CIBSE TM59
OVERHEATING ANALYSIS

PROJECT:
Meadows Hall, Richmond

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P2197

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1.0 EXECUTIVE SUMMARY

QuinnRoss Energy has conducted a Chartered Institute of Building Services Engineers (CIBSE) Technical Memoranda (TM) 59 thermal comfort assessment of the design for Meadows Hall, Richmond, development to ensure the compliance requirements with respect to overheating are met.

Planning Policies: The following planning policies are applicable for overheating, ventilation, and general inhabitant comfort:

- National Design Guide, Policy H1, paragraph 125.
- London Plan 2021, Policy D3, Experience.
- London Plan 2021, Policy SI 4, Managing Heat Risk.
- Approved Document Part O, Overheating.

TM59: CIBSE's TM59 is a set of overheating criteria specifically aimed at residential spaces. It is also mandatory to perform the calculations using a Dynamic Simulation Modelling (DSM) software capable of running hourly simulations for a whole year using approved weather data.

Weather file: TM59 recommends the use of a CIBSE Design Summer Year (DSY) weather file. This analysis used the DSY1 for the year 2020 which is moderately warmer than average summer.

Internal gains: TM59 defines internal gains. To avoid any ambiguity. This data is outlined in this report and has been applied to the simulation software.

Opening windows: All living room/kitchen areas will have openable windows.

Mechanical ventilation: Mechanical supply ventilation was supplied.

Criteria for compliance: TM59 requires compliance by passing both of the following two criteria:

- (a) All living rooms, kitchens and bedrooms areas must have ΔT greater than or equal to one degree (K) during the period May to September (identical to TM52 criterion 01: 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 which is 33 hours.

Simulation software: The DSM software used is the Integrated Environmental Suite (IES) software Virtual Environment (VE) Version 2022.0.0.0. IES is one of the world leaders in developing DSM software and is used internationally for all manner of dynamic simulation calculations, including TM59, Part L2A and ASHRAE 90.1 calculations. The software was used to create a 3-D model based on information provided by the design team as defined in the following section. Hourly simulations for a year were run as part of the overheating thermal analysis using the relevant weather file for the location to produce the hourly results for assessment.

Results: The results show that, when using the inputs outlined in section 6.04, all applicable residential spaces studied comply with the TM59 criteria.

2.0 INTRODUCTION

QuinnRoss Energy has conducted a Chartered Institute of Building Services Engineers (CIBSE) Technical Memoranda (TM) 59 thermal comfort assessment of the design for Meadows Hall, Richmond, development to ensure the compliance requirements with respect to overheating are met.

Meadows Hall is a residential development located in Richmond, London. The development includes a new 4 storey block of 1 no. Support Accom, 7 no. apartments and a series of 5 no. duplex town houses at the rear.

The development is under the authority of the London Borough of Richmond upon Thames.

3.0 PLANNING POLICY

Several planning policies refer to overheating, which are outlined in this section.

3.01 National Design Guide, Policy H1

The National Design Guide, Policy H1, paragraph 125 states *"Well designed homes and buildings are efficient and cost effective to run. They help to reduce greenhouse gas emissions by incorporating features that encourage sustainable lifestyles. They have good ventilation, avoid overheating, minimise sound pollution and have good air quality, while providing comfort and personal control for their users."*

3.02 London Plan 2021, Policy D3

The London Plan 2021, Policy D3, Experience, states *"all development must achieve indoor and outdoor environments that are comfortable and inviting for people to use".*

3.03 London Plan 2021, Policy SI4

Policy SI4 seeks to reduce the impact of the urban heat island effect in London and encourages the design of places and spaces to avoid overheating and excessive heat generation, and to reduce overheating due to the impacts of climate change. All developments should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the cooling hierarchy, a visual representation of which is shown below:

