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Domestic Overheating Assessment

1 Hampshire Street
London, NW5 2TE

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CONTENTS

Introduction 4

General 4
The Model 4
Assessment Criteria 4
Geometry 5
Building Fabric 6

Environmental 8

Climate 8
Solar 8

Internal Gains 9

Internal Heat Gains 9
Heat Gain Profiles 10

Heating and Ventilation 13

Infiltration 13
Heating and Cooling 13
Ventilation 13

Results 15

Criterion A 15
Criterion B 16

Conclusions 17

Introduction

Build Energy Ltd was appointed by Redtree Ventures Ltd to undertake a domestic overheating assessment of the proposed residential development at 1 Hampshire Street, London.

General

This report assesses the overheating risk of a number of occupied spaces within the proposed development. Spaces were selected on the basis of their perceived vulnerability to overheating and to give a representative sample of spaces from across the proposals.

The intention is that this study will help inform the design of the scheme, thereby providing the basis for mitigating overheating risk and producing a building that provides comfortable environmental conditions for occupants.

It is important to note that with any modelling exercise there are assumptions and approximations that have to be made. As far as possible, details of all assumptions and approximations are supplied within the report. These were predominantly informed by information provided by the Client and should be reviewed carefully.

All results are based on the output from computer modelling software and should be taken as an indication of the likely final situation, but these conditions cannot be guaranteed.

The Model

The building was modelled using TAS 9.4.1 dynamic thermal modelling software developed by EDSL Ltd. The software was selected and applied in accordance with CIBSE AM11.

The BEEM checklist confirming the compliance of the software with CIBSE AM11 can be found at the following URL:

http://www.edsl.myzen.co.uk/downloads/misc/BEEM%20check%20list%20AM11.pdf

Assessment Criteria

The occupied spaces being assessed are to have their performance measured against the requirements of CIBSE Technical Memorandum 59 ‘Design methodology for the assessment of overheating risk in homes’, which was published in 2017.

The guidance requires that both of the following criteria must be met:

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 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).

Geometry

The following images are taken of the 3D analysis model generated of the building. The model was developed using drawn information provided by Sada Architecture. Figures 1 and 2 below show the analysis model that has been developed, with the areas not being assessed included in grey.

