CIBSE TM52
OVERHEATING ANALYSIS

PROJECT:
154 Shaftesbury Avenue, London

PROJECT NUMBER:
P3077

DOCUMENT REF:
P3077-TM52-R03

Revision	Date	Details	Authored	Checked
R1	14.02.2025	Issued for comment	W. Liu	C. Armstrong
R2	26.02.2025	Issued for comment	W. Liu	C. Armstrong
R3	05.03.2025	Issued for comment	W. Liu	C. Armstrong

KENT (HQ)
Unit 3 Grove Dairy Farm Business Centre I Bobbing Hill I Bobbing I Sittingbourne I Kent I ME9 8NY

LONDON
One Bridge Wharf I 56 Caledonian Road I London I N1 9UU

CONTENTS

1.0 EXECUTIVE SUMMARY

QuinnRoss Energy has carried out a Chartered Institute of Building Services Engineers (CIBSE) Technical Memoranda (TM) 52 thermal comfort assessment of the design for the basement & ground floor of the 154 Shaftesbury Avenue, Camden, to ensure the compliance requirements with respect to overheating are met and advise accordingly if not.

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 SI 4, Managing Heat Risk.
- Camden Local Plan (2017) Policy CC2, Adapting to Climate Change, Parts D and E.
- Approved Document Part O, Overheating.

TM52: As mentioned above, the overheating assessment will be undertaken using CIBSE's TM52 thermal comfort criteria and will assess the "occupied" areas of the building only. An "occupied" area is defined as an internal space in the building that has occupants for more than 30 mins at any one time. The assessment will be conducted with internal conditions that have been presented within section 5.0 of this report. 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 thermal comfort criteria for the assessment are defined in CIBSE's TM52. This criteria states that a room or building that fails any two of the following three criteria is classed as overheating:

- Criterion 1 - "The first criterion sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature (upper limit of the range of comfort temperature) by 1 K or more during the occupied hours of a typical non-heating season (1 May to 30 September)."
- Criterion 2 - "The second criterion deals with the severity of overheating within any one day, which can be as important as its frequency, the level of which is a function of both temperatures rise and its duration. This criterion sets a daily limit for acceptability."
- Criterion 3 - "The third criterion sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable."

Weather file: TM52 does not recommend specific weather data, other than to use an "appropriate" weather file. The most commonly used weather data to use for such analyses is CIBSE's Design Summer Year (DSY) weather files. The model will be simulated using the London LWC 01 for the predicted year 2020, high 50th percentile.

Internal gains: TM52 does not define internal gains specifically, therefore, to avoid any ambiguity, the estimated design input data is outlined in this report and has been applied to the dynamic model.

Natural Ventilation using existing louver openings: In line with the cooling hierarchy the spaces will be initially run under a natural ventilation scenario. All louvres have around 70° openings.

Mechanical ventilation: Any spaces that do not comply under the natural ventilation scenario will be simulated using mechanical ventilation at a rate of 10 l/s/person.

Air conditioning: Any spaces that do not comply under a mechanical ventilation will have air conditioning applied to the space.

Simulation software: The DSM software used is the Integrated Environmental Suite (IES) software Virtual Environment (VE) Version 2024.5.2.0. 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.

Results: The simulations produced the following results:

Zone	Criteria 1 (%Hrs Top-Tmax>=1K)			Criteria 2 (Max. Daily Deg.Hrs)			Criteria 3 (Max. DeltaT)		
	Nat vent	Mech Vent	Air Con	Nat vent	Mech Vent	Air Con	Nat vent	Mech Vent	Air Con
Basement: Eating/Drinking 01	14	6	0	19	13	0	3	3	0
Basement: Eating/Drinking 02	11	5	0	18	11	0	3	2	0
Basement: Eating/Drinking 03	11	5	0	18	11	0	3	3	0
Ground: Individual space	10	7	0	17	13	0	4	3	0
Ground: Eating/Drinking 01	15	12	0	22	19	0	6	5	0
Ground: Eating/Drinking 02	15	12	0	23	19	0	6	5	0
Ground: Eating/Drinking 03	16	14	0	24	21	0	7	6	0
Ground: Eating/Drinking 04	15	12	0	22	20	0	6	6	0
Ground: Eating/Drinking 05	18	15	0	29	26	0	9	8	0
Ground: Eating/Drinking 06	16	14	0	25	23	0	7	7	0

Table 01: Results summary

Conclusion: As the results above show, compliance is not achieved under a natural and/or a mechanical ventilation scenario. As per the cooling hierarchy there is no alternative other than to install air conditioning if thermally comfortable levels are to be maintained.

