WE MAKE BUILDINGS WORK.
SUSTAINABLY.

CBG
CONSULTANTS

DENVILLE HALL

OVERHEATING REPORT

Prepared by: CBG CONSULTANTS LTD

OXFORD: South House, 3 Farmoor Court, Cumnor Road, OXFORD, OX2 9LU

Tel: 01865 864500

LONDON: 38 Warren Street, London, W1T 6AE

Tel: 02073 874 175

CAMBRIDGE: 50-60 Station Road, Cambridge, CB1 2JH

Tel: 01223 637746

MANCHESTER: 1 St Peters Square, Manchester, M2 3AE

Tel: 0161 5272805

info@cbgc.com

www.cbgc.com

COPYRIGHT & DISCLAIMERS

Version	Comments	Author	Checked	Approved	Date
1	First issue	LA	GK	GMW	09.09.2022
2	First issue for planning	LA	GK	CT	22.11.2022

CONTENTS

1. INTRODUCTION

This overheating report has been prepared by CBG Consultants on behalf of Denville Hall in support of its planning application to Hillingdon Borough Council. It is proposed to extend the existing facility with three new buildings with link structures. Twelve new assisted-living apartments are proposed alongside new communal facilities: a café and dining area, a cinema, a yoga studio and rehabilitation gym.

This report covers the Cooling and Overheating section of the Greater London Authority's Energy Assessment Guidance (June 2022). Overheating modelling was conducted during stage 2 for Building B. From this exercise several iterations and design improvements have been made to reduce the overheating risk, such as reducing glazing areas, adding external shading and fully opening windows. The results presented here are the conclusion of that work, and the same passive design improvements were applied to Buildings A and C.

All results are based on the output from dynamic computer modelling software and should be taken as an indication of the likely final situation. These conditions, however, cannot be guaranteed as they can be influenced by a variety of factors, including occupant lifestyle, where behaviour will not always conform to modelled assumptions.

2. COOLING HIERARCHY

London Plan policy SI 4 Managing Heating Risk requires proposals to demonstrate how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy.

2.1 Reducing the Amount of Heat Entering the Building

Overhangs on balconies, fixed and movable external shades, low fabric U-values and the surrounding trees will all contribute to reducing the amount of heat entering the building.

2.2 Minimising Internal Heat Generation

Internal heat generation has been minimised by having direct electric domestic hot water and VRF heating: there are no heat losses from distribution networks.

2.3 Use of Thermal Mass & High Ceilings

The proposed sustainable cross-laminated timber construction means there is very little thermal mass to dampen diurnal temperature variations.

2.4 Passive Ventilation

Sections 5 and 6 outlines the dynamic thermal modelling inputs and results for a natural ventilation scenario. Results show it is not possible to achieve compliance in all areas for Category 1 vulnerable occupants when using the London weather file.

2.5 Mechanical Ventilation

MVHR with in-built summer bypass function has been used in order to ventilate and provide good levels of fresh air, without the use of heat recovery in summer months. The bypass opens when the extract air temperature exceeds the outside temperature. By providing this facility, the heat exchanger is isolated and the risk of unnecessarily warming the incoming air is removed. However, without openable windows, the ventilation rates from domestic MVHR units are not enough – they are designed for background fresh air rates, not for maintaining comfortable temperatures in summer.

2.6 Active cooling systems

Natural ventilation can still be occupants' preferred method of managing overheating however, extensive thermal modelling has shown these methods cannot always be relied upon, and therefore cooling is also proposed. This also incorporates resilience to future climate conditions rather than expensive retrofitting measures.

Cooling (and heating) will be provided by Variable Refrigerant Flow (VRF) units. Building A will have one stand-alone external unit while Buildings B & C will have a shared external unit. Refer to the Energy Statement written by CBG Consultants for more information about the proposed system.

3. LONDON PLAN OVERHEATING RISK ANALYSIS

All developments are also required to undertake a detailed analysis of the risk of overheating as part of the planning application. For non-domestic developments the GLA requires applicants to:

- Undertake dynamic overheating modelling in line with the guidance and data sets in CIBSE TM52 and TM49 respectively
- Provide evidence of how the development performs against the overheating criteria along with an outline of the assumptions made in the energy assessment. This should include mitigation measures to reduce the risk of overheating during extreme weather years, through use of the CIBSE DSY2 and DSY3 weather files, and a strategy for occupants to deal with extreme overheating events.

