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House of Social, Manchester

Intrusive Noise Study

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Flint Glass Works, 64 Jersey Street, Manchester, M4 6JW

0161 605 0905 

info@fisheracoustics.co.uk 

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PROJECT TITLE

HOUSE OF SOCIAL, MANCHESTER

REPORT TITLE

INTRUSIVE NOISE STUDY

CLIENT

HOUSE OF SOCIAL ONE LIMITED

HORSESHOE FARM

ELKINGTON WAY

ALDERLEY EDGE

CHESHIRE

SK9 7GU

REPORT REFERENCE

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MATT FISHER, BENG (HONS) CENG MIOA

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1.0 SUMMARY

Fisher Acoustics Ltd has been commissioned by House of Social One Limited to compile an intrusive noise report relating to a planning-approved student residential development at First Street, Manchester.

Surveys of environmental noise have determined the pre-existing environmental noise levels during the day and night at and around the site.

The recommended acoustic performance of the façade elements of the proposed building to achieve the noise criteria stipulated in the planning approval has been determined.

A study of external noise in relation to the control of overheating within dwellings has been carried out, with specific reference to the 'Acoustics, Ventilation and Overheating Residential Design Guide' (AVO), published by the Association of Noise Consultants and the Institute of Acoustics in January 2020 and to Approved Document O of the Building Regulations. The proposed strategy to mitigate overheating is considered commensurate with the achievement of acceptable acoustic conditions within the proposed rooms.

2.0 INTRODUCTION

Fisher Acoustics Ltd has been commissioned by House of Social One Limited to conduct an intrusive noise study relating to a proposed student residential development at First Street, Manchester. The proposed development will provide purpose-built student accommodation from 1st to 13th floor with communal amenities at ground floor and first floor.

This report responds to condition 14a of the planning approval for the development. In particular, the report examines the pre-existing environmental noise conditions at the site and advises on the required sound insulation performance of façade elements to habitable rooms to achieve the noise criteria stipulated in the planning approval.

In addition, this report includes an assessment in line with 'Acoustics, Ventilation and Overheating, Residential Design Guide', (AVO) published by the Association of Noise Consultants and the Institute of Acoustics in January 2020 and with Approved Document O of the Building Regulations.

The steps undertaken in compiling this study are as follows:

- Receipt of daytime and night time external noise survey data provided by Cundall Johnston & Partners LLP (Cundall) that confirms the measured levels of noise at the site
- Calculation of the required sound reduction index of the façade elements to habitable rooms to allow the achievement of appropriate internal noise levels due to external noise sources.
- Assessment of potential internal noise levels in relation to the control of overheating

3.0 DESCRIPTION OF SITE

General Site Description

The proposed development is Plot 10B of the First Street Development Framework, Manchester.

Plot 10B is bounded by River Street to the north and east, Hulme Street to the south and Plot 10A to the west. Plot 10A has planning approval for a 13-storey office building (planning reference 136043/FO/2023).

The buildings in the immediate vicinity of the site include residential apartments at Macintosh Mill, a Vita Student residential building, office buildings and retail/commercial units. A major residential development is currently under construction to the immediate south of the site

River Street and Hume Street and Chester Street are relatively lightly trafficked side roads. The closest major roads to the site are the Mancunian Way (A57(M)) and Medlock Street. The Mancunian Way (A57(M)) lies approximately 155 metres to the south of the site. Medlock Street lies approximately 125 metres to the west of the site.

