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35 Piccadilly
London
W1J 0DW
+44 (0) 20 7734 3030
www.consolux.com
mail@consolux.com

Planning Statement

Overheating Analysis

Gladstone Road

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Assessment information	Prepared by:	Checked by:
	H.Greig	R.Greenough

Contents

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Introduction
Overheating Analysis
Gladstone Road

Introduction

Consolux M&E Consulting has been appointed in order to undertake an overheating analysis of the Gladstone Road student accommodation in order to provide design stage guidance and maximise occupant comfort levels. Consequently, thermal modelling has been undertaken to demonstrate compliance with CIBSE TM59 requirements. The current proposal is to minimise overheating risk by following the Cooling Hierarchy.

Building Summary

The Gladstone Road building development comprises of 1No. building of various heights consisting of 7No. storeys.

The proposed scheme comprises of the following uses:
Below Ground Floor: Student Accommodation
Ground Floor: Student Accommodation
First Floor: Student Accommodation
Second Floor: Student Accommodation
Third Floor: Student Accommodation
Fourth Floor: Student Accommodation
Fifth Floor: Student Accommodation

Planning Context

This report is aligned with national standards and regulations.

Methodology

The methodology used within this report has been to establish the thermal comfort levels in the occupied spaces through using dynamic simulation modelling. All assumptions in the modelling are provided in the model inputs section of this report.

Please note that the climate change scenario has been excluded from this report. Note that 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.

The report will analyse a sample of dwellings (as per CIBSE TM59). The dwellings that are at high risk of overheating have been analysed in this report. These dwellings have the following characteristics:

- Large glazing areas
- Topmost floor
- South orientation
- Single aspect

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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 must 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 must 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).
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 the annual hours (1% of the annual hours between 22:00 and 07:00)

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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 Ministry of Housing, Communities and Local Government 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 2020 High), London Gatwick, has been used for the purposes of this report.

Building Fabric U-Values

Element	Proposed U-value ($W.m^{-2}.K^{-1}$)
External walls	0.18
Ground floors	0.10
Flat Roof	0.12
Windows	1.4 (G-value 0.63)

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Internal Gains

The occupied hours are assumed as follows:

- Communal Areas: 8am to 10pm Monday to Sunday
- Bedroom Areas: 8pm to 8am, Monday to Sunday
- Cluster rooms 7am to 10am, 12pm to 2pm 5pm to 11pm Monday to Sunday

Gain Source	Living Room
Lighting ($W.m^{-2}$)	10 $W.m^{-2}$
Equipment ($W.m^{-2}$)	15 $W.m^{-2}$
Fridge/Freezer (W)	1380 W (24 hours)
Electric hob (W)	1900 W (0800-0830, 1230-1300, 1700-1730, 2000-2030)
Oven (W)	3100 W (1200-1300, 1700-1800, 2000-2100)
Occupancy ($per.m^{-2}$)	18 persons
Occupancy Sensible/Latent ($W.per^{-1}$)	75/55 $W.per^{-1}$
Gain Source	**Bedrooms**
Lighting ($W.m^{-2}$)	50 W
Equipment ($W.m^{-2}$)	40 W
Occupancy ($per.m^{-2}$)	1 per
Occupancy Sensible/Latent ($W.per^{-1}$)	70/45 $W.per^{-1}$

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Passive

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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 does not form part of this report.
Windows	Glazing will be a crucial aspect to ensure thermal comfort of the occupied spaces. Windows with a g value of 0.63 have been modelled for every glazed area as per information provided by the architects.
Shading	The model design has been produced with & without the inclusion of blinds, to assess the impact. Where indicated to be in use, they are assumed to be used throughout the day.
Thermal Mass	The development consists of an outer leaf brick wall structure with insulation and a cavity, concrete block inner leaf structure with plasterboard and a dry line finish. The structure has the potential to absorb heat energy during the day and release it at night, which will attenuate oscillations in temperature.
Natural Ventilation Rates	All residential areas are naturally ventilated without active cooling. All windows are openable with a restrictor, resulting in a 15% free vent area excluding the Lounge/Kitchen/Dining area on the Third floor NW which is 20%. Moreover, the scheme has been modelled with a discharge coefficient of 0.56 and a wind factor of 1. The windows were open when the internal temperature went above 23°C and when the rooms are occupied.

