UK OVERHEATING

Churchill Living

WORTHING ROAD, SOUTHWATER

TM59 Overheating Assessment



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1. EXECUTIVE SUMMARY

UK Overheating produced an Approved Document O compliant overheating strategy for Churchill Living for the proposed retirement living accommodation on Roundstone Caravan Park, Worthing Road, Southwater RH13 9JF, as reported in UK Overheating report UKO0110-R01-P01.

Horsham District Council Environmental Health have requested further modelling in relation to satisfying Planning Condition No. 8, which is as follows:

> *"No development above ground floor slab level of any part of the development hereby permitted shall take place until a revised Noise Assessment has been submitted, with details of appropriate ventilation, has been submitted to and approved by the Local Planning Authority in writing. The approved details hereby permitted shall be implemented prior to occupation and thereafter retained as such."*

Specifically, the additional modelling has been requested to demonstrate that the development can mitigate overheating via *appropriate ventilation* whilst at the same time provide reasonable internal noise levels during the daytime in Living/Kitchen rooms. From the correspondence with Horsham District Council Environmental Health, this modelling exercise has assumed that reasonable internal noise levels according to the Council comprise daytime Living/Kitchen Rooms to be ≤35 dB $L_{Aeq,16hr}$ during mitigation of summer overheating.

The modelling has followed the same assumptions as reported in UK Overheating report UKO0110-R01-P01 except for the following:

- Windows are to be modelled as closed where any living room window is predicted to be exposed to ≥ 45 dB $L_{Aeq,16hr}$ outside
- Windows are to be modelled as closed where any bedroom window is predicted to be exposed to ≥ 55 dB $L_{Aeq,16hr}$ outside

The noise exposure has been based on the Peninsular Acoustics report 'PA0316-R01-P02 Worthing Road, Southwater Acoustics Assessment'.

This has resulted in the simulations assuming:

- all ground floor living/kitchen windows are closed during the daytime and night-time;
- ground floor bedrooms windows of Flats 05 to 12a are closed during the daytime and night-time; and
- all upper floor living/kitchen windows being closed during the day and fully open to their maximum reach (limited for protection from falling by Approved Document O) during the night.

The requirement to close living room windows during the daytime deviates from the requirements of Approved Document O, which states that all rooms occupied during the day are to be modelled with windows opening according to room internal temperature.

Additionally, modelling with closed windows during the daytime and night-time for an entire dwelling requires overheating evaluation to assume the home is predominantly mechanically ventilated, necessitating evaluation of overheating risk using a different (more onerous) criterion.

With this revised modelling, generally the ground floor living/kitchen rooms adequately mitigate overheating due to the previously proposed mechanical ventilation in combination with the prevention of daytime hot air entering the room (i.e. deviating from the requirement of Approved Document O). The results have required additional mitigation to some rooms, mostly in the form of reduced g-value glazing or additional mechanical ventilation rates. For one ground floor bedroom (Bedroom 2 of Cottage C2) this has necessitated replacing the previously proposed mechanical extract fan with a mechanical cooling unit.

2. INTRODUCTION

2.1. PURPOSE

UK Overheating produced an Approved Document O compliant overheating strategy for Churchill Living for the proposed retirement living accommodation on Roundstone Caravan Park, Worthing Road, Southwater RH13 9JF, as reported in UK Overheating report UKO0110-R01-P01.

Horsham District Council Environmental Health have requested further modelling in relation to satisfying Planning Condition No. 8, which is as follows:

> *"No development above ground floor slab level of any part of the development hereby permitted shall take place until a revised Noise Assessment has been submitted, with details of appropriate ventilation, has been submitted to and approved by the Local Planning Authority in writing. The approved details hereby permitted shall be implemented prior to occupation and thereafter retained as such."*

Specifically, the additional modelling has been requested to demonstrate that the development can mitigate overheating via *appropriate ventilation* whilst at the same time provide reasonable internal noise levels during the daytime in Living/Kitchen rooms.

This report is necessarily technical in nature. To assist the reader, a glossary of technical terms is provided in Appendix A.

2.2. ASSESSMENT CRITERIA

2.2.1. CIBSE TM59

CIBSE TM59 was published in April 2017 and provides a standardised assessment methodology to determine the risk of overheating in residential properties. It includes assumptions for internal heat gains and occupancy profiles and presents criteria which differ depending on whether the home is predominantly naturally ventilated, or it is predominantly mechanically ventilated.

For homes that are predominantly naturally ventilated, including homes that have mechanical ventilation with heat recovery [MVHR], with good opportunities for natural ventilation in the summer, compliance is based on passing *both* of the following two criteria:

Table 1: CIBSE TM59 Predominantly Naturally Ventilated Criteria

Criterion	Requirement
a)	*For living rooms, kitchens and bedrooms*: the number of hours during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of occupied hours.
b)	For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26 °C for more than 1% of annual hours. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26 °C will be recorded as a fail).

For homes predominantly mechanically ventilated, because they have either no opportunity or extremely limited opportunities for opening windows (e.g. due to noise levels or air quality), occupied rooms should not exceed an operative temperature of 26 °C for more than 3% of annual occupied hours.

Care homes and accommodation for vulnerable occupants, which are predominantly naturally ventilated, should use criteria (a) and (b), but should assume Type 1 occupancy, as defined in CIBSE TM52. This results in a reduction in the acceptable comfortable temperature range from ±3K to ±2K (and a reduction of predicted mean vote from ±0.5 to ±0.2), reflecting the higher sensitivity of vulnerable occupants to increases in internal temperature.

2.2.2. NOISE

From the correspondence with Horsham District Council Environmental Health, this modelling exercise has assumed that reasonable internal noise levels according to the Council comprise daytime Living/Kitchen Rooms to be ≤35 dB $L_{Aeq,16hr}$ during mitigation of summer overheating.

