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Report E20062/NIA/R1-C
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Project **5 - 17 Haverstock Hill**
London

Title **Noise & Vibration Impact Assessment**
Sub Title **Planning Report**

Client OD Camden Hotel Ltd
C/O Best Star Real estate 2 Ltd
33 Cavendish Square
London W1G 0PW

Case No

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Checked Robert Adnitt MEng FIOA

Revision	Reason	Checked	Signature
A	Updated assessment based on final plans	RA	
B	Update of restaurant description	GS	
C	Minor updates following feedback from CBRE	GS	

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0. CHECKLIST

0.1 The link to the Council's own checklist appears to have been moved at the time of writing this report so the following checklist is based on paragraph 6.20 in the LBC Planning Guidance – Amenity March 2018 and paragraph 6.20 in the LBC Planning Guidance – Amenity Draft July 2020.

Item	Included	Report Reference
Description of the proposal	Yes	Section 1 and Section 3
Description of the site and surroundings, a site map showing noise and vibration sources and measurement locations	Yes	Section 3 and Section 4
Background noise levels measured over a minimum of 24 hours	Yes	Section 4 and Section 5
Details of instruments and methodology used for noise measurements (including reasons for settings and descriptors used, calibration details)	Yes	Section 4
Details of the plant or other source of noise and vibration both on plan and elevations and manufacturers specifications	The details of the mechanical plant equipment are not known at this stage. Noise limits from mechanical plant items have been proposed.	Section 12
Noise or vibration output from proposed plant or other source of noise and vibration, including: noise or vibration levels; frequency of the output; and length of time of the output.		
Features of the noise or vibration e.g. impulses, distinguishable continuous tone, irregular bursts;		
Specification of the plant, supporting structure, fixtures and finishes		
Location of noise sensitive uses and neighbouring windows;	Yes	Section 3
Details of measures to mitigate noise and vibration	Yes	Section 10, 11, 13 and 14
Details of any associated work including acoustic enclosures and/or screening	Yes	Section 10, 11, 13 and 14
Cumulative noise levels; and	Noise limits from mechanical plant items have been proposed and the noise from the proposed hotel courtyard has been assessed	Section 12 and 13
hours/days of operation	Yes	Section 12 and 13

1. INTRODUCTION

1.1 Adnitt Acoustics have been commissioned by OD Camden Hotel Ltd to undertake a noise and vibration impact assessment of the proposed residential and hotel development at 5-17 Haverstock Hill, London.

1.2 A noise and vibration impact assessment is required by The London Borough of Camden, LBC, as part of the planning application.

1.3 The proposal is for the demolition of the existing building and the erection of a new residential and hotel building.

1.4 This report contains the results of the external noise survey, vibration screening survey and associated assessments including façade and ventilation guidance, external amenity area assessment and mechanical plant noise emission limits.

1.5 This report has been prepared as part of the planning process and is not intended to be used for the detailed design of the proposed development.

1.6 The current proposed hotel operator, OD Hotel, does not have any specific acoustic requirements that we have been made aware of.

1.7 This should be kept under review and once the operator has been confirmed an assessment against the acoustic requirements (if any) would be required to determine if there are more onerous requirements than the planning requirements in this report.

1.8 As this is a technical report it will refer to some technical terms. To assist the reader a glossary has been included in Appendix A.

Statement of Qualification

1.9 The assessment was undertaken by Graham Shaw BSc(Hons) MSc MIOA MInstP for and on behalf of Adnitt Acoustic Services Ltd.

1.10 Graham has a BSc(Hons) in Physics with Music from the University of Edinburgh (2010) and an MSc (Distinction) in Architectural and Environmental Acoustics from London South Bank University (2012).

1.11 He has over eight years post-graduate experience as an Acoustical Consultant working as a Consultant for Adnitt Acoustics since January 2012.

1.12 Graham is a corporate member of both the Institute of Acoustics and Institute of Physics.

2. NATIONAL AND LOCAL AUTHORITY REQUIREMENTS

2.1 The following regulations, standards and guidance have been used in setting the acoustic criteria for the proposed development:

- National Planning Policy Framework (NPPF)
- LBC Local Plan 2017
- LBC Planning Guidance – Amenity March 2018
- LBC Planning Guidance – Amenity July Draft 2020 (minimal changes with respect to noise)
- The London Plan – March 2016
- The London Plan – Intend to Publish December 2019
- British Standard BS 8233:2014 – "Guidance on sound insulation and noise reduction for buildings"
- British Standard BS 4142:2014+A1:2009 – "Methods for rating and assessing industrial and commercial sound"
- ProPG: Planning & Noise – Professional Practice Guidance on Planning & Noise (May 2017)
- ANC Measurement and Assessment of Groundborne Noise and Vibration, 3rd edition, March 2020

National Planning Policy

2.2 Since March 2012 national planning policy has been governed by the National Planning Policy Framework (NPPF). The February 2019 version of the NPPF states:

Paragraph 170
Planning policies and decisions should contribute to and enhance the natural and local environment by:… (e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans;

Paragraph 180
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: a) 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; b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason…

Paragraph 182
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.

2.3 The National Planning Practice Guidance (Updated July 2019) provides the following advice regarding noise:

"Plan-making and decision making need to take account of the acoustic environment and in doing so consider:

- *whether or not a significant adverse effect is occurring or likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur; and*
- *whether or not a good standard of amenity can be achieved.*

In line with the Explanatory note of the Noise Policy Statement for England (NPSE), this would include identifying whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation. As noise is a complex technical issue, it may be appropriate to seek experienced specialist assistance when applying this policy."

2.4 The observed effect levels are defined as follows:

Significant Observed Adverse Effect Level (SOAEL): This is the level of noise exposure above which significant adverse effects on health and quality of life occur.

Lowest Observed Adverse Effect Level (LOAEL): this is the level of noise exposure above which adverse effects on health and quality of life can be detected.

No Observed Effect Level (NOEL): this is the level of noise exposure below which no effect at all on health or quality of life can be detected.

2.5 Although the word 'level' is used here, this does not mean that the effects can only be defined in terms of a single value of noise exposure. In some circumstances adverse effects are defined in terms of a combination of more than one factor such as noise exposure, the number of occurrences of the noise in a given time period, the duration of the noise and the time of day the noise occurs.

2.6 The table shown in Appendix B summarises the noise exposure hierarchy, based on the likely average response of those affected.

Local Authority Requirements

2.7 LBC have two policy documents that refer to noise and vibration:

- LBC Local Plan 2017, CLP
- LBC Planning Guidance – Amenity March 2018, CPGA

2.8 The LBC Local Plan sets out the relevant policy, A4, in relation to noise and vibration impacts and gives guidance in Appendix 3 regarding how to assess those impacts.

2.9 The LBC Planning Guidance – Amenity document gives further background to the assessments and outlines what is expected to be submitted as part of a noise impact assessment report.

2.10 A checklist is linked to in the document but this page no longer appears to exist on the LBC website. We have put together a checklist based on the items listed in paragraph 6.20 to assist the council (see Section 0).

2.11 In terms of assessment levels the CPGA refers back to Appendix 3 in the CLP.

2.12 Policy A4 is as follows:

> **Policy A4 Noise and vibration**
>
> The Council will seek to ensure that noise and vibration is controlled and managed.
>
> Development should have regard to Camden's Noise and Vibration Thresholds (Appendix 3). We will not grant planning permission for:
>
> a. development likely to generate unacceptable noise and vibration impacts; or
> b. development sensitive to noise in locations which experience high levels of noise, unless appropriate attenuation measures can be provided and will not harm the continued operation of existing uses.
>
> We will only grant permission for noise generating development, including any plant and machinery, if it can be operated without causing harm to amenity. We will also seek to minimise the impact on local amenity from deliveries and from the demolition and construction phases of development.

2.13 The following relevant items are taken from Appendix 3 in the CLP.

The significance of noise impact varies dependent on the different noise sources, receptors and times of operation presented for consideration within a planning application. Therefore, Camden's thresholds for noise and vibration evaluate noise impact in terms of various 'effect levels' described in the National Planning Policy Framework and Planning Practice Guidance:

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

Three basic design criteria have been set for proposed developments, these being aimed at guiding applicants as to the degree of detailed consideration needed to be given to noise in any planning application. The design criteria outlined below are defined in the corresponding noise tables. The values will vary depending on the context, type of noise and sensitivity of the receptor:

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

Vibration

Table A: Vibration levels from uses such as railways, roads, leisure and entertainment premises and/or plant or machinery at which planning permission will not normally be granted

Vibration description and location of measurement	Period	Time	Vibration Levels (Vibration Dose Values)
Vibration inside critical areas such as a hospital operating theatre	Day, evening and night	00:00-24:00	0.1 VDV ms-1.75
Vibration inside dwellings	Day and evening	07:00-23:00	0.2 to 0.4 VDV ms-1.75
Vibration inside dwellings	Night	23:00-07:00	0.13 VDV ms-1.75
Vibration inside offices	Day, evening and night	00:00-24:00	0.4 VDV ms-1.75
Vibration inside workshops	Day, evening and night	00:00-24:00	0.8 VDV ms-1.75

Proposed Developments likely to be Sensitive to Noise

Special consideration will need to be given to noise sensitive developments that are proposed in areas which are, or expected to become, subject to levels of noise likely to have an adverse effect. The threshold of acceptability of the noise will primarily depend on two factors: the intended use of the noise sensitive development and the source of the noise experienced, or likely to be experienced.

Table B: Noise levels applicable to noise sensitive residential development proposed in areas of existing noise

Dominant Noise Source	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAEL (Red)
Anonymous noise such as general environmental noise, road traffic and rail traffic ~	Noise at 1 metre from noise sensitive façade/free field	Day	<50dB$L_{Aeq,16hr}$*	50dB to 72dB$L_{Aeq,6hr}$*	>72dB$L_{Aeq,16hr}$*
		Night	<45dB$L_{Aeq,8hr3}$ <40 dB$L_{Aeq,8hr}$**	45dB to 62dB$L_{Aeq,8hr}$* >40dBL_{night}**	>62dB$L_{Aeq,8hrs}$*
	Inside a bedroom	Day	<35dB$L_{Aeq,16hr}$	35dB to 45dB$L_{Aeq,16hr}$	>45dB$L_{Aeq,16hr}$
		Night	<30dB$L_{Aeq,8hr}$ 42dB$L_{Amax,fast}$	30dB to 40dB$L_{Aeq,16hr}$ 40dB to 73dB$L_{Amax,fast}$	>40dB$L_{Aeq,\ 8hr}$ >73dB$L_{Amax,fast}$
	Outdoor living space (free field)	Day	<50dB$L_{Aeq,16hr}$	50dB to 55dB$L_{Aeq,6hr}$	>55dB$L_{Aeq,16hr}$
Non-anonymous noise	See guidance note on non-anonymous noise				

*LAeq, T values specified for outside a bedroom window are façade levels
**Lnight values specified for outside a bedroom window are free field levels

The levels given above are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises. The Council will also take into account the likely times of occupation for types of development and will be amended according to the times of operation of the establishment under consideration.

2.14 Table B appears to contain a typo with regards to maximum noise levels inside a bedroom with the LOAEL greater than the lower limit given in the LOAEL to SOAEL section (42dB vs 40dB).

2.15 ProPG: Planning & Noise – Professional Practice Guidance on Planning & Noise (May 2017) says:

"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"*

2.16 We have used the *typical* maximum noise level criteria of 42dB L_{AFMax} in our assessment as this is consistent with the advice given in the ProPG regarding maximum noise level assessments and the recommended criteria in LBC Local Plan Table B.

Industrial and Commercial Noise Sources

A relevant standard or guidance document should be referenced when determining values for LOAEL and SOAEL for non-anonymous noise. Where appropriate and within the scope of the document it is expected that British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' (BS 4142) will be used. For such cases a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion).

Table C: Noise levels applicable to proposed industrial and commercial developments (including plant and machinery)

Existing Noise sensitive receptor	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings**	Garden used for main amenity (free field) and Outside living or dining or bedroom window (façade)	Day	'Rating level' 10dB* below background	'Rating level' between 9dB below and 5dB above background	'Rating level' greater than 5dB above background
Dwellings**	Outside bedroom window (façade)	Night	'Rating level' 10dB* below background and no events exceeding 57dBL_{Amax}	'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB L_{Amax}	'Rating level' greater than 5dB above background and/or events exceeding 88dBL_{Amax}

*10dB should be increased to 15dB if the noise contains audible tonal elements. (day and night). However, if it can be demonstrated that there is no significant difference in the character of the residual background noise and the specific noise from the proposed development then this reduction may not be required. In addition, a frequency analysis (to include, the use of Noise Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.

**levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises.

Entertainment Noise

Assessments for noise from entertainment and leisure premises must include consideration to amplified and unamplified music, human voices, footfall and vehicle movements and other general activity. Appropriate metrics must be used to measure and assess the noise impact including LAeq and LAmax metrics and appropriate frequency spectrum. Planning permission will not be granted in instances where it is not possible to achieve suitable and sufficient internal noise levels with reference to the most up to date and appropriate guidance within proposed noise sensitive receptors despite appropriate mitigation proposals due to the totality of noise from existing entertainment venues.

Table D: Noise levels applicable to proposed entertainment premises (customer noise)

Noise sensitive receptor	Assess-ment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings	Garden used for amenity (free field)	Day	The higher of 55dB $L_{Aeq,5min}$ Or 10dB below existing $L_{Aeq,5min}$ Without entertainment noise	56dB to 60dB $L_{Aeq,5min}$ Or 9dB to 3dB below existing $L_{Aeq,5min}$ Without entertainment noise	The higher of 61dB $L_{Aeq,5min}$ Or 2dB below existing $L_{Aeq,5min}$ Without entertainment noise
Dwellings	Garden used for amenity (free field)	Evening	The higher of 50dB $L_{Aeq,5min}$ Or 10dB below existing $L_{Aeq,5min}$ Without entertainment noise	51dB to 55dB $L_{Aeq,5min}$ Or 9dB to 3dB below existing $L_{Aeq,5min}$ Without entertainment noise	The higher of 56dB $L_{Aeq,5min}$ Or 2dB below existing $L_{Aeq,5min}$ Without entertainment noise
Dwellings	Garden used for amenity (free field)	Night	The higher of 45dB $L_{Aeq,5min}$ Or 10dB below existing $L_{Aeq,5min}$ Without entertainment noise	46dB to 50dB $L_{Aeq,5min}$ Or 9dB to 3dB below existing $L_{Aeq,5min}$ Without entertainment noise	The higher of 51dB $L_{Aeq,5min}$ Or 2dB below existing $L_{Aeq,5min}$ Without entertainment noise

For entertainment and plant noise rating curves should be measured as a 15 minute linear Leq at the octave band centre frequencies.

Room	Noise rating curve	Design period
Bedrooms	NR25	23:00-07:00hrs
All habitable rooms	NR35	07:00-23:00hrs

Regional Guidance

2.17 The London Plan – March 2016 has the following policy which relates to noise:

POLICY 7.15 REDUCING AND MANAGING NOISE, IMPROVING AND ENHANCING THE ACOUSTIC ENVIRONMENT AND PROMOTING APPROPRIATE SOUNDSCAPES

Strategic

A The transport, spatial and design policies of this plan will be implemented in order to reduce and manage noise to improve health and quality of life and support the objectives of the Mayor's Ambient Noise Strategy.

Planning decisions

B Development proposals should seek to manage noise by:

a avoiding significant adverse noise impacts on health and quality of life as a result of new development;

b mitigating and minimising the existing and potential adverse impacts of noise on, from, within, as a result of, or in the vicinity of new development without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens on existing businesses;

c improving and enhancing the acoustic environment and promoting appropriate soundscapes (including Quiet Areas and spaces of relative tranquillity);

d separating new noise sensitive development from major noise sources (such as road, rail, air transport and some types of industrial development) through the use of distance, screening or internal layout – in preference to sole reliance on sound insulation;

e where it is not possible to achieve separation of noise sensitive development and noise sources, without undue impact on other sustainable development objectives, then any potential adverse effects should be controlled and mitigated through the application of good acoustic design principles;

f having particular regard to the impact of aviation noise on noise sensitive development;

g promoting new technologies and improved practices to reduce noise at source, and on the transmission path from source to receiver.

LDF preparation

C Boroughs and others with relevant responsibilities should have policies to:

a manage the impact of noise through the spatial distribution of noise making and noise sensitive uses;

b identify and nominate new Quiet Areas and protect existing Quiet Areas in line with the procedure in Defra's Noise Action Plan for Agglomerations[1].

