

Project: **Heath Road, Breachwood Green – House Type C2 – Plot 9 only**

Report Title: **TM59 Dynamic Simulations Overheating Assessment**

Date: 29th November 2024

Job Reference: 24211

Report by: Robert Atherton of Low Carbon Box

Client: **Blakeney Homes Ltd**
Unit 4, Water End Barns
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MK17 9EA



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Executive Summary

This report outlines the input and results for the **TM59 Overheating Assessment** for **Heath Road, Breachwood Green – House Type C2 – Plot 9 only**.

The building has been modelled using **DesignBuilder Dynamic Simulation Modelling Software**, using the **EnergyPlus Simulation Engine**.

The weather files used are:

Swindon Brize Norton DSY1 2020 High 50

The model has been undertaken by Robert Atherton of Low Carbon Box, accredited under the Elmhurst Energy Approved Overheating Competency Scheme.

The analysis has been undertaken to demonstrate how the proposed dwelling complies with TM59:2017 Design Methodology for the assessment of overheating risk in homes.

The proposed dwellings comply with TM59 Overheating with the following criteria:

1. Ensure adequate opening casement for natural ventilation complies with Part F.
2. Ground floor windows open by 70 degrees.
3. Upper floor windows open to a depth of 650mm from inside face of external wall.
4. Upper floor window sills modelled as being 1000mm from finished floor level. If not achieved, then they will need internal guarding to 1000mm from FFL.
5. Bedroom windows modelled closed at night due to external noise issues.
6. Continuous ventilation to achieve up to 0.45 air changes per hour.
7. Window Glazing 'g' value at 0.66.
8. Rear rooflight glazing 'g' value = 0.45.
9. Bedrooms 1 & 2 only glazing 'g' value = 0.50.
10. See Figure 1 for locations for glazing.
11. Mechanical purge ventilation required to rooms and rates as set out in table 3 at the back of this report.
Noise limit for purge fan to be maximum 40 dB.

- 0 LCB Beam & Block
- Project semi-exposed floor
- Project semi-exposed wall
- 0 LCB Timber frame PIR enhanced
- new Door
- 1 Roof010
- 0 LCB Timber Floor insulated
- 0 LCB Timber partition
- Project internal door
- 0 Flat roof warm
- 0 Party wall timber
- 0 LCB sloping roof
- 0 TF dormer
- Project unoccupied pitched roof
- Project external glazing
- Low g external glazing

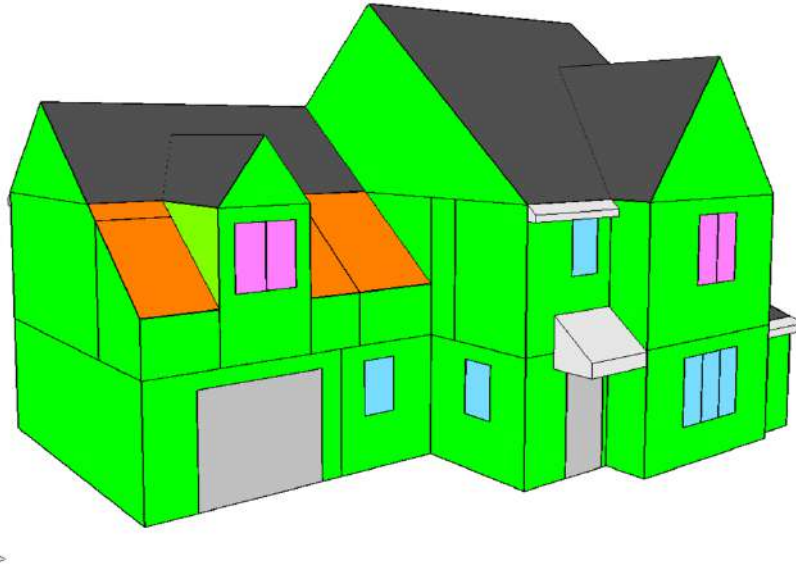


Figure 1: Front elevation to type C2 showing solar glazing to Beds 1 & 2 only

Part O Overheating Assessment Criteria

2b.1 Modelling Details

Dynamic software name and version	DesignBuilder with EnergyPlus 9.40 Version = 7.2.0.032
Weather file location used, including any additional, more extreme weather files	Swindon Brize Norton DSY1 2020 High 50 Based on location
Number of sample units modelled, including an explanation of why the size/selection has been chosen	Plot 9 modelled