3. NOISE EXPOSURE

3.1. NOISE

The noise assessment by Peninsular Acoustics (ref. PA0316-R01-P01, dated May 2024) has informed noise exposure on the site.

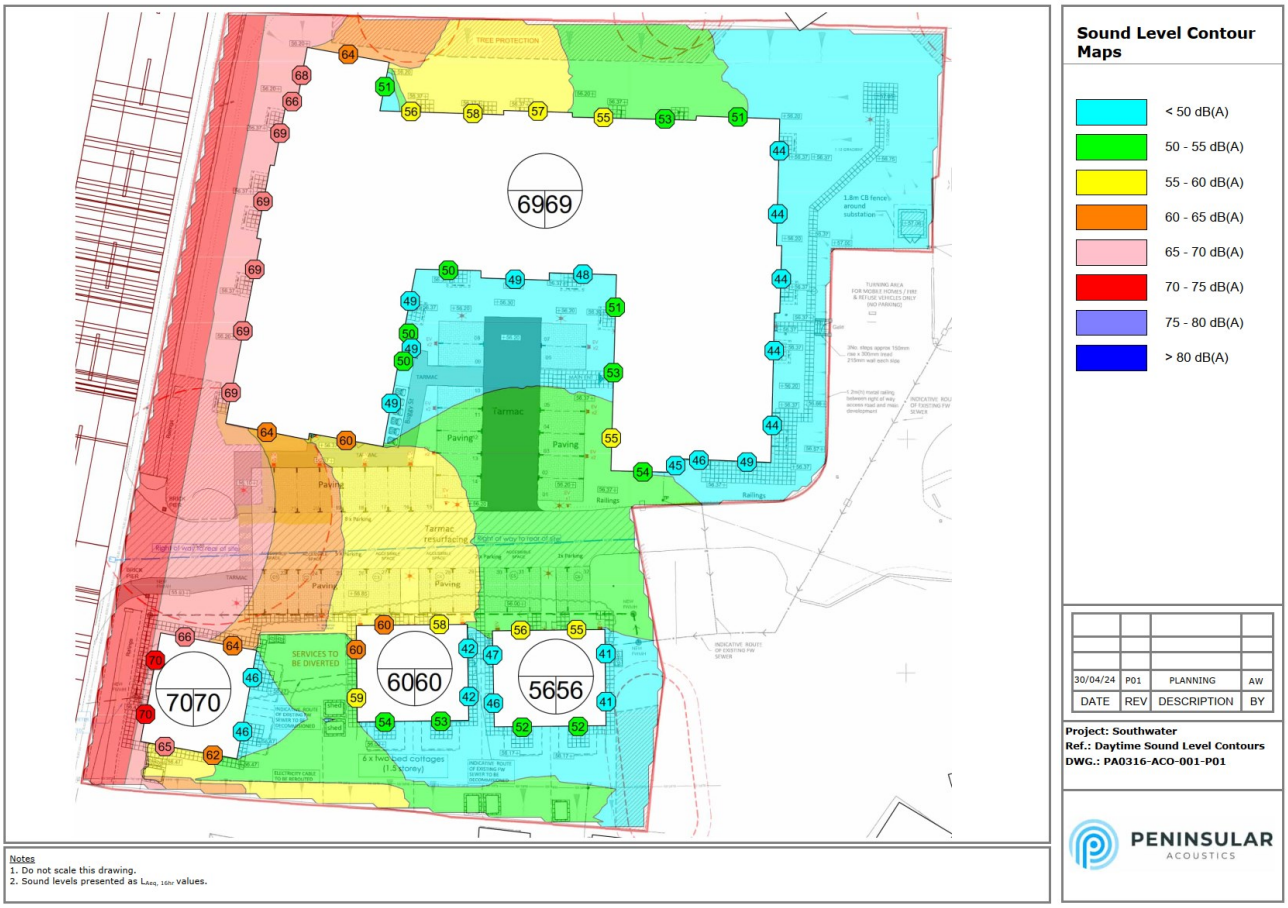


Figure 1: Daytime Noise Exposure

3.2. OPEN WINDOW CONSTRAINTS

The open window sound insulation has been estimated based on Peninsular Acoustics / Apex Acoustics research on alignment of acoustic and thermal models for partially open windows.

Most Living Rooms have three openings, a patio/balcony door (1.89m^2 Equivalent Area) and two no. opening windowpanes either side of the patio/balcony door (1.00m^2 Equivalent Area each). The cumulative outside to inside sound insulation when all these doors/windowpanes are open is 5dB.

Even with Living room / Kitchen windows closed, sound intrusion via an open bedroom window and open internal doors will contribute to the noise level in the living room / kitchens. The estimated outside to inside sound insulation via bedroom open windows and internal open doors is 20dB.

Based on the daytime noise exposure and requirements by Horsham District Council, the following rules apply to opening of windows:

- Windows are to be modelled as closed where any living room window is predicted to be exposed to ≥ 40 dB $L_{Aeq,16hr}$ outside
- Windows are to be modelled as closed where any bedroom window is predicted to be exposed to ≥ 55 dB $L_{Aeq,16hr}$ outside

On this basis, the following window openings have been assumed in the model:

- all ground floor living/kitchen windows are closed during the daytime and night-time;
- ground floor bedrooms windows of Flats 05 to 12a are closed during the daytime and night-time; and
- all upper floor living/kitchen windows being closed during the day and fully open to their maximum reach (limited for protection from falling by Approved Document O) during the night.

