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Planning Statement
Overheating Analysis
Barrie House

Document information

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Introduction

Eight Associates has been appointed to undertake an overheating analysis of the Barrie House scheme to provide design stage guidance and maximise occupant comfort levels. Consequently, thermal modelling has been undertaken to demonstrate compliance with CIBSE TM52 and TM59 requirements. The current proposal is to minimise overheating risk by following the Cooling Hierarchy.

Building Summary

The project consists of the development of a 5-storey residential block to create 9 residential units. The scheme is located in the London Borough of Camden and has a total gross internal area of approximately 750 m^2.

Methodology

The methodology used within this report has been to establish the thermal comfort levels in the occupied spaces through using dynamic simulation modelling and respond with suitable passive design measures to mitigate solar gains, provide adequate ventilation and increase thermal mass. National regulations have set high standards and numerous iterations have been undertaken to determine suitable fabric improvements. All assumptions in the modelling are provided in the model inputs section of this report.

Please note that the climate change scenario has not been included in this report. External temperatures are likely to increase because of climate change. The consequences of increased summer peak temperatures could be non-compliance with the thermal comfort recommendations unless further measures were implemented.

Criteria for defining overheating

According to the CIBSE TM 52 – The limits of thermal comfort: avoiding overheating in European buildings (2013) and CIBSE Guide A – Environmental Design (2015), to reduce the risk of overheating the space has to comply with at least two of the following three criteria:

a. 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).
b. 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.
c. The third criterion sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable.

According to the CIBSE TM59: 2017 – Design methodology for the assessment of overheating risk in homes, to reduce the risk of overheating the space has to comply with the following criteria:

a. For living rooms, kitchen and bedrooms: the number of hours 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 (Same as Criterion 1 of TM52).
d. 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 the annual hours (1% of the annual hours between 22:00 and 07:00, equivalent to 32 hours).

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Model Input
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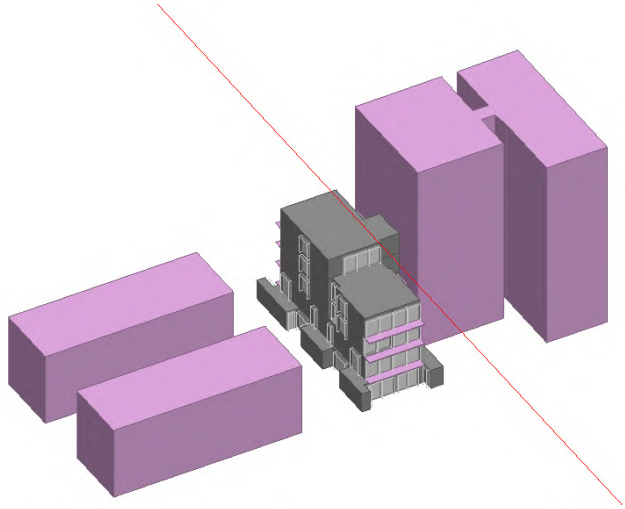
Simulation Software

An overheating analysis has been undertaken using Dynamic Simulation Modelling, Design Builder has been employed for this. Design Builder is a DCLG approved simulation environment that complies with the requirements of CIBSE Guide A. A screenshot of the model is shown below.



Weather File

The CIBSE Design Summer Year (DSY1) Current Series, London Heathrow, has been used for the purposes of this report.

Building Fabric U-Values

Element	Proposed U-value (W/m^{2}K)
External walls	0.16
Ground floors	0.10
Exposed floors	0.10
Roofs	0.12
Windows (g-value of 0.55)	1.20

Internal Gains

Typical hours based, according to TM 59 and CIBSE Guide A on the relative activity for class use, on weekdays and weekends throughout the year have been specified for lighting, equipment and occupancy.