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Results

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Overview of Results

The tables below show the results of compliance to TM59.

The overheating criteria of the building must comply with two of the following three criteria.

In order to comply with TM59 assessment of overheating risk in dwellings,

Criterion A – Same as criterion 1 for TM52. (Not applicable for mechanically ventilated homes)

Criterion B - For bedrooms only: The operative temperature in bedrooms from 10 pm to 7 am shall not exceed 26°C for more than 1% of the hours (3% for mechanically ventilated homes).

Note: For mechanically ventilated homes Criterion B applies to all occupied rooms, with exceedance no more than 3% of the annual occupied hours. A home is considered mechanically ventilated when there is no or very low provision of openable windows.

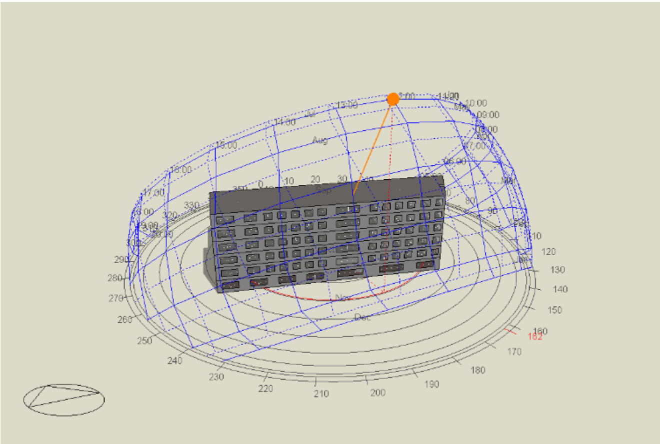

Figure 1 North Elevation

Figure 2 East Elevation

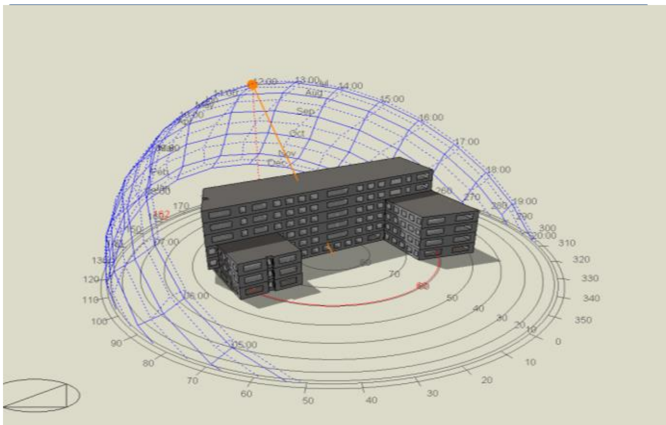

Figure 3 South Elevation

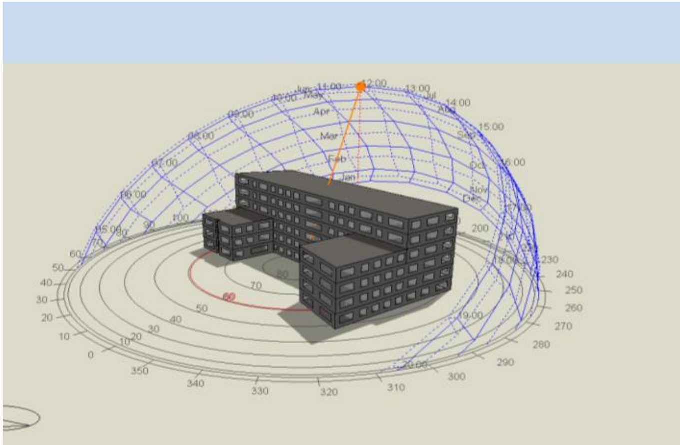

Figure 4 West Elevation

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In order to assess the overheating within the building, all floors were modelled, to reflect general issues which may arise. Detailed below are the results from the simulated model:

CIBSE TM59 dataset: All areas pass except room 3X1ThirdFloorNW Kitchen/Lounge.