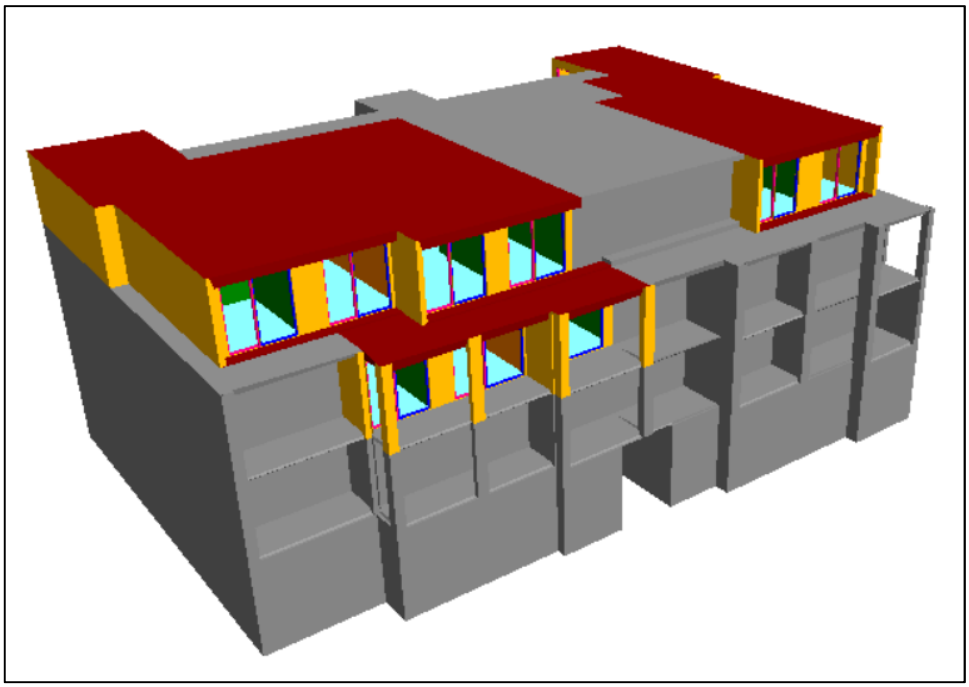


Figure 1: Image of the 3D analysis model generated, viewed from the north

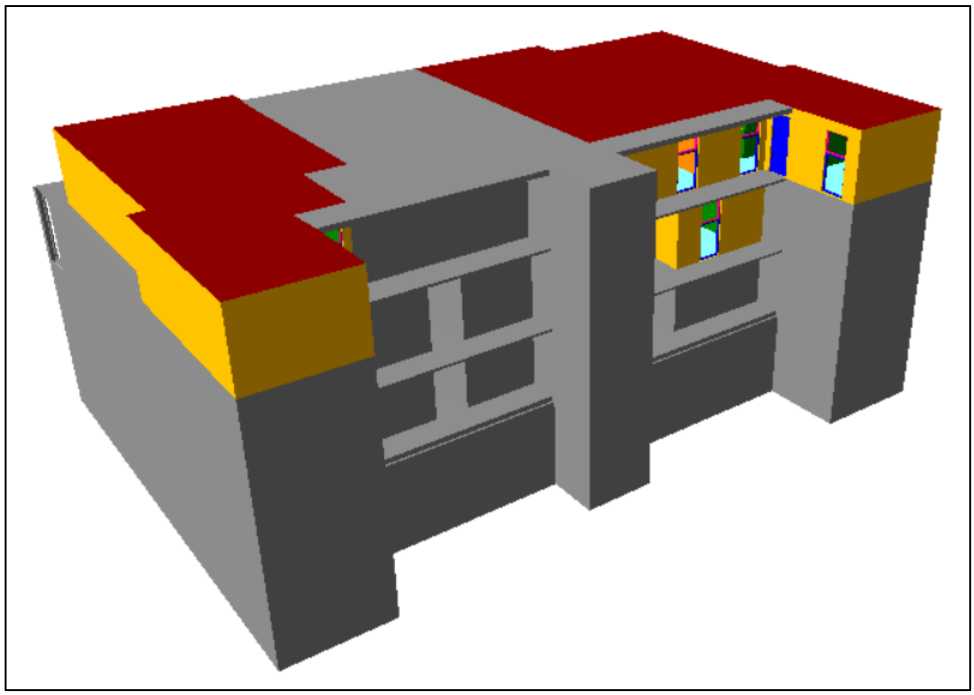


Figure 2: Image of the 3D analysis model generated, viewed from the south

As stipulated in TM59, a sample of units is selected for analysis on the basis of perceived risk of overheating. This is principally based on the amount of glazing present, the location of the unit within the development (top floor is generally more vulnerable), the presence of any shading, the exposure to solar gain, whether the units are single or dual aspect, and also whether there are limited openings.

Based on the above criteria, the following units have been selected:

Unit Reference	Description
Flat 08	Two bedroom second floor apartment with elevations facing south-east and north-west.
Flat 09	One bedroom second floor apartment with elevations facing south-east and north-west.
Flat 13	Three bedroom top floor apartment with elevations facing south-east and north-west.
Flat 14	Two bedroom top floor apartment with elevations facing south-east and north-west.
Flat 16	Three bedroom top floor apartment with elevations facing south-east and north-west.

Table 1

Building Fabric

The levels of fabric performance levels listed in Table 2 are proposed for the scheme.

Heat transfer between assessed spaces and adjacent internal spaces is considered adiabatic (i.e. zero heat transfer).

Building Element	Solar Transmittance g-value	U-value (W/m2.K)	Construction
External Walls	N/A	0.18	Brick exterior with insulated cavity and plasterboard lined block inner
Roof	N/A	0.13	Plasterboard ceiling with insulated concrete roof over
Floor	N/A	0.18	Screeded ground floor slab with insulation under

Windows	0.35	1.4	Double glazed with solar control
Pedestrian Doors	N/A	2.0	Solid insulated doors
Internal Walls	N/A	0.65	Single plasterboard stud walls
Party Walls	N/A	0.60	Double plasterboard stud walls
Internal Floors	N/A	0.38	Carpet over screeded and insulated floor slab with void and plasterboard ceiling below

Table 2

Environmental

The development involves the construction of new residential accommodation, sited in Camden, north London.