Space	Occupancy people/m^2	Lighting W/m^2	Small power W/m^2
Bedroom	0.15	2	5
Kitchen / Living room	0.075	2	11

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Passive Design Measure
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Cooling Hierarchy	Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy: 1. Minimise internal heat generation through energy efficient design; 2. Reduce the amount of heat entering a building in summer through shading, albedo, fenestration, insulation and green roofs and walls; 3. Manage the heat within the building through exposed internal thermal mass and high ceilings; 4. Passive ventilation; 5. Mechanical ventilation; 6. Active cooling systems (ensuring they are the lowest carbon options).
Cooling Strategy	The cooling strategy is to implement energy efficient lighting and appliances to reduce internal heat gains; create a super-insulated fabric with internal shading devices and solar control glazing to keep the heat out.
Windows	Glazing will be a crucial aspect to ensure thermal comfort of the occupied spaces. In order to minimise solar gains, and consequently cooling demand, windows with a solar factor of 0.55 have been modelled for every glazed area.
Shading	Internal shade roll (medium opaque) have been modelled to reduce solar gains. This system will operate using inside air temperature controls, shadings will be activated when the inside temperature exceeds the threshold temperature of 18°C. Overhangs (balconies) have been specified as per architectural drawings.
Mechanical Ventilation Rates	Mechanical ventilation with heat recovery has been specified. The system has to provide at least an air flow of 0.3 l/s/m^2 as per Part F.
Natural Ventilation Rates	Natural ventilation through openable windows has been adopted for this scheme. The ventilation rate has been calculated by the software according to the percentage of openable windows for each space and the varying environmental conditions throughout the year. This percentage has been estimated as 50% for all areas, except the living area of flat 9, which has been modelled with a percentage of 100%. Moreover, the scheme has been modelled with a discharge coefficient rate of 0.65 and a wind factor of 1. The windows are to open when the internal temperature is above 22°C and when the rooms are occupied.

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Summary of results
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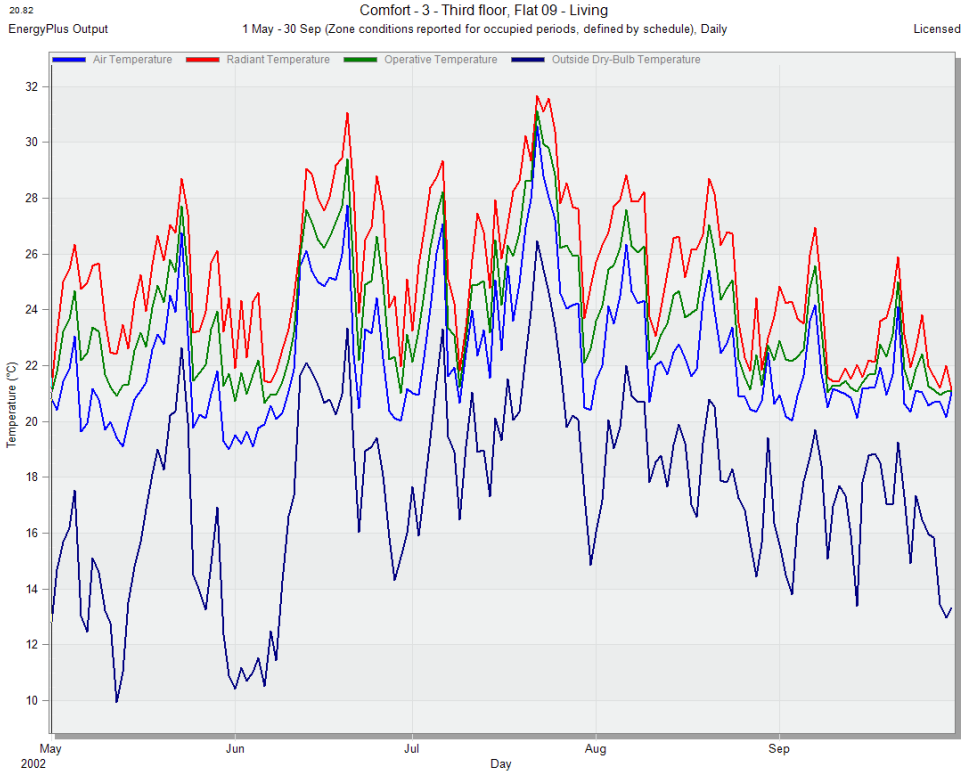
Results

The graphs below present the outdoor, indoor mean air, indoor mean radiant and operative temperature for a sample of the worst performing rooms. A table confirming the results for all rooms is shown in Appendix A.

