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Plot 9B, First Street, Manchester

Acoustics, Ventilation & Overheating

March 2025

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PROJECT TITLE PLOT 9B, FIRST STREET, MANCHESTER

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1.0 SUMMARY

A planning application has been submitted for purpose-built student residential accommodation at Plot 9B, First Street, Manchester (planning application number 141786/FO/2024). Manchester City Council has requested that additional information is provided in the form of a level two overheating assessment in line with the Acoustics Ventilation and Overheating Residential Design Guide ('AVO'), published in 2020, to determine the level of alternative ventilation that will be required and how long the windows to the proposed residential accommodation can be open during the day to avoid overheating.

Fisher Acoustics Ltd has been commissioned by Vita Meadow Limited to compile the required assessment.

This report examines the pre-existing environmental noise conditions at the site and advises on the allowable opening duration of windows to comply with the target internal noise levels discussed in the AVO guide. The allowable opening duration of windows has been entered into the thermal model of the building to determine if compliance with the daytime criterion of CIBSE Technical Memorandum 59 'Design methodology for the assessment of overheating risk in homes (TM59) can be achieved.

The thermal modelling has determined that compliance with the daytime temperature criterion of TM59 can be achieved given the window opening durations identified in this report.

The window opening durations are also expected to allow the achievement of the target internal noise levels suggested by the AVO guide

2.0 INTRODUCTION

A planning application has been submitted for purpose-built student residential accommodation at Plot 9B, First Street, Manchester (planning application number 141786/FO/2024). Manchester City Council has requested that additional information is provided in the form of a level two overheating assessment in line with the Acoustics Ventilation and Overheating Residential Design Guide ('AVO'), published in 2020, to determine the level of alternative ventilation that will be required and how long the windows to the proposed residential accommodation can be open during the day to avoid overheating.

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3.0 DESCRIPTION OF SITE

General Site Description

The proposed development site is Plot 9B of the First Street Development Framework, Manchester.

Plot 9B is bounded by Hulme Street to the south, Medlock Street to the west, an office building currently under construction at Plot 9A to the north and the Plot 10A of First Street to the east. Plot 10A has planning approval for an office building.

Other uses around the site include residential buildings, a hotel, offices, the 'Home' arts centre and bars at the northern perimeter of the First Street development.

A main railway route into Manchester centre is located along the northern boundary of the overall First Street development site. Further to the south of the site lies the Mancunian Way (A57(M)).

The Mancunian Way (A57(M)) and Medlock Street are major roads that are heavily trafficked. River Street and Hulme Street are relatively lightly trafficked side streets that provide local access.

Figure 1 shows the site in the context of the surrounding roads and buildings.

