
TM59 Overheating Report

21-0136 – Holly Lodge
05th December 2022

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Revision Log

Section	Revision	Issue	Date
	For review and comment	Issue 1	01/11/2022
	Updated to include TM59 information	Issue 2	21/11/2022
	Full results included in the appendix	Issue 3	05/12/2022

1 Introduction

Overview

Eileen and Hans have been working closely with Paul Archer Design on 15 Holly Lodge Gardens, where they are planning to extend the original property and refurbish the internal aspects.

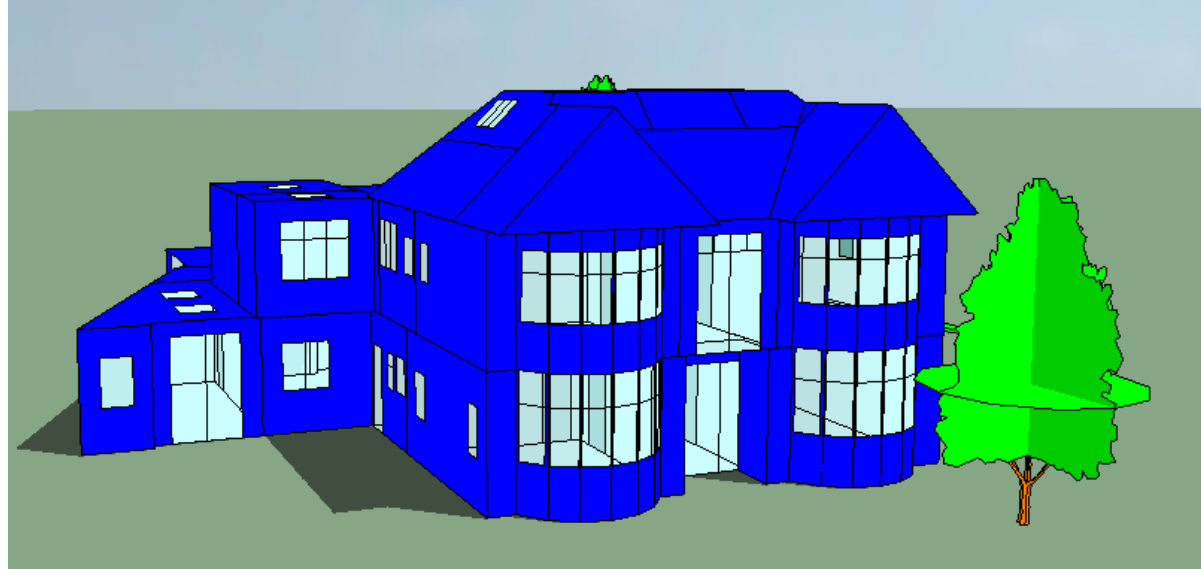


Figure 1: IES-VE model of the property

Mesh Energy have been commissioned to carry out CIBSE TM59 thermal modelling to demonstrate that occupant thermal comfort cannot be maintained year-round through natural ventilation.

The purpose of the report is to demonstrate that various rooms throughout the property do not maintain sufficient occupant thermal comfort levels to comply with TM59.

2 Executive Summary

The findings of the report conclude that the Lounge, Master bedroom, Bedroom F3, Office and Study fail to meet the criteria required to demonstrate that they do not suffer from overheating under current climatic conditions (DSY1) representing a moderately warm summer. All other rooms failed to maintain an adequate level of thermal comfort and do not suffer overheating under current climatic conditions (DSY1) representing a moderately warm summer.

With climatic conditions changing, it is important to see into the future to understand how rising temperatures will affect the performance of the house.

Overheating analysis carried for the expected conditions between 2041 and 2070 (DSY2) representing an intense single warm spell, and radical conditions between 2041 and 2070 (DSY3) with a prolonged period of sustained warmth, show that as the climate changes, all the bedrooms are likely to overheat.

3 Fabric First

The fabric-first approach

A ‘fabric first’ approach to building design involves maximising the performance of the components and materials that make up the building fabric itself, before considering the use of mechanical or electrical building services systems. This can help reduce capital and operational costs, improve energy efficiency, and reduce CO₂ emissions through methods such as:

- Maximising airtightness.
- Using super-high insulation.
- Optimising solar gain through the provision of openings and shading.
- Optimising natural ventilation.
- Using the thermal mass of the building fabric.
- Using energy from occupants, electronic devices, cookers and so on.

