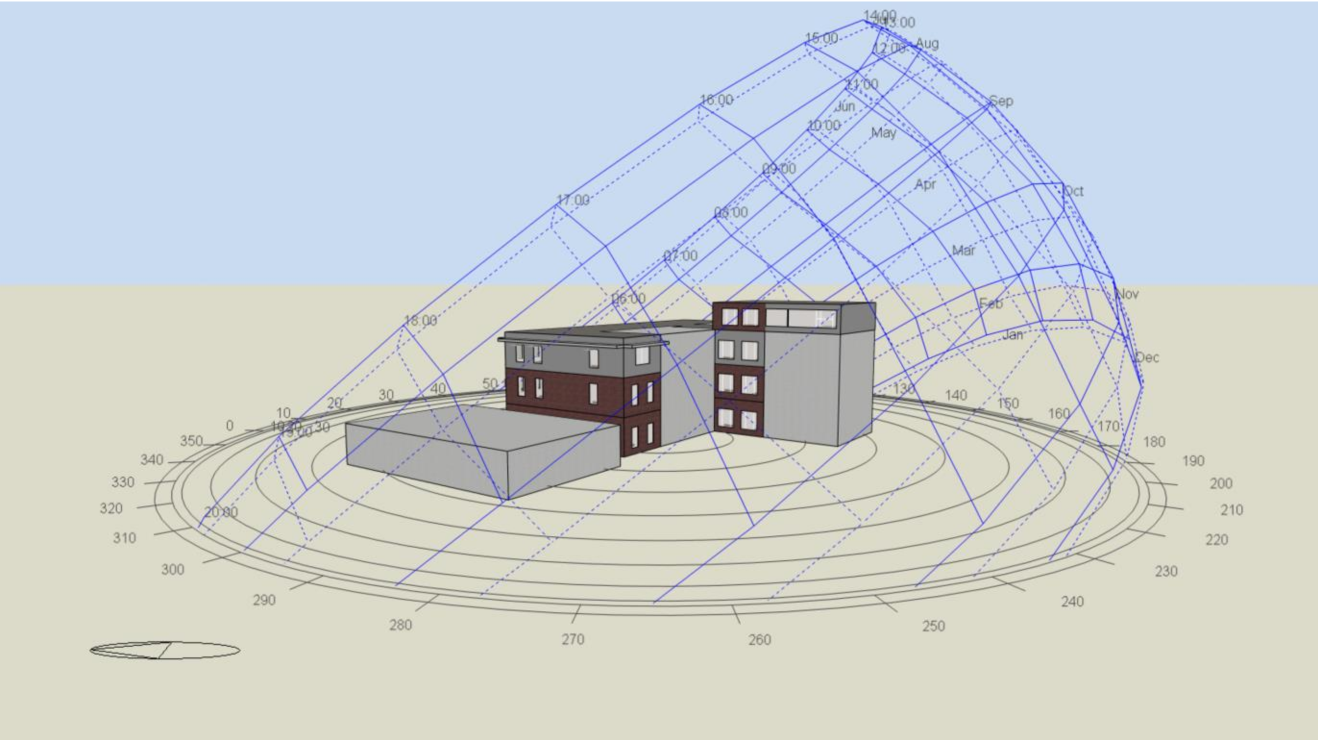


Domestic Overheating Assessment

TM59

Bedfont Cross
Feltham

14 Dic. 21

North:

t: 0151 933 0328
m: info@baseenergy.co.uk

202 Stanley Road
Bootle
Liverpool
L20 3EP

South:

t: 020 3266 2016
m: info@baseenergy.co.uk

117 Knyvett House,
Watermans Business
Park, the Causeway.
Staines-upon-Thames
TW18 3BA

Client: Davies Partnership

Site: Bedfont Cross, Stanwell Road, Feltham, TW14 8NX

Proposals: Conversion of an existing office space to include 52 self-contained dwellings.

Contents:

Appendices:

Document Control Record:

Prepared by	Checked by	Date	Project	Revision
Sergio Gomez	Peter Kinsella	14-12-2021	9278	1.0

1 Scope

This Domestic Overheating Assessment report has been prepared in support of the conversion of an existing office space to include 52 self-contained dwellings on the land at Bedfont Cross, Stanwell Road, Feltham, TW14 8NX.

This report assesses the overheating risk on a sample 29 dwellings. The units were selected on the basis of their perceived vulnerability to overheating, mainly influenced by the orientation and the characteristics presented on the section 4 of this report.

The intention is that this study helps inform and verify the design proposals, 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 Silverline Architects 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.

Moreover, this Overheating Assessment across the development supports the Planning Application and demonstrate that the proposed development complies with the relevant current guidance CIBSE TM59: Design Methodology for the Assessment of Overheating Risk in Homes (2017).

2 Executive Summary

An overheating assessment has been undertaken on a sample of worst-case units from the proposed residential development Bedfont Cross, Stanwell Road, Feltham, TW14 8NX.

The assessment has been undertaken in accordance with CIBSE Technical Memorandum 59, which deals with overheating risk in domestic properties. The methodology stipulated in TM59 has been followed and the sample units assessed against the overheating criteria detailed.

The present assessment has aimed to explore a number of strategies to reduce the overheating risk and the possible cooling demand, the report has followed the cooling hierarchy described in the GLA – Energy Assessment guidance. A Baseline scenario (Appendix B) has been set and reflect the actual specifications of the building described in section 4. The inclusion of passive and mechanical measures has been approached; the results are summarized in Table 8 of section 5.

3 CIBSE TM59 Assessment Criteria

CIBSE TM 59: Design methodology for the assessment of overheating risk in homes (2017):

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 be met:

Criterion 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).

Criterion 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 failure).

Criteria for predominantly mechanically ventilated:

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)).

4 The Model

The building was modelled using Design Builder software (DSB) which is based on the Energy Plus engine. The software complies with CIBSE Application Manual AM11: 1998 Building Energy and Environmental Modelling and provides a full dynamic simulation of thermal conditions in the building.

Geometry

A three-dimensional analysis model has been generated for the proposed scheme. The model was developed using drawn information supplied by Silverline Architects.

As with any modelling exercise, some approximations have been made, but care has been taken to ensure the scale and internal dimensions of the model are as close as practicable to the design drawings, and that glazing areas are as accurately represented as the provided information allows.