In summary, all rooms meet TM52 and TM59 requirements.

Flat 9, Living room / kitchen



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Summary of results
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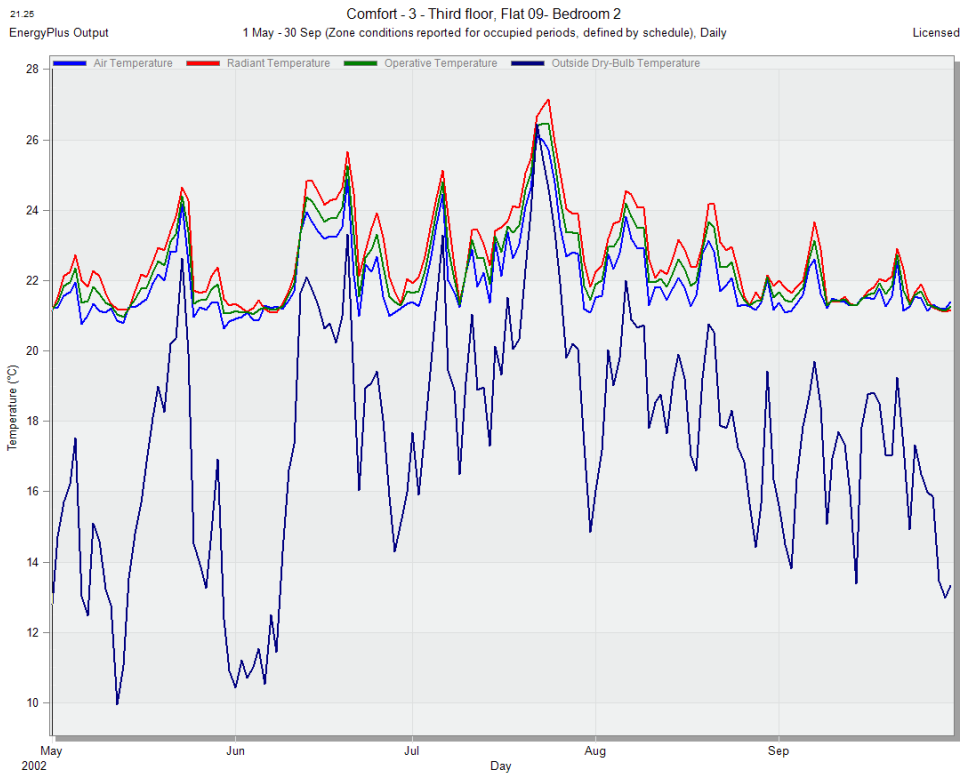
Flat 9,
Bedroom 2



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Conclusions
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Conclusions

The proposal has responded to CIBSE TM52 and TM59 requirements relating to overheating. The report has set out how the occupied spaces perform against strict thermal comfort standards for overheating. The scheme has implemented passive design measures and the modelling results indicate that the scheme is compliant with the overheating requirements as set out in CIBSE TM52 and TM59.

The proposal maximises passive design measures by responding to the local context in the following ways:

- Energy efficient lighting and appliances have been recommended to reduce internal heat gains;
- The building fabric will be insulated over and above the standards set out by Building Regulations and reduced solar gains from a glazing solar factor of 0.55 will help to keep heat out of the building;
- Overhangs (balconies) as per architectural drawings;
- Internal shading devices to further limit solar gains;
- Mechanical ventilation with heat recovery and summer bypass to provide fresh air and purging of heat;
- Natural ventilation to supply fresh air to the building through openable windows (as per ventilation rates section of this report).