Fabric specification

The proposed U-values (W/m²K) for the project based on information provided by Paul Archer Design:

Construction Element	U-Value (W/m ² K)
Ground floor – existing	0.40
Ground floor – new	0.13
Ground floor – pool house	0.13
External walls - existing	2.1
External walls – existing with EWI	0.30
External walls – new, W1	0.26
Walls – pool house	0.18
New flat roofs	0.13
New pitched roof	0.15
Pool house roof	0.13
Windows	1.40 g-value – 0.4
Front elevation windows - existing	4.80 g-value – 0.71
2 door sliding windows	1.10 g-value – 0.4
4 door sliding windows	1.30 g-value – 0.4
Windows – fixed panel	1.30 g-value – 0.4
Rear elevation windows	1.36 g-value – 0.4
Pool house windows	1.40 g-value – 0.4
Rooflights	1.10
Pivot door	1.80
Infiltration Rate – main house	25m ³ /h.m ² @50Pa
Infiltration Rate – pool house	5m ³ /h.m ² @50Pa

4 Occupant Thermal Comfort

Overheating compliance is assessed in accordance with TM59. The TM59 corridor assessment does not apply to hallways of houses, we therefore haven’t applied any internal pipework to assess whether the hallways overheat. The heating set points are in accordance with TM59 and cannot be changed.

Overheating and the inability for occupants to adapt for their own comfort is generally taken to occur above 28°C. The occurrence of overheating is determined by the interplay of the following factors:

- The shape of the property.
- The degree of insulation and thermal mass.
- Internal and external overhangs, louvres and blinds.
- The size of windows and the direction they face.
- Heat from people, lights and equipment.
- The degree of ventilation provided.
- The ability to allow air to flow through the property through open windows and internal doors.

RIBA 2030 target

The CIBSE TM59 ‘Design methodology for the assessment of overheating risk in homes’ has been followed to assess the effectiveness of the ventilation of the building. The assessment criteria for overheating for natural ventilation between May and September are:

1. Criteria ‘a’, sets a 3% limit on the number of occupied hours that the room temperature can exceed the threshold comfort temperature of 28°C. This is applied to living and sleeping spaces.
2. Criteria ‘b’, for bedrooms sets a limit of >26°C between 10pm and 7am for no more than 32 hrs/yr, or 1% of the annual occupied hours. This is to ensure a good nights sleep.
3. All other ancillary spaces are assessed to see if a ‘significant risk’ of overheating is posed.
4. Criteria ‘a’ and ‘b’ must be met to achieve a pass.

Weather files

Overheating is assessed for the periods’, namely the 2020s (2011-2040) and 2050s (2041-2070). Weather data files are provided by CIBSE.

2011-2040 is assessed against a moderately warm summer, while 2041-2070 is assessed against a year with a very intense single warm spell, and the problematic year with a prolonged period of sustained warmth.

Window opening

The dynamic thermal model allows window opening behaviour to be emulated for each season, depending on whether the window is for a room on the ground or upper floor, or an internal or external door. Windows and doors are assigned the following ‘behaviour’.

Opening type by season*	In use	20°C	22°C	26°C	28°C
Winter internal door	07-22hrs		Closed	30% open	
Spring internal door	07-22hrs		Closed	60% open	
Summer internal door	07-22hrs		Closed		100% open**
Autumn internal door	07-22hrs		Closed	60% open	
External door	24hrs	Closed			
Winter window ground floor	07-22hrs		Closed	30% open	
Winter window upper floor	24hrs		Closed	30% open	
Spring window ground floor	07-22hrs		Closed	60% open	
Spring window upper floor	24hrs		Closed	60% open	
Summer window ground floor	07-22hrs		Closed		100% open**
	22-07hrs	Closed			
Summer window upper floor	07-22hrs		Closed		100% open**
	22-07hrs	Closed	100% open		
Autumn window ground floor	07-22hrs		Closed	60% open	
Autumn window upper floor	24hr		Closed	60% open	

* Winter (1st Dec-28th Feb), Spring (1st Mar-31st May), Summer (1st Jun-31st Aug), Autumn (1st Sep-30th Nov)

** If the internal temperature is greater than the external temperature

Table 1 Window opening behaviour

As natural ventilation will be employed, windows are opened in response to indoor CO₂, which equates to the sensation of stuffiness. Windows are considered likely to opened at any time through-out the year between 700ppm and 1000ppm CO₂, regardless of the outdoor temperature. The degree of opening ranges from 30% to 100% according to the season as set out in the table above.

