CIBSE TM52

OVERHEATING ANALYSIS

PROJECT:

27 Goodge Street

PROJECT NUMBER:

P2283

DOCUMENT REF:

P2283-TM52-R01

Revision	Date	Details	Authored	Checked
R1	11.01.2023	Issued for comment	W. Liu	C. Armstrong
R2	27/01/2023	Revised after feedback	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 conducted a Chartered Institute of Building Services Engineers (CIBSE) Technical Memoranda (TM) 52 thermal comfort assessment of the design for 27 Goodge Street, to ensure the compliance requirements with respect to overheating are met.

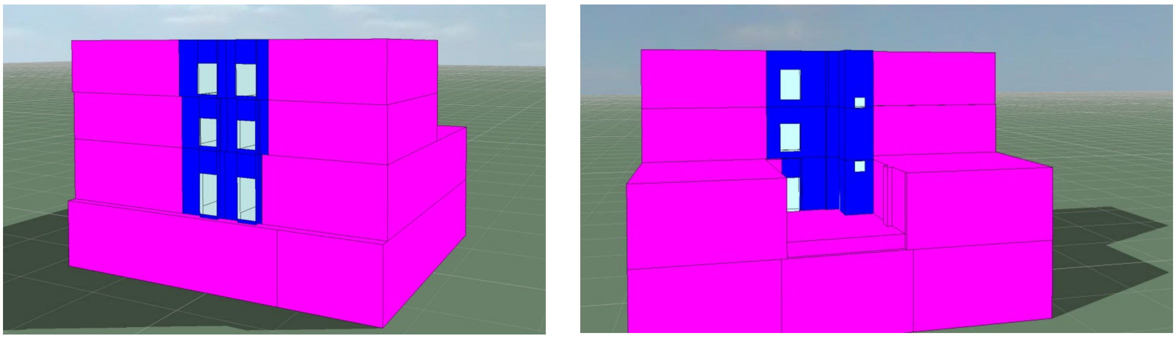

Figure 01: Front and rear model image as modelled in IES

TM52: CIBSE's TM52 is a set of overheating criteria aimed at any types of building. 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: TM52 recommends the use of a CIBSE Design Summer Year (DSY) weather file for the year 2020 50th percentile.

Internal gains: Factors affecting overheating include occupancy patterns and internal gains, which are not under the control of the designers. TM52 does not define internal gains specifically, however CIBSE Guide A, 2019 provides typical internal gains for some common buildings and uses. This data has been applied to this building for this study to avoid any ambiguity. This data is outlined in this report and has been applied to the simulation software.

Ventilation Strategy: The simulation will be calculated using a completely natural ventilation scenario, using opening windows, and a mechanical ventilation scenario using air supplied mechanically at external temperatures.

Criteria for compliance: TM52 requires compliance by passing all of the following three criteria:

- (a) All occupied 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) shall not be more than 3% of occupied hours. For data not applicable for the whole period than 3% of available hours should be used.
- (b) The severity of overheating within any one day must be less than or at least 6, which can be as important as its frequency, the level of which is a function of both temperatures rise and its duration.
- (c) An absolute maximum value for the indoor operative temperature the value of ΔT shall not exceed 4K.

Simulation software: The DSM software used is the Integrated Environmental Suite (IES) software Virtual Environment (VE) Version 2022.2.0.0. 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.

Results: The results show that all occupied spaces within the development do not comply with the TM52 criteria. This shows that natural ventilation or mechanical ventilation strategies are not sufficient to maintain inhabitant comfort during the summer months. Mechanical cooled system will have to be considered.