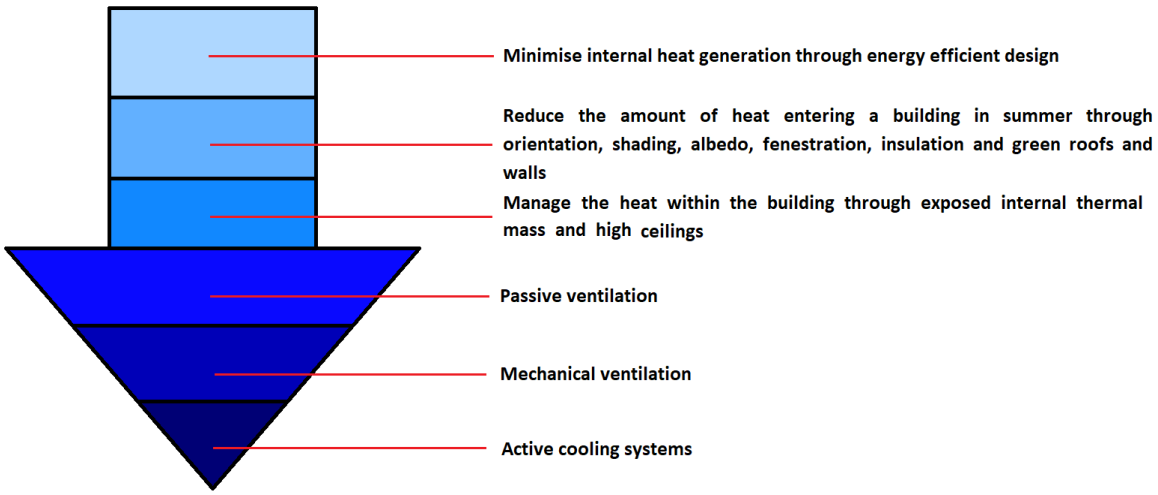

Figure 01: Cooling hierarchy

3.04 Approved Document Part O, Overheating

The Approved Document Part O states an aim *"to protect the health and welfare of occupants of the building by reducing the occurrence of high indoor temperatures."*

It also states that a dynamic thermal modelling tool must be used along with the guidance and targets as set out in the Chartered Institute of Building Services Engineers (CIBSE) Technical Memorandum (TM) 59.

4.0 CRITERIA FOR COMPLIANCE – TM59

4.01 Target Overheating Hours

As mentioned above, the overheating assessment will be undertaken using CIBSE's TM59 thermal comfort criteria and will assess all occupied areas of the development. An "occupied" area is defined as an internal space in the building that has occupants for more than 30 mins at any one time, in this case bedrooms and living room / kitchen / dining rooms. The assessment requires that all occupied spaces must pass as "free running" areas. "Free running" is defined by a space having no active cooling systems, such as air conditioning.

Consistent overheating in buildings affects health and well-being of occupants and their productivity. Assessing overheating and thermal comfort is required to ensure free-running buildings do not overheat and the need for comfort cooling is avoided. The TM59 criteria states that for predominantly mechanically ventilated spaces or spaces with limited window openings, which this building falls under, a room that fails the following criteria is classed as overheating:

TM59 requires compliance by passing both of the following two criteria:

- Criterion 01: All living rooms and kitchens areas must have ΔT greater than or equal to one degree (K) during the period May to September (identical to TM52 criterion 01: hours of exceedance).

- Criterion 02: 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 which will be 33 hours.

4.02 Internal Gains

Factors affecting overheating include occupancy patterns and internal gains, which are not under the control of the designers. TM59 does define internal gains specifically, to avoid any ambiguity. This data is outlined in this report and has been applied to the simulation software.

