QUEENSBERRY DESIGN LTD.
ENGINEERING, SUSTAINABILITY & ARCHITECTURAL CONSULTANTS

Axis House
Harlington

Part O - Overheating Risk, Thermal Model CIBSE TM59:2017 Report

Ref: QD2139-01

Date: 18th September 2023

Contents

Proposed Front Elevation

Image courtesy of Fluent Architectural Design Services

Disclaimer

This report is based on the information provided by the client. Should this information prove to be inaccurate, or the original design specification change the findings and conclusions of this report will be invalidated. This report includes simulation results for the estimated thermal performance of the building (part of the building) using detailed modelling methods. Within the calculations, assumptions are made based on NCM defaults and practical industry standards that may not reflect the actual building. Although Queensberry Design takes great care in producing a high-quality simulation model, variables in building construction and external factors outside the CIBSE TM52 & TM59 metric requirements will affect the actual performance of the building. It is therefore the responsibility of the designers and construction team to construct the building appropriately.

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1.0 Executive Summary

A detailed dynamic thermal model of the proposed apartment block at *Axis House, Harlington,* produced using Design Builder Energy Plus. The model has been used to simulate a selection of the highest-risk plots within the proposed development. The purpose of the simulation is to determine that the buildings satisfy the requirements of the thermal comfort metrics CIBSE TM59:2017, accounting for the limitations of Building Regulation Part O. The building specification inputs are detailed within section 6 of this report, and the full results of the simulation model are illustrated in section 7 of this report

1.1   Results - 2020's DSY1 weather scenario

Simulation models have been completed for a sample of worst-case apartments. Assessed under the methodology of CIBSE TM59:217 accounting for the limitations of Building Regulation Part O, all high-risk units can comply based on the ventilation strategy, and proposed window g-values incorporated into the design. All inputs used for this scenario can be found in section 6 of this report.

2020 DSY 1 Overheating Mitigation:

Due to the acoustic report requiring windows to be closed at all times, all bedrooms will need an alternative form of ventilation, and increase ventilation to top floor Living/Kitchens to reduce the overheating risk.

Proposed glazing: **1.20 W/m2K - G-Value 0.30 to all windows**

- **Lowest floor – Additional mechanical purge ventilation >4ACH to all bedrooms**
- **Mid floors – Additional mechanical purge ventilation >6ACH to all bedrooms**
- **Top floor – Additional mechanical purge ventilation >6ACH to all bedrooms & Living/kitchens.**

Table 1 – 2020's DSY 1 Simulation Results, Sample units (CIBSE TM59:2017)			
House Type / Plot	**Criteria A (%)**	**Criteria B (hr)**	**Pass / Fail**
Lowest Floor – 1st Floor, Apartment 02	Pass	Pass	**Pass**
Lowest Floor – 1st Floor, Apartment 04	Pass	Pass	**Pass**
Lowest Floor – 1st Floor, Apartment 10	Pass	Pass	**Pass**
Mid Floor – 4th Floor, Apartment 32	Pass	Pass	**Pass**
Mid Floor – 4th Floor, Apartment 34	Pass	Pass	**Pass**
Mid Floor – 4th Floor, Apartment 40	Pass	Pass	**Pass**
Top Floor - 6th Floor, Apartment 52	Pass	Pass	**Pass**
Top Floor - 6th Floor, Apartment 53	Pass	Pass	**Pass**
Top Floor - 6th Floor, Apartment 54	Pass	Pass	**Pass**
Top Floor - 6th Floor, Apartment 59	Pass	Pass	**Pass**
Top Floor - 6th Floor, Apartment 60	Pass	Pass	**Pass**

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2.0 Introduction

This report had been produced to assess the design stage proposals *Axis House, Harlington,* against the overheating criteria outlined by CIBSE TM59:2017 accounting for the limitations of Building Regulation Part O. The calculations have been prepared by Queensberry Design. The outcome of the overheating analysis is intended to advise the design team by providing an estimated performance of the building, allowing them to make informed design decisions to minimise overheating risk within the building.

("Map data ©2023 Google")

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3.0 Overheating Criteria

The most recognised methodology for assessing thermal comfort in domestic spaces is CIBSE TM59:2017. The guidance document is available online for further information.

3.1 CIBSE TM59:2017

CIBSE TM59:2017 provides a methodology for the assessment of overheating risk in domestic buildings. This is predominantly designed for flats/apartments, as these are deemed to be high risk, but can also be applied to Houses. Compliance is based on passing criterion A&B:

- Criterion A - For living rooms, kitchens and bedrooms: The number of hours during which temperature is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3% of occupied hours.

- Criterion B - For bedrooms only: To guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26 °C for more than 1% of annual hours. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26 °C will be recorded as a fail).

3.2 Approved Document O: Overheating (TM59 limitations)

Compliance with Part O can be shown by using one of the following two methods:
1. The Simplified Method, as set out within Section 1 of the Approved Document O.
2. The Dynamic Thermal Modelling Method, as set out within Section 2 of the Approved Document O.

The CIBSE TM59 criteria for The Dynamic Thermal Modelling Method has been in use since 2017. The Part O document mandates certain limitations to be included with the TM59 methodology.