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

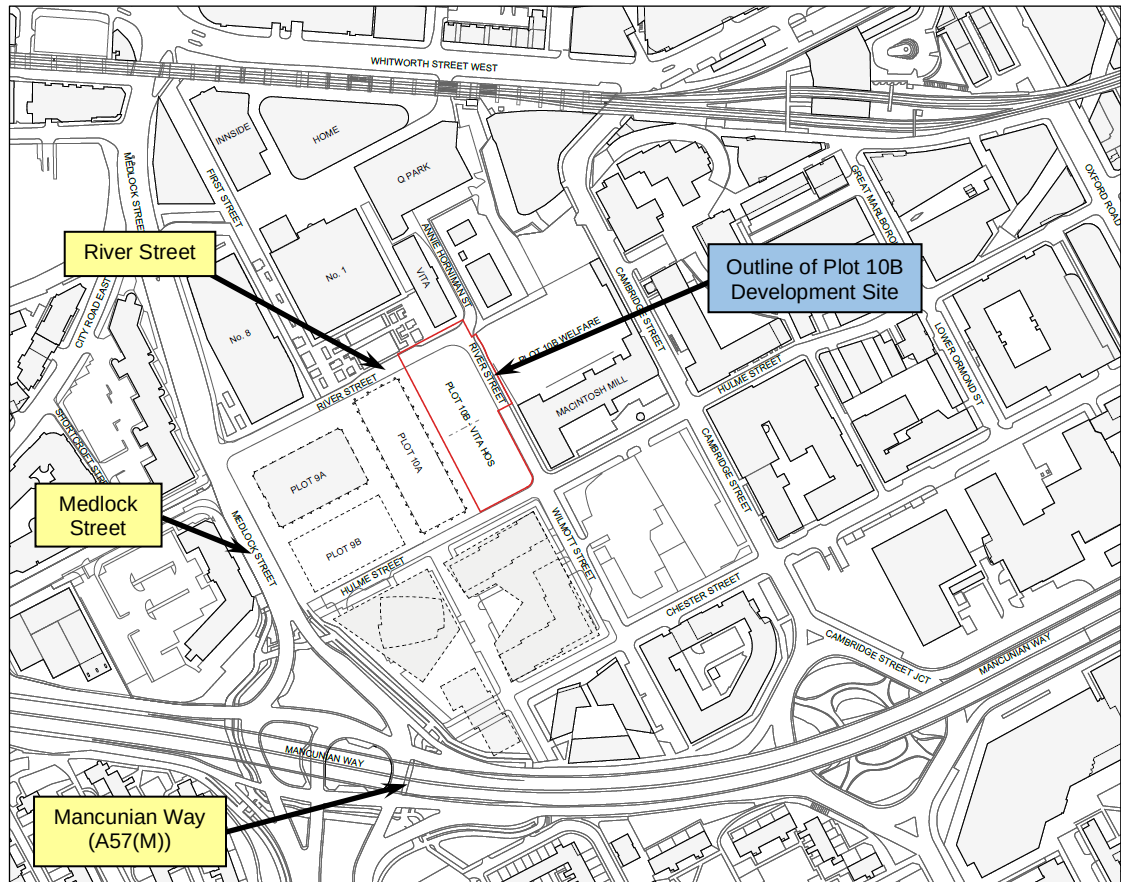


Figure 1: Site location plan – Plot 10B

4.0 DESCRIPTION OF PROPOSED DEVELOPMENT

The proposed development at Plot 10B will provide purpose-built student accommodation from 1st to 13th floor with communal amenities at ground floor and first floor.

The majority of the residential accommodation is to be arranged in clusters, each of which includes either five or six bedrooms and a communal living/dining area. Twenty four individual studio rooms are also proposed. A total of five hundred and seventy six student bed spaces are to be provided, split between clusters and studios.

Figure 2 shows the site boundary of the proposed development.