1 https://consult.defra.gov.uk/comunications/https-consult-defra-gov-ukenvironmentalnoise/

2.18 The London Plan – Intend to Publish December 2019 has the following policies which relate to noise.

Policy D13 Agent of Change

A The Agent of Change principle places the responsibility for mitigating impacts from existing noise **and other nuisance**-generating activities or uses on the proposed new noise-sensitive development. Boroughs should ensure that Development Plans and planning decisions reflect the Agent of Change principle and take account of existing noise **and other nuisance**-generating uses in a sensitive manner when new development is proposed nearby.

B Development should be designed to ensure that established noise **and other nuisance**-generating **uses** remain viable and can continue or grow without unreasonable restrictions being placed on them.

C New noise and other nuisance-generating development proposed close to residential and other noise-sensitive uses should put in place measures to mitigate and manage any noise impacts for neighbouring residents and businesses.

D Development proposals should manage noise and other potential nuisances by:

1) ensuring good design mitigates and minimises existing and potential nuisances generated by existing uses and activities located in the area

2) exploring mitigation measures early in the design stage, with necessary and appropriate provisions including ongoing and future management of mitigation measures secured through planning obligations

3) separating new noise-sensitive development where possible from existing noise-generating businesses and uses through distance, screening, internal layout, sound-proofing, insulation and other acoustic design measures.

E Boroughs should not normally permit development proposals that have not clearly demonstrated how noise and other nuisances will be mitigated and managed.

Policy D14 Noise

A In order to reduce, manage and mitigate noise to improve health and quality of life, residential and other non-aviation development proposals should manage noise by:

1) avoiding significant adverse noise impacts on health and quality of life

2) reflecting the Agent of Change principle as set out in Policy D13 Agent of Change

3) mitigating and minimising the existing and potential adverse impacts of noise on, from, within, as a result of, or in the vicinity of new development without placing unreasonable restrictions on existing noise-generating uses

4) improving and enhancing the acoustic environment and promoting appropriate soundscapes (including Quiet Areas and spaces of relative tranquillity)

5) separating new noise-sensitive development from major noise sources (such as road, rail, air transport and some types of industrial use) through the use of distance, screening, layout, orientation, uses and materials – in preference to sole reliance on sound insulation

6) where it is not possible to achieve separation of noise-sensitive development and noise sources without undue impact on other sustainable development objectives, then any potential adverse effects should be controlled and mitigated through applying good acoustic design principles

7) promoting new technologies and improved practices to reduce noise at source, and on the transmission path from source to receiver.

B Boroughs, and others with relevant responsibilities, should identify and nominate new Quiet Areas and protect existing Quiet Areas in line with the procedure in Defra's Noise Action Plan for Agglomerations.

2.19 The principles of the London Plan (2016 and 2019) have been incorporated into the LBC local planning policy.

British Standard BS8233:2014

2.20 BS 8233:2014 provides recommendations for the control of noise within buildings. The following table summarises the relevant guidance from this standard which is appropriate to this scheme.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35dB $L_{Aeq,\ 16hour}$	-
Dining	Dining room/area	40dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35dB $L_{Aeq,16hour}$	30dB $L_{Aeq,8hour}$

Table E20062/T1. – Indoor Ambient Noise Level Criteria

2.21 Advice provided by the standard for the noise levels presented in Table 1939/T1 states that:

(i) "*These levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks night or New Year's Eve.*

(ii) "*Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{amax,F}$ depending on the character and number of events per night. Sporadic noise events could require separate values.*

2.22 Additionally, BS 8233:2014 states the following with respect to external amenity areas:

*"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 $L_{Aeq,T}$**, with an upper guideline value of **55 dB $L_{Aeq,T}$** which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable.*

In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited."

2.23 ProPG Figure 2 clarifies the following with respect to maximum noise levels during the night time period:

*"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"*

2.24 This is expanded in more detail in *Appendix A* of *ProPG* which brings together the current research on sleep disturbance.

British Standard BS 4142:2014

2.25 BS 4142:2014 provides the following guidance on determining typical background noise levels.

"The background sound level is an underlying level of sound over a period, T, and might in part be an indication of relative quietness at a given location. It does not reflect the occurrence of transient and/or higher sound level events and is generally governed by continuous or semi-continuous sounds.

In using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods.

Among other considerations, diurnal patterns can have major influence on background sound levels and, for example, the middle of the night can be distinctly different (and potentially of lesser importance) compared to the start or end of the night-time period for sleep purposes. Furthermore, in this general context it can also be necessary to separately assess weekends and weekday periods.

Since the intention is to determine a background sound level in the absence of the specific sound that is under consideration, it is necessary to understand that the background sound level can in some circumstances legitimately include industrial and/or commercial sounds that are present as separate to the specific sound."

2.26 BS 4142:2014 provides the following guidance on the assessment of impacts:

"Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level and consider the following:

a) *Typically the greater this difference, the greater the magnitude of the impact.*

b) *A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.*

c) *A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.*

d) *The lower the rating level is relative to the measured background sound level, the less likely it is that specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.*

NOTE 2 Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."

Re-Radiated Noise from Vibration

2.27 The potential effects of re-radiated noise from vibration on the occupants of the proposed new flats and hotel should be assessed. The threshold for annoyance is generally considered to be lower for re-radiated noise sources where the source cannot be seen, such as with underground trains.

2.28 There is currently no British Standard for the assessment of re-radiated noise from underground trains.

2.29 LBC do not currently have numerical targets for radiated noise from ground-borne vibration but do state in the CPGA 2018 that:

"The implications of noise and vibration should be considered at the beginning of the design process so that the impacts of noise and vibration can be minimised."

2.30 And;

"Vibrations transmitted through the structure of a building can be detected by its occupants and can result in adverse effects. Depending on the timing and the nature of the vibration, occupants may have disturbed sleep or struggle to work efficiently."

2.31 It is clear from these statements and others in the CPGA 2018 that LBC expect to see an assessment of reradiated noise.

2.32 The ANC Measurement and Assessment of Groundborne Noise and Vibration, 3rd edition, March 2020, has collated various targets which have been used around the world.

- London Underground has set a complaint threshold at 40dB L_{Amax}.
- Crossrail in London has set a re-reradiated noise level target of ≤40dB L_{AMax} in the residential properties above the line (although ≤35dB L_{AMax} where this is practicable) and other London boroughs have also set similar targets.
- LBC have previously set a target of ≤35dB L_{Amax} for re-radiated noise levels, however policy A4 no longer gives numerical targets and Appendix 3 in the LBC Local Plan gives guidance only on tactile vibration, VDV.

2.33 We recommend that a target of ≤35dB L_{ASMax} in the flats and hotel is adopted for the proposed scheme where practical with an upper limit of no more than 40dB L_{ASMax}.

2.34 Note that a level of ≤35dB L_{ASMax} does not mean inaudibility, rather, it is reducing the risk of adverse impact and sleep disturbance.

2.35 The current proposed hotel operator, OD Hotel, does not have any specific re-radiated noise requirements that we have been made aware of.

2.36 It is recommended that the operator is confirmed as soon as possible as a more onerous target could require a structural review.

British Standard BS 6472-1:2008

2.37 British Standard BS 6472-1:2008 '*Guide to evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting*' provides thresholds of perception for continuous whole-body vibration:

"Perception thresholds for continuous whole-body vibration vary widely among individuals. Approximately half the people in a typical population, when standing or seated, can perceive a vertical weighted peak acceleration of 0.015 m/s^2. The weighting used is W_b. A quarter of the people would perceive a vibration of 0.01 m/s^2 peak, but the least sensitive quarter would only be able to detect a vibration of 0.02 m/s^2 peak or more. Perception thresholds are slightly higher for vibration duration of less than about 1 s."

2.38 British Standard BS 6472-1:2008 also provides an indication of what vibration levels could produce "adverse comment" from building occupiers based upon the Vibration Dose Value (VDV).

2.39 The VDV is obtained from the root mean quad (RMQ) acceleration, $\left(\int_0^T a(t)dt\right)^{0.25}$, and provides a good correlation with measured dose-response curves for vibration annoyance within buildings. Table S19010/T4 below presents the values of VDV associated with differing levels of "adverse comment" according to this standard.

Place and time	Low probability of adverse comment, ($m/s^{1.75}$)	Adverse comment possible ($m/s^{1.75}$)	Adverse comment probable ($m/s^{1.75}$)
Residential buildings (07:00 – 23:00)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings (23:00 – 07:00)	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Table E20062/T2. – VDV ranges which might result in adverse comment

Hotel Operator Requirements

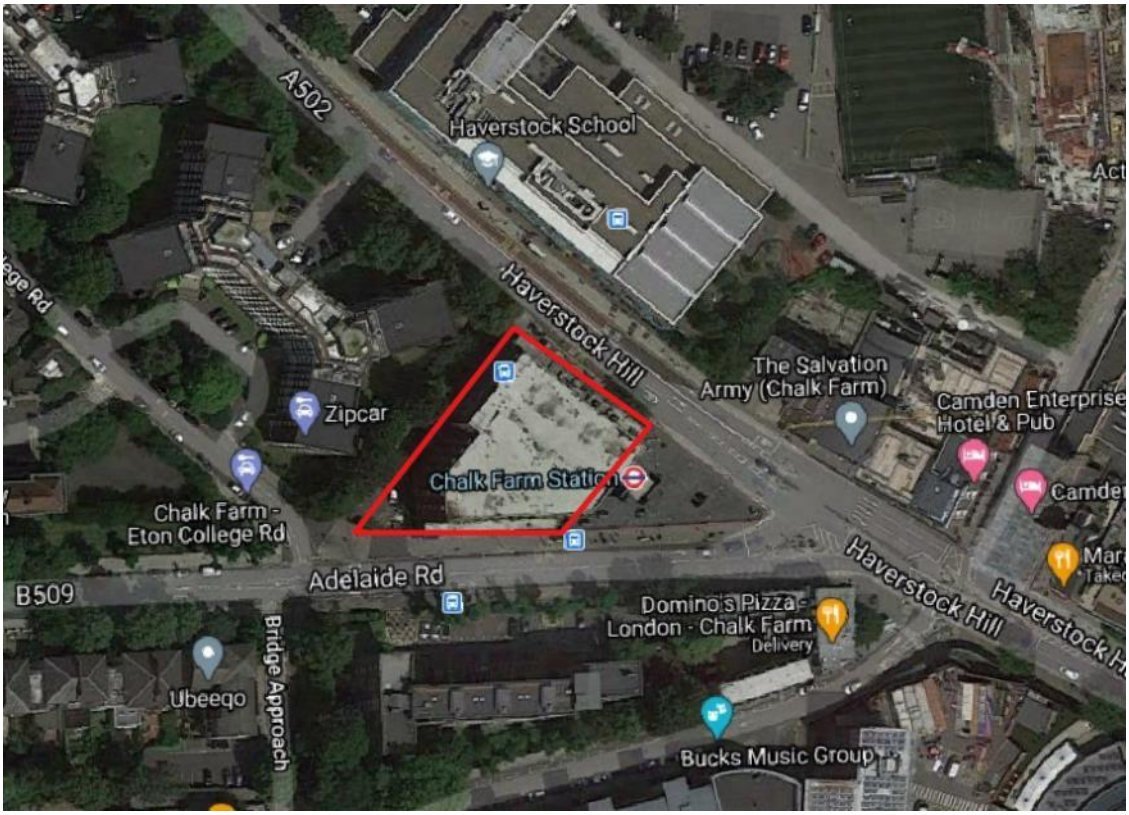
2.40 The current proposed hotel operator does not appear to have any specific acoustic requirements.

2.41 This should be kept under review and once the operator has been confirmed an assessment against the acoustic requirements (if any) would be required to determine if there are more onerous requirements.

3. SITE DESCRIPTION

3.1 The site is located between Haverstock Hill and Adelaide Road immediately behind the Chalk Farm London Underground station.

3.2 The site is currently occupied by a disused car park and associated offices.



The approximate site boundary is shown in red. © Google 2020

3.3 The proposal is for the demolition of the existing building and the erection of a new residential and hotel building.

The immediate area is a mixture of commercial and residential properties; to the south and west there are existing residential flats; to the north is Haverstock School and to the east is Chalk Farm station and several retail premises.

3.4 The London Underground northern line passes immediately to the north east boundary of the site, approximately following the line of Haverstock Hill. The top of the tunnels are approximately 10m below the ground level at this location.

3.5 The reradiated noise from underground trains was clearly audible in the existing building.

3.6 The site sits outside the published noise contours for Heathrow airport but noise from aircraft can be heard.

3.7 However, the traffic noise is dominant in this area so aircraft noise is expected to have a minimal impact on the overall prevailing noise climate.

Prevailing Noise Climate

3.8 The dominant noise source in the surrounding area is road traffic on Haverstock Hill and Adelaide Road both of which are busy local routes with several buses and lorries noted on each road during the survey.

3.9 The traffic flows are likely to have been affected as the measurements were undertaken during the Covid-19 restrictions.

3.10 We discuss the likely impact of the Covid-19 restrictions on the measured noise levels in Section 6. This discussion makes use of available DEFRA noise map data and the previous noise impact assessment undertaken by Sandy Brown for the same site in July 2016.

3.11 Haverstock School was shut for the duration of the survey due to Covid-19 restrictions and there were fewer flights to and from Heathrow airport, although as the road traffic noise dominates in this location this is likely to have a minimal impact on the measured noise levels.

3.12 The nearest noise sensitive buildings have been identified as:

- Eton Place flats to the north west
- Bridge House flats to the south
- Haverstock School to the north east
- 20 Haverstock Hill flats to the east

Agent of Change

3.13 As discussed above the main source of noise in the immediate surrounding area is road traffic noise and there are no other obvious noise generating uses which would fall under the agent of change principle.

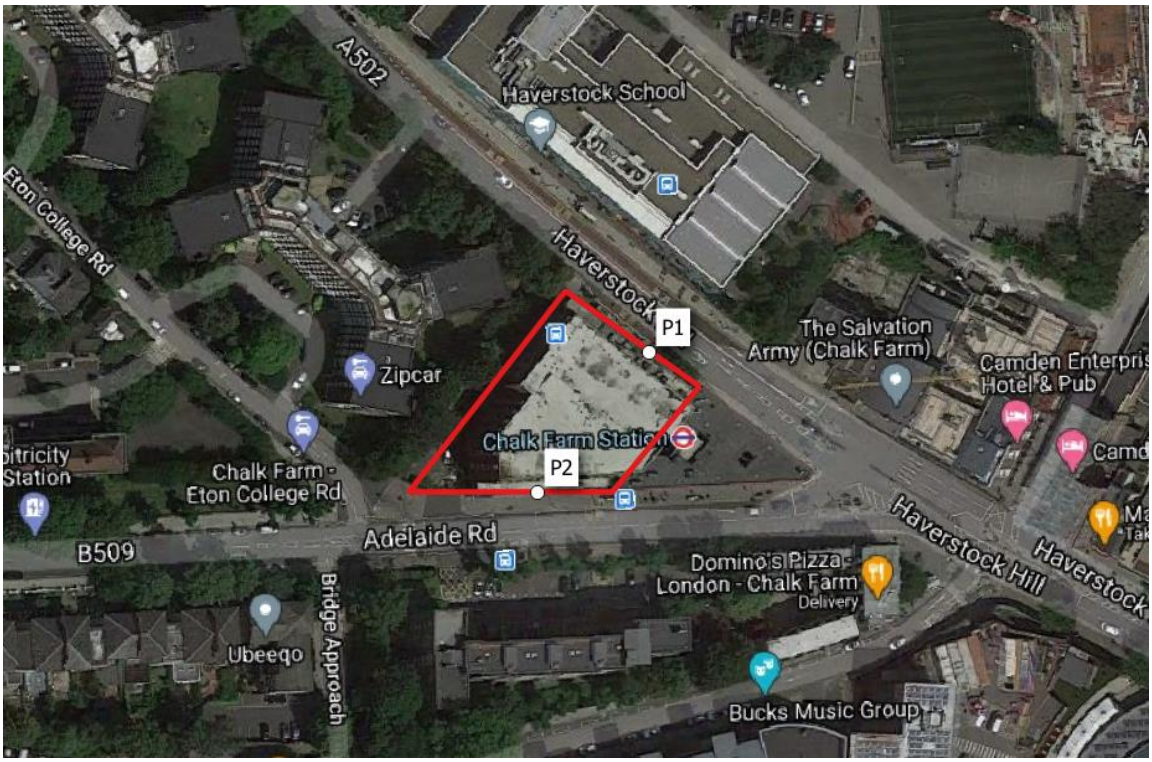
4. MEASUREMENT METHODOLOGY

Noise Measurements

4.1 To obtain daytime and night-time noise levels, automated noise measurements where undertaken at the following locations.