5 Overheating Outcome

A moderately warm summer 2011-2040

A pass is required for both criteria – where applicable – to demonstrate compliance. The overheating criteria for occupied spaces were met for the Lounge, Master bedroom, Bedroom F3, Office and Study. All other rooms failed to maintain an adequate level of thermal comfort. Additionally, 2 ancillary areas were found to have significant risk of overheating.

Room name	Criterion (a) result	Criterion (b) result	Pass/Fail
GF: Snug	Fail	NA	Fail
GF: Guest Bedroom	Pass	Fail	Fail
GF: Lounge	Pass	NA	Pass
FF: Master Bedroom	Pass	Pass	Pass
FF: Bedroom F3	Pass	Pass	Pass
GF: Dining / Living	Fail	NA	Fail
FF: Office	Pass	NA	Pass
FF: Bedroom F2	Pass	Pass	Pass
SF: Study	Pass	NA	Pass

Space	Criteria a	Status	Criteria b	Status
GF: Snug	8	Fail	NA	NA
GF: Guest Bedroom	0.1	Pass	38	Fail
GF: Lounge	1.1	Pass	NA	NA
FF: Master Bedroom	0.1	Pass	12	Pass
FF: Bedroom F3	0.7	Pass	20	Pass
GF: Dining / Living	4.2	Fail	NA	NA
FF: Office	0.8	Pass	NA	NA
FF: Bedroom F2	0.9	Pass	29	Fail
SF: Study	2.9	Pass	NA	NA

Weather settings on IES - London Weather Centre DSY1 2020 High Emissions in the 50th percentile for a moderately warm summer 2011-2040

An intense single warm spell 2041-2070

All the rooms failed to maintain adequate levels of thermal comfort, with some rooms starting to experience significant overheating. Criteria ‘a’ was met for both the Guest bedroom and Master bedroom, but both failed criteria ‘b’ by a significant margin. Additionally, 4 ancillary areas were found to have significant risk of overheating.

Room name	Criterion (a) result	Criterion (b) result	Pass/Fail
GF: Snug	Fail	NA	Fail
GF: Guest Bedroom	Fail	Fail	Fail
GF: Lounge	Fail	NA	Fail
FF: Master Bedroom	Pass	Fail	Fail
FF: Bedroom F3	Fail	Fail	Fail
GF: Dining / Living	Fail	NA	Fail
FF: Office	Fail	NA	Fail
FF: Bedroom F2	Fail	Fail	Fail
SF: Study	Fail	NA	Fail

Space	Criteria a	Status	Criteria b	Status
GF: Snug	15.5	Fail	NA	NA
GF: Guest Bedroom	3.1	Fail	140	Fail
GF: Lounge	6.7	Fail	NA	NA
FF: Master Bedroom	2.8	Pass	61	Fail
FF: Bedroom F3	4.5	Fail	96	Fail
GF: Dining / Living	9.7	Fail	NA	NA
FF: Office	6.3	Fail	NA	NA
FF: Bedroom F2	5.2	Fail	107	Fail
SF: Study	11.9	Fail	NA	NA

Weather settings on IES - London Weather Centre DSY2 2050 Medium Emissions in the 50th percentile for a moderately warm summer 2041-2070

A period of sustained warmth 2041-2070

All the rooms failed to maintain adequate levels of thermal comfort, with some rooms starting to experience significant overheating. Criteria ‘a’ was met for both the Guest bedroom and Master bedroom, but both failed criteria ‘b’ by a significant margin. Additionally, 6 ancillary areas were found to have significant risk of overheating.