Zone Name	Criteria 1 (%Hrs Top-Tmax>=1K) Target <3	Criteria 2 (Max. Daily Deg.Hrs) Target <6	Criteria 3 (Max. DeltaT) Target <4	Criteria Failing	Overall Complaince
Level 1 - Office 01	5.1	11.0	3.0	1 & 2	FAIL
Level 1 - Office 02	5.2	12.0	4.0	1 & 2	FAIL
Level 1 - Office 03	6.7	13.0	4.0	1 & 2	FAIL
Level 2 - Office 01	8.4	16.0	5.0	1 & 2 & 3	FAIL
Level 2 - Office 02	7.3	14.0	4.0	1 & 2	FAIL
Level 3 - Office 01	5.8	12.0	4.0	1 & 2	FAIL
Level 3 - Office 02	7.3	16.0	4.0	1 & 2	FAIL
Level 3 - Office 03	8.4	18.0	4.0	1 & 2	FAIL
Level 2 - Office 03	11.1	19.0	5.0	1 & 2 & 3	FAIL

Table 01: Nature Ventilation TM52 Results

Zone Name	Criteria 1 (%Hrs Top-Tmax>=1K) Target <3	Criteria 2 (Max. Daily Deg.Hrs) Target <6	Criteria 3 (Max. DeltaT) Target <4	Criteria Failing	Results
Level 1 - Office 01	4.7	11.0	3.0	1 & 2	FAIL
Level 1 - Office 02	4.9	11.0	3.0	1 & 2	FAIL
Level 1 - Office 03	5.9	12.0	4.0	1 & 2	FAIL
Level 2 - Office 01	7.5	14.0	4.0	1 & 2	FAIL
Level 2 - Office 02	6.5	14.0	4.0	1 & 2	FAIL
Level 3 - Office 01	5.4	12.0	4.0	1 & 2	FAIL
Level 3 - Office 02	6.7	13.0	4.0	1 & 2	FAIL
Level 3 - Office 03	7.7	17.0	4.0	1 & 2	FAIL
Level 2 - Office 03	9.6	18.0	5.0	1 & 2 & 3	FAIL

Table 02: Mechanical Ventilation TM52 Results

- The results show that all areas do not comply with the TM52 criteria using a natural ventilation or mechanical ventilation scenario. Therefore, the internal spaces will not be maintained at a comfortable level for the inhabitants when using passive or mechanical measures.
- Air conditioning or comfort cooling will be required.

2.0 INTRODUCTION

QuinnRoss Energy has carried out a Chartered Institute of Building Services Engineers (CIBSE) Technical Memoranda (TM) 52 thermal comfort assessment of the design for 27 Goodge Street, to ensure the compliance requirements with respect to overheating are met.

27 Goodge Street is a commercial use development located in the London Borough of Camden (LBC). The site consists of three floors of commercial units from 1st to 3rd floor.

3.0 PLANNING REQUIREMENTS

LBC only accepts mechanically cooled system where it is shown a natural or mechanical ventilation scenario cannot maintain internal comfort. Prior to the commencement of any works on site, Condition 8.41 of the Local Planning requires an overheating assessment to be completed to mitigate the risk of overheating.

Condition 8.41 states:

> *"All new developments will be expected to submit a statement demonstrating how the London Plan's 'cooling hierarchy' has informed the building design. Any development that is likely to be at risk of overheating (for example due to large expanses of south or south west facing glazing) will be required to complete dynamic thermal modelling to demonstrate that any risk of overheating has been mitigated."*

4.0 PLANNING POLICY

4.01 London Plan 2021

The London Plan 2021 outlines a number of policies to underpin London's response to climate change. These policies cover adaptation, waste, aggregates, contaminated land, hazardous substances and most applicable to this development climate change mitigation. The key policies within the London Plan relating to overheating is policy SI4 Managing heat risk.

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 (outlined below).

4.02 Camden Local Plan 2017

The Camden Local Plan, policy CC2, states that developments must reduce the risk of overheating in accordance with the cooling hierarchy, which is very similar to the London Plan's hierarchy as outlined below.