- P1 – Automated continuous survey from Thursday 9th July 2020 to Saturday 11th July 2020;
- P2 – Automated continuous survey from Thursday 9th July 2020 to Monday 13th July 2020;

4.2 The measurement locations are shown on site plan E20062 and described in more detail below.



E20062/SP1 – Site Plan Showing Measurement Locations [© Google 2020]

Position P1 – The microphone was located on the edge of the third floor roof area overlooking Haverstock Hill, 1.5m from local roof level and at least 3m away from any vertical reflecting surfaces. We consider it to be under free-field conditions.

The existing mechanical plant items were not functioning for the duration of survey.

Position P1 – The microphone was located out of the fourth floor window overlooking Adelaide Road at 1m from the façade.

The window was closed as far as possible and we consider it to be under façade conditions.

4.3 The acoustic parameters L_{Aeq}, L_{A90} and $L_{AF,Max}$ were measured in every 15 minutes during the survey along with octave band frequency measurements.

4.4 An audio trigger was set up to allow for retrospective source identification if required.

4.5 A one second time history was also recorded which allows post processing of the results to different measurement time bases if required.

4.6 Survey measurements were carried out in accordance with guidelines laid down in BS 7445:1991 Part 2, BS 5228:2009 Part 1 & 2, and other relevant standards.

4.7 The measurement locations are representative of the noise climate at the nearest noise sensitive receivers.

Equipment and Weather Conditions - Noise

4.8 The equipment used is detailed in Table E20062/T3 below. The sound level meter was fitted with a windshield. A sensitivity check was undertaken on the sound level meters before and after the measurements and the variation was within 0.5dB. Calibration certificates are available on request.

	Equipment			Calibration	
Measurement Location	**Description**	**Manufacturer & Type Number**	**Serial Number**	**Last Date**	**Certificate Number**
P2	Integrating sound level meter	**Cirrus Optimus Green CR:171A**	G061849	27/01/2020	137042
	Microphone	**Cirrus MK224**	210243A	20/01/2020	137044
P1	Integrating sound level meter	**Cirrus Optimus Green CR:171A**	G061843	19/07/2018	262090
	Microphone	**Cirrus MK224**	20045639	12/07/2018[1]	120871
-	Acoustic Calibrator	**Cirrus CR:515**	64545	27/01/2020	137041

Table E20062/T3. – Equipment Details – Noise Survey

4.9 There was no suitable secure location to install our weather station therefore the weather has been reviewed using local publicly available weather station data[2].

4.10 The weather during the survey period, as measured at nearby local weather stations, was mainly dry with some intermittent rainfall and with average wind speeds below 5m/s (11mph).

4.11 As the average wind speed was below 5m/s (11mph) for the survey, we consider the wind to have a minimal effect on the measured noise levels.

4.12 Based on the analysis of the measurements the periods of rainfall did not have a material effect on the measured noise levels.

Attended Vibration Measurements

4.13 Attended vibration measurements were undertaken within the existing building to determine the vibration levels from passing underground trains. The measurements were undertaken on Thursday 9th July and Thursday 16th July 2020.

4.14 Simultaneous noise measurements were also undertaken at each measurement location to assist with calibrating the re-radiated noise model.

Position V1 – The accelerometer was affixed to a metal baseplate which in turn was in contact with the solid ground in this location via three contact points. These contact points were adjusted so that the baseplate and accelerometer were level.

The x-axis was located parallel to the underground tunnels.

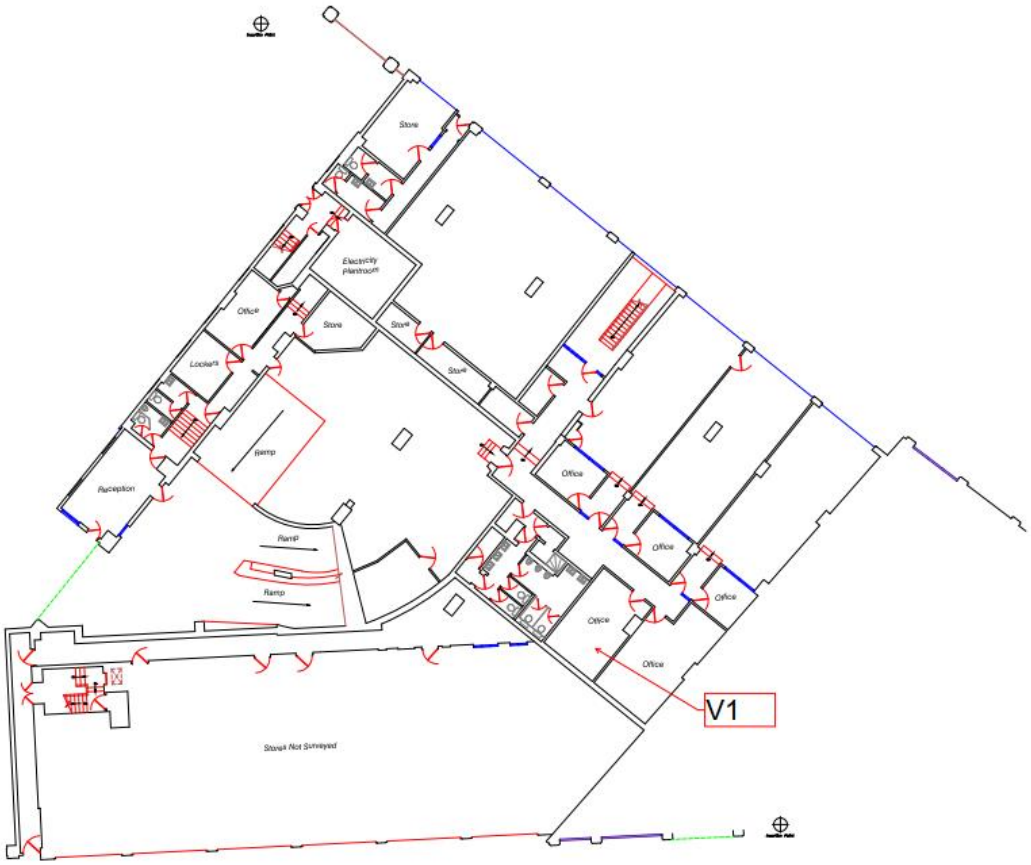
Simultaneous noise measurements were undertaken using the same noise and vibration analyser.

[1] The measurements at location P1 stopped on the 11/07/2020 which is within the calibration period
[2] https://www.wunderground.com/

Position V2 – The accelerometer was affixed to a metal baseplate which in turn was in contact with the solid ground in this location via three contact points. These contact points were adjusted so that the baseplate and accelerometer were level.

The x-axis was located parallel to the underground tunnels.

Simultaneous noise measurements were undertaken using the same noise and vibration analyser.



4.15 At each location measurements of RMS velocity (m/s) and VDV ($m/s^{1.75}$) were undertaken in three axes (X, Y and Z) for each train pass-by during the measurement period.

4.16 A one second buffer of the RMS velocity levels was also recorded in each location for each train pass by. The one second buffer was used to determine the predicted L_{ASMax} from the measured vibration levels.

4.17 A TFL timetable was used to determine the typical number of train pass-bys per day to help calculate the predicted vibration dose value (VDV) for the tactile vibration.

4.18 Re-radiated noise from the passing underground trains was clearly audible at the measurement locations in the existing building.

Equipment - Vibration

4.19 The equipment used is detailed in Table E20062/T4 below. Calibration certificates are available on request.

Equipment			Calibration	
Description	**Manufacturer & Type Number**	**Serial Number**	**Last Date**	**Certificate Reference**
Noise & Vibration analyser	**Svantek SV958**	81188	10/03/2020	No.81188 200310
Microphone	**Microtech Gefell MK 255**	18819	06/03/2020	No.18819 200306
Triaxial Accelerometer	**Svantek SV84**	D4229	08/02/2019	14011722-1
Acoustic Calibrator	**Cirrus CR:515**	64545	27/01/2020	137041

Table E20062/T4. – Equipment Details – Vibration Survey

5. NOISE & VIBRATION MEASUREMENTS

5.1 Tables E20062/T5 present a summary of the noise measurements from the automated survey. The time history charts are appended for reference, E20062 TH1 and TH2.

Location	Time Period, T	$L_{Aeq,T}$ (dB)	*Typical L_{AFMax} (5 min) (dB)	**Typical L_{A90} (15 min) (dB)
P1	07:00-23:00	63	-	55
	23:00-07:00	57	77	40
P2	07:00-23:00	60	-	46
	23:00-07:00	58	78	36

Table E20062/T5. – Automated Measurement Summary

All values are free-field values
*** - Typical L_{AFmax} value is the value not normally exceeded more than 10 times a night**
**** - Visual estimation based on time history chart**

5.2 The summary of the vibration measurements are as follows:

Location	Date & time	X	Y	Z
		VDV [m/s^1.75]	VDV [m/s^1.75]	VDV [m/s^1.75]
V1	16/07/2020 18:47	4.01E-04	3.83E-04	1.32E-02
	16/07/2020 18:49	4.70E-04	9.99E-04	1.16E-02
	16/07/2020 18:50	2.86E-04	6.62E-04	8.78E-03
	16/07/2020 18:50	1.24E-04	1.69E-04	1.37E-03
	16/07/2020 18:52	3.06E-04	6.31E-04	1.06E-02
	16/07/2020 18:54	8.14E-04	9.46E-04	1.02E-02
	16/07/2020 18:54	3.31E-04	7.22E-04	1.03E-02
	16/07/2020 18:55	5.92E-04	3.22E-04	1.15E-03
	16/07/2020 18:55	4.35E-04	9.04E-04	9.01E-03
	16/07/2020 18:56	1.78E-04	2.33E-04	2.24E-03
	16/07/2020 18:58	5.09E-04	1.08E-03	1.13E-02
	16/07/2020 18:59	3.09E-04	6.21E-04	1.04E-02
	16/07/2020 19:01	5.15E-04	1.08E-03	1.28E-02
V2	16/07/2020 17:32	1.08E-02	4.33E-03	5.08E-03
	16/07/2020 17:35	3.04E-04	3.96E-04	5.72E-03
	16/07/2020 17:36	2.17E-04	2.09E-04	4.34E-03
	16/07/2020 17:39	2.80E-04	2.71E-04	4.39E-03
	16/07/2020 17:40	2.46E-04	2.22E-04	4.13E-03
	16/07/2020 17:40	3.09E-04	4.04E-04	6.41E-03
	16/07/2020 17:41	2.31E-04	2.08E-04	1.21E-03
	16/07/2020 17:43	2.00E-04	2.08E-04	4.38E-03
	16/07/2020 17:43	2.93E-04	3.75E-04	6.82E-03
	16/07/2020 17:45	2.37E-04	2.28E-04	4.22E-03
	16/07/2020 17:45	2.51E-04	2.14E-04	2.27E-03
	16/07/2020 17:47	3.37E-04	4.20E-04	7.39E-03

Table E20062/T6. – Summary of Measured VDV

Measurement Location	Date & time	X RMS [m/s]	Y RMS [m/s]	Z RMS [m/s]
V1	09/07/2020 16:16:33	3.88E-06	4.67E-06	1.55E-05
	09/07/2020 16:18:49	3.44E-06	3.37E-06	6.08E-06
	09/07/2020 16:20:01	1.1E-05	7.95E-06	1.16E-05
	09/07/2020 16:22:07	4.94E-06	6.44E-06	6.49E-06
	09/07/2020 16:23:23	8.69E-06	5.11E-06	5.68E-06
	09/07/2020 16:26:15	6E-06	4.26E-06	7.93E-06
	09/07/2020 16:27:41	8.02E-06	7.66E-06	9.78E-06
	09/07/2020 16:29:15	4.44E-06	5.23E-06	5.77E-06
	09/07/2020 16:30:15	3.81E-06	3.8E-06	5.87E-06
	09/07/2020 16:32:21	4.69E-06	6.62E-06	8.23E-06
	09/07/2020 16:35:27	7.41E-06	5.05E-06	9.45E-06
V2	09/07/2020 16:42:17	7.49E-06	1.11E-05	1.66E-05
	09/07/2020 16:45:31	7.34E-06	4.42E-06	8.67E-06
	09/07/2020 16:47:17	7.48E-06	4.38E-06	6.46E-06
	09/07/2020 16:50:21	5.94E-06	4.41E-06	8.15E-06
	09/07/2020 16:53:11	4.94E-06	3.79E-06	1E-05
	09/07/2020 16:53:49	6.72E-06	5.83E-06	9.18E-06
	09/07/2020 16:56:19	8.11E-06	7.5E-06	1.32E-05
	09/07/2020 16:58:19	5.05E-06	6E-06	6.28E-06
	09/07/2020 16:59:08	5.59E-06	5.79E-06	6.28E-06

Table E20062/T7. – Summary of Measured Velocity

6. COVID-19 DISCUSSION

6.1 Some Covid-19 restrictions were still in place at the time of undertaking the noise survey although the most stringent restrictions had started to be relaxed with pubs and restaurants reopening on the 4th July and people were being encouraged to go back to work.

Noise Measurements

6.2 The measurements have been referenced against the DEFRA noise maps[3] and the noise impact assessment undertaken by Sandy Brown[4] for the same site in July 2016 to determine the likely impact from the restrictions that were still in place.

6.3 Our measurement locations were chosen to be as close as possible to the Sandy Brown measurement locations so that a direct comparison can be made.

6.4 The comparison against our measured noise levels is as follows:

Measurement Location	Metric	DEFRA Noise Data, dB	Sandy Brown Measured Noise Levels (2016), dB	Adnitt Measured Noise Levels (2020), dB
P1	$L_{Aeq,\ day}$	65-70	65	63
	$L_{Aeq,\ night}$	55-60	63	57
	$L_{AFMax,Typical\ (night)}$	-	81	77
	$L_{A90,\ day}$	-	55	55
	$L_{A90,\ night}$	-	52	40
P2	$L_{Aeq,\ day}$	-	63	60
	$L_{Aeq,\ night}$	-	61	58
	$L_{AFMax,Typical\ (night)}$	-	84	78
	$L_{A90,\ day}$	-	53	46
	$L_{A90,\ night}$	-	46	35

Table E20062/T8. - Noise Level Comparison

All levels are free-field levels
***Interpreted from the Sandy Brown Data**

6.5 The review of the data indicates that there has been a slight reduction in measured noise levels compared with the Sandy Brown 2016 survey. The biggest difference appears to be during the night-time period with the typical background noise levels much lower in the 2020 survey.

6.6 The measured daytime average noise levels are broadly in line with the DEFRA noise map.

[3] https://www.gov.uk/government/publications/strategic-noise-mapping-2019 [accessed on 21/08/20]
[4] 5-17 Haverstock Hill, London, Noise and vibration planning report, 15436-R01-C, 27 April 2016

6.7 There does not appear to have been any significant changes to the traffic management in the area between the 2016 and 2020 surveys therefore the difference between the measured data is likely to be due to reduced road traffic noise because of the Covid-19 restrictions.

6.8 To allow for the Covid-19 uncertainty we have adjusted our measured noise levels, L_{Aeq} L_{AFMax} to equal the 2016 measured levels.

6.9 The background LA90 levels have been adjusted to half way between the 2016 and 2020 levels as once the restrictions are lifted we expect that the background noise levels will increase.

6.10 The following adjusted noise levels will be used in the assessment.

Location	Time Period, T	$L_{Aeq,T}$ (dB)	*Typical L_{AFMax} (5 min) (dB)	Typical L_{A90} (15 min) (dB)
P1	07:00-23:00	65	-	55
	23:00-07:00	63	81	46
P2	07:00-23:00	63	-	50
	23:00-07:00	61	84	41

Table E20062/T9. – Adjusted Noise Levels Used in Assessment

All values are free-field values
*** - Typical L_{AFmax} value is the value not normally exceeded more than 10 times a night**

6.11 The background LA90 levels have been adjusted to half way between the 2016 and 2020 levels as once the restrictions are lifted we expect that the background noise levels will increase.

Vibration Measurements

6.12 The London Underground services had returned to frequency levels that were similar to the pre-Covid levels with the exception of the night tube services which were still restricted.

6.13 When calculating the re-radiated noise levels maximum noise levels of train pass-bys are assessed which, in any case, would be unaffected by Covid-19 restrictions on the frequency of trains.

6.14 For the tactile vibration assessment, VDV, we have used the current London Underground timetable and also included the night tube operating every 15 minutes in each direction (based on the frequency given on the London Underground website).