Room name	Criterion (a) result	Criterion (b) result	Pass/Fail
GF: Snug	Fail	NA	Fail
GF: Guest Bedroom	Fail	Fail	Fail
GF: Lounge	Fail	NA	Fail
FF: Master Bedroom	Pass	Fail	Fail
FF: Bedroom F3	Fail	Fail	Fail
GF: Dining / Living	Fail	NA	Fail
FF: Office	Fail	NA	Fail
FF: Bedroom F2	Fail	Fail	Fail
SF: Study	Fail	NA	Fail

Space	Criteria a	Status	Criteria b	Status
GF: Snug	22.1	Fail	NA	NA
GF: Guest Bedroom	5.6	Pass	225	Fail
GF: Lounge	9.6	Fail	NA	NA
FF: Master Bedroom	5	Pass	103	Fail
FF: Bedroom F3	7	Fail	138	Fail
GF: Dining / Living	14.8	Fail	NA	NA
FF: Office	10.1	Fail	NA	NA
FF: Bedroom F2	7.8	Fail	162	Fail
SF: Study	18.6	Fail	NA	NA

Weather settings on IES - London Weather Centre DSY3 2050 Medium Emissions in the 50th percentile for a moderately warm summer 2041-2070

Appendix A – Openable Windows

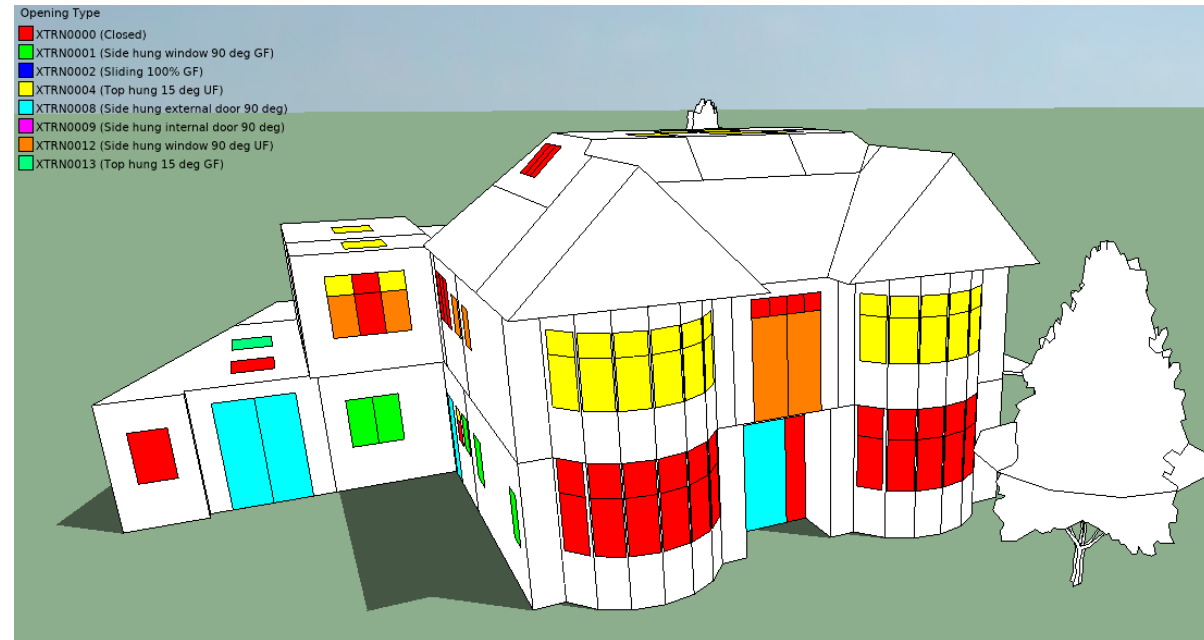
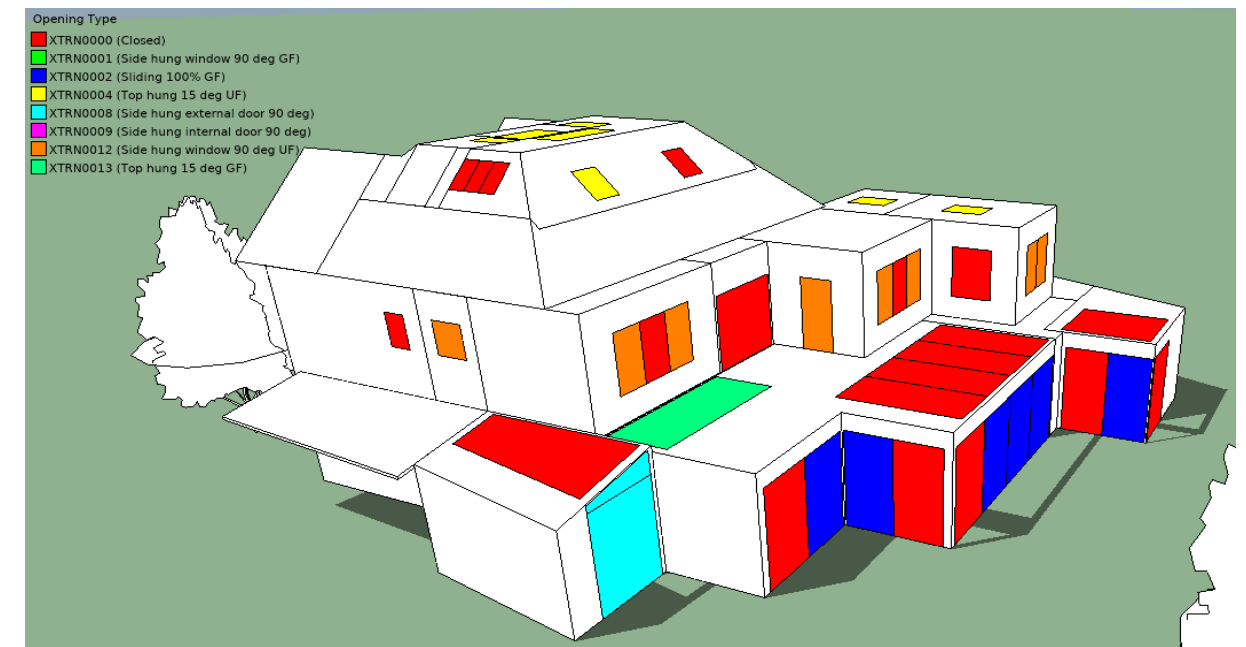


