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Green

THERMAL COMFORT REPORT

179-181 High Street Hampton Hill Retail Area

On behalf of
Clive Chapman Architects

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Job Ref: 5388

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CONTENTS

1.0 Introduction

1.1 This report provides results of the overheating analysis performed by Metropolis Green in order to assess performance of the proposed retail space at 179-181 High Street Hampton Hill, Hampton against CIBSE TM52 standards.

1.2 Dynamic simulation modelling (DSM) of the building has been carried out to appraise the thermal comfort likely to be experienced, based on scheme design and the passive and active measures introduced to help regulate temperatures in the warmer months. The predicted internal temperature was simulated considering all aspects of occupancy, solar gain, and predicted internal heat gains.

2.0 CIBSE TM52 Requirements

2.1 Overheating is assessed using CIBSE TM52. The following three criteria, taken together, provide a robust yet balanced assessment of the risk of overheating of buildings in the UK and Europe. A room or building that fails any two of the three criteria is classed as overheating.

2.2 CIBSE recommends that new buildings, major refurbishments and adaptation strategies should conform to Category II in BS EN 15251 (BSI, 2007), which sets a maximum acceptable temperature of 3 °C above the comfort temperature for buildings in free-running mode. For such buildings the maximum acceptable temperature (Tmax) can be calculated from the running mean of the outdoor temperature (Trm) using the formula:

$T_{max} = 0.33\ T_{rm} + 21.8$

The criteria are all defined in terms of ΔT the difference between the actual operative temperature in the room at any time (Top) and Tmax the limiting maximum acceptable temperature. ΔT is calculated as:

$\Delta T = T_{op} - T_{max}$

- ***Criterion 1: Hours of Exceedence (He):***
  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).
  The number of hours (He) during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of occupied hours.

- ***Criterion 2: Daily Weighted Exceedence (We):***
  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 temperature rise and its duration. This criterion sets a daily limit for acceptability.
  The weighted exceedence (We) shall be less than or equal to 6 in any one day where:

  $We = (\sum he) \times WF = (he0 \times 0) + (he1 \times 1) + (he2 \times 2) + (he3 \times 3)$

  where the weighting factor wf = 0 if ΔT ≤ 0, otherwise
  WF = ΔT, and hey is the time (h) when WF = y

- ***Criterion 3: Upper Limit Temperature (Tupp)***
  The third criterion sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable.
  To set an absolute maximum value for the indoor operative temperature the value of ΔT shall not exceed 4 K. The absolute maximum value of the indoor operative temperature is expressed as Tupp