As Part O Building Regulations also covers residential care homes, the extra care apartments have been assessed under the Approved Document O Dynamic Simulation Modelling methodology. This is essentially the same as the CIBSE TM59 methodology, but with some changes to the window opening profiles.

3.1 CIBSE TM49: Design Summer Years for London

CIBSE TM49 is a document that discusses the most appropriate weather files for London accounting for factors such as the urban heat island effect and future climate change. The London Heathrow weather file is the most appropriate location as it is suburban area, like the Denville Hall site.

With reference to CIBSE TM49, The London Plan specifies the weather files to be used for the dynamic overheating modelling:

> *Overheating modelling for both domestic and non-domestic developments should be conducted using the following design weather file:*
>
> - *DSY1 (Design Summer Year) for the 2020s, high emissions, 50% percentile scenario*
>
> *It is expected that the CIBSE compliance criteria are met for the DSY1 weather scenario.*
>
> *Additional testing should be undertaken using the 2020 versions of the following more extreme design weather years:*
>
> - *DSY2 – 2003: a year with a very intense single warm spell.*
> - *DSY3 – 1976: a year with a prolonged period of sustained warmth.*
>
> *It is acknowledged that meeting the CIBSE compliance criteria is challenging for the DSY 2 & 3 weather files. Where the CIBSE compliance criteria is not met for a particular weather file the applicant must demonstrate that the risk of overheating has been reduced as far as practical and that all passive measures have been explored, including reduced glazing and increased external shading. The applicant should also outline a strategy for residents to cope in extreme weather events, e.g. use of fans.*

3.2 CIBSE TM52: The Limits of Thermal Comfort

CIBSE TM52 *The Limits of Thermal Comfort* (2013) has been used as a guide for what is regarded as acceptable thermal conditions.

TM52 uses the "adaptive thermal comfort" approach to assess the risk of overheating. It is based on research which shows people adapt to the external temperature; throughout the year there is no single fixed temperature that most people feel comfortable at. Therefore, to assess whether a building is at risk of overheating, the upper limit of the indoor comfort temperature needs to be known for each day. The maximum comfort temperature (T_{max}) is calculated with consideration of the recent daily average outdoor temperatures.

CIBSE TM52 provides three criteria for defining the risk of overheating in buildings. Each criterion sets a target for what the indoor temperature—known as the operative temperature (T_{op})—should be compared to T_{max}. If a room or building fails to achieve any two of the following three criteria it is classed as overheating:

- Criterion 1 sets a limit on the number of hours the operative temperature can exceed the maximum comfort temperature:

  T_{op} should not exceed T_{max} by more than 1 degree for more than 3% of occupied hours during the months of May to September.

- Criterion 2 sets a daily limit on the length and severity the operative temperatures:

  T_{op} should not exceed T_{max} by more than 6 degree-hours.

  This means that, for example, T_{op} could exceed T_{max} by 1 degree for a maximum of 6 hours each day (i.e. 1 degree x 6 hours = 6 degree-hours), or by 2 degrees but only for 3 hours (i.e. 2 degrees x 3 hours = 6 degree-hours).

- Criterion 3 sets an absolute upper temperature limit:

  T_{op} should never exceed T_{max} by more than 4 degrees.

As this assessment is for a care home where occupants are more sensitive to heat, is has been assessed as a Category I buildings. This means the T_{max} is set at 1°C lower than typical new build assessments.

3.3 CIBSE TM59: Assessment of Overheating Risk in Homes

CIBSE TM59 outlines a specific methodology for how residential buildings, including care homes should be modelled. Unlike TM52, TM59 uses standardised heat gains, profiles and constraints for opening windows and doors. The compliance criteria are listed below:

CIBSE TM59: Criteria for homes predominately naturally ventilated

The following applies for naturally ventilated homes[1]:

> *(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. (CIBSE TM52 Criterion 1: Hours of exceedance).*
>
> *(b) For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10pm to 7am shall not exceed 26°C for more than 1% of annual hours.*

CIBSE TM59: Criteria for Homes Predominantly Mechanically Ventilated

> *For homes with restricted window openings, the CIBSE fixed temperature test must be followed, i.e. all occupied rooms should not exceed an operative temperature of 26°C for more than 3% of the annual occupied hours.*

While it is proposed that MVHR will be provided for background fresh air rates, the extra care homes will be predominantly naturally ventilated for the purposes of managing overheating risk.

CIBSE TM59 Criteria for Corridors

The overheating test for corridors should be based on the number of annual hours for which an operative temperature of 28°C is exceeded. Whilst there is no mandatory target, if an operative temperature of 28°C is exceeded for more than 3% of the total annual hours, this should be flagged as a significant risk within the report.

