Boddingtons, Manchester – C2164

Technical Note – Planning Condition 23a Discharge

June 24, 2025

Our Ref: CSGA-C2164-TN01 – Boddingtons, Planning Condition Discharge 23a

Technical Note for Discharge of Planning Condition 23a at Boddingtons Residential Development.

This technical note addresses the following planning condition from MCC relating to Noise Break-in to the residential units at Boddingtons, Manchester:

Condition No.	Trigger	Topic	Condition wording	Documents required
23a	Prior to above ground works	Noise - Residential Units	Notwithstanding the Noise and Vibration Assessment prepared by Cundall received by the City Council, as Local Planning Authority on the 20 September 2023, prior to any above ground works: (a) a scheme for acoustically insulating and ventilating the proposed residential accommodation against noise from the local traffic network and, following an assessment of the potential for overheating (AVO Assessment), any further noise mitigation measures to deal with equipment to mitigate overheating shall be submitted for approval in writing by the City Council, as Local Planning Authority. The approved noise insulation and ventilation scheme shall be completed before the first occupation of the development. Noise survey data must include measurements taken during a rush-hour period and night time to determine the appropriate sound insulation measures necessary. The following noise criteria will be required to be achieved: Bedrooms (night time - 23.00 - 07.00) 30 dB L Aeq (individual noise events shall not exceed 45 dB L Amax,F by more than 15 times) Living Rooms (daytime - 07.00 - 23.00) 35 dB L Aeq Gardens and terraces (daytime) 55 dB L Aeq Where applicable (entertainment/music): Additionally, where entertainment noise is a factor in the noise climate the sound insulation scheme shall be designed to achieve internal noise levels in the 63Hz and 125Hz octave centre frequency bands so as not to exceed (in habitable rooms) 47dB and 41dB, respectively.	Acoustic Scheme (Residential)

CSG Acoustics Ltd have carried out the necessary review and assessment of the relevant noise survey data and provided suitable façade/glazing/ventilation specification in line with the above internal noise requirements of the planning condition.

The proposed scheme material specifications and overheating mitigation (ADO/AVO) are compliant with the above condition, as demonstrated in the assessment detailed below.

1 Noise Break-in and Façade Specification

The following assessment provides sound insulation requirements for façade elements to control noise break-in to apartments. A review of noise break-in has been carried out by Cundall and is detailed in the Planning Stage Noise Impact Assessment Report (*Ref: BODM-CDL-XX-XXRP-AS-45200 P02 dated 16th August 2023*). The report details the criteria in terms of ProPG, British Standard guidance BS8233:2014 and Manchester City Council (MCC) entertainment noise requirements.

The Cundall report (appended to this technical note) details the noise surveys and assessment of noise impact on the development from all measured sources for compliance with internal ambient noise level criteria.

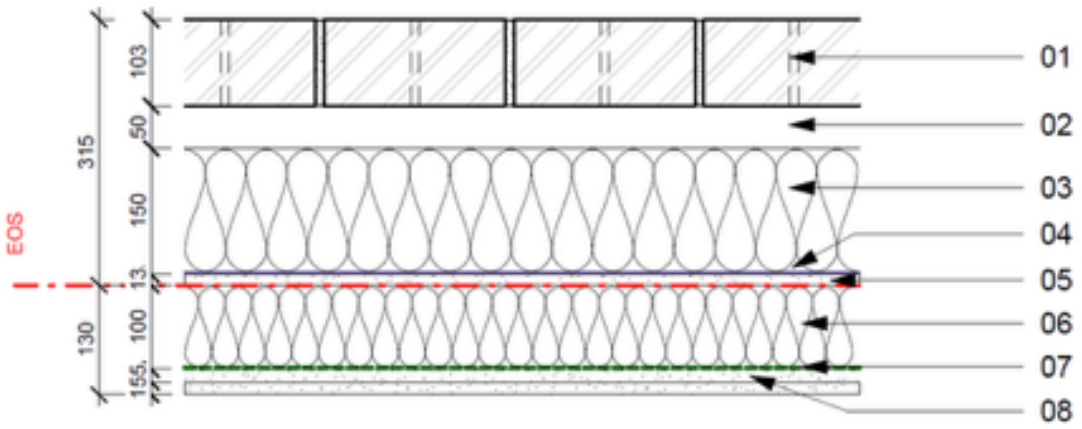
The site is located close to Great Ducie Street and the AO arena and is therefore potentially subject to entertainment noise and significant road traffic noise. The Cundall assessment concludes that entertainment noise from the AO Arena is below the level of traffic noise at the development and therefore predicts it will meet MCC criteria for entertainment noise.

The noise break-in from other sources e.g. traffic noise is required to meet the ProPG planning (BS8233:2014) and project internal ambient noise level limits, which is in line with the above detailed planning condition internal level requirements.

1.1 Proposed Façade Construction

The proposed façade construction is an SFS buildup as detailed in figure 8.1 below and is suitable to control noise break-in. The acoustic weakness in the façade are the glazed elements as assessed in 1.2 below.

Figure 1.1: Facade Construction (non-glazed elements)



1. *Facing Brickwork*
2. *Air Cavity*
3. *Mineral Wool Insulation*
4. *Breather Membrane*
5. *External Sheathing Board (assumed to be Cement Board)*
6. *SFS System with mineral wool infill between studs*

7. *Vapour Control Layer (VCL)*
8. *2 x 15mm Dense Plasterboard e.g. BG Soundbloc*

1.2 Façade Acoustic Specification

Noise mapping of the site has been untaken and is detailed in the planning stage Noise Impact Assessment Report (appended to this note). The assessment establishes façade incident noise levels based on surveys and specifies glazing performance requirements.

The glazing acoustic performance requirements are detailed in three performance bands as detailed in Figure 1.2 and 1.3 below.

Figure 1.2: Glazing Acoustic Performance Specification – (Cundall NIA Report)

Scenario	Example suitable glazing	Sound reduction index (dB)						Single figure R_w (Ctr) dB
		125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	
Condition 1	▪ 6 mm pane ▪ 6 – 20 mm air gap ▪ 8.8 mm Pilkington Optiphon	24	26	40	48	46	54	41 (-7)
Condition 2	▪ 4 mm pane ▪ 6 – 20 mm air gap ▪ 10 mm pane	24	21	32	37	32	43	35 (-5)
Condition 3	▪ 6 mm pane ▪ 6 – 20 mm air gap ▪ 4 mm	21	20	26	38	37	39	31 (-4)

Figure 1.3: Glazing Specification Locations

The noise break-in has been predicted to be 27dBA during the night-time period as shown in the calculation below:

Figure 1.4: Noise Break-in Prediction – Ducie Street at Night-Time

CSGA 8233 Noise Breakin Calculation
Great Ducie Street - Bedroom Night-time

Façade Area (Typical Including Window)	**5.8**
Window Area (typical)	**2.6**
Area of Ceiling	**0**
Total Area	**5.8**
Room Vol	23

Calculation Inputs		**125**	**250**	**500**	**1000**	**2000**	**4000**	**dBA**
Source Noise Level (Day)	LAeq	64.8	61.3	58.9	62.3	56.6	49.2	65
Glazing (Great Ducie Street) Rw 41dB	Rwi	24.4	31.9	40.4	45.1	45.3	58.9	
SFS System	Rew	38	40	50	50	50	50	
Absorption Area		5	6	7	7	7	7	

Composite Performance Calc		**125**	**250**	**500**	**1000**	**2000**	**4000**	
Glazing (Great Ducie Street) Rw 41dB	Rwi	24	32	40	45	45	59	
SFS System	Rew	38	40	50	55	55	60	
Composite Perfromance		**-27.6**	**-34.6**	**-43.3**	**-48.0**	**-48.2**	**-59.5**	
+10*LOG(S)		7.6	7.6	7.6	7.6	7.6	7.6	
-10*log(A)		-7.2	-7.9	-8.7	-8.7	-8.7	-8.7	
+3		3	3	3	3	3	4	
Total dBA		**40.7**	**29.4**	**17.5**	**16.2**	**10.3**	**0.0**	**26.9**

1.3 Approved Document O (ADO) and AVO Compliance – Overheating Mitigation

Cundall NIA report identified apartment bedrooms which are likely to exceed the ADO internal noise limits during periods when opening windows may be required to control overheating. MVHR units are proposed to each apartment to provide ventilation and remove the need to open windows during the night-time periods.

A dynamic thermal model has been carried out by Wallace Whittle to assess the requirement for openable windows overnight in accordance with ADO overheating requirements.

The Wallace Whittle Ltd thermal compliant model is based on:

- Condition 1 – windows to open during the day and are closed throughout the night.
- Condition 2 and 3 – windows are allowed to open* during the day and night.

* Condition 2 and 3 noise/ADO compliance is based on partially open windows with equivalent free area of no greater than 4% of the floor area.

1.4 Building Services – Internal to Apartments Cupboards

A hot water heat pump and mechanical ventilation heat recovery unit are proposed to each of the apartments. These two items of plant will be located within a cupboard in the entrance hall to each apartment. The following details the units and their noise level predictions.

1.4.1 Mechanical Ventilation heat recovery Units (MVHR)

MVHRs will be located within a cupboard in the entrance hallway to each apartment. The ductwork will run through the apartments with the supply and extract termination at the façade of each dwelling.

The proposed MVHR for each apartment is:

- Vent Axia Sentinel Kinetic B – 61dBA Lw with acoustic solution.

MVHR Down Duct Noise Assessment

The typical ventilation duct layout drawings 'DN0107-WWL-ZZ-ZZ-DR-M-50001 RevP05, DN0107-WWL-ZZ-ZZ-DR-M-50002 RevP05 and DN0107-WWL-ZZ-ZZ-DR-M-50003 RevP03' supplied by Wallace Whittle have been used to calculate the down duct noise levels affecting the internal spaces of the dwellings.

The Vent Axia data for the MVHR with the manufacturers **'Acoustic solution'** running at 60% has been used to assess in the internal building services noise levels within the dwellings.

Figure 1.5: MVHR Noise Data

Sound Data (Unit with Acoustic Solution)

		Octave band, Hz, dB SWL									SPL dB(A)
Speed	Test mode	63	125	250	500	1k	2k	4k	8k	LwA	@ 3m
20%	Supply	57.1	44.6	36.4	27.9	20.6	14.8	18.1	23.8	35.2	17.7
	Extract	54.4	40.1	29.6	22.2	17.5	14.5	17.8	23.5	31.1	13.6
	Breakout	37.5	33.8	29.1	22.9	17.0	14.0	17.8	23.6	27.7	7.2
40%	Supply	64.9	56.3	46.4	36.1	28.2	15.4	18.1	23.8	44.6	27.1
	Extract	60.2	46.8	35.7	28.2	21.9	14.8	18.1	23.7	36.6	19.1
	Breakout	46.0	43.6	36.3	30.4	23.9	15.9	18.1	23.6	33.5	13.0
60%	Supply	72.3	63.0	55.6	43.1	34.1	19.5	18.6	24.0	51.9	34.4
	Extract	61.4	53.3	43.4	34.7	27.2	15.5	18.1	23.8	41.4	23.9
	Breakout	52.2	50.5	44.4	38.2	33.5	23.8	19.3	23.8	41.0	20.5
80%	Supply	73.8	67.9	61.6	50.0	38.6	23.4	20.2	25.2	56.8	39.3
	Extract	68.6	58.2	50.5	40.5	31.1	17.2	18.2	23.9	47.5	30.0
	Breakout	65.6	55.5	50.5	43.8	39.7	32.7	24.9	24.0	47.4	26.9
100%	Supply	77.3	70.8	64.9	53.8	41.4	26.3	21.9	26.8	60.1	42.6
	Extract	71.5	60.6	53.5	43.9	33.4	19.1	18.5	24.0	50.5	33.0
	Breakout	69.0	58.4	53.4	47.1	43.0	37.5	29.9	24.9	51.1	30.6

hemispherical. For in-duct data, end reflections are added based on the spigot size of the unit.

Supply Air Attenuation

An attenuator will be fitted on the supply duct of the MVHR. The Vent Axia MVHR units will utilise the manufactures 'Acoustic Solution' with an additional attenuator to meet the internal ambient noise level requirements.

The supply side down duct noise level in the living areas is predicted to be NR 25 with the inclusion of an attenuator of the following specification.

Table 1.1: Supply Side MVHR Attenuator Specification

600mm Attenuator	Octave Band Centre Frequency, Hz						
	63	125	250	500	1k	2k	4k
Insertion Loss, dB	0	1	3	6	11	11	9

Extract Air

The extract air in duct sound power is lower that the Supply side and no additional attenuator is required.

The extract side down duct noise level in the living areas is predicted to be NR 23 and therefore predicted to meet project requirements.

CUNDALL

Boddingtons Site, Manchester

Noise Impact Assessment

Latimer Developments

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1.0

Introduction

1.0 Introduction

It is proposed to redevelop the former Boddington's Brewery site in Manchester at Great Ducie Street, Cheetham Hill, Manchester, M3 1PT, to provide 505 new dwellings. Cundall have been appointed to carry out the works necessary to support a planning application for the site.

The noise assessment will assess the suitability of the proposed site and development in terms of noise, which relate to:

- Impact of the existing external noise conditions on sensitive sections of the proposed development; and
- Impact from the proposed development on the surrounding areas.

The assessment for the noise impact on the proposed development detailed in this report has been undertaken based on the methodology outlined in 'Professional Practice Guidance on Planning & Noise' (ProPG) and internal ambient noise level criteria identified in 'BS 8233:2014 Guidance on sound insulation and noise reduction for buildings' (BS 8233) and 'Overheating: Approved Document O' (AD-O).

Calculations and assessments have been undertaken which demonstrate that acceptable conditions can be achieved. Full copies of these calculations are available at request.

This report provides details of the relevant local and national planning policy, guidance and standards, undertaken noise surveys, assessment and details of appropriate acoustic mitigation to achieve suitable internal noise levels.

1.1 Previous consented scheme

Cundall previously provided a Noise Impact Assessment[1] in support of the previous iteration of the development (application ref: 132416/FO/2021) which granted conditional approval on 30 June 2022.

As well as undertaking additional 3D noise modelling for changes to building massing as part of current Development proposals, this report presents an assessment against night-time internal ambient noise limits in bedrooms in accordance with Approved Document O of the Building Regulations which took effect on 15 June 2022.

[1] Cundall report ref 1032195-RPT-AS-001_P02 dated 31 January 2021

2.0

Planning policy and guidance

2.0 Planning policy and guidance

The proposed development has been assessed for suitability in terms of noise, based on the following policy, standards and guidance documents:

- The National Planning Policy Framework (2021) (NPPF)
- The Noise Policy Statement for England (2010) (NPSE)
- The Planning Practice Guidance - Noise (2019) (PPG Noise)
- ProPG: Planning & Noise Professional Practice Guidance on Planning & Noise – New residential development (2017) (ProPG)
- BS 8233:2014 – Guidance on sound insulation and noise reduction for buildings (BS 8233)
- Building Regulations 2010 Overheating: Approved Document O (AD-O)
- BS 4142:2014+A1:2019 – Methods for rating and assessing industrial and commercial sound (BS 4142)
- Manchester City Council's Planning & Noise: Technical Guidance (October 2022)
- Manchester's Local Development Framework – Core Strategy Development Plan Document 2012 to 2027
- Manchester Citywide Development Control Policies

2.1 National Planning Policy Framework

The revised National Planning Policy Framework was updated on 20 July 2021 and sets out the government's planning policies for England and how these are expected to be applied.