  $Tupp = Tmax + 4$

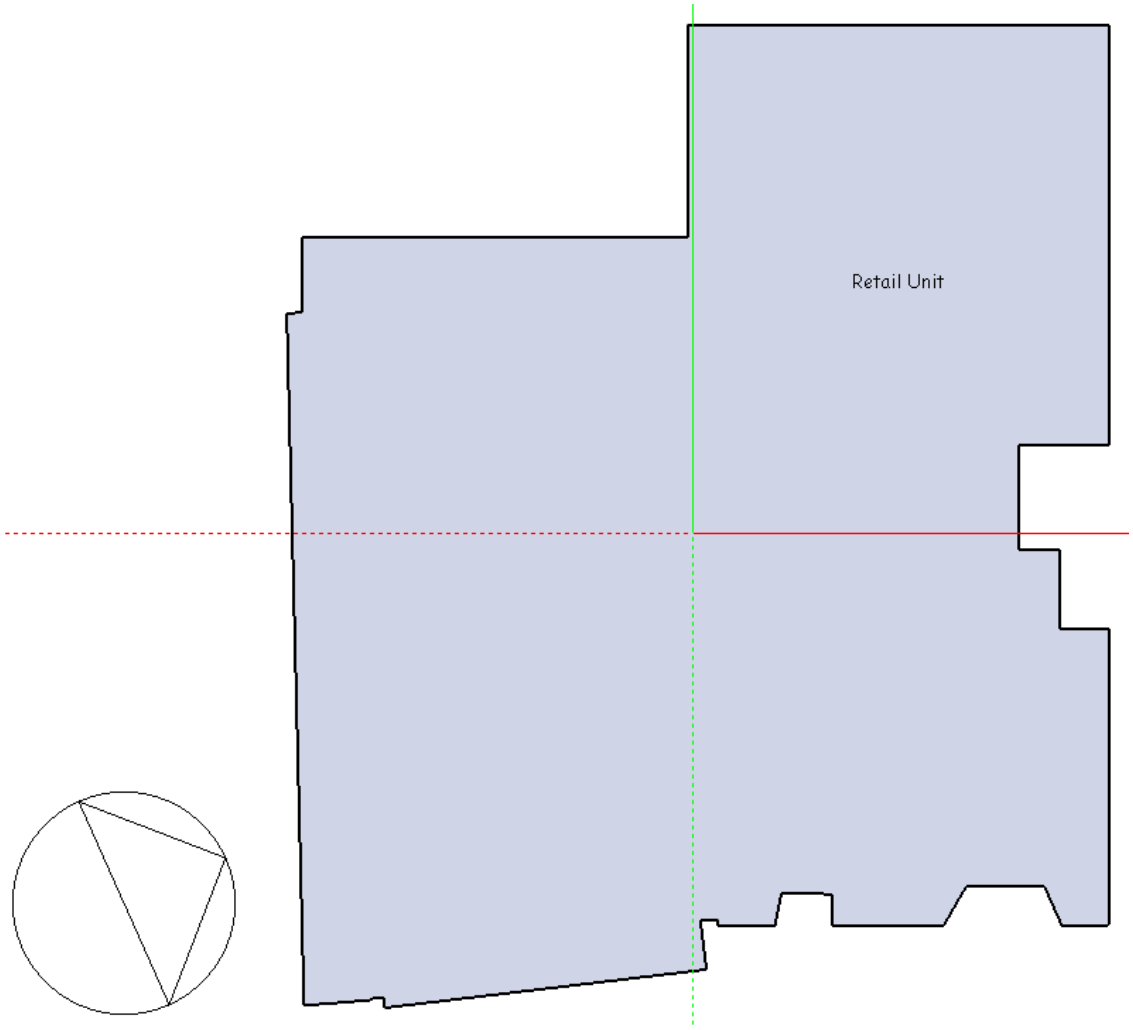
2.3 In order to demonstrate that the proposed retail space is not at risk of overheating, two of the three criteria must be met.

2.4 CIBSE London DSY 2050MH (GBR_London_2050s_MediumHigh.037720_CIBSE-DSY) weather data has been used in the calculations.

3.0 Dynamic Simulation Model

3.1 The analysis was carried out using DesignBuilder 4.2.0.054 - EnergyPlus v8.1 engine.

3.2 The 3D model is based on the architectural drawings and other specifications.



4.0 Model Inputs and Methodology

4.1 The dynamic simulation model created for the proposed 179-181 High Street Hampton Hill is as shown in Figure 1 below.