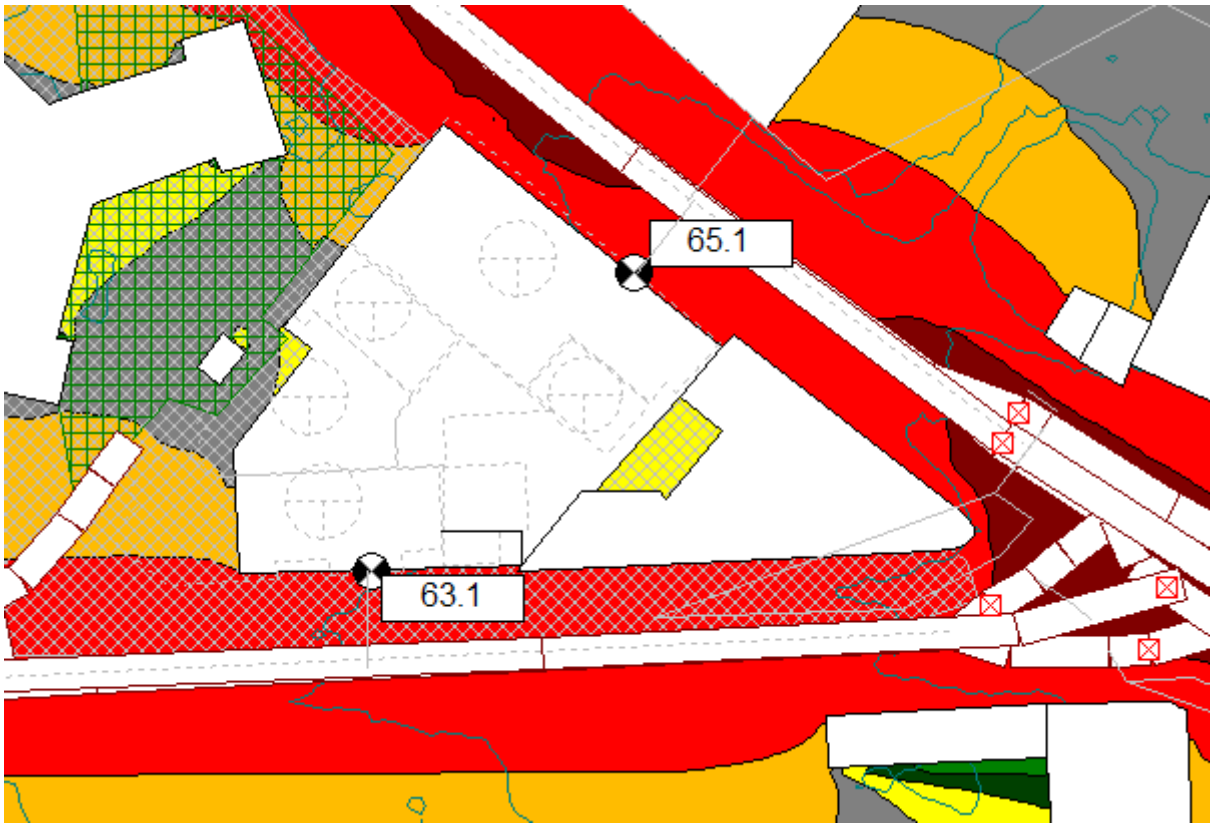
6.15 Therefore the vibration assessment is representative of 'normal' operating conditions.

7. NOISE MODEL

7.1 A 3D noise model has been produced using proprietary software Canda(A) v.2020 to show the propagation around the site.

7.2 The noise model has been adjusted to the measurement noise levels and has been used to assess the predicted sound propagation across the site and assist in determining the likely impact from the various noise sources.

7.3 A snapshot of the model is shown below for reference (existing building during the daytime, $L_{Aeq,T}$ @4m). Detailed noise contour maps have been appended to this report for the different noise sources that have been assessed.



7.4 The following parameters were used in setting up the Cadna(A) model:

- Ground absorption of 0.5;
- All buildings set to partially reflect;
- Order of reflections set to 2;
- Noise sources calibrated to the adjusted levels (see Section 6)
- Open Street Map data has been used for the buildings, road and railways; and
- The plan of the proposed development has been taken from the current proposed site layout

8. PRINCIPLES OF GOOD ACOUSTIC DESIGN

8.1 The advice contained within 'ProPG: Planning & Noise – Professional Practice Guidance on Planning & Noise' can be used when assessing a new development near existing noise sources. ProPG Supplementary Document 2 states the following with respect to Good Acoustic Design:

"In requiring good acoustic design, there is a hierarchy of noise management measures that LPAs should encourage, including the following, in descending order of preference:

(iii) Maximising the spatial separation of noise source(s) and receptor(s).
(iv) Investigating the necessity and feasibility of reducing existing noise levels and relocating existing noise sources.
(v) Using existing topography and existing structures (that are likely to last the expected life of the noise-sensitive scheme) to screen the proposed development site from significant sources of noise.
(vi) Incorporating noise barriers as part of the scheme to screen the proposed development site from significant sources of noise.
(vii) Using the layout of the scheme to reduce noise propagation across the site.
(viii) Using the orientation of buildings to reduce the noise exposure of noise-sensitive rooms.
(ix) Using the building envelope to mitigate noise to acceptable levels."

8.2 The measures for reducing noise exposure listed above have been reviewed and the results presented in the table below.

Reference	Process	Comment
1	Maximising the spatial separation of noise source(s) and receptor(s).	There is limited space on the site and the buildings (residential and hotel) are set back as far as possible from the noise sources.
2	Investigating the necessity and feasibility of reducing existing noise levels and relocating existing noise sources.	The main noise source affecting the site is road traffic. Therefore, it is not feasible to reduce noise levels from the road or moving the noise sources.
3	Using existing topography and existing structures (that are likely to last the expected life of the noise-sensitive scheme) to screen the proposed development site from significant sources of noise.	The noise sources are directly adjacent to the proposed building (residential and hotel) and the site is relatively flat – therefore this cannot be implemented.
4	Incorporating noise barriers as part of the scheme to screen the proposed development site from significant sources of noise.	The height of the building (residential and hotel) makes noise barriers impractical.
5	Using the layout of the scheme to reduce noise propagation across the site.	The internal courtyard area provides some screening for the rooms on these facades (residential and hotel bedrooms)
6	Using the orientation of buildings to reduce the noise exposure of noise-sensitive rooms.	For the dual aspect flats in the residential block the bedrooms have been located towards the courtyard area or on the quieter facades. The hotel bedrooms are single aspect and on all sides of the development so the orientation of the building will have a limited effect here.
7	Using the building envelope to mitigate noise to acceptable levels	An assessment and feasibility study has been carried out for the acoustic performance requirements of the façades in the development (residential flats and hotel bedrooms) using the guidance in BS 8233:2014 as a reference.

Table E20062/T10. – Good Acoustic Design considerations

9. EXTERNAL NOISE LEVEL ASSESSMENT

9.1 As part of the noise impact assessment LBC have provided some guidance on external noise levels which have been categorised in to LOAELS and SOAELS.

Table B: Noise levels applicable to noise sensitive residential development proposed in areas of existing noise

Dominant Noise Source	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAEL (Red)
Anonymous noise such as general environmental noise, road traffic and rail traffic ~	Noise at 1 metre from noise sensitive façade/free field	Day	<50dB$L_{Aeq,16hr}$*	50dB to 72dB$L_{Aeq,6hr}$*	>72dB$L_{Aeq,16hr}$*
		Night	<45dB$L_{Aeq,8hr3}$ <40 dB$L_{Aeq,8hr}$**	45dB to 62dB$L_{Aeq,8hr}$* >40dBL_{night}**	>62dB$L_{Aeq,8hrs}$*
	Inside a bedroom	Day	<35dB$L_{Aeq,16hr}$	35dB to 45dB$L_{Aeq,16hr}$	>45dB$L_{Aeq,16hr}$
		Night	<30dB$L_{Aeq,8hr}$ 42dB$L_{Amax,fast}$	30dB to 40dB$L_{Aeq,16hr}$ 40dB to 73dB$L_{Amax,fast}$	>40dB$L_{Aeq,\ 8hr}$ >73dB$L_{Amax,fast}$
	Outdoor living space (free field)	Day	<50dB$L_{Aeq,16hr}$	50dB to 55dB$L_{Aeq,6hr}$	>55dB$L_{Aeq,16hr}$
Non-anonymous noise	See guidance note on non-anonymous noise				

*LAeq, T values specified for outside a bedroom window are façade levels
**Lnight values specified for outside a bedroom window are free field levels

9.2 The following table summarises the adjusted external noise levels against the LBC criteria given in Table B.

Location	Time Period, T	$L_{Aeq,T}$ (dB)	LBC Criteria
P1 (Haverstock Hill)	07:00-23:00 (façade)	68	Amber
	23:00-07:00 (façade)	66	Amber/Red
	23:00-07:00 (free-field)	63	
P2 (Adelaide Road)	07:00-23:00 (façade)	66	Amber
	23:00-07:00 (façade)	64	Amber/Red
	23:00-07:00 (free-field)	61	

Table E20062/T11. – External Noise Levels Against the LBC Criteria

9.3 The external noise levels at 1m from the facade are in the LBC amber and amber/red categories based on Table B. A further assessment of the internal ambient noise levels is required to confirm the mitigation measures for the façade of both the hotel and residential buildings (see Section 10).

9.4 The external amenity areas are assessed in Section 11.

10. EXTERNAL BUILDING FABRIC ASSESSMENT

10.1 An assessment of the required acoustic performance for the external building fabric of the proposed buildings has been undertaken using the methodology provided in Annex G of British Standard BS 8233:2014 "Guidance on Sound Insulation and Noise Reduction in Buildings" to assess the impact from the surrounding road and rail noise impacting on the site.

10.2 Table E20062/T12 below shows the acoustic criteria used during the assessment from BS 8233:2014 "Guidance on Sound Insulation and Noise Reduction in Buildings", WHO "Guidelines for Community Noise" and Table B in the LBC Local Plan 2017

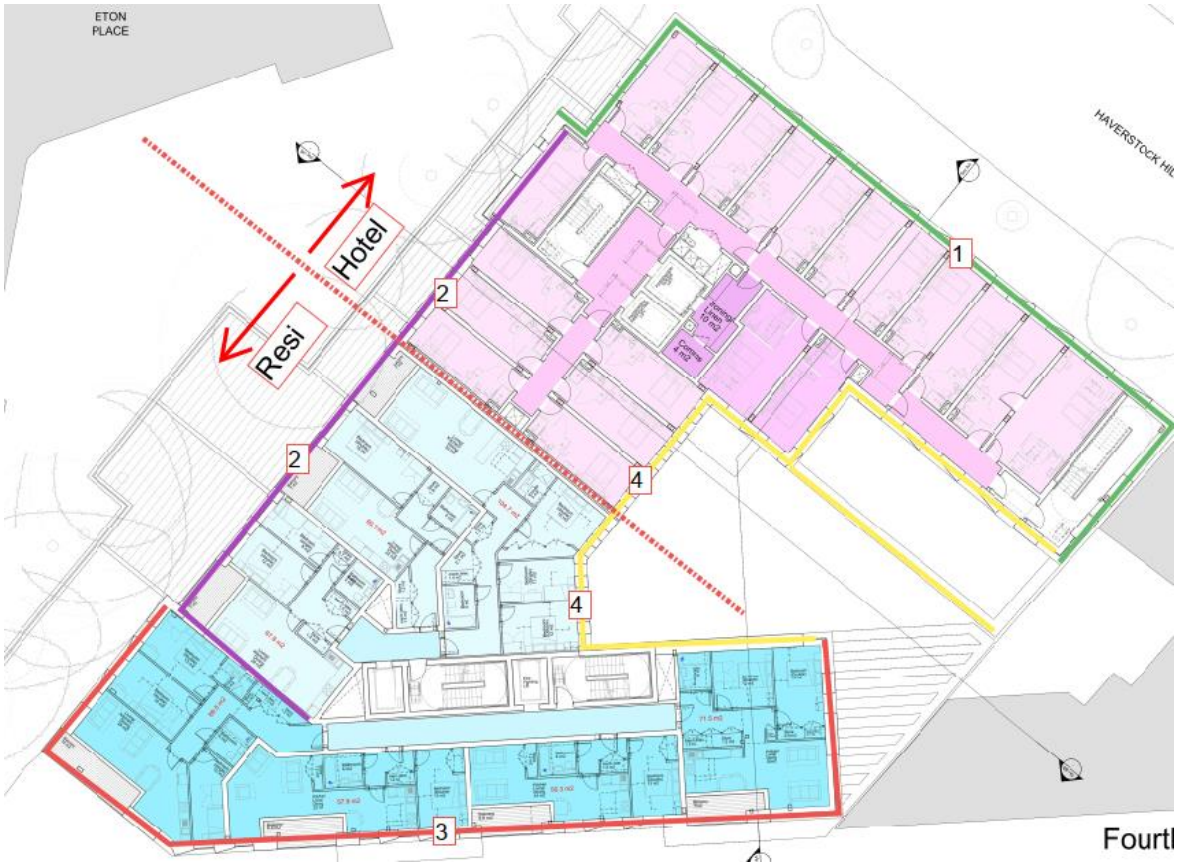
Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35dB $L_{Aeq,\ 16hour}$	-
Dining	Dining room/area	40dB $L_{Aeq,16hour}$	-
Sleeping (or daytime resting)	Bedroom	35dB $L_{Aeq,16hour}$	30dB $L_{Aeq,8hour}$ 42dB $L_{AFMax,\ Typical}$ [1]

Table E20062/T12. – Indoor Ambient Noise Level Criteria

[1]**The L_{AFMax} criteria for the typical L_{AFMax} noise levels is based on 5 minute data in this assessment**

10.3 The assessment noise levels presented in table E20062/T13 below have been derived from the measured noise data and the output of calibrated Cadna(A) model and we consider them to be representative of the prevailing noise climate at the proposed building facades.

10.4 The development has been split into the following facades as part of the assessment:



10.5 The noise levels used in the external building fabric assessment are as follows:

Façade Location	Time Period, T	Parameter	Broadband Level (dBA)	Octave Band Sound Levels (dB)				
				125Hz	250Hz	500Hz	1kHz	2kHz
1 (Haverstock Hill)	Daytime (07:00 – 23:00)	$L_{eq,T}$	66	70	62	61	63	60
	Night-time (23:00 – 07:00)	$L_{eq,T}$	64	61	61	59	60	57
		$L_{AFMax, Typical}$	82	77	83	75	79	75
2 (facing Eton Place)	Daytime (07:00 – 23:00)	$L_{eq,T}$	56	60	52	51	53	50
	Night-time (23:00 – 07:00)	$L_{eq,T}$	54	51	51	49	50	47
		$L_{AFMax, Typical}$	72	67	73	65	69	65
3 (Adelaide Road and Courtyard)*	Daytime (07:00 – 23:00)	$L_{eq,T}$	64	61	59	58	60	59
	Night-time (23:00 – 07:00)	$L_{eq,T}$	62	58	59	56	59	57
		$L_{AFMax, Typical}$	85	83	79	79	82	78
4 (Courtyard)*	Daytime (07:00 – 23:00)	$L_{eq,T}$	52	49	47	46	48	47
	Night-time (23:00 – 07:00)	$L_{eq,T}$	50	46	47	44	47	45
		$L_{AFMax, Typical}$	75	73	69	69	72	68

Table E20062/T13. - Noise Levels Used in External Building Fabric Assessment

All values presented are free-field values
***This does not include customer noise from the proposed courtyard area associated with the hotel. This is assessed in section 13.**

10.6 The following assumptions have been used in the façade assessment.

Assumption	New Residential
Room Finishes	Plasterboard ceiling; Plasterboard walls; Soft floor finish within the bedrooms, i.e. carpet; and Hard floor finish with the living rooms.
Ventilation	The current design is based on MVHR ventilation in both the Hotel and Residential blocks which has been confirmed by the MEP engineers. No through wall/window trickle vents have been allowed for. Suitable in-duct attenuation for the MVHR ductwork will be required and should be allowed for at this stage.
Room/Window Sizes	Indicative areas have been taken from the most up to date planning drawings at the time of writing this report. We have assumed that the windows will be 60% of the external façade area for each room.
External Façade (non-glazed sections)	We have assumed that this will be either a cavity masonry construction: or a typical lightweight Steel Frame System (SFS) with the internal section consisting of 1x12mm cement particle board, 150mm SFS stud with 150mm mineral wool insulation (33-45Kg/m^3), 2x12.5mm fireline boards, or equal and approved. Exact specification to be determined during the design process.

Table E20062/T14.– List of Assumptions – New Residential

10.7 The performance requirements for the external façade are presented below along with associated indicative constructions.