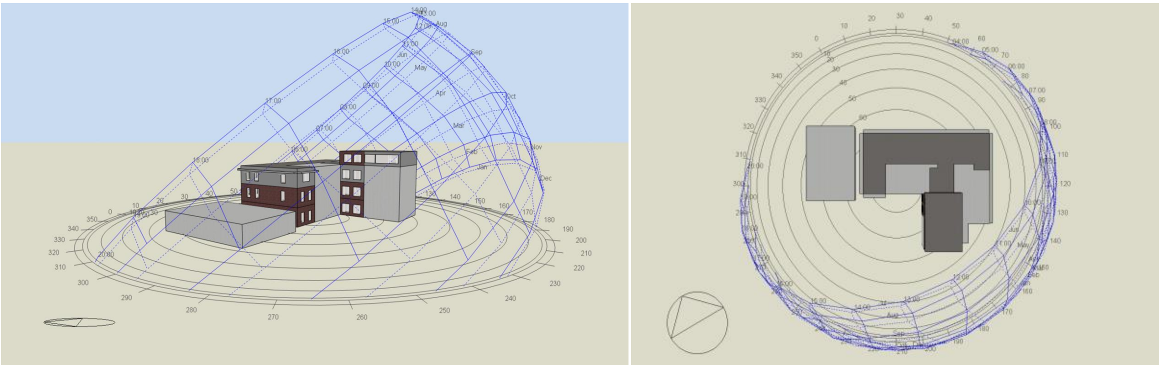


Figure 01.- Solar Path & Isometric view

Climate

The GLA Energy Assessments guidance (March 2021), refers to the CIBSE TM:49 weather files to be used on overheating assessments.

Overheating modelling for domestic developments should be conducted using the following design weather file:

DSY1 (Design Summer Year) for the 2020s, high emissions, 50% percentile scenario

The most representative weather data set for the project location should be used as follows:

- London Weather Centre data: The Central Activity Zone (CAZ) and other high density urban areas (e.g., Canary Wharf).
- London Heathrow airport data: lower density urban and suburban areas.
- Gatwick Airport data: rural and peri-urban areas around the edge of London.

Additional testing should be undertaken using the 2020 versions of the following more extreme design weather years:

DSY2 – 2003: a year with a very intense single warm spell.
DSY3 – 1976: a year with a prolonged period of sustained warmth

It is acknowledged that meeting the CIBSE TM 59 compliance criteria is challenging for the DSY 2 & 3 weather files, although it is expected that in most cases a significant proportion of spaces will be able to achieve compliance if passive measures are fully exploited. Where the CIBSE MT 59 compliance criteria is not met for a particular weather file the applicant must demonstrate that the risk of overheating has been reduced as far as practical and that all passive measures have been explored, including reduced glazing, and increased external shading.

The weather data used in this study is based on projected 2020 weather data for London Heathrow airport data which is intended to be indicative of a semi-urban location, accounting for local microclimatic factors. The DSY1 weather file has been used, which represents a moderately warm summer with a return period of seven years.

The outputs for the extreme DSY2 and DSY3 weather files that were additionally tested are shown in Appendix D. As per described on the CIBSE TM59, adaptation measures for the more extreme weather scenarios are proposed to help occupants cope in the event of extreme weather conditions.

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.

Units Selected for Analysis

As required by TM59, sample units have been selected for analysis on the basis of perceived risk of overheating. These selections are 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 the provision of openings.

Based on the above criteria, the following units have been selected for analysis.

Table 1: Units Selected for Analysis

Level	Unit Reference	Description
Ground Floor	Flat 6	Ground floor self-contained unit with glazing facing Southeast and Northeast.
	Flat 7	Ground floor self-contained unit with glazing facing Northeast.
	Flat 8	Ground floor self-contained unit with glazing facing Northeast.
	Flat 9	Ground floor self-contained unit with glazing facing Northeast.
	Flat 10	Ground floor self-contained unit with glazing facing Northeast.
	Flat 11	Ground floor self-contained unit with glazing facing Northeast and Northwest.
	Flat 12	Ground floor self-contained unit with glazing facing Northwest and Southwest.
	Flat 15	Ground floor self-contained unit with glazing facing Northwest.

	Flat 16	Ground floor self-contained unit with glazing facing Northwest.
First Floor	Flat 22	First floor self-contained unit with glazing facing Southeast and Northeast.
	Flat 23	First floor self-contained unit with glazing facing Northeast.
	Flat 24	First floor self-contained unit with glazing facing Northeast.
	Flat 25	First floor self-contained unit with glazing facing Northeast.
	Flat 26	First floor self-contained unit with glazing facing Northeast.
	Flat 27	First floor self-contained unit with glazing facing Northeast and Northwest.
	Flat 28	First floor self-contained unit with glazing facing Northwest and Southwest.
	Flat 32	First floor self-contained unit with glazing facing Northwest.
	Flat 33	First floor self-contained unit with glazing facing Northwest.
Second Floor	Flat 39	Second floor self-contained unit with glazing facing Southeast and Northeast.
	Flat 40	Second floor self-contained unit with glazing facing Northeast.
	Flat 41	Second floor self-contained unit with glazing facing Northeast.
	Flat 42	Second floor self-contained unit with glazing facing Northeast.
	Flat 43	Second floor self-contained unit with glazing facing Northeast.
	Flat 44	Second floor self-contained unit with glazing facing Northeast and Northwest.
	Flat 45	Second floor self-contained unit with glazing facing Northwest and Southwest.
	Flat 49	Second floor self-contained unit with glazing facing Northwest.
	Flat 50	Second floor self-contained unit with glazing facing Northwest.

Third Floor	Flat 51	Third floor self-contained unit with glazing facing Northwest
	Flat 52	Third floor self-contained unit with glazing facing Northwest

Refer to appendix A, which shows the location of the sample units on the floor plan layouts.

Building Elements

The fabric performance listed in Table 2 is proposed in line with the SAP Calculation Inputs. Thermal transmittance U-values for external elements were provided by the Client.

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

Table 2: Thermal Transmittance of Building Elements

Building Element	U-Value (W/M²k)	G-Value	Notes
Walls	0.38/0.25/0.21	n/a	Insulated cavity wall with plasterboard lining internally
Roof	0.18	n/a	Insulated concrete deck
Ground Floor	0.70	n/a	Concrete floor with screed over
Internal Walls	1.00	n/a	Insulated metal frame lining plasterboard
Internal Floors	1.00	n/a	Insulated concrete deck
Glazing	1.07	0.32	Double glazed units

Solar Control

The glazing specification is proposed as to meet a U-Value of 1.07 W/m2K. Solar control has been assumed for the sake of the analysis as a means of helping to mitigate the amount of solar radiation being transmitted into the building. All glazing has a g-value of 0.32 as per indicated in the information provided by Silverline Architects and Guardian Glass.

It is important to note that external elements such as the overhangs on third floor act as local shading devices, any alteration in the size of these elements will have a direct impact in the TM59 results.

Model Geometry and Local Shading

The Model has included the immediate surrounding elements (vegetation and building blocks) to account the overshadowing during simulations. Control forms an integral part of overheating mitigation strategies.

Environmental

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 figures outlined in TM59 for various types of residential space.

Internal Heat Gains
The internal gains assumptions (Table 4) stipulated by the TM 59 guidance have been included in the dynamic thermal. Table 3 below provides details of the heat gains associated with lighting, meanwhile table 4 shows all equipment and occupancy load (Sensible and latent).