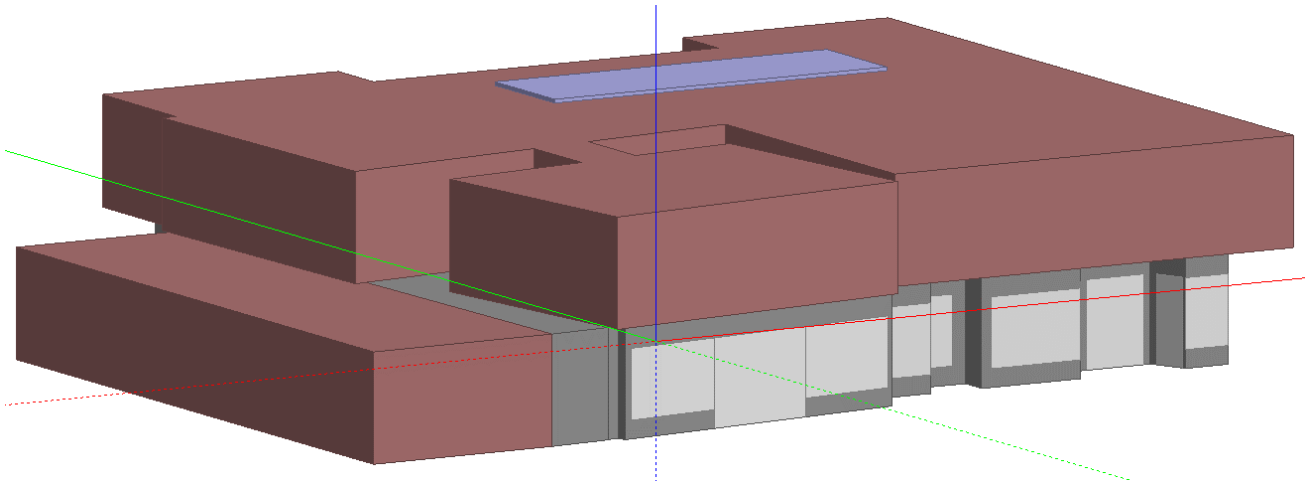


Figure 1: Axonometric view

4.2 The building fabric parameters applied are as follows;

Building Elements	U Values
Roof	0.18 W/m^{2}K
External Wall	0.22 W/m^{2}K
Ground Floor	0.15 W/m^{2}K
Windows and Openings	1.5 W/m^{2}K
Window g-value	0.63
Mechanical Ventilation Rate	3ac/h
Infiltration rate	0.5ac/h

4.3 Internal design conditions applied in the model are as follows;

Rooms Analysed	Mechanical Ventilation rate (with night time purge)	Internal gains		
		Occupancy	Lighting	Equipment
Retail unit	3ac/h	8.6 m^2/p	5 W/m^2	5.20 w/m^2