[1] CIBSE TM59: 2017, Section 4

4. THERMAL MODEL

Architectural drawings from Kalli Architecture and Design were used to create a 3D model of Building B for the overheating analysis. Several iterations and design improvements have been made to reduce the overheating risk, such as reducing glazing areas, adding external shading and fully opening windows. The results presented here are the conclusion of that work. The overheating risk assessment was completed before the energy modelling and further improvements to design have been implemented, therefore the image in Figure 1 shows design at the time of completing the overheating modelling.

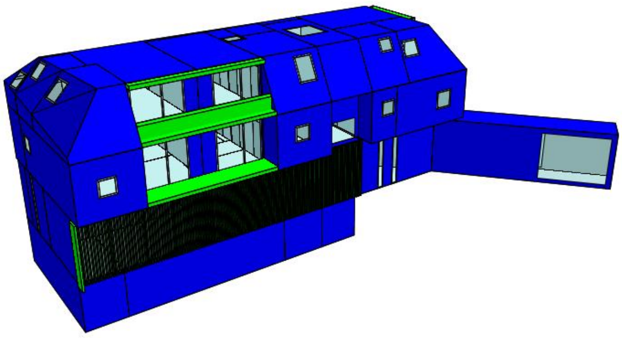

Figure 1: Overheating modelling of Building B in IES VE software.

4.1 Weather File

The London Heathrow weather file is the most appropriate location as it is suburban area, like the Denville Hall site. As per the London plan requirements, 3 weather files have been used for the analysis:

- London Heathrow DSY1 2020s 50% percentile scenario.
- London Heathrow DSY2 2020s 50% percentile scenario (very intense single warm spell).
- London Heathrow DSY3 2020s 50% percentile scenario (prolonged period sustained warmth).

4.2 Constructions

The table below shows the thermal properties of constructions applied to the model. However, since completing the overheating analysis, the U-values have been improved further as part of the work for the Energy Statement to reduce carbon emissions.

Element Type	U Value (W/m^{2}k)	G Value
Walls	0.15	
Floor	0.24	
Roof	0.13	
Glazing	1.40	0.4
Rooflights	1.60	0.4

Table 1: Building fabric U-Values applied to the overheating model.

4.2.1 Thermal Mass

A lightweight construction has been used for the overheating modelling with no exposed concrete soffits.

4.2.2 Air Leakage

An air leakage rate of 0.25 air changes per hour has been assumed.

4.3 Internal Gains

For the extra care apartments, internal gains from occupants, lighting and equipment are set by the CIBSE TM59 methodology. Whilst all homes will be occupied differently, these set profiles represent a robust test that ensures the key aspects of overheating are captured. The test is intended to ensure the dwellings will perform reasonably during the day and night. The table below shows their variation on a daily basis[2].

# people	Description	Peak load (W)		Period																							
		Sensible	Latent	00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24
				Hour-ending																							
				1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00	24.00
1	Single bedroom occupancy	75	55	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.7
2	Double bedroom occupancy	150	110	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.7
2	Studio occupancy	150	110	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1-bed: living/kitchen occupancy	75	55	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
1	1-bed: living occupancy	75	55	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
1	1-bed: kitchen occupancy	75	55	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0
2	2-bed: living/kitchen occupancy	150	110	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
2	2-bed: living occupancy	150	110	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
2	2-bed: kitchen occupancy	150	110	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0
3	3-bed: living/kitchen occupancy	225	165	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
3	3-bed: living occupancy	225	165	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
3	3-bed: kitchen occupancy	225	165	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0
	Single bedroom equipment	80		0.13	0.13	0.13	0.13	0.13	0.13	0.13	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.13
	Double bedroom equipment	80		0.13	0.13	0.13	0.13	0.13	0.13	0.13	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.13
	Studio equipment	450		0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	1	1	0.44	0.44	0.24	0.24
	Living/kitchen equipment	450		0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	1	1	0.44	0.44	0.24	0.24
	Living equipment	150		0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	1	1	1	1	0.4	0.4
	Kitchen equipment	300		0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	1	1	0.17	0.17	0.17	0.17
	Lighting profile]	2 (W/m2)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0

Table 2: CIBSE TM59 internal gains.

[2] CIBSE TM59 2017, Figure 1 Heat Gain Profile, Page 8.

For the non-residential areas, heat gains have been applied based on the expected usage of each space.