Table 3: Lighting gains (CIBSE TM 59)

Room Type	Occupancy	Equipment Load
All Rooms - Lighting	N/A	Lighting assumed 2 W/m^2 from 6pm to 11 pm

Table 4: Occupancy & Equipment gains (CIBSE TM 59)

Room Type	Occupancy	Equipment Load
1-bedroom apartment: living room/kitchen	1 person from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
2-bedroom apartment: living room/kitchen	2 people from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
Double bedroom	2 people at 70% gains from 11 pm to 8 am, 2 people at full gains from 8 am to 9 am and from 10 pm to 11 pm, 1 person at full gain in the bedroom from 9 am to 10 pm	Peak load of 80 W from 8 am to 11 pm Base load of 10 W during the sleeping hours
Single bedroom	1 person at 70% gains from 11 pm to 8 am, 1 person at full gains from 8 am to 11 pm	Peak load of 80 W from 8 am to 11 pm Base load of 10 W during sleeping hours

Profiles
Figures 03-08 below illustrate the profiles applied to the heat gains associated with occupancy, lighting and equipment. These profiles are defined by the methodology described in CIBSE TM59.

The vertical axis of the graphs represents the proportion of the full gains applied for each hour of the day, with maximum internal gain figures given in Table 5 above. Further information can be found in Appendix E.

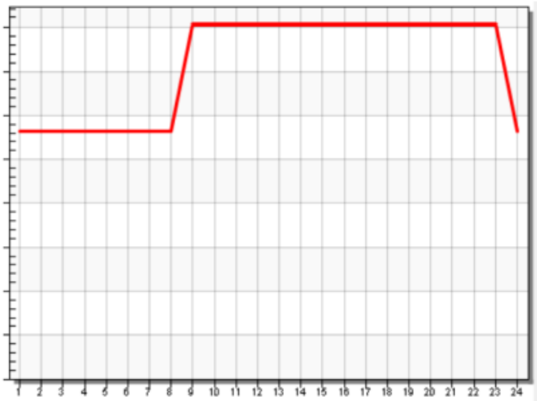


Figure 03: Occupancy of Single Bedrooms

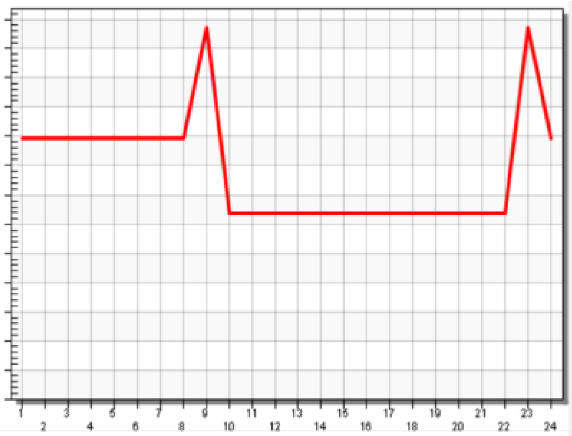


Figure 04: Occupancy of Double Bedrooms

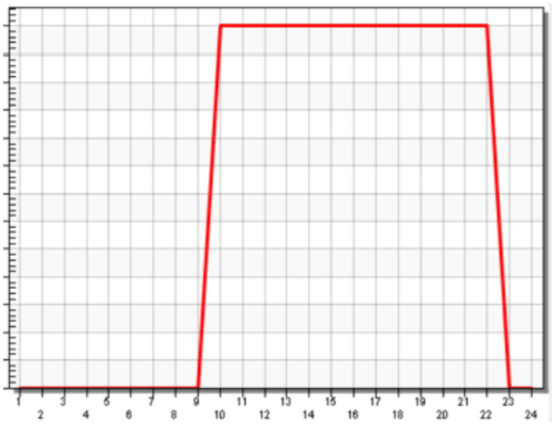


Figure 05.- Occupancy of Living/Kitchen

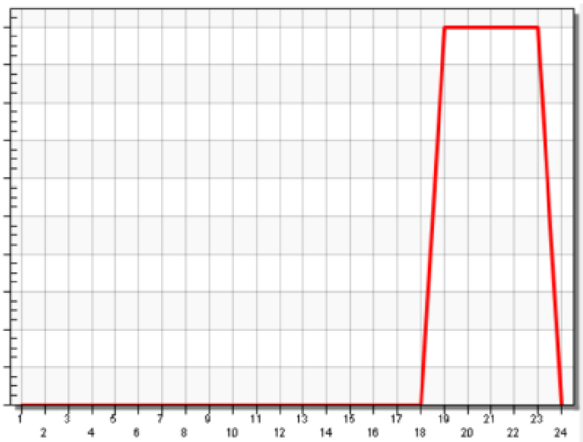


Figure 06: Lighting in all areas

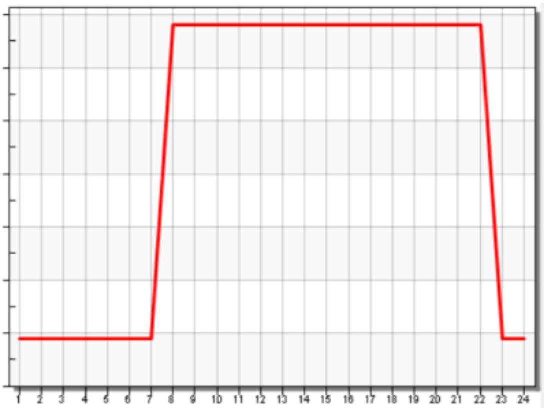


Figure 07: Equipment in Bedrooms

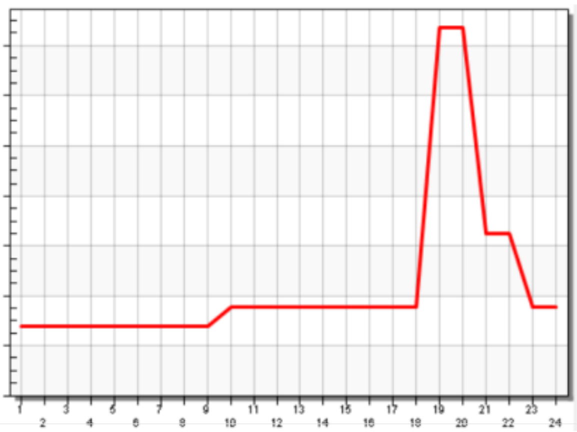


Figure 08: Equipment in Living/Kitchen

Infiltration

The outside definition method has been considered by zone. 5.00 air changes per hour (ACH) have been assumed. This is based on empirical air permeability data published in CIBSE Guide A and the National Calculation Methodology.

Heating and Cooling

All spaces are assumed to be heated to 18°C & 21°C.

No mechanical cooling has been applied to any areas.

Mechanical Ventilation

Mechanical Ventilation with Heat Recovery has been applied to all the areas. The flow rate in all the domestic spaces is based on the information provided by Davies Partnership, 22 l/s has been assumed for Living-Kitchen areas and 8 l/s are considered for all bedrooms, it is assumed that due to the operability of indoor doors the bedroom areas can draw air from outside though habitable rooms if operating continuously.

Natural ventilation

All occupied spaces can have natural ventilation openings for purge ventilation. When temperatures begin to rise within the spaces, occupants will be able to open doors and windows in order to permit the flow of outside air into relevant spaces. Nevertheless, based on the Noise Impact Assessment Report produced by KP acoustics due to the potential environmental noise affecting the development, the selected strategy to provide ventilation to the units will be through MVHR systems.