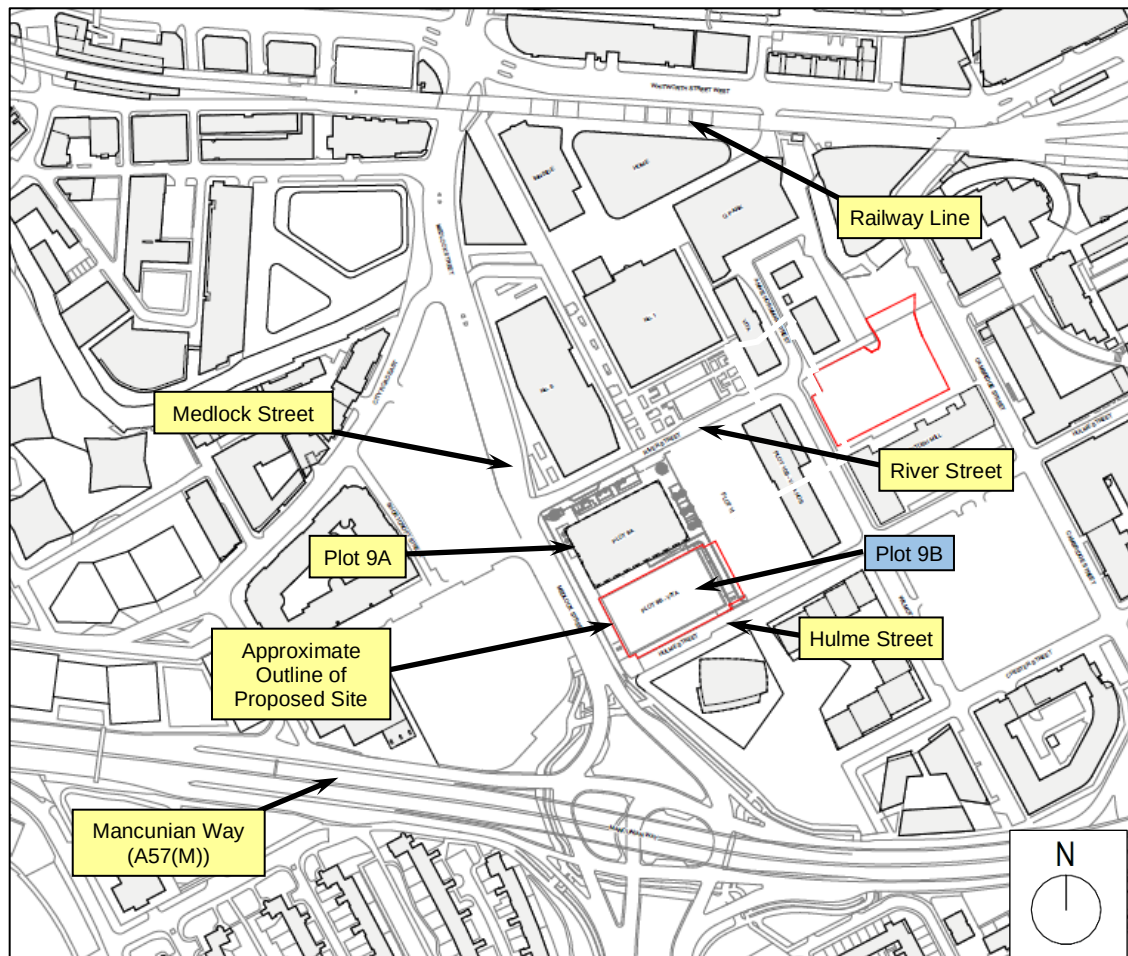


Figure 1: Site location plan – Plot 9B, First Street

4.0 DESCRIPTION OF PROPOSED DEVELOPMENT

The proposed development provides purpose-built student residential accommodation from Level 1 to Level 31 with communal amenity space at Level 0 and Level 1.

The residential accommodation provides a total of eight hundred and sixty-one bed spaces.

The proposed uses within the building are as follows:

- Ground Floor: Reception, Hub, Gym, Staff Room, Back Office, FM Store, Cleaners Store, Parcel Room, BOH Kitchen, Comms, WCs, Laundry, Machine Store, Substation, LV Switch, Refuse Store, Life Safety Systems, Plantroom, Domestic Water Storage, Cycle Store
- Level 01: Residential Studios, Private Dining Rooms, Quiet Study, Group Study rooms
- Levels 2 to 31: Residential Studios, Cleaners Store
- Level 32 Roof: Internal Plantroom, external plant

5.0 ACOUSTICS, VENTILATION AND OVERHEATING

The studios within the proposed development are to be ventilated using continuous mechanical supply and extract with heat recovery and summer bypass (MVHR) units in order to comply with the 'whole dwelling' ventilation requirements of Approved Document F of the Building Regulations (ADF).

Therefore, no passive trickle ventilators are required within the façade of the proposed habitable rooms and opening windows are not required to achieve the background ventilation requirements of ADF. Therefore under normal circumstances, the full acoustic benefit of the windows and external wall to studios will be available.

Purge ventilation is required under ADF to rapidly dilute pollutants (eg paint fumes) and/or water vapour to maintain indoor air quality. Purge ventilation of the studios is to be provided by opening windows and manually-operated inward-opening doors (purge panels) within the curtain wall.

The provisions for purge ventilation (eg openable purge panels) can also be used to improve thermal comfort. The AVO recommends that when using provisions for purge ventilation such as opening windows, an assessment is carried out of the potential effect of the subsequent internal noise levels within dwellings.

As stated in the Foreword of the document, the AVO

- 'provides an approach as to how the competing aspects of thermal and acoustic comfort can be managed'.