2b.2 Modelled Occupancy

Has the project passed the assessment described in CIBSE's TM59, taking into account the limits detailed in paragraphs 2.5 and 2.6?(1)	Yes, the model has been undertaken using the template profiles for TM59 within DesignBuilder
Details of the occupancy profiles used	TM59 Standard profiles
Details of the equipment profiles used	TM59 Standard profiles
Details of the opening profiles used	TM59 Standard profiles for opening windows Used Part O ventilation rules

2b.3 Modelled overheating mitigation strategy

Free Area	Calculated Equivalent Areas using the calculation in line with BS EN 13141-1 Windows open 70 degrees. Upper floor windows open to 650mm from back face of external wall Opening casement as per elevation.
Infiltration and mechanical flow rates	Infiltration has been modelled as 'Good' Continuous ventilation to achieve up to 0.45 air changes per hour Windows open
Window U value	1.30 W/m ² .K
Glazing 'g' value	0.66
Rooflight glazing 'g' value	0.45
Bedrooms 1 & 2 Window glazing 'g' value	0.50
Shading Strategy	As shown on the model
Mechanical Cooling	None

2b.4 Modelling Results

Has the project passed the assessment described in CIBSE's TM59, taking into account the limits detailed in paragraphs 2.5 and 2.6?	Yes
What is the overall overheating strategy (i.e. what design features are key to the project passing)?	1. Ensure adequate opening casement for natural ventilation complies with Part F. 2. Ground floor windows open by 70 degrees. 3. Upper floor windows open to a depth of 650mm from inside face of external wall. 4. Upper floor window sills modelled as being 1000mm from finished floor level. If not achieved, then they will need internal guarding to 1000mm from FFL. 5. Bedroom windows modelled closed at night due to external noise issues. 6. Continuous ventilation to achieve up to 0.45 air changes per hour. 7. Window Glazing 'g' value at 0.66. 8. Rear rooflight glazing 'g' value = 0.45. 9. Bedrooms 1 & 2 only glazing 'g' value = 0.50. 10. See Figure 1 for locations for glazing. 11. Mechanical purge ventilation required to rooms and rates as set out in table 3 at the back of this report. Noise limit for purge fan to be maximum 40 dB.

2b.5 Designers Declaration

Has the building construction proposal been modelled accurately?	Yes
Designer's name (Overheating Consultant)	Robert Atherton
Designer's organisation	Low Carbon Box Ltd
Designer's signature	
Registration number (if applicable)	EES/011387
Date of design	29.11.2024

Introduction

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The building has been modelled using **DesignBuilder Dynamic Simulation Modelling Software**, using the **EnergyPlus Simulation Engine**.

The weather files used are:

Swindon Brize Norton DSY1 2020 High 50

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)

Classification of Overheating

TM59 provides a single criterion for assessing comfort and overheating in mechanically ventilated buildings:

For homes with restricted window openings, the CIBSE fixed temperature test must be followed, i.e. all occupied rooms should not exceed an operative temperature of 26 °C for more than 3% of the annual occupied annual hours (CIBSE Guide A (2015a)).

Specification for Model

The following information has been used to produce the building model:

Drawings

Title	Drawing
Site Plan	2427 - RM-01D - Proposed Site Layout
Floor Plans	2427 - RM-04C - Proposed Type C1 & C2
Elevations	2427 - RM-04C - Proposed Type C1 & C2
Sections	2427 - RM-04C - Proposed Type C1 & C2

Model image extracts



Image 1: Site Plan

	<None>
	TM59_3-BedLivingKitchen
	Domestic Kitchen
	<Unoccupied>
	TM59_CirculationAreas
	TM59_3-BedLiving
	Domestic Toilet