Further detail regarding the occupancy schedules, stipulated by CIBSE TM 59 can be found in Appendix E.

Table 5 summarizes the natural ventilation strategy adopted in each space.

Table 5: Proposed natural ventilation strategy.

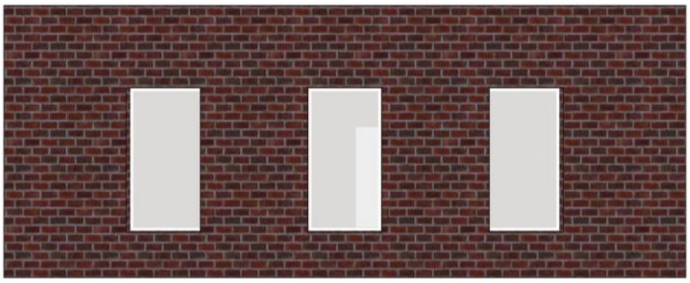
Room	Occupied Hours	Ventilation Strategy
Living Room	09:00 – 22:00	Windows and glazed doors closed all time. MVHR to provide ventilation.
Bedroom	24/7 (sleeping hours 22:00-07:00)	Windows and glazed doors closed all time. MVHR to provide ventilation.

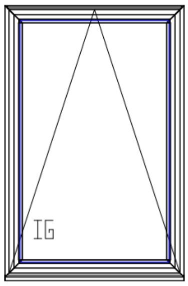
Windows Operability

Due to the location constraints of the site, the noise assessment has been ruled out opening he windows and maintain the windows closed. However, we have also reviewed the possibility to open the windows, although a scenario with restricted opening windows has been approached (Appendix C).

The equivalent free area of the windows has been defined under the concepts of the CIBSE 2016 article “Air of Credibility”. Table 06-16 shows all top hind windows openable 15% **free area**, calculated using the security restriction of 100mm opening limit, which results are shown in appendix B (not including internal blinds). Internal doors are assumed to have a free area equivalent to 50%.