Figure 2 Front and side elevation



Figure 3 Back elevation



Appendix B – TM59 Results

TM59 – DSY 1 Results

Summary

Natvent room name	Natvent criterion (a) result	Natvent criterion (b) result	Pass/Fail
GF:Snug	Fail	NA	Fail
GF:Guest Bedroom	Pass	Fail	Fail
GF:Lounge	Pass	NA	Pass
FF:Master Bedroom	Pass	Pass	Pass
FF:Bedroom F3	Pass	Pass	Pass
GF:Dining / Living	Fail	NA	Fail
FF:Office	Pass	NA	Pass
FF:Bedroom F2	Pass	Pass	Pass
SF:Study	Pass	NA	Pass

Natural Ventilation Criterion A

Room Name	Occupied hours	No. hours $\Delta T \geq 1^{\circ}K$	% Occupied hours $\Delta T \geq 1^{\circ}K$	Pass/Fail
GF:Snug	1989	160	8	Fail
GF:Guest Bedroom	3672	5	0.1	Pass
GF:Lounge	1989	22	1.1	Pass
FF:Master Bedroom	3672	4	0.1	Pass
FF:Bedroom F3	3672	24	0.7	Pass
GF:Dining / Living	1989	83	4.2	Fail
FF:Office	1989	16	0.8	Pass
FF:Bedroom F2	3672	32	0.9	Pass
SF:Study	1989	58	2.9	Pass

Natural Ventilation Criterion B

Room Name	No. hours > 26°C 22:00-24:00	No. hours > 26°C 00:00-07:00	Total hours > 26°C	Pass/Fail
GF:Snug	NA	NA	NA	NA
GF:Guest Bedroom	15	23	38	Fail
GF:Lounge	NA	NA	NA	NA
FF:Master Bedroom	8	4	12	Pass