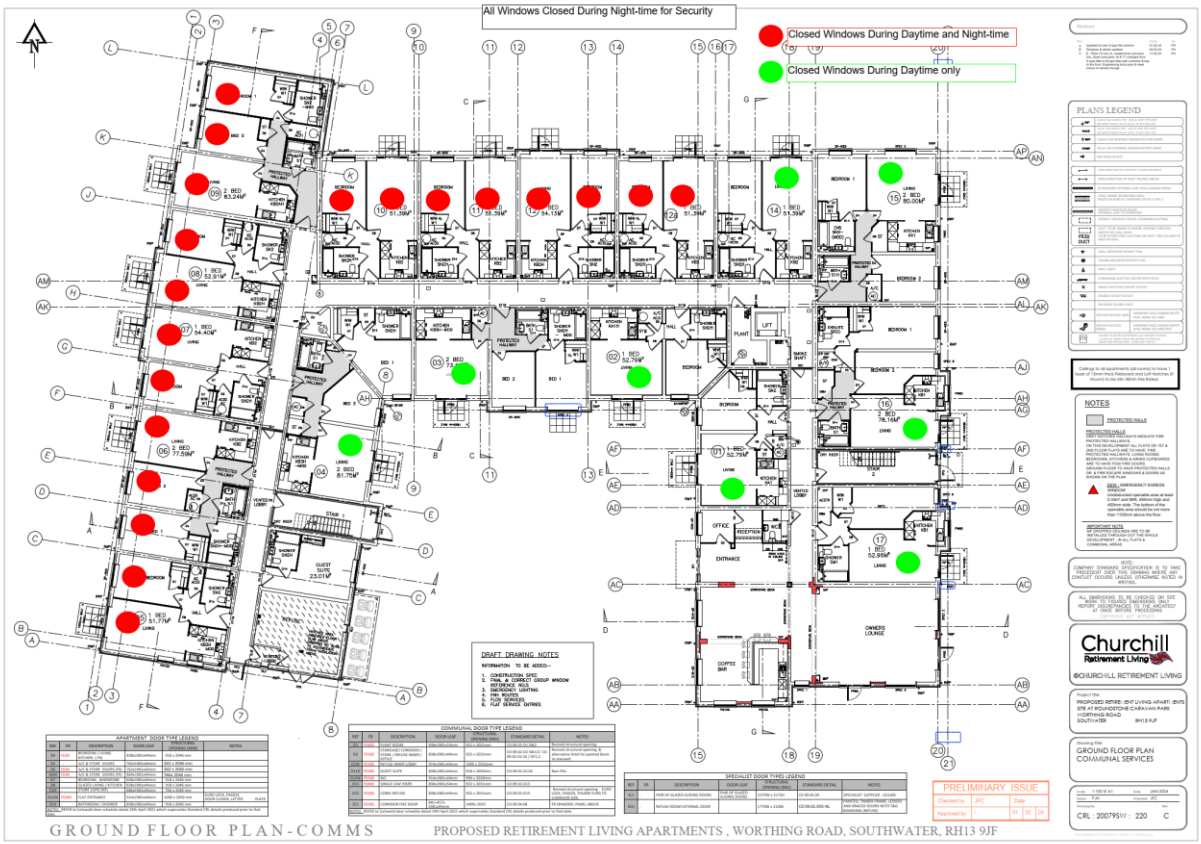


Figure 2: Ground Floor Closed Windows

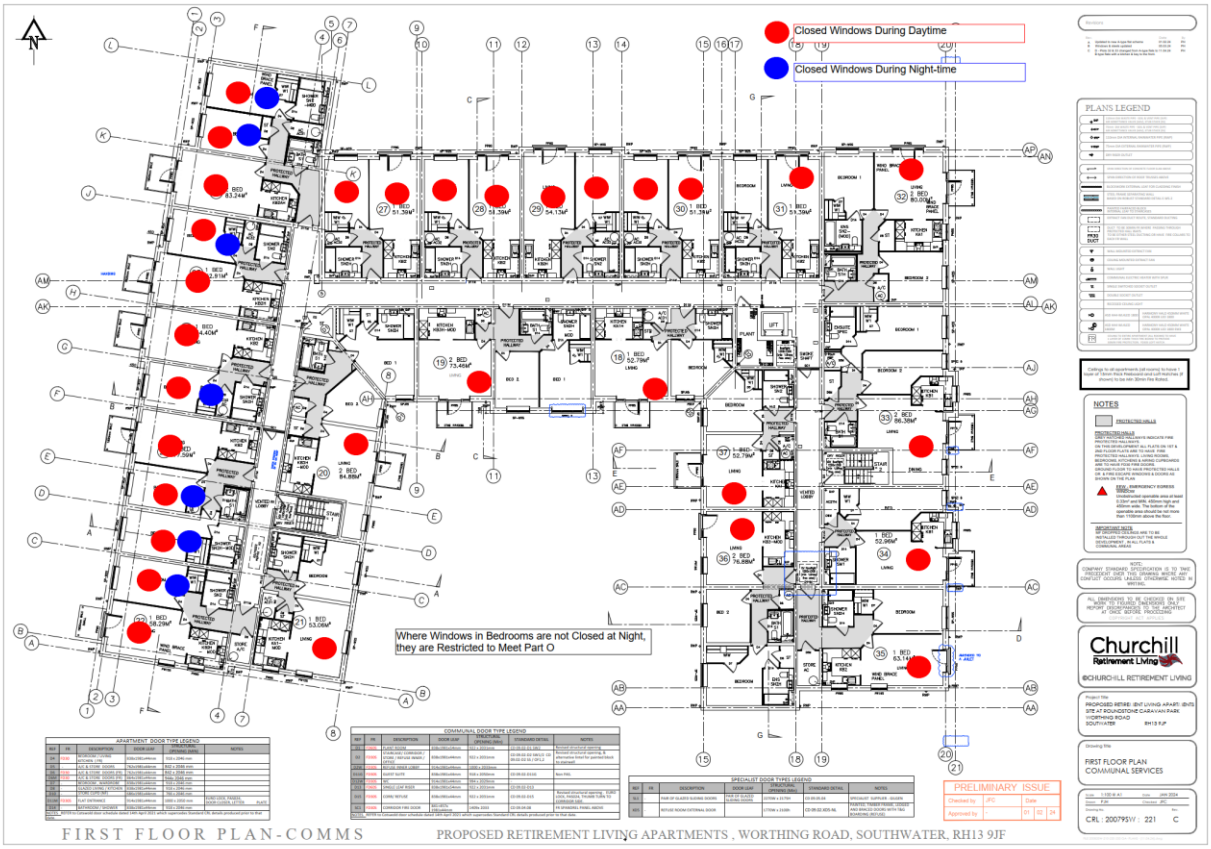


Figure 3: First Floor Closed Windows

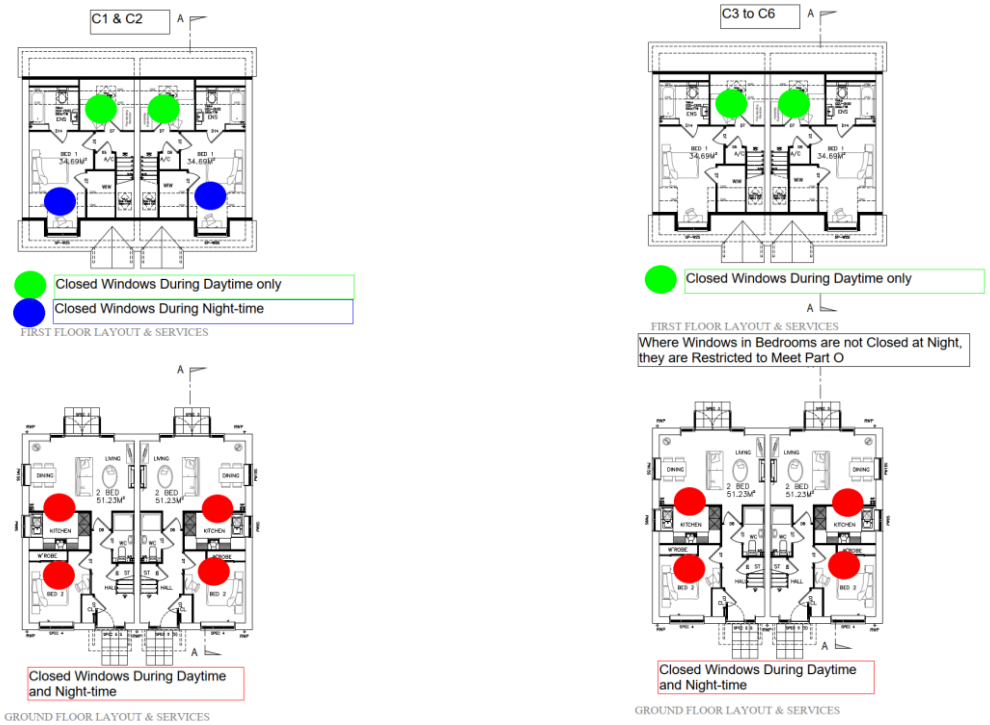


Figure 4: Cottage Closed Windows

4. ASSESSMENT METHODOLOGY

4.1. DYNAMIC THERMAL MODELLING

All assumptions in the dynamic thermal modelling exercise are the same as reported in UKO0110-R01-P01, except:

- all ground floor living/kitchen windows are closed during the daytime and night-time;
- ground floor bedrooms windows of Flats 05 to 12a are closed during the daytime and night-time; and
- all upper floor living/kitchen windows being closed during the day and fully open to their maximum reach (limited for protection from falling by Approved Document O) during the night.