4.03 Cooling Hierarchy

The design team has adhered to the *London Plan's Cooling Hierarchy* approach to thermal comfort which sets out a six-level hierarchy of cooling designed to maximise passive measures to minimise the need for active cooling. The cooling hierarchy is set out below:

4.04 External Weather Data

Design Summer Year (DSY) weather files contain a whole year's weather variables for various locations throughout the UK designed for use in dynamic thermal simulation. The thermal model will be simulated using the London *LWC DSY1 2020High50.*

5.0 DYNAMIC SIMULATION MODELLING (DSM) SOFTWARE

The DSM software used is the Integrated Environmental Suite (IES) software Virtual Environment (VE) Version 2022.0.0.0. IES is one of the world leaders in developing DSM software and is used internationally for all manner of dynamic simulation calculations, including TM52, Part L2A and ASHRAE 90.1 calculations. The software was used to create a 3-D model based on information provided by the design team as defined in the following section. Hourly simulations for a year were run as part of the overheating thermal analysis using the relevant weather file for the location to produce the hourly results for assessment.

6.0 BUILDING INPUT DATA

The following section highlights the key inputs that were used to model the development.

6.01 Spaces analysed.

All applicable spaces were analysed.

6.02 Construction U-values

The following construction U-values were used within the overheating simulation which were derived from the development's SAP 10 calculations as used in the energy strategy:

Construction U-values W/m².K	
Ground/Exposed floor	0.10
External Wall	0.16
Roof	0.12

Table 01: Construction U-values

6.03 Glazing & Rooflight Parameters

The following glazing U-values were used within the overheating simulation which were derived from the development's SAP 10 calculations as used in the energy strategy:

Glazing Parameters	
Overall U-value (including frame)	1.20 W/m².K
g-value	0.55

Table 02: Glazing parameters

6.04 Window Openings

The thermal model's window dimensions are in line with architect's drawings.

With the architect's drawing in mind, the following opening profiles were assumed to gain full compliance with TM59 Regulations:

Figure 02: Glazing types (Mansion block, west elevation)

Figure 03: Glazing types (Mansion block, east elevation)

Figure 04: Glazing types (Mansion block (left) and Mews block (right), south elevation)

Figure 05: Glazing types (Mansion block (right) and Mews block (left), north elevation)

Figure 06: Glazing types (Mews block, west elevation)

Figure 07: Glazing types (Mews block, east elevation)

- Windows (blue area): These are assumed to have an opening/free area 60% of the glazed unit area, in line with a side hung window with a 60° opening angle.
- Doors (green area): These are assumed to be side hung fully openable doors, with a 90° opening angle.

6.05 Mechanical Ventilation

Mechanical ventilation heat recovery (MVHR) is installed. Their flow rates are stated in the table below.

6.06 Internal Gains

The following internal gains are applied to the spaces. As stated above, all gains and their hours of use are taken from CIBSE's TM59:

Internal Gains								
Room Group	Temp Set-Point (℃)		Occupancy	Lighting Gains (W/m2)	Miscelaneous Gains (W)		Mech Vent (l/s)	Infilteation (ach)
	Heating	Cooling			Sens	Latent		
Living / Kitchen	18.00	-	2 people	2.00	450	-	30.00	0.50
Bedroom	18.00	-	2 people	2.00	80	-	30.00	0.15
Bathroom / Ensuite	18.00	-	-	-	-	-	-	0.15
Circulation	18.00	-	-	-	-	-	-	0.15
Cupboard	-	-	-	-	-	-	-	0.15

Table 03: Internal gains

All occupancy gains are based on 75 W/person sensible and 55 W/person latent.

6.07 Air Conditioning

No air conditioning is scheduled to be installed.

7.0 RESULTS

Using the input data outlined above the DSM calculations were performed, and the following results were produced:

7.01 Criterion 01

Hours of Exceedence (He) - %Hrs Top-Tmax>=1K	
Zone	Target <3
Ground Mansion Block: Living Room	0
Ground Mansion Block: Communal Room	1.6
Ground Mews Block: Unit 1: Living Room	1.6
Ground Mews Block: Unit 6: Living Room	1.4
Ground Mews Block: Unit 3: Dining Room	1.5
Ground Mews Block: Unit 2: Dining Room	1.5
Ground Mews Block: Unit 2: Living Room	2.7
Third Mansion Block: Unit 4: Living Room	2.9
Ground Mews Block: Unit 5: Living Room	1.6
Ground Mews Block: Unit 4: Living Room	1.7
Ground Mews Block: Unit 3: Living Room	2.5
First Mansion Block: Unit 1: Living Room	2.7
First Mansion Block: Unit 2: Living Room	2.6
Second Mansion Block: Unit 1: Living Room	3
Second Mansion Block: Unit 2: Living Room	3
Third Mansion Block: Unit 3: Living Room	3