When a room is occupied during the day (8am to 11pm), openings should be modelled to do all of the following.
- Start to open when the internal temperature exceeds 22°C.
- Be fully open when the internal temperature exceeds 26°C.
- Start to close when the internal temperature falls below 26°C.
- Be fully closed when the internal temperature falls below 22°C.
At night (11pm-8am), windows should be assumed to be fully open if:
- The opening is on the first floor or above and not easily accessible.
- The internal temperature exceeds 23°C at 11pm.
When a ground floor or easily accessible room is unoccupied, both of the following apply.
- In the day, windows, patio doors and balcony doors should be modelled as open, if this can be done securely.
- At night, windows, patio doors and balcony doors should be modelled as closed.
An entrance door should be included, which should be shut all the time.

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4.0 Modelling Software

To carry out the thermal simulations, Queensberry Design Ltd has modelled the building in an appropriate Dynamic Simulation software: Design Builder Energy Plus version 7.2.0.032

The DSM model can be used to provide:

- Overheating analysis (this report)
- Energy consumption prediction
- Heating and Cooling Load prediction
- Thermal Fluid Dynamics Assessment
- Building Compliance Assessment (Building Regulations Part-L and EPC)

5.0 3D Generated Models

A three-dimensional thermal model of the Apartments has been produced based on information provided by the client/architect or otherwise stated in this report. Where specific information is provided building fabric, occupancy densities, profiles, and small power gains were based on the TM59 profiles and NCM assumptions. Specific lighting, heating and ventilation are as per the information provided (see section 6).

5.2 Sample Units

A sample of high-risk apartments has been selected for simulation. Sample apartments have been selected based on the following criteria:

South-West and South-East facing bedrooms and 50% of Top floor units.

- Lowest Floor – 1st Floor, Apartments 02 – 2 bed South West facing bedroom.
- Lowest Floor – 1st Floor, Apartments 04 – 3 bed South West facing bedroom.
- Lowest Floor – 1st Floor, Apartments 10 – 2 bed West facing bedroom.
- Mid Floor – 4th Floor, Apartments 32 – 3 bed South West facing bedroom.
- Mid Floor – 4th Floor, Apartments 34 – 2 bed South East facing bedroom.
- Mid Floor – 4th Floor, Apartments 40 – 3 bed South East facing bedroom.
- Top Floor - 6th Floor, Apartments 52 – 3 bed South West facing bedroom.
- Top Floor - 6th Floor, Apartments 53 – 3 bed South West facing bedroom.
- Top Floor - 6th Floor, Apartments 54 – 2 bed South East facing bedroom.
- Top Floor - 6th Floor, Apartments 59 – 2 bed South East facing bedroom.
- Top Floor - 6th Floor, Apartments 60 – 2 bed South East facing bedroom.

5.3 Lowest Floor – 1st Floor

5.4 Mid Floor – 4th Floor

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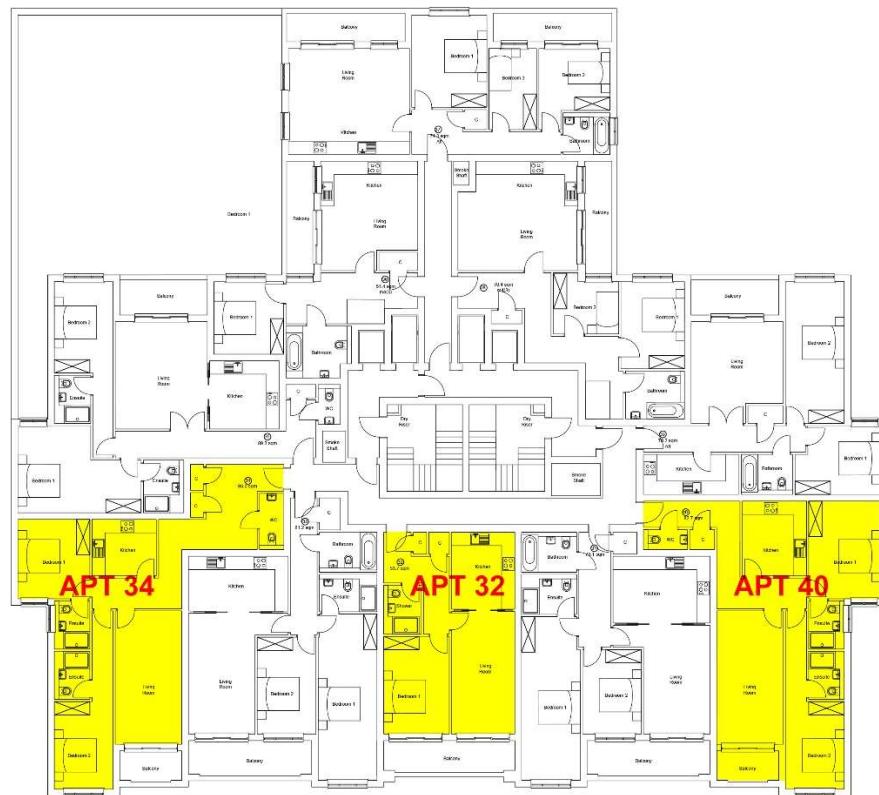
5.5   Top Floor 6th Floor

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6.0 Summary of Model Inputs

6.1   Location Data

Building type: Residential
Building Location: Harlington
Orientation: Building Entrance Faces North
Latitude: 51.3° North
Longitude: 0.26° West
Weather file: DSY 1 (Design Summer Year) 2020's, high emissions, 50% percentile scenario.