2.0 INTRODUCTION

QuinnRoss Energy has carried out a Chartered Institute of Building Services Engineers (CIBSE) Technical Memoranda (TM) 52 thermal comfort assessment for the refurbishment works at basement & ground floor of 154 Shaftesbury Avenue, Camden, development to ensure the compliance requirements with respect to overheating are met.

Both basement and ground floor of 154 Shaftesbury Avenue are commercial spaces located in Camden. The site is currently restaurant at basement and ground, and office/ residential on the upper floors.

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 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:

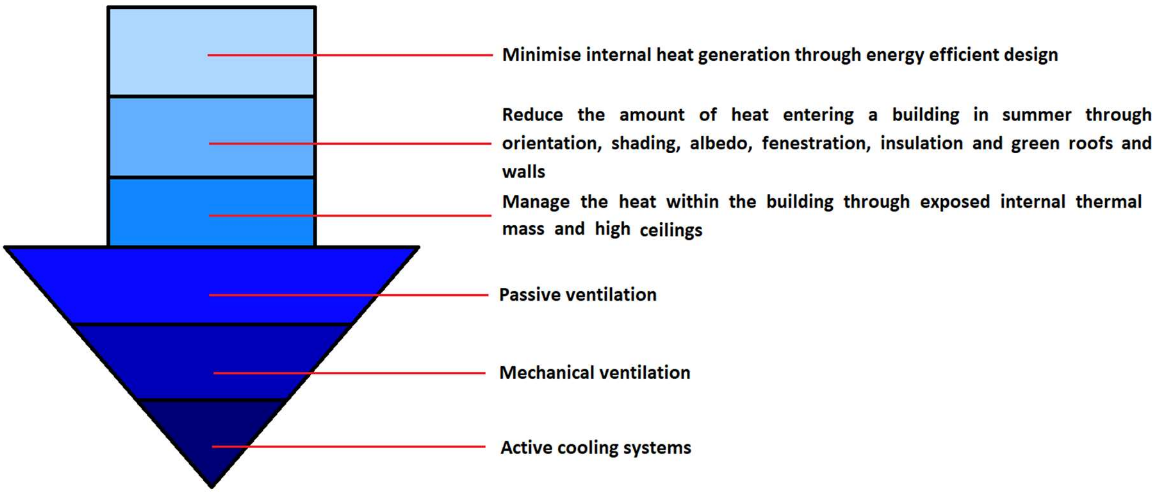

Figure 01: Cooling hierarchy

3.03 Camden Local Plan (2017) Policy CC2, Adapting to Climate Change, Parts D and E

Policy CC2 Adapting to Climate Change in the Camden Local Plan (2017) states that all development should adopt appropriate climate change adaptation measures such as:

- D. Measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.
- E. Ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation.

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) 52.

4.0 CRITERIA FOR COMPLIANCE

4.01 Target Overheating Hours

As mentioned above, the overheating assessment will be undertaken using CIBSE's TM52 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 restaurant spaces. 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 TM52 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:

TM52 requires compliance by passing the following criteria:

- (a) All areas must have ΔT greater than or equal to one degree (K) during the period May to September.
- (b) Spaces must allow for the severity of overheating the weighted exceedance (W_e) shall be less than or equal to 6 in any one day.
- (c) To sets an absolute maximum value for the indoor operative temperature the value of ΔT shall not exceed 4K.

5.0 DYNAMIC SIMULATION MODELLING (DSM) SOFTWARE

The DSM software used is the Integrated Environmental Suite (IES) software Virtual Environment (VE) Version 2024.5.2. 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 building.