FF:Bedroom F3	12	8	20	Pass
GF:Dining / Living	NA	NA	NA	NA
FF:Office	NA	NA	NA	NA
FF:Bedroom F2	16	13	29	Pass
SF:Study	NA	NA	NA	NA

TM59 – DSY 2 Results

Summary

Room name	Criterion (a) result	Criterion (b) result	Pass/Fail
GF:Snug	Fail	NA	Fail
GF:Guest Bedroom	Fail	Fail	Fail
GF:Lounge	Fail	NA	Fail
FF:Master Bedroom	Pass	Fail	Fail
FF:Bedroom F3	Fail	Fail	Fail
GF:Dining / Living	Fail	NA	Fail
FF:Office	Fail	NA	Fail
FF:Bedroom F2	Fail	Fail	Fail
SF:Study	Fail	NA	Fail

Natural Ventilation Criterion A

Room Name	Occupied hours	No. hours $\Delta T \geq 1^{\circ}K$	% Occupied hours $\Delta T \geq 1^{\circ}K$	Pass/Fail
GF:Snug	1989	308	15.5	Fail
GF:Guest Bedroom	3672	113	3.1	Fail
GF:Lounge	1989	134	6.7	Fail
FF:Master Bedroom	3672	103	2.8	Pass
FF:Bedroom F3	3672	166	4.5	Fail
GF:Dining / Living	1989	192	9.7	Fail
FF:Office	1989	126	6.3	Fail
FF:Bedroom F2	3672	192	5.2	Fail
SF:Study	1989	236	11.9	Fail

Natural Ventilation Criterion B

Room Name	No. hours > 26°C 22:00-24:00	No. hours > 26°C 00:00-07:00	Total hours > 26°C	Pass/Fail
GF:Snug	NA	NA	NA	NA
GF:Guest Bedroom	48	92	140	Fail

GF:Lounge	NA	NA	NA	NA
FF:Master Bedroom		29	32	61
FF:Bedroom F3		39	57	96
GF:Dining / Living	NA	NA	NA	NA
FF:Office	NA	NA	NA	NA
FF:Bedroom F2		43	64	107
SF:Study	NA	NA	NA	NA

TM59 – DSY 3 Results

Summary

Natvent room name	Natvent criterion (a) result	Natvent criterion (b) result	Pass/Fail
GF:Snug	Fail	NA	Fail
GF:Guest Bedroom	Fail	Fail	Fail
GF:Lounge	Fail	NA	Fail
FF:Master Bedroom	Fail	Fail	Fail
FF:Bedroom F3	Fail	Fail	Fail
GF:Dining / Living	Fail	NA	Fail
FF:Office	Fail	NA	Fail
FF:Bedroom F2	Fail	Fail	Fail
SF:Study	Fail	NA	Fail

Natural Ventilation Criterion A

Room Name	Occupied hours	No. hours ΔT ≥ 1°K	% Occupied hours ΔT ≥ 1°K	Pass/Fail
GF:Snug	1989	439	22.1	Fail
GF:Guest Bedroom				
Bedroom	3672	206	5.6	Fail
GF:Lounge	1989	191	9.6	Fail
FF:Master Bedroom				
Bedroom	3672	183	5	Fail
FF:Bedroom F3	3672	257	7	Fail
GF:Dining / Living	1989	295	14.8	Fail
FF:Office	1989	201	10.1	Fail
FF:Bedroom F2	3672	288	7.8	Fail
SF:Study	1989	370	18.6	Fail

Natural Ventilation Criterion B

Room Name	No. hours > 26°C 22:00-24:00	No. hours > 26°C 00:00-07:00	Total hours > 26°C	Pass/Fail
GF:Snug	NA	NA	NA	NA
GF:Guest Bedroom				
Bedroom	76	149	225	Fail
GF:Lounge	NA	NA	NA	NA
FF:Master Bedroom				
Bedroom	43	60	103	Fail
FF:Bedroom F3	54	84	138	Fail
GF:Dining / Living	NA	NA	NA	NA
FF:Office	NA	NA	NA	NA
FF:Bedroom F2	65	97	162	Fail
SF:Study	NA	NA	NA	NA

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Awards & Accreditations



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