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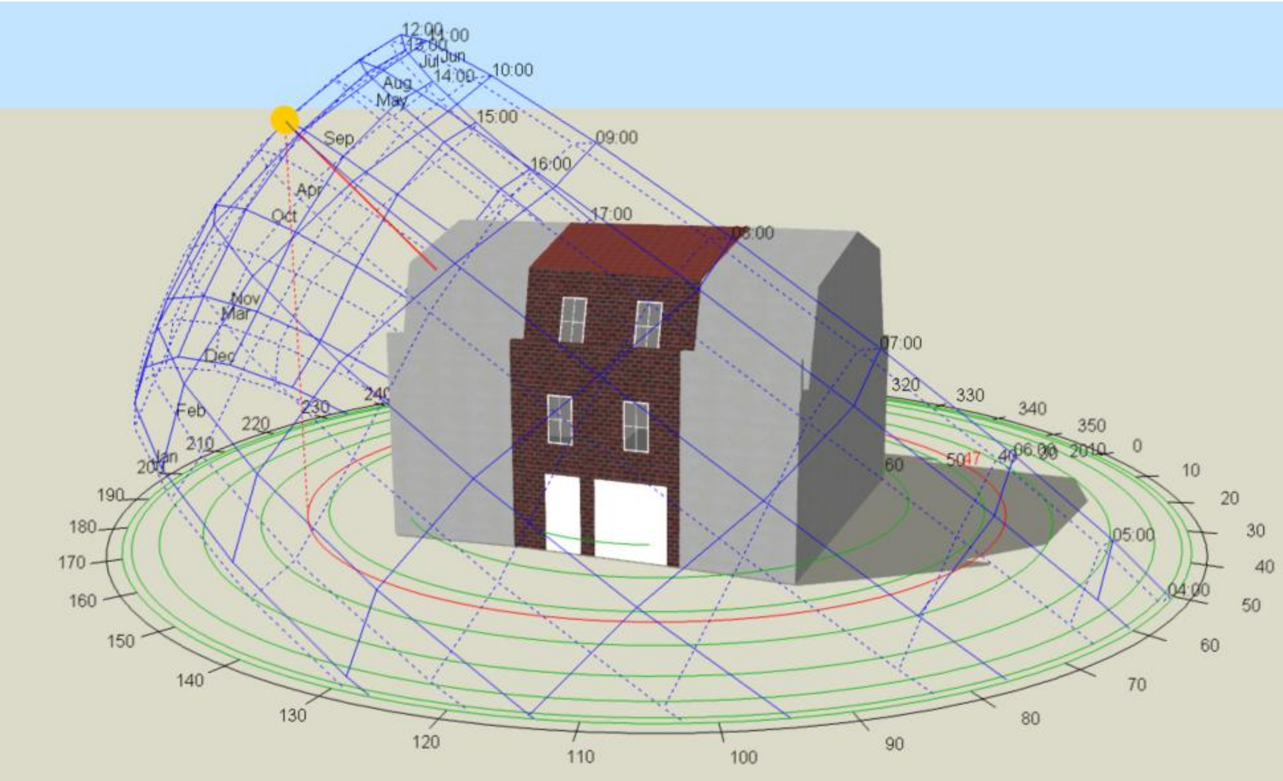

Domestic Overheating Assessment

CIBSE TM59

6 Byron Mews
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24th March 2025

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Document Status

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Proposals: Installation of an AC unit to provide cooling to the second floor bedrooms

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Document Control Record:

Prepared by	Checked by	Date	Job	Revision
MH	PK	24-03-2025	12916	0

1 Scope

This report and accompanying domestic overheating assessment have been prepared in support of the planning application to install an AC unit to provide cooling to the second-floor bedrooms of the existing dwelling at 6 Byron Mews, London.

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. This report assesses the overheating risk of the second-floor bedrooms in the dwelling and follows Policy CC2 Adapting to Climate Change of the London Borough of Camden Local Plan, which follows the requirements of the London Plan Policy SI 4: Managing heat risk.

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 deUNIT 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 demonstrates 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 the existing residential dwelling at 6 Byron Mews, London.

The assessment has been undertaken in accordance with CIBSE Technical Memorandum 59, which deals with overheating risk in domestic properties.