Room Name	Occupancy	Occupancy Sens. Gain (W/Person)	Occupancy Latent Gain (W/person)	Lighting Gain (W/m^2)	Equipment Gain (W/m^2)
0_Circulation	-	-	-	7.2	-
0_Connection Lobby	-	-	-	7.2	-
0_Entrance Stair	-	-	-	7.2	-
0_Fire Escape	-	-	-	7.2	-
0_Nurse Station	1	75	55	7.2	5.0
0_Physio Massage Room	2	140	125	7.2	-
0_Rehabilitation Gym	2	140	125	7.2	-
0_Void	-	-	-	7.2	-
0_Yoga Exercise Studio	10	140	125	7.2	-
B_Bar	-	-	-	7.2	-
B_Cinema	60	75	55	7.2	5.0
B_Circulation	-	-	-	7.2	-
B_Escape Route	-	-	-	7.2	-
B_Rest Room	3	75	55	7.2	-
B_Stair	-	-	-	7.2	-

4.4 Opening Windows

Openable windows on the first and second floor have been modelled as being top- or side-hung with a clear 300mm opening. Sliding doors on the ground, first and second floor have been modelled as 100% open. The tall thin window on the ground floor have been modelled as side-hung open to 100mm.

Windows have been modelled as open whenever the internal temperature exceeds 22°C during the day, as stated in Approved Document O. Windows on the first and second floor were also modelled as open during the night.

4.5 Ventilation & Cooling Strategy

The table below details the ventilation and cooling strategy for each type of space:

Room Name	Temperature Control Strategy	Nat Vent Free Area (% Floor Area)	Mech. Vent. Supply Rate (l/s)
0_Circulation	None	0.0	
0_Connection Lobby	None	0.0	
0_Entrance Stair	None	0.0	
0_Fire Escape	None	0.0	
0_Nurse Station	Mech. Vent.	4.7	10
0_Physio Massage Room	Mech. Vent.	35.1	20
0_Rehabilitation Gym	Mech. Vent.	1.2	20
0_Void	None	0.0	
0_Yoga Exercise Studio	Nat. Vent.	29.4	
B_Bar	None	0.0	
B_Cinema	Comfort Cooling	0.0	600
B_Circulation	None	0.0	
B_Escape Route	None	0.0	
B_Rest Room	Mech. Vent.	0.0	30
B_Stair	None	0.0	
01_Circulation	Nat. Vent.	1.055	
01_Flat 1 Bathroom	Dirty Extract	4.02	
01_Flat 1 Bedroom	Nat. Vent.	1.63	
01_Flat 1 Living Dining Kitchen	Nat. Vent.	7.15	
01_Flat 2 Bedroom	Nat. Vent.	1.27	
01_Flat 2 Living Dining Kitchen	Nat. Vent.	10.84	
01_Flat 2 Shower	Dirty Extract	0.00	
01_Flat 3 Bathroom	Dirty Extract	7.15	
01_Flat 3 Bedroom	Nat. Vent.	1.87	
01_Flat 3 Living Dining Kitchen	Nat. Vent.	9.83	
01_Stairs	Nat. Vent.	0.00	
02_Circulation	Nat. Vent.	2.69	
02_Flat 4 Bathroom	Dirty Extract	0.00	
02_Flat 4 Bedroom	Nat. Vent.	1.49	
02_Flat 4 Living Dining Kitchen	Nat. Vent.	5.89	
02_Flat 5 Bedroom	Nat. Vent.	1.62	
02_Flat 5 Living Dining Kitchen	Nat. Vent.	10.84	
02_Flat 5 Shower	Dirty Extract	8.00	
02_Flat 6 Bathroom	Dirty Extract	3.25	
02_Flat 6 Bedroom	Nat. Vent.	1.84	
02_Flat 6 Living Dining Kitchen	Nat. Vent.	8.51	
02_Stairs	Nat. Vent.	0.00	

Table 3: Ventilation & cooling strategy.

4.6 Distribution Heat Loss

For domestic developments, it is a requirement to account for heat gains from distribution equipment in the overheating modelling:

> *Communal heating systems: Heat losses from pipework and heat interface units (HIUs) should be included within the model for all community heating systems.*

At the time of completing the overheating modelling the type of the heating system was not certain, and therefore an allowance of 12 W/m of pipework was included in the model for distribution heat losses.

4.7 Blinds

In line with Approved Document O, internal blinds and curtains have not be taken into account when considering whether the CIBSE TM59 criteria has been met. External blinds are proposed on the full height glazing in the extra care apartments and these have been included in the model.