Block	Zone	Criterion A (%)	Criterion B (hr)	Pass/Fail
0GroundFloor	GFBedroom1	0.03	1	Pass
0GroundFloor	GFBedroom10	0	0	Pass
0GroundFloor	GFBedroom11	0	0	Pass
0GroundFloor	GFBedroom12	0	0	Pass
0GroundFloor	GFBedroom13	0	0	Pass
0GroundFloor	GFBedroom14	0	0	Pass
0GroundFloor	GFBedroom15	0	0	Pass
0GroundFloor	GFBedroom2	0	0.5	Pass
0GroundFloor	GFBedroom3	0	0	Pass
0GroundFloor	GFBedroom4	0	0	Pass
0GroundFloor	GFBedroom5	0	0	Pass
0GroundFloor	GFBedroom6	0	0	Pass
0GroundFloor	GFBedroom7	0	0	Pass
0GroundFloor	GFBedroom8	0	0	Pass
0GroundFloor	GFBedroom9	0	0	Pass
0GroundFloor	GFLngKtchnDnng2	0	N/A	Pass
0GroundFloor	GFLngKtchnDnnr	1.45	N/A	Pass
0GroundFloor	GFStudio10	0.76	25	Pass
0GroundFloor	GFStudio11	2.28	1	Pass
0GroundFloor	GFStudio9	0	0	Pass
1FirstFloor	FFBedroom1	0	1.5	Pass
1FirstFloor	FFBedroom10	0	0	Pass
1FirstFloor	FFBedroom11	0.22	6.5	Pass
1FirstFloor	FFBedroom12	0	0	Pass
1FirstFloor	FFBedroom13	0.22	6.5	Pass
1FirstFloor	FFBedroom14	0	0	Pass
1FirstFloor	FFBedroom15	0.29	7	Pass
1FirstFloor	FFBedroom16	0.38	6.5	Pass
1FirstFloor	FFBedroom17	0	0	Pass
1FirstFloor	FFBedroom18	0	0.5	Pass

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1FirstFloor	FFBedroom19	0	0.5	Pass
1FirstFloor	FFBedroom2	0	1	Pass
1FirstFloor	FFBedroom20	0	0	Pass
1FirstFloor	FFBedroom21	0	0.5	Pass
1FirstFloor	FFBedroom22	0	0	Pass
1FirstFloor	FFBedroom23	0	0.5	Pass
1FirstFloor	FFBedroom24	0	0	Pass
1FirstFloor	FFBedroom25	0	1	Pass
1FirstFloor	FFBedroom26	0	1.5	Pass
1FirstFloor	FFBedroom27	0.01	2	Pass
1FirstFloor	FFBedroom28	0.24	2	Pass
1FirstFloor	FFBedroom29	1.51	7.5	Pass
1FirstFloor	FFBedroom3	0	0.5	Pass
1FirstFloor	FFBedroom4	0	0	Pass
1FirstFloor	FFBedroom5	0	0	Pass
1FirstFloor	FFBedroom6	0	0	Pass
1FirstFloor	FFBedroom7	0	0	Pass
1FirstFloor	FFBedroom8	0	0	Pass
1FirstFloor	FFBedroom9	0.28	7	Pass
1FirstFloor	FFLngKtchnDnng	1.55	N/A	Pass
1FirstFloor	FFLngKtchnDnng2	0.59	N/A	Pass
1FirstFloor	FFLngKtchnDnng3	0	N/A	Pass
1FirstFloor	FFLngKtchnDnng4	0	N/A	Pass
1FirstFloor	FFStudio1	0	0	Pass
1FirstFloor	FFStudio2	0.06	1	Pass
1FirstFloor	FFStudio3	0.29	2.5	Pass
1FirstFloor	FFStudio4	0	0.5	Pass
1FirstFloor	FFStudio5	0.84	1	Pass
1FirstFloor	FFStudio6	0	0.5	Pass
1FirstFloor	FFStudio7	0	0.5	Pass
1FirstFloor	FFStudioDDA	0.49	1.5	Pass
2SecondFloor	2FBedroom1	0.06	3.5	Pass
2SecondFloor	2FBedroom10	0	0	Pass
2SecondFloor	2FBedroom11	0	0.5	Pass
2SecondFloor	2FBedroom12	0	0	Pass
2SecondFloor	2FBedroom13	0	0.5	Pass
2SecondFloor	2FBedroom14	0	0	Pass
2SecondFloor	2FBedroom15	0	0.5	Pass
2SecondFloor	2FBedroom16	0	1.5	Pass