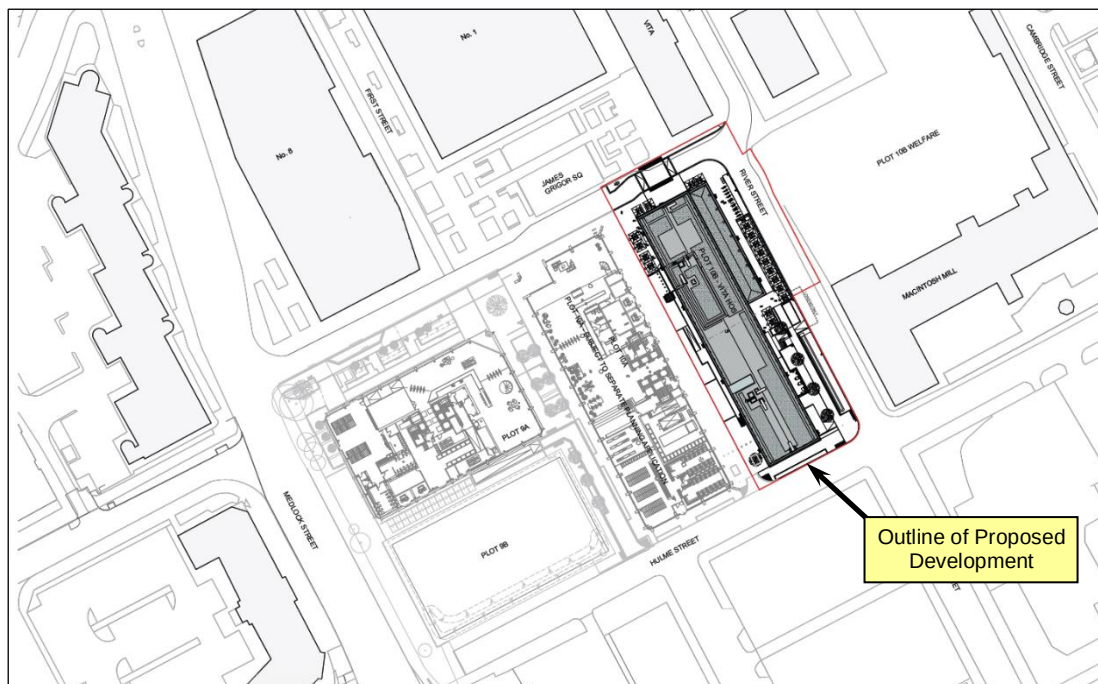


Figure 2: Site boundary plan – Plot 10B

5.0 PLANNING CONDITION

Planning condition 14a of the planning permission for Plot 10B, reference: 136170/FO/2023 dated 25 July 2023, as amended by 137946/NMC.2023, dated 12 September 2023, states:

- *'14) Notwithstanding the details within the First Street Plot 10a Noise Impact Assessment First Street Developments Limited Ref PLOT10A-XX-XX-RP-Y-45001 P03 12 January 2023 by Cundall stamped as received on 17-02-23:*

a) Within 8 weeks of core construction commencing a scheme for acoustically insulating the proposed residential accommodation against noise from the nearby road network and any nearby commercial premises shall be submitted to and approved in writing by the City Council as local planning authority. There may be other actual or potential sources of noise which require consideration on or near the site.

The potential for overheating shall also be assessed and the noise insulation scheme shall take this into account. The approved noise insulation and ventilation scheme shall be completed before any of the dwelling units are occupied.

Noise survey data shall include measurements taken during a rush-hour period and night time to determine the appropriate sound insulation measures necessary. The following noise criteria shall be required to be achieved with windows closed:

Bedrooms (night time - 23.00 - 07.00) 30 dB LAeq (individual noise events shall not exceed 45 dB LAmax,F by more than 15 times)

Living Rooms (daytime - 07.00 - 23.00) 35 dB LAeq

Gardens and terraces (daytime) 55 dB LAeq

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 (Leq,5min), respectively.

The approved noise insulation scheme and vibration mitigation measures shall be completed before any of the dwelling units are occupied.'

Condition 14a refers in error to 'First Street Plot 10a Noise Impact Assessment First Street Developments Limited Ref PLOT10A-XX-XX-RP-Y-45001 P03 12 January 2023 by Cundall'. This should read 'First Street Plot 10b Noise Impact Assessment First Street Developments Limited Ref PLOT10B-XX-XX-RP-Y-45001 P01 23 January 2023 by Cundall'.