5. RESULTS

5.1 Design Summer Year (DSY) 1 Results

With the model constructed, a simulation was run using the "London Heathrow DSY1 2020s 50th percentile" weather file. During these dynamic simulations the room temperatures were calculated on an hourly basis for the whole year.

5.1.1 CIBSE TM52 Results

Room Name	Peak Temp (°C)	Time of Exceedance (%)	Daily Weighted Exceedance	Maximum ΔT (°C)	TM52 Outcome
0_Nurse Station	38.2	19	39	8	Fail
0_Physio Massage Room	36.1	10	19	7	Fail
0_Rehabilitation Gym	33.9	3	11	4	Pass
0_Yoga Exercise Studio	34.7	3	15	4	Pass
B_Cinema	23.8	0	0	0	Pass

Table 4: DSY1 CIBSE TM52 results for occupied areas.

5.1.2 CIBSE TM59 Results

Room Name	Peak Temp (°C)	Nat Vent: Living, Kitchen & Bedrooms TM59 Criterion 1 (% Occupied Hours)	Nat Vent: Bedrooms Operative Temperature (Hours @ Night > 26°C)	Corridors Operative Temp. (% Hours > 28°C)	Outcome
01_Circulation	34.7	-	-	2.9	Pass
01_Flat 1 Bedroom	34.5	3.1	7	-	Fail
01_Flat 1 Living Dining Kitchen	34.4	4.2	-	-	Fail
01_Flat 2 Bedroom	34.3	3.3	12	-	Fail
01_Flat 2 Living Dining Kitchen	34.7	4.8	-	-	Fail
01_Flat 3 Bedroom	34.1	2.2	6	-	Pass
01_Flat 3 Living Dining Kitchen	34.4	3.9	-	-	Fail
01_Stairs	34.0	-	-	3.3	Fail
02_Circulation	36.7	-	-	5.7	Fail
02_Flat 4 Bedroom	35.4	5.1	17	-	Fail
02_Flat 4 Living Dining Kitchen	34.8	5.7	-	-	Fail
02_Flat 5 Bedroom	35.7	5.3	14	-	Fail
02_Flat 5 Living Dining Kitchen	35.5	7.3	-	-	Fail
02_Flat 6 Bedroom	34.8	2.7	7	-	Pass
02_Flat 6 Living Dining Kitchen	34.8	4.8	-	-	Fail
02_Stairs	35.7	-	-	7.0	Fail

Table 5: DSY1 CIBSE TM59 results for occupied areas.

5.2 Design Summer Year (DSY) 2 Results

The results using the "London Heathrow DSY2 2020s 50th percentile" weather file are shown below:

5.2.1 CIBSE TM52 Results

Room Name	Peak Temp (°C)	Time of Exceedance (%)	Daily Weighted Exceedance	Maximum ΔT (°C)	TM52 Outcome
0_Nurse Station	40.3	19	62	10	Fail
0_Physio Massage Room	38.4	6	34	8	Fail
0_Rehabilitation Gym	36.4	3	24	6	Fail
0_Yoga Exercise Studio	37.5	4	30	7	Fail
B_Cinema	23.8	0	0	0	Pass

Table 6: DSY2 CIBSE TM52 results for occupied areas.

5.2.2 CIBSE TM59 Results

Room Name	Peak Temp (°C)	Nat Vent: Living, Kitchen & Bedrooms TM59 Criterion 1 (% Occupied Hours)	Nat Vent: Bedrooms Operative Temperature (Hours @ Night > 26°C)	Corridors Operative Temp. (% Hours > 28°C)	Outcome
01_Circulation	38.3	-	-	2.8	Pass
01_Flat 1 Bedroom	38.0	3.1	6	-	Fail
01_Flat 1 Living Dining Kitchen	38.0	5.2	-	-	Fail
01_Flat 2 Bedroom	37.4	3.4	10	-	Fail
01_Flat 2 Living Dining Kitchen	38.1	5.3	-	-	Fail
01_Flat 3 Bedroom	37.4	2.5	6	-	Pass
01_Flat 3 Living Dining Kitchen	37.9	4.7	-	-	Fail
01_Stairs	37.0	-	-	3.4	Fail
02_Circulation	39.8	-	-	4.9	Fail
02_Flat 4 Bedroom	38.5	5.2	13	-	Fail
02_Flat 4 Living Dining Kitchen	38.2	5.9	-	-	Fail
02_Flat 5 Bedroom	38.8	5.0	11	-	Fail
02_Flat 5 Living Dining Kitchen	38.5	6.9	-	-	Fail
02_Flat 6 Bedroom	37.9	3.1	6	-	Fail
02_Flat 6 Living Dining Kitchen	38.4	5.2	-	-	Fail
02_Stairs	38.5	-	-	6.3	Fail

Table 7: DSY2 CIBSE TM59 results for occupied areas.