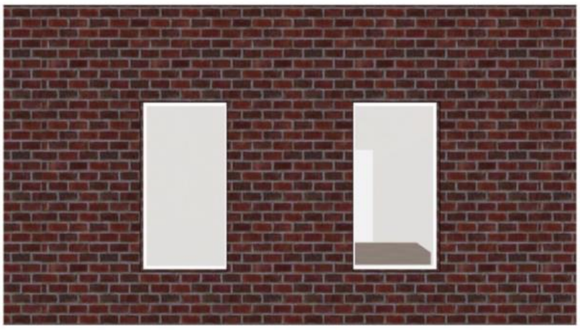
Figure 06: GF - Unit 06 - Studio

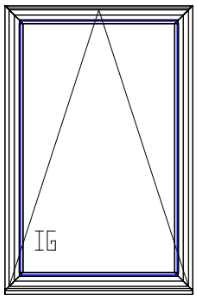




Free area (%):	Window: 15
Discharge Coefficient	0.14

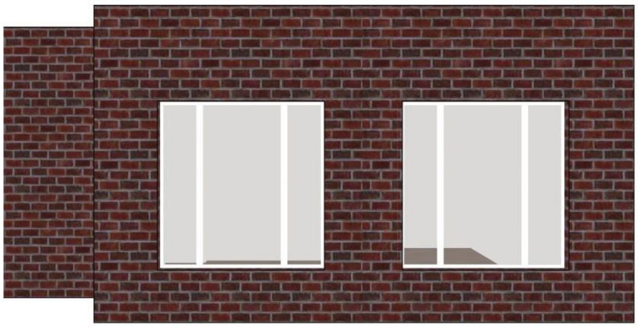
Figure 07: GF - Unit 11 - Studio

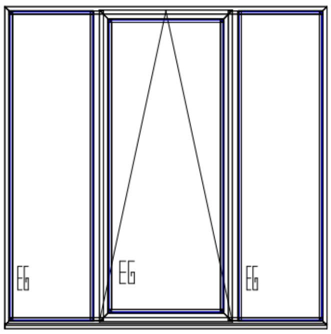




Free area (%):	Window: 15
Discharge Coefficient	0.14

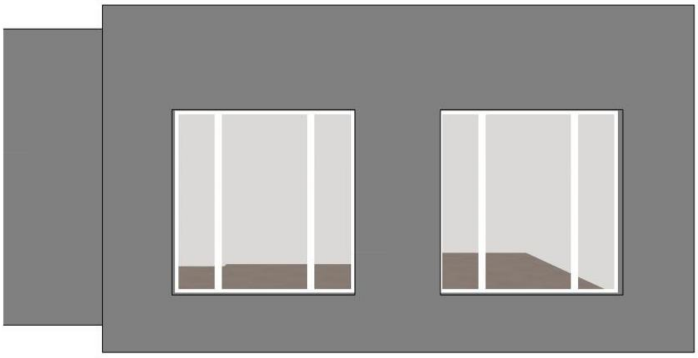
Figure 07: GF - Unit 16 - Studio

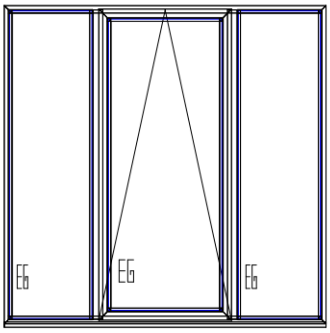




Free area (%):	Window: 15
Discharge Coefficient	0.14

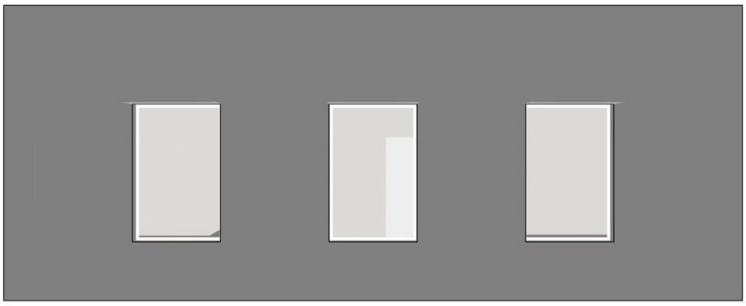
Figure 07: GF - Unit 50 - Studio

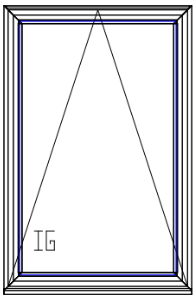




Free area (%):	Window: 15
Discharge Coefficient	0.14

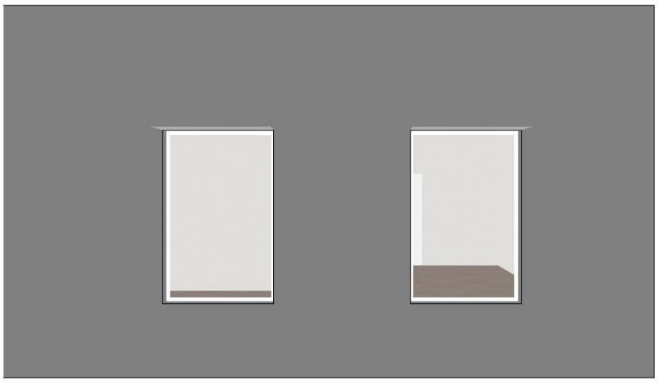
Figure 07: GF - Unit 39 - Studio

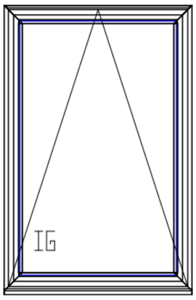




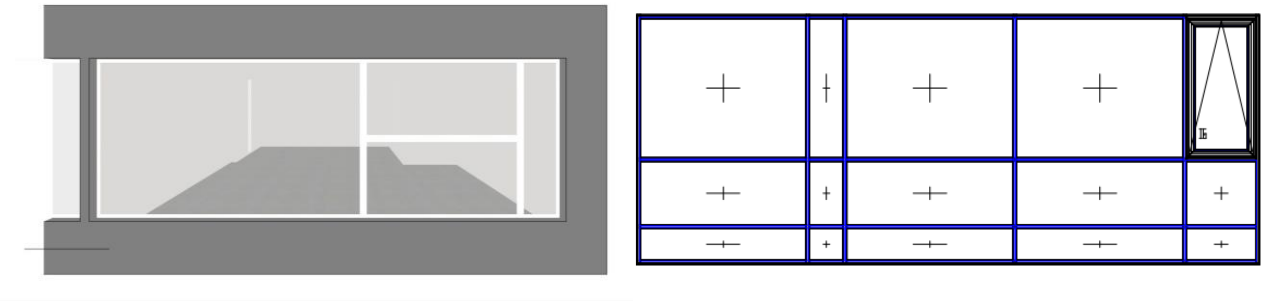
Free area (%):	Window: 15
Discharge Coefficient	0.14

Figure 07: GF - Unit 44 - Studio





Free area (%):	Window: 15
Discharge Coefficient	0.14

Figure 07: GF - Unit 52 - Studio	
	
Free area (%):	Window: 15
Discharge Coefficient	0.14

All of the openings are assumed to be maintained close, a boost of the airflow rates will be provided by the MVHR when the internal temperature of the adjacent zone reaches 22°C. This is intended to simulate the likely behaviour of occupants.

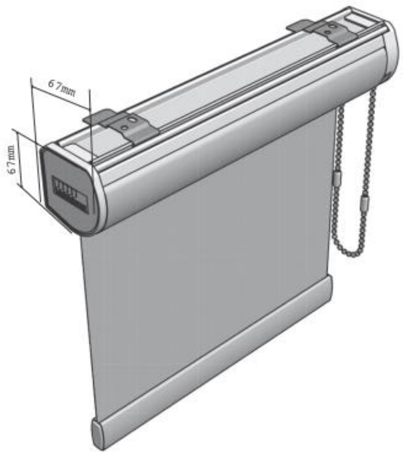
Openings have been set to be closed at any time of the day, considering the diverse occupancy of residential properties. It is assumed that internal doors will be open during the day to encourage the flow of air within the property.

Solar Control Devices

A possible scenario to include white polyester Internal blinds have been applied to all apartments within the analysis model, as per specification detailed below:

Solar Transmittance: 10
Solar Reflectance: 80
Solar Absorption: 8

Blinds with medium reflectivity slat has been explored, the operational method assumed is to be on at night if the outside air temperature is less than the outside air temperature setpoint (22 C). Shading is on and is defined by a time only through the respective occupation schedule of the area.



Closed Cassette system

Figure 10: Internal blinds

5 Results

This section details the results obtained from the assessment of overheating risk in the 29 self-contained units selected for analysis.

All occupied spaces have been assessed against the requirements of the criterion for mechanical ventilated houses. The assessment criteria are described in detail earlier in the report.

Table 8: Residential units overheating assessment results – Mechanical Ventilation Criteria

Level		% Hours Exceeded	Pass/Fail
Ground Floor	0F-Flat 06-Studio	2.60	Pass
	0F-Flat 07-Studio	2.50	Pass
	0F-Flat 08-Studio	2.42	Pass
	0F-Flat09-Studio	2.38	Pass
	0F-Flat 10-Studio	2.36	Pass
	0F-Flat 11-Studio	2.57	Pass
	0F-Flat 12-Studio	2.03	Pass
	0F-Flat 15-Studio	1.73	Pass
	0F-Flat 16-Studio	1.96	Pass
First Floor	1F-Flat 22-Studio	2.19	Pass
	1F-Flat 23-Studio	2.53	Pass
	1F-Flat 24-Studio	2.87	Pass
	1F-Flat 25-Studio	2.83	Pass
	1F-Flat 26-Studio	2.84	Pass
	1F-Flat 27-Studio	2.87	Pass
	1F-Flat 28-Studio	2.49	Pass
	1F-Flat 32-Studio	1.98	Pass
	1F-Flat 33-Studio	2.35	Pass
Second Floor	2F-Flat 39-Studio	2.98	Pass
	2F-Flat 40-Studio	2.91	Pass
	2F-Flat 41-Studio	2.69	Pass

	2F-Flat 42-Studio	2.92	Pass
	2F-Flat 43-Studio	2.74	Pass
	2F-Flat 44-Studio	2.78	Pass
	2F-Flat 45-Studio	2.61	Pass
	2F-Flat 49-Studio	2.73	Pass
	2F-Flat 50-Studio	2.88	Pass
Third Floor	3F-Flat 51-Studio	2.95	Pass
	3F-Flat 52-Studio	2.98	Pass

The outputs presented in table 06 illustrates that all the assessed areas have shown compliance with the TM59 criteria. In areas, the number of hours exceeding the comfort range remains within the maximum threshold level.

6 Cooling Hierarchy Summary

In accordance with the CIBSE TM 59 guidance, the following table summarized the steps taken to avoid the risk of overheating on the dwellings:

Table 19: Cooling hierarchy

Cooling Hierarchy	Cooling Strategy
1. Minimise internal heat generation	The fabric of the building has been assessed in line with the heating requirements specified in the energy statement, which has adopted a "fabric first" approach to design the most suitable heating system.
2. Reduce the amount of heat entering a building in summer though orientation, shading, albedo fenestration, insulation and green roofs and walls.	1. Low energy lighting will be installed across the development to reduce internal heat gains and improve energy consumption. 2. Solar control glazing to reduce the amount of solar energy being transmitted into the building, g-value 0.32. 3. Inclusion of high reflectance- low transmittance blinds approached.
4. Manage the heat withing the building though exposed internal thermal mass and high ceilings	1. The potential of introducing thermal mass to building elements was considered, but due to the required levels of insulation necessary to achieve the applied U-values, the impact of thermal mass in managing heat in the spaces is medium. 2. The building maximises floor to ceiling height to accommodate. building services.
3. Passive Ventilation	1. Natural ventilation is restricted through outward/inward opening windows across all dwellings.
2. Mechanical ventilation	Mechanical ventilation with heat recovery has been installed and will act as the main source of ventilation.
3. Active Cooling Systems	Active cooling is not proposed

7 Summary

An overheating assessment has been undertaken on the conversion of an existing office space to include 52 self-contained dwellings on the land at Bedfont Cross, Stanwell Road, Feltham, TW14 8NX.