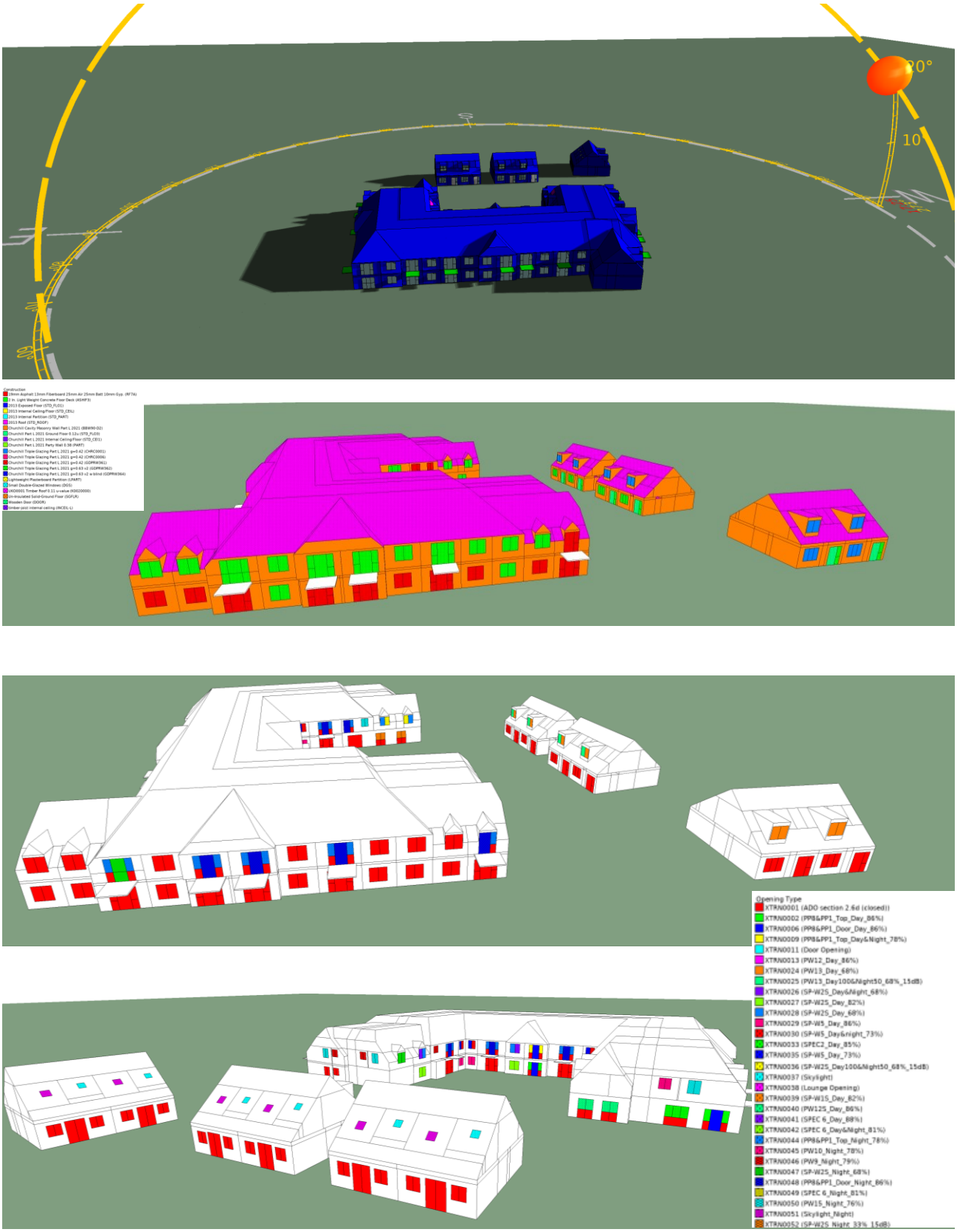
4.2. FAÇADE SOUND INSULATION

Façade sound insulation calculations are based on the guidance in BS EN ISO 12354-3:2017 ‘Building acoustics – Estimation of acoustic performance of buildings from the performance of elements. Part 3: Airborne sound insulation against outdoor sound’.

The calculations are also in line with the recommendations of the joint Association of Noise Consultants / Institute of Acoustics ‘Guide to Demonstrating Compliance with the Noise Requirements of Approved Document O’, currently in consultation form.

Furthermore, the window opening sound insulation performance has been based on Equivalent Area, as per the latest research.

4.2.1. MODEL IMAGES



5. OVERHEATING STRATEGY

5.1. DEVELOPMENT OF STRATEGY

The primary purpose of the strategy has been to avoid excessive internal heat gains and reduce solar gain to enable a passive means of removing excess heat.

The internal heat gain reducing measures have comprised:

- Placing some kitchens internally rather than on the façade
- Removing all doors between kitchens and living rooms

The solar gain reducing measures have comprised:

- Reducing the size of the study room windows in the cottages
- Adopting low g-value glazing where required
- Adopting external blinds to some rooms
- Introducing mechanical ventilation where required
- Introducing mechanical cooling where the above passive measures have been exhausted

The mitigation outlined in UKO0110-R01-P01 has been adopted as a starting point. This comprised:

- Reduced g-value glazing to most ground floor rooms facing Worthing Road, in addition to Flat 05 (ground floor south-west corner flat) and Flat 15 (ground floor north-east corner flat)
- Reduced g-value glazing to Flat 22 (first floor south-west corner flat) and Flat 32 (first floor north-east corner flat)
- External blind to one window of Flat 05 Living / Kitchen and one window of Flat 15 Living / Kitchen
- Reduced g-value glazing to all cottage rooms
- Increased mechanical ventilation provision for all ground floor rooms
- Increased mechanical ventilation for all first-floor bedrooms facing Worthing Road (due to windows being closed at night)
- Increased mechanical ventilation for the living / kitchen and Bedroom 2 of all cottages
- Increased mechanical ventilation for the study rooms of cottages C1 and C2
- Mechanical cooling for Bedroom 1 of cottage C1 and C2
- Mechanical cooling for the study rooms of cottages C3 to C6

5.2. RESULTS

5.2.1. OVERHEATING

The window openings were amended following the assumptions in this report, and mitigation has been applied in the order of exploring all available passive means first (reducing g-value, then increasing mechanical ventilation up to a maximum practical limit for the room). Where any rooms still fail the TM59 requirements, mechanical cooling has been applied.

Additional mitigation measures have subsequently been needed, as follows:

Room	Previous g-value	New g-value	Previous mechanical ventilation	New mechanical ventilation	New mechanical cooling
05 Bed	0.63	0.42	20 l/s	30 l/s	None
06 Bed 2	0.63	0.42	20 l/s	40 l/s	None
07 Living / Kitchen	No change		37 l/s	65 l/s	None
07 Bed	No change		20 l/s	30 l/s	None
09 Living / Kitchen	0.63	0.42	No change		None
09 Bed 1	0.63	0.42	No change		None
09 Bed 2	0.63	0.42	20 l/s	40 l/s	None
16 Living / Kitchen	0.63	0.42	No change		None
22 Bed	No change		20 l/s	30 l/s	None
23 Bed 2	No change		20 l/s	40 l/s	None
24 Bed	No change		20 l/s	30 l/s	None
25 Bed	No change		20 l/s	30 l/s	None
26 Bed 1	No change		20 l/s	40 l/s	None
26 Bed 2	No change		20 l/s	40 l/s	None
36 Living / Kitchen	0.63	0.42	No change		None
C2 Living	No change		20 l/s	50 l/s	None
C2 Bed 2	No change		Mechanical cooling		20l/s @ 1kW
C4 Living	No change		20 l/s	50 l/s	None
C4 Bed 2	No change		20 l/s	40 l/s	None
C6 Living	No change		20 l/s	50 l/s	None
C6 Bed 2	No change		20 l/s	40 l/s	None

With the mitigation, the modelling produces the following results.