The NPPF states:

134. Development that is not well designed should be refused, especially where it fails to reflect local design policies and government guidance on design, taking into account any local design guidance and supplementary planning documents such as design guides and codes. Conversely, significant weight should be given to:

a) development which reflects local design policies and government guidance on design, taking into account any local design guidance and supplementary planning documents such as design guides and codes; and/or

b) outstanding or innovative designs which promote high levels of sustainability, or help raise the standard of design more generally in an area, so long as they fit in with overall form and layout of their surroundings.

174. 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;

186. 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; […]

187. 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.

2.2 Noise Policy Statement for England

The noise policy statement for England (NPSE) was published by Defra in March 2010. The NPSE sets out the long-term vision of Government noise policy.

Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

The NPSE long term vision is supported by the following aims:

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvement on health and quality of life.*

2.3 Planning Practice Guidance

The Department for Communities and Local Government (DCLG) launched a planning practice guidance in March 2014 (last updated July 2019) which is a web-based resource and includes a section on Noise. This resource provides guidance on how to determine the noise impact in terms of whether a significant adverse effect is likely to occur and/or whether a good standard of amenity can be achieved.

In line with the NPSE, PPG Noise introduces the concept of:

- 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.

Table 2-1 summarises the noise exposure hierarchy, based on the likely average response.

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

Table 2-1: PPG noise exposure hierarchy

2.4 ProPG – Professional Practice Guidance on Planning & Noise

The 'Professional Practice Guidance on Planning & Noise – New Residential Development' (ProPG) was produced to provide practitioners with guidance and a recommended approach for the assessment of noise impact on residential developments during the planning stage. The production of the document was overseen by a working group consisting of members of the Chartered Institute of Environmental Health (CIEH), Institute of Acoustics (IOA) and the Association of Noise Consultants (ANC).

The primary goal of the ProPG is to:

Assist the delivery of sustainable development by promoting good health and wellbeing through the effective management of noise.

The document seeks to do this by:

'*Encouraging a good acoustic design process in and around proposed new residential development having regard to national policy on planning and noise'*

The ProPG advocates a 2-stage approach to facilitate *'straightforward accelerated decision making for lower risk sites and assists proper consideration of noise issues where the acoustic environment is challenging'*.

The recommended approach is summarised below:

- Stage 1 – an initial noise risk assessment of the proposed development site; and
- Stage 2 – a systematic consideration of four key elements.
  - Element 1 – demonstrating a "Good Acoustic Design Process";
  - Element 2 – observing internal "Noise Level Guidelines";
  - Element 3 – undertaking an "External Amenity Area Noise Assessment"; and
  - Element 4 – consideration of "Other relevant Issues".

In addition to the above, the ProPG states:

The approach is underpinned by the preparation and delivery of an 'Acoustic Design Statement' (ADS). An ADS for a site assessed as high risk should be more detailed than for a site assessed as low risk. An ADS should not be necessary for a site assessed as low risk.

Having followed the recommended approach, the ProPG suggests that the noise practitioner should be able to make one of four recommendations to the relevant planning decision maker:

A) Planning consent may be granted without any need for noise conditions;
B) Planning consent may be granted subject to the inclusion of suitable noise conditions ;
C) Planning consent should be refused on noise grounds in order to avoid significant adverse effects ("avoid"); or
D) Planning consent should be refused on noise grounds in order to prevent unacceptable adverse effects ("prevent").

2.5 BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings'

British Standard 8233:2014 provides guidance on maximum internal ambient noise levels in residential and non-residential spaces, based on guidelines issued by the World Health Organisation (WHO). The following table summarise the guidance relevant to internal noise levels in residential spaces.

Activity	Location	Daytime (07:00 to 23:00 hrs)	Night time (23:00 – 07:00 hrs)
Resting	Living room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	-
Sleeping	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

Table 2-2: Summary of BS8233 criteria for internal noise levels in dwellings

The following notes should be considered when following the guidance above:

If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level

In relation to the noise guidelines in Table 2-2 above, BS 8233 states:

Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved

2.6 Building Regulations: Approved Document O (AD-O)

Approved Document O was published on 15 December 2021 as part of the government's Building Regulations. It covers two overheating mitigation requirements for new residential buildings (Requirement O1):

a. Limiting unwanted solar gains in summer;
b. Providing an adequate means to remove heat from the indoor environment.

The aim of the requirements is to "…*protect the health and welfare of occupants of the building by reducing the occurrence of high indoor temperatures"*. Compliance can be demonstrated by using one of the following methods:

- The simplified method, as set out in Section 1 of the document;
- The dynamic thermal modelling method, as set out in Section 2 of the document.

The requirement O1(2) of the document states that in meeting the requirement O1 as per above *"…account must be taken of the safety of any occupant, and their reasonable enjoyment of the residence…".* This is also in regard to noise assessments.

Paragraph 3.2 to 3.4 of the document states in regard to noise and overheating assessment that:

3.2 In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11 pm to 7 am);

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

a. 40 dB $L_{Aeq,T}$, averaged over 8 hours (between 11 pm and 7 am)

b. 55 dB L_{AFmax}, more than 10 times a night (between 11 pm and 7 am);

3.4 Where in-situ noise measurements are used as evidence that these limits are not exceeded, measurements should be taken in accordance with the Association of Noise Consultants' Measurement of Sound Levels in Buildings with the overheating mitigation strategy in use.

The detailed thermal modelling shall be undertaken in accordance with CIBSE TM59 (using the criteria specified within AD-O) during detailed design phases and, where the risk of overheating is identified, will identify a strategy for limiting solar gains (shutters, blinds, ceiling fans, etc) and removing excess heat.

Where passive means to remove heat (e.g. opening windows, ventilation louvres) conflict with acceptable internal noise levels, alternative mechanical means of cooling may need to be introduced. This analysis will be used by the design team to develop a suitable overheating strategy for the residential uses of the proposed development.

2.7 BS 4142:2014+2019 'Methods for rating and assessing industrial and commercial sound'

The BS 4142 assessment method involves comparing the rating level (the 'specific' noise level plus a range of potential feature corrections) of a sound source to the measured background sound level in order to estimate its initial impact, as follows:

Typically, the greater this difference, the greater the magnitude of the impact.

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

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

c) The lower the rating level is relative to the measured background sound level, the less likely it is that the 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.

The standard suggests that the noise source of interest will have a 'low impact' when the 'rating level' of a noise source is less than the existing background noise. It is also important to note that the standard requires that any quantitative assessment results are assessed in light of the context in which the sound occurs.

With regard to background noise levels, BS 4142 states:

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.

2.8 Manchester City Council - Planning & Noise: Technical Guidance (October 2022)

2.8.1 Fixed mechanical services plant

With respect to noise from fixed mechanical services plant items, this document states that:

Any noise assessment needs to consider not only the overall level of noise emitted but also its particular characteristics. The noise assessment should be based on BS 4142: 2014 and any application for fixed plant, equipment or machinery must demonstrate that:

'Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location'.

2.8.2 Residential developments

Section 3.6.1.1 of the document relates to internal / external ambient noise limits for residential properties and adopts the following criteria based on BS 8233 guidance:

Manchester City Council has adopted the following internal noise limits for residential properties:

- ***Bedrooms (night-time – 23.00 – 07.00) 30 dB L_{Aeq} (individual noise events should not normally exceed 45 dB $L_{Amax,F}$ by more than 15 times)***
- ***Living Rooms (daytime – 07.00 – 23.00) 35 dB L_{Aeq}***
- ***Gardens and terraces (daytime) 55 dB L_{Aeq}***

2.8.3 Structure-borne entertainment noise

Should there be the potential for amplified music within the ground-floor of the development, Section 3.6.1.2 of the MCC Planning & Noise Technical Guidance document states the following criteria with respect to "new residential developments that are structurally connected to entertainment venues" in order to achieve a condition of 'inaudible' / 'virtually inaudible':

'Music noise levels in the 63Hz and 125Hz octave centre frequency bands (L_{eq}) should be controlled so as not to exceed (in habitable rooms) 47dB and 41dB (L_{eq}) respectively'.

In addition to the above limits in 63 Hz and 125 Hz octave bands, we would suggest that entertainment noise frequency content in other octave bands up to 8 kHz do not exceed NR 20 values where measured in adjacent habitable rooms. The maximum acceptable noise levels in each octave band from 63 Hz to 8 kHz are as shown in Table 2-3 below:

Maximum permissible structure-borne entertainment noise levels, dB (L_{eq})							
63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
47	41	31	24	20	17	14	13

Table 2-3: Structure-borne entertainment noise limits

It is also noted that:

This criterion may also be applicable for new residential developments that are structurally separate from an existing entertainment venue.

2.8.4 Airborne entertainment noise

Section 3.6.1.2 of the MCC document also makes reference to airborne entertainment noise from new entertainment venues that are structurally detached from other buildings. Music noise from the proposal will not be 'audible' in nearby properties, assuming that the residential properties in question have their windows open. The criterion here is:

Entertainment noise (L_{Aeq}) should be controlled to 10dB below the background noise level (L_{A90}) without the entertainment noise present, in each octave band at the nearest noise sensitive location.

2.9 Manchester's Local Development Framework - Core Strategy

The Core Strategy was adopted by Manchester City Council in July 2012. It is the key document in Manchester's Local Development Framework and outlines the Council's vision for Manchester in 2027 along with the planning policies which will be used to deliver that vision. Section of Policy DM1 of the Core Strategy which are relevant to noise and good acoustic design are reproduced below:

Policy DM 1

Development Management

All development should have regard to the following specific issues for which more detailed guidance may be given within a supplementary planning document:

- *Appropriate siting, layout, scale, form, massing, materials and detail.*

[…]

- *Effects on amenity, including privacy, light, noise, vibration, air quality, odours, litter, vermin, birds, road safety and traffic generation. This could also include proposals which would be sensitive to existing environmental conditions, such as noise.*
- *Design for health.*

[…]

2.10 Citywide Development Control Policies

Item DC26 of the Manchester City Council 'Citywide Development Control Policies' document is relevant to noise and is taken into regard when considering whether permission should be granted.

26. DEVELOPMENT AND NOISE

DC26.1 The Council intends to use the development control process to reduce the impact of noise on people living and working in, or visiting, the City. In giving effect to this intention, the Council will consider both:

a. *the effect of new development proposals which are likely to be generators of noise; and*
b. *the implications of new development being exposed to existing noise sources which are effectively outside planning control*

DC26.2 New noise-sensitive developments (including large-scale changes of use of existing land or buildings), such as housing, schools, hospitals or similar activities, will be permitted subject to their not being in locations which would expose them to high noise levels from existing uses or operations, unless the effects of the noise can realistically be reduced. In giving effect to this policy, the Council will take account both of noise exposure at the time of receiving a planning application and of any increase that may reasonably be expected in the foreseeable future.

DC26.3 Developments likely to result in unacceptably high levels of noises will not be permitted:

a. *in residential areas;*
b. *near schools, hospitals, nursing homes and similar institutions;*
c. *near open land used frequently for recreational purposes.*

DC26.4 Where the Council believes that an existing noise source might result in an adverse impact upon a proposed new development, or where a new proposal might generate potentially unacceptable levels of noise, it will in either case require the applicant to provide an assessment of the likely impact and of the measures he proposes to deal satisfactorily with it. Such measures might include the following:

a. *engineering solutions, including reduction of noise at source, improving sound insulation of sensitive buildings or screening by purpose-built barriers;*
b. *layout solutions, including consideration of the distance between the source of the noise and the buildings or land affected by it; and screening by natural barriers or other buildings or non-critical rooms within a building; and*
c. *administrative steps, including limiting the operating times of the noise source, restricting activities allowed on the site or specifying an acceptable noise limit. Any or all of these factors will be considered appropriate for inclusion in conditions on any planning permission.*

DC26.5 The Council will control noise levels by requiring, where necessary, high levels of noise insulation in new development as well as noise barriers where this is appropriate.

DC26.6 Exceptions to the general policy will be considered on their merits. The Council accept, as an example, that the occasional use of outdoor facilities such as sports stadia for concerts can be acceptable in certain circumstances. Any such proposal will be considered in the light of consultation with local residents and others, and the practicability of appropriate conditions on any approval.

Reasons :-

It has become increasingly accepted that noise is a major source of environmental pollution, affecting peoples' physical and mental health. The Council considers that the planning process has a role to play in reducing noise levels generally and, through the development control system, to consider carefully the relationship between different land-uses from the point of view of noise generation and impact. Reaching judgments on what is or is not an acceptable amount or type of noise is a complex matter, consideration of which will depend on the particular circumstances on the ground.

(NOTE: The Council will issue more detailed advice on the subject as supplementary guidance, and this will have regard to current Government policy. The UDP policies therefore are limited to broad principles. Two key areas are:

i) a presumption against allowing highly "noise sensitive" uses (such as housing and schools) so close to existing noise sources that problems would be likely to result. An existing noisy factory, for example, is entitled to some protection from objection about its activities from future residential neighbours, who would themselves feel entitled to a reasonable degree of residential amenity; and

ii) the reverse situation, where there would be an equal presumption against allowing noisy, or potentially noisy, activities into an area with low ambient noise levels, and where people would have a reasonable expectation that no significant increase in those background levels would be allowed. Where the relationship is difficult to predict, the Council will place the onus for assessing the noise impact of, or upon, a proposed new development on the developer, and will consult (in particular) with the Director of Environmental Health. The policy sets out the range of measures which are available to help to reduce the noise effect to acceptable levels. As well as conditions on any planning permission, a "planning obligation" (for example, an Agreement under Section 106 of the Town and Country Planning Act 1990) may be appropriate to ensure key measures are taken effectively).

3.0

Environmental noise survey

3.0 Environmental noise survey

3.1 Site description

The site is located at Great Ducie Street, Cheetham Hill, Manchester, M3 1PT in central Manchester. The former Boddingtons brewery site is currently operated as an open-air car park with Great Ducie Street (A56) bounding the site to the west. Beyond the A56 are warehousing units with the River Irwell behind them.

At the north boundary of the site is the Travelodge Manchester Central Arena hotel, at the corner of Great Ducie Street and Francis Street, with warehousing units and HMP Strangeways beyond to the north. East of the site are a couple of vacant lots, with mixed retail and open-air car parking areas beyond.

At the south boundary of the site is an ongoing development of a new five-storey educational development for The Manchester College beyond which is the internal Ring Road and the AO Manchester Arena.

3.2 August 2021 survey – road traffic impacts

3.2.1 Survey locations

To assess the levels of environmental noise affecting the site, a number of attended noise measurements undertaken at various parts of the daytime and night-time period have been carried out, generally in accordance with BS 7445. During the attended noise survey at the site, the dominant noise source throughout the daytime period was the A56 running adjacent to the site, with some contribution from other distant roads. As the site was unsecure, it was not possible to leave unattended long-term monitoring equipment at the site.

Measurement periods were selected to try and capture the quietest part of the day (12:30 to 16:15), quietest part of the night (00:00 to 04:00) and the loudest parts of the night and day corresponding to morning rush hour (05:00 to 09:00). All measurements were undertaken on typical weekdays.

No contributions from other sources were noted.

With a view to establishing the existing noise climate across the site, attended noise surveys were undertaken at the following locations, highlighted in Figure 3-1, overleaf.

MP1 – Selected as being representative of typical noise climate at worst-case affected dwellings situated closest to Great Ducie Street

MP2 – Selected as being representative of background noise climate at closest façade of adjacent Travelodge Manchester Central Arena hotel

MP3 – Selected as being representative of the quieter noise climate towards the rear of the site

The approximate site boundary is shown in **RED**, with the adjacent Travelodge hotel highlighted in **CYAN**. 30-minute measurements were undertaken at each of the three highlighted measurement positions, with the microphone at a height of approximately 3.5 m above local ground level, in a free field location.