6.0 ENVIRONMENTAL NOISE SURVEY

In order to determine the prevailing ambient noise levels at and around the site, reference has been made to noise measurement surveys conducted by Cundall in 2018 and 2022.

Full survey details are given in the Noise Impact Assessment for Plot 10B, reference: PLOT10B-XX-XX-RP-Y-45001, dated 23 January 2023. The noise impact assessment report includes the output of a 3D modelling exercise, from which the predicted external road traffic noise levels have been determined.

Table 1 identifies the highest predicted daytime and night time external road traffic noise levels on each elevation of the building.

Facade	Free-field External Noise Level, dB LAeq	
	Daytime (7am to 11pm)	Night time (11 pm to 7am)
North Elevation (River Street)	63	55
East Elevation (River Street)	60	55
South Elevation (Hulme Street)	63	60
West Elevation	63	60

Table 1: Predicted external noise levels

As reported in the Noise Impact Assessment for Plot 10B, 'PLOT10B-XX-XX-RP-Y-45001', dated 23 January 2023, the measured maximum night time (11pm to 7am) noise level at the site is no greater than 76dB LAmax.

7.0 NOISE INGRESS

The external noise survey data have been used to calculate the required sound insulation performance of façade elements to achieve the internal noise criteria within residential rooms due to external noise, as detailed in the planning approval (see Section 5 of this report). The calculations are based on the 'more rigorous' calculation method identified in Annex G.2.1 of BS8233:2014 'Guidance on sound insulation and noise reduction for buildings'.

The calculations take into account the measured levels of noise at the site, the areas of individual façade elements, (e.g. glazing, window framing and external wall) identified in the drawings submitted for planning purposes and the expected reverberation time of the residential rooms.

The dwellings within the proposed development are to be provided with continuously running supply and extract ventilation in order to achieve the background ventilation requirements of Approved Document F of the Building Regulations. Therefore, no passive trickle ventilators are required within the façade of the proposed habitable rooms. Purge ventilation as defined in Approved Document F of the Building Regulations is to be achieved via opening windows. The calculations of noise ingress assume that the windows are closed.

WINDOWS TO RESIDENTIAL ROOMS

During the pre-Tender design stage, it was determined that a single acoustic specification for the windows to the proposed dwellings would be required to achieve the internal noise criteria detailed in the planning approval. Table 2 identifies the minimum recommended sound reduction index of the windows. The performance values in Table 2 relate to the composite performance of the full window assembly including glazing, frames and seals when measured in a laboratory in accordance with BS EN ISO 10140-2: 2021 and rated in accordance with BS EN ISO 717-1: 2020.

Windows	Sound Reduction Index (dB) @ Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
All residential rooms	20	20	23	31	40	39	39

Table 2: Minimum sound reduction index of windows to residential rooms, including frame

It must be noted that the performance values given in Table 2 were developed for Tender purposes and that other combinations of sound reduction index across the frequency range would allow the internal noise criteria detailed in the planning approval to be achieved. Where the performance values of any proposed window system do not comply with every octave band value in Table 2, it may be the case that compliance with the internal noise criteria can still be achieved, subject to appropriate checks.