5.2.1.1. Homes Predominantly Mechanically Ventilated

Room	Room Type	Occupied Hours	Max. Hours	Result
05 Bed	Bedroom	8760	262	150
05 Kit/Liv	Living/Kitchen	4745	142	142
06 Bed 1	Bedroom	8760	262	199
06 Bed 2	Bedroom	8760	262	201
06 Kit/Liv	Living/Kitchen	4745	142	166
07 Bed	Bedroom	8760	262	139
07 Kit/Liv	Living/Kitchen	4745	142	160
08 Bed	Bedroom	8760	262	228
08 Liv/Kit	Living/Kitchen	4745	142	174
09 Bed 1	Bedroom	8760	262	139
09 Bed 2	Bedroom	8760	262	191
09 Kit/Liv	Living/Kitchen	4745	142	163
10 Bed	Bedroom	8760	262	112
10 Kit/Liv	Living/Kitchen	4745	142	92
11 Bed	Bedroom	8760	262	174
11 Kit/Liv	Living/Kitchen	4745	142	98
12 Bed	Bedroom	8760	262	119
12 Kit/Liv	Living/Kitchen	4745	142	93
12a Bed	Bedroom	8760	262	174
12a Kit/Liv	Living/Kitchen	4745	142	174

Table 2: Results for Homes Predominantly Mechanically Ventilated

5.2.1.2. Homes Predominantly Naturally Ventilated

Room	Room Type	Occupied Summer Hours	Max. Daytime Hours	Max. Night-time Hours	Criterion 1 (≤3%)	Criterion 2 (≤32)
01 Bed	Bedroom	3672	110	32	0.8	21
01 Kit/Liv	Living / Kitchen	1989	59	N/A	1.4	
02 Bed	Bedroom	3672	110	32	0.7	18
02 Kit/Liv	Living / Kitchen	1989	59	N/A	0.7	
03 Bed 1	Bedroom	3672	110	32	2.2	17
03 Bed 2	Bedroom	3672	110	32	2.1	23
03 Kit/Liv	Living / Kitchen	1989	59	N/A	1.5	
04 Bed 1	Bedroom	3672	110	32	0.8	23
04 Bed 2	Bedroom	3672	110	32	1.2	20
04 Kit/Liv	Living / Kitchen	1989	59	N/A	1.6	
14 Bed	Bedroom	3672	110	32	0.6	17
14 Kit/Liv	Living / Kitchen	1989	59	N/A	0.4	
15 Bed 1	Bedroom	3672	110	32	1	20
15 Bed 2	Bedroom	3672	110	32	1.4	20
15 Kit/Liv	Living / Kitchen	1989	59	N/A	1.8	
16 Bed 1	Bedroom	3672	110	32	0.8	20
16 Bed 2	Bedroom	3672	110	32	1	20
16 Kit/Liv	Living / Kitchen	1989	59	N/A	2	
17 Bed	Bedroom	3672	110	32	1	22
17 Kit/Liv	Living / Kitchen	1989	59	N/A	3	
18 Bed	Bedroom	3672	110	32	0.7	12
18 Kit/Liv	Living / Kitchen	1989	59	N/A	0.8	
19 Bed 1	Bedroom	3672	110	32	2	12
19 Bed 2	Bedroom	3672	110	32	1.2	12
19 Kit/Liv	Living / Kitchen	1989	59	N/A	0.9	
20 Bed 1	Bedroom	3672	110	32	0.7	12
20 Bed 2	Bedroom	3672	110	32	1	12
20 Kit/Liv	Living / Kitchen	1989	59	N/A	0.6	
21 Bed	Bedroom	3672	110	32	0.8	12
21 Kit/Liv	Living / Kitchen	1989	59	N/A	0.8	

Room	Room Type	Occupied Summer Hours	Max. Daytime Hours	Max. Night-time Hours	Criterion 1 (≤3%)	Criterion 2 (≤32)
22 Bed	Bedroom	3672	110	32	0.5	23
22 Kit/Liv	Living / Kitchen	1989	59	N/A	0.5	
23 Bed 1	Bedroom	3672	110	32	0.8	21
23 Bed 2	Bedroom	3672	110	32	1.1	19
23 Kit/Liv	Living / Kitchen	1989	59	N/A	1.1	
24 Bed	Bedroom	3672	110	32	1.1	25
24 Kit/Liv	Living / Kitchen	1989	59	N/A	1.4	
25 Bed	Bedroom	3672	110	32	1.2	27
25 Kit/Liv	Living / Kitchen	1989	59	N/A	2.7	
26 Bed 1	Bedroom	3672	110	32	0.9	19
26 Bed 2	Bedroom	3672	110	32	1	19
26 Kit/Liv	Living / Kitchen	1989	59	N/A	0.9	
27 Bed	Bedroom	3672	110	32	0.1	11
27 Kit/Liv	Living / Kitchen	1989	59	N/A	0	
28 Bed	Bedroom	3672	110	32	0.2	15
28 Kit/Liv	Living / Kitchen	1989	59	N/A	0	
29 Bed	Bedroom	3672	110	32	0.1	15
29 Kit/Liv	Living / Kitchen	1989	59	N/A	0	
30 Bed	Bedroom	3672	110	32	0.2	16
30 Kit/Liv	Living / Kitchen	1989	59	N/A	0	
31 Bed	Bedroom	3672	110	32	0.5	11
31 Kit/Liv	Living / Kitchen	1989	59	N/A	0.1	
32 Bed 1	Bedroom	3672	110	32	0.8	12
32 Bed 2	Bedroom	3672	110	32	0.8	8
32 Kit/Liv	Living / Kitchen	1989	59	N/A	1.3	
33 Bed 1	Bedroom	3672	110	32	0	0
33 Bed 2	Bedroom	3672	110	32	0	0
33 Kit/Liv/Dining	Living / Kitchen	1989	59	N/A	0	
34 Bed	Bedroom	3672	110	32	0	0
34 Kit/Liv	Living / Kitchen	1989	59	N/A	0	
35 Bed	Bedroom	3672	110	32	0.9	9