5.0 CRITERIA FOR COMPLIANCE

5.01 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 office areas. 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 both of the following three criteria:

- Criterion 01: All occupied 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) shall not be more than 3% of occupied hours. For data not applicable for the whole period than 3% of available hours should be used.
- Criterion 02: The severity of overheating within any one day must be less than or at least 6, which can be as important as its frequency, the level of which is a function of both temperatures rise and its duration.
- Criterion 03: An absolute maximum value for the indoor operative temperature the value of ΔT shall not exceed 4K.

5.02 Internal Gains

Factors affecting overheating include occupancy patterns and internal gains, which are not under the control of the designers. TM52 does not define internal gains specifically, however CIBSE Guide A, 2019 provides typical internal gains for some common buildings and uses. This data has been applied to this building for this study to avoid any ambiguity. This data is outlined in this report and has been applied to the simulation software.

5.03 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 *LHR DSY1 2020High50*.

6.0 DYNAMIC SIMULATION MODELLING (DSM) SOFTWARE

The DSM software used is the Integrated Environmental Suite (IES) software Virtual Environment (VE) Version 2022.2.0.0. 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.

7.0 BUILDING INPUT DATA

The following section highlights the key inputs that were used to model the development. The images below show the 3D geometry of the development:

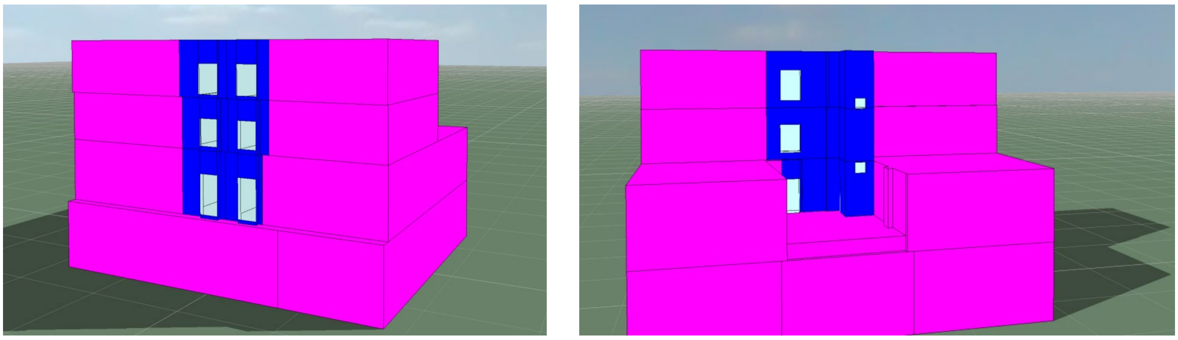

Figure 01: 3D model image as modelled in IES

7.01 Construction U-values

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

Construction U-values W/m².K	
External Wall (Existing)	0.28
Roof (Existing)	0.18

Table 03: Construction U-values

7.02 Glazing & Rooflight Parameters

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

Glazing Parameters	
Overall U-value (including frame)	1.40 W/m².K
g-value	0.40

Table 04: Rooflight & glazing parameters

7.03 Window Openings – For Natural Ventilation Scenario

The thermal models window dimensions are in line with *Fresson and Tee Building Consultancy* drawing A-501-T1. The windows are clearly sliding sash windows and will use the following assumed opening / free area:

- Front elevation sash windows must open 50%
- Rear elevation sash windows must open 50%

7.04 Supply Ventilation – For Mechanical Ventilation Scenario

For this scenario, all office areas will be equipped with mechanical ventilation system supplying external air at 10 l/s/person.