6.2   Weather Data Report

In accordance with TM59 the DSY1 weather file used for the simulation model is based on the site location, as shown on the map below. There are three weather files for London, each representing different areas:

- Central Activity Zone: London Weather Central
- Inner London: London Heathrow weather file
- Outer London: London Gatwick weather file

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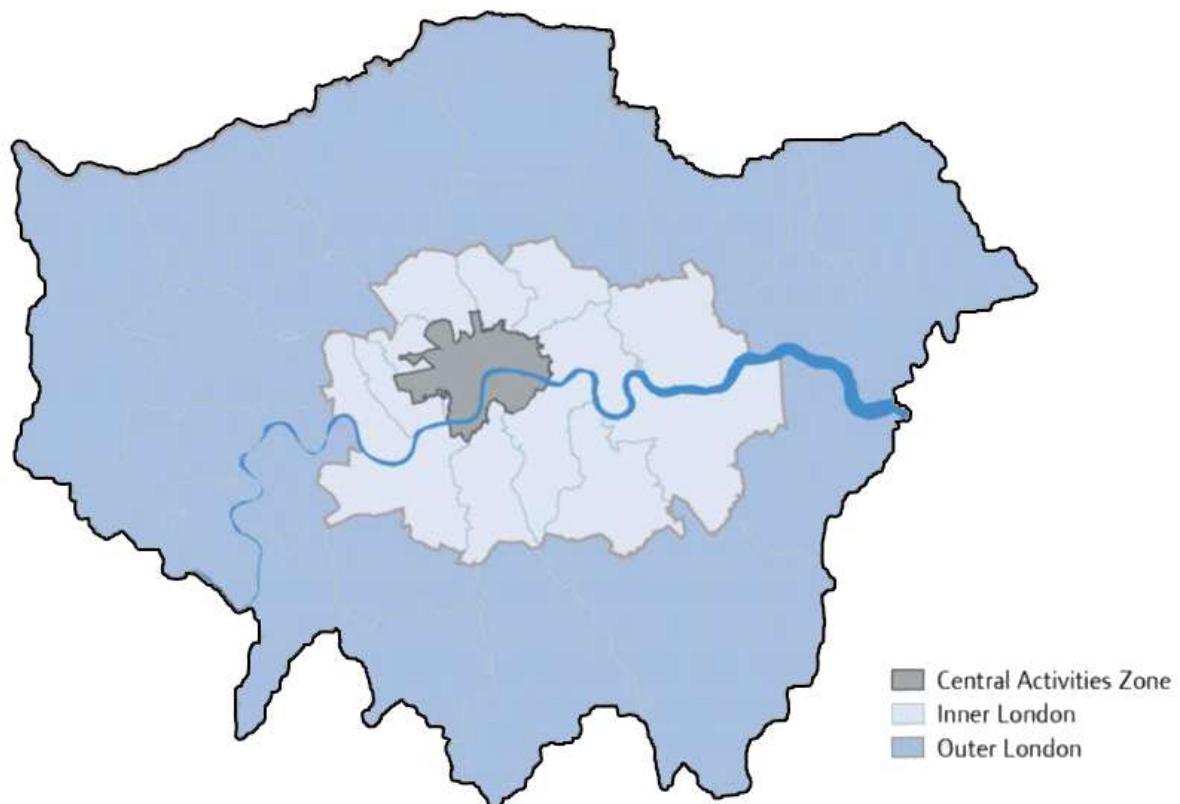
6.3 Building Fabric

Fabric U-vales are based on preliminary information provided.

Table 2 – Building Fabric		
Element	**Construction**	**U-Value**
Main External Wall	Cavity Wall construction	**0.15 W/m2K**
Flat Roof	Concrete deck Construction	**0.10 W/m2K**
Ground Floor	Concrete, medium density 150mm, ESP insulation 300mm, Screed 70mm	**0.11 W/m2K**
Entrance Doors		**1.00 W/m2K**
Table 3 – Glazing Specification		
Windows	G-Value 0.30	**1.20 W/m2K**

6.4.1 Building Services:

- *Heating and hot waters*: Communal air source heat pumps with indoor units in each flat connected to a medium temperature loop connected to common chiller units on the roof of each block.
- *Lighting:* For Domestic areas, In the absence of a project-specific lighting design inputs are based on CIBSE TIM59 guidance 5.2:
  - *"For the purposes of the assessment, lighting energy is assumed to be proportional to floor area, and lighting loads are measured in W/m_2. From 6pm to 11pm, 2 W/m_2 should be assumed as the default for an efficient new-build home."*
  - *It is assumed that Communal corridor lighting will be equipped with PIR sensors.*
- *Ventilation*: Domestic ventilation to each apartment is Mechanical Ventilation with heat recovery (MVHR). No product extract rates are available, so rates are based on minimum Part F ventilation rates for habitable rooms, bathrooms and en-suites based on 8 l/s, Kitchen-Livingroom 13l/s heat recovery based on worst-case 70% efficiency:
- *Additional mechanical Purge ventilation Bedrooms:* As all windows are required to be modelled as closed for acoustic reasons, additional mechanical purge ventilation systems will be required to provide >4AC/HR.
  The following ventilation rates are proposed to ensure the requirements of TM59 are satisfied:
  - *Lowest floor – Additional mechanical purge ventilation >4ACH to all bedrooms*
  - *Mid floors – Additional mechanical purge ventilation >6ACH to all bedrooms*
  - *Top floor – Additional mechanical purge ventilation >6ACH to all bedrooms & Living/kitchens.*

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6.5 Internal Heat Gains

The simulation software automatically calculates the solar gains based on the building orientation, window openings, and glazing specification.