Room	Room Type	Occupied Summer Hours	Max. Daytime Hours	Max. Night-time Hours	Criterion 1 (≤3%)	Criterion 2 (≤32)
35 Bed 1	Bedroom	3672	110	32	1.7	28
35 Bed 2	Bedroom	3672	110	32	2.3	23
35 Kit/Liv	Living / Kitchen	1989	59	N/A	1.9	
36 Bed	Bedroom	3672	110	32	0.9	12
36 Kit/Liv	Living / Kitchen	1989	59	N/A	1.4	
37 Kit/Liv	Living / Kitchen	1989	59	N/A	1.2	
C1 Bed 1	Bedroom	3672	110	32	0.1	0
C1 Bed 2	Bedroom	3672	110	32	1.7	30
C1 Kitchen	Kitchen	1989	59	N/A	2.3	
C1 Liv/Din	Living / Dining	1989	59	N/A	2.5	
C1 Study	1 Bed Living	1989	59	N/A	1.4	
C2 Bed 1	Bedroom	3672	110	32	0.1	0
C2 Bed 2	Bedroom	3672	110	32	0	0
C2 Kitchen	Kitchen	1989	59	N/A	0.6	
C2 Liv/Din	Living / Dining	1989	59	N/A	0.3	
C2 Study	1 Bed Living	1989	59	N/A	1.3	
C3 Bed 1	Bedroom	3672	110	32	0.4	17
C3 Bed 2	Bedroom	3672	110	32	0.8	22
C3 Kitchen	Kitchen	1989	59	N/A	1.9	
C3 Liv/Din	Living / Dining	1989	59	N/A	2.3	
C3 Study	1 Bed Living	1989	59	N/A	0	
C4 Bed 1	Bedroom	3672	110	32	0.3	17
C4 Bed 2	Bedroom	3672	110	32	0.8	18
C4 Kitchen	Kitchen	1989	59	N/A	1.8	
C4 Liv/Din	Living / Dining	1989	59	N/A	1.7	
C4 Study	1 Bed Living	1989	59	N/A	0	
C5 Bed 1	Bedroom	3672	110	32	0.4	12
C5 Bed 2	Bedroom	3672	110	32	0.8	21
C5 Kitchen	Kitchen	1989	59	N/A	1.8	
C5 Liv/Din	Living / Dining	1989	59	N/A	2.3	
C5 Study	1 Bed Living	1989	59	N/A	0	

Room	Room Type	Occupied Summer Hours	Max. Daytime Hours	Max. Night-time Hours	Criterion 1 (≤3%)	Criterion 2 (≤32)
C6 Bed 1	Bedroom	3672	110	32	0.3	17
C6 Bed 2	Bedroom	3672	110	32	0.8	18
C6 Kitchen	Kitchen	1989	59	N/A	1.8	
C6 Liv/Din	Living / Dining	1989	59	N/A	1.7	
C6 Study	1 Bed Living	1989	59	N/A	0	
Guest Bed Room	Bedroom	3672	110	32	0.7	16

Table 3: Results for Homes Predominantly Naturally Ventilated

5.2.2. NOISE

The resultant assumptions with windows closed where noise affected living rooms means the façade sound insulation as outlined in the Peninsular Acoustics report would be provided (i.e. windows closed and acoustic trickle vents).

As demonstrated in the Peninsular Acoustics report, internal noise levels from road traffic would achieve 35 dB $L_{Aeq,16hr}$ with the proposed façade mitigation.

Where more ventilators are required to enable sufficient air flow for overheating, the cumulative value of the ventilators should meet the Peninsular Acoustics report specification, and each ventilator shall be increased in performance using the principle of +10 Log (N), where N = number of ventilators.

All air exchanges referenced relate to the movement of air out the referred space. Any ventilation system shall be designed to enable sufficient air movement without causing excessive pressure on the system and without creating turbulent noise from the movement of air between spaces.

Noise from mechanical systems should satisfy the advisory limits in Table 4.

Room	Parameter
Living Rooms	≤ $L_{Aeq,T}$ 35 (±5) dB
Bedrooms	≤ $L_{Aeq,T}$ 30 (±5) dB

Table 4: Noise limits from mechanical ventilation or mechanical cooling systems

6. CONCLUSIONS

UK Overheating produced an Approved Document O compliant overheating strategy for Churchill Living for the proposed retirement living accommodation on Roundstone Caravan Park, Worthing Road, Southwater RH13 9JF, as reported in UK Overheating report UKO0110-R01-P01.

Horsham District Council Environmental Health requested further modelling in relation to satisfying Planning Condition No. 8, which is as follows:

> *"No development above ground floor slab level of any part of the development hereby permitted shall take place until a revised Noise Assessment has been submitted, with details of appropriate ventilation, has been submitted to and approved by the Local Planning Authority in writing. The approved details hereby permitted shall be implemented prior to occupation and thereafter retained as such."*

Specifically, the additional modelling has been requested to demonstrate that the development can mitigate overheating via *appropriate ventilation* whilst at the same time provide reasonable internal noise levels during the daytime in Living/Kitchen rooms. From the correspondence with Horsham District Council Environmental Health, this modelling exercise has assumed that reasonable internal noise levels according to the Council comprise daytime Living/Kitchen Rooms to be ≤35 dB $L_{Aeq,16hr}$ during mitigation of summer overheating.

This has resulted in the simulations assuming:

- all ground floor living/kitchen windows are closed during the daytime and night-time;
- ground floor bedrooms windows of Flats 05 to 12a are closed during the daytime and night-time; and
- all upper floor living/kitchen windows being closed during the day and fully open to their maximum reach (limited for protection from falling by Approved Document O) during the night.

With this revised modelling, generally the ground floor living/kitchen rooms adequately mitigate overheating due to the previously proposed mechanical ventilation in combination with the prevention of daytime hot air entering the room (i.e. deviating from the requirement of Approved Document O).

The results have required additional mitigation to some rooms, mostly in the form of reduced g-value glazing or additional mechanical ventilation rates.