Façade	Element	Single Figure Value		Indicative Construction Only (does not form part of the specification)[1]	Predicted Internal Noise Levels	LBC Category
1 (Haverstock Hill)	Glazing and frame (Hotel Bedroom)	46dB R_w	40dB $R_w + C_{tr}$	12mmVSG/16mm/8mmVSG in a suitable frame or equal and approved	Daytime (Hotel Bedroom): 30dB $L_{Aeq,16hr}$ Night Time (Hotel Bedroom): <25dB $L_{Aeq,8hr}$; & <41dB $L_{AFMax,typical}$	Green
	External Wall	55dB R_w	-	Traditional cavity masonry construction; or; A lightweight Steel Frame System with 1x12mm cement particle board, 150mm SFS stud with 150mm mineral wool insulation (33-45Kg/m^3), 2x12.5mm fireline boards or equal and approved.		
	Ventilation	-	-	MVHR with suitable in-duct attenuator		
2 (facing Eton Place)	Glazing and frame (Hotel Bedroom)	38dB R_w	32dB $R_w + C_{tr}$	8.8mm Laminated Pane/ 16mm Air/ 8mm Pane in a suitable frame or equal and approved	Daytime (Living Room): <30dB $L_{Aeq,16hr}$ Night Time (Residential and Hotel Bedrooms): <25dB $L_{Aeq,8hr}$; & <41dB $L_{AFMax,typical}$	Green
	Glazing and frame (Residential Bedroom)	38dB R_w	32dB $R_w + C_{tr}$	8.8mm Laminated Pane/ 16mm Air/ 8mm Pane in a suitable frame or equal and approved		
	Glazing and frame (Residential Living Room)	30dB R_w	22dB $R_w + C_{tr}$	4mm Pane /12mm Air/ 6mm Pane in a suitable frame or equal and approved		
	External Wall	55dB R_w	-	Traditional cavity masonry construction; or; A lightweight Steel Frame System with 1x12mm cement particle board, 150mm SFS stud with 150mm mineral wool insulation (33-45Kg/m^3), 2x12.5mm fireline boards or equal and approved.		
	Ventilation	-	-	MVHR with suitable in-duct attenuator		
3 (Adelaide Road and Courtyard)	Glazing and frame (Residential Bedroom)*	50dB R_w	43dB $R_w + C_{tr}$	Secondary glazing system consisting of double gazed unit with one 6mm primary pane, 150mm air gap with 3x acoustic reveal liners, 8.8m acoustic laminated pane in a suitable framing system, or equal and approved	Daytime (Living Room): <30dB $L_{Aeq,16hr}$ Night Time (Bedroom): <25dB $L_{Aeq,8hr}$; & <42dB $L_{AFMax,typical}$	Green
	Glazing and frame (Residential Living Room)	38dB R_w	32dB $R_w + C_{tr}$	8.8mm Laminated Pane/ 16mm Air/ 8mm Pane in a suitable frame or equal and approved		
	External Wall	55dB R_w	-	Traditional cavity masonry construction; or; A lightweight Steel Frame System with 1x12mm cement particle board, 150mm SFS stud with 150mm mineral wool insulation (33-45Kg/m^3), 2x12.5mm fireline boards or equal and approved.		
	Ventilation	-	-	MVHR with suitable in-duct attenuator		
	Ventilator (Living Room)	44dB D_{new}	-	DucoMax Corto 10 trickle vent or equal and approved (1 per room)		

Façade	Element	Single Figure Value		Indicative Construction Only (does not form part of the specification)[1]	Predicted Internal Noise Levels	LBC Category
4 (Courtyard)	Glazing and frame (Hotel Bedroom)*	50dB R_w	43dB $R_w + C_{tr}$	Secondary glazing system consisting of double gazed unit with one 6mm primary pane, 150mm air gap with 3x acoustic reveal liners, 8.8m acoustic laminated pane in a suitable framing system, or equal and approved	Daytime (Living Room): <30dB $L_{Aeq,16hr}$ Night Time (Bedroom): <25dB $L_{Aeq,8hr}$; & <42dB $L_{AFMax,typical}$	Green
	Glazing and frame (Residential Bedroom)*	50dB R_w	43dB $R_w + C_{tr}$	Secondary glazing system consisting of double gazed unit with one 6mm primary pane, 150mm air gap with 3x acoustic reveal liners, 8.8m acoustic laminated pane in a suitable framing system, or equal and approved		
	Glazing and frame (Residential Living Room)	30dB R_w	22dB $R_w + C_{tr}$	4mm Pane /12mm Air/ 6mm Pane in a suitable frame or equal and approved		
	External Wall	55dB R_w	-	Traditional cavity masonry construction; or; A lightweight Steel Frame System with 1x12mm cement particle board, 150mm SFS stud with 150mm mineral wool insulation (33-45Kg/m^3), 2x12.5mm fireline boards or equal and approved.		
	Ventilation	-	-	MVHR with suitable in-duct attenuator		

Table E20062/T15. – Sound Reductions of Façade Elements – New Residential

Please note that the construction elements above are required to meet both the Rw and Rw + Ctr values.

[1]The indicative constructions *do not* form part of the specification and are provided here for guidance only. It is the acoustic performance only that is specified.

*** Secondary glazing is recommended in the courtyard area for the two bedrooms in the end flats overlooking the hotel courtyard and the hotel bedrooms in this area. Please see the detailed discussion in Section 13.**

10.8 The façade mitigation measures above have been specified to achieve the 'green' LBC internal ambient noise level categories.

10.9 Note that it is the acoustic performance that is specified, **and any given construction is indicative only**. Approval of constructions will be subject to provision of suitable independently verified acoustic performance test data, including all opening windows, window frames, doors, and ventilation elements.

10.10 Please note that other façade and ventilation options/configurations could be used to achieve the indoor ambient noise level criteria. If the acoustic performance of the final confirmed façade elements differs from the performance provided in this report an assessment carried out by a suitably qualified acoustic consultant (as defined in BREEAM) must be provided to show the predicted indoor ambient noise levels achieve the values stated in Table E20062/T12.

10.11 The predicted indoor ambient noise levels are required to show compliance with the requirements of the Local Authority and not the performance of the façade elements alone.

Summertime Overheating - Residential

10.12 Based on the measured external noise levels some areas of the residential building may require alternative overheating ventilation strategies to openable windows.

10.13 We have undertaken a Level 2 assessment of internal ambient noise levels from the *Acoustics Ventilation and Overheating: Residential Design Guide January 2020, AVO Guide*.

10.14 This assessment is intended to assess the risk of internal ambient noise levels during periods of overheating.

10.15 The approach of the Design Guide is to trade off internal noise level during a potential over-heating event against the frequency of predicted over-heating occurring.

i. When frequent over-heating is predicted, a noise criterion relaxation of 5 dBA is proposed based on the BS8233 note 7 to Table 4 for reasonable internal conditions;

ii. When predicted over-heating is infrequent, internal noise criteria could be higher subject to a maximum value that should not be exceeded;

iii. This approach and the advice below are subject to agreement with the Local Authority.

10.16 We have looked at the three main residential facades and the predicted internal ambient noise levels with openable windows. The internal ambient noise levels have then been compared against Table 3-3 and Figure 3-2 in the AVO Guide and a risk determined for each area.

Facade	Time Period,T	Measurement Metric	External Noise Level, dB	Partially Open Window Reduction, dB	Internal Noise Level, dB	LBC Category	Comments
Façade 2 Residential (facing Eton Place)	Day	$L_{Aeq,T}$	54	-13	41	Amber	Using open windows to mitigate against overheating could be acceptable on this façade provided the number of overheating days per year is low.
	Night	$L_{Aeq,T}$	52	-13	39	Amber	
		$L_{AFMax,\ Typical}$	72	-13	59	Amber	
Façade 3 Residential (Adelaide Road and Courtyard)	Day	$L_{Aeq,T}$	64	-13	51	Red	Alternative to open windows to control overheating is predicted to be required. See the discussion below
	Night	$L_{Aeq,T}$	62	-13	49	Red	
		$L_{AFMax,\ Typical}$	85	-13	72	Amber	
Façade 4 Residential (Courtyard)	Day	$L_{Aeq,T}$	57*	-13	44	Amber	Using open windows to mitigate against overheating could be acceptable on this façade provided the number of overheating days per year is low.
	Night	$L_{Aeq,T}$	50	-13	37	Amber	
		$L_{AFMax,\ Typical}$	67	-13	54	Amber	

Table E20062/T16. – Overheating Level 2 Risk Assessment

*predicted noise level from the use of the proposed courtyard

10.17 Using open windows to mitigate against overheating could be acceptable on Façade 2 and Façade 4 provided the number of overheating days per year is low and the Local Authority agrees this approach.

10.18 The assessment indicates that an alternative means of cooling to openable windows is required on residential façade 3 (Adelaide Road) during the daytime and night-time.

10.19 The proposed overheating mitigation has not yet been finalised. The following options are to be explored during the detailed design phase:

- Natural ventilation options other than open windows – e.g. through wall vents with acoustic attenuation or acoustic louvres behind window vents; or
- A tempered MVHR system – e.g. adding a small level of cold air to the already proposed MVHR system to reduce the overall levels; or
- Full mechanical cooling.

10.20 The predicted sound reduction required on façade 3 is at least 22dBA between outside and inside provided that overheating is limited to a handful of days per year. If the number of overheating days is much larger than this, then mechanical cooling is likely to be required (tempered MVHR or full mechanical cooling).

10.21 The 22dBA reduction may be able to be achieved with a natural ventilation design involving acoustic louvres or ventilators in the external façade. Note that the required reduction is on the upper practical limit for these types of natural ventilation solutions given the areas that are required.

10.22 'Plenum windows' could be investigated however the current level of testing and use of this type of system is low and would require significant design input and likely require a bespoke design.

10.23 Openable windows for short term purge ventilation should be acceptable from an acoustic point of view.

Summertime Overheating - Hotel

10.24 The current proposal is for mechanical cooling for the hotel so there is no increased risk of noise break-in during overheating events (LBC 'green').

11. EXTERNAL AMENITY AREAS

11.1 LBC have the following recommended noise levels for external amenity areas:

Table B: Noise levels applicable to noise sensitive residential development proposed in areas of existing noise

Dominant Noise Source	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAEL (Red)
Anonymous noise such as general environmental noise, road traffic and rail traffic ~	Noise at 1 metre from noise sensitive façade/free field	Day	<50dB$L_{Aeq,16hr}$*	50dB to 72dB$L_{Aeq,6hr}$*	>72dB$L_{Aeq,16hr}$*
		Night	<45dB$L_{Aeq,8hr3}$ <40 dB$L_{Aeq,8hr}$**	45dB to 62dB$L_{Aeq,8hr}$* >40dBL_{night}**	>62dB$L_{Aeq,8hrs}$*
	Inside a bedroom	Day	<35dB$L_{Aeq,16hr}$	35dB to 45dB$L_{Aeq,16hr}$	>45dB$L_{Aeq,16hr}$
		Night	<30dB$L_{Aeq,8hr}$ 42dB$L_{Amax,fast}$	30dB to 40dB$L_{Aeq,16hr}$ 40dB to 73dB$L_{Amax,fast}$	>40dB$L_{Aeq,\ 8hr}$ >73dB$L_{Amax,fast}$
	Outdoor living space (free field)	Day	<50dB$L_{Aeq,16hr}$	50dB to 55dB$L_{Aeq,6hr}$	>55dB$L_{Aeq,16hr}$
Non-anonymous noise	See guidance note on non-anonymous noise				

*LAeq, T values specified for outside a bedroom window are façade levels
**Lnight values specified for outside a bedroom window are free field levels

11.2 The current proposal shows balcony areas on all facades of the residential building. The daytime noise levels for the balcony areas on the south façade (four balconies including the corner balconies) overlooking Adelaide Rd are greater than 55dB $L_{Aeq,daytime}$.

11.3 This puts the areas into the 'Red' category so further mitigation is recommended by LBC.

11.4 The following guidance is provided on External Amenity Areas (ProPG Stage 2: Element 3-External Amenity Area Noise Assessment):

"Where, despite following a good acoustic design process, significant adverse noise impacts remain on any private external amenity space (e.g. garden or balcony) then that impact may be partially off-set if the residents are provided, through the design of the development or the planning process, with access to:

- *a relatively quiet facade (containing openable windows to habitable rooms) or a relatively quiet externally ventilated space (i.e. an enclosed balcony) as part of their dwelling; and/or*
- *a relatively quiet alternative or additional external amenity space for sole use by a household, (e.g. a garden, roof garden or large open balcony in a different, protected, location); and/or*
- *a relatively quiet, protected, nearby, external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings; and/or*
- *a relatively quiet, protected, publicly accessible, external amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance). The local planning authority could link such*

provision to the definition and management of Quiet Areas under the Environmental Noise Regulations."

11.5 The proposal for the development is to provide a rooftop amenity area for the residents.

11.6 The predicted noise levels on the rooftop are <50dB $L_{Aeq,T}$ which is below the lower threshold in BS 8233:2014 and is in the LBC 'green' category.

11.7 The approach is consistent with options 2 and 3 given in the ProPG.

12. MECHANICAL PLANT

12.1 At the time of this report the final location and selection of mechanical plant items has not been confirmed.

12.2 The cumulative mechanical plant noise emission limits at nearby noise sensitive premises are provided below based on the guidance in BS4142:2014 and LBC Local Policy 2017.

12.3 The proposed cumulative mechanical plant equipment noise emission limits are based on the typical adjusted daytime and night-time background sound levels described in Table E20062/T9 in Section 6 and apply at 1m from the nearest noise sensitive premises other than the development itself.

Noise Sensitive Location	Measurement Period	Typical[5] Background Sound Level (Free-field)	**'Green'** Cumulative Mechanical Plant Noise Criteria (BS4142:2014 Rating Level)*	'Amber' Cumulative Mechanical Plant Noise Criteria (BS4142:2014 Rating Level)
Eton Place flats to the north west & 20 Haverstock Hill flats to the east	Daytime (07:00 – 23:00)	55 dB $L_{A90,15min}$	≤45 dB $L_{Ar,Tr}$	46 dB $L_{Ar,Tr}$ - 60 dB $L_{Ar,Tr}$
	Night-time (23:00 – 07:00)	46 dB $L_{A90,15min}$	≤36 dB $L_{Ar,Tr}$	37 dB $L_{Ar,Tr}$ - 51 dB $L_{Ar,Tr}$
Bridge House flats to the south	Daytime (07:00 – 23:00)	50 dB $L_{A90,15min}$	≤40 dB $L_{Ar,Tr}$	41 dB $L_{Ar,Tr}$ - 55 dB $L_{Ar,Tr}$
	Night-time (23:00 – 07:00)	41 dB $L_{A90,15min}$	≤31 dB $L_{Ar,Tr}$	32 dB $L_{Ar,Tr}$ - 46 dB $L_{Ar,Tr}$
Haverstock School	Daytime (07:00 – 23:00)	55 dB $L_{A90,15min}$	≤45 dB $L_{Ar,Tr}$	46 dB $L_{Ar,Tr}$ - 60 dB $L_{Ar,Tr}$

Table E20062/T17. – Mechanical Plant Noise Emission Criteria

This is a cumulative noise limit for ALL fixed mechanical plant equipment associated with the new development

***LBC say that the reduction should be increased to 15dB if the noise contains audible tonal elements and an NR assessment may be required for sources with significant tones or low frequency content.**

12.4 The night-time noise limits are onerous and will likely require mitigation measures such as, but not limited to, acoustic attenuators, quieter fans/set back limits and noise barriers.

12.5 If the 'green' noise limits cannot be met with mitigation measures, then it may be acceptable to use the 'amber' noise limits with agreement from LBC.

12.6 For context, BS4142:2014 states that:

"Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."

[5] The typical background sound levels have been taken from the adjusted levels described in Table E20062/T9 in Section 6

13. NEW COMMERCIAL ASSESSMENT

13.1 There is a retail unit, ground floor, and café, ground floor and first floor, proposed for the residential building and a bar/restaurant area operated by or under licence from the hotel on the ground floor of the hotel building.

13.2 At the time of writing this report the tenants of the retail units have not been confirmed.

New Commercial to New Residential

13.3 The minimum sound insulation requirements between the new retail units to the new residential units above are covered under the building regulations. This sets out a minimum airborne sound insulation requirement of 45dB $D_{ntw} + C_{tr}$

13.4 This is a minimum standard, however, and we recommend the following uplifted requirements are targeted:

Commercial Use	Separating Floor/Wall Sound Insulation Minimum Building Regulations Requirement	Separating Floor Sound Insulation Recommended Uplifted Target
Retail/Cafe (background music only and open during the daytime only)	≥45dB $D_{ntw} + C_{tr}$	≥55dB $D_{ntw} + C_{tr}$

Table E20062/T18.- Proposed Separating Floor Sound Insulation Requirements

13.5 In conjunction with the sound insulation requirements the following music noise limits from the retail/cafe units apply in the residential units and these should be written into the tenant lease:

Time Period	$L_{eq,5mins}$, dB		
	31.5Hz	63Hz	125Hz
07:00-23:00*	65	47	41

Table E20062/T19.- Proposed Low Frequency Music Noise Limits[6]

***We have assumed that the retail units will only be open during the daytime period. Music is not recommended to be played during the night time period, 23:00-07:00.**
Speakers should not be mounted directly to the separating floor/ceiling as this is likely to reduce the effectiveness of the sound insulation treatment.