Table 04: TM59 Criterion 01 Results

The results above show that all living rooms do not exceed the number of hours that the operative temperature can exceed the threshold comfort temperature of 3 (in this case).

7.02 Criterion 02

Bedroom Overheating Hours - Target Hours < 33											
Zone	> 20°C	> 21°C	> 22°C	> 23°C	> 24°C	> 25°C	> 26°C	> 27°C	> 28°C	> 29°C	> 30°C
Ground Mansion Block: Bedroom	585	359	196	135	83	45	21	11	5	4	2
Ground Mansion Block: Support Staff Bedroom	693	414	234	159	100	63	31	13	8	4	4
First Mansion Block: Unit 1: Bedroom	543	306	170	114	74	36	19	11	4	4	2
First Mansion Block: Unit 2: Bedroom	558	326	176	122	76	39	19	11	5	4	2
First Mews Block: Unit 1: Bedroom	770	474	307	182	121	72	33	14	8	4	3
First Mews Block: Unit 2: Bedroom 1	730	444	267	167	111	67	33	13	7	4	3
First Mews Block: Unit 2: Bedroom 2	591	362	182	112	75	36	18	8	4	4	1
First Mews Block: Unit 3: Bedroom 1	728	445	269	167	111	67	33	13	7	4	3
First Mews Block: Unit 3: Bedroom 2	587	341	169	112	71	33	16	9	5	4	1
First Mews Block: Unit 6: Bedroom	735	448	269	169	109	68	33	14	7	4	3
Second Mansion Block: Unit 1: Bedroom	551	311	170	115	74	37	19	11	4	4	2
Second Mansion Block: Unit 2: Bedroom	557	324	175	121	75	38	19	11	5	4	2
Third Mansion Block: Unit 3: Bedroom	551	311	170	114	73	37	19	11	4	4	2
Third Mansion Block: Unit 4: Bedroom	554	322	174	122	74	38	19	11	5	4	2
First Mews Block: Unit 5: Bedroom	738	440	257	160	101	59	26	13	6	4	2
First Mews Block: Unit 4: Bedroom	739	440	257	160	101	59	26	13	6	4	2

Table 05: TM59 Criterion 02 Results

The results above show that all bedrooms will not exceed the comfort levels during sleeping hours as they do not exceed 26°C for more than 1% of annual hours (33 hours).

8.0 CONCLUSION

The analysis found the following conclusions:

Planning policy	How compliance is achieved
National Design Guide, Policy H1	Compliance with CIBSE TM59 shows the spaces will not overheat.
London Plan 2021, Policy D3	Compliance with CIBSE TM59 shows the spaces will be thermally comfortable.
London Plan 2021, Policy SI 4	The development has applied as much shading, high albedo materials, fenestration, insulation, and green infrastructure that is feasible on site. Internal gains will be very low, and all ceilings will be exposed concrete mass with only a finish for aesthetics. There are no proposals for air conditioning in any way.
Approved Document Part O	Compliance with CIBSE TM59 shows compliance with Part O.

Table 06: Compliance with planning policy conclusion

- The results show that all applicable residential spaces studied comply with the TM59 criteria considering the input data outlined in section 6.04 are implemented.

- This shows that the proposed design measures and ventilation arrangement outlined in this report are sufficient so that the occupants will not experience any discomfort during the summer months.

- Considering the development has shown it can comply with the overheating criteria and has followed the cooling hierarchy to the best of its ability it can be deemed compliant with the London Plan 2021 criteria.