For one ground floor bedroom (Bedroom 2 of Cottage C2) this has necessitated replacing the previously proposed mechanical extract fan with a mechanical cooling unit.

Sizing of mechanical systems will need to be completed by a specialist to satisfy the air exchanges and cooling requirements to meet this strategy.

This report should not be used to demonstrate compliance with Approved Document O.

Appendix A

TECHNICAL TERMINOLOGY

Noise	Typically defined as unwanted, unpleasant or disturbing sound
Frequency (Hz)	The number of oscillations in acoustic pressure per second. It represents the 'tone' of the sound. Often determined in octave bands
Maximum sound pressure level (L_{Fmax})	The maximum or highest sound pressure level measured with a 'fast' time weighting
Equivalent continuous sound pressure level ($L_{eq,T}$)	The average of the total sound energy over a specified time period (T). L_{eq} represents the equivalent sound level that a fluctuating source would have compared to a steady source with the same total sound energy over a specific time period. Commonly used as a descriptor of human perception of sound over time.
'A' weighting	Frequency-dependent weighting based on the response of the human auditory system which has been found to correlate well with the subjective response to sound. Denoted by the use of the letter 'A'. For example, dBA denotes an 'A' weighted sound level in decibels, or L_{Amax} denotes an 'A' weighted maximum sound pressure level.
Internal Ambient Noise Level (IANL)	The noise level within a room or enclosed space. Usually determined as an equivalent continuous sound pressure level over a specific time period ($L_{Aeq,T}$, dB)
Noise Rating (NR) curve	A single figure term used to reflect the spectral frequency content of noise. Although originally proposed to assess environmental noise, NR curves are now typically used to describe noise from mechanical ventilation systems in buildings.
$L_{night,outside}$	The incident external A-weighted long-term average sound level as defined in ISO 1996-2: 1987, determined over all the night periods of a year, in which the night is eight hours between 23:00 and 07:00.
AVO	Acoustics, Ventilation, Overheating (e.g. AVO Guide, AVO Group).
Overheating Strategy Overheating Condition	The situation where measures are in place to mitigate overheating to meet agreed compliance criteria.
Dynamic thermal modelling	A technique that can be used to simulate internal temperatures in dwellings before they are built
Ventilative cooling	Cooling by means of introducing external ambient temperature air at a high ventilation rate. Can be either passive (no fans) or mechanical (with fans).
Purge ventilation	Ventilation to aid removal of high concentrations of pollutants and water vapour released from occasional activities such as painting and decorating or accidental releases such as smoke from burnt food or spillage of water.
Mechanical cooling	Cooling by means of a refrigerant cycle. This would include 'air conditioning' systems and the use of fan coil units (FCUs).
MEV	Mechanical extract ventilation.
"Free area" as used in AD-O	Approved Document O uses the term "Minimum free area" that is required to be achieved by the Equivalent area of the window openings. AD-O provides the accepted definition of Equivalent area for the description of "free area". The term "free area" is therefore avoided in this document to avoid further confusion.
Acoustic open area	The measurable, cross-sectional, geometric area of an opening. For a partially open window, this is considered to be the lesser of either the size of the hole in the window frame that is left by the opening light, or the combined cross-sectional area around the opening light through which air must pass to move from outside to inside. The area around a hinged opening light includes the triangular areas on the sides adjacent to the hinge, and the rectangular area on the side opposite the hinge. This should not be used for comparing the air-flow performance

	of elements because this will also be dependent on factors such as depth (length of air-path), surface roughness and tortuosity. Refer to reference 6 for further information.
Effective area, A_{eff}	Defined as the product of the free area and discharge coefficient, this is the preferred parameter for comparing the air-flow performance of elements.
Equivalent area, A_{eq} **a.k.a. EA**	The area of a sharp-edged, circular orifice that gives the same flow rate as the actual opening at a given pressure-difference. In other words, the free-area of a notional circular hole made in an infinitely thin, infinite extent baffle that gives the same air-flow performance as the real opening. Used to describe the area of trickle vents in Approved Document F. Not to be confused with Effective area.
Coefficient of Discharge, Cd	The ratio of the mass flow rate at the discharge end of the nozzle to that of an ideal nozzle which expands an identical working fluid from the same initial conditions to the same exit pressures.
$D_{n,e}$ / $D_{n,e,w}$	The laboratory tested sound insulation of small building elements, normalised to an equivalent absorption area of $10m^2$.
Façade level	The sound pressure level measured close to a building façade that includes contribution from both the incident sound and the sound reflected from the façade. Normally taken to be 3dB higher than the equivalent free-field level, when located at 1 metre from a façade.
Free-field level	A measured sound pressure level that is independent of any contributions due to reflections from nearby surfaces and is therefore representative of the direct path only.
R / R_w	The laboratory tested airborne sound insulation of a building element
Sound insulation	The capacity of a structure to prevent sound from reaching a receiving location. Sound energy is not necessarily absorbed; impedance mismatch, or reflection back toward the source, is often the principal mechanism

Appendix B

REPORT LIMITATIONS

This report has been prepared for the titled project or named part thereof and should not be used in whole or part and relied upon for any other project without the written authorisation of UK Overheating Limited. UK Overheating Limited accept no responsibility or liability for the consequences of this document if it is used for a purpose other than that for which it was commissioned. Persons wishing to use or rely upon this report for other purposes must seek written authority to do so from the owner of this report and/ or UK Overheating Limited and agree to indemnify UK Overheating Limited for any and all loss or damage resulting therefrom. UK Overheating Limited accepts no responsibility or liability for this document to any other party other than the person by whom it was commissioned.

The findings and opinions expressed are relevant to the dates of the site works and design drawings/specifications and should not be relied upon to represent conditions at substantially later dates. Opinions included therein are based on information gathered during the study and from our experience. If additional information becomes available which may affect our comments, conclusions or recommendations UK Overheating Limited reserve the right to review the information, reassess any new potential concerns and modify our opinions accordingly.



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