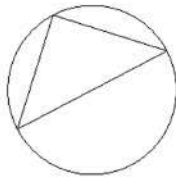
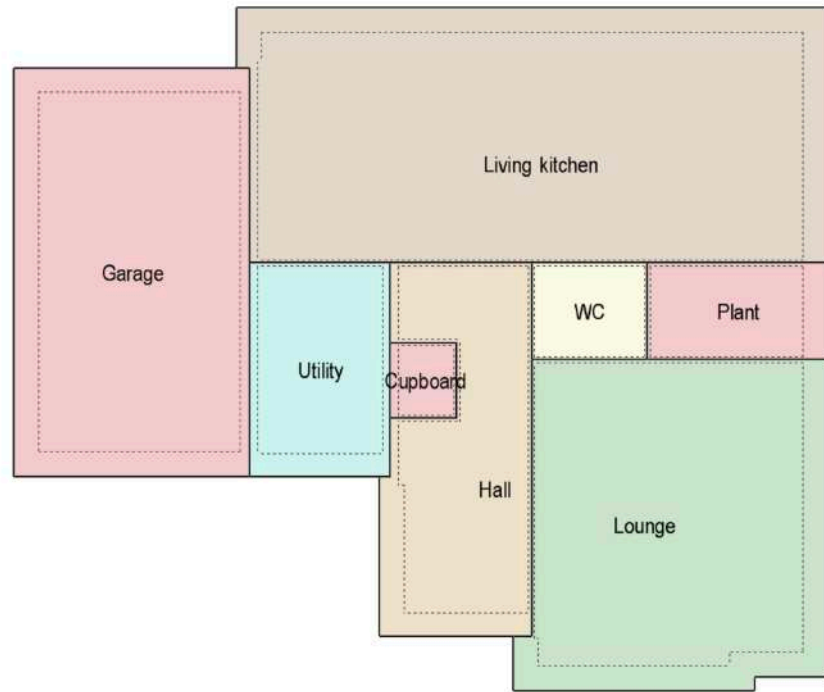


Image 2: Ground Floor Plan

	TM59_SingleBedroom
	TM59_DoubleBedroom
	Domestic Bathroom
	<Unoccupied>
	TM59_CirculationAreas

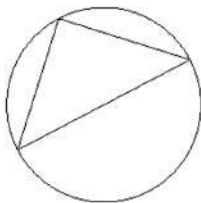
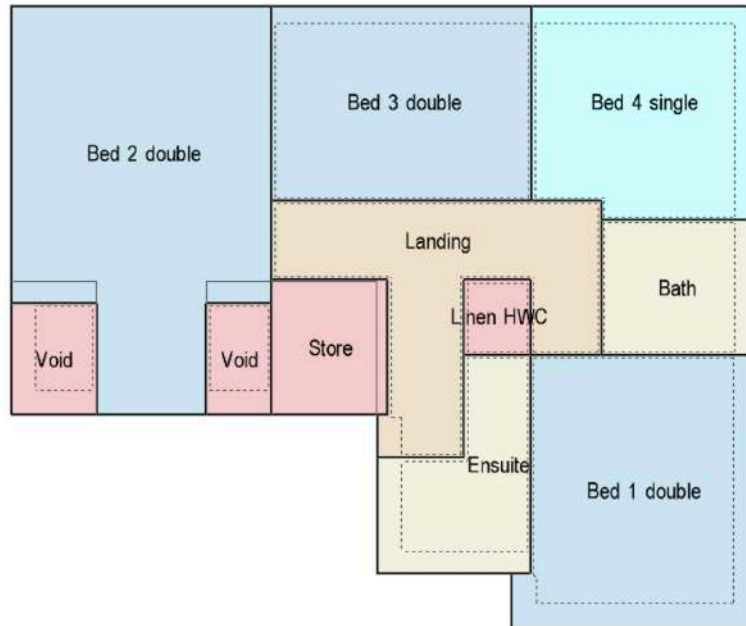