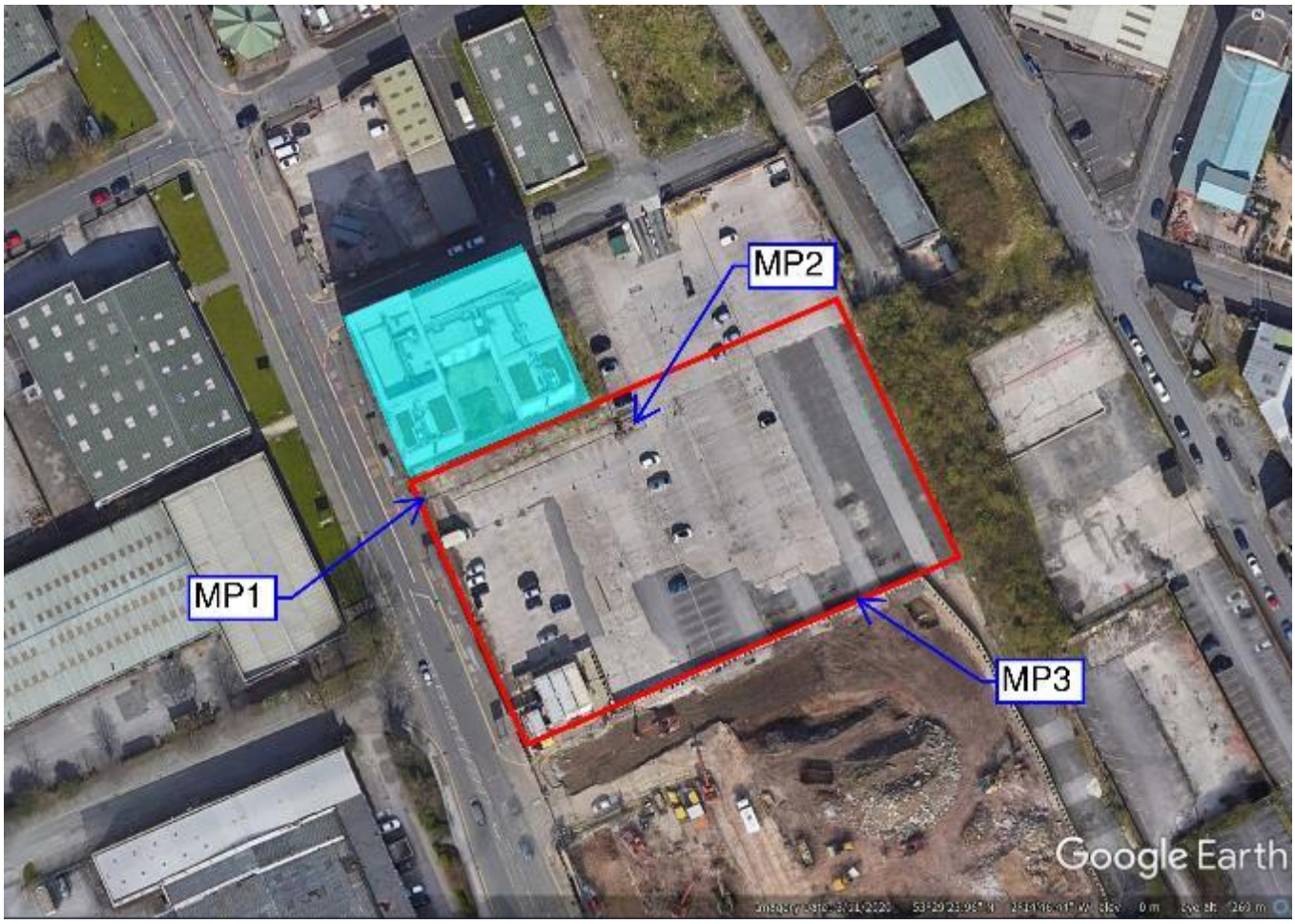


Figure 3-1: Site overview showing measurement positions (August 2021)

3.2.2 Equipment used

The instrumentation used during the surveys conforms to BS EN 60651 Type 1 accuracy. External laboratory certificates can be provided upon request. For attended survey works, the sound level meter was extended with a cable and the microphone fitted inside a weatherproof windshield, which was then mounted on a pole.

The sound level meter was calibrated before and after each survey in accordance with the manufacturer's instructions. No significant drift was noted to have occurred.

An NTi XL2-TA Class 1 sound level meter was used for all measurements.

3.2.3 Weather conditions

During the early morning and daytime measurements, the weather was warm, dry and still, while at night the temperature was mild. All windspeeds were <5ms^{-1}.

3.2.4 Survey results

The following table summarises the results gathered across the four days of measurements undertaken. The values shown include the following notations:

- Average noise levels: for short term monitoring, the $L_{Aeq,T}$ values are shown with the time, *T*, being equivalent to the monitoring duration (30 minutes);
- Maximum noise levels: for short term monitoring periods, the highest measured maximum instantaneous noise level, L_{AFmax}, is declared;
- Background noise levels: for short term monitoring, the L_{A90} is declared, with the time period equivalent to the measurement period (30 minutes).

All values in Table 3-1 below are A-weighted decibels, dB(A).

Position	Date	$L_{Aeq,30min}$ dB	L_{AFmax} dB	$L_{A90,30min}$ dB
MP1	23/08/2021 12:34-13:04	71	88	62
	23/08/2021 14:31-15:01	71	83	61
	24/08/2021 00:16 - 00:46	67	79	48
	24/08/2021 02:05 - 02:35	65	79	45
	26/08/2021 07:08 - 07:38	72	92	62
	26/08/2021 05:10 - 05:40	65	81	45
MP2	23/08/2021 13:20 - 13:50	62	83	54
	23/08/2021 15:07 - 15:37	58	74	54
	24/08/2021 00:52 - 01:22	54	71	43
	24/08/2021 02:41 - 03:11	50	65	40
	26/08/2021 07:42 - 08:12	60	85	56
	26/08/2021 05:48 - 06:18	55	68	46
MP3	23/08/2021 13:56 - 14:26	57	80	51
	23/08/2021 15:45 - 16:15	56	79	51
	24/08/2021 01:27 - 01:57	47	61	39
	24/08/2021 03:26 - 03:56	45	61	36
	26/08/2021 08:18 - 08:48	62	88	53
	26/08/2021 06:27 - 06:57	53	72	48

Table 3-1: Summary of noise survey results (August 2021)

3.3 January 2022 survey – AO Arena Impacts

3.3.1 Survey locations

At the time of the August 2021 Cundall survey, it was not possible to undertake a survey during a music performance at the AO Arena due COVID-19 related event postponements.

Separate attended measurements of noise impacts during an AO Arena event were subsequently undertaken on 24 January 2022 during the 'Big Night of Musicals' event at the Arena. The event comprised a number of music performances including songs from rock music based musicals such as Bat Out of Hell and School of Rock. Timings of the event taken from the AO arena website were confirmed as being "between 7.30pm and 9.00 pm".

Measurement periods were selected to capture the noise climate immediately before the event (starting from approximately 18:15) in the absence of entertainment noise, and then continuing for the full duration of the event until the 21:00 curfew.

With a view to establishing the ambient noise climate across the site during an event, attended noise surveys were undertaken at two separate locations as highlighted in Figure 3-2 and in the photographs presented in Figure 3-3.

MP4A – Selected as being representative of typical noise climate at worst-case area of current car park (Note: Measurement position was outside of the Development red line boundary, in a position which allowed for direct line-of-sight to the AO Arena)

MP4B – Selected as being positioned closer to the AO area in a location more screened from the A56 Great Ducie Street due to the massing of the Manchester College scheme which is nearing completion.

Figure 3-2: Site overview showing measurement positions (January 2022 survey)

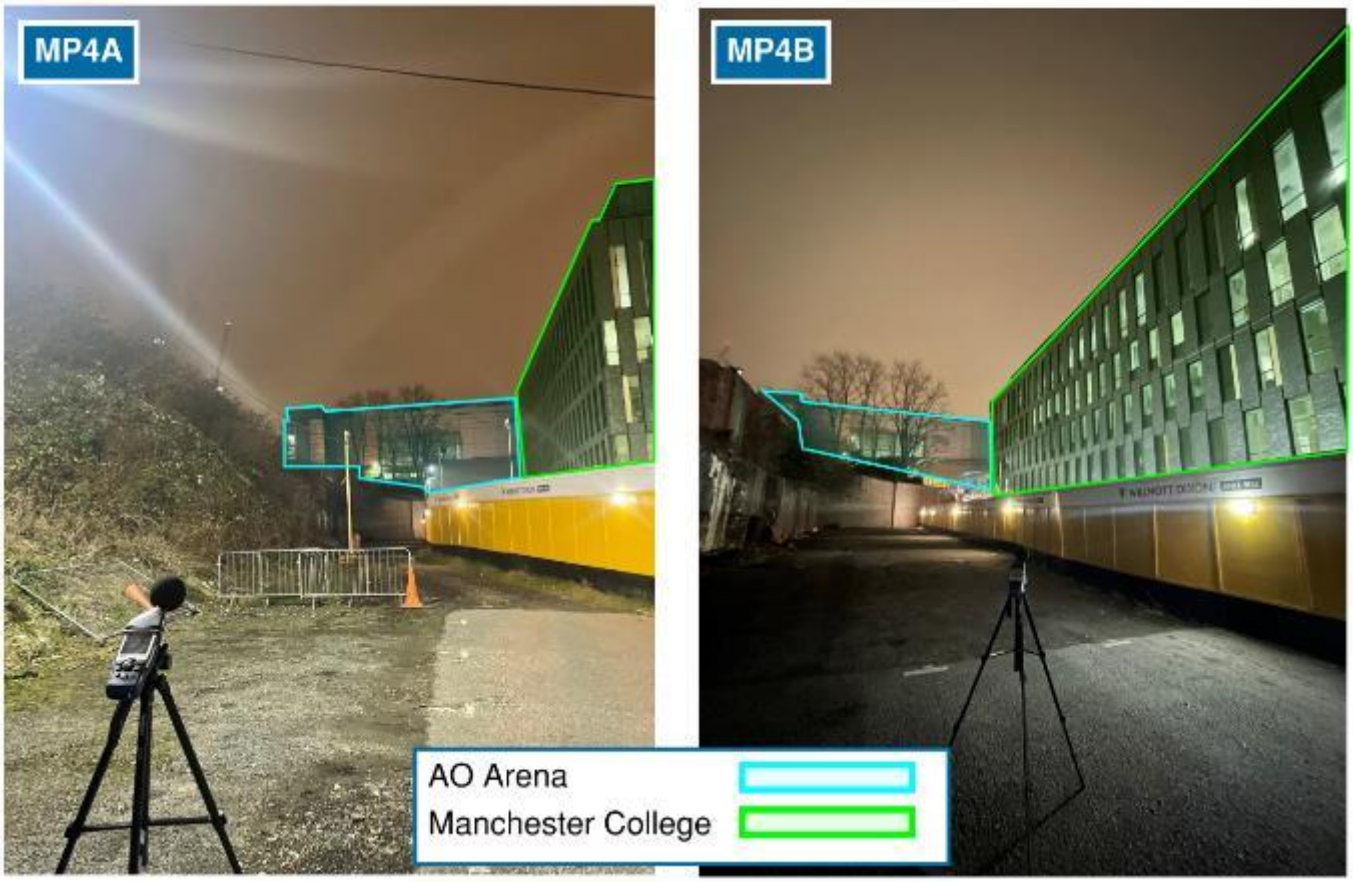


Figure 3-3: Measurement positions with views to AO Arena

Subjective impressions of the noise climate during the survey at both locations are summarised in the following table:

Position	Subjective impressions	
	Before music event	**During music event**
MP4A	Noise climate dominated by road traffic along A56 Great Ducie Street with some contribution from other surrounding roads.	Road traffic along Great Ducie Street remained the dominant noise source, although low-frequency music contributions were audible between lulls in local traffic. Peaks in $L_{AF,max}$ and low-frequency noise from the AO Arena were noted to be lower than from the highest contributions due to loud music from passing vehicles.
MP4B	Noise climate dominated by road traffic along A6042 Ring Road with some contribution from other surrounding roads.	Road traffic along A6042 Ring Road remained the dominant noise source, although low-frequency music contribution was just audible throughout most of the measurement.

Table 3-2: Subjective impressions during attended survey

3.3.2 Equipment weather conditions

The equipment used was identical to that reference in Section 3.2.2. The weather was cold, dry and calm with all windspeeds <5ms^{-1}.

3.3.3 Survey results

The following table summarises the results gathered across the four days of measurements undertaken. The values shown include the following notations:

- Average noise levels: the $L_{Aeq,T}$ values are shown with the time, *T*, being equivalent to the measurement duration;
- 1/1 individual octave band level: the low-frequency content in 63 Hz octave band is declared;
- Background noise levels: for short term monitoring, the L_{A90} is declared, with the time period equivalent to the measurement period (30 minutes)

All values in Table 3-1 below are A-weighted decibels, dB(A).

Locations	Start (hh:mm)	Duration (h:mm:ss)	$L_{Aeq,T}$ dB	$L_{Aeq,T}$ @ 63 Hz dB	L_{AFmax} dB
MP4A	18:10	0:14:55	49	37	66
MP4B	18:30	0:14:40	50	37	66
MP4A	18:47	1:12:05	49	34	68
MP4B	20:00	0:14:15	50	36	59
MP4A	20:18	0:41:44	50	35	67

Table 3-3; Summary of noise survey results (January 2021 survey)

Time trace plots for the instantaneous (Δt = 0.01 second) 63 Hz octave band results are presented in 0

3.3.4 Analysis of AO Arena impacts

As can be seen from the results presented in Table 4, there is minimal variation in the overall average $L_{Aeq,T}$ or the 63 Hz octave band content when comparing pre- and during-event values. This is in line with the subjective impression that whilst low-frequency AO Arena noise was occasionally audible, it was not a dominant contributor to the overall ambient noise climate.

In terms of the magnitude of low-frequency noise impacts, the measured levels of ≤ 37 dBA @ 63 Hz would be considered relatively modest for a city centre environment. For context, the measured 63 Hz octave band value at MP3 during the daytime (08:18 - 08:48) was 39 dBA.

Due to the physical properties of low-frequency sound pressure waves, partially open windows (and other small opening in general) provide much better sound insulation at lower frequencies in comparison to mid-frequencies. This is demonstrated in the following sound insulation research data presented by 'The Building Performance Centre, School Of The Built Environment, Napier University[2]' for a variety of windows tested with different opening configurations.

[2]Fuller, T., Lurcock, D., Mackenzie, R., & MacKenzie, R. (2006). Open/closed window research: sound insulation through ventilated domestic window

	Octave Band Centre Frequency (Hz)							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	$D_{n,e,w}$ (C_i;C_{tr})
Opening A-1	20.6	15.7	15.5	20.2	18.7	22.0	23.0	21 (-1; -2)
Opening A-2	20.2	16.6	15.2	20.2	18.6	21.6	23.0	21 (-1; -2)
Opening A-3	21.3	15.1	18.5	19.0	15.9	20.7	23.6	20 (-1; -2)
Opening B	22.1	14.9	15.5	19.2	12.5	18.4	23.6	17 (-1; -2)
Opening C-1	24.0	18.4	22.5	17.9	16.4	21.8	25.1	19 (0; -1)
Opening C-2	24.4	18.3	20.6	20.1	15.8	23.0	26.9	21 (-2; -3)
Opening C-3	24.1	19.2	24.8	18.0	16.9	22.3	26.0	20 (-1; -1)
Opening C-4	24.4	19.0	22.9	20.1	15.9	23.2	27.1	21 (-1; -3)
Opening D-1	23.7	17.3	20.8	16.9	19.7	19.8	21.1	19 (0; 0)
Opening D-2	24.8	16.5	14.4	21.5	13.7	17.7	18.6	17 (-1; -1)
Opening D-3	25.0	16.8	15.6	21.0	18.0	20.2	22.1	20 (-1; -1)
Opening E	24.4	18.6	19.6	18.7	19.0	20.6	21.9	20 (0; -1)
Opening F	24.7	17.8	19.2	18.6	19.6	20.2	22.7	20 (0; -1)
Opening G	24.0	17.5	18.8	18.1	18.5	17.6	19.6	18 (0; 0)

Table 5-4 Derived $D_{n,e}$ result for "100,000 mm²" open windows (L6, S1, R2-6) (dB)

Figure 3-4: Research data showing increased sound insulation performance at 63 Hz in comparison to other octave bands

Based on the sound insulation values presented in Figure 3-4 and the measured 63 Hz values in Table 3-3, it can be seen that external noise intrusion associated with low-frequency noise from the AO Arena is likely to be negligible, even with partially open windows. Even if accounting for possible increase to the measured low-frequency content (e.g. due to potentially louder AO Arena events, apartments at upper floor levels which may have greater line-of-sight to AO Arena) it is expected that the external noise break-in will remain negligible, especially when considering masking internal noise generated by MVHR systems.