The proposed window system to all habitable rooms is the Velfac 200 Energy. The proposed glazing unit to all habitable rooms is as follows:

- Triple glazed unit comprising 9.5 mm laminated glass -14 mm thermal cavity – 4 mm clear glass - 14 mm thermal cavity – 6 mm clear glass

With reference to acoustic test data held on file by Fisher Acoustics, the expected sound insulation performance of the proposed glazing, both in isolation and when installed in the Velfac 200 Energy window is as follows:

Glazing	Sound Reduction Index (dB) @ Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
9.5 mm laminated glass -14 mm thermal cavity – 4 mm clear glass - 14 mm thermal cavity – 6 mm clear glass	20	20	29	38	45	42	54
Velfac 200 Energy glazed as above	20	20	27	37	41	40	51

Table 3: Minimum sound reduction index of windows to residential rooms, including frame

With reference to Tables 2 and 3, it can be seen that the expected sound insulation performance of the proposed window meets or exceeds the recommended performance values in Table 2. Calculations of noise ingress have confirmed that the given the performance values of the Velfac 200 Energy window system, full compliance with the internal noise criteria of planning condition 14a is expected. In particular, the following internal noise levels have been calculated on the noisiest elevation and floor level of the building:

- Daytime: 28 dB LAeq,16h
- Night time: 25 dB LAeq,8h

Given the expected sound insulation performance of the proposed windows, no excesses over an internal night time noise level of 45dB LAmax are expected.

EXTERNAL WALL

The external wall of the proposed building is to comprise areas of brickwork and metal panels fixed to an insulated SFS frame which is drylined internally.

Table 4 identifies the minimum recommended sound reduction index of the external wall to the residential rooms to allow the achievement of the internal noise criteria detailed in the planning approval.

Areas	Sound Reduction Index (dB) @ Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Brickwork, SFS system drylined internally	33	42	48	55	55	55	55
Insulated metal panel, SFS system drylined internally	17	24	39	44	50	50	50

Table 4: Minimum sound reduction index of external wall to residential rooms

The proposed build-up of the external wall to the residential rooms is understood to be as follows:

1. At Gable ends, Levels 12 and 13:
 - Profiled ventilated rainscreen cladding panel
 - Cavity of depth 100 mm to 150 mm
 - 150 mm mineral wool insulation
 - 12.5 mm sheathing board fixed to outer face of 150 mm SFS studs
 - 150 mm mineral wool between the SFS studs
 - 50 mm metal stud fixed independently of the SFS studs
 - 2 x 12.5 mm dense plasterboard fixed to 50 mm stud

-
2. At Gable ends, Levels 1 to 11:
 - 100 mm brickwork
 - 112 mm clear cavity
 - 150 mm mineral wool insulation
 - 12.5 mm sheathing board fixed to outer face of 150 mm SFS studs
 - 150 mm mineral wool between the SFS studs
 - 50 mm metal stud fixed independently of the SFS studs
 - 2 x 12.5 mm wallboard fixed to 50 mm stud
 3. Typical brickwork panel
 - 100 mm brickwork
 - 50 mm cavity
 - 150 mm mineral wool insulation
 - 12.5 mm sheathing board fixed to outer face of 150 mm SFS studs
 - 150 mm mineral wool between the SFS studs
 - 2 x 12.5 mm wallboard fixed to inner face of SFS studs
 4. Typical rainscreen panel
 - Ventilated rainscreen cladding panel
 - 25 mm minimum clear cavity
 - 180 mm minimum mineral wool insulation
 - 12.5 mm sheathing board fixed to outer face of 150 mm SFS studs
 - 150 mm mineral wool between the SFS studs
 - 2 x 12.5 mm wallboard fixed to inner face of SFS studs

Given the proposed through-wall build-ups of the external wall, full compliance with the values of Table 4 is expected.

Roof

The principle acoustic elements of the proposed roof of each proposed building are a concrete slab and a ceiling that comprises a single layer of 12.5 mm wallboard fixed to a suspended metal frame. The expected minimum weighted sound reduction index of the roof construction is 60 dB R_w . This performance is fully commensurate with the achievement of the target internal noise levels within the proposed dwellings.

CONCLUSION

The proposed window system and glazing, external wall build-ups and roof construction are expected to allow full compliance with the daytime and night time 'average' noise level criteria identified in planning condition 14a. Similarly, full compliance with the recommendations of Manchester City Council in relation to maximum (LA_{max}) night time noise levels in bedrooms is expected.