As no project-specific schedules are available for this development and no equipment gain information has not been provided by the design team, default schedules for inputs are being used as per CIBSE TM59 methodology Table 2 (see appendix 10.1).

Communal corridor pipework heat gains are based on default heat loss from pipework set out in the domestic building services compliance guide 2013. Pipework assumed 22mm.

6.6 Air Infiltration Rate

The air permeability of the building envelope must conform to the standard set by the criterion of Part L, namely a maximum air permeability of 8 m3h-1m2 at 50 Pa. It is proposed that the air permeability of this development will be significantly less than the maximum value. The airtightness crack template is set to Good in the simulation model.

Airflow within the building is aided by the opening of internal doors. Doors have been assigned to be left open in the daytime but have been assumed closed at night.

6.7 Window Openings

The acoustic report (230712 - Bath Road, Heathrow - Noise and Vibration Assessment) requires all windows to be modelled closed. Alternative ventilation or mechanical cooling will be required to overcome the obvious overheating this will cause.

- Lowest Floor – 1st Floor, Apartments 02 – 2 bed South West facing bedroom.
- Lowest Floor – 1st Floor, Apartments 04 – 3 bed South West facing bedroom.
- Lowest Floor – 1st Floor, Apartments 10 – 2 bed West facing bedroom.
- Mid Floor – 4th Floor, Apartments 32 – 3 bed South West facing bedroom.
- Mid Floor – 4th Floor, Apartments 34 – 2 bed South East facing bedroom.
- Mid Floor – 4th Floor, Apartments 40 – 3 bed South East facing bedroom.
- Top Floor - 6th Floor, Apartments 52 – 3 bed South West facing bedroom.
- Top Floor - 6th Floor, Apartments 53 – 3 bed South West facing bedroom.
- Top Floor - 6th Floor, Apartments 54 – 2 bed South East facing bedroom.
- Top Floor - 6th Floor, Apartments 59 – 2 bed South East facing bedroom.
- Top Floor - 6th Floor, Apartments 60 – 2 bed South East facing bedroom.

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7. Results and Simulation Outcomes – 2020's Weather Data

7.1   Simulation Baseline Results

Based on the natural ventilation strategy, with mitigating ventialtion the simulation model has been completed for a sample of units, assessed under the methodology of CIBSE TM59:217. All inputs used for this scenario can be found in section 6 of this report.   The results below show all worst-case sample plots pass criteria A and B set by CIBSE TM59:2017

Table 4 – 2020's DSY 1 Initial Simulation Results, Sample units (CIBSE TM59:2017)			
Zone	Criteria A (%)	Criteria B (hr)	Pass / Fail
Lowest Floor – Apartments 02 – Bedroom	0	13.17	Pass
Lowest Floor – Apartments 02 – Living Kitchen	0	N/A	Pass
Lowest Floor – Apartments 04 – Bedroom 1	0	13.17	Pass
Lowest Floor – Apartments 04 – Bedroom 2	0	24.5	Pass
Lowest Floor – Apartments 04 – Living Kitchen	0	N/A	Pass
Lowest Floor – Apartments 10 – Bedroom 1	0	16.17	Pass
Lowest Floor – Apartments 10 – Bedroom 2	0	27	Pass
Lowest Floor – Apartments 10 – Living Kitchen	0	N/A	Pass
Mid Floor – Apartments 32 – Bedroom 1	0	22.67	Pass
Mid Floor – Apartments 32 – Living Kitchen	0	N/A	Pass
Mid Floor – Apartments 34 – Bedroom 1	0	18	Pass
Mid Floor – Apartments 34 – Bedroom 2	0	24	Pass
Mid Floor – Apartments 34 – Living Kitchen	0	N/A	Pass
Mid Floor – Apartments 40 – Bedroom 1	0	16.5	Pass
Mid Floor – Apartments 40 – Bedroom 2	0	27.5	Pass
Mid Floor – Apartments 40 – Living Kitchen	0	N/A	Pass
Mid Floor – Block C – Plot 94 – Bedroom 1	0.12	21.5	Pass
Mid Floor – Block C – Plot 94 – Bedroom 2	0.08	N/A	Pass
Mid Floor – Block A – Plot 16 – Living Kitchen	0.09	20.67	Pass
Mid Floor – Block A – Plot 16 – Bedroom 1	0.17	21	Pass
Mid Floor – Block A – Plot 16 – Bedroom 2	0.14	N/A	Pass
Mid Floor – Block A – Plot 16 – Bedroom 3	0.02	29.67	Pass
Mid Floor – Block A – Plot 17 – Living Kitchen	0.07	24.67	Pass
Mid Floor – Block A – Plot 17 – Bedroom 1	0.32	N/A	Pass
Mid Floor – Block A – Plot 17 – Bedroom 2	0	21.17	Pass
Top Floor – Block A – Plot 36 – Living Kitchen	0.1	25.33	Pass
Top Floor – Block A – Plot 36 – Bedroom 1	0.35	N/A	Pass
Top Floor – Block A – Plot 36 – Bedroom 2	0.12	21.5	Pass
Top Floor – Block A – Plot 36 – Bedroom 3	0.18	22.17	Pass
Top Floor – Block A – Plot 37 – Living Kitchen	0.18	N/A	Pass
Top Floor – Block A – Plot 38 – Bedroom 2	0.06	19.17	Pass