Climate

As required by TM59, developments should refer to the latest CIBSE design summer year (DSY) weather files and be required to pass using the DSY1 file most appropriate to the site location. It is required that the weather file that is selected relate to the 2020 high emissions, 50% percentile scenario.

The weather data used in this study is based on projected 2020 weather data for the London Weather Centre which is intended to be indicative of an inner city location in London, accounting for urban microclimatic factors. The DSY1 weather file has been used, which represents a moderately warm summer with a return period of seven years.

Solar

Solar gains are calculated automatically by the modelling software based on the orientation of the building, the transmission coefficients of the glazing and the solar angles. Figure 3 below shows the sun arcs and analemmas for the site, accounting for the orientation of the building.

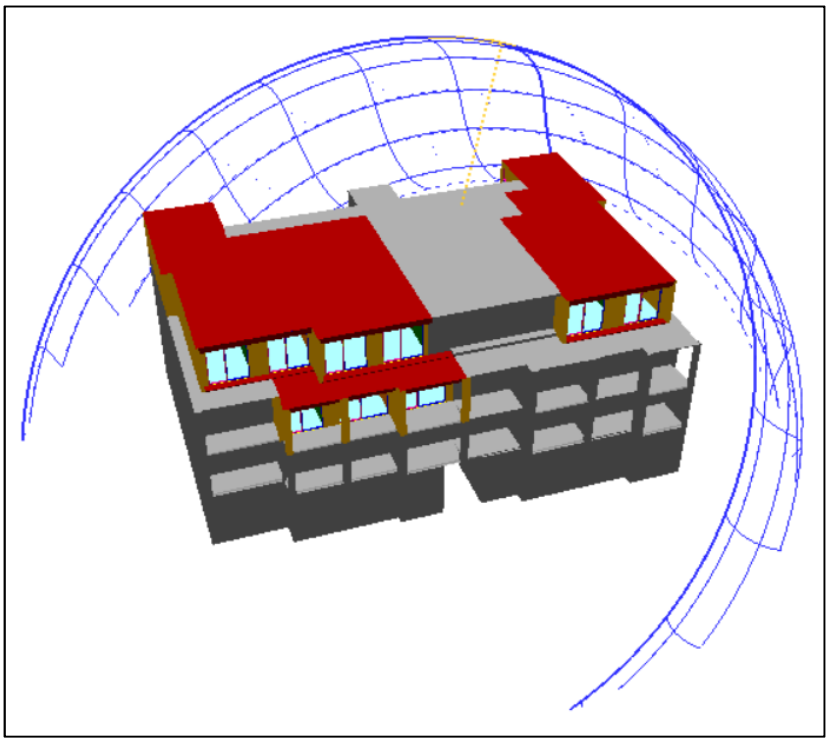


Figure 3: Sun arcs for the site, viewed from the north-west

Internal Gains

Internal conditions are attributed to each assessed zone. Within the internal conditions, heat gains attributable to lighting, occupancy and equipment are detailed.

The heat gains and occupancy patterns are based on recommended figures outlined in TM59 for various types of residential unit.

Internal Heat Gains

Table 3 below displays the heat gains and the spaces in which they are applied:

Room	Lighting W/m²	Occupancy		Equipment W/m²
		Sensible W/m²	Latent W/m²	
Flat 08 Bedroom (Double)	2.00	8.80	6.45	4.69
Flat 08 Bedroom (Single)	2.00	7.10	5.21	7.57
Flat 08 Living/Dining	2.00	6.52	4.78	19.56
Flat 09 Bedroom (Single)	2.00	8.46	6.20	9.02
Flat 09 Living/Dining	2.00	3.46	2.54	20.76
Flat 13 Bedroom (Double)	2.00	11.79	8.65	6.29
Flat 13 Bedroom (Single) 1	2.00	8.16	5.98	8.71
Flat 13 Bedroom (Single) 2	2.00	8.41	6.17	8.97
Flat 13 Living/Dining	2.00	8.86	6.50	17.72
Flat 14 Bedroom (Double)	2.00	14.35	10.53	7.65
Flat 14 Bedroom (Single)	2.00	7.78	5.71	8.30
Flat 14 Living/Dining	2.00	5.27	3.87	15.81
Flat 16 Bedroom (Double) 1	2.00	14.95	10.96	7.97
Flat 16 Bedroom (Double) 2	2.00	14.31	10.50	7.63
Flat 16 Bedroom (Single)	2.00	8.32	6.10	8.88
Flat 16 Living/Dining	2.00	7.54	5.53	15.09