4.0

Initial noise risk assessment

4.0 Initial noise risk assessment

This section of the report presents a 'Stage 1' initial noise risk assessment for the development based on the guidance in the ProPG. This risk assessment will be based on the noise measurement data described in Section 3.0.

The Stage 1 assessment of the ProPG process aims to provide an indication of the likely risk of adverse effects on future residential development as a result of the existing baseline noise climate on and around the proposed development site. The ProPG states that this risk assessment should not include any subsequent mitigation to be included as part of the development proposal.

4.1 Analysis of measured noise levels

The noise survey results detailed in Section 3.2.4 shows that the measured noise levels across the site range from 58 to 72 dB L_{Aeq} during the daytime, and between 45 and 67 dB L_{Aeq} during the night-time.

The site is dominated by road traffic noise from Great Ducie Street with the highest noise levels measured at the western site boundary where it is closest to Great Ducie Street. Noise levels generally decrease across the site, with greater distance from this road. This is demonstrated by the noise modelling produced for the site which has been calibrated with the measured noise levels at individual measurement positions.

Figure 4-1 and Figure 4-2 show the calculated daytime and night-time noise propagation across the existing site and immediate surrounding area (see Section 5.1.1 for details of noise model calibration process).

The outline of the proposed buildings indicated for reference, although this is not included in the calculation.

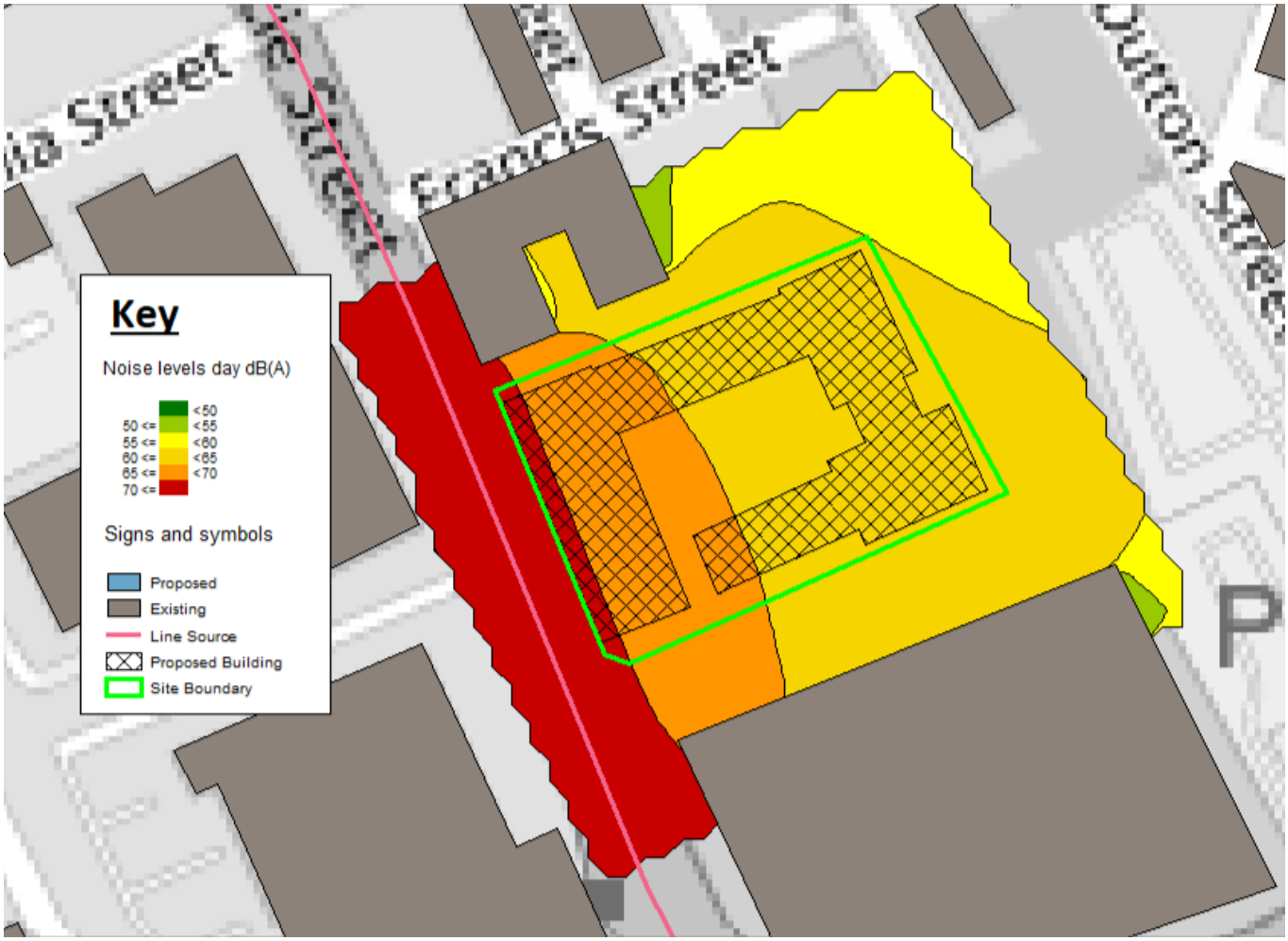


Figure 4-1; Calculated daytime noise level across the site

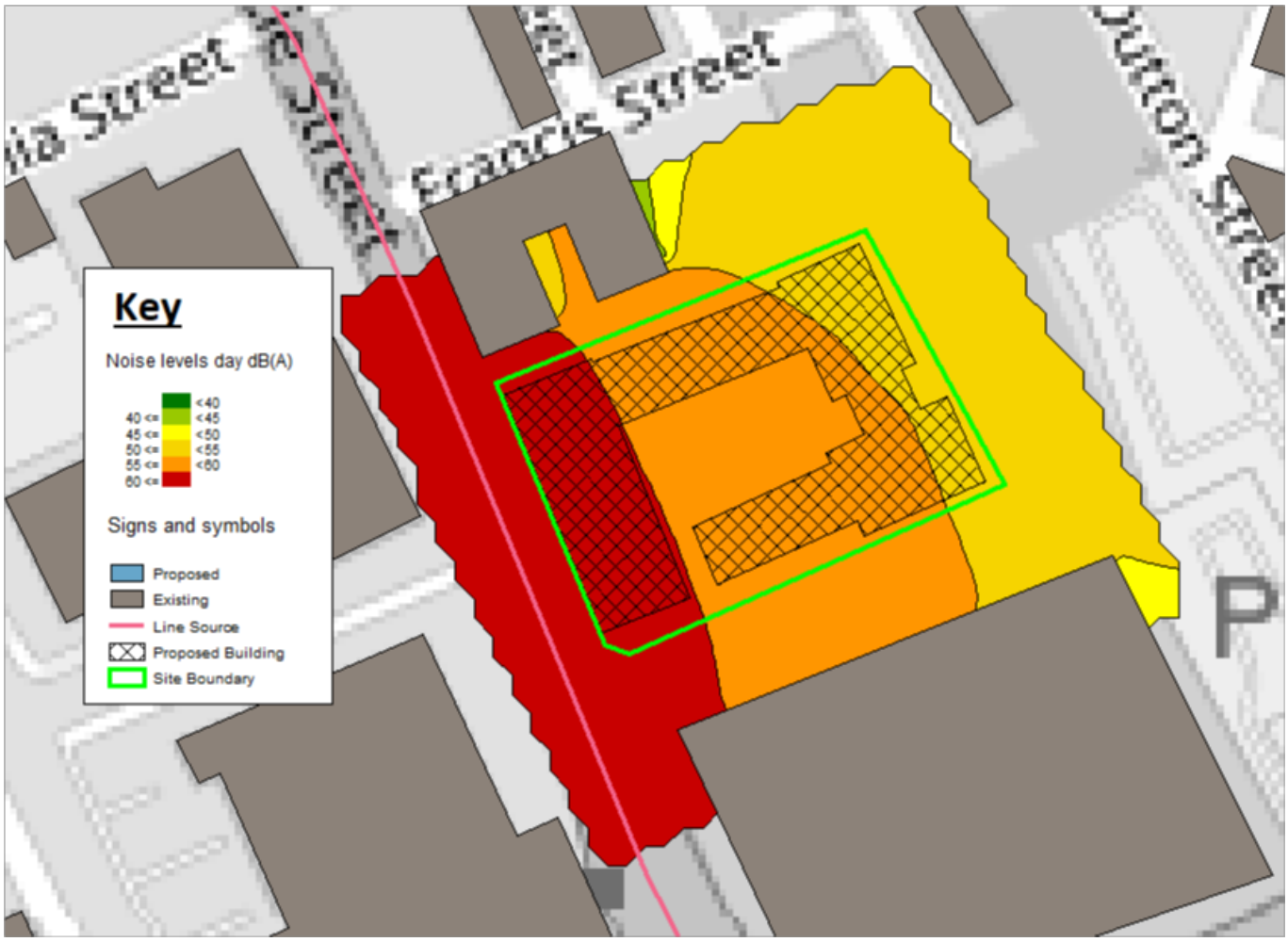


Figure 4-2: Calculated night-time noise level across the site

When compared to the risk assessment table of the ProPG (reproduced below in Figure 4-3), the most exposed areas of the site (west boundary) are likely to be between the 'medium' and 'high' risk from a noise perspective, whilst the quieter eastern sections of the site (eastern boundary) are likely to present between a 'low' and 'negligible' noise risk. When examining the night-time noise levels incident upon the site a similar conclusion is reached.

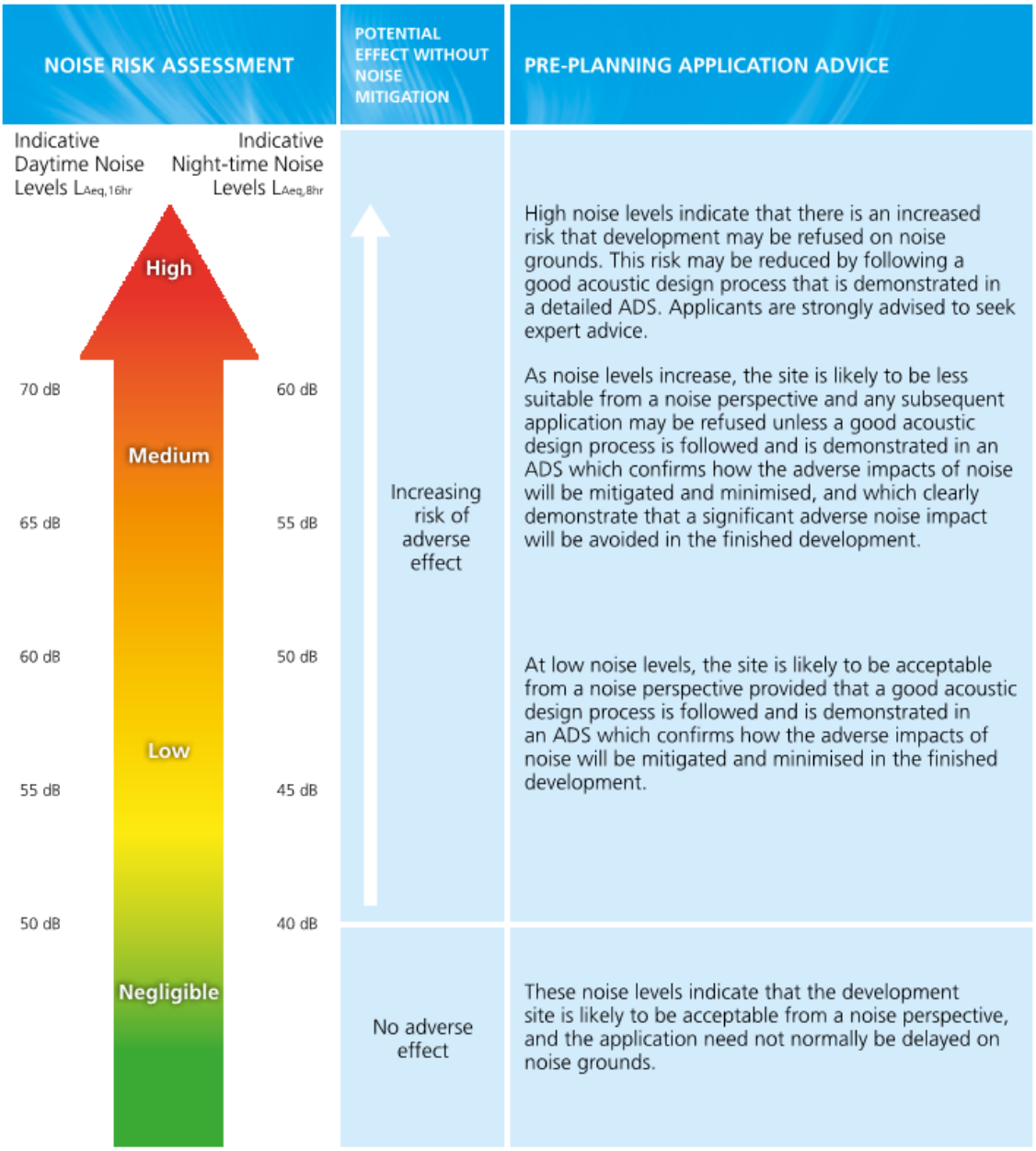


Figure 4-3 : ProPG stage 1 risk assessment table (Fig 1 ref. ProPG)

The Stage 1 assessment indicates that across the majority of the proposed development site the noise risk is higher than ‘negligible’. It is therefore considered that a ProPG Stage 2 assessment is required to be undertaken for the site.

5.0

Acoustic design statement

5.0 Acoustic design statement

An initial noise risk assessment undertaken in line with ProPG (Stage 1 assessment detailed in Section 4.0), has found that some of the site is likely to be above 'negligible' risk from a noise perspective. Therefore, as recommended by the ProPG, an Acoustic Design Statement (ADS) has been produced.

This section of the report provides an ADS based on the recommended approach outlined in ProPG to assess the level of noise impact on the proposed development.

5.1 Stage 2 Assessment – Acoustic Design Statement

The ProPG suggests that an ADS should consider four key elements. Each of these four elements are discussed in the following sections.

5.1.1 Noise modelling

As part of this assessment, a noise model has been produced to evaluate the noise climate across the site and estimate the noise levels likely to be incident upon the proposed building facades. The results of this modelling have been used to inform the ADS and are referred to in the following sections of this report.