4.4 Figures 2 to 5 provide an illustrative description of the proposed 179-181 High Street Hampton Hill.

Figure 2 – West Elevation

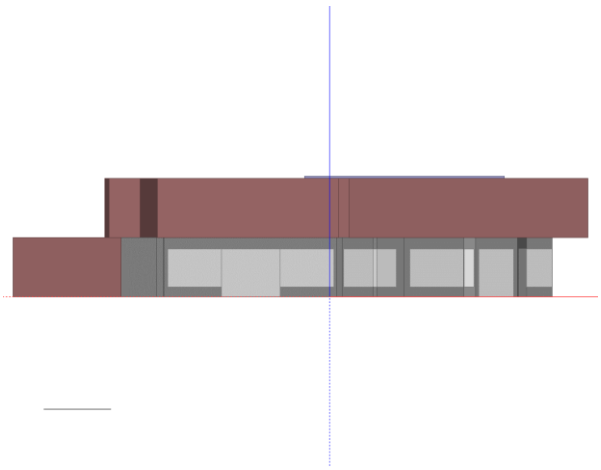


Figure 3 – East Elevation

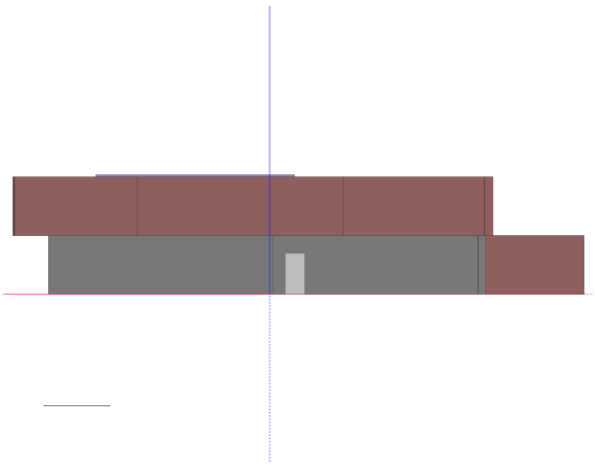


Figure 4 – South Elevation

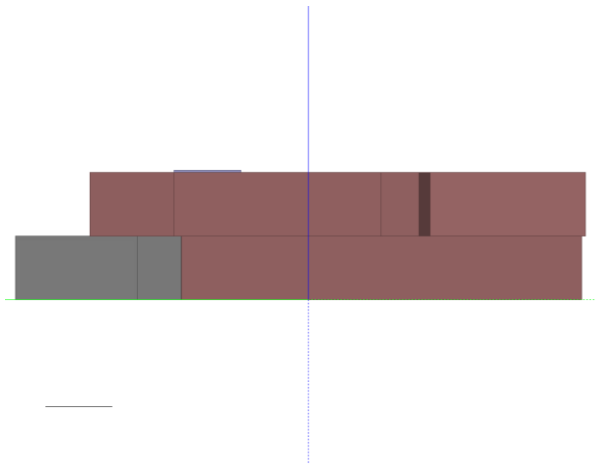
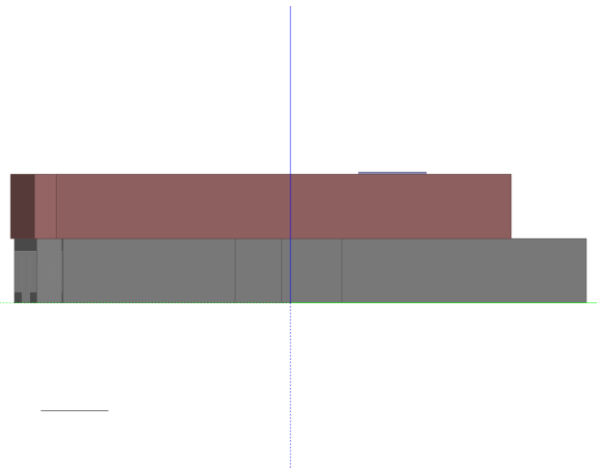


Figure 5 – North Elevation



5.0 The Cooling Hierarchy

5.1 The Cooling Hierarchy[1] has been followed to ensure that suitable passive design measures have been incorporated into the design prior to the inclusion of any active cooling.

Minimising internal heat generation through energy efficient design

5.2 Stage one of the Cooling Hierarchy is to minimise internal heat generation through energy efficient design. Low energy lighting has been specified with a very high luminaire efficacy of 85 lm/cW.

5.3 The modelling accounts for retail usage, which has higher internal gains, as a result of occupants and equipment. These internal gains cannot be controlled through the design as they relate to occupant patterns and the equipment which may be included as part of the fit-out process.

5.4 Energy efficient equipment such as mechanical ventilation supply and extract fans with highly efficiency heat recovery system has been specified and detailed in the mechanical ventilation section.

5.5 Energy efficient lighting will be utilised throughout the building, to minimise energy demand and reduce internal heat gains.

Reducing the amount of heat entering the building in summer

5.6 Stage two of the hierarchy is to reduce the amount of heat entering the building in summer through passive measures such as glazing and insulation.

5.7 Windows with G-values of 0.63 have been used to reduce the amount of solar energy transmitted through the glass. In addition, high performing windows with U-values of 1.5W/m^2K has been specified to the display windows which provides a significant contribution to the performance of this space as display windows do not have a limiting parameter according to Part L of the Building regulations.

5.8 In addition, it has not been possible to include shading devices such as internal/external blinds or shutters due to the importance of the retail display windows.

Passive Ventilation

5.9 Stage three of the hierarchy considers passive ventilation as the preferred means for the removal of heat build-up from the building.

5.10 Passive ventilation through openable windows is not suited to the retail units, due to its high quality design specification.

Mechanical Ventilation

5.11 Finally, stage four is to consider the inclusion of mechanical ventilation. To meet the ventilation requirements of the occupants, highly efficient Mechanical Ventilation with Heat Recovery (MVHR), has been provided for retail unit. At this early stage, the specification for the MVHR units are:

- **Retail unit –** Mechanical ventilation with heat recovery (3ac/h)

[1] GLA Guidance on Preparing Energy Assessments March 2016

5.12 In addition, night time purge ventilation will be included to ensure that any heat build-up during the day in the warmer months can be efficiently expelled from the building during the night when temperatures drop.

5.13 The retail space has therefore followed the Cooling Hierarchy and as shown in the next section, no overheating occurs in the proposed retail space and is therefore in compliance with CIBSE TM52 Overheating criteria.

5.14 However, due to the type and use of the proposed retail space with a likely food section, the demand for cooling will be an imperative requirement for controlling and maintaining the indoor environment as opposed to mitigating overheating due to internal or solar gains.

6.0 Results of Overheating Analysis

6.1 The results of the overheating calculations are set out in the following tables and graphs.

retail	
Criterion 1	
H_e Percentage:	2.18%
Criterion:	3%
Result:	**Pass**
Criterion 2	
Maximum W_e in a day	10 K
Criterion:	6 K
Result:	**Fail**
Criterion 3	
Maximum ΔT:	2 K
Criterion:	4 K
Result:	**Pass**
Overall compliance	**Pass**