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7.3 Corridors Baseline Results 2020's

Corridors have been tested under the advisory TM59 overheating criteria. (Internal temperatures are advised not to exceed 28°C for more than 3% of annual hours). There is no mandatory requirement to meet the overheating requirement for communal corridors, however, the developer should consider installing ventilation to reduce overheating to any failing zones.

Table 5 – 2020's DSY 1 Simulation Results for Corridors (CIBSE TM59:2017)		
Zone	**Exceedance 28° (%)**	**Pass / Fail**
Lowest South Corridor	6.28	Fail
Mid floor South Corridor	31.50	Fail
Top-floor South Corridor	1.72	Pass

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8. CIBSE TM59– Extreme conditions DSY 2 and DSY 3

Additional simulations have been run using extreme conditions DSY 2 and DSY 3 weather data files to demonstrate projected building performance under these scenarios. Calculations for confirm for DSY2 All bedrooms will fail the overheating criteria B defined by CIBSE TM59:2017, but all zones pass Criteria A (see table 6). Calculations for DSY3 confirm all bedrooms will fail the overheating criteria B defined by CIBSE TM59:2017, and most of the living-Kitchen rooms also fail criteria A (see table 6). Further recommendations have been made to mitigate the potential for future overheating.

Table 6 – 2020's DSY 2 Initial Simulation Results, Sample units (CIBSE TM59:2017)			
Zone	Criteria A (%)	Criteria B (hr)	Pass / Fail
Lowest Floor – Apartments 02 – Bedroom	0.09	50	Fail
Lowest Floor – Apartments 02 – Living Kitchen	0.5	N/A	Fail
Lowest Floor – Apartments 04 – Bedroom 1	0	39.17	Fail
Lowest Floor – Apartments 04 – Bedroom 2	0	56.17	Fail
Lowest Floor – Apartments 04 – Living Kitchen	0	N/A	Fail
Lowest Floor – Apartments 10 – Bedroom 1	0	40.67	Fail
Lowest Floor – Apartments 10 – Bedroom 2	0.12	57.17	Fail
Lowest Floor – Apartments 10 – Living Kitchen	0.1	N/A	Fail
Mid Floor – Apartments 32 – Bedroom 1	0.04	47.83	Fail
Mid Floor – Apartments 32 – Living Kitchen	1.02	N/A	Fail
Mid Floor – Apartments 34 – Bedroom 1	0	48	Fail
Mid Floor – Apartments 34 – Bedroom 2	0.06	55.83	Fail
Mid Floor – Apartments 34 – Living Kitchen	0.29	N/A	Fail
Mid Floor – Apartments 40 – Bedroom 1	0	39.17	Fail
Mid Floor – Apartments 40 – Bedroom 2	0.07	55.33	Fail
Mid Floor – Apartments 40 – Living Kitchen	0.35	N/A	Fail
Mid Floor – Block C – Plot 94 – Bedroom 1	0.04	47.83	Fail
Mid Floor – Block C – Plot 94 – Bedroom 2	1.02	N/A	Fail
Mid Floor – Block A – Plot 16 – Living Kitchen	0	48	Fail
Mid Floor – Block A – Plot 16 – Bedroom 1	0.06	55.83	Fail
Mid Floor – Block A – Plot 16 – Bedroom 2	0.29	N/A	Fail
Mid Floor – Block A – Plot 16 – Bedroom 3	0	39.17	Fail
Mid Floor – Block A – Plot 17 – Living Kitchen	0.07	55.33	Fail
Mid Floor – Block A – Plot 17 – Bedroom 1	0.35	N/A	Fail
Mid Floor – Block A – Plot 17 – Bedroom 2	0.04	47.83	Fail
Top Floor – Block A – Plot 36 – Living Kitchen	0.82	49.33	Fail
Top Floor – Block A – Plot 36 – Bedroom 1	1.18	N/A	Fail
Top Floor – Block A – Plot 36 – Bedroom 2	0.77	48	Fail
Top Floor – Block A – Plot 36 – Bedroom 3	1.25	47.17	Fail
Top Floor – Block A – Plot 37 – Living Kitchen	1.18	N/A	Fail
Top Floor – Block A – Plot 38 – Bedroom 2	0.65	68.5	Fail