This model has been developed using the commercially available SoundPLAN (Version 8.2) software. The model has been 'calibrated' against the measured traffic noise levels from the survey and neighbouring buildings have been included in the model to account for the screening / reflections that these buildings may provide. It is important to note that this model only takes account of traffic noise from Great Ducie Street (A56) and Ring Road (A6042), and assumes that the Ring Road noise spectrum and level is identical to that of Great Ducie Street. However, this is considered to be a reasonable assumption as Great Ducie Street is the dominant noise source across the site.

5.1.2 Element 1 – Good acoustic design process

The potential effects of noise have been considered throughout the design of the masterplan.

During the initial stages of the project, a number of site layouts and orientation options were considered by the project team. During this process, a range of factors were considered including acoustics. One of the benefits of the proposed layout is that only a relatively small portion of the proposed residences are located in areas of the site exposed to the highest noise levels (i.e. on the western site boundary adjacent to Great Ducie Street).

The proposed layout also provides screening to external areas of the site located away from the road.

5.1.3 Element 2 – Internal noise level guidelines

This element of the assessment seeks to identify if and how the 'internal noise level guidelines' (INLGs) defined in the ProPG can be achieved in noise sensitive rooms within the proposed development.

In relation to the INLGs, the ProPG states the following:

"*Most residents value the ability to open windows at will, for a variety of reasons, and LPSs should therefore normally request that designers principally aim through the use of good acoustic design, to achieve the internal noise level guidelines in noise-sensitive rooms with windows open. Where internal noise levels are assessed with windows closed the justification for this should be included in the ADS.*

"*Where the LPA accepts that there is a justification that the internal target noise levels can only be practically achieved with the windows closed, which may be the case in urban areas and at sites adjacent to transportation noise sources special care must be taken to design the accommodation so that it provides good standards of acoustic, ventilation and thermal comfort without unduly compromising other aspects of the living environment. In such circumstances, internal noise levels can be assessed with windows closed but with any façade openings used to provide 'whole dwelling ventilation' in accordance with Building Regulations Approved Document F (e.g. trickle ventilation) in the open position. Furthermore, in this scenario the internal L_{Aeq} target noise levels should not generally be exceeded.*"

The proposed site is located in an urban area and directly adjacent to a major transport route. This means that in much of the site, it will not be possible to meet the ProPG INLGs whilst windows are open. Therefore, for this site, internal noise levels will be assessed with windows closed. However, consideration of ventilation and thermal comfort has been undertaken during the pre-planning design process to avoid and minimise the potential for adverse noise effects.

The proposed design solutions relating to ventilation and thermal comfort are described in detail in sections 5.1.3.2 and 5.1.3.3. However, one key design decision taken early in the project was that 'whole dwelling ventilation' (previously known as background ventilation) will be provided by a mechanical ventilation and heat recovery system (MVHR). Providing the necessary whole dwelling house ventilation rates via an MVHR system removes the need for ventilation openings in the façade in sensitive spaces (e.g. trickle vents).

The ProPG INLGs are based on BS 8233, which contains guidance on suitable internal noise levels (described in Section 2.5 of this document). These values are reproduced below; however, it is also important to take into account the note from ProPG which states that it is generally accepted that the internal noise criteria outlined in BS 8233 (and the 45 dB L_{AFmax} maximum noise criteria from ProPG) represent the lowest observable adverse effect level (LOAEL ref. the NPSE, described in Section 2.2 of this document). Therefore, if these internal noise levels are met, it is unlikely that adverse noise effects on future residents will occur. If the noise levels exceed these values, adverse effects may occur but they will not necessarily be significant (assuming they are below the SOAEL) and therefore are likely to be acceptable in some situations.

Activity	Location	Daytime (07:00 to 23:00 hrs)	Night time (23:00 – 07:00 hrs)
Resting	Living room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	-
Sleeping	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

Table 5-1: Summary of BS8233 criteria for internal noise levels in dwellings

ProPG also references BS 8233 regarding the internal noise levels. As noted in Section 2.5, the BS 8233 criteria themselves are based on guidelines issued by the World Health Organisation (WHO).

"*Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal L_{Aeq} target levels may be relaxed by up to 5 dB and reasonable internal noise conditions still achieved.*

"*The more often internal L_{Aeq} levels start to exceed the internal L_{Aeq} target levels by more than 5 dB, the more that most people are likely to regard them as 'unreasonable'. Where such exceedances are predicted, applicants should be required to show how the relevant number of rooms affected has been kept to a minimum. Once internal L_{Aeq} levels exceed the target levels by more than 10 dB, they are highly likely to be regarded as 'unacceptable' by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing 'unacceptable' noise levels at all and where such levels are likely to occur frequently, the development should be prevented in its proposed form.*"

The following sections describe the proposed measures included as part of the design to control internal noise levels and help achieve the ProPG INLGs.

5.1.3.1 Façade break-in

Calculations have been undertaken to determine a suitable façade sound insulation strategy for the development. Based on the results of the survey, noise modelling has been used to estimate the level of noise on the various sections of the building façade. Figures detailing the calculated free-field façade noise levels during daytime and night-time are presented in **0** to this report.

The calculated noise levels incident upon the façades of the development have then been used to identify the required acoustic performance of façade elements to meet the ProPG INLGs, summarised below. The calculation procedure used in this assessment follows the more rigorous calculation method outlined in BS 8233. This equation is reproduced below:

$$L_{eq,2} = l_{eq,ff} + 10log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,c}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10log_{10}\left(\frac{S}{A}\right) + 3$$

The calculation process considers the free field external noise level at the façade and the area coverage and sound insulation properties of all façade elements (e.g. glazing and external walls). The internal noise level calculations are also dependent on the room layouts and geometry shown in the architectural layout drawings presented for this planning application.

The worst-case scenarios have been assessed taking into consideration a combination of the highest incident noise levels upon the façades at bedroom locations, internal noise level criteria and ratio of glazed / non-glazed external building fabric elements.

The following assumptions have also been made:

- The sound reduction index of the non-glazed elements of the external building fabric is similar to a 'typical' SFS façade build-up.
- It has also been assumed that no significant break-in will occur through the roof / ceiling
- A reverberation time (T_{mf}) of 0.5 seconds has been assumed in all bedrooms, and 0.8 seconds in all living rooms
- The calculations have considered daytime $L_{Aeq,T}$, noise levels, night-time $L_{Aeq,T}$ noise levels and L_{AFmax} noise levels
- $L_{Aeq,day}$, $L_{Aeq,night}$ and L_{AFmax} noise levels incident upon the façade have been taken from the SoundPLAN 8.2 noise modelling exercise
- All calculations have been undertaken using octave band frequency data. Example calculations for worst-case affected apartments for daytime and night-time assessment periods are presented in Appendix III. Full details of calculations for other spaces can be provided on request.

The results of the façade noise map modelling have allowed to categorise the façade noise exposure in three different scenarios. Break-in noise calculations have allowed for glazing system requirements to be specified according to these noise exposure scenarios, as indicated in Figure 5-1. Example suitable glazing specifications are presented in Table 5-2 below. Whilst other glazing specifications may be considered acceptable, any proposed alternative systems should be forwarded to Cundall for review.

Scenario	Example suitable glazing	Sound reduction index (dB)						Single figure R_w (Ctr) dB
		125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	
Condition 1	▪ 6 mm pane ▪ 6 – 20 mm air gap ▪ 8.8 mm Pilkington Optiphon	24	26	40	48	46	54	41 (-7)
Condition 2	▪ 4 mm pane ▪ 6 – 20 mm air gap ▪ 10 mm pane	24	21	32	37	32	43	35 (-5)
Condition 3	▪ 6 mm pane ▪ 6 – 20 mm air gap ▪ 4 mm	21	20	26	38	37	39	31 (-4)

Table 5-2: Glazed external building fabric sound insulation requirements

Figure 5-1: Locations of proposed glazing conditions

Based on the recommended minimum glazing specification presented above, the ProPG and MCC INLGs are likely to be met in all spaces in the proposed development.

On the most exposed façades with direct line-of-sight onto the A57 (Condition 1) relatively high-performance windows and robust external façade construction would be required. These will require careful design and at this level of performance, it will be necessary to take account of the window frame performance as well as the glazing.

In other dwelling set slightly back from the A57 (Condition 2A/2B), robust acoustic double-glazing systems will also be required. However, for the majority of the development (Condition 3), standard thermal double glazing is expected to be suitable from an acoustic perspective.

It is therefore considered that assuming appropriate façade treatments are used in the proposed development, required internal ambient noise levels can be achieved in all cases.

It is important to note, this assessment has demonstrated that suitable glazing and façade treatments can be used to achieve the ProPG INLGs. However, as the assessment only looked at four scenarios, including worst case noise levels and room geometry, it is likely that more detailed review during the design stage will find that ProPG INLGs can be achieved with less robust glazing in many locations.

5.1.3.2 Ventilation systems (whole dwelling ventilation)

It is a requirement of the building regulations that 'whole dwelling ventilation' (previously known as 'background' ventilation) is provided in dwellings. It is proposed that Mechanical Ventilation and Heat Recovery (MVHR) units will be used to provide necessary whole dwelling ventilation rates to all dwellings.

This will mean that where MVHR units are used, no façade openings (e.g. trickle vents) are required directly into habitable rooms. Therefore, assuming any mechanical ventilation system is appropriately designed, it will be possible to achieve the ProPG INLGs whilst 'whole dwelling ventilation' is provided.

MVHR ventilation systems tend to have inherently high sound attenuation and rarely results in intrusive noise issues via supply / extract duct paths. However, where air inlets and outlets associated with the system are located on noisy façades, this will be examined in detail during the design of the scheme. Additionally, if necessary, appropriate mitigation measures will be applied (silencers) so the ProPG INLGs are met.

In addition, any mechanical ventilation system used will need to be appropriately designed so that noise generated by the system itself does not result in significant adverse effects. This should be examined in more detail during the design stage of the project, but the following initial internal mechanical services noise level limits as adopted from CIBSE Guide A 2016 are proposed within dwellings:

Location	Daytime (07:00 to 23:00 hrs)	Night time (23:00 – 07:00 hrs)
Living room	NR30	NR30
Bedroom	NR30	NR25

Table 5-3: Summary of proposed MVHR noise limits in dwellings when providing 'whole dwelling' ventilation

As 'whole dwelling ventilation' will be provided by a mechanical system, the only time windows will be required to be open for the purposes of ventilation will be for occasional 'purge' ventilation. With respect to noise levels during purge ventilation the ProPG states the following:

It should also be noted that the internal noise level guidelines are generally not applicable under "purge ventilation" conditions as defined by Building Control Approved Document F, as this should only occur occasionally (e.g. to remove odour from painting and decorating or from burnt food)

It is therefore not considered necessary to further consider noise levels during purge ventilation conditions and using windows for this purpose is unlikely to result in any significant adverse effects. Other reasons why windows may be opened include for thermal comfort (e.g. to provide relief from overheating) or at the occupant's choice. This is discussed in more detail in Section 5.1.3.3 below.

5.1.3.3 Thermal comfort (overheating)

If a building overheats the normal method of providing thermal comfort (i.e. cooling the space down) is to open a window. However, when a window is opened to provide 'ventilative' cooling internal noise levels are likely to be increased.

Since noise plays an important role in the quantity and quality of sleep, AD-O mandates that night-time internal noise levels should be limited to see that should open windows be required to control overheating, this does not come at the cost of adverse overnight noise levels to occupants. The limiting levels are as follows:

- **40 dB $L_{Aeq,T}$**, averaged over 8 hours (between 11pm and 7am)
- **55 dB L_{AFmax}**, more than 10 times a night (between 11pm and 7am)

Unlike overheating parameters, these levels are not targeted according to a percentage occurrence over a year. Should these levels be exceeded on any night of the year, the approach is considered non-compliant with Approved Document O.

Approved Document O describes two methods to control overheating – the simplified method, and dynamic thermal modelling, as summarised below:

5.1.3.4 Simplified method

For the simplified method, different approaches apply depending on whether the location is a 'High Risk' or 'Moderate Risk' location, where the higher risk category has a greater chance of overheating, and therefore requires a greater degree of cooling. The relevant parameter that states the amount a window should be opened in the simplified method is expressed as a free area of 13% of the floor area for high-risk locations, and 4% for moderate risk locations.

A joint draft publication from the Association of Noise Consultants (ANC) and Institute of Acoustics (IOA) has analysed these open window areas based on typical bedroom sizes and has found that having windows open by these amounts means that to meet internal noise targets, external levels must be no higher than those presented in the following table.

Parameter	Moderate Risk Locations
$L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am)	49 dB
L_{AFmax}, more than 10 times a night (between 11pm and 7am)	64 dB

Table *5-4:* External noise limits for Simplified Method from 'Guide to Demonstrating Compliance with the Noise Requirements of Approved Document *O (draft)'*

5.1.3.5 Dynamic thermal modelling

The dynamic thermal modelling process required by Approved Document O closely follows the approach outlined in CIBSE's TM59 guidance document. The document and subsequent FAQ guidance clarifies that windows can be modelled as partially open at night – this can be an important mitigating tool for noise since as previously mentioned, one way of attenuating noise is to reduce a window opening to as small as is possible.

How small the window opening can be reduced to can and will be dictated by how large the opening must be according to the thermal modelling, to achieve appropriate overheating mitigation. Similarly, the opening of the window to control overheating can and will equally be determined by limits on how much noise the opening will allow in.

5.1.3.6 Risk factors for proposed development

Based on the previously surveyed noise levels and 3D noise modelling undertaken for the Development, the Appendix IV façade noise maps present a risk assessment of AD-O noise limit compliance based on the following noise criteria:

Scale colour	Façade level	Definition of risk criteria / comment on risk
Green	< 49 dB $L_{Aeq,night}$ < 64 dB $L_{AF,max}$	Façade levels are compliant with the 'Simplified Method' limits presented in Table 5-4 above.* AD-O noise limits are expected to be achieved with partially open windows for cooling at night.
Amber	49 <= 52 dB $L_{Aeq,night}$ 64 <= 67 $L_{AF,max}$	Façade levels are up to +3 dB above the 'Simplified Method' limits presented in Table 5-4 above.* Dynamic thermal modelling required; openable windows may be suitable, subject to review of the window free area requirement as a percentage of the floor area of the room.
Red	> 52 dB $L_{Aeq,night}$ >67 dB $L_{AF,max}$	Façade levels over +5 dB above the 'Simplified Method' limits presented in Table 5-4 above.* Dynamic thermal modelling required although openable windows are unlikely to be suitable.

**Assumes 'moderate risk' location with a partially open window providing an equivalent free area of no greater than 4% of the floor area*

Table *5-5:* Risk criteria *for Appendix grid noise maps.*

5.1.3.7 Overheating assessment scoping and mitigation

A mitigation solution to control overheating has been developed whereby necessary additional air flow rates will be provided by mechanical ventilation heat recovery units on a 'boost' setting.

As detailed dynamic thermal modelling has not been completed at the time of writing, this proposed MVHR 'boost' solution is proposed to both 'red' and 'amber' facades, as summarised in Table 5-6.

AD-O risk factor		Proposed cooling strategy
Red facades	Amber facades	Apartments will feature larger than typical MVHR units with a 'boost' ventilation mode (operated manually by occupants). The additional air flow rates provided during the 'boost' operation will negate the need for opening window cooling at any time. This boost mode is based on an Air Change Rate (ACR) of 3, with the exact Air Flow Rates to be confirmed by the mechanical services engineers. Noise from MVHR systems during 'boost' setting will generally be designed to not exceed 30 dB L_{Aeq} in bedrooms
Green facades		Occasional requirement for open window ventilative cooling to control overheating.

Table 5-6: Proposed overheating ventilation strategy

A more detailed assessment of 'boost' MVHR requirements to amber facades (and the possible acceptability of opening window cooling) will be undertaken at the next design stage following the completion of the dynamic thermal modelling.