The results of the overheating assessment show that the second-floor bedrooms are currently overheating significantly and that TM59 compliance cannot be achieved through the implementation passive measures alone. Therefore, it is advised to incorporate active cooling to the second-floor bedrooms to ensure comfortable internal temperatures are achieved.

3 London Plan Policy

The London Plan Policy SI 4 Managing heat risk states the following:

Development proposals should minimise adverse impacts on the urban heat island (UHI) through design, layout, orientation, materials, and the incorporation of green infrastructure.

Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following **cooling hierarchy**:

1. Reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure.
2. Minimise internal heat generation through energy efficient design.
3. Manage the heat within the building through exposed internal thermal mass and high ceilings.
4. Provide passive ventilation.
5. Provide mechanical ventilation.
6. Provide active cooling systems.

Passive ventilation should be prioritised, taking into account external noise and air quality in determining the most appropriate solution. The increased use of air conditioning systems is not desirable as these have significant energy requirements and, under conventional operation, expel hot air, thereby adding to the urban heat island effect. If active cooling systems, such as air conditioning systems, are unavoidable, these should be designed to reuse the waste heat they produce. Future district heating networks are expected to be supplied with heat from waste heat sources such as building cooling systems.

The Chartered Institution of Building Services Engineers (CIBSE) has produced guidance on assessing and mitigating overheating risk in new developments, which can also be applied to refurbishment projects. TM 59 should be used for domestic developments and TM 52 should be used for non-domestic developments. In addition, TM 49 guidance and datasets should also be used to ensure that all new development is designed for the climate it will experience over its design life. Further information will be provided in guidance on how these documents and datasets should be used.

Further details and guidance regarding overheating and cooling are outlined in the Energy Assessment Guidance (2022). Which in section 8 “Cooling and overheating” sets out the following recommendations to avoid overheating risks and reduce the impact of UHI effects in new developments:

1. The London Plan encourages developers to carry out overheating modelling against extreme weather scenarios, which will provide the necessary detail for developers to design developments with appropriate mitigation measures.

2. The London Plan requires developers to follow the cooling hierarchy to reduce the risk of developments overheating and reduce the impact on the UHI effect through avoiding mechanical cooling where possible and promoting passive cooling measures. Where mechanical cooling is proposed, developers will need to consider the use of low global warming potential refrigerants to reduce harmful emissions.

As stated above this report demonstrates how the scheme has been produced in line with the cooling hierarchy of London Plan Policy SI 4, and has identified the CIBSE TM 59 guidance, presented in chapter 4 of this report, as the most appropriate methodology for the assessment of overheating risk of homes.

4 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 for predominantly natural ventilated homes:

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).

Additionally, the following criteria is set for homes that are **predominantly mechanically ventilated:**

For homes with restricted window openings, all occupied rooms should not exceed an operative temperature of 26°C for more than 3% of the annual occupied annual hours.

5 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 dwelling. The model was developed using drawn information supplied by deUNIT 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.