Table 3

The above heat gains are based on the following assumptions:

- Sensible heat gains due to occupants: 75W per person
- Latent heat gains due to occupants: 55W per person
- Bedroom equipment gains: 80W
- Living/Dining equipment gains: 450W

Heat Gain Profiles

Figures 4-10 illustrate the profiles applied to the heat gains associated with occupancy, lighting and equipment. The vertical axis represents the proportion of the full gains applied to the space at different times of the day, with maximum internal gain figures given in Table 3 in the previous section of this report.

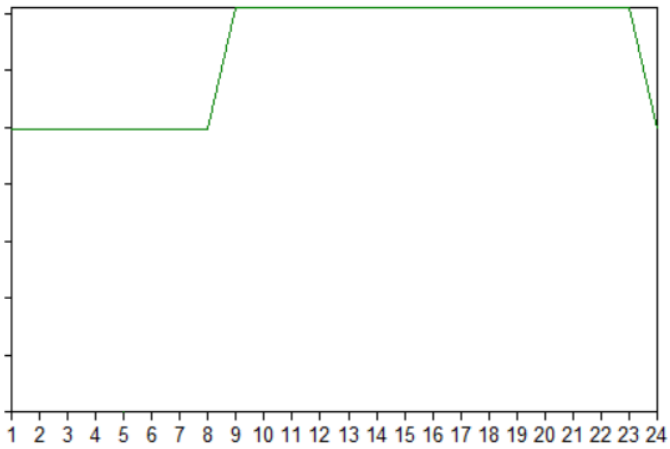