In the absence of mandatory requirements under the Building Regulations in relation to the overheating of dwellings at the time that the AVO was written, the AVO is

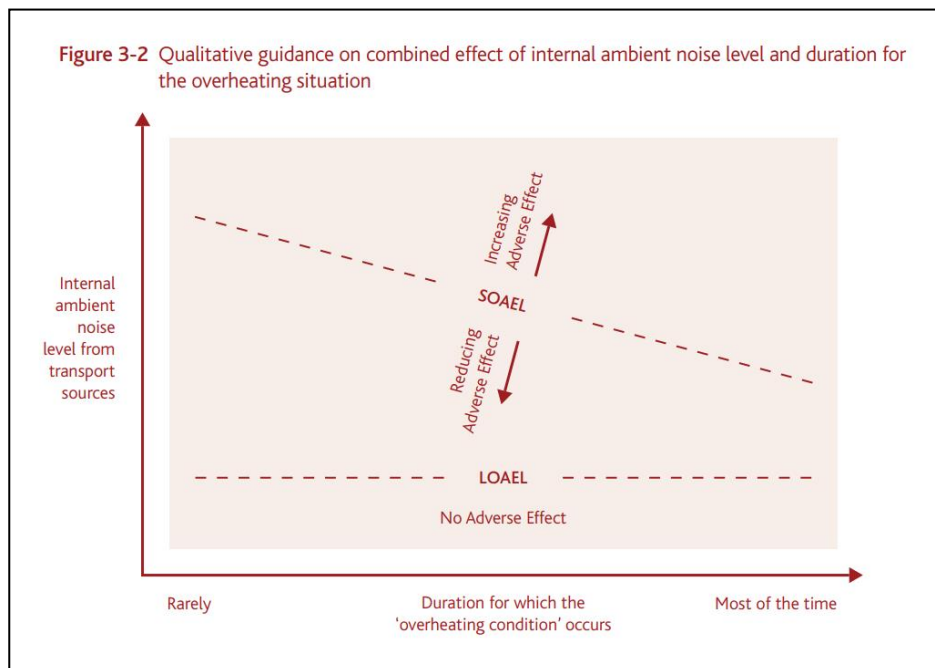
- 'intended to be used by acoustics practitioners as well as all those involved in the planning, development, design and commissioning of new dwellings. It recommends an approach to acoustic assessments for new residential development that takes due regard of the interdependence of provisions for acoustics, ventilation, and overheating'.

The AVO presents a method for assessing the risk of an adverse effect on occupants depending on 1) the potential internal noise level within dwellings with windows open and 2) the duration of window opening.

With regard to the duration of window opening required to mitigate overheating, the AVO states:

- No quantitative guidance regarding the combined effect of level and duration for the overheating condition is included in the current version of this document. However, the situation is summarised qualitatively in Figure 3-2 and also addressed in the worked examples included in Appendix B.

Figure 3-2 from the AVO is reproduced below.



It will be noted that no absolute noise levels are indicated on the y-axis and no specific durations are identified on the x-axis of Figure 3.2.

With regard to the duration of the overheating condition (i.e. the time that windows or purge panels may be open), 'rarely' and 'most of the time', as reference in Figure 3-2 of the AVO are not defined, although reference is made to 'Overheating in New Homes', published by the Good Homes Alliance in July 2019, which provides an early design stage tool in order to identify key factors contributing to overheating risk, and possible mitigation measures.

The tool 'is not meant to provide a detailed assessment, but instead to sit between existing high level guidance...and detailed calculation and modelling tools...'.

The AVO recognises that further development work is required to better understand how long people will tolerate higher noise levels in their homes in order to stay cool, with the ultimate aim of creating 'cost effective and sustainable buildings'.

Furthermore, the AVO advises that:

- In the case of the overheating condition, the effect of increased internal ambient noise from external noise sources will depend both on the absolute noise level and the amount of time for which the overheating condition occurs. A good design process should therefore, as a priority, seek to minimise heat gains thereby reducing the amount and duration of ventilation required to control overheating and the consequential effect from increased ingress of noise.

Importantly, the AVO acknowledges that

- Appropriate research work is urgently needed to better inform the guidance for the overheating condition.

and

- There are other benefits for occupants from opening windows, such as the connection with the outside, sense of fresh air, experience of draughts when overheating, and sense of control over one's environment' and states that 'consideration of these factors is also beyond the scope of the AVO Guide.