Note that the analysis was performed assuming that opening windows were controlled based on the level of occupancy and the operative indoor temperature of the space. To achieve the thermal comfort levels shown in this report the level of occupant control for the opening windows would need to be optimum i.e. fully responsive to indoor temperature.

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Appendix A
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Appendix A	Appendix A – Result tables

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Appendix A - Results - DSY1

Barrie House

Block / Floor / Room / Unit	Flat	TM52				TM59		
		Criterion 1 (%)	Criterion 2 (K.hr)	Criterion 3 (hr)	Compliance	Criterion 1 (%)	Criterion 4 (hr)	Compliance
GroundFloor	Flat01-Living	1.9	11	0	Pass	1.9	N/A	Pass
GroundFloor	Flat02-Living	1.6	12	0	Pass	1.6	N/A	Pass
GroundFloor	Flat03-Living	0.8	10	0	Pass	0.8	N/A	Pass
GroundFloor	Flat04-BedroomIII	0.0	0	0	Pass	0.0	10.5	Pass
GroundFloor	Flat04-Living	0.7	9	0	Pass	0.7	N/A	Pass
LowerGroundFloor	Flat01-BedroomII	1.0	8	0	Pass	1.0	10.25	Pass
LowerGroundFloor	Flat02-BedroomII	0.0	0	0	Pass	0.0	6.25	Pass
LowerGroundFloor	Flat03-BedroomII	0.0	0	0	Pass	0.0	4.75	Pass
LowerGroundFloor	Flat03-BedroomIII	0.0	1	0	Pass	0.0	10	Pass
LowerGroundFloor	Flat04-BedroomII	0.0	0	0	Pass	0.0	9.25	Pass
LowerGroundFloor	Flt01-MstrsBdrm	0.0	0	0	Pass	0.0	14.25	Pass
LowerGroundFloor	Flt02-MstrsBdrm	1.2	11	0	Pass	1.2	9.25	Pass
LowerGroundFloor	Flt03-MstrsBdrm	0.2	6	0	Pass	0.2	7.75	Pass
LowerGroundFloor	Flt04-MstrsBdrm	0.2	5	0	Pass	0.2	9	Pass
FirstFloor	Flat05-BedroomII	0.0	0	0	Pass	0.0	9.5	Pass
FirstFloor	Flat05-Living	2.1	18	0	Pass	2.1	N/A	Pass
FirstFloor	Flat06-Living	2.1	14	0	Pass	2.1	N/A	Pass
FirstFloor	Flt05-MstrsBdrm	0.0	0	0	Pass	0.0	11.5	Pass
FirstFloor	Flt06-MstrsBdrm	0.0	0	0	Pass	0.0	11	Pass
SecondFloor	Flat07-BedroomII	0.0	0	0	Pass	0.0	8.25	Pass
SecondFloor	Flat07-Living	2.5	19	0	Pass	2.5	N/A	Pass
SecondFloor	Flat08-Living	2.7	19	0	Pass	2.7	N/A	Pass
SecondFloor	Flt07-MstrsBdrm	0.0	0	0	Pass	0.0	11.25	Pass
SecondFloor	Flt08-MstrsBdrm	0.1	4	0	Pass	0.1	12.5	Pass
ThirdFloor	Flat09-Bedroom1	0.0	0	0	Pass	0.0	12.75	Pass
ThirdFloor	Flat09-Bedroom2	0.0	0	0	Pass	0.0	9.5	Pass
ThirdFloor	Flat09-Living	2.4	22	0	Pass	2.4	N/A	Pass
Total Rooms		27				27		
Pass		27			100.0%	27		100.0%
Fail		0			0.0%	0		0.0%