Figure 4: Occupancy of Single Bedrooms

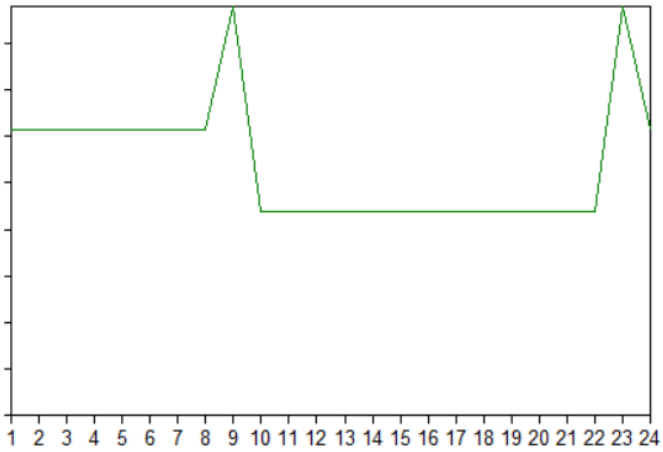


Figure 5: Occupancy of Double Bedrooms

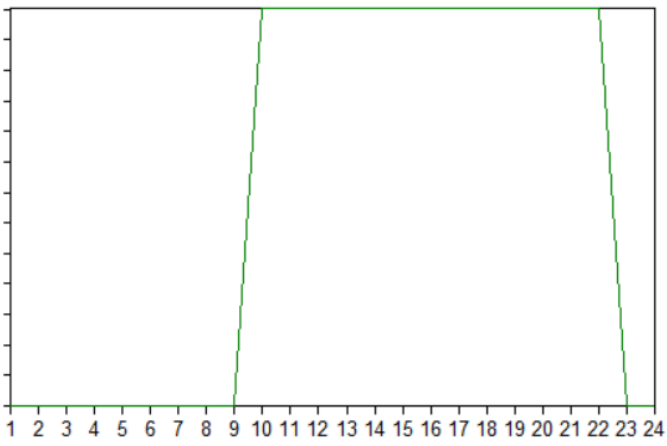


Figure 6: Occupancy of Living/Kitchen

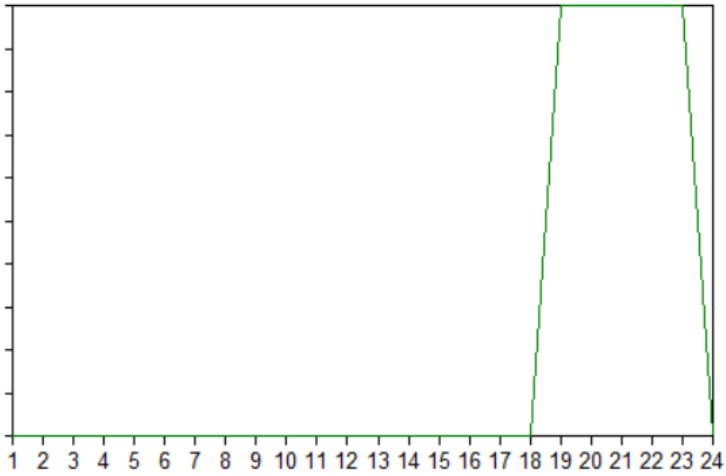


Figure 7: Lighting in all areas

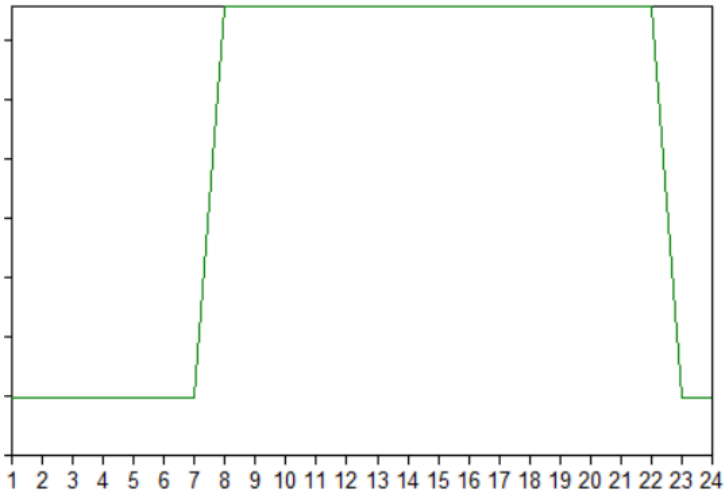


Figure 8: Equipment in Single Bedrooms

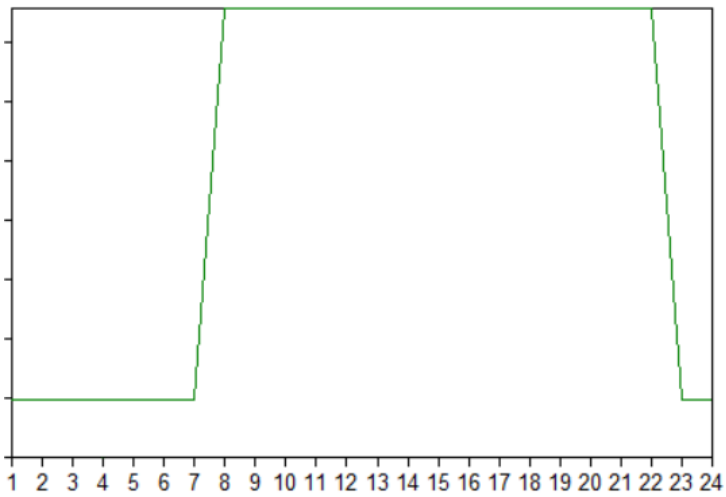


Figure 9: Equipment in Double Bedrooms

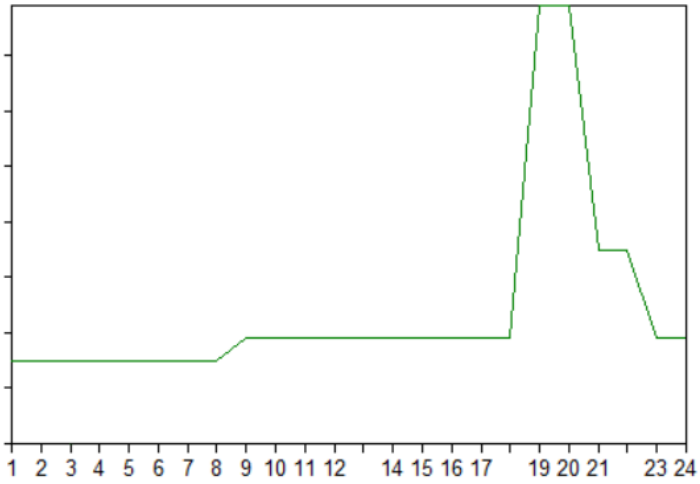


Figure 10: Equipment in Living/Kitchen

Heating and Ventilation

The following section deals with the heating of spaces and the provision of fresh air.