5.1.4 Element 3 – External amenity area noise assessment

This element of the assessment seeks to assess the noise levels in external amenity areas as part of the proposed development. In relation to noise levels in external amenity areas, ProPG states that:

'*The acoustic environment of the external amenity areas that are an intrinsic part of the overall design should always be assessed and noise ideally not be above the range 50 – 55 dB LAeq,16hr*'.

The ProPG also references BS 8233 which states:

'*…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 prohibit.ed.*

'*Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space.*'

It is understood that there are no balconies or roof terraces proposed as part of this development. However, the central courtyard area of the development is likely to be used as a communal external amenity area.

Noise modelling suggests that most of the internal courtyard area will experience noise levels below 55 dB $L_{Aeq,T}$ following the construction of the building. The grid noise map presented in Figure 5-2 details the noise propagation across the applications site at a height of 1.5 m above ground floor level, based on the noise modelling exercise reference in Section 5.1.1.

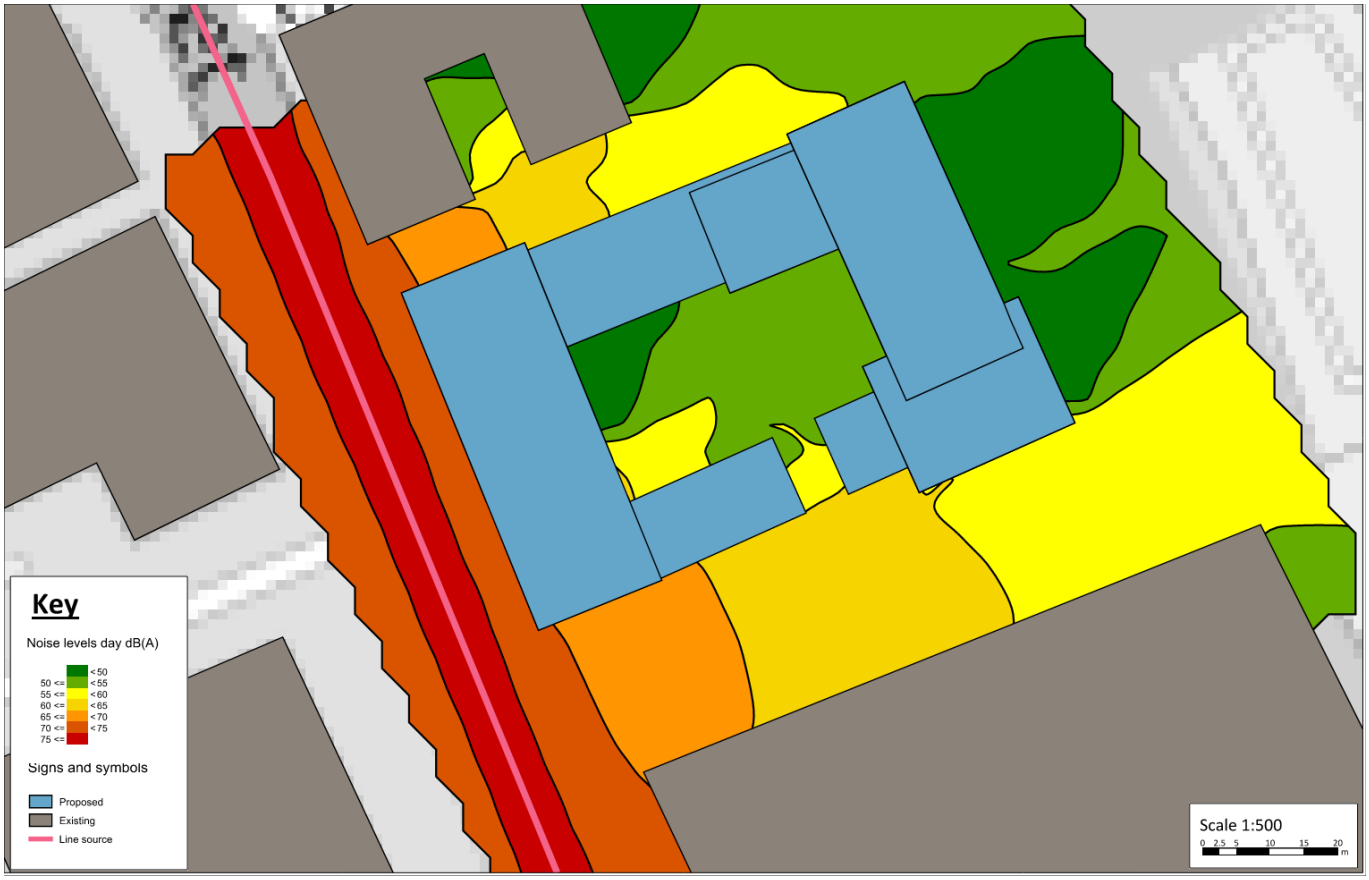


Figure 5-2: External noise levels with development included in model

The layout of the development provides significant acoustic screening to the central courtyard area, which may be utilised as an external amenity area / garden. The noise levels in this area, as can be seen from Figure 5-2 above, are below the guideline noise criteria level of 55 dB $L_{Aeq,daytime}$ described in BS 8233:2014.

5.1.5 Element 4 – Assessment of other relevant issues

The final element of the ProPG Stage 2 assessment is to review other relevant issues. The ProPG identifies 5 specific areas to review and each of these is discussed in the following sections.

5.1.5.1 Compliance with relevant national and local policy

In line with the NPSE and NPPF, it is believed that the preceding assessment has demonstrated that the proposed scheme avoids significant adverse impacts as a result of noise and seeks to minimise any adverse impacts. By following a 'good acoustic design' process as outlined in the ProPG it is considered that, from an acoustic perspective, the scheme aligns with the requirements of Manchester City Council's Planning and Noise: Technical Guidance, which is detailed in Section 2.8 of this report.

5.1.5.2 Magnitude and extent of compliance with ProPG

It is considered that the scheme complies with guidance in the ProPG and that a good acoustic design process has been followed. This is summarised in the following bullet points:

- The impact of noise has been considered throughout the initial design of the scheme including building orientation and the selected ventilation / thermal comfort strategy.

- Assuming appropriate façade materials are used, internal ambient noise levels are expected to comply with the ProPG INLGs.
- The noise impact of ventilation and thermal comfort systems has been considered at an early stage of the project.
- The masterplan scheme includes shared and private external amenity where noise levels are likely to be within the ProPG / BS 8233 guidance values of 55 dB $L_{Aeq,T}$.

5.1.5.3 Likely occupants of the development

It is understood that the scheme contains standard residential dwellings only (i.e. no care home or nursing home type dwellings etc.) and that future residents are unlikely to be more sensitive than is typically expected.

5.1.5.4 Acoustic design versus unintended consequences

Cundall are not aware of any unintended adverse consequences of the acoustic design.

5.1.5.5 Acoustic design versus wider planning objectives

Cundall are not aware of any reason why the proposed acoustic design conflicts with wider planning objectives.

5.2 Recommendations to the decision maker

An assessment has been undertaken in line with the guidance in the new ProPG document.

The Stage 1 risk assessment found that the noise risk associated with the site varied across the side, with the majority of the site found to be between ‘low’ and ‘medium’ risk.

A ProPG Stage 2 assessment has been undertaken and a detailed ADS has been produced for the site. It is believed that the ADS demonstrates that a good acoustic design process has been followed and appropriate design and mitigation measures are included in the scheme to avoid significant adverse effects and, where possible, mitigate adverse effects.

An assessment against guidance contained in the Overheating: Approved Document O (AD-O) has identified apartment bedrooms which are likely to exceed the AD-O internal noise limits during periods when opening windows may be required to control overheating. An alternative cooling strategy reliant on ‘boost’ mechanical ventilation flows has therefore been developed to negate the need for opening windows at affected apartments. In NPSE terms, the level of level of impact is expected to be above the Lowest Observed Adverse Effect Level (LOAEL) but below the Significant Observed Adverse Effect Level (SOAEL).

Therefore, it is recommended that from an acoustic perspective, planning consent be granted subject to the inclusion of suitable noise conditions.

6.0

External plant noise

6.0 External plant noise

To comply with the guidance contained within Manchester City Council's Planning & Noise Technical Guidance document (December 2015) detailed in Section 2.8.1 of this report, noise limits are being set for the site at a level of -5 dB relative to the measured background noise levels at the site. To ensure the noise limits being set are robust, they are set against the lowest measured $L_{A90,T}$ noise levels measured in the day- and night-time periods as shown in Table 6-1 below:

Measurement position / noise-sensitive receptor	Period	Existing background sound level - dB L_{A90}	Rating level limit not to be exceeded at 1m from façade of noise-sensitive receptor – dB $L_{Ar,Tr}$
MP2 Assumed representative of the Travelodge Manchester Central Arena hotel	Daytime (07:00 to 23:00)	54	49
	Night-time (23:00 to 07:00)	40	35
MP3 Assumed representative of the Manchester College building under construction	Daytime (07:00 to 23:00)	51	46
	Night-time (23:00 to 07:00)	36	31

Table 6-1: Summary plant noise limits

These plant noise limits are applicable to the combined noise emissions from all mechanical services plant items to be installed at the development. The noise limits are not to be exceeded in any time period at 1 m from the façade of the nearest and / or most noise sensitive receptor.

The limits identified above could potentially be included within a suitably worded planning condition.

7.0

Entertainment noise limits

7.0 Entertainment noise limits

7.1 Entertainment noise limiting criterion

In the event that flexible-use Class E units at ground floor level feature a PA system, it will be necessary to see that amplified music break-out impacts will be suitably controlled.

To meet the requirements of the Manchester City Council Planning Policy for entertainment noise, sound levels attributable to amplified music should be limited to 10 dB below the background noise level (L_{A90}) at nearby sensitive receptors.

The octave spectrums of the lowest measured $L_{A90,15min}$ periods as measured at Position MP2 have been used to define these limits as they were measured at the nearest noise sensitive receptor. The following noise limits are proposed which are not to be exceeded at 1 m from the façade of any noise-sensitive receptors:

	Octave band centre frequency (Hz)						
	63	125	250	500	1k	2k	4k
Daytime & Evening (07:00 – 23:00)							
Existing background level, dB	50	44	45	43	45	40	35
MCC noise limits, dB	**40**	**34**	**35**	**33**	**35**	**30**	**25**
MCC noise limits dB (A-weighted)	14	18	26	30	35	31	26
Night-time (23:00 – 07:00)							
Existing background level, dB	38	35	30	28	30	26	20
MCC noise limits, dB	**28**	**25**	**20**	**18**	**20**	**16**	**10**
MCC noise limits dB (A-weighted)	**<10**	**<10**	**11**	**15**	**20**	**17**	**11**

Table 7-1: Limiting entertainment noise levels

To see that amplified music noise levels do not exceed the above criteria at the nearest noise-sensitive receptors, it will likely be necessary to install a suitable limiter within any amplified music systems installed at the development.

The limits identified above could potentially be included within a suitably worded planning condition.

8.0

Summary

8.0 Summary

A noise impact assessment has been undertaken for the proposed development at the former Boddington's Brewery site in Manchester at Great Ducie Street, Cheetham Hill, Manchester, M3 1PT which will provide 505 new dwellings. The assessment has been undertaken based on the guidance in the 'Professional Practice Guidance on Planning & Noise (2017)' document.

A noise survey has been completed to quantify the existing external noise climate at the site, consisting of multiple sets of measurements undertaken over the day time and night-time periods to capture the loudest and quietest parts of the day and night.

In line with the ProPG, an initial noise risk assessment for the site has been completed. In addition, a detailed acoustic design assessment (ADS) relating mainly to the good acoustic design process, internal noise levels and noise levels in external amenity areas has been completed. Where appropriate, this ADS contains details of design and mitigation measures to reduce the impact of noise on future developments.

An assessment against guidance contained in the Overheating: Approved Document O (AD-O) has identified apartment bedrooms which are likely to exceed the AD-O internal noise limits during periods when opening windows may be required to control overheating. An alternative cooling strategy reliant on 'boost' mechanical ventilation flows has therefore been developed to negate the need for opening windows at affected apartments. In NPSE terms, the level of level of impact is expected to be above the Lowest Observed Adverse Effect Level (LOAEL) but below the Significant Observed Adverse Effect Level (SOAEL).

Noise limits for externally mounted plant associated with the proposed development have been proposed based on the requirements of Manchester City Council and BS 4142:2014. There is also potential for noise emissions from entertainment sources within ground-floor retail areas, so noise limits have also been set based on the requirements of Manchester City Council.

It is believed that the ADS demonstrates that a good acoustic design process has been followed. In addition, design / mitigation measures have been included in the scheme to avoid significant adverse noise effects and, where possible, mitigate any adverse effects.

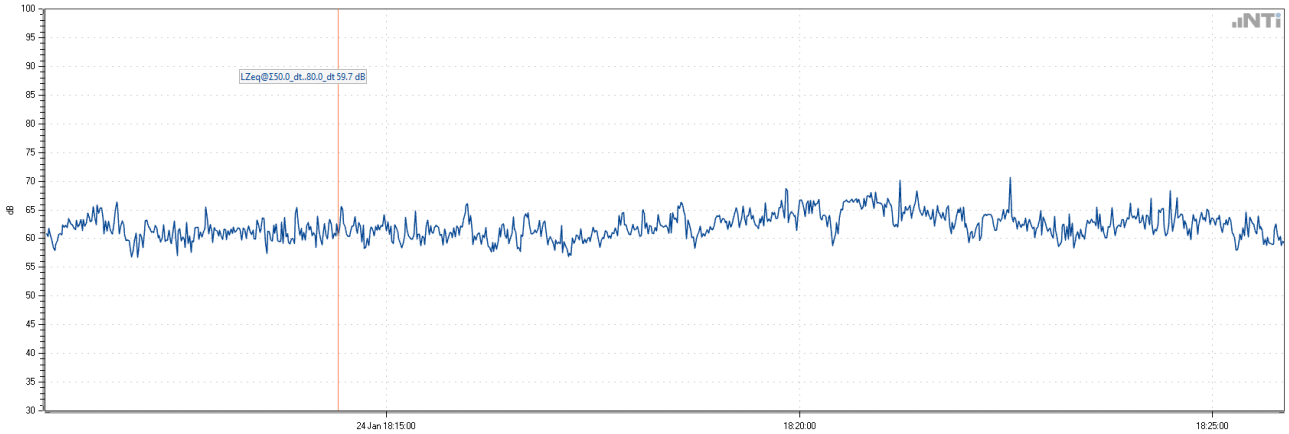
Therefore, it is recommended that from an acoustic perspective, planning consent be granted subject to the inclusion of suitable noise conditions.

