

Dynamic Simulation of Ground Floor Dwelling
At
233 London Road
Reading

Report prepared by

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1.0 Introduction

HIBEC have undertaken a Dynamic Thermal Simulation overheating analysis of the ground floor dwelling, at 233 London Road, Reading.

The thermal model has been run to demonstrate that the dwellings design and services strategy can deliver thermal comfort levels in "occupied spaces" in accordance with the criteria set out in Approved Document Part O (based on TM59). In particular, that internal summer operative temperature ranges will be in line with the recommended comfort criteria as detailed in TM59. In particular, the occupied areas internal summer temperatures do not exceed a "threshold" temperature for more than a reasonable number of hours per year when the dwelling is tested against the CIBSE 2020 Design Summer Year.

Also, that the "summer peak" temperatures are not excessive nor do the areas overheating above a maximum temperature due to solar and other gains.

2.0 Design Data

The dwelling has been modelled as a mixed ventilation dwelling, using the following construction data.

Construction U values

External Cavity Walls	0.26	W/m ² K
Flat Roof	0.16	W/m ² K
Ground Floor	0.18	W/m ² K
Glazing	1.60	W/m ² K
Solid Door	1.60	W/m ² K

Glazing

Light Transmittance 70%

Solar Energy Transmittance (G Value) 0.52 assumed

As the windows show the top half opening, it is assumed that the windows will be sash style to increase ventilation rates.

Internal Gains

The Internal gains have been based on CIBSE TM59 recommendations and are as follows:

Occupancy Levels:

The occupancy time of the dwelling and for each 'occupied zone' has been set as per the TM59 Occupancy gains and profiles recommendations.

Lighting gains

The lighting gains for all zones has been assumed at 2W/m² during 18.00-23.00.

Equipment gains:

All Equipment gains and profiles have been set as per the TM59 recommendations.

Ventilation:

When a room is occupied during the day (8am to 11pm), openings have been modelled to do all the following (as covered in ADO clause 2.6.)

- i. Start to open when the internal temperature exceeds 22°C.
- ii. Be fully open when the internal temperature exceeds 26°C.
- iii. Start to close when the internal temperature falls below 26°C.
- iv. Be fully closed when the internal temperature falls below 22°C.

When a ground floor or easily accessible room is unoccupied, both of the following apply.

- i. In the day, windows, patio doors and balcony doors have been modelled as open.
- ii. 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.

NB. All unoccupied areas have been modelled with lighting gains only as these areas may affect adjacent occupied areas. There are no equipment or occupancy gains in these unoccupied zones.

Air permeability is assumed to be 5.00 m³/h.m².

3.0 Strategies Considered

Approved Document Part O (clause 2.7) requires solar gains to be limited by the following methods.

- a. Fixed shading devices, comprising any of the following.
 - i. Shutters.
 - ii. External blinds.
 - iii. Overhangs.
 - iv. Awnings.
- b. Glazing design, involving any of the following solutions.
 - i. Size.
 - ii. Orientation.
 - iii. g-value.
 - iv. Depth of the window reveal.
- c. dwelling design – for example, the placement of balconies.
- d. Shading provided by adjacent permanent buildings, structures, or landscaping.

Internal blinds/curtains and external foliage have not been modelled (clauses 2.8 & 2.9)

The design of the dwelling must also consider strategies to remove excess heat (as per clause 2.10), this is achieved via opening windows. By using this strategy, the requirement O1 has been satisfied (as per clause 2.11).

Additional considerations should also be made with regards to noise, pollution, security, and protection from falling (section 3).