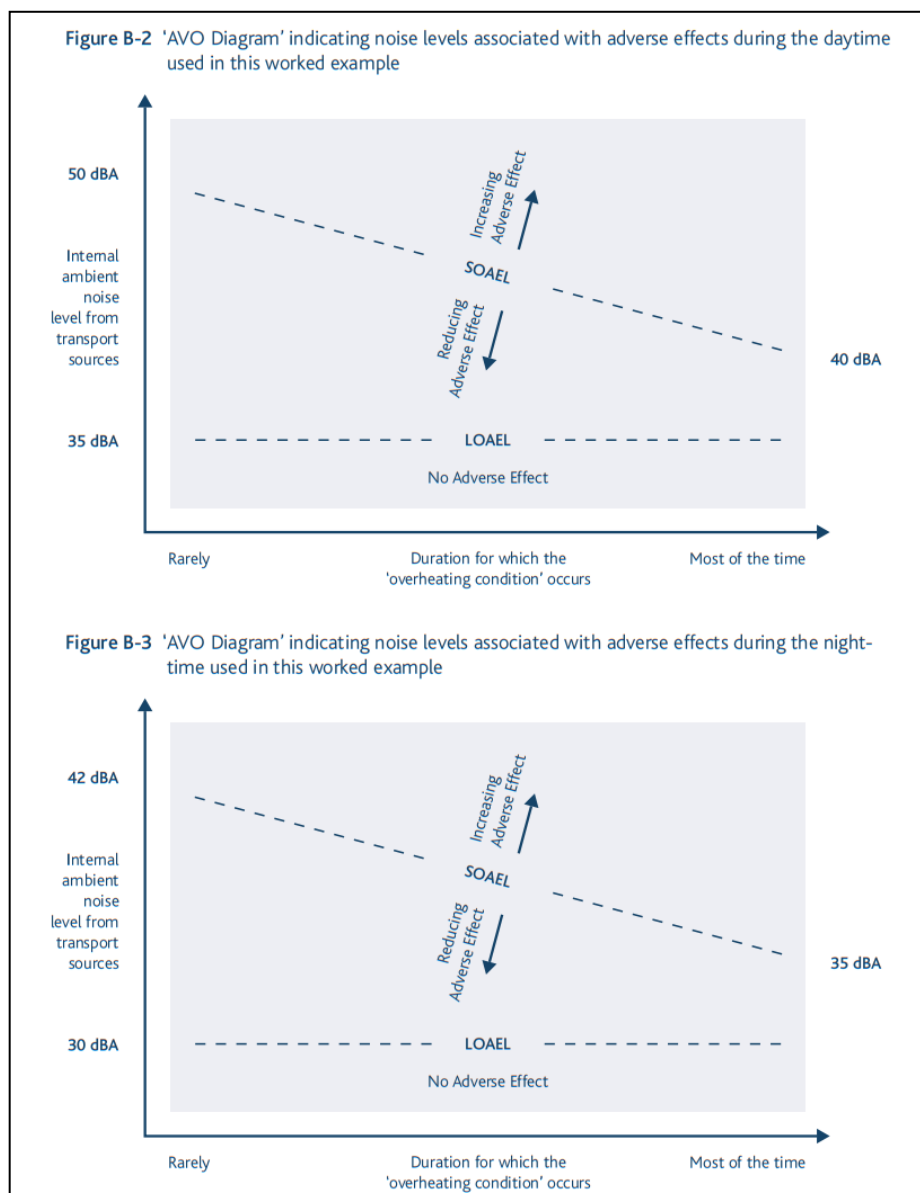
Worked examples are provided in Appendix B of the AVO. These examples give suggested absolute dB levels for the SOAEL (Significant Observed Adverse Effect Level) and LOAEL (Lowest Observed Adverse Effect Level) curves in Figure 3-2. The LOAEL is defined as the level above which adverse effects on health and quality of life can be detected. The SOAEL is defined as the level above which significant adverse effects on health and quality of life occur.

The AVO advises that

- 'although for both LOAEL and SOAEL, the word 'level' is used, this does not mean that the impact can only be described as an individual noise level or exposure. It could also include factors such as the number of times the noise impact occurs, the duration of the impact, and the time of day the impact occurs. Thus, depending on the circumstance, the noise impact could be managed by reducing how often it occurs rather than just reducing the level of impact when it does occur.

The AVO advises that the NPSE (Noise Policy Statement for England) states it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times.

Figures B-2 and B-3 from the AVO worked examples are reproduced below.



The AVO states that the suggested upper daytime noise limit of 50 dB LAeq,T is defined on the basis that it represents the upper end of the range for reliable speech communication. The upper night time noise limit of 42 dB LAeq,T is defined in the AVO with reference to the WHO Night Noise guidelines, which state that for external levels above 55dB LAeq,T, 'adverse health effects occur frequently and a sizeable proportion of the population is highly annoyed and sleep-disturbed'.

A noise level of 50dB LAeq,T is also the upper limit for indoor long-term ambient noise within open plan offices recommended in BS8233: 2014 'Guidance on sound insulation and noise reduction for buildings'.