The assessment includes a sample of 29 self-contained residential units considered to represent a range of unit types from across the scheme, including those perceived to be most at risk of overheating.

A number of passive measures have been included to help mitigate overheating risk:

- Natural ventilation openings have been approached to all occupied spaces, with single-aspect ventilation employed wherever possible, however, does not act as the principal source of fresh air.
- The use of solar control glazing to reduce the amount of solar energy being transmitted into the building.
- The openings have explored the option to incorporate internal solar reflective blinds to assist in mitigating the overheating risk (Table 08)

Based on the parameters outlined in this report, all spaces assessed have demonstrated to halve the number of hours exposed to overheating conditions when compared to the baseline specifications (Appendix B).

The baseline scenario shown in Appendix B reflects the overheating risk nature of the project without implementing internal blinds, therefore the baseline scenario displays a much higher breakdown with the TM 59 criteria for mechanical ventilated buildings.

In accordance with the assessment of the building under the DSY2 and DSY3 weather files, it can be observed (Appendix D) a minimal reduction in the overheating risk through the inclusion of solar control glazing and internal blinds. Nonetheless, the criteria cannot be met by the application of the aforementioned passive measures, hence there is still the overheating risk due to the onerous nature of the more severe weather scenarios, the inclusion of active cooling would be advisable to surpass the TM 59 requirements for these extreme weather files.

Based on the parameters outlined in this report, all the areas have demonstrated compliance with the CIBSE TM59 criteria, passive measures such as solar control glazing and internal blinds were introduced, therefore there is no reliance on mechanical cooling. It is incumbent on the local planning authority to approve the present assessment.