Image 3: First Floor Plan

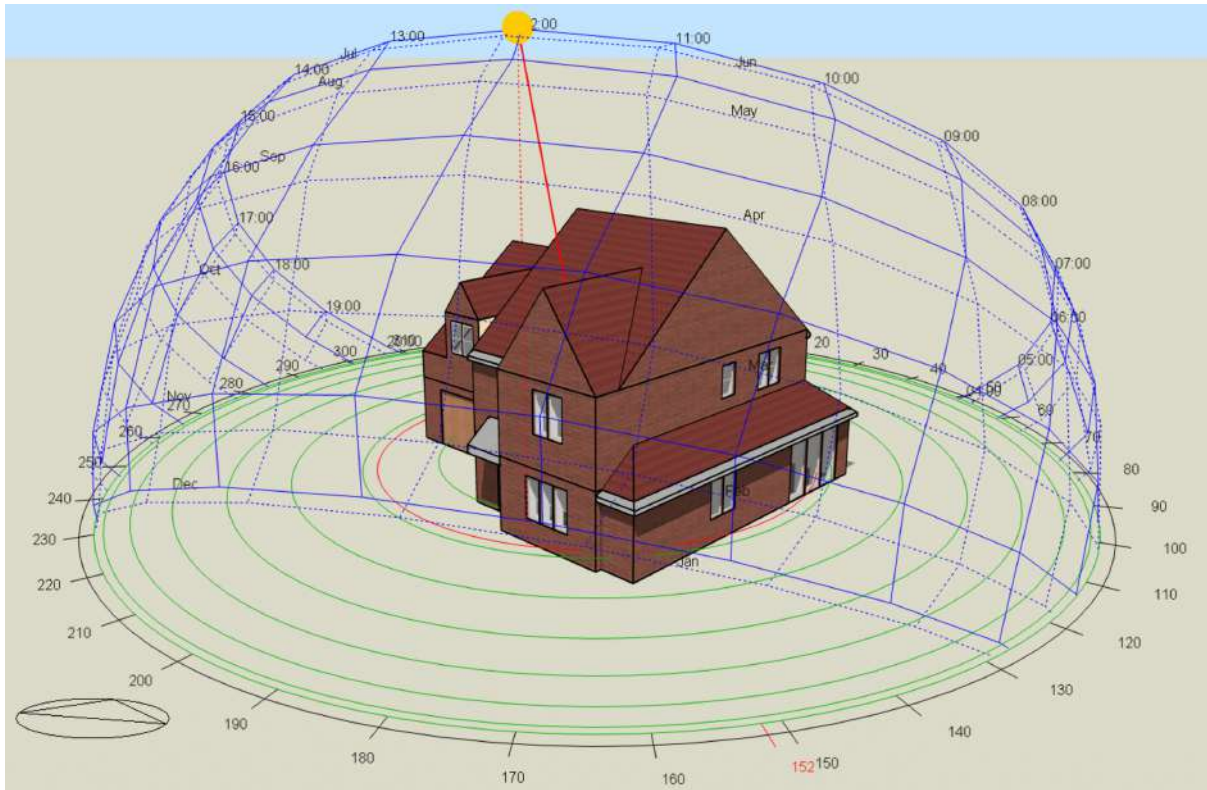


Image 4: West Perspective

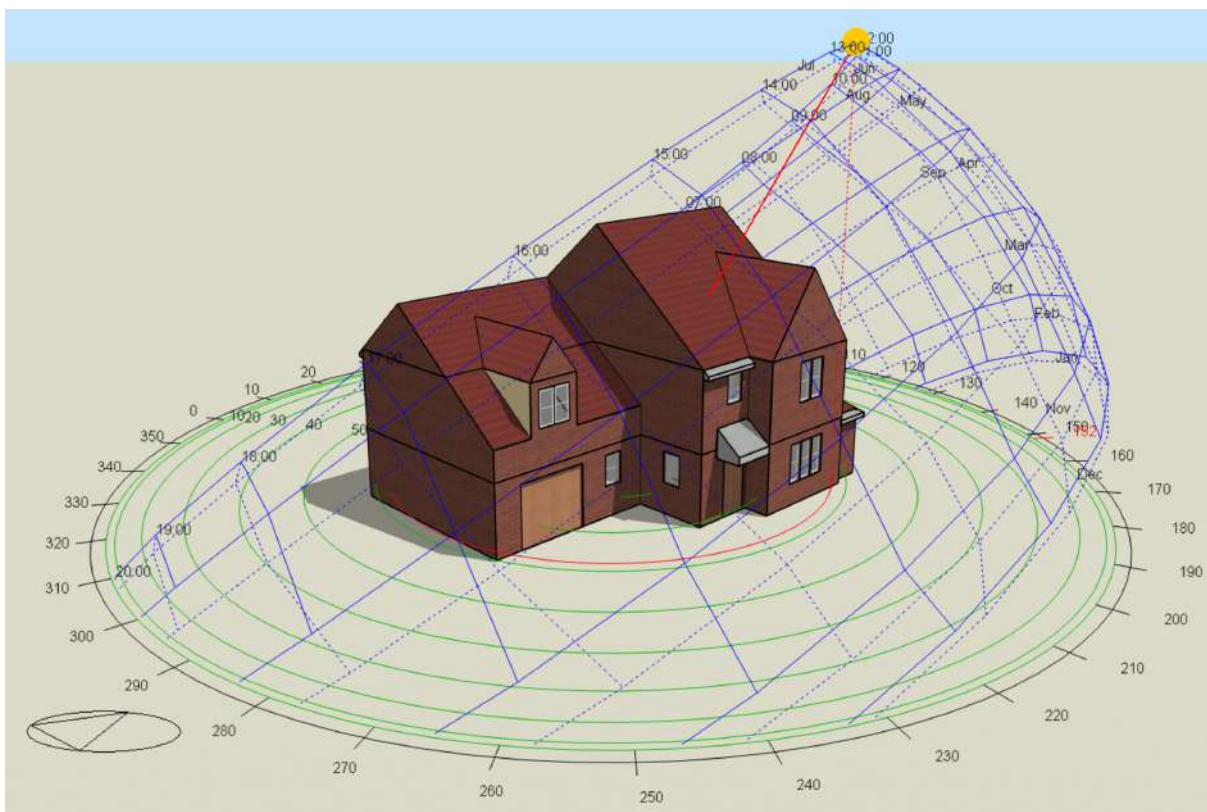


Image 5: North Perspective

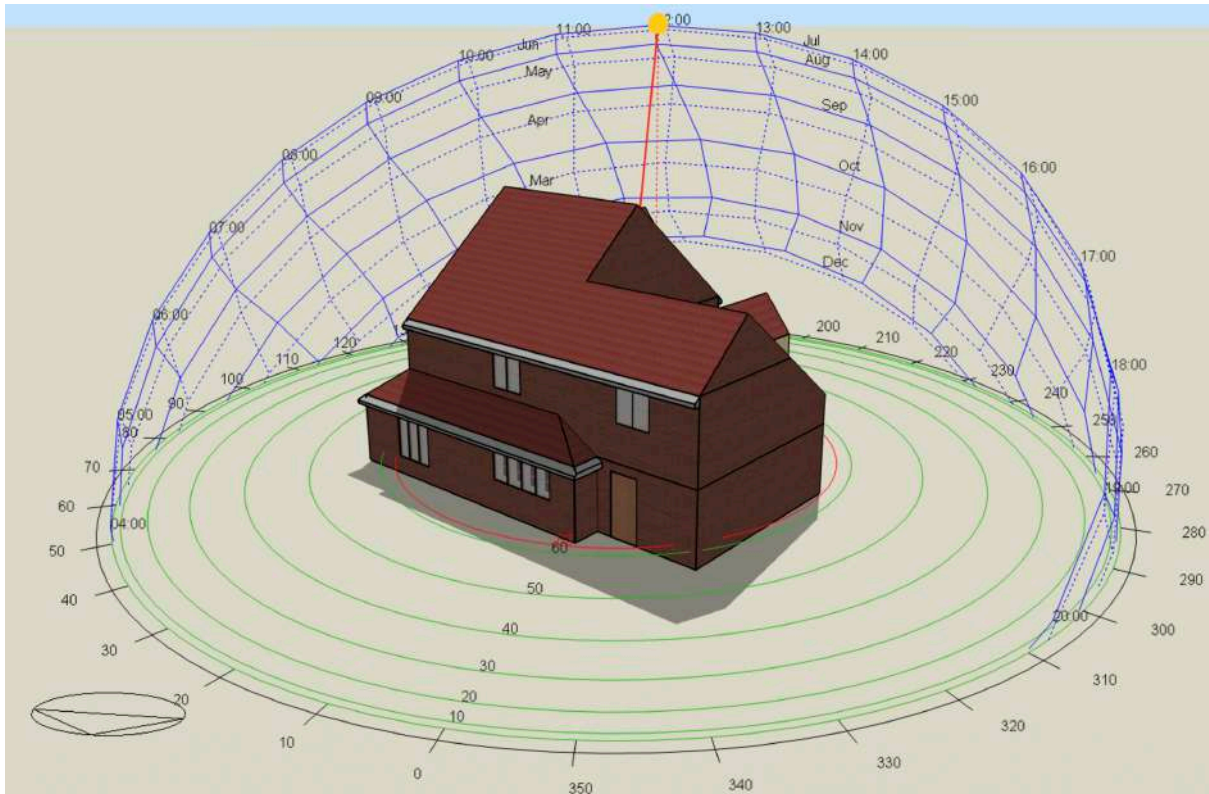


Image 6: East Perspective

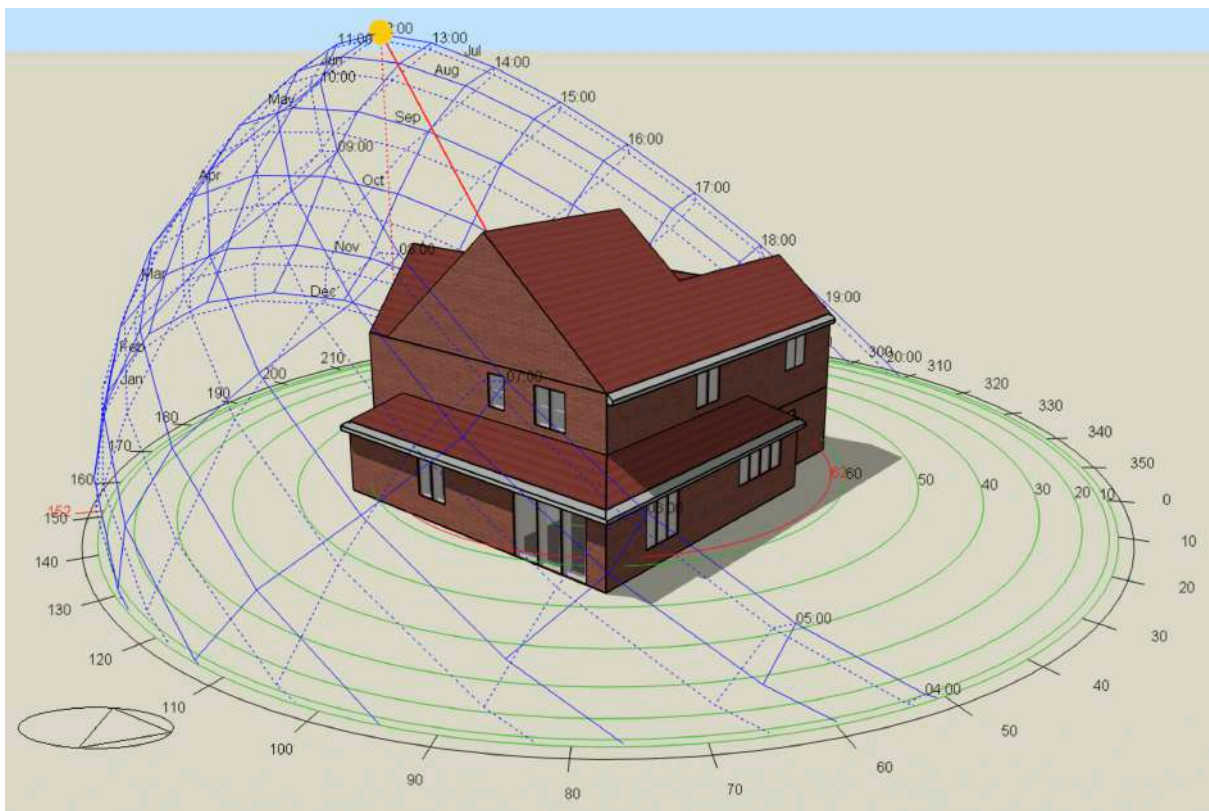


Image 7: South Perspective

Table 1: Input data used for the Model Building Fabric

Item	Standard	Specification
Walls	0.14 W/m2.K	102.5mm brickwork; 50mm cavity; Low-e breather membrane; 9mm OSB; 140mm timber stud; 120mm PIR insulation between studs; 50mm PIR insulation to indie face of studs with reflective VCL; battens; 2x 12.5mm plasterboard.