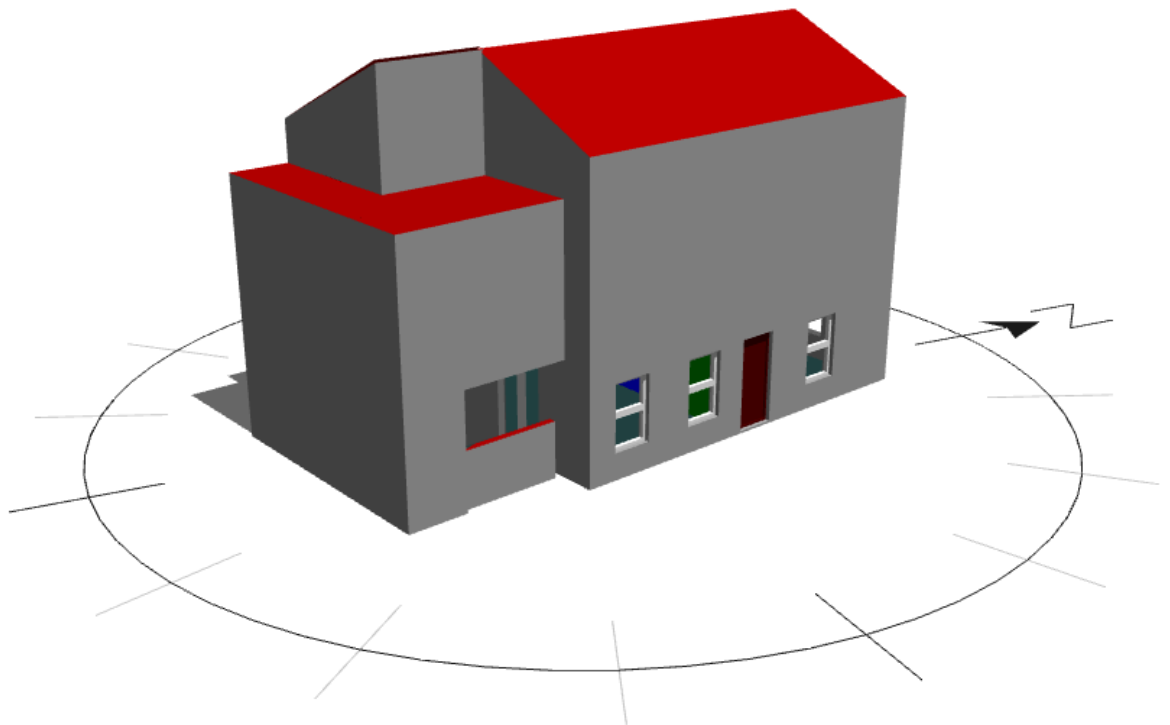
With regards to protection from falling, consideration should be made to ensure bedroom windowsill heights are sufficient to limit the risk of occupant falling from height.

Also, window sizes are such that the openable part of the window limits the distance of the window handle to the inside face of the wall to no more than 650mm when fully open. Suitable guarding must also be in place to lower the risk of falling.

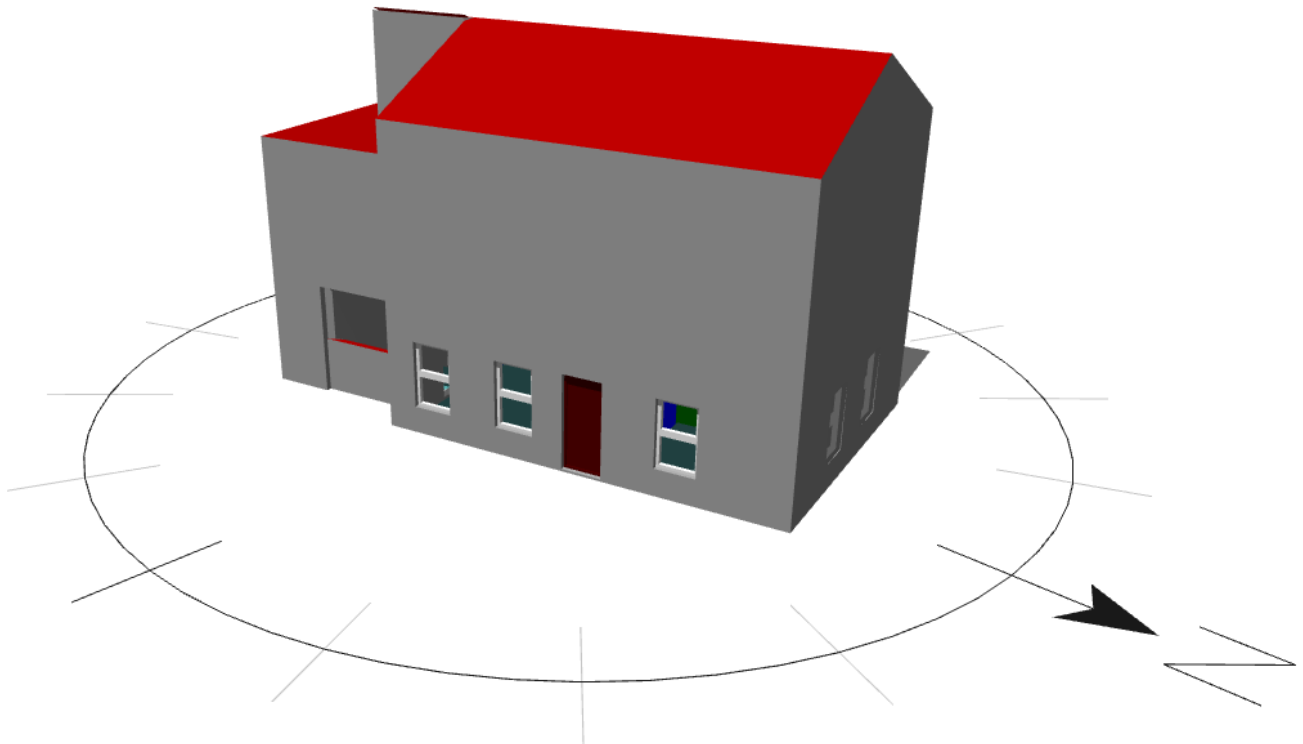
Internal Doors are open during the day and closed between 11pm and 8am.