6.01 Drawings

The 3D model of the building used was created using the drawings from Workman Design delivered to Quinn Ross Consultants in February 2025. Figure 2 below shows the 3D geometry of the development:

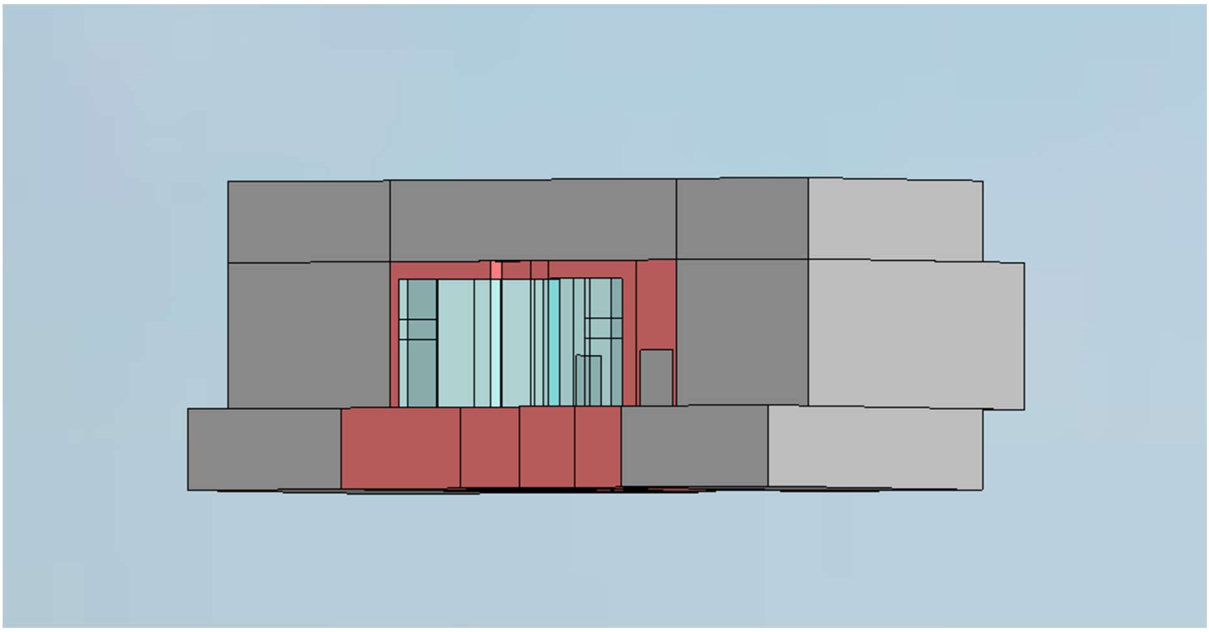

Figure 02: 3D model images as modelled in IES

6.02 Construction U-values

Construction U-values W/m².K	
External Wall	1.54
Roof	1.42
Exposed Floor	0.77

Table 02: Construction U-values

6.03 Glazing Parameters

The following glazing U-values were used within the overheating simulation:

Glazing Parameters	
Overall U-value (including frame)	5.50 W/m².K
g-value	0.60

Table 03: Glazing & rooflight parameters

6.04 Existing Louver Openings

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

Figure 03: Opening Types

The existing side louvers are set to be openable (in red); all other areas are permanently shut. These are assumed to have an opening/free area 70% of the unit area.

Please note basement floor does not have window/louver openings.

6.05 Mechanical Ventilation

It is assumed mechanical ventilation in the eating/ drinking spaces will operate at 10 l/s/person of external air.

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 TM52:

Overheating Analysis Input Data								
Room Group	Temp Set-Point (°C)		Occupancy	Lighting Gains	Miscelaneous		Mech	Infiltration
	Heating	Cooling		W/m²	Sens	Latent	Vent	ach
Restaurant	18.00	23.00	3 m²/person	20.00	5.00	-	10.00	0.50
WC's	18.00	-	-	-	-	-	-	0.50
Circulation	18.00	-	-	-	-	-	-	0.50
Adjacent - Conditioned	18.00	-	-	-	-	-	-	0.50

Table 04: Internal gains

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

6.07 Air Conditioning

The final simulation will include air conditioning to check that compliance is met using internal temperatures from section 6.06 (above).

7.0 WEATHER FILES

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.*

8.0 RESULTS

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

Results: Under a Natural Ventilation Scenario.