Infiltration

An infiltration rate of 0.35 air changes per hour (ACH) at 3m/s wind speed has been assumed, based on the targeted air permeability rate of **5m^2/hr/m^2 at 50Pa**. This is derived from empirical data published in CIBSE Guide A.

Heating and Cooling

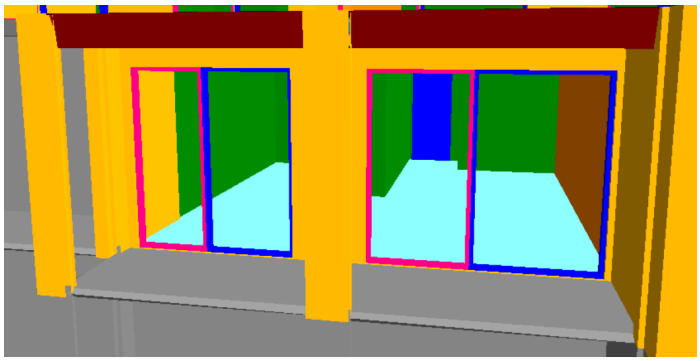
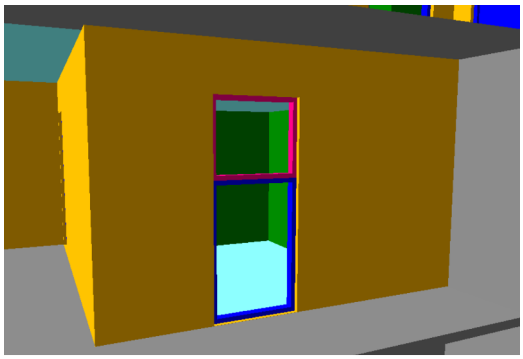
All occupied spaces are assumed to be heated to 20°C.

No mechanical cooling has been applied to any of the spaces.

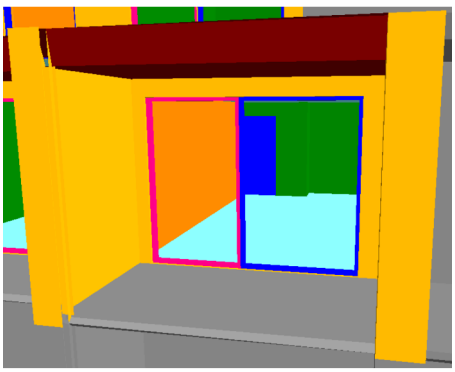
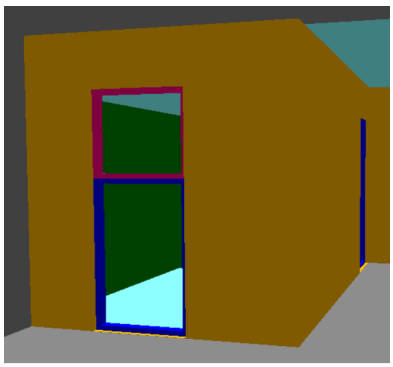
Ventilation

All occupied spaces are assumed to have natural ventilation openings to provide summertime ventilation. When temperatures begin to rise within the spaces, occupants will open doors and windows in order to permit the flow of outside air into the relevant space to purge it of heat.