4.0 The Models

The 3D Model was developed using EDSL TAS Version 9.5.6 which is approved by CIBSE AM11 and has been developed in accordance with the architects' drawings and design data issued. Please note that surrounding buildings have not been modelled due to not casting shadows on any windows. Windows are assumed to be sash throughout to allow a larger openable area.



Ground Floor Dwelling 3D Model (Southeast Elevation June 28th 12pm)



Ground Floor Dwelling 3D Model (Northeast Elevation June 28th 12pm)

5.0 Simulation Period and Weather Data

The model is based on the operational hours for the dwelling detailed below.

Hours Occupied	Whole Dwelling 24Hrs 7 Days a Week
Simulation Period	Day 1 to Day 365 (Summer: 1 st May to 30 th September)
Weather Data	London Gatwick DSY1-2020 High 50% Percentile – obtained from CIBSE
Reporting Interval	Hourly

The results are an indication of the dwellings likely response to thermal gains based on the information provided for input to the model and CIBSE weather data set for the London Gatwick Region (Design Summer Year).

The simulation has been run to accommodate the operational hours and the results are presented for the entire dwelling.

Each zone modelled and listed in the attached results are based on the above data set and architectural drawings.

6.0 Part O 'TM59' performance criteria for dwellings predominantly naturally ventilated.

The performance standards for summertime overheating in compliance with CIBSE TM59.

- a) For Living rooms, Kitchens, 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 (CIBSE TM52 Criterion 1: Hours of Exceedance).
- b) For Bedrooms Only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10pm to 7am shall not exceed 26°C for more than 1% of the 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).

To show that the proposed dwelling will not suffer overheating both criteria must be met.

7.0 Results

The following results are based on the As Designed specification without any modifications.

Natural Ventilation Overheating Results

Zone Name	Room Use	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Annual Night Occupied Hours for Bedroom	Max Exceedable Night Hours	Criterion 2: Number of Night Hours Exceeding 26 °C for Bedrooms.	Result
Bed 1	Bedroom	3672	110	35	3285	32	283	Fail
Bed 2	Bedroom	3672	110	65	3285	32	300	Fail
Kitchen Living	Living Room / Kitchen	1989	59	23	N/A	N/A	N/A	Pass

*Zone names that have an orange coloured font are bedrooms which do not have 24/7 365 days a year occupancy, as per the TM59 guidance.

The results above show that both bedroom zones fail the criteria.

Adding 22L/s of ventilation to bed 1, and 27L/s of ventilation to bed 2 achieves the following results.

Natural Ventilation Overheating Results

Zone Name	Room Use	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Annual Night Occupied Hours for Bedroom	Max Exceedable Night Hours	Criterion 2: Number of Night Hours Exceeding 26 °C for Bedrooms.	Result
Bed 1	Bedroom	3672	110	4	3285	32	30	Pass
Bed 2	Bedroom	3672	110	10	3285	32	29	Pass
Kitchen Living	Living Room / Kitchen	1989	59	18	N/A	N/A	N/A	Pass

*Zone names that have an orange coloured font are bedrooms which do not have 24/7 365 days a year occupancy, as per the TM59 guidance.

8.0 Conclusion

The results above show that both bedroom zones fail the Part O Criteria.

Adding continuous ventilation to these zones can achieve a pass; below are the flow rates required.

Bed 1 22L/s

Bed 2 27L/s

The As Designed dwelling is assumed to use the following information:

Air permeability: 5.00m³/m²h

Glazing G-Value: 0.52

Mechanical ventilation: Kitchen 14L/s,
 Bedroom 1 22L/s
 Bedroom 2 27L/s
 Bathroom 11L/s

Ground floor windows openable 8AM – 11PM

Internal doors openable 8AM – 11PM

The required ventilation rates fall within specified 'Envirovent' flow rates shown on the "ENV-12129" drawing.