7.05 Internal Gains

The following internal gains are applied to the spaces:

Internal Gains							
Room Group	Temp Set-Point (°C)		Occupancy	Lighting Gains W/m²	Miscelaneous Gains W/m²		Infiltration ach
	Heating	Cooling			Sens	Latent	
Office	18.00	-	10 m²/pers	10.0	25	-	0.15
Bathroom	18.00	-	-	-	-	-	-
Staircase	-	-	-	-	-	-	-

Table 05: Internal gains

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

8.0 RESULTS

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

8.01 Natural Ventilation

Zone Name	Criteria 1 (%Hrs Top-Tmax>=1K) Target <3	Criteria 2 (Max. Daily Deg.Hrs) Target <6	Criteria 3 (Max. DeltaT) Target <4	Criteria Failing	Overall Complaince
Level 1 - Office 01	5.1	11.0	3.0	1 & 2	**FAIL**
Level 1 - Office 02	5.2	12.0	4.0	1 & 2	**FAIL**
Level 1 - Office 03	6.7	13.0	4.0	1 & 2	**FAIL**
Level 2 - Office 01	8.4	16.0	5.0	1 & 2 & 3	**FAIL**
Level 2 - Office 02	7.3	14.0	4.0	1 & 2	**FAIL**
Level 3 - Office 01	5.8	12.0	4.0	1 & 2	**FAIL**
Level 3 - Office 02	7.3	16.0	4.0	1 & 2	**FAIL**
Level 3 - Office 03	8.4	18.0	4.0	1 & 2	**FAIL**
Level 2 - Office 03	11.1	19.0	5.0	1 & 2 & 3	**FAIL**

Table 06: Nature Ventilation TM52 Results

8.02 Mechanical Ventilation

Zone Name	Criteria 1 (%Hrs Top-Tmax>=1K) Target <3	Criteria 2 (Max. Daily Deg.Hrs) Target <6	Criteria 3 (Max. DeltaT) Target <4	Criteria Failing	Results
Level 1 - Office 01	4.7	11.0	3.0	1 & 2	FAIL
Level 1 - Office 02	4.9	11.0	3.0	1 & 2	FAIL
Level 1 - Office 03	5.9	12.0	4.0	1 & 2	FAIL
Level 2 - Office 01	7.5	14.0	4.0	1 & 2	FAIL
Level 2 - Office 02	6.5	14.0	4.0	1 & 2	FAIL
Level 3 - Office 01	5.4	12.0	4.0	1 & 2	FAIL
Level 3 - Office 02	6.7	13.0	4.0	1 & 2	FAIL
Level 3 - Office 03	7.7	17.0	4.0	1 & 2	FAIL
Level 2 - Office 03	9.6	18.0	5.0	1 & 2 & 3	FAIL

Table 07: Mechanical Ventilation TM52 Results

9.0 COOLING HIERACHY

In line with the GLA guidance, the cooling hierarchy has been addressed as follows:

Cooling Hierarchy Stage	Mitigation
Reduce the amount of heat entering the building	As the building is existing and terraced orientation and shading are not under the control of these works.
	Building materials cannot be altered either as they are existing.
	The walls and roofs, which were previously uninsulated, have been upgraded with insulation.
	All existing single glazing has been upgraded with new double glazed units.
Minimise internal heat gain	All internal gains under the control of the developer, lighting in this case, have been reduced as far as possible.
	Control of the tenant occupancy numbers or heat emitting equipment is not possible.
	There is no hot water pipework running through the building, the system uses air source heat pumps.
Manage heat within the building	There are no ceiling voids in the building, the mass of the structure is exposed.
Provide passive ventilation	There is no mechanical supply in the building, ventilation is purely natural.
Provide Mechanical ventilation	The building was analysed using a mechanical ventilation system and it was not compliant.
Provide active cooling	VRF heat pump cooling will be installed as internal conditions could not be maintained with a natural or mechanical ventilation approach.

Table 08: Cooling hierarchy mitigation summary

10.0 CONCLUSION

The analysis found the following conclusions:

- The cooling hierarchy was followed with a number of mitigation measures installed on site where feasible.

- The results show that, despite the mitigation measures, all areas do not comply with the TM52 criteria using a natural ventilation or mechanical ventilation scenario. Therefore, the internal spaces will not be maintained at a comfortable level for the inhabitants when using passive or mechanical measures.

- Air conditioning or comfort cooling will be required.