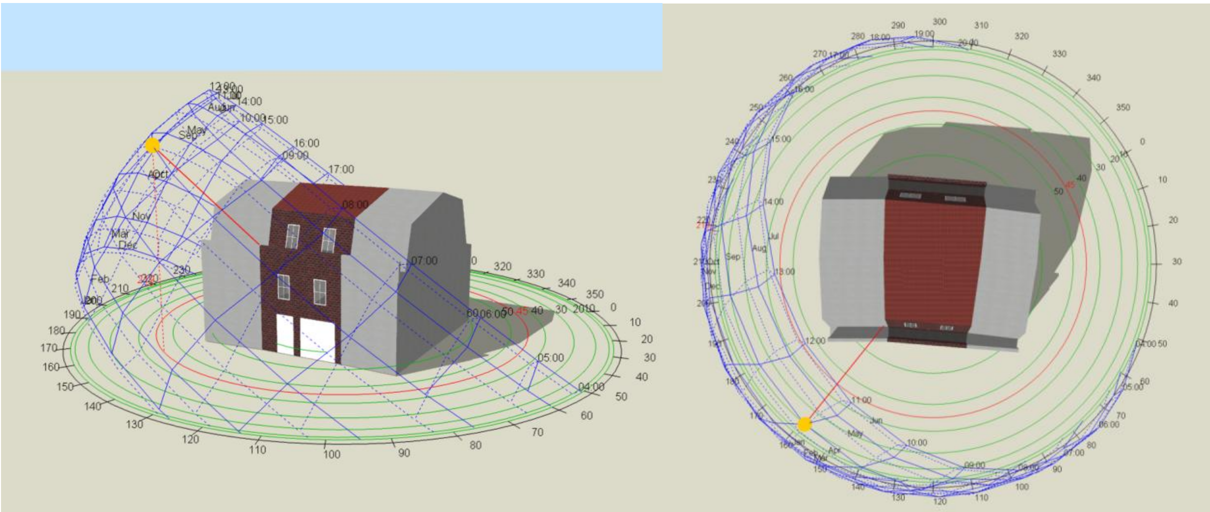


Figure 01.- Solar Path & Isometric view

Climate

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

Overheating modelling for both domestic and non-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 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 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 2020 weather data for Heathrow which is intended to be indicative of a low-rise urban location. 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 B. As per the GLA Guidance for Energy assessments, 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.

Building Elements

The fabric performance listed in table 01 has been assumed based on the age of the dwelling.

A glazing specification was not proposed, however one that incorporates 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.

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

Table 01: Thermal Transmittance of Building Elements for constructed elements

Building Element	Retained U-Value (W/M²k)	G-Value	Notes
Walls	0.27	n/a	Assumed specification
Roof	0.35	n/a	Assumed specification
Internal Walls	1.00	n/a	Assumed specification
Internal Floors	1.00	n/a	Assumed specification
Glazing	2.70	0.76	Double glazed units

Solar Control

The glazing specific is assumed to have a U-Value of 2.70 W/m2K and have a g-value of 0.76 as per the SAP Appendix S (reduced data sap for existing dwellings). For the purpose of this analysis, additional scenarios with reduced g-values have been simulated to identify the impact of this passive measure on reducing overheating risk.

Model Geometry and Local Shading

The Model has included the immediate surrounding elements (vegetation and building blocks) to account the overshadowing during simulations.

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 02-03) stipulated by the TM 59 guidance have been included in the dynamic thermal model. Table 02 below provides details of the heat gains associated with lighting, meanwhile table 03 shows all equipment and occupancy load (Sensible and latent).

Table 02: Lighting gains (CIBSE TM 59)

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

Table 03: Occupancy & Equipment gains (CIBSE TM 59)

Room Type	Occupancy	Equipment Load
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

Profiles

Figures 03-04 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 3 above. Further information can be found in Appendix C.

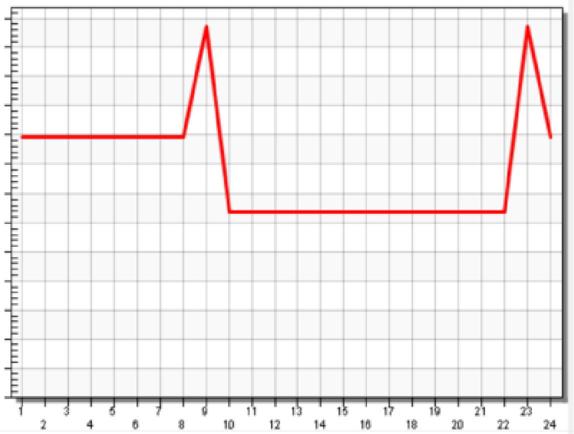


Figure 03: Occupancy of Double Bedrooms

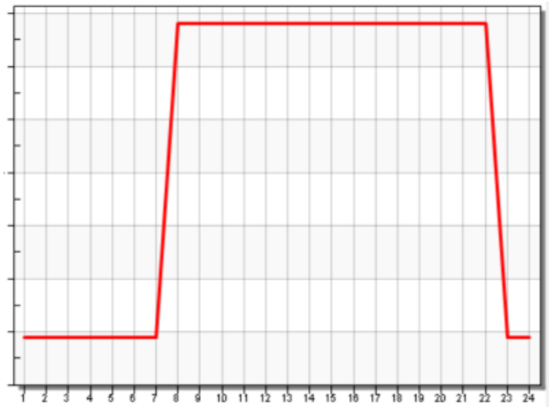


Figure 04: Equipment in Bedrooms

Heating, Cooling and Ventilation

Infiltration

An infiltration rate of 5 air changes per hour (ACH) has been assumed, based on the assumed air permeability rate of 15 m3/ (h.m2) at 50 Pa. This is based on empirical air permeability data published in CIBSE Guide A and the National Calculation Methodology.