Dormer Cheek	0.16 W/m2.K	External finish; 12mm WBP plywood; 100mm timber studs; 100mm PIR insulation (0.022 W/mK) between studs; 62.5mm insulated plasterboard (50mm PIR (0.022 W/mK) + VCL + 12.5mm Plasterboard)
Roof (ceiling)	0.10 W/m2.K	12.5mm plasterboard; 400mm insulation consisting of 100mm Knauf Loft Roll 40 between ceiling joists; 150mm + 150mm Knauf Loft Roll 40 over ceiling joists; ventilated roof void
Roof (sloping)	0.15 W/m2.K	Roof finish; battens; membrane; rafters at 600mm centres with; min 50mm air gap; 120mm PIR Insulation (0.022 W/mK) between rafters; 62.5mm Celotex PL4050 insulated plasterboard (50mm PIR Insulation (0.022 W/mK) VCL; 12.5mm plasterboard) below rafters
Roof (Flat)	0.15 W/m2.K	Roof finish on 150mm Roof grade PIR (0.024 W/mK); VCL; WBP Plywood; Timber Joists; Plasterboard
Ground Floor	0.11-0.12 W/m2.K	75mm screed; Vapour control layer; 150mm PIR Insulation (0.022 W/mK); DPM; Beam & block Floor
Windows & Glazed doors	1.30 W/m2.K	Double glazed 'g' value = 0.66
Solar glass windows	1.30 W/m2.K	Double glazed 'g' value = 0.45 In locations as itemised in the summary.
Front door	1.20 W/m2.K	
Rooflights	1.40 W/m2.K	Double glazed 'g' value = 0.54
Air test	4.50 m3/hr/m2	Crack profile = good