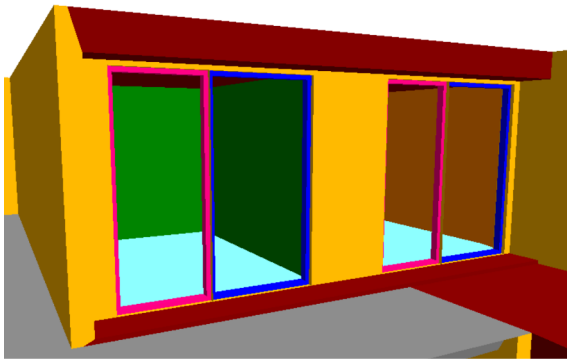
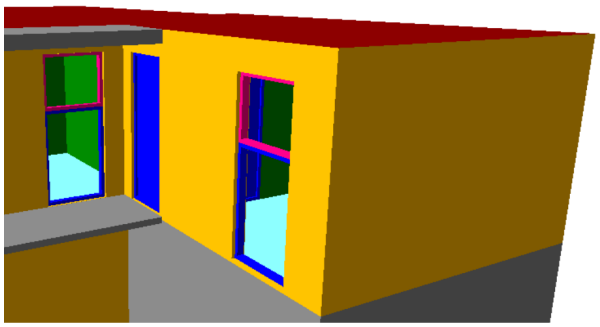
The glazed areas with magenta frames in in Figures 11-20 are considered openable. Openable windows are assumed to be top hung and openable to at least 35°, equivalent to a free area of 78% of the window pane area. Sliding doors are assumed to have a free area equivalent to 45% of the total door arrangement pane area.

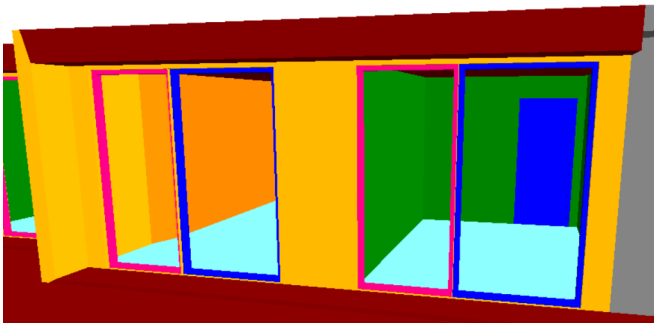
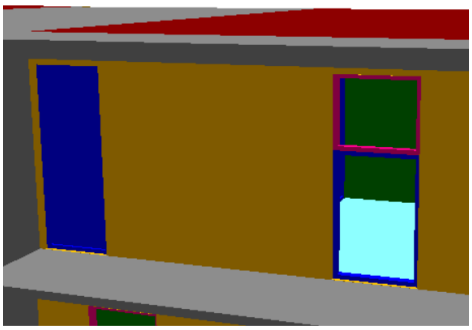
Figures 11 & 12: External views of Flat 08

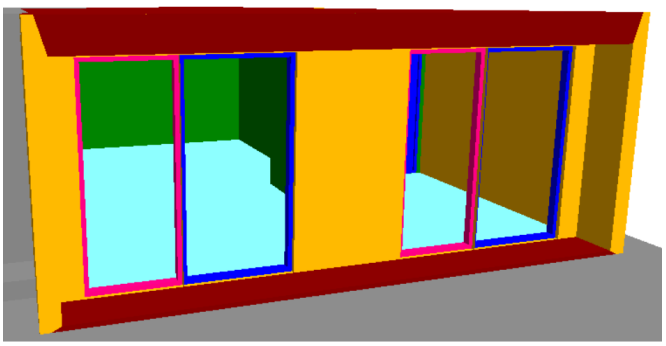
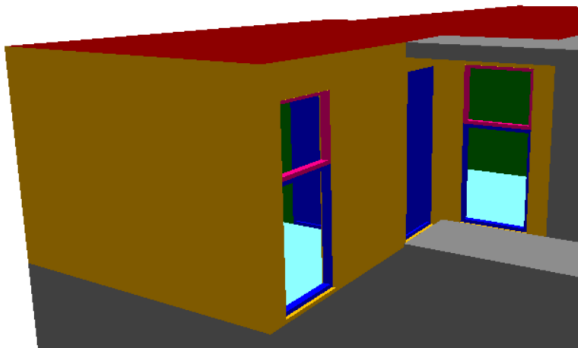
Figures 13 & 14: External views of Flat 09

Figures 15 & 16: External views of Flat 13

Figures 17 & 18: External views of Flat 14

Figures 19 & 20: External view of Flat 16

All of the openings (windows and sliding doors) are assumed to start being opened when the internal temperature of the adjacent zone reaches 22°C and to be open to their full extent by the time the internal temperature reaches 24°C. This is intended to simulate the likely behaviour of occupants.