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2SecondFloor	2FBedroom17	0	0	Pass
2SecondFloor	2FBedroom18	0	0.5	Pass
2SecondFloor	2FBedroom19	0	0	Pass
2SecondFloor	2FBedroom2	0	2	Pass
2SecondFloor	2FBedroom20	0	0	Pass
2SecondFloor	2FBedroom21	0	0	Pass
2SecondFloor	2FBedroom22	0	0	Pass
2SecondFloor	2FBedroom23	0	0	Pass
2SecondFloor	2FBedroom24	0	0	Pass
2SecondFloor	2FBedroom25	0	1.5	Pass
2SecondFloor	2FBedroom26	0.15	2	Pass
2SecondFloor	2FBedroom27	0.21	3	Pass
2SecondFloor	2FBedroom28	1.94	2.5	Pass
2SecondFloor	2FBedroom29	2.54	5.5	Pass
2SecondFloor	2FBedroom3	0	1.5	Pass
2SecondFloor	2FBedroom4	0	0.5	Pass
2SecondFloor	2FBedroom5	0	1	Pass
2SecondFloor	2FBedroom6	0	0	Pass
2SecondFloor	2FBedroom7	0	0.5	Pass
2SecondFloor	2FBedroom8	0	0	Pass
2SecondFloor	2FBedroom9	0	0.5	Pass
2SecondFloor	2FLngKtchnDnng	1.86	N/A	Pass
2SecondFloor	2FLngKtchnDnng2	0.18	N/A	Pass
2SecondFloor	2FLngKtchnDnng3	0	N/A	Pass
2SecondFloor	2FLngKtchnDnng4	0	N/A	Pass
2SecondFloor	2FStudio1	0	0	Pass
2SecondFloor	2FStudio2	0.04	1	Pass
2SecondFloor	2FStudio3	0	0.5	Pass
2SecondFloor	2FStudio4	0	0.5	Pass
2SecondFloor	2FStudio5	0.89	2	Pass
2SecondFloor	2FStudio6	0	1	Pass
2SecondFloor	2FStudio7	0	1	Pass
2SecondFloor	2FStudioDDA	0.41	1.5	Pass
3ThirdFloorMain	3FBedroom10	0	0	Pass
3ThirdFloorMain	3FBedroom11	0	0	Pass
3ThirdFloorMain	3FBedroom12	0	0	Pass
3ThirdFloorMain	3FBedroom13	0	0	Pass
3ThirdFloorMain	3FBedroom14	0	0	Pass
3ThirdFloorMain	3FBedroom15	0	0	Pass

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3ThirdFloorMain	3FBedroom16	0	0.5	Pass
3ThirdFloorMain	3FBedroom17	0	0	Pass
3ThirdFloorMain	3FBedroom18	0	0	Pass
3ThirdFloorMain	3FBedroom19	0	0	Pass
3ThirdFloorMain	3FBedroom20	0	0	Pass
3ThirdFloorMain	3FBedroom21	0	0	Pass
3ThirdFloorMain	3FBedroom22	0	0	Pass
3ThirdFloorMain	3FBedroom23	0	0	Pass
3ThirdFloorMain	3FBedroom24	0	0	Pass
3ThirdFloorMain	3FBedroom9	0	0	Pass
3ThirdFloorMain	3FLngKtchnDnng2	0	N/A	Pass
3ThirdFloorMain	3FLngKtchnDnng3	0.15	N/A	Pass
3ThirdFloorMain	3FStudio1	0	0.5	Pass
3ThirdFloorMain	3FStudio2	0.04	1	Pass
3ThirdFloorMain	3FStudio3	0.39	1.5	Pass
3ThirdFloorMain	3FStudio4	0	0	Pass
3ThirdFloorMain	3FStudio5	0	0.5	Pass
3ThirdFloorMain	3FStudio6	1.01	2.5	Pass
3ThirdFloorMain	3FStudio7	0.11	1	Pass
3X1ThirdFloorNW	3FBedroom1	0.6	3.5	Pass
3X1ThirdFloorNW	3FBedroom2	0.18	2	Pass
3X1ThirdFloorNW	3FBedroom3	0.11	2	Pass
3X1ThirdFloorNW	3FBedroom4	0.07	1.5	Pass
3X1ThirdFloorNW	3FBedroom5	0.08	1.5	Pass
3X1ThirdFloorNW	3FBedroom6	0	0.5	Pass
3X1ThirdFloorNW	3FBedroom7	0.01	1	Pass
3X1ThirdFloorNW	3FBedroom8	0	0	Pass
3X1ThirdFloorNW	3FLngKtchnDnng	3.46	N/A	Fail
4FourthFloor	4FBedroom1	0	0.5	Pass
4FourthFloor	4FBedroom10	0	1	Pass
4FourthFloor	4FBedroom11	0	0	Pass
4FourthFloor	4FBedroom12	0	0	Pass
4FourthFloor	4FBedroom13	0	0	Pass
4FourthFloor	4FBedroom14	0	0	Pass
4FourthFloor	4FBedroom15	0	0	Pass
4FourthFloor	4FBedroom16	0	0.5	Pass
4FourthFloor	4FBedroom2	0	0	Pass
4FourthFloor	4FBedroom3	0	0	Pass
4FourthFloor	4FBedroom4	0	0	Pass