Heating and Cooling

The bedrooms are assumed to be heated to 18°C.

Mechanical Ventilation

An additional iteration to include mechanical ventilation with heat recovery and summer bypass (MVHR) has been assessed (table 07 option 05). It has been assumed that the MVHR unit is capable of providing the following flow rates:

1. Bedrooms: 30 l/s

Natural ventilation

All occupied spaces 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 the relevant space.

As previously mentioned, the operability of the windows is managed by the CIBSE TM59 occupancy templates, which indicates that the window opening is allowed only when the room is occupied

Further detail regarding the occupancy schedules, stipulated by CIBSE TM59 can be found in Appendix C. Table 5 summarizes the natural ventilation strategy adopted in the proposed bedroom.

Table 05: Proposed natural ventilation strategy in domestic areas.

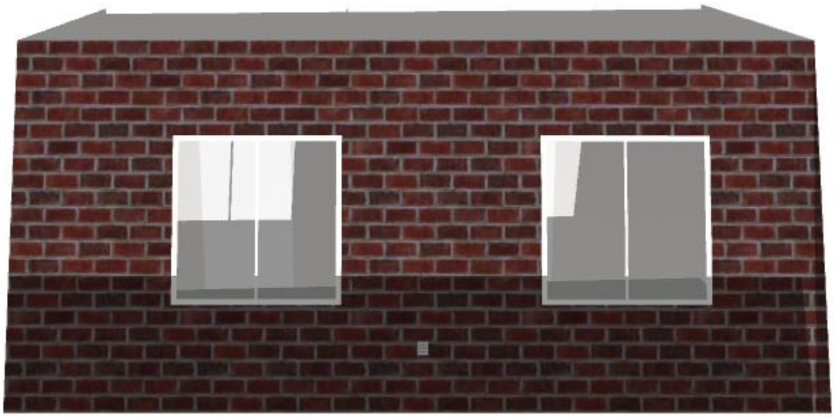
Room	Occupied Hours	Ventilation Strategy
Bedroom	24/7 (sleeping hours 22:00-07:00)	Windows open during sleeping hours (07:00-22:00).

Windows Operability

The equivalent free area of the windows has been defined under the concepts of the CIBSE 2016 article "Air of Credibility". Figures 6&7 show the opening details of all the windows in the development.

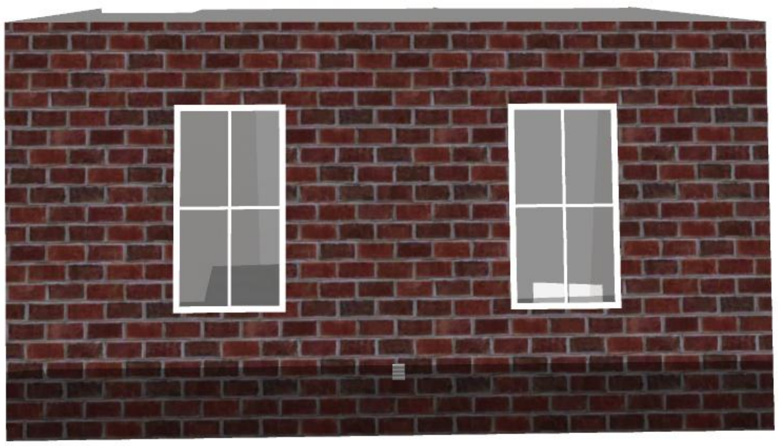
Internal domestic unit doors are assumed to be open during daytime.

Figure 06: Bedroom 2 Windows



Free area (%):	100
Discharge Coefficient	0.50

Figure 07: Bedroom 3 Windows



Free area (%):	50.0
Discharge Coefficient	0.50

All of the openings 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 23°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 during the day to encourage the flow of air within the property.

Solar Control Devices

There is a parapet wall on the second floor to both sides of the dwelling which acts as a solar control device. Additionally, the dwelling is shaded by neighbouring buildings to the south. These have been modelled in all calculations but have little impact on the overall results.