Appendices

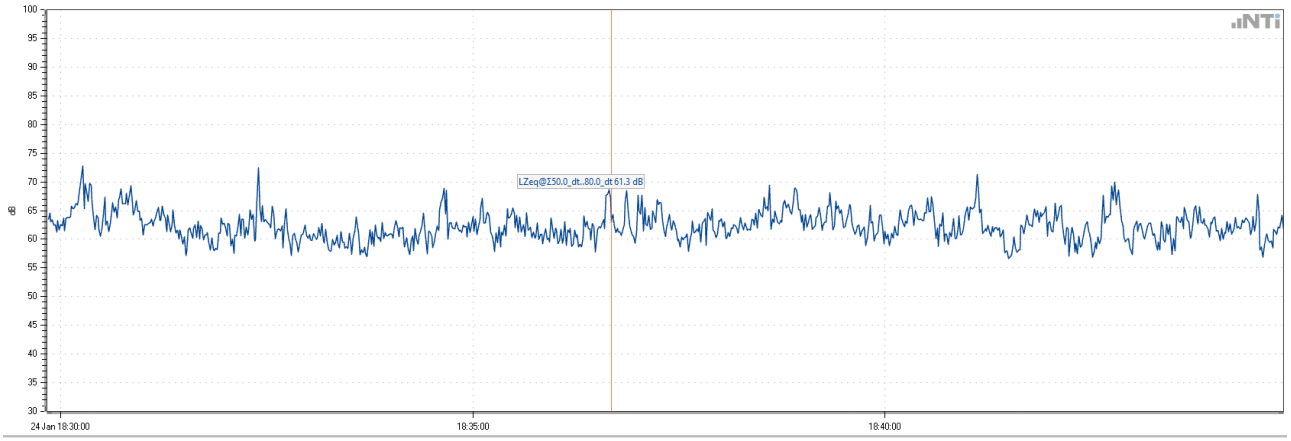
Appendices

Appendix I AO Arena time history plots @ 63 Hz

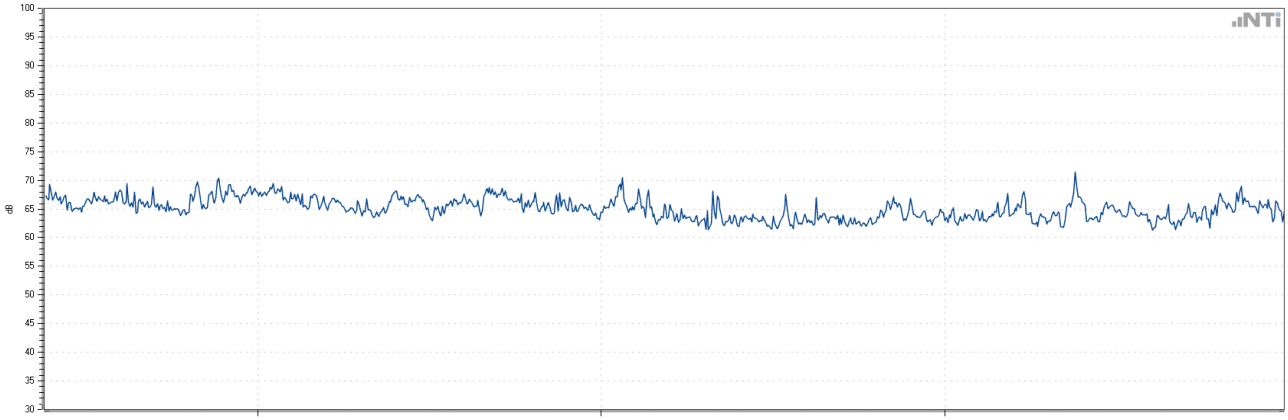
MP4A: Start time 18:10



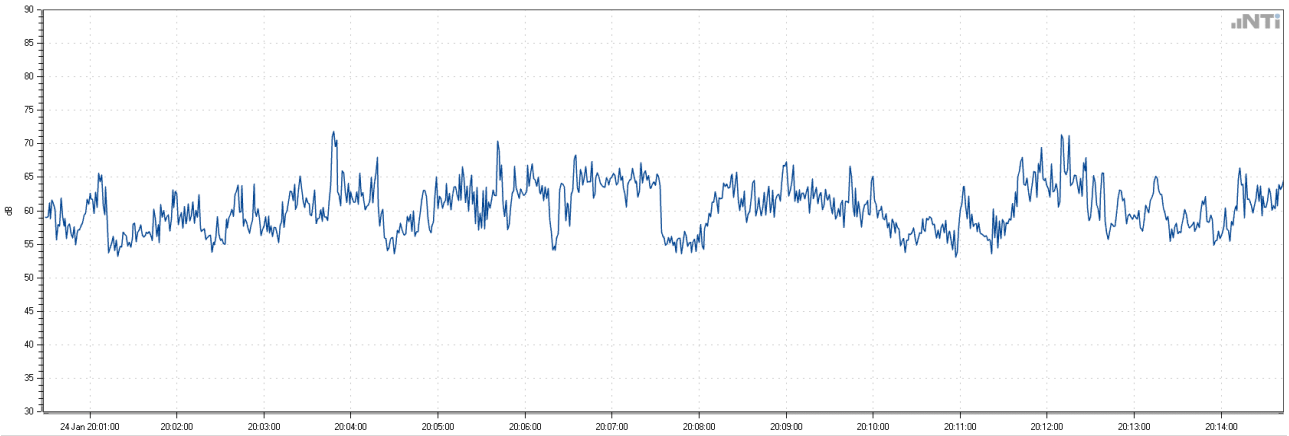
MP4B: Start time 18:30



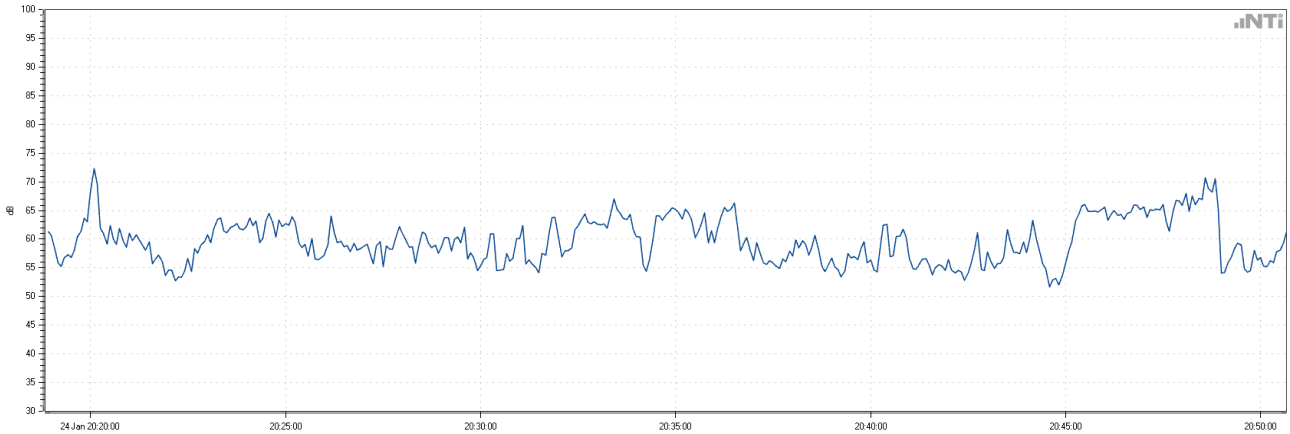
MP4A: Start time 18:47



MP4B: Start time 20:00



MP4A: Start time 20:18

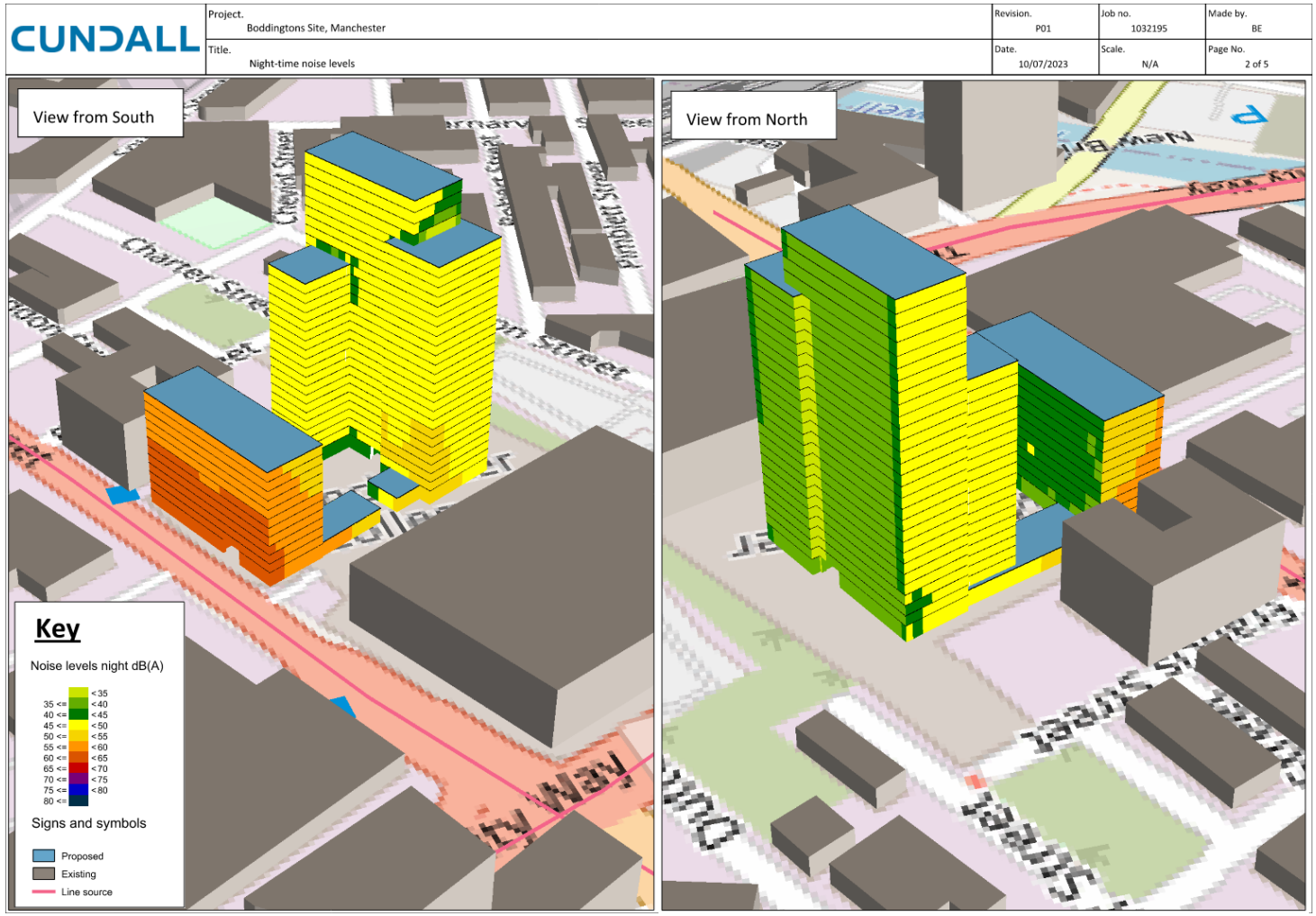


Appendix II Façade noise maps

Façade noise maps –Daytime L_{Aeq}

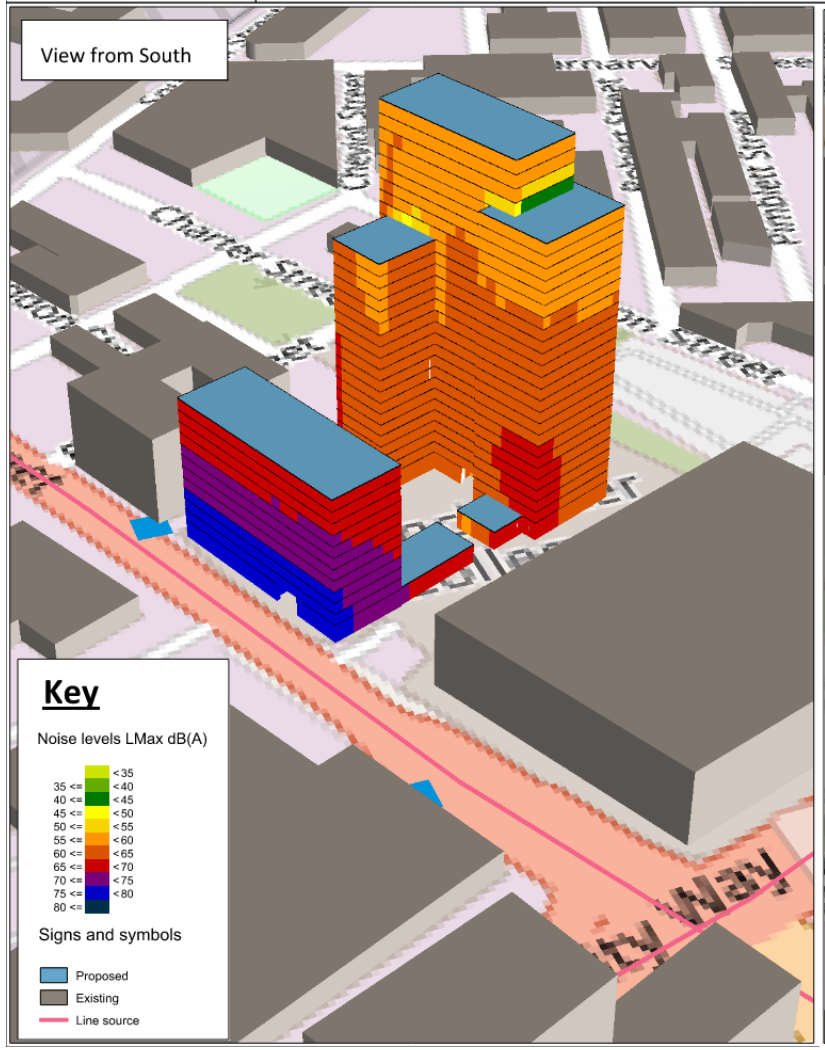
CUNDALL	Project. Boddingtons Site, Manchester	Revision. P01	Job no. 1032195	Made by. BE
	Title. Daytime noise levels	Date. 10/07/2023	Scale. N/A	Page No. 1 of 5

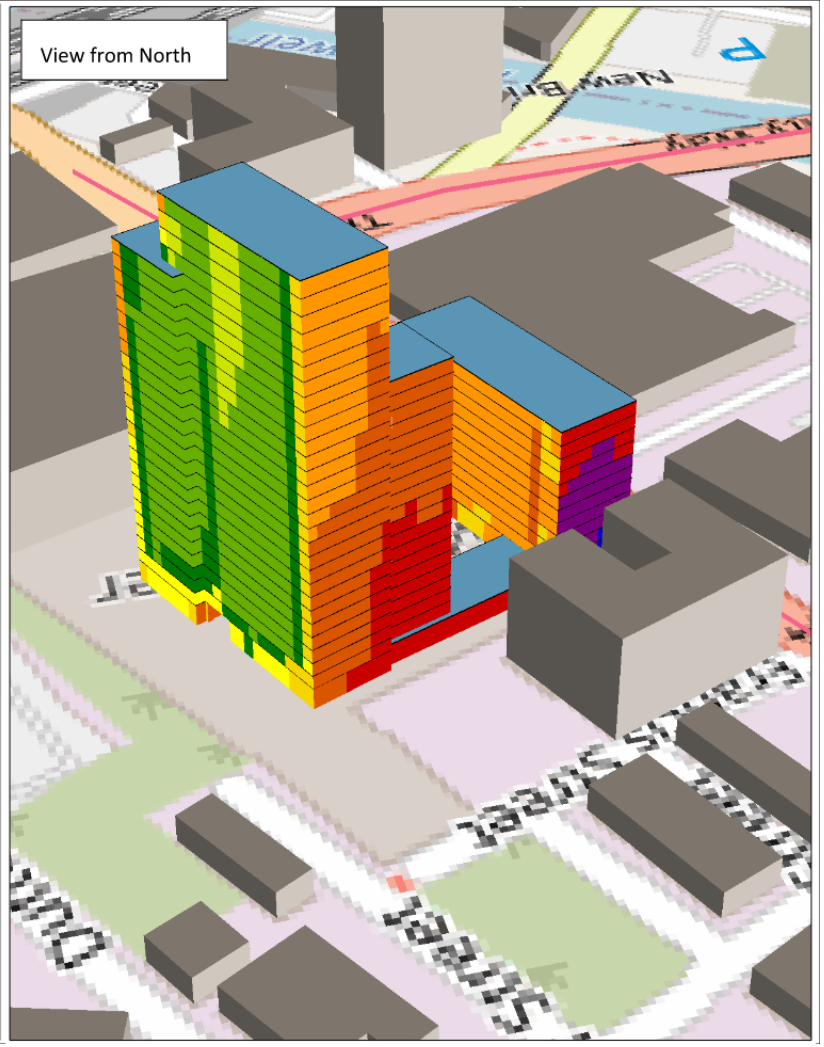
Façade noise maps – Night-time L_{Aeq}



Façade noise maps – Night-time $L_{AFmax(10th\ highest\ exceedance)}$

CUNDALL	Project. Boddingtons Site, Manchester	Revision. P01	Job no. 1032195	Made by. BE
	Title. Night-time LMax noise levels	Date. 10/07/2023	Scale. N/A	Page No. 3 of 5