New Hotel courtyard

13.6 A courtyard is proposed at the entrance to the hotel on Adelaide street. The intended use of the space is as a break-out space from the hotel lobby and restaurant/bar area and seating areas are shown on the current plans.

13.7 This is immediately below and next to the new residential block.

[6] This is based on guidance in the 'Procedure for the assessment of low frequency noise disturbance', Moorhouse et al, University of Salford, 2005.

13.8 The noise levels expected from the use of the space have been modelled in proprietary software Cadna(A) using a sound power level of a raised and normal voice taken from 'Noise Control in Building Services – SRL'.

Source	Broadband Level (dBA)	Octave Band Sound Power Levels (dB)				
		125Hz	250Hz	500Hz	1kHz	2kHz
Raised Voice (per person)	78	67	70	74	75	70
Normal Voice (per person)	71	57	61	64	68	65

Table E20062/T20. – Voice Sound Power Levels

13.9 For a typical situation we have assumed that the courtyard is close to full with 28 people, half with raised voices, half with normal voices and over the course of a daytime period an 'on time' of 50%.

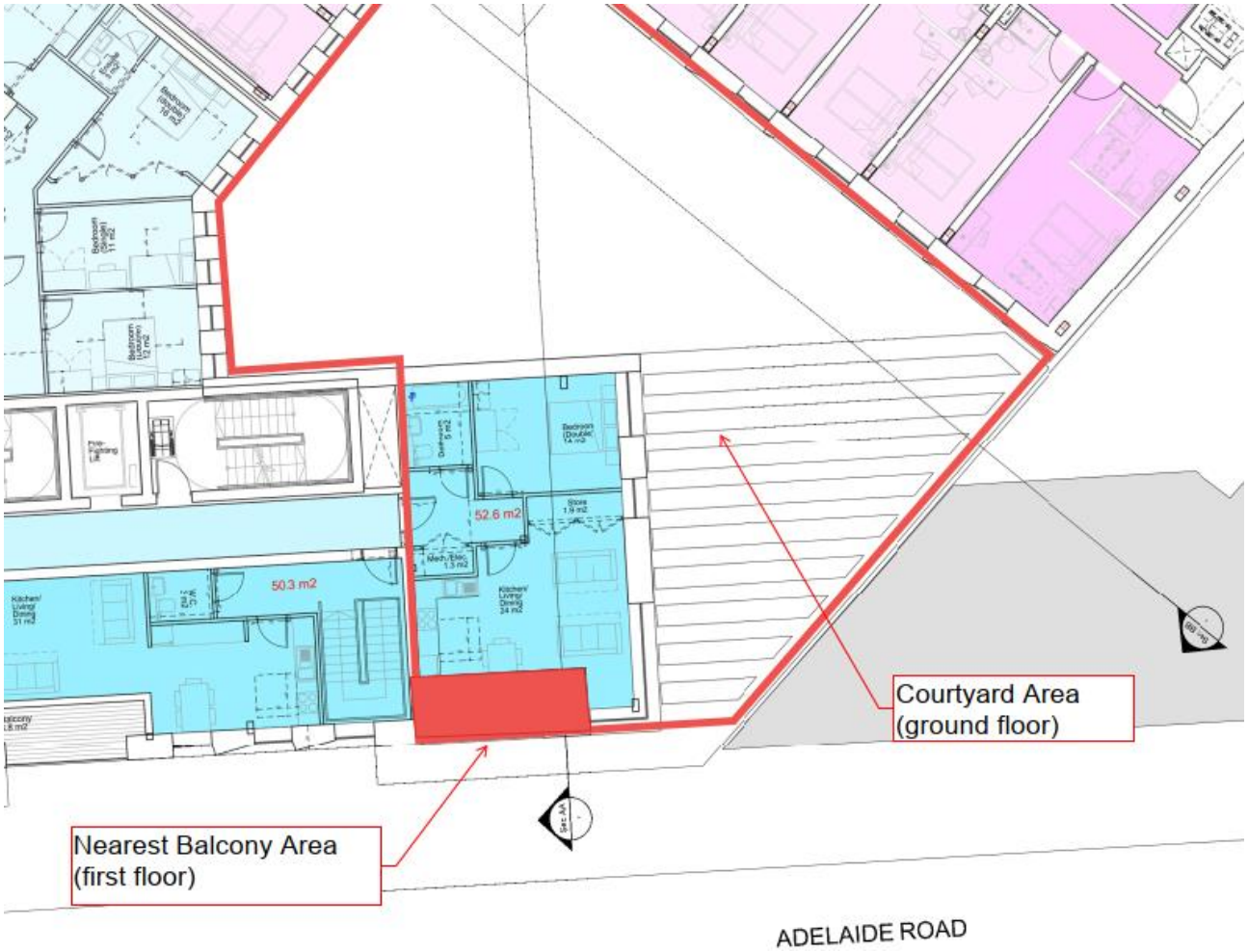
13.10 We have also assumed that there is no music playing externally in the courtyard area.

13.11 The predicted noise levels from the courtyard areas have been assessed against the 'customer noise' criteria in Table D of the LBC Local Plan 2017.

Table D: Noise levels applicable to proposed entertainment premises (customer noise)

Noise sensitive receptor	Assess-ment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings	Garden used for amenity (free field)	Day	The higher of 55dB $L_{Aeq,5min}$ Or 10dB below existing $L_{Aeq,5min}$ Without entertainment noise	56dB to 60dB $L_{Aeq,5min}$ Or 9dB to 3dB below existing $L_{Aeq,5min}$ Without entertainment noise	The higher of 61dB $L_{Aeq,5min}$ Or 2dB below existing $L_{Aeq,5min}$ Without entertainment noise
Dwellings	Garden used for amenity (free field)	Evening	The higher of 50dB $L_{Aeq,5min}$ Or 10dB below existing $L_{Aeq,5min}$ Without entertainment noise	51dB to 55dB $L_{Aeq,5min}$ Or 9dB to 3dB below existing $L_{Aeq,5min}$ Without entertainment noise	The higher of 56dB $L_{Aeq,5min}$ Or 2dB below existing $L_{Aeq,5min}$ Without entertainment noise
Dwellings	Garden used for amenity (free field)	Night	The higher of 45dB $L_{Aeq,5min}$ Or 10dB below existing $L_{Aeq,5min}$ Without entertainment noise	46dB to 50dB $L_{Aeq,5min}$ Or 9dB to 3dB below existing $L_{Aeq,5min}$ Without entertainment noise	The higher of 51dB $L_{Aeq,5min}$ Or 2dB below existing $L_{Aeq,5min}$ Without entertainment noise

13.12 As the flats don't have gardens, we have assessed the noise levels at the nearest balcony area highlighted in red below:



13.13 The predicted noise levels at nearest balcony area is as follows:

Location	Predicted Noise Level, $L_{Aeq,5mins}$, dB (free-field)	LBC Category
Nearest Balcony	<40	'Green' – daytime 'Green'- evening

Table E20062/T21. – Predicted Noise Levels from Courtyard at Balconies (no mitigation)

13.14 The predicted noise level at the nearest balcony from the operation of the courtyard is in the LBC 'green' category therefore no additional mitigation is required for the balcony areas.

13.15 Although not specially required by the Table D assessment, we recommend secondary glazing is allowed for in *all* of the residential flat bedrooms going up the building which overlook the courtyard.

13.16 With secondary glazing the internal noise level from the operation of the courtyard is predicted to be ≤20dB $L_{Aeq,T}$ in the bedrooms. And with the specified double glazing from Table E20062/T15 in the living rooms the predicted internal noise level is ≤30dB $L_{Aeq,T}$.

13.17 The secondary glazing may be able to be omitted on the higher floors following a more detailed assessment undertaken at Stage 3 or 4.

13.18 As the courtyard is connected to the hotel then the noise levels from the courtyard affecting the hotel bedrooms overlooking the courtyard is a commercial issue and can be managed by the hotel, however, the following is recommended:

- We recommend making an allowance for secondary glazing for the hotel bedrooms overlooking the courtyard area which would allow for more flexibility in the use of the space. This can be discussed with the hotel operator as the design progresses and can be removed if agreed with the operator.
- Good management of the area with clear signage encouraging the patrons to be considerate to the residents should be included in a management plan and it is recommended that the courtyard is only open for the daytime period, 07:00-23:00.
- It is recommended that the seating in the courtyard area is located away from residential windows.

New Commercial to Existing Residential

13.19 In the case of shops, cafes and restaurants playing background music only, we expect these uses to have a minimal impact on the existing residential properties on Adelaide Road and Haverstock Hill.

13.20 The noise levels in the restaurant/bar will be controlled by the internal ambient noise requirements to the hotel bedrooms on the floor immediately above so the break-out noise from the associated activities in the restaurant/bar to the surrounding nearest noise sensitive receptors is expected to be minimal.

13.21 The road traffic noise is likely to dominate for these uses and there is already a mix of shops and cafes in the immediate area.

13.22 A lobbied entrance door is shown on the current plans to the restaurant/bar and we recommend that this is retained as the design progresses.

13.23 In the case of cafes opening late into the evening there should be reminders to the patrons to leave quietly and be considerate to the local neighbours.

New Hotel Courtyard to existing residential

13.24 The same calculation methodology and source data has been used for this assessment as described above for the courtyard area to the new residential balconies.

13.25 The predicted noise levels at the nearest noise sensitive receivers from customer activity in the courtyard area is as follows:

Location	Predicted Noise Level, $L_{Aeq,5mins}$, dB (free-field)	LBC Category
Eton Place flats to the north west	35	'Green' – daytime 'Green'- evening
20 Haverstock Hill flats to the east	25	'Green' – daytime 'Green'- evening
Bridge House flats to the south	41	'Green' – daytime 'Green'- evening
Haverstock School	30	'Green' – daytime 'Green'- evening

Table E20062/T22. – Predicted Noise Levels from Courtyard at Nearest Noise Sensitive Receivers

13.26 The predicted noise levels are within the LBC 'green' category and no further mitigation measures are required.

14. VIBRATION ASSESSMENT

RE-RADIATED NOISE FROM GROUND-BORNE VIBRATION

14.1 As discussed in Section 2 of this report in the latest local plan LBC do not provide a target number for noise from re-radiated train vibration.

14.2 We propose a noise level less than or equal to 35dB L_{ASMax} as a criteria for both hotel bedrooms and residential flats where practical with an upper limit of no more than 40dB L_{ASMax}.

14.3 This is based on current guidance which is similar to targets set by London Underground and others.

14.4 We are not aware of any specific acoustic requirements from the current preferred hotel operator although this is to be reviewed if specific requirements are presented.

14.5 The predicted internal maximum noise levels from the underground trains are as follows.

Building Level	Building Construction Type **Large Masonry on Piles[1], dB L_{ASMax}**	Target Criteria, dB L_{ASMax}	Dominant Frequency
Ground Floor	48	≤35	30-40Hz
1st Floor	44	≤35	30-40Hz
2nd Floor	42	≤35	30-40Hz
3rd Floor	40	≤35	30-40Hz
4th Floor	38	≤35	30-40Hz
5th Floor and above	36	≤35	30-40Hz

Table E20062/T23.- Summary of Predicted Internal Maximum Noise Levels from Re-Radiated Train Vibration

[1]Any change in the construction method will require a revised re-radiated noise assessment

14.6 Vibration isolation should be allowed for at the base of the building with design development progressed during Stage 3 and Stage 4 with input from specialist vibration isolation engineers.

14.7 The solution is likely to consist of either spring or elastomeric isolation bearings to the base of the building structure.

14.8 Spring bearings are the most onerous in terms of design coordination and cost, with elastomeric bearings generally more cost effective.

14.9 Based on the predicted internal maximum noise levels elastomeric bearings or equivalent should be possible but design input from specialist vibration isolation engineers will be required.

14.10 There is a large uncertainty associated with the prediction model at this stage although undertaking simultaneous noise measurements of the maximum noise levels in the existing structure has helped to reduce the uncertainty. The assessment uncertainty is estimated to be at least +/- 5dB.

TACTILE VIBRATION

14.11 LBC give the following tactile vibration targets in terms of VDV in the LBC Local Plan 2017:

Vibration description and location of measurement	**Period**	**Time**	**Vibration Levels (Vibration Dose Values)**
Vibration inside critical areas such as a hospital operating theatre	Day, evening and night	00:00-24:00	0.1 VDV ms-1.75
Vibration inside dwellings	Day and evening	07:00-23:00	0.2 to 0.4 VDV ms-1.75
Vibration inside dwellings	Night	23:00-07:00	0.13 VDV ms-1.75
Vibration inside offices	Day, evening and night	00:00-24:00	0.4 VDV ms-1.75
Vibration inside workshops	Day, evening and night	00:00-24:00	0.8 VDV ms-1.75

14.12 The predicted tactile vibration levels due to underground trains are as follows based on the current LUL timetable and the night tube operating every 15 minutes in both directions:

Location	Time Period	X, VDV, mm/s$^{-1.75}$	Y, VDV, mm/s$^{-1.75}$	Z, VDV, mm/s$^{-1.75}$	Train Movements
Ground	07:00-23:00	0.0042	0.0056	0.0679	697
	23:00-07:00	0.0028	0.0038	0.0461	148
First floor and above	07:00-23:00	0.0017	0.0022	0.0380	697
	23:00-07:00	0.0012	0.0015	0.0258	148

Table E20062/T24.- Predicted VDV levels

14.13 The predicted VDV levels are below the LBC requirements and therefore tactile vibration in terms of VDV is not considered to be an issue at this site.

15. CONCLUSION

15.1 Adnitt Acoustics have undertaken a noise impact assessment for the proposed hotel and residential development at 5-17 Haverstock Hill, London.

15.2 A noise and vibration impact assessment is required by The London Borough of Camden, LBC, as part of the planning application.

15.3 The proposal is for the demolition of the existing building and the erection of a new residential and hotel building.

15.4 This report contains the results of the external noise survey, vibration screening survey and associated assessments including façade and ventilation guidance, external amenity area assessment and mechanical plant noise emission limits.

15.5 This report has been prepared as part of the planning process and is not intended to be used for the detailed design of the proposed development.

15.6 The current proposed hotel operator, OD Hotel, does not have any specific acoustic requirements that we have been made aware of.

15.7 This should be kept under review and once the operator has been confirmed an assessment against the acoustic requirements (if any) would be required to determine if there are more onerous requirements.

Covid-19 Discussion

15.8 Some Covid-19 restrictions were still in place at the time of undertaking the noise survey therefore the measurements have been referenced against the DEFRA noise maps[7] and the noise impact assessment undertaken by Sandy Brown[8] for the same site in July 2016 to determine the likely impact.

15.9 The review of the data indicates that there has been a slight reduction in measured noise levels compared with the Sandy Brown 2016 survey. The biggest difference appears to be during the night-time period with the typical background noise levels much lower in the 2020 survey.

15.10 The measured daytime average noise levels are broadly in line with the DEFRA noise map.

15.11 To allow for the Covid-19 uncertainty we have adjusted our measured noise levels, L_{Aeq} L_{AFMax} to equal the 2016 measured levels and the background LA90 levels have been adjusted to half way between the 2016 and 2020 levels as once the restrictions are lifted we expect that the background noise levels will increase.

15.12 The vibration assessment is representative of 'normal' operating conditions and an allowance for the night tube has been included in the calculations.

External Noise Level Assessment

15.13 The external noise levels at 1m from the facade are in the LBC amber and amber/red categories based on Table B. A further assessment of the internal ambient noise levels is required to confirm the mitigation measures for the façade (see Section 10).

[7] https://www.gov.uk/government/publications/strategic-noise-mapping-2019 [accessed on 21/08/20]
[8] 5-17 Haverstock Hill, London, Noise and vibration planning report, 15436-R01-C, 27 April 2016

15.14 The external amenity areas are assessed in Section 11.

External Building Fabric Assessment

15.15 The façade mitigation measures above have been specified to achieve the 'green' LBC internal ambient noise level categories.