Internal blinds to the windows have been modelled and are assumed to be closed during the day time.

5 Results

This section details the results obtained from the assessment of overheating risk.

The two second-floor bedrooms have been assessed against the requirements of Criterion A and Criterion B. These assessment criteria are described in detail earlier in the report.

Criterion A & B

The results presented below in table 06 demonstrate the performance of the second-floor bedrooms against Criterion A & B of TM59:

Table 06: CIBSE TM59 overheating assessment results for DSY1 2020s weather file:

N.				Criterion A (%)	Criterion B (Hrs)
	G-value	Type of Ventilation	Shading Devices	No. of rooms meeting the criteria	No. of rooms meeting the criteria
01	0.76	Natural Ventilation	Internal Blinds	1 of 2	0 of 2
02	0.40	Natural Ventilation	Internal Blinds	1 of 2	0 of 2
03	0.40	MVHR Ventilation	Internal Blinds	2 of 2	0 of 2

The above scenarios have demonstrated that the passive measures described by the cooling hierarchy will fail to meet the CIBSE TM59 criteria. Therefore, the incorporation of active cooling is advised.

6 Cooling Hierarchy Summary

In accordance with the CIBSE TM59 guidance, the steps taken to avoid the risk of overheating on the dwellings are summarised in the following table:

Table 07: Cooling hierarchy

Cooling Hierarchy	Cooling Strategy
1. Minimise internal heat generation	1. Low energy lighting should be installed to reduce internal heat gains and improve energy consumption.
2. Reduce the amount of heat entering a building in summer though orientation, shading, albedo fenestration, insulation and green roofs and walls.	2. Due to nature of existing building, there are limited options for altering building fabric. Solar control to glazing could be considered but would have minimal impact on nighttime overheating. 3. Internal blinds have been modelled to reduce solar gain during the day.
3. Manage the heat within the building though exposed internal thermal mass and high ceilings	4. Due to the existing nature of the building, introducing further thermal mass to building elements has not been considered, the thickness and construction type the thermal mass in managing heat in the spaces is considered high.
4. Passive Ventilation	5. Natural ventilation is possible through the openable windows. 6. Due to the nature of the building, cross ventilation is facilitated by the double aspect.
5. Mechanical ventilation	7. Mechanical ventilation with heat recovery has been assessed as a potential option, but not incorporated as it has a minor impact on the overheating risk.
6. Active Cooling Systems	8. Active cooling is proposed (a cooling set-point of 21C has been modelled)

7 Summary

An overheating assessment has been undertaken for the second-floor bedrooms in the existing dwelling at 6 Byron Mews, London, NW3 2NQ.

This report has assessed the overheating risk in the second-floor bedrooms where it is proposed to install an Air Conditioning Unit to provide cooling to the bedrooms which are currently overheating.

A number of passive measures have been assessed to help mitigate overheating risk to identify the need for the AC installation:

- Natural ventilation openings are currently provided to the bedrooms with cross-ventilation aspect and double ventilation employed.
- The openings have been assessed with solar control glazing and internal blinds to assist in mitigating the overheating risk.
- The parapet wall and neighbouring buildings are providing external shading to the dwelling.
- Mechanical Ventilation with Heat Recovery units has been assessed to enhance the ventilation rate but has not been included in the final proposal.

By following the GLA cooling hierarchy, different passive measures have been considered in order to tackle overheating. However, the risk of overheating remains high as the development has failed to comply with the CIBSE TM59 criteria, thus active cooling is being proposed.

The dwelling has also been assessed with the DSY2 and DSY3 weather files (Appendix C) to account for extreme weather scenarios. This shows that the criteria cannot be met by the application of the aforementioned measures, hence there is still an overheating risk due to the onerous nature of the more severe weather scenarios. Therefore, the inclusion of active cooling would be advisable to comply the TM59 requirements.

Homes that overheat pose a significant risk to the health and well-being of occupants. This analysis shows that the existing conditions exceed the acceptable TM59 thermal comfort requirements, and that the installation of active cooling (in the form of an Air Conditioning unit) would ensure that the overheating risk is mitigated in current conditions as well as future conditions with increased temperatures due to climate change.