8.0 ACOUSTICS, VENTILATION AND OVERHEATING

Condition 14a of the planning approval requires that ‘the potential for overheating shall also be assessed and the noise insulation scheme shall take this into account’.

The dwellings within the 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’ background ventilation requirements of Approved Document F of the Building Regulations (ADF).

Purge ventilation is required under Approved Document F of the Building Regulations to rapidly dilute indoor air pollutants (e.g. paint fumes) and extract water vapour when necessary in habitable rooms. Purge ventilation of the proposed dwellings is to be provided by manually-operated opening windows within the facade.

The provisions for purge ventilation can also be used to improve thermal comfort.

Guidance on achieving an appropriate balance between thermal comfort and internal noise levels in dwellings is given in the ‘Acoustics Ventilation and Overheating Residential Design Guide (‘AVO’) published by the Association of Noise Consultants and the Institute of Acoustics in January 2020. 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 apartment rooms.

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 at the time that the AVO was written in relation to the overheating of dwellings, the AVO is

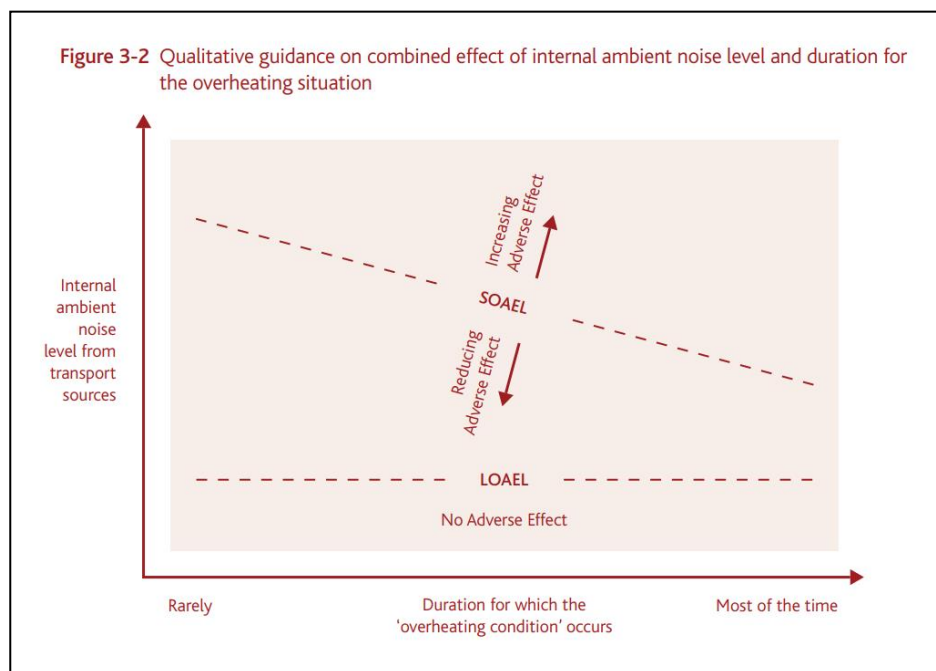
- ‘intended to be used by acoustics practitioners as well as all those involved in the planning, development, design and commissioning of new dwellings. It recommends an approach to acoustic assessments for new residential development that takes due regard of the interdependence of provisions for acoustics,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