The value of 'T', the averaging period used to determine the 'average' noise level 'LAeq,T', is not defined in the AVO. However, when discussing the further work required to better understand the issue of noise disturbance when windows are opened to control overheating, AVO states that further information is required, including

- how long will people tolerate higher noise levels in order to stay cool? One suggestion is to consider the overall average day (16h) and night (8h) time average noise levels. There is some logic to this as we all know that we can tolerate high noise levels for a short duration and moderately high levels for a little longer.

With regard to the absolute dB noise levels representing the LOAEL and the SOAEL in Figures B-2 and B-3, AVO states:

- The values presented....should not be regarded as fixed thresholds and reference can also be made to relevant dose-response relationships such as those described in a DEFRA 2014 study.the references are based on evidence drawn from *external* noise levels. There is currently very little robust evidence linking *internal* averaged noise levels with health outcomes and occupant behaviour.

Therefore, the noise levels identified in Figures B-2 and B-3 must be viewed with caution.

BUILDING REGULATIONS APPROVED DOCUMENT O – OVERHEATING

Approved Document O of the Building Regulations (Overheating) requires that ‘reasonable provision must be made in respect of a dwelling, institution or any other building containing one or more rooms for residential purposes, other than a room in a hotel (“residences”) to:

- (a) limit unwanted solar gains in summer;
- (b) provide an adequate means to remove heat from the indoor environment.

In meeting the obligations stated above, account must be taken of the safety of any occupant, and their reasonable enjoyment of the residence, including in relation to noise. The document also states that mechanical cooling may only be used where insufficient heat is capable of being removed from the indoor environment without it.

With regard to noise, the document states:

- where external noise may be an issue, the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am)
- Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits:
 - a. 40dB LAeq,T, averaged over 8 hours (between 11pm and 7am).
 - b. 55dB LAFmax, more than 10 times a night (between 11pm and 7am).

Given the measured external noise levels at the site, the windows to all studios within the building must be closed between 11pm and 7am to comply with Approved Document O.

Part O does not include requirements or recommendations relating to internal noise targets due to the opening of windows during the daytime. Therefore, from a Building Regulations perspective, windows to all studios could be opened as required to achieve appropriate internal temperatures.

CIBSE TECHNICAL MEMORANDUM 59 'DESIGN METHODOLOGY FOR THE ASSESSMENT OF OVERHEATING RISK IN HOMES (TM59)'

CIBSE TM59 provides guidance on the assessment of overheating in dwellings. The document sets out a standardised methodology for predicting temperatures inside dwellings using dynamic thermal modelling and also provides overheating compliance criteria.

Dynamic thermal modelling of the proposed accommodation has been carried out by Futureserv. The detailed output from the modelling studies are provided under separate cover.

The input parameters for the TM59 model include the solar energy transmittance (G value) of the glazing and the proposed mechanical ventilation rate in the overheating condition of 51 l/s.

For the TM59 model, the opening windows and purge panels to studios are prevented from opening between 11pm and 7am. Thus if compliance with the bedroom temperature criterion of TM59 is achieved, then the studio window and openable purge vents can remain closed all night and the internal night time noise criteria of BS8233: 2014 and WHO guidance can be achieved.

It should be noted that the opening hours of the windows and purge vent are based on the vent opening at an internal temperature of 22 deg C. It could be considered that the TM59 model represents a worst case in terms of opening hours, as not all occupants may feel the need to open a window at this temperature.

Furthermore, the TM59 modelling results identify the opening hours of the vent on the basis of the vent only closing when the internal temperature has dropped to 22 Deg C.

Therefore the opening hours of the purge vents identified by the TM59 model are not necessarily the opening hours required to maintain thermal comfort for the occupants. It is expected to be possible to achieve thermal comfort with shorter purge vent opening hours than those determined by the TM59 modelling.

EXTERNAL NOISE LEVELS

The prevailing noise levels at the development site have been determined by Fisher Acoustics by reference to noise surveys carried out as detailed in Fisher Acoustics report 'Vita Student Plot 9B First Street Manchester, Environmental Noise Study', report reference Z19B-FAC-A180-Rp-XX-001 P02, dated 11 November 2024 (issued as part of the Environmental Statement for the project).

Figure 2 shows the external daytime average (LAeq) noise levels expected to be incident upon the façades of the proposed building.