CIBSE TM52 - London LWC					
Zone	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Deg.Hrs)	Criteria 3 (Max. DeltaT)	Criteria Failing	Results
Basement: Eating/Drinking 01	14.3	19	3	1 & 2	FAIL
Basement: Eating/Drinking 02	10.8	18	3	1 & 2	FAIL
Basement: Eating/Drinking 03	11	18	3	1 & 2	FAIL
Ground: Individual space	9.5	17	4	1 & 2	FAIL
Ground: Eating/Drinking 01	15.0	22	6	1 & 2 & 3	FAIL
Ground: Eating/Drinking 02	15.2	23	6	1 & 2 & 3	FAIL
Ground: Eating/Drinking 03	16.3	24	7	1 & 2 & 3	FAIL
Ground: Eating/Drinking 04	15.3	22	6	1 & 2 & 3	FAIL
Ground: Eating/Drinking 05	17.8	29	9	1 & 2 & 3	FAIL
Ground: Eating/Drinking 06	15.7	25	7	1 & 2 & 3	FAIL

Table 05: Natural ventilation results summary

Results: Under a Mechanical Ventilation Scenario.

CIBSE TM52 - London LWC					
Zone	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Deg.Hrs)	Criteria 3 (Max. DeltaT)	Criteria Failing	Results
Basement: Eating/Drinking 01	5.8	13	3	1 & 2	FAIL
Basement: Eating/Drinking 02	5	11	2	1 & 2	FAIL
Basement: Eating/Drinking 03	5	11	3	1 & 2	FAIL
Ground: Individual space	6.7	13	3	1 & 2	FAIL
Ground: Eating/Drinking 01	11.5	19	5	1 & 2 & 3	FAIL
Ground: Eating/Drinking 02	11.8	19	5	1 & 2 & 3	FAIL
Ground: Eating/Drinking 03	13.9	21	6	1 & 2 & 3	FAIL
Ground: Eating/Drinking 04	12.4	20	6	1 & 2 & 3	FAIL
Ground: Eating/Drinking 05	15.1	26	8	1 & 2 & 3	FAIL
Ground: Eating/Drinking 06	13.5	23	7	1 & 2 & 3	FAIL

Table 06: Mechanical ventilation results summary

Results: Under an Air Conditioning Scenario.

CIBSE TM52 - London LWC					
Zone	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Deg.Hrs)	Criteria 3 (Max. DeltaT)	Criteria Failing	Results
Basement: Eating/Drinking 01	0	0	0	-	PASS
Basement: Eating/Drinking 02	0	0	0	-	PASS
Basement: Eating/Drinking 03	0	0	0	-	PASS
Ground: Individual space	0	0	0	-	PASS
Ground: Eating/Drinking 01	0	0	0	-	PASS
Ground: Eating/Drinking 02	0	0	0	-	PASS
Ground: Eating/Drinking 03	0	0	0	-	PASS
Ground: Eating/Drinking 04	0	0	0	-	PASS
Ground: Eating/Drinking 05	0	0	0	-	PASS
Ground: Eating/Drinking 06	0	0	0	-	PASS

Table 07: Air Conditioning ventilation results summary

9.0 CONCLUSION

The analysis found the following conclusions:

Planning policy	Has compliance been achieved
National Design Guide, Policy H1	The initial results show the spaces will overheat using a natural or mechanical strategy. This is solved by implementing an air-conditioning system.
London Plan 2021, Policy SI 4	The spaces are not compliant initially with the overheating criteria using natural or mechanical ventilation. This is solved by implementing an air-conditioning system.
Camden Local Plan (2017) Policy CC2, Adapting to Climate Change, Parts D and E	The preliminary results show the spaces will overheat with a natural or mechanical strategy. This is resolved by further following the cooling hierarchy and implementing an air-conditioning system that utilises the most efficient units.
Approved Document Part O	Non-compliance with CIBSE TM52 also shows non-compliance with Part O under natural or mechanical. This is solved by implementing an air-conditioning system.

Table 09: Compliance with planning policy conclusion

- The results show that the restaurant eating and drinking space does comply with the TM52 criteria taking into account the input data outlined in section 6.04 and under a natural and mechanical ventilation scenario.

- The cooling hierarchy has been followed, and it can be concluded that the development cannot maintain comfortable working conditions for its inhabitants under a natural or mechanical ventilation scenario. Air conditioning is the only alternative to ensure thermal comfort is achieved.