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London
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www.consolux.com
mail@consolux.com

4FourthFloor	4FBedroom5	0	0	Pass
4FourthFloor	4FBedroom6	0	0	Pass
4FourthFloor	4FBedroom7	0	0.5	Pass
4FourthFloor	4FBedroom8	0	1.5	Pass
4FourthFloor	4FBedroom9	0	0	Pass
4FourthFloor	4FLngKtchnDnng1	0	N/A	Pass
4FourthFloor	4FLngKtchnDnng2	0.23	N/A	Pass
4FourthFloor	4FStudio1	0.13	1	Pass
4FourthFloor	4FStudio2	0.07	1.5	Pass
4FourthFloor	4FStudio3	0.46	2.5	Pass
4FourthFloor	4FStudio4	0	0.5	Pass
4FourthFloor	4FStudio5	0	1	Pass
4FourthFloor	4FStudio6	1.17	3	Pass
4FourthFloor	4FStudio7	0.25	1.5	Pass
5FifthFloor	5FBedroom1	0.15	1	Pass
5FifthFloor	5FBedroom10	0.31	2	Pass
5FifthFloor	5FBedroom11	0	0	Pass
5FifthFloor	5FBedroom12	0.08	1	Pass
5FifthFloor	5FBedroom13	0	0	Pass
5FifthFloor	5FBedroom14	0.06	1	Pass
5FifthFloor	5FBedroom15	0	0.5	Pass
5FifthFloor	5FBedroom16	0.2	1	Pass
5FifthFloor	5FBedroom2	0	0.5	Pass
5FifthFloor	5FBedroom3	0.06	1	Pass
5FifthFloor	5FBedroom4	0	0	Pass
5FifthFloor	5FBedroom5	0.06	1	Pass
5FifthFloor	5FBedroom6	0	0.5	Pass
5FifthFloor	5FBedroom7	0.15	1	Pass
5FifthFloor	5FBedroom8	0.32	2	Pass
5FifthFloor	5FBedroom9	0	0	Pass
5FifthFloor	5FLngKtchnDnng1	0.13	N/A	Pass
5FifthFloor	5FLngKtchnDnng2	0.96	N/A	Pass
5FifthFloor	5FStudio1	1.45	1.5	Pass
5FifthFloor	5FStudio2	1.1	2	Pass
5FifthFloor	5FStudio3	2.31	2	Pass
5FifthFloor	5FStudio4	0.31	1	Pass
5FifthFloor	5FStudio5	0.41	1	Pass
5FifthFloor	5FStudio6	2.54	1.5	Pass
5FifthFloor	5FStudio7	1.26	1.5	Pass

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London
W1J 0DW
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Conclusions

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Conclusions

The analysis has responded to CIBSE TM59 requirements relating to overheating.

The report has set out how the occupied spaces perform against strict thermal comfort standards for overheating. When naturally ventilated, many of the units meet the TM59 requirements, except the room 3X1ThirdFloorNW Kitchen/Lounge, even with the inclusion of 4 AC/H and window shading.

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.

In order to improve on the thermal comfort criteria, the following solutions could be utilised.

1. Increasing the natural ventilation available to the rooms by increasing the free ventilation area. This would allow for better airflow and reduction of bedroom temperatures during the night.
2. Reducing the solar gain throughout the day by reducing the glazing area by blocking out the lower portion of the window.
3. Reducing the solar gain through windows by reducing the transparent areas of the window or by using localised shading.

Further iterations of the model are required in order to investigate the effect of the above changes and whether there will be a change to the TM59 results.