Openings have been set to be openable at any time of the day, taking into account the diverse occupancy of residential properties. It is assumed that internal doors will be open to encourage air flow within the property.

Solar reflective blinds have been assumed in operation on areas of fixed glazing. These have a solar transmission of 0.15 and solar reflectance of 0.50.

Results

This section details the results obtained from the assessment of overheating in the occupied areas of the building.

All occupied spaces have been assessed against the requirements of Criterion A and all sleeping spaces against the requirements of Criterion B. These assessment criteria are described in more detail earlier in this report.

Criterion A

The results presented below demonstrate the performance of all occupied areas against Criterion A of TM59:

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Result
Flat 08 Bedroom (Double)	3672	110	28	Pass
Flat 08 Bedroom (Single)	3672	110	15	Pass
Flat 08 Living/Dining	1989	59	40	Pass
Flat 09 Bedroom (Single)	3672	110	18	Pass
Flat 09 Living/Dining	1989	59	34	Pass
Flat 13 Bedroom (Double)	3672	110	10	Pass
Flat 13 Bedroom (Single) 1	3672	110	20	Pass
Flat 13 Bedroom (Single) 2	3672	110	62	Pass
Flat 13 Living/Dining	1989	59	37	Pass
Flat 14 Bedroom (Double)	3672	110	109	Pass
Flat 14 Bedroom (Single)	3672	110	25	Pass
Flat 14 Living/Dining	1989	59	40	Pass
Flat 16 Bedroom (Double) 1	3672	110	7	Pass
Flat 16 Bedroom (Double) 2	3672	110	19	Pass
Flat 16 Bedroom (Single)	3672	110	54	Pass
Flat 16 Living/Dining	1989	59	33	Pass

The results above have demonstrated that all assessed areas have been able to demonstrate compliance with Criterion A of TM59. In all cases, the number of hours exceeding the comfort range remains within the maximum threshold level.

Criterion B

The results presented below demonstrate the performance of sleeping areas against Criterion B of TM59:

Zone Name	Max. Exceedable Hours	#Hours Exceeding 26°C	Result
Flat 08 Bedroom (Single)	32	25	Pass
Flat 08 Bedroom (Double)	32	27	Pass
Flat 09 Bedroom (Single)	32	25	Pass
Flat 13 Bedroom (Single) 1	32	20	Pass
Flat 13 Bedroom (Single) 2	32	22	Pass
Flat 13 Bedroom (Double)	32	20	Pass
Flat 14 Bedroom (Single)	32	26	Pass
Flat 14 Bedroom (Double)	32	31	Pass
Flat 16 Bedroom (Single)	32	22	Pass
Flat 16 Bedroom (Double) 1	32	20	Pass
Flat 16 Bedroom (Double) 2	32	23	Pass

The results above have demonstrated that all assessed areas have been able to demonstrate compliance with Criterion B of TM59. In all cases the number of hours exceeding the night-time temperature threshold of 26°C remains within the maximum permissible limit.

Conclusions

An assessment of overheating risk has been undertaken for a sample of 5No. residential units in the proposed new mixed-use development at 1 Hampshire Street, London. The units have been selected on the basis of perceived overheating risk and to provide a selection of different unit types within the assessment.

An overheating assessment has been undertaken in accordance with the recommendations of CIBSE TM59, an industry recognised methodology for assessing overheating risk in domestic buildings. TM59 requires that domestic developments comply with two assessment criteria.

The following passive design measures have been implemented in order to reduce overheating risk:

- Solar control glazing to limit solar gain
- Overhangs/balconies to provide shading to glazed facades
- Provision of suitably sized natural ventilation openings in all occupied spaces
- The ability to open up apartments internally and achieve cross-ventilation across the floor plan

All of the units assessed have been able to demonstrate compliance with the TM59 overheating criteria. All occupied spaces have demonstrated suitably low levels of hours falling outside of the comfort range, while all sleeping areas have been able to demonstrate compliance with the limit of night-time hours that exceed 26°C.