Table 2: Building Services

Item	Standard	Specification
Heat Pump	Air source heat pump for space heating & hot water	Refer to SAP assessment
Heating Controls	Time & Temperature Zone Control	
Heating Features	Via underfloor & radiators	
Hot Water (Cylinder)	Hot water cylinder connected to ASHP	80W cylinder in first floor laundry or airing cupboard
Showers	All thermostatic showers	No electric showers
Ventilation – System 3	Natural with System 3 continuous extract with rigid ductwork	Greenwood Unity CV2 To each wet room (including utility & kitchen) and achieve minimum 0.3 litres/second/m2 background rate 0.45 ACH
Purge ventilation to meet overheating requirements	Mechanical Purge ventilation	To achieve purge ventilation rates set out in Table 3 in the TM59 Overheating Report. To have maximum noise level of 40 dB
Lighting	As per TM59 template	

**** Heating and hot water system to be confirmed by heating engineer, assumption made at this stage.**

Table 3 - Results:

Room	Mechanical ventilation	Criterion A (%)	Criterion B (hr)	Pass/Fail
Living/kitchen/diner		1.34	N/A	Pass
Lounge		1.10	N/A	Pass
Bed 1 double	7.5 ACH = 66 l/s	0.20	31.17	Pass
Bed 2 double	4.6 ACH = 59 l/s	0.16	31.50	Pass
Bed 3 double	6.6 ACH = 52 l/s	0.20	31.33	Pass
Bed 4 single	7.8 ACH = 52 l/s	0.27	31.50	Pass

The dwelling type therefore meets the requirements for TM59 and Approved Document Part O.

General notes

- 4 x house types:
 - Type A – selected plots 1 and 5 to cover both possible orientations
 - Type B – selected plots 4 and 6 to cover both possible orientations
 - Type C1 Plot 8
 - Type C2 Plot 9 (same layout as C1 but different windows)
- Using DB version 7.2.0.032 with Part O rules
- Early stage planning drawings
- Construction details as template
- Glazing:
 - Frames set to width 0.08m (0.04m fixed), outside reveal 0.08 m, inside reveals 0.15m
 - Glazed doors shown with wider frames, set to width 0.12m (0.04m fixed)
 - Windows: g-value 0.66, U-value 1.3 W/m²K
 - Rooflights: g-value 0.54, U-value 1.2 W/m²K
- Window opening:
 - Window openings as marked
 - Bed windows shut at night due to noise requirements
 - For bifold doors, the end panel was set to 50% to allow for the frame area when open for five panels design and 70% for three panel design
 - First floor windows height above floor just < 1,000mm so restricted to 100mm (but a couple tested with guarding assumed to allow 650mm opening)
 - Velux windows in Type A living/kitchen set to 15° (same as roof slope)
 - Used discharge coefficients derived from FHH spreadsheet tool, so all openable windows set to 100% and reduced Cd value entered depending on opening angle and opening type. Cd entered in DB also corrected to account for opening frame area not being included in DB opening area
- Mechanical ventilation for background ventilation set to the following values depending on ceiling height to give the required Part F 0.3 l/s/m²:
 - Types B and C both floors 2.4m ceilings, set to 0.45 ACH
 - Type A ground floor with 2.45m ceilings, set to 0.44 ACH
 - Type A first floor with 2.95m ceilings, set to 0.37 ACH
- HWC 80W in first floor laundry cupboard
- Crack template set to 'good'
- Orientation: See each house type section for plot orientation details, but **note**: north arrow is pointing towards the top left so angle measurements off the site plan needed 27.6° adding to give the correct plot orientation
- Swindon weather file