Table 7 – 2020's DSY 3 Initial Simulation Results, Sample units (CIBSE TM59:2017)			
Zone	**Criteria A (%)**	**Criteria B (hr)**	**Pass / Fail**
Lowest Floor – Apartments 02 – Bedroom	0.07	85.5	**Fail**
Lowest Floor – Apartments 02 – Living Kitchen	1.34	N/A	**Fail**
Lowest Floor – Apartments 04 – Bedroom 1	0	66.83	**Fail**
Lowest Floor – Apartments 04 – Bedroom 2	0	100.5	**Fail**
Lowest Floor – Apartments 04 – Living Kitchen	0.12	N/A	**Fail**
Lowest Floor – Apartments 10 – Bedroom 1	0	70.5	**Fail**
Lowest Floor – Apartments 10 – Bedroom 2	0	101.5	**Fail**
Lowest Floor – Apartments 10 – Living Kitchen	0.69	N/A	**Fail**
Mid Floor – Apartments 32 – Bedroom 1	0	79.5	**Fail**
Mid Floor – Apartments 32 – Living Kitchen	2.26	N/A	**Fail**
Mid Floor – Apartments 34 – Bedroom 1	0	79.83	**Fail**
Mid Floor – Apartments 34 – Bedroom 2	0	96	**Fail**
Mid Floor – Apartments 34 – Living Kitchen	0.76	N/A	**Fail**
Mid Floor – Apartments 40 – Bedroom 1	0	71	**Fail**
Mid Floor – Apartments 40 – Bedroom 2	0	102.5	**Fail**
Mid Floor – Apartments 40 – Living Kitchen	1.13	N/A	**Fail**
Mid Floor – Block C – Plot 94 – Bedroom 1	1.13	73	**Fail**
Mid Floor – Block C – Plot 94 – Bedroom 2	1.15	N/A	**Fail**
Mid Floor – Block A – Plot 16 – Living Kitchen	0.89	70.5	**Fail**
Mid Floor – Block A – Plot 16 – Bedroom 1	1.75	66.33	**Fail**
Mid Floor – Block A – Plot 16 – Bedroom 2	1.21	N/A	**Fail**
Mid Floor – Block A – Plot 16 – Bedroom 3	0.87	105.5	**Fail**
Mid Floor – Block A – Plot 17 – Living Kitchen	1.29	84.83	**Fail**
Mid Floor – Block A – Plot 17 – Bedroom 1	3.07	N/A	**Fail**
Mid Floor – Block A – Plot 17 – Bedroom 2	0.55	87.83	**Fail**
Top Floor – Block A – Plot 36 – Living Kitchen	1.61	85.67	**Fail**
Top Floor – Block A – Plot 36 – Bedroom 1	3.21	N/A	**Fail**
Top Floor – Block A – Plot 36 – Bedroom 2	1.01	72	**Fail**
Top Floor – Block A – Plot 36 – Bedroom 3	1.94	68.5	**Fail**
Top Floor – Block A – Plot 37 – Living Kitchen	1.43	N/A	**Fail**
Top Floor – Block A – Plot 38 – Bedroom 2	0.07	85.5	**Fail**

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8.1   Further recommendations

The following additional advisory recommendations have been made to reduce potential future overheating risks based on extreme weather scenarios. Advisory mitigation measures should be considered by the developer for installation prior to occupation or for future retrofit.

Low – G glazing throughout:

To reduce the projected solar gains to living rooms and kitchens the developer should consider installing the same low g-value glazing as proposed to the bedrooms, such as Pilkington Suncool to the bedroom windows (see appendix 10.3 for details).

Window Design:

The design of windows and consideration of opening has a significant impact on the potential for solar glare and the ability of occupants to naturally ventilate the building. The following design measures should be considered as part of future retrofit options:

- Windows should be set back 300m.
- All fixed pain windows removed.
- Openable windows with widths that allow maximum opening following the part O guidance.

Bedroom Purge Ventilation:

Bedroom compliance with Criteria B is a significant challenge, particularly for extreme weather scenarios. Additional mechanical purge ventilation (4ACH) can assist in reducing the overheating risk.

Externals Overhead shading devices:

The most effective way to reduce summer heat gain through windows is to provide external shading that prevents sunlight before it hits the glass. Overhead shading devices 1-2m, such as eaves, awnings, pergolas and louvres can regulate solar gains throughout the year, without requiring any user effort, particularly to the south facade.

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External Side shading devices:
Vertical fins to avoid the low-angled sun, 0.5-1.5m in length. Overhead or side window shading should be considered for initial installation or for the potential for future retrofit.

Mechanical:
For instances of severe overheating risk, the developer should consider the potential future installation of mechanical cooling or passive ventilation to combat the future rise in temperatures and the likely hood that design measures will be insufficient to reduce overheating risk completely.

8.2   Weather Data / Simulation Results

The weather data used is London Gatwick 2020's, high emissions, 50% percentile scenario.

Extreme conditions:
DSY 2
DSY 3

Table 6 – 2020's Extreme DSY2&3 Simulation Results, Sample units (CIBSE TM59:2017)			
Weather file	**Criteria A (%)**	**Criteria B (hr)**	**Mitigation required to pass**
2020's DSY 2	All Pass	All Bedrooms Fail	0.2 Low G glazing throughout Set back windows 300mm Bedroom purge ventilation 10ACH
2020's DSY 3	Almost all Pass	All Bedrooms Fail	All mitigation measures and potential mechanical cooling.