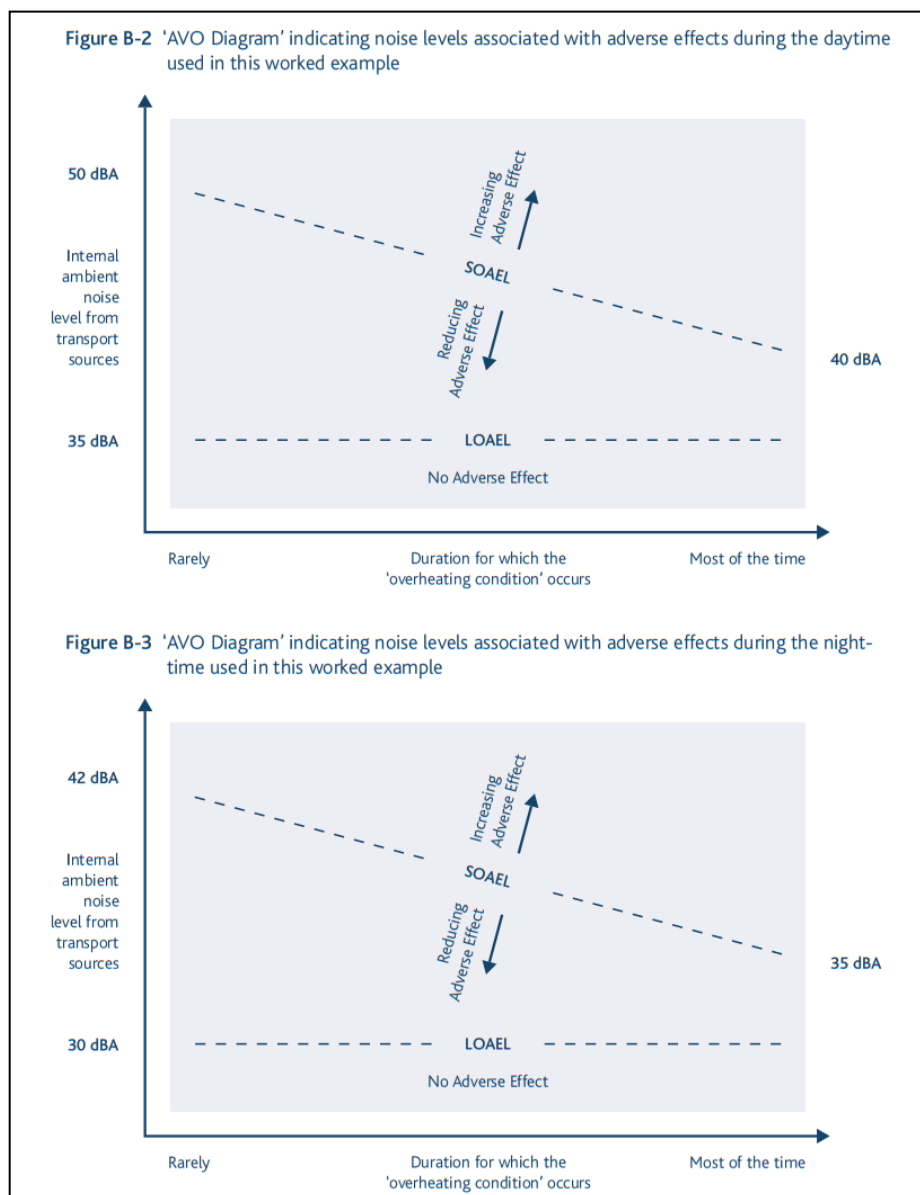
The AVO advises that:

- '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 50 dB 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 (2021)

Requirement O1 ‘Overheating mitigation’ of Approved Document O is as follows:

- (1) 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.
- (2) In meeting the obligations in paragraph (1)—
 - (a) account must be taken of the safety of any occupant, and their reasonable enjoyment of the residence; and
 - (b) mechanical cooling may only be used where insufficient heat is capable of being removed from the indoor environment without it.

Approved Document O further states:

- In the Secretary of State’s view, requirement O1(2)(a) is met in a new residential building if the building’s overheating mitigation strategy for use by occupants taking account of all of the following.
 - a. Noise at night – paragraphs 3.2 - 3.4.
 - b. Pollution – paragraphs 3.5
 - c. Security – paragraphs 3.6 - 3.7.
 - d. Protection from falling – paragraphs 3.8 - 3.10.
 - e. Protection from entrapment – paragraph 3.11

With regard to noise in dwellings, Section 3 of Approved Document O, ‘Ensuring the overheating mitigation strategy is usable’, states

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 (11pm to 7am).