5.3 Design Summer Year (DSY) 3 Results

The results using the "London Heathrow DSY3 2020s 50th percentile" weather file are shown below:

5.3.1 CIBSE TM52 Results

Room Name	Peak Temp (°C)	Time of Exceedance (%)	Daily Weighted Exceedance	Maximum ΔT (°C)	TM52 Outcome
0_Nurse Station	39.5	30	57	10	Fail
0_Physio Massage Room	36.5	11	35	8	Fail
0_Rehabilitation Gym	34.3	7	25	6	Fail
0_Yoga Exercise Studio	35.2	9	30	7	Fail
B_Cinema	23.7	0	0	0	Pass

Table 8: DSY3 CIBSE TM52 results for occupied areas.

5.3.2 CIBSE TM59 Results

Room Name	Peak Temp (°C)	Nat Vent: Living, Kitchen & Bedrooms TM59 Criterion 1 (% Occupied Hours)	Nat Vent: Bedrooms Operative Temperature (Hours @ Night > 26°C)	Corridors Operative Temp. (% Hours > 28°C)	Outcome
01_Circulation	36.5	-	-	4.0	Fail
01_Flat 1 Bedroom	36.1	5.0	9	-	Fail
01_Flat 1 Living Dining Kitchen	35.7	7.5	-	-	Fail
01_Flat 2 Bedroom	35.9	5.3	14	-	Fail
01_Flat 2 Living Dining Kitchen	36.0	7.7	-	-	Fail
01_Flat 3 Bedroom	35.3	4.2	8	-	Fail
01_Flat 3 Living Dining Kitchen	35.8	7.1	-	-	Fail
01_Stairs	36.1	-	-	4.8	Fail
02_Circulation	38.0	-	-	6.2	Fail
02_Flat 4 Bedroom	37.0	7.3	17	-	Fail
02_Flat 4 Living Dining Kitchen	36.4	8.5	-	-	Fail
02_Flat 5 Bedroom	37.2	7.1	15	-	Fail
02_Flat 5 Living Dining Kitchen	36.9	9.5	-	-	Fail
02_Flat 6 Bedroom	35.5	5.0	10	-	Fail
02_Flat 6 Living Dining Kitchen	36.0	8.1	-	-	Fail
02_Stairs	38.4	-	-	7.8	Fail

Table 9: DSY3 CIBSE TM59 results for occupied areas.

6. CONCLUSION

As mentioned in Section 4, compliance with the Design Summer Year 1 weather file is mandatory for occupied spaces. However, results show that most spaces fail to comply with the overheating criteria. Of the non-domestic spaces, the rehabilitation gym and yoga studio meet the TM52 criteria but only just, and do not comply under the DSY2 and DSY3 weather files. Of the spaces assessed under TM59 all but three spaces fail to meet the overheating criteria, with results being worse under DSY2 and DSY3.

These results are after multiple design improvements. Solar gains have been managed by reducing glazing areas and providing external shading from balcony surrounds, and a mixture of fixed and moveable external shading. Windows and balcony doors have been modelled as fully open to maximise natural ventilation air flow. This assessment therefore concludes that active cooling is required to maintain acceptable conditions for care home residents during peak summer conditions.

Although only Building B has been modelled, the results are conclusive and due to the similar designs in Building A and C, cooling will be required in all three buildings. However, the same passive design principles for reducing solar gains have also been applied to Buildings A and C to reduce cooling demand.

The results are not unexpected as the design has been assessed against the Category I (vulnerable occupants) overheating criteria which have more stringent targets. Cooling is required to maintain comfortable temperatures in peak summer conditions however natural ventilation from openable windows and doors can still be used as the primary method of managing overheating risk.

CBG
CONSULTANTS

OXFORD: South House, Farmoor Court, Cumnor Road, Oxford, OX2 9LU Tel: 01865 864500 Email: oxf@cbgc.com

LONDON: 38 Warren Street, London, W1T 6AE Tel: 02073 874 175 Email: lon@cbgc.com

www.cbgc.com