Providing the above mitigation measures are incorporated, CIBSE compliance with criteria A and B can be achieved for extreme weather scenarios DSY2 and DSY3.

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9. Conclusions

A detailed dynamic thermal model of the proposed *Axis House, Harlington,* has been produced using Design Builder Energy Plus. The model has been used to simulate a selection of the highest-risk flats within the proposed development.

The objective of the simulation is to determine if the building satisfies the requirements of the thermal comfort metrics CIBSE TM59:2017. A full set of results of the simulation model are illustrated in section 7 of this report.

9.1   Results Summary

Results show that based on a sample of the worst-case apartments compliance with the overheating criteria as defined by CIBSE TM59:2017, weather file 2020's DSY1, can be achieved.

9.2   Advisory Recommendations

All high-risk units can comply based on the ventilation strategy, and proposed mitigation measures incorporated into the design. However advisory recommendations have been made to future-proof the building and reduce any overheating risk for DSY 2 and DSY 3 extreme weather scenarios.

Due to the acoustic report requiring windows to be closed at all times, all bedrooms will need an alternative form of ventilation, and increase ventilation to top floor Living/Kitchens to reduce the overheating risk.

- **Lowest floor – Additional mechanical purge ventilation >4ACH to all bedrooms**
- **Mid floors – Additional mechanical purge ventilation >6ACH to all bedrooms**
- **Top floor – Additional mechanical purge ventilation >6ACH to all bedrooms & Living/kitchens.**

Table 1 – 2020's DSY 1 Simulation Results, Sample units (CIBSE TM59:2017)			
House Type / Plot	**Criteria A (%)**	**Criteria B (hr)**	**Pass / Fail**
Lowest Floor – 1st Floor, Apartment 02	Pass	Pass	**Pass**
Lowest Floor – 1st Floor, Apartment 04	Pass	Pass	**Pass**
Lowest Floor – 1st Floor, Apartment 10	Pass	Pass	**Pass**
Mid Floor – 4th Floor, Apartment 32	Pass	Pass	**Pass**
Mid Floor – 4th Floor, Apartment 34	Pass	Pass	**Pass**
Mid Floor – 4th Floor, Apartment 40	Pass	Pass	**Pass**
Top Floor - 6th Floor, Apartment 52	Pass	Pass	**Pass**
Top Floor - 6th Floor, Apartment 53	Pass	Pass	**Pass**
Top Floor - 6th Floor, Apartment 54	Pass	Pass	**Pass**
Top Floor - 6th Floor, Apartment 59	Pass	Pass	**Pass**
Top Floor - 6th Floor, Apartment 60	Pass	Pass	**Pass**

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10. Appendix

10.1 Occupancy and Equipment gain Description

Data source CIBSE TM59: Design methodology for the assessment of overheating risk in homes.

Supplementary information on profile development

Table 2 Occupancy and equipment gain descriptions

Unit/ room type	Occupancy	Equipment load
Studio	2 people at all times	Peak load of 450 W from 6 pm to 8 pm*. 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and 10 pm to 12 pm Base load of 85 W for the rest of the day
1-bedroom apartment: living room/kitchen	1 person from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
1-bedroom apartment: living room	1 person at 75% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 150 W from 6 pm to 10 pm 60 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 35 W for the rest of the day
1-bedroom apartment: kitchen	1 person at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 300 W from 6 pm to 8 pm Base load of 50 W for the rest of the day
2-bedroom apartment: living room/kitchen	2 people from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
2-bedroom apartment: living room	2 people at 75% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 150 W from 6 pm to 10 pm 60 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 35 W for the rest of the day
2-bedroom apartment: kitchen	2 people at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 300 W from 6 pm to 8 pm Base load of 50 W for the rest of the day
3-bedroom apartment: living room/kitchen	3 people from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
3-bedroom apartment: living room	3 people at 5% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 150 W from 6 pm to 10 pm 60 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 35 W for the rest of the day
3-bedroom apartment: kitchen	3 people at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 300 W from 6 pm to 8 pm base load of 50 W for the rest of the day
Double bedroom	2 people at 70% gains from 11 pm to 8 am 2 people at full gains from 8 am to 9 am and from 10 pm to 11 pm 1 person at full gain in the bedroom from 9 am to 10 pm	Peak load of 80 W from 8 am to 11 pm Base load of 10 W during the sleeping hours
Single bedroom (too small to accommodate double bed)	1 person at 70% gains from 11 pm to 8 am 1 person at full gains from 8 am to 11 pm	Peak load of 80 W from 8 am to 11 pm Base load of 10 W during sleeping hours
Communal corridors	Assumed to be zero	Pipework heat loss only; see section 3.1 above

* All times in GMT

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10.2 Example low-G Glazing specification

Glass Range
for Architects
and Specifiers

Technical Information Datasheet

Table 1 – Performance Data Pilkington **Insulight**™ Sun with 6 mm Pilkington **Optifloat**™ Clear Inner Pane.