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

- a. 40 dB LAeq, T, averaged over 8 hours (between 11pm and 7am).
- b. 55 dB LAFmax, more than 10 times a night (between 11pm and 7am)

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.

NOTE: Guidance on reducing the passage of external noise into buildings can be found in the *National Model Design Code: Part 2 – Guidance Notes* (MHCLG, 2021) and the Association of Noise Consultants' *Acoustics, Ventilation and Overheating: Residential Design Guide* (2020).

It can be seen therefore that Approved Document O, whilst referring to the AVO design guide, only requires that internal noise levels within bedrooms at night achieve certain criteria when combating overheating within dwellings. No requirement for the achievement of daytime internal noise levels within dwellings in the overheating condition is presented in Approved Document O.

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 has been carried out by Ridge and Partners LLP for a number of representative dwellings within the proposed development. The detailed output from the modelling studies is available on request.

The input parameters for the TM59 model include the solar energy transmittance (G value) of the glazing and the MVHR ventilation rate.

In particular, the thermal design of the buildings includes the following measures to mitigate overheating:

- 1) Low G value (0.40) of vision glazing to curtain wall to minimize solar heat gain to dwellings
- 2) Continuously-running whole-house ventilation (MVHR) units with Summer Bypass within each dwelling
- 3) Passive ventilative cooling via opening windows

For the TM59 model, the opening of windows to all bedrooms within the development is prevented between 11pm and 7am. Thus if compliance with the bedroom temperature criterion of TM59 is achieved, then the bedroom windows can remain closed all night and the internal night time noise criteria stipulated by planning condition 14a can be achieved.

In addition, the TM59 model assumes that windows to all habitable rooms can be opened for only five hours during the daytime (defined as 7am to 11pm).

It should be noted that the opening hours of the windows 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 windows on the basis of the windows only closing when the internal temperature has dropped to 22 Deg C.

If the occupant of an apartment chose to close their window before the internal temperature dropped back to 22 Deg C, it could be the case that the internal temperature would not then rise above the 'fail' temperature criterion of TM59.

Therefore the opening hours of the windows 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 window opening hours than those determined by the TM59 modelling.

RESULTS OF TM59 MODELLING AND EXPECTED INTERNAL NOISE LEVELS**Night time**

The dynamic thermal modelling has determined that the night time temperature criterion of TM59 is achieved without the need to open windows to the bedrooms and living rooms of all dwellings within the proposed development between 11pm and 7am. Therefore, the internal noise criteria stipulated by planning condition 14a for bedrooms at night time can be achieved whilst avoiding overheating as defined by TM59.

Therefore, the temperature mitigation strategy for the development would be in compliance with Approved Document O and the AVO guide in relation to noise.

Daytime

As identified above, the TM59 model assumes that the windows to habitable rooms can only be opened for five hours during the daytime (defined as 7am to 11pm).

Given the allowable opening hours of the windows and the daytime external noise levels around the buildings, Table 5 identifies the calculated worst-case internal noise levels within living rooms on a typical floor level on each elevation of the proposed development.

Calculated internal noise level within living rooms, LAeq,16h noise levels (daytime)					
Location	May	June	July	August	September
North	45	45	45	45	45
East	42	42	42	42	42
South	45	45	45	45	45
West	45	45	45	45	45

Table 5: Calculated daytime internal noise levels in living rooms and bedrooms given open hours of windows

It can be seen that compliance with the suggested upper noise limit within the AVO guide of 50 dB LAeq,16h is expected to be achieved within all living rooms and bedrooms on all elevations of the building. The proposed strategy to mitigate overheating is therefore considered commensurate with the achievement of acceptable acoustic conditions within the proposed rooms.