Appendices

Appendix A: Assessed Zones Internal Layouts

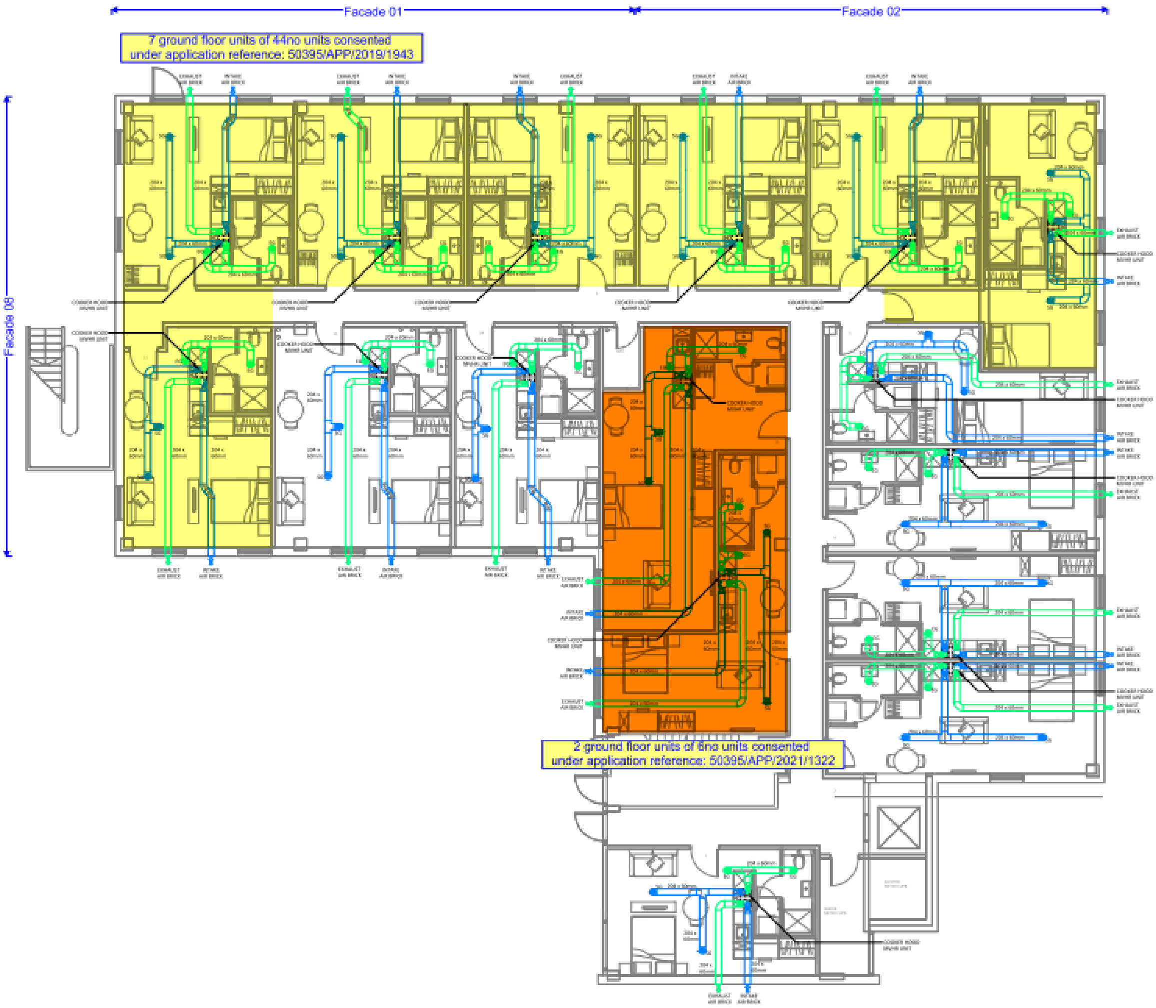


Figure 20: Ground Floor sample units

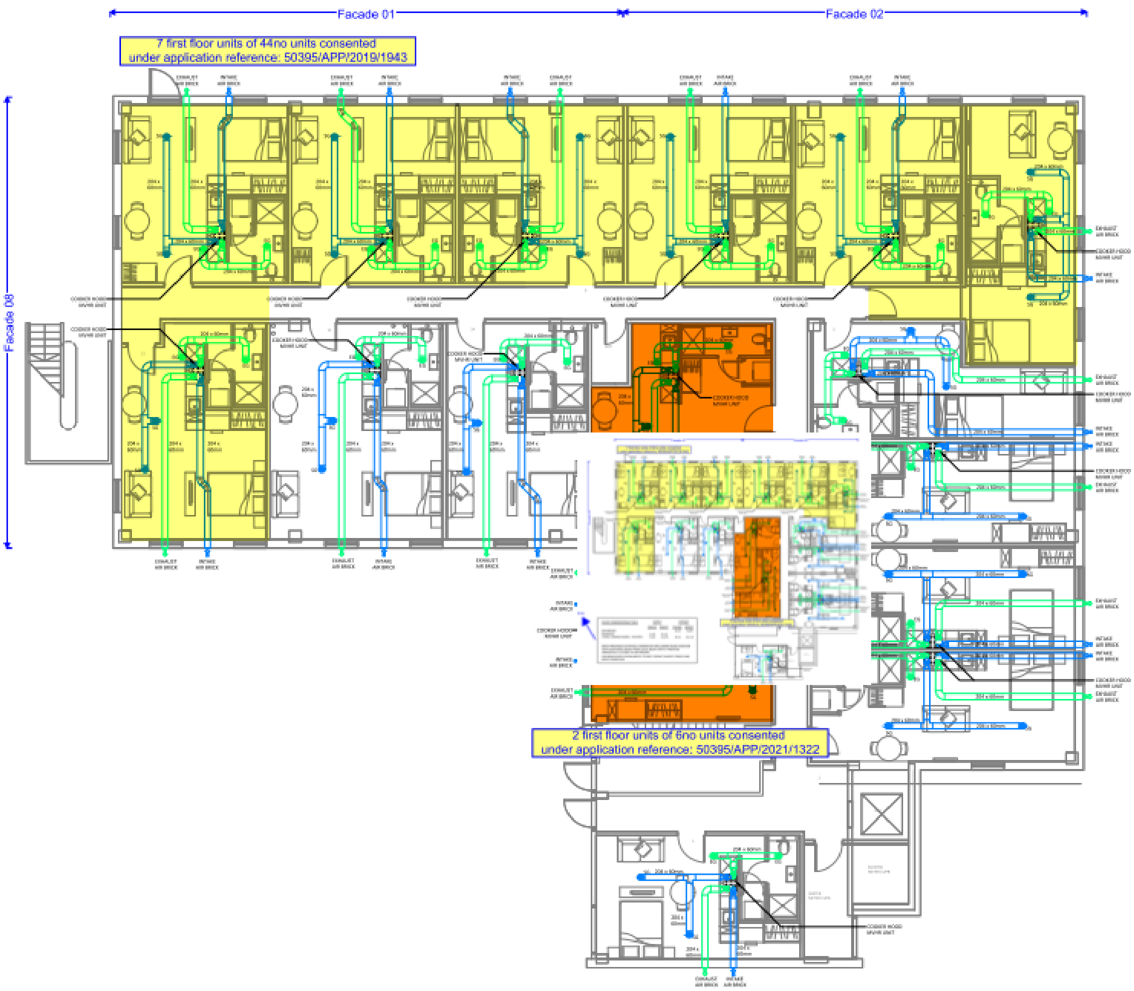


Figure 21: Frist Floor sample units

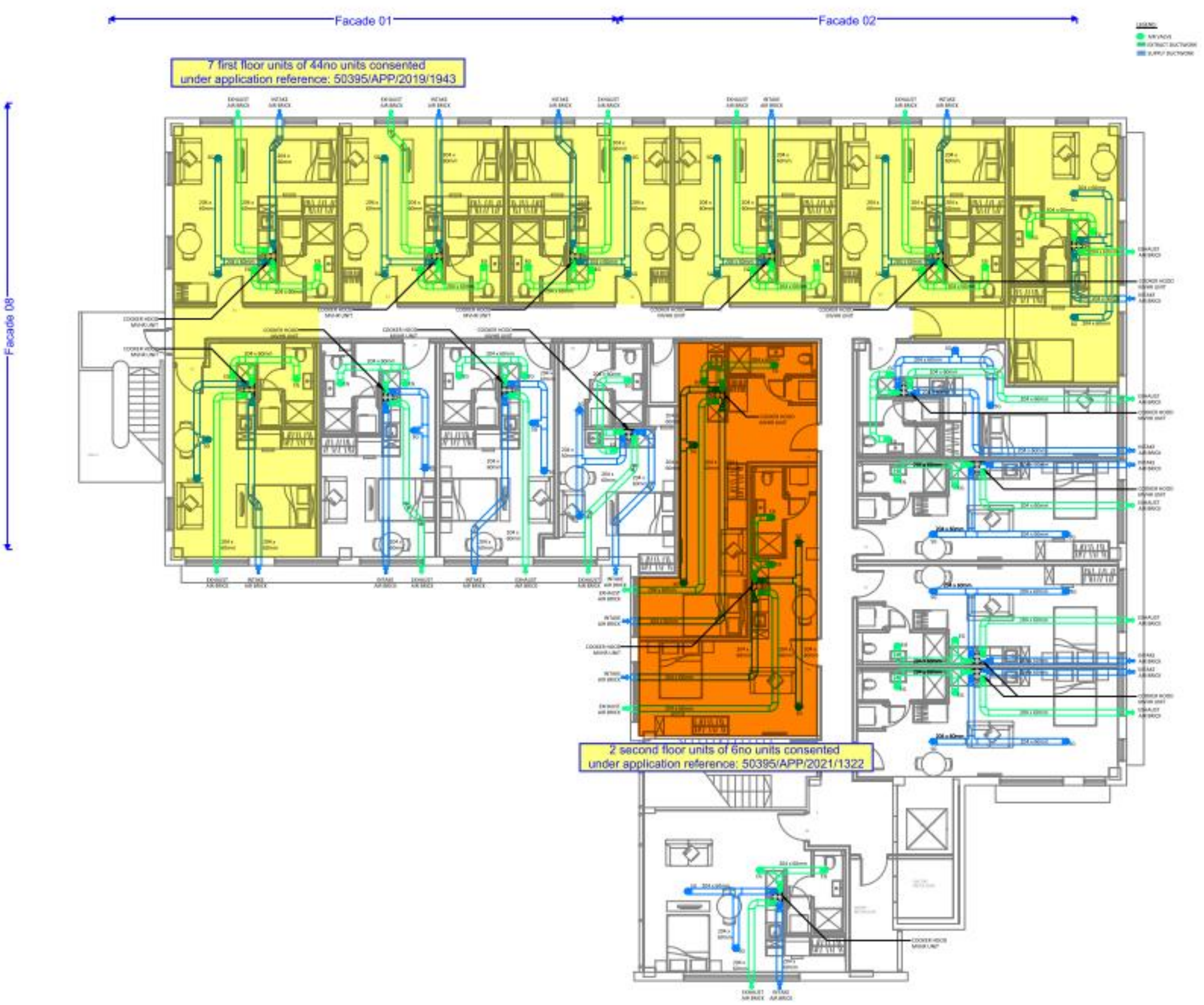


Figure 21: Second Floor sample units

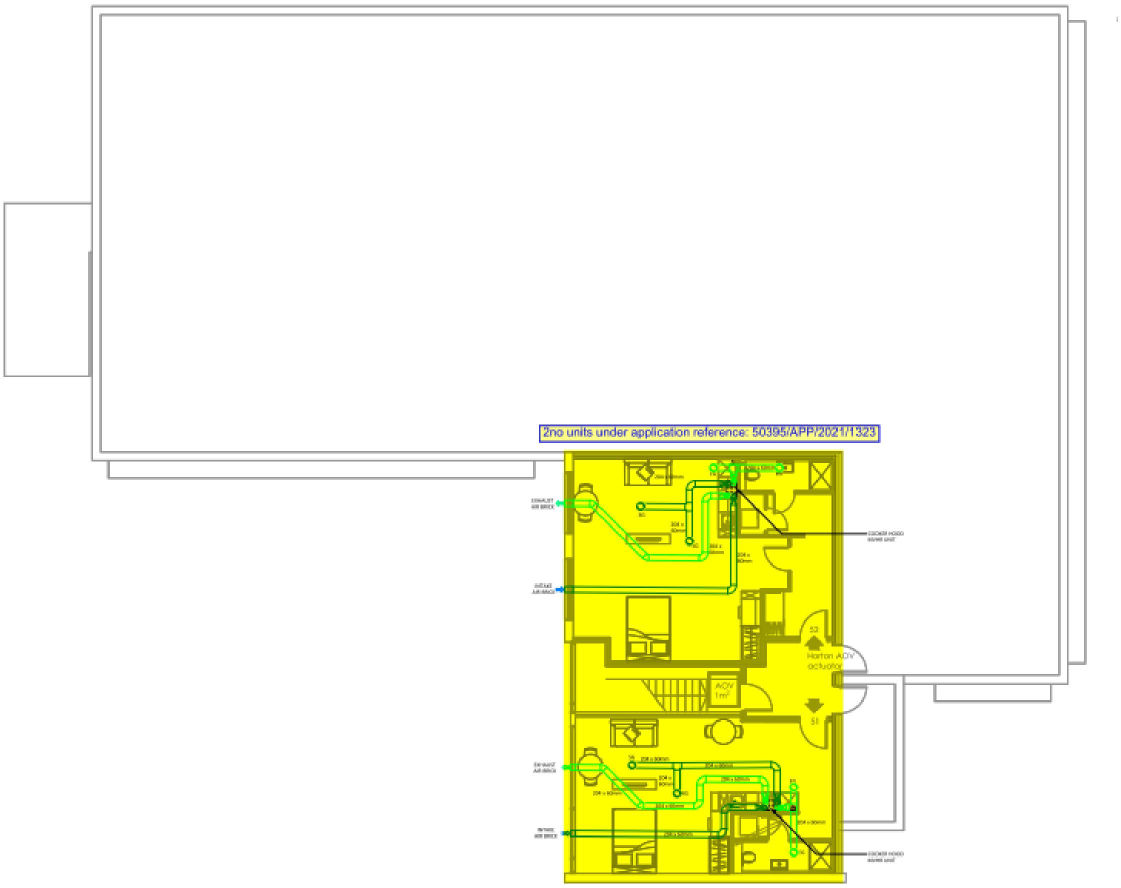


Figure 21: Third Floor sample units

Appendix B: Baseline Overheating Results - No internal Blinds.

Level		% Hours Exceeded	Pass/Fail
Ground Floor	0F-Flat06-Studio	2.87	Pass
	0F-Flat07-Studio	2.83	Pass
	0F-Flat08-Studio	2.73	Pass
	0F-Flat09-Studio	2.70	Pass
	0F-Flat10-Studio	2.65	Pass
	0F-Flat11-Studio	2.90	Pass
	0F-Flat12-Studio	2.49	Pass
	0F-Flat15-Studio	1.87	Pass
	0F-Flat16-Studio	2.15	Pass
First Floor	1F-Flat22-Studio	2.65	Pass
	1F-Flat23-Studio	2.78	Pass
	1F-Flat24-Studio	2.95	Pass
	1F-Flat25-Studio	2.99	Pass
	1F-Flat26-Studio	2.95	Pass
	1F-Flat27-Studio	2.99	Pass
	1F-Flat28-Studio	2.85	Pass
	1F-Flat32-Studio	2.42	Pass
	1F-Flat33-Studio	2.66	Pass
Second Floor	2F-Flat39-Studio	3.15	Fail
	2F-Flat40-Studio	3.87	Fail
	2F-Flat41-Studio	2.95	Fail
	2F-Flat42-Studio	3.85	Fail
	2F-Flat43-Studio	3.87	Fail
	2F-Flat44-Studio	3.91	Fail
	2F-Flat45-Studio	3.53	Fail

	2F-Flat49-Studio	3.74	Fail
	2F-Flat50-Studio	3.95	Fail
Third Floor	3F-Flat51-Studio	3.97	Fail
	3F-Flat52-Studio	3.98	Fail

Appendix C: Overheating Results – Natural Ventilation Strategy – No Internal Blinds

Level		Criterion A (%)	Criterion B (Hrs)	Pass/Fail
Ground Floor	0F-Flat 06-Studio	0.00	29.67	Pass
	0F-Flat 07-Studio	0.05	20.50	Pass
	0F-Flat 08-Studio	0.00	20.83	Pass
	0F-Flat09-Studio	0.00	20.33	Pass
	0F-Flat 10-Studio	0.00	20.50	Pass
	0F-Flat 11-Studio	0.05	24.50	Pass
	0F-Flat 12-Studio	0.00	20.17	Pass
	0F-Flat 15-Studio	0.00	16.17	Pass
	0F-Flat 16-Studio	0.00	22.00	Pass
First Floor	1F-Flat 22-Studio	0.15	32.67	Fail
	1F-Flat 23-Studio	0.13	33.67	Fail
	1F-Flat 24-Studio	0.12	33.50	Fail
	1F-Flat 25-Studio	0.11	33.17	Fail
	1F-Flat 26-Studio	0.11	33.67	Fail
	1F-Flat 27-Studio	0.20	33.50	Fail