15.16 The recommended construction for each façade are summarised below:

Façade	Façade Element	Indicative Construction[1]
1 (Haverstock Hill)	Windows (glazing & frame)	High performance double glazed units
	External Wall	Cavity Masonry Walls or Lightweight Steel Frame System with cement board, mineral wool insulation and fireline boards
	Ventilation	MVHR with suitable in-duct attenuators
2 (facing Eton Place)	Windows (glazing & frame)	Moderate and high performance double glazed units
	External Wall	Cavity Masonry Walls or Lightweight Steel Frame System with cement board, mineral wool insulation and fireline boards
	Ventilation	MVHR with suitable in-duct attenuators
3 (Adelaide Road and Courtyard)	Windows (glazing & frame)	Secondary glazing in the bedrooms including the bedrooms in the courtyard area on this façade* (see façade area mark-up) and high performance double glazed units in the living rooms
	External Wall	Cavity Masonry Walls or Lightweight Steel Frame System with cement board, mineral wool insulation and fireline boards
	Ventilation	MVHR with suitable in-duct attenuators
4 (Courtyard)	Windows (glazing & frame)	Secondary glazing in the hotel bedrooms*, high performance double glazing in the residential bedrooms* and moderate performance double glazing in the residential living rooms
	External Wall	Cavity Masonry Walls or Lightweight Steel Frame System with cement board, mineral wool insulation and fireline boards
	Ventilation	MVHR with suitable in-duct attenuators

Table E20062/T25. – **Summary of Indicative Constructions**

[1]The indicative constructions *do not* form part of the specification and are provided here for guidance only. It is the acoustic performance only that is specified.

*** Secondary glazing is recommended in the courtyard area for the two bedrooms in the end flats overlooking the hotel courtyard and the hotel bedrooms in this area. Please see the detailed discussion in Section 13.**

15.17 Where the flats are dual aspect it has been recommended that the bedrooms are located on the quieter facades where possible.

15.18 Please note that other façade and ventilation options/configurations could be used to achieve the indoor ambient noise level criteria. If the acoustic performance of the final confirmed façade elements differs from the performance provided in this report an assessment carried out by a suitably qualified acoustic consultant (as defined in BREEAM) must be provided to show the predicted indoor ambient noise levels achieve the values stated in Table E20062/T12.

15.19 The predicted indoor ambient noise levels are required to show compliance with the requirements of the Local Authority and not the performance of the façade elements alone.

External Amenity Areas

15.20 The current proposal shows balcony areas on all facades of the residential building. The daytime noise levels for the balcony areas on the south façade (four balconies including the corner balconies) overlooking Adelaide Rd are greater than 55dB $L_{Aeq,daytime}$.

15.21 This puts the areas into the 'Red' category so further mitigation is recommended by LBC.

15.22 The proposal for the development is to provide a rooftop amenity area for the residents.

15.23 The predicted noise levels on the rooftop are <50dB $L_{Aeq,T}$ which is below the lower threshold in BS 8233:2014 and is in the LBC 'green' category.

15.24 The approach is consistent with options 2 and 3 given in the ProPG but should be *agreed with LBC*.

Mechanical Plant

15.25 At the time of this report the final location and selection of mechanical plant items has not been confirmed.

15.26 Mechanical plant noise emission limits have been proposed based on the recommendations in the LBC Local Plan 2017.

15.27 If the 'green' noise limits cannot be met with mitigation measures then it may be acceptable to use the 'amber' noise limits with agreement from LBC.

New Commercial Assessment

15.28 There is a new retail unit, ground floor, and café, ground floor and first floor, proposed for the residential building and a bar/restaurant area operated by or under licence from the hotel on the ground floor of the hotel building.

15.29 At the time of writing this report the tenants of the retail units have not been confirmed.

15.30 Uplifted sound minimum sound insulation requirements have been recommended for the retail areas to the residential areas and a music noise limit proposed based on guidance in the 'Procedure for the assessment of low frequency noise disturbance', Moorhouse et al, University of Salford, 2005.

15.31 In the case of shops, cafes and restaurants playing background music only, we expect these uses to have a minimal impact on the existing residential properties on Adelaide Road and Haverstock Hill.

15.32 The noise levels in the restaurant/bar will be controlled by the internal ambient noise requirements to the hotel bedrooms on the floor immediately above so the break-out noise from the associated activities in the restaurant/bar to the surrounding nearest noise sensitive receptors is expected to be minimal.

15.33 The road traffic noise is likely to dominate for these uses and there is already a mix of shops and cafes in the immediate area.

15.34 A lobbied entrance door is shown on the current plans to the restaurant/bar and we recommend that this is retained as the design progresses.

15.35 In the case of cafes opening late into the evening there should be reminders to the customers to leave quietly and be considerate to the local neighbours.

Hotel Courtyard Assessment

15.36 The predicted noise level at the nearest balcony from the operation of the courtyard is in the LBC 'green' category therefore no additional mitigation is required for the balcony areas.

15.37 Although not specially required by the Table D assessment, we recommend secondary glazing is allowed for in *all* of the residential flat bedrooms going up the building which overlook the courtyard.

15.38 As the courtyard is connected to the hotel then the noise levels from the courtyard affecting the hotel bedrooms overlooking the courtyard is a commercial issue and can be managed by the hotel.

15.39 We recommend, however, making an allowance for secondary glazing for the hotel bedrooms in the courtyard area which would allow for more flexibility in the use of the space. This can be discussed with the hotel operator as the design progresses and can be removed if agreed with the operator.

15.40 Good management of the area with clear signage encouraging the patrons to be considerate to the residents should be included in a management plan.

Vibration Assessment – Reradiated Noise

15.41 In the latest local plan LBC do not provide a target number for noise from re-radiated train vibration.

15.42 We propose a noise level less than or equal to 35dB L_{ASMax} as a criteria for both hotel bedrooms and residential flats where practical with an upper limit of no more than 40dB L_{ASMax}.

15.43 Vibration isolation should be allowed for at the base of the building with design development progressed during Stage 3 and Stage 4 with input from specialist vibration isolation engineers.

15.44 The solution is likely to consist of either spring or elastomeric isolation bearings to the base of the building structure.

15.45 Spring bearings are the most onerous in terms of design coordination and cost, with elastomeric bearings generally more cost effective.

15.46 Based on the predicted internal maximum noise levels elastomeric bearings or equivalent should be possible but design input from specialist vibration isolation engineers will be required.

Vibration Assessment – Tactile Vibration

15.47 The predicted VDV levels are below the LBC requirements and therefore tactile vibration in terms of VDV is not considered to be an issue at this site.

Overall Summary

15.48 A noise and vibration impact assessment has been carried out based on local, regional and national planning requirements.

15.49 The façade mitigation measures have been specified to achieve the 'green' LBC internal ambient noise level categories.

15.50 Mitigation measures have been proposed so that the internal ambient noise levels and noise levels from the use of the proposed hotel courtyard area achieve the 'green' category as defined by LBC which is commensurate to a LOAEL as defined by national planning guidance.

15.51 Mechanical plant noise limits have been proposed based on the guidance in the LBC Local Plan 2017.

15.52 Therefore provided the mitigation measures are installed as proposed (or equal and approved) the development should not be refused on noise grounds.

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for ADNITT ACOUSTICS

APPENDIX A: GLOSSARY OF ACOUSTIC TERMS

Ambient Noise	The noise climate heard over a period of time due to all normal sources, in the absence of extraneous or atypical sounds. Used to describe noise in the absence of the introduced sound, generally.	
Ambient Noise Level	Describes the average noise level of the ambient noise over a stated period of time, e.g. hourly noise	
	Parameter: A-weighted Continuous Equivalent Sound Pressure Level determined over the time period T.	$L_{eq,T}$ or $L_{Aeq,T}$
	Expressed in decibels / A-weighted decibels	dB(A) or dB
Decibel scale dB	A linear numbering scale used to define a logarithmic amplitude scale, thereby compressing a wide range of amplitude values to a small set of numbers	
dB(A)	An electronic filter in a sound level meter, which approximates under defined conditions the frequency response of the human ear.	
$L_{Aeq,T}$	The equivalent continuous sound level. The steady dB(A) level which would produce the same A-weighted sound energy over a stated period of time as the measured sound pressure level.	
L_{Amax}	The maximum dB(A) level measured during a survey period.	
L_{A10}	The dB(A) level exceeded for 10% of the survey period, often used as a quantifier of traffic noise level.	
L_{A90}	The dB(A) level exceeded for 90% of the survey period. Used in BS 4142:1997/2014 as being representative of the background noise level.	
Acoustic screening	Physical barrier to sound formed by fence, wall, building or other structure, which has the effect of reducing the sound transmitted.	
Individual Event Noise	The noise of a distinctive event with the varying noise climate, usually a transient activity, such as a vehicle pass-by, aircraft flyover or similar, rather than an isolated impulsive noise.	
Individual Event Noise Level	Describes the highest noise level during the event as measured under particular conditions of time-weighting	
	Parameter: A-weighted Maximum Sound Pressure Level with FAST or SLOW time weighting	$L_{Amax,FAST}$ or $L_{Amax,F}$ $L_{Amax,SLOW}$ or $L_{Amax,S}$
	Expressed in decibels / A-weighted decibels	dB(A) or dB
Sound Reduction Index R_w	Single number rating used to describe the sound insulation of building elements as defined in BS EN ISO 717 1997.	
Weighted element-normalized level difference $D_{n,e,w}$	Single number rating used to describe the sound insulation of building elements as defined in BS EN ISO 717 1997.	

APPENDIX B: NOISE EXPOSURE HIERARCHY

Response	*Examples of Outcomes*	*Increasing Effect Level*	*Action*
No Observed Effect *Level*			
Not present	*No Effect*	*No Observed Adverse Effect Level*	*No specific measures required*
No Observed Adverse Effect Level			
Present and not intrusive	*Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response.* Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life	*No Observed Adverse Effect Level*	*No specific measures required*
Lowest Observed Adverse Effect Level			
Present and intrusive	*Noise can be heard and causes small changes in behaviour, attitude* or other physiological response, e.g. 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 small actual or perceived change in the quality of life.	*Observed Adverse Effect*	*Mitigate and reduce to a minimum*
Significant Observed Adverse Effect Level			
Present and disruptive	*The noise causes a material change in behaviour, attitude or other physiological response,* e.g. 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*
Present and very disruptive	***Extensive and regular changes in behaviour, attitude or other physiological response and/or* an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.**	***Unacceptable Adverse Effect***	***Prevent***

Figure E20062/ TH 1 : Time History P1 (free-field)

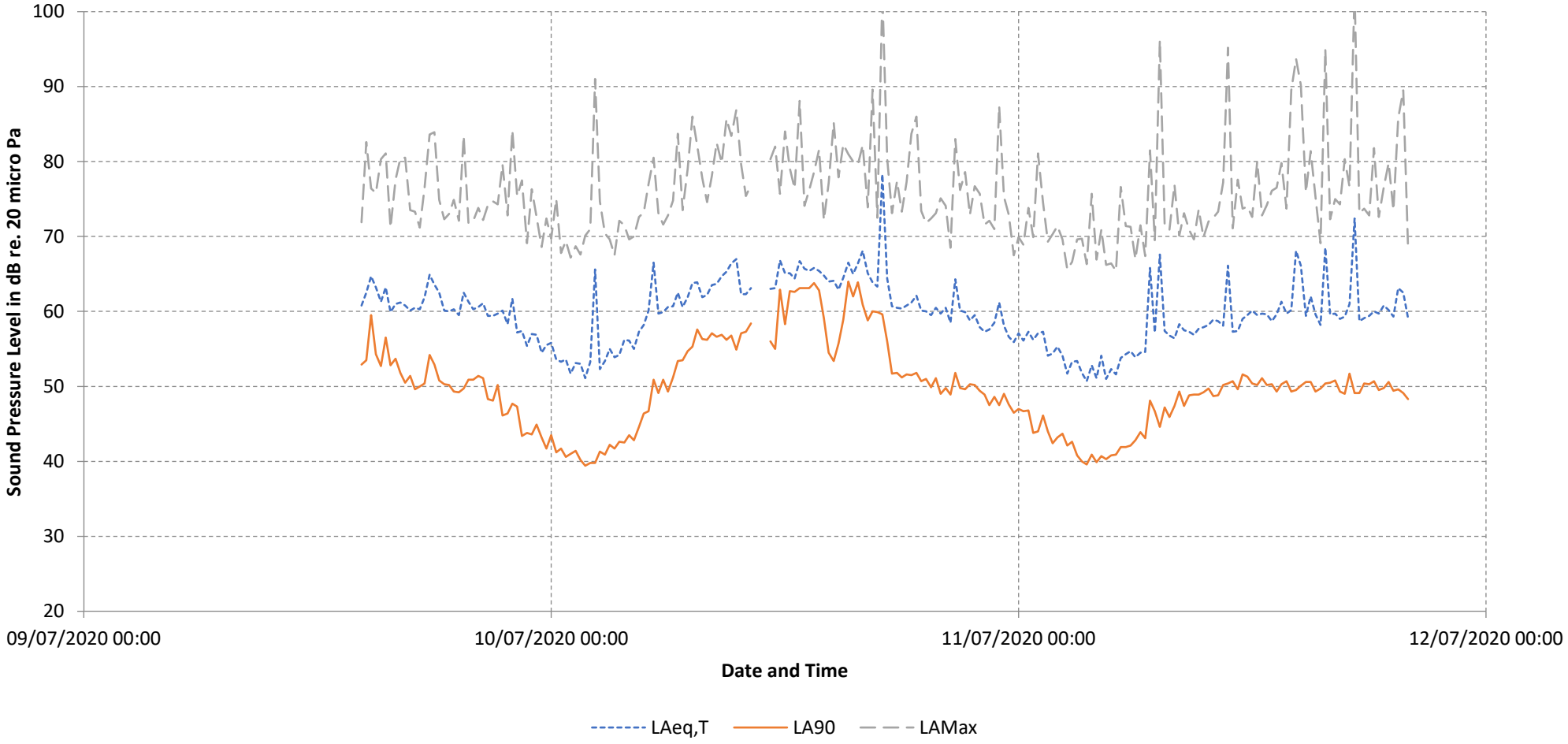

Figure E20062/ TH 1 : Time History P2 (façade)