Product Description	Light		Solar Radiant Heat				Shading Coefficient			U$_g$-value (W/m²K)	Unit Maximum Sizes†		
Outer Pane	Transmittance	Reflectance	Direct Transmittance	Reflectance	Absorptance	Total Transmittance (g-value)	Short Wavelength	Long Wavelength	Total	Argon (90%)	Annealed (mm)	Toughened (mm)	Descriptive Code
Pilkington **Insulight**™ Sun (with 6 mm Pilkington **Optifloat**™ Clear inner pane and 16 mm 90% argon filled cavity – unless otherwise indicated)													
Pilkington **Suncool**™													
6 mm 70/40	0.70	0.10	0.38	0.28	0.34	0.42	0.44	0.04	0.48	1.1	2500 x 1500	4000 x 2000	70/42
6 mm 70/35	0.69	0.16	0.34	0.35	0.31	0.37	0.39	0.04	0.43	1.0	2500 x 1500	4000 x 2000	69/37
6 mm 66/33	0.65	0.16	0.32	0.35	0.33	0.36	0.37	0.04	0.41	1.0	2500 x 1500	4000 x 2000	65/36
6 mm 60/31	0.59	0.11	0.28	0.32	0.40	0.32	0.32	0.05	0.37	1.0	2500 x 1500	4000 x 2000	59/32
6 mm Silver 50/30	0.49	0.39	0.28	0.43	0.29	0.31	0.32	0.04	0.36	1.0	2500 x 1500	4000 x 2000	49/31
6 mm Blue 50/27	0.49	0.19	0.25	0.35	0.40	0.28	0.29	0.03	0.32	1.1	2500 x 1500	4000 x 2000	49/28
6 mm 50/25	0.49	0.18	0.24	0.33	0.43	0.27	0.28	0.03	0.31	1.0	2500 x 1500	4000 x 2000	49/27
6 mm 40/22	0.39	0.20	0.19	0.35	0.46	0.23	0.22	0.04	0.26	1.1	2500 x 1500	4000 x 2000	39/23
6 mm 30/17	0.30	0.25	0.15	0.37	0.48	0.18	0.17	0.04	0.21	1.1	2500 x 1500	4000 x 2000	30/18
Pilkington **Suncool**™ OW (with 6 mm Pilkington **Optiwhite**™ inner pane and 16 mm 90% argon filled cavity)													
6 mm 70/40	0.73	0.10	0.44	0.39	0.17	0.45	0.51	0.01	0.52	1.1	2500 x 1500	4000 x 2000	73/45
6 mm 70/35	0.73	0.16	0.38	0.47	0.15	0.39	0.44	0.01	0.45	1.0	2500 x 1500	4000 x 2000	73/39
6 mm 66/33	0.61	0.17	0.36	0.47	0.17	0.37	0.41	0.02	0.43	1.0	2500 x 1500	4000 x 2000	69/37
6 mm Blue 50/27	0.52	0.20	0.28	0.46	0.26	0.29	0.32	0.01	0.33	1.1	2500 x 1500	4000 x 2000	52/29
6 mm 50/25	0.52	0.19	0.27	0.44	0.29	0.28	0.31	0.01	0.32	1.0	2500 x 1500	4000 x 2000	52/28
6 mm 40/22	0.41	0.21	0.22	0.46	0.32	0.24	0.25	0.03	0.28	1.1	2500 x 1500	4000 x 2000	41/24
Pilkington **Eclipse Advantage**™													
6 mm Clear	0.60	0.29	0.47	0.22	0.31	0.55	0.54	0.09	0.63	1.6	2500 x 1500	4000 x 2000	60/55
6 mm Blue-Green	0.51	0.21	0.31	0.13	0.56	0.37	0.36	0.07	0.43	1.6	2500 x 1500	4000 x 2000	51/37
6 mm Bronze	0.34	0.13	0.28	0.11	0.61	0.35	0.32	0.08	0.40	1.6	2500 x 1500	4000 x 2000	34/35
6 mm Grey	0.29	0.10	0.24	0.09	0.67	0.31	0.28	0.08	0.36	1.6	2500 x 1500	4000 x 2000	29/31
6 mm EverGreen	0.43	0.17	0.22	0.10	0.68	0.27	0.25	0.06	0.31	1.6	2500 x 1500	4000 x 2000	43/27
6 mm Arctic Blue	0.35	0.13	0.21	0.09	0.70	0.27	0.24	0.07	0.31	1.6	2500 x 1500	4000 x 2000	35/27
6 mm Pilkington **Solar-E**™	0.53	0.11	0.38	0.10	0.52	0.45	0.44	0.08	0.52	1.5	2500 x 1500	4000 x 2000	53/45

The above performance data has been determined in accordance with BS EN 410 and BS EN 673.

† Maximum unit sizes are for guidance only. These are not recommended for glazing sizes. For further information please consult with the processor.

For other glass combinations, cavities, gases and thicknesses please visit Pilkington Spectrum at www.pilkington.co.uk /spectrum

For performance data relating to other Pilkington products please refer to our product specific literature.

The primary performance data (e.g. U value, g value, etc.) for Pilkington **Suncool**™ Pro T is the same as that of the corresponding annealed Pilkington **Suncool**™ but there may be slight differences in the secondary performance data (e.g. solar reflectance). Full performance data for Pilkington **Suncool**™ Pro T is available via www.pilkington.co.uk/spectrum

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