Appendix III Example noise break-in calculation (worst-case apartment)

Worst case living room – Daytime

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - Red Day									
Noise Levels		**-**	**71.6**	**68.1**	**65.7**	**69.1**	**63.4**	**56.0**	**-**
Distance Correction									
		-	*-1.0*	*-1.0*	*-1.0*	*-1.0*	*-1.0*	*-1.0*	*-*
-SRI									
Main Element - Steel Fame External Wall									
Glazed Element - 6 - 6 to 20 mm - 8.8 Pilkington Optiphon™									
Window Width (m)	2.3								
Window Height (m)	2.4								
No. of Windows (no)	1.0								
Vent - High Spec									
No. of Vents (no)	0.0								
		-	*-26.2*	*-28.2*	*-42.2*	*-50.2*	*-48.2*	*-56.2*	*-*
10 log (S/A)									
Receiver - Red Living Room									
		-	*-0.3*	*-0.7*	*-1.2*	*-1.2*	*-1.2*	*-1.2*	*-*
+3									
		-	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*-*
Red Living Room Day									
Bands		-	47.1	41.2	24.3	19.7	16.0	0.6	-
dBA	35.2								
Levels In		**-**	**47.1**	**41.2**	**24.3**	**19.7**	**16.0**	**0.6**	**-**

Worst-case bedroom – Daytime

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - Red Day									
Noise Levels		**-**	**71.6**	**68.1**	**65.7**	**69.1**	**63.4**	**56.0**	**-**
Distance correction									
		-	*-1.0*	*-1.0*	*-1.0*	*-1.0*	*-1.0*	*-1.0*	*-*
-SRI									
Main Element - Steel Fame External Wall									
Glazed Element - 6 - 6 to 20 mm - 8.8 Pilkington Optiphon™									
Window Width (m)	1.1								
Window Height (m)	2.4								
No. of Windows (no)	1.0								
Vent - High Spec									
No. of Vents (no)	0.0								
		-	*-27.2*	*-29.2*	*-43.1*	*-51.1*	*-49.2*	*-57.1*	*-*
10 log (S/A)									
Receiver - Red Bedroom									
		-	*0.4*	*-0.3*	*-1.1*	*-1.1*	*-1.1*	*-1.1*	*-*
+3									
		-	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*-*
Red Bedroom Day									
Bands		-	46.8	40.6	23.5	18.9	15.1	-0.2	-
dBA	34.7								
Levels In		**-**	**46.8**	**40.6**	**23.5**	**18.9**	**15.1**	**-0.2**	**-**

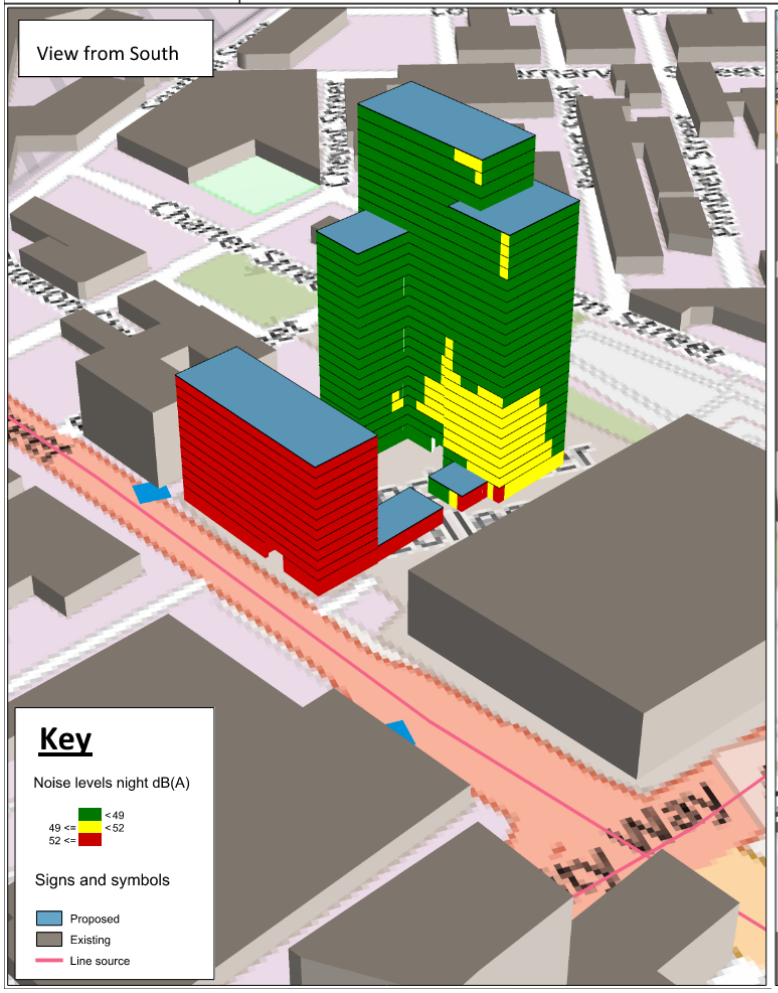
Worst-case bedroom – Night-time

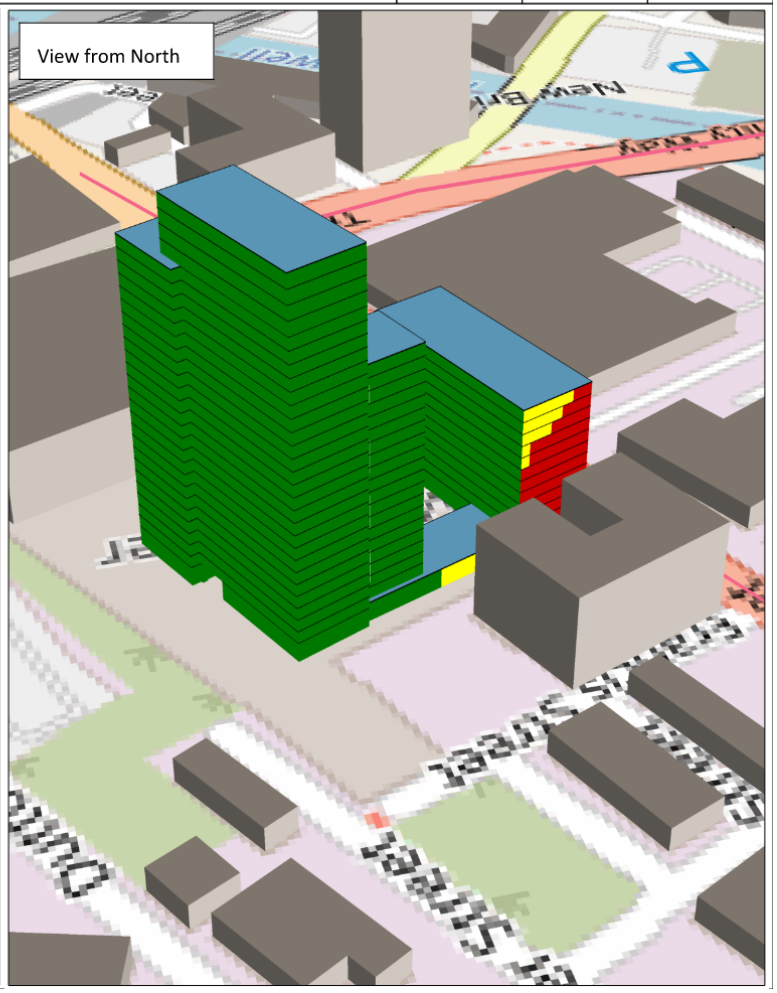
		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - Red Night									
Noise Levels		**-**	**64.8**	**61.3**	**58.9**	**62.3**	**56.6**	**49.2**	**-**
-SRI									
Main Element - Steel Fame External Wall									
Glazed Element - 6 - 6 to 20 mm - 8.8 Pilkington Optiphon™									
Window Width (m)	1.1								
Window Height (m)	2.4								
No. of Windows (no)	1.0								
Vent - High Spec									
No. of Vents (no)	0.0								
		-	*-27.2*	*-29.2*	*-43.1*	*-51.1*	*-49.2*	*-57.1*	*-*
10 log (S/A)									
Receiver - Red Bedroom									
		-	*0.4*	*-0.3*	*-1.1*	*-1.1*	*-1.1*	*-1.1*	*-*
+3									
		-	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*-*
Red Bedroom Night									
Bands		-	41.0	34.8	17.7	13.1	9.3	-6.0	-
dBA	28.9								
Levels In		**-**	**41.0**	**34.8**	**17.7**	**13.1**	**9.3**	**-6.0**	**-**

Appendix IV Façade noise maps (AD-O)

Façade noise maps (AD-O risk categories) – Night-time L_{Aeq}

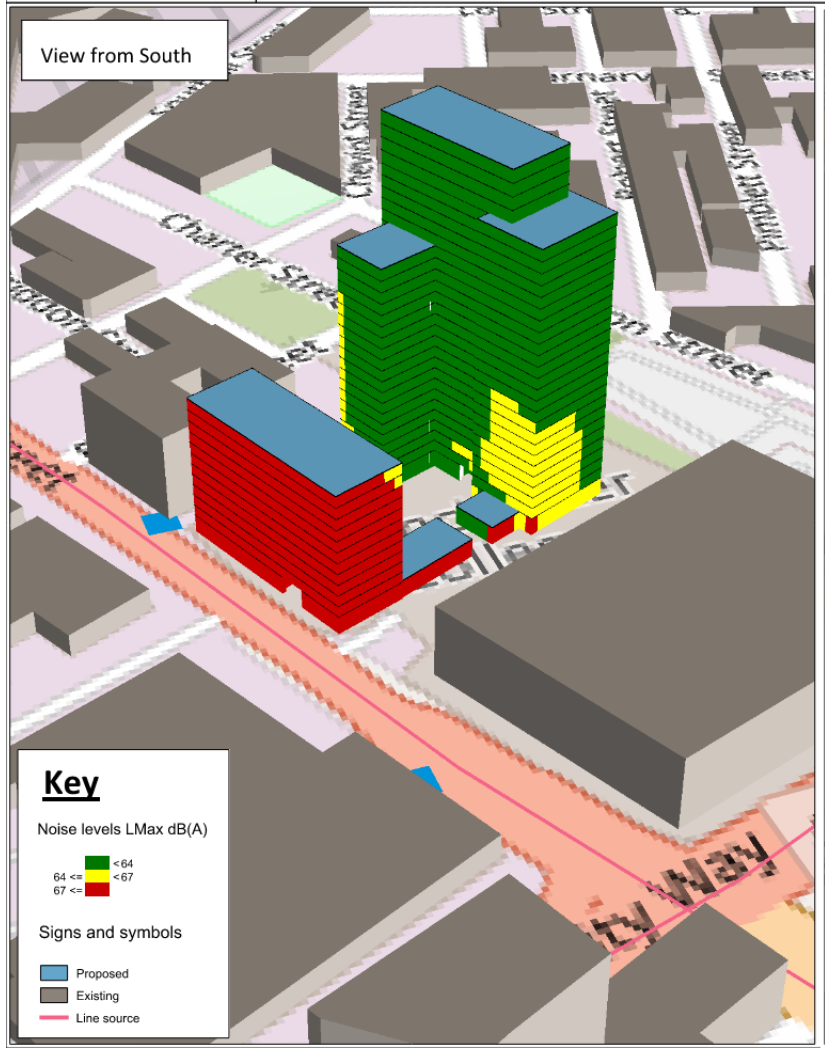
CUNDALL	Project. Boddingtons Site, Manchester	Revision. P01	Job no. 1032195	Made by. BE
	Title. AD-O Risk Assessment - Night-time LAeq,T Noise levels	Date. 10/07/2023	Scale. N/A	Page No. 4 of 5

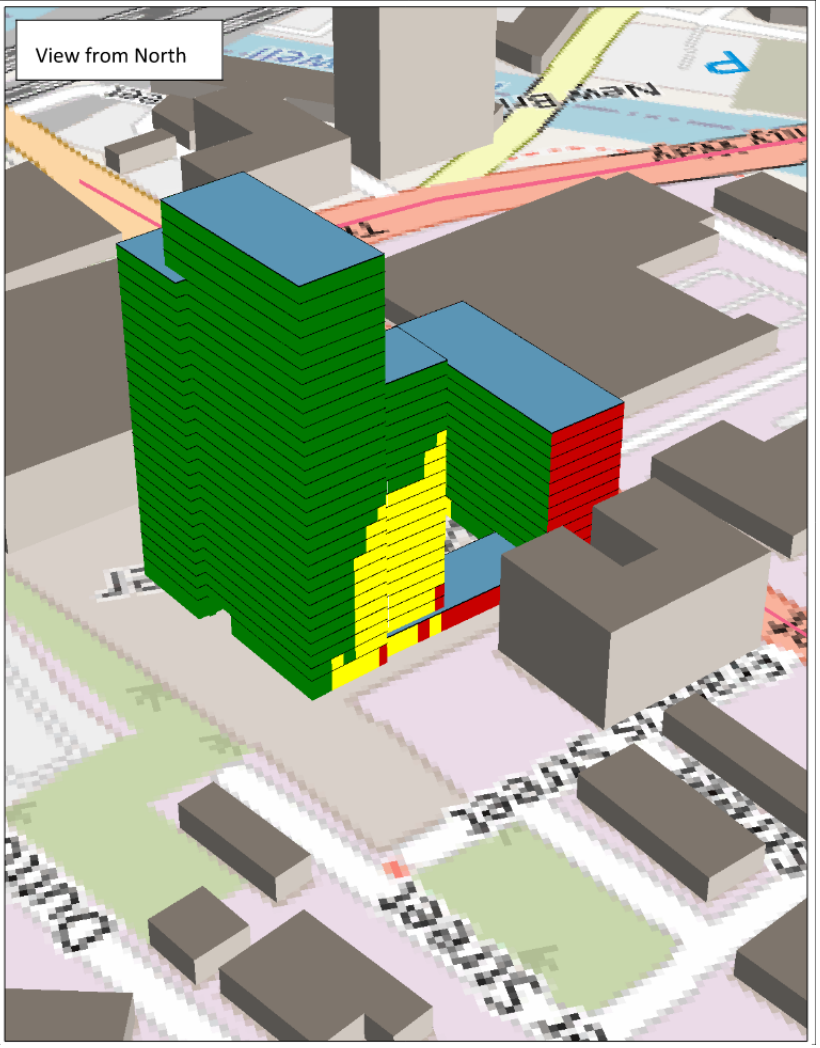




Façade noise maps (AD-O risk categories) – Night-time $L_{AFmax(10th\ highest\ exceedance)}$

CUNDALL	Project. Boddingtons Site, Manchester	Revision. P01	Job no. 1032195	Made by. BE
	Title. AD-O Risk Assessment - Night-time LMax Noise levels	Date. 10/07/2023	Scale. N/A	Page No. 5 of 5





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