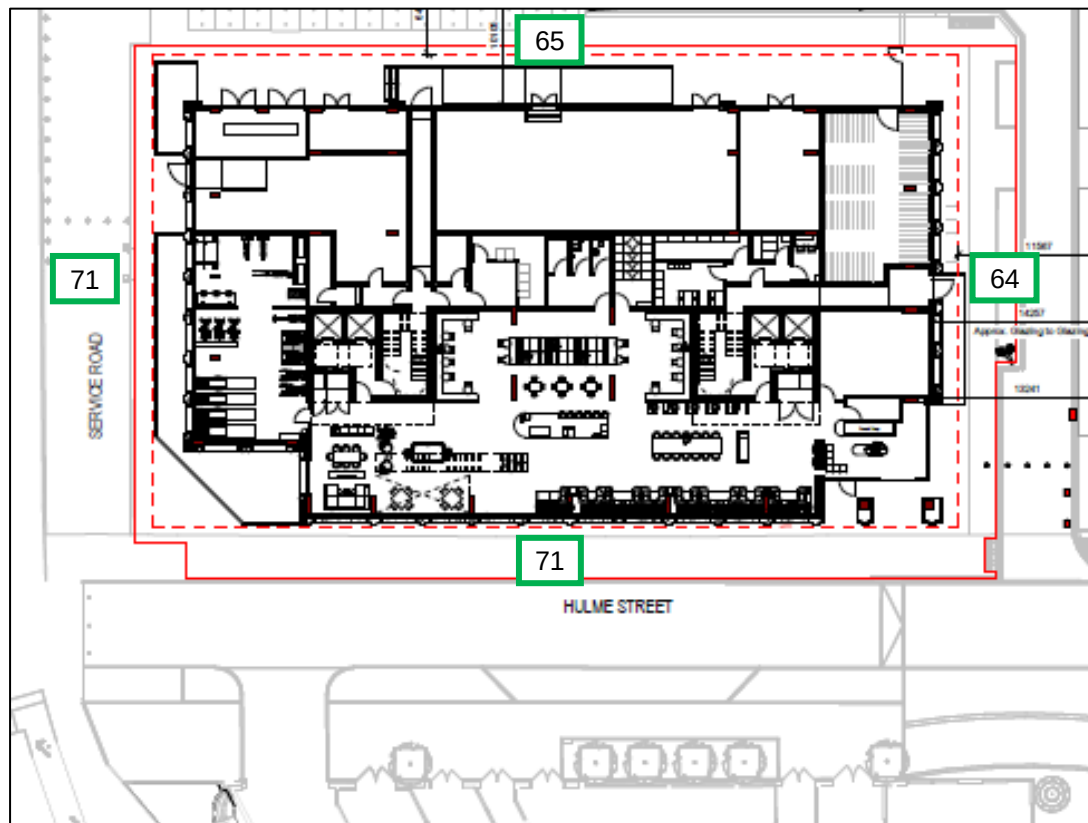


Figure 2: Summary external daytime noise levels incident on each façade (dB LAeq)

RESULTS OF TM59 MODELLING AND EXPECTED INTERNAL NOISE LEVELS

Night time

The dynamic thermal modelling carried out by Futureserv has determined that the night time temperature criterion of TM59 is achieved without the need to open windows or purge vents to the studios within the proposed development between 11pm and 7am. Therefore, full compliance with the internal noise criteria of Manchester City Council for bedrooms at night time can be achieved.

Daytime

Given the external noise levels identified in Figure 2 above, the allowable opening duration of windows and purge vents during the day to achieve an internal noise level in the overheating condition of 50dB LAeq, 16 hrs has been determined. The assessment assumes that a partially open window or purge vent will provide an outside-to-inside level difference of 13 dB, as identified in the AVO Guide.

Figure 3 identifies the opening duration of purge vents and windows at Levels 1 to 12 of the building applied in the TM59 model.



Figure 3: Maximum allowable daytime opening duration of windows and purge vents, Levels 1 to 12

Figure 4 identifies the opening duration of purge vents and windows at Levels 13 to 31 of the building applied in the TM59 model.



Figure 4: Maximum allowable daytime opening duration of windows and purge vents, Levels 13 to 31

The thermal modelling, detailed in the TM59 report has determined that compliance with the daytime temperature criterion of TM59 can be achieved given the opening durations identified in Figures 3 and 4.

Therefore, compliance with the criteria of TM 59 and the target internal noise levels suggested by the AVO guide can be achieved given the identified opening hours of windows and purge to the proposed residential accommodation.