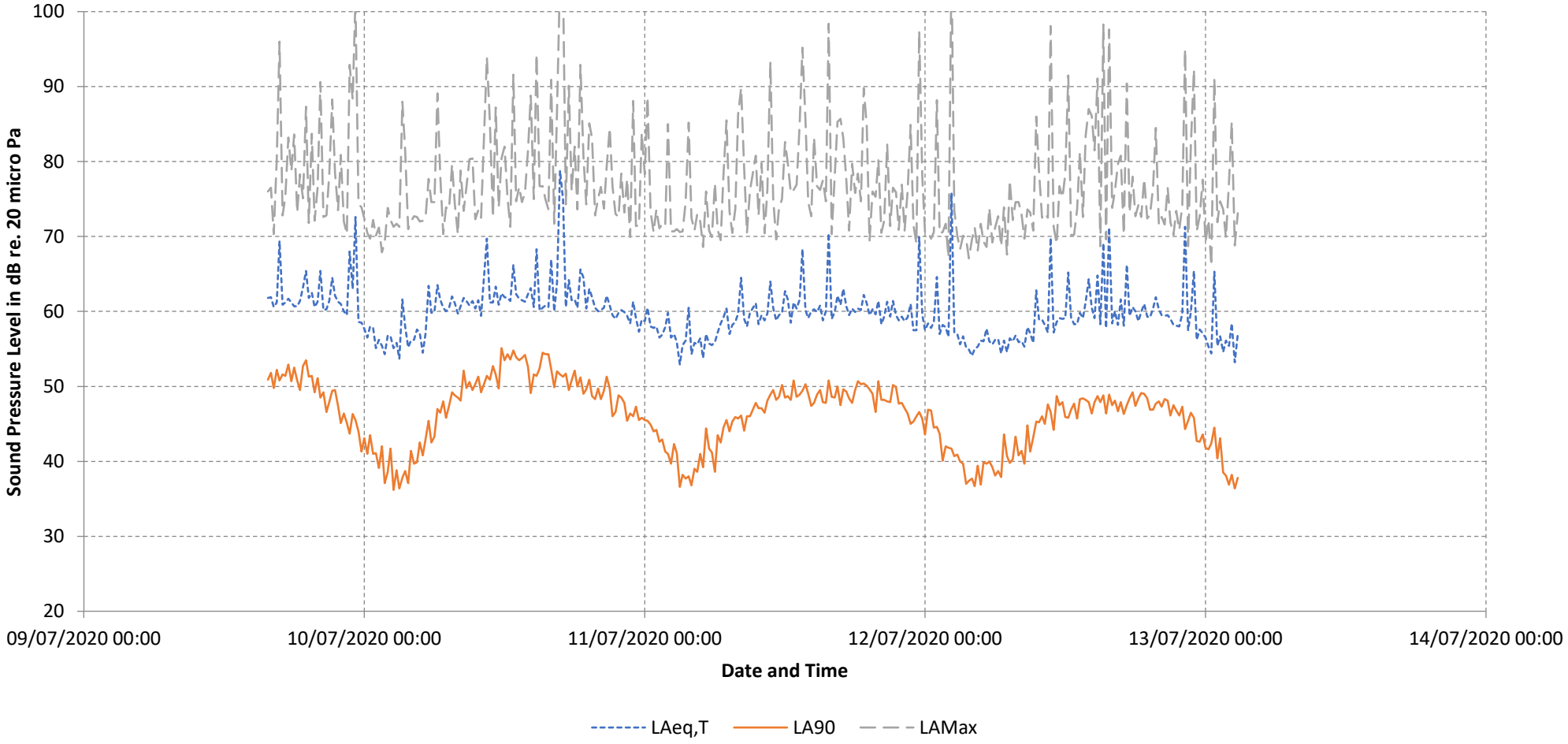

Figure E20062/ NM 1 : Noise Contour Map, $L_{Aeq,Day}$ @ 4m

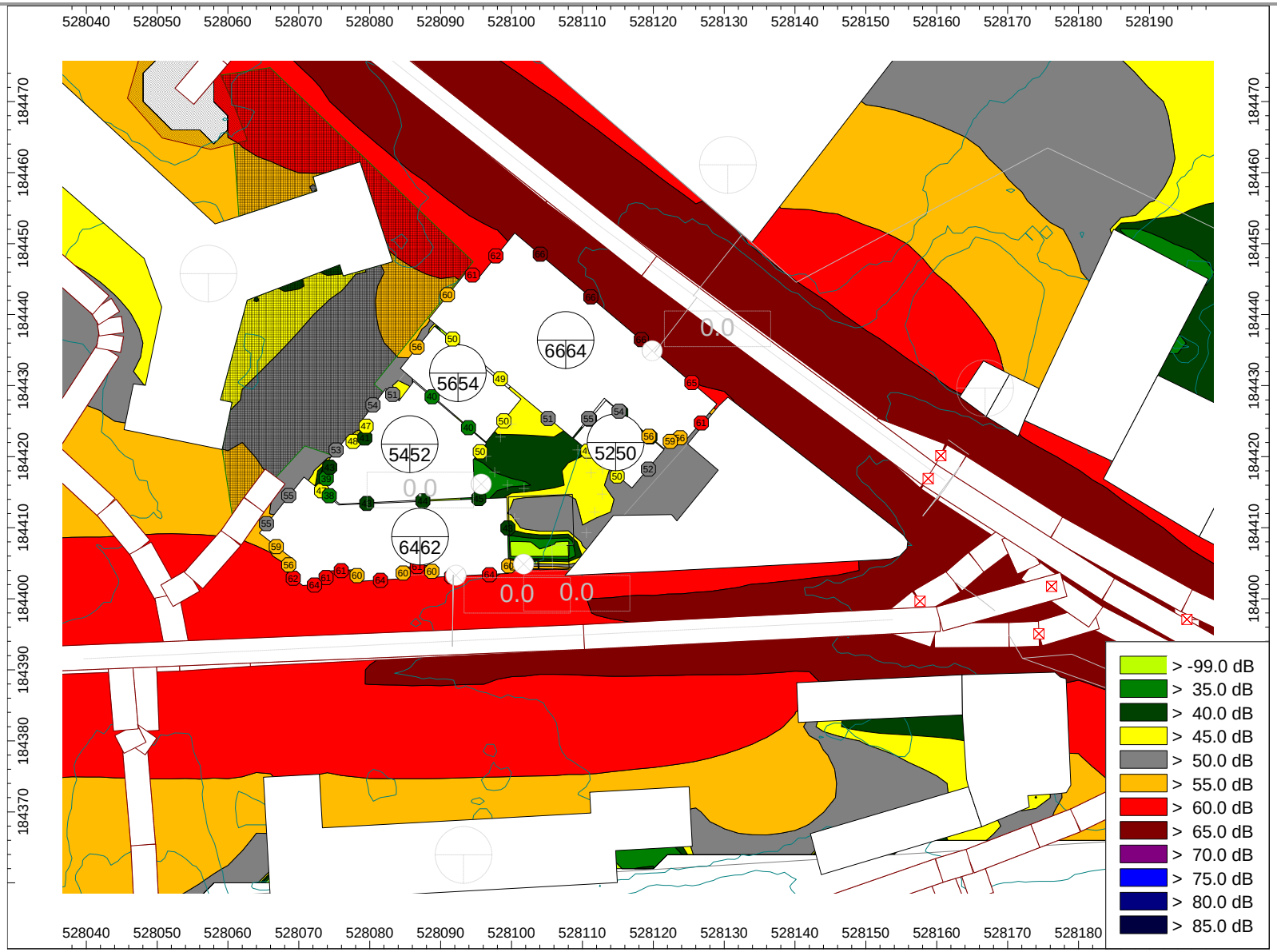

Figure E20062/ NM 2 : Noise Contour Map, $L_{Aeq,night}$ @ 4m

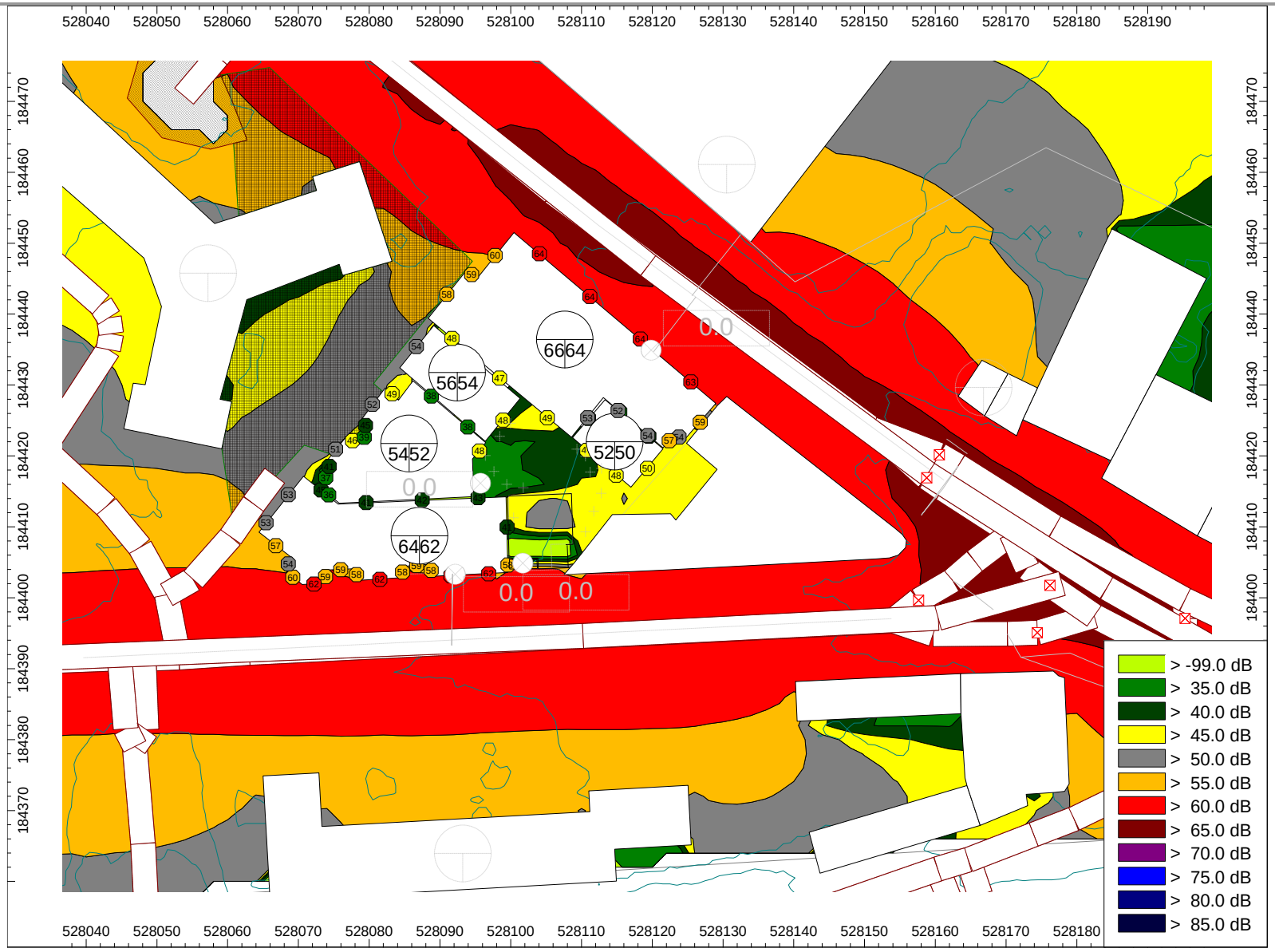

Figure E20062/ NM 3 : Noise Contour Map, $L_{AFMax,Typical}$ @ 4m

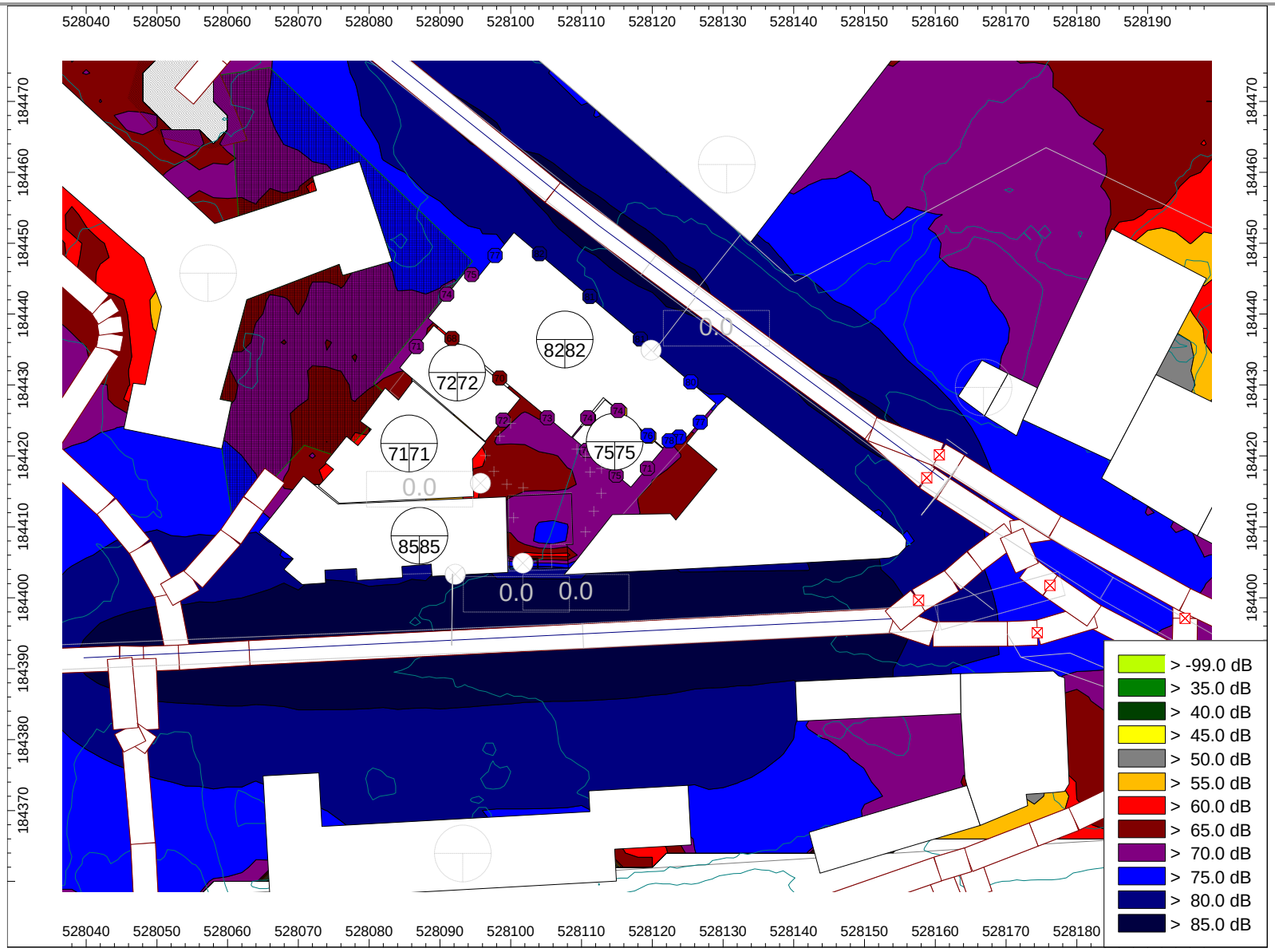

Figure E20062/ NM 4 : Noise Contour Map, External Amenity @ 1.8m

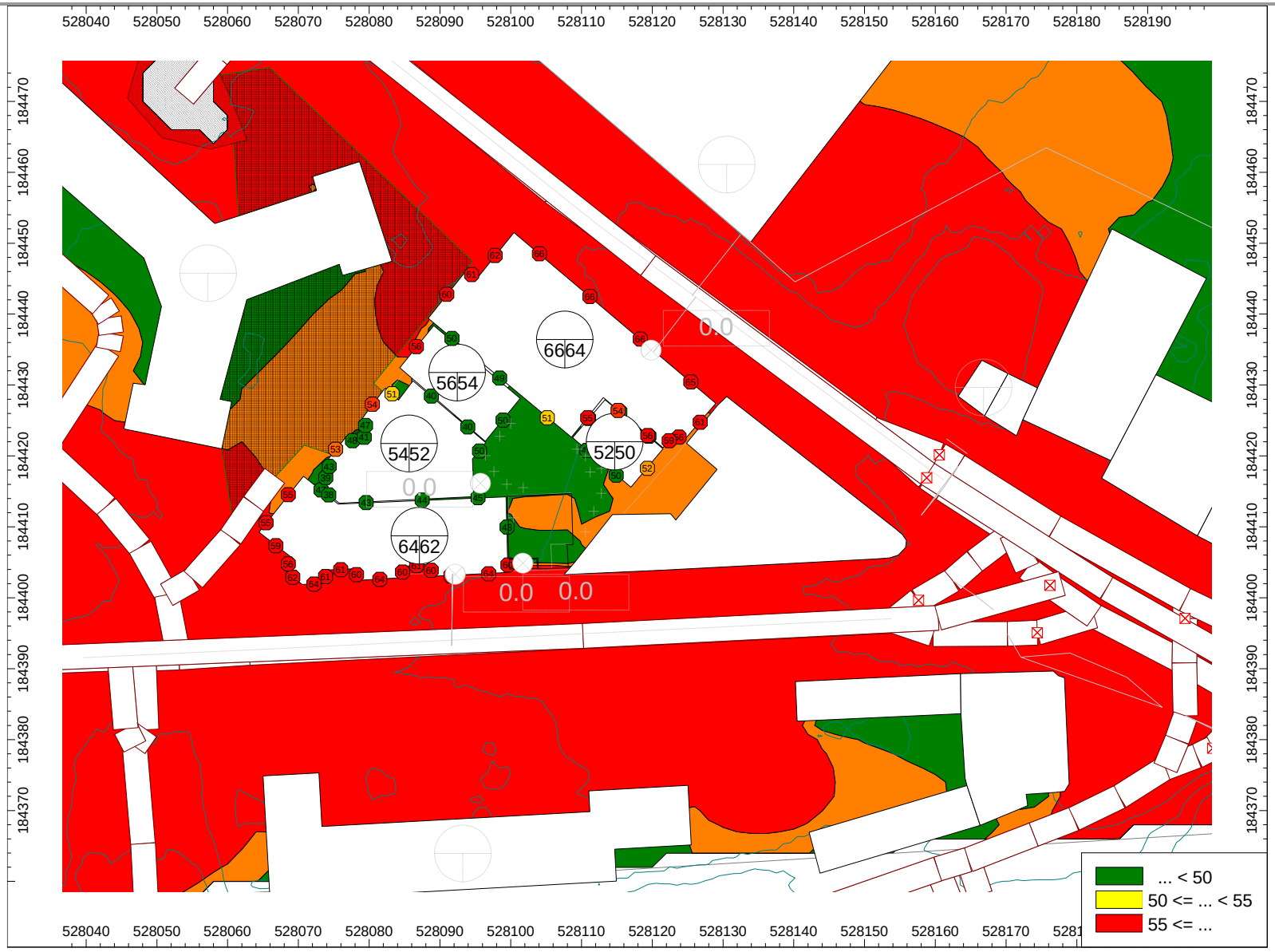

Figure E20062/ NM 5 : Noise Contour Map, Hotel Courtyard @ 4m