	1F-Flat 28-Studio	0.12	32.40	Fail
	1F-Flat 32-Studio	0.09	29.83	Pass
	1F-Flat 33-Studio	0.12	28.50	Pass
Second Floor	2F-Flat 39-Studio	0.99	34.83	Fail
	2F-Flat 40-Studio	0.31	34.73	Fail
	2F-Flat 41-Studio	0.00	34.67	Fail
	2F-Flat 42-Studio	0.05	35.67	Fail
	2F-Flat 43-Studio	0.00	34.00	Fail
	2F-Flat 44-Studio	0.00	35.50	Fail
	2F-Flat 45-Studio	0.00	34.50	Fail

	2F-Flat 49-Studio	0.05	33.83	Fail
	2F-Flat 50-Studio	0.00	33.00	Fail
Third Floor	3F-Flat 51-Studio	0.00	34.87	Fail
	3F-Flat 52-Studio	0.00	34.89	Fail

Appendix D: DSY2 & DSY 3 Overheating Results

Scenario	Solar control			% Hours Exceeded
	G-value	No. of rooms meeting the criteria	Window free area (%)	No. of rooms meeting the Criteria
DSY 2	0.32	MVHR	0.00	2 of 29
DSY 3	0.32	MVHR	0.00	0 of 29

Appendix E: Detailed Occupancy Schedules – CIBSE TM 59 Heat gain Profile

Number of People	Description /Occupancy	Period																							
		00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24
		Hour ending																							
		1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00	24.00
1	Single Bedroom	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.7
2	Double Bedroom	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.7
2	Studio	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.7
1	1-bedroom /living/Kitchen	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
1	1 - bedroom /living	0	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
1	1 - bedroom Kitchen	0	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0
2	2-bedroom /living/Kitchen	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
2	2 - bedroom /living	0	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
2	2 - bedroom Kitchen	0	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0
3	3 - bedroom/living/Kitchen	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
3	3 - bedroom /living	0	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
3	3 - bedroom Kitchen	0	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0