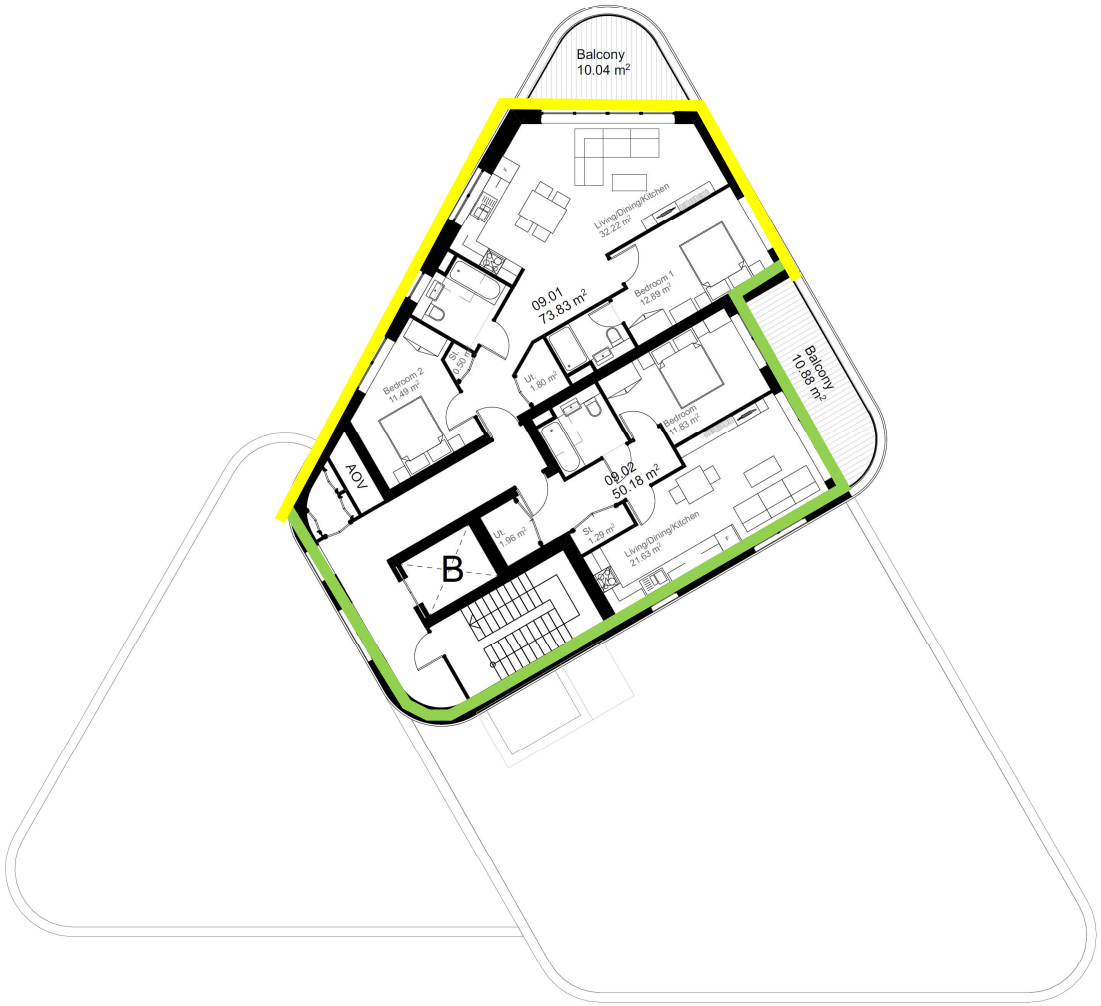
Noise Impact Overheating Risk Categories – Night

Risk Category for Level 1 Assessment according to: *Table 3-2 Acoustics, Ventilation and Overheating: Residential Design Guide*	
	High
	Medium
	Low
	Negligible

Noise Impact Overheating Risk Categories – Night

Risk Category for Level 1 Assessment according to: *Table 3-2 Acoustics, Ventilation and Overheating: Residential Design Guide*	
	High
	Medium
	Low
	Negligible

Noise Impact Overheating Risk Categories – Night



Risk Category for Level 1 Assessment according to: *Table 3-2 Acoustics, Ventilation and Overheating: Residential Design Guide*	
	High
	Medium
	Low
	Negligible

APPENDIX E

ACOUSTIC TERMINOLOGY

The effects of noise on human beings may be expressed in terms of physiological damage and annoyance. It is, however, only the annoyance impacts that need to be considered in detail when addressing environmental noise impacts. Annoyance also includes the immediate effects of activity interference, for example sleep disturbance and speech interference.

The practice has become to measure sound levels in decibels (dB). The decibel scale is logarithmic rather than linear and it is useful to bear in mind that a noise level change of 3dB would be equivalent to doubling the energy level (for example doubling the volume of traffic) and that an increase of 10 dB is perceived, subjectively, as a doubling of loudness. The human ear responds differently to sounds of different frequency. The ear perceives high frequency sound of a given sound pressure level more loudly than a low frequency sound at the same level. The A-weighted sound level, dB(A), takes this response into consideration and is commonly used for measurement of environmental noise in UK. It thus indicates the subjective human response to sound.

Environmental noise levels vary continuously from second to second, it is clearly impractical to specify the sound level continuously and thus time averaging is required. In practice human response has been related to various units which include allowance for the fluctuating nature of sound with time. For the purpose of this report these include:

LAeq,T : the equivalent A-weighted continuous sound level.

This unit relates to the equivalent level of continuous sound for a specific time period T, for example 16 hours for daytime noise. It contains all the sound energy of the varying sound levels over the same time period and expresses it as a continuous sound level over that period. The unit is used for assessing traffic and industrial noise for planning purposes and in particular for PPG24.

LA10,T : the A-weighted level of sound exceeded for 10% of the time period T.

This unit is used for traffic noise measurement and is the preferred unit for prediction of traffic noise in the publication, 'Calculation of Road Traffic Noise'.

LA90,T : the A-weighted level of sound exceeded for 90% of the time period T.

This unit is commonly used to represent the background noise and is used in assessing the effects of industrial noise in UK.

LAmax : the maximum A-weighted level of sound over a period of measurement.

LAr,T : the rating level.

The specific Noise plus any adjustments for the characteristic features of the noise. Used for comparison between background levels with the noise source off.

SEL : the Sound Exposure Level.

Sound exposure level abbreviated as SEL and LAE, is the total noise energy produced from a single noise event condensed into a 1 second time period.

Rw : weighted sound reduction index.

A laboratory-measured value as defined in ISO717 Part 1.

DnTw :

The equivalent of Rw, but measured onsite as oppose to in a laboratory