Appendices

Appendix A: Assessed Zones Internal Layouts

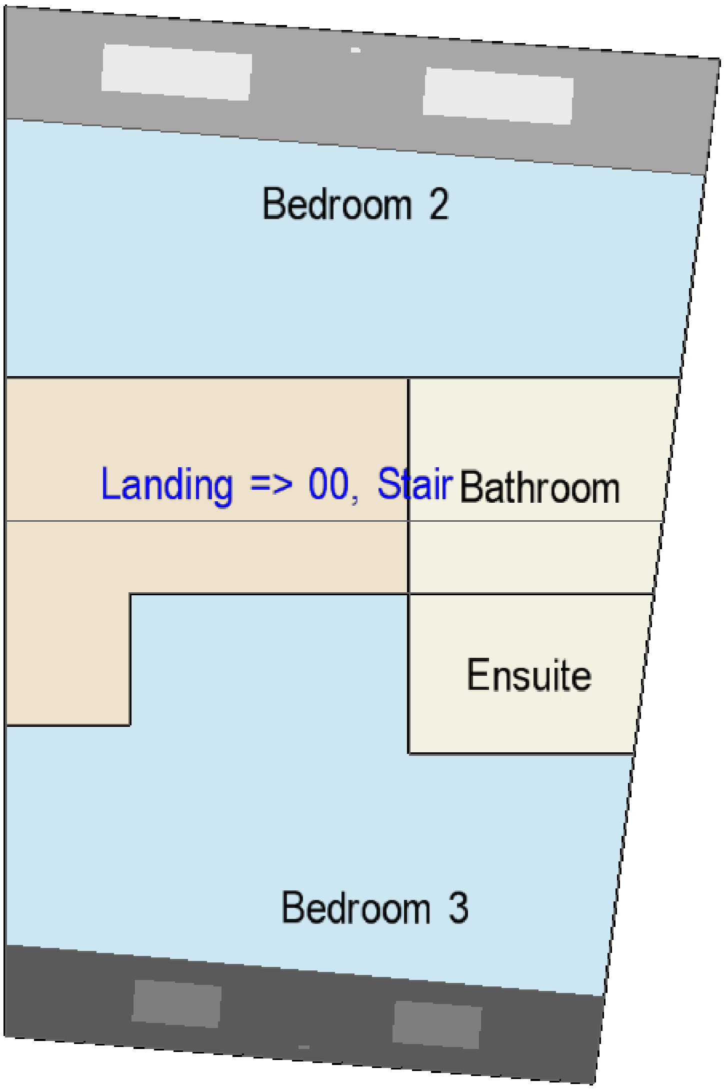


Figure 8: Second Floor

Appendix B: DSY2 & DSY3 Results

Table 08: CIBSE TM59 results - DSY-2.

N.				Criterion A (%)	Criterion B (Hrs)
	G-value	Type of Ventilation	Shading Devices	No. of rooms meeting the criteria	No. of rooms meeting the criteria
01	0.76	Natural Ventilation	Internal Blinds	1 of 2	0 of 2
02	0.40	Natural Ventilation	Internal Blinds	1 of 2	0 of 2
03	0.40	MVHR Ventilation	Internal Blinds	1 of 2	0 of 2

Table 08: CIBSE TM59 results – DSY-3.

N.				Criterion A (%)	Criterion B (Hrs)
	G-value	Type of Ventilation	Shading Devices	No. of rooms meeting the criteria	No. of rooms meeting the criteria
01	0.76	Natural Ventilation	Internal Blinds	0 of 2	0 of 2
02	0.40	Natural Ventilation	Internal Blinds	0 of 2	0 of 2
03	0.40	MVHR Ventilation	Internal Blinds	0 of 2	0 of 2

Baseline – Existing conditions (TM59 results)

Room	Criterion a (%)	Criterion b (Hr)	Pass/Fail
Bedroom 2	2.02	59.00	Fail
Bedroom 3	4.03	145.00	Fail

Proposed AC Installation (TM59 results DSY1)

Room	Criterion a (%)	Criterion b (Hr)	Pass/Fail
Bedroom 2	1.59	7.00	Pass
Bedroom 3	1.27	1.00	Pass

Proposed AC Installation (TM59 results DSY2)

Room	Criterion a (%)	Criterion b (Hr)	Pass/Fail
Bedroom 2	1.69	15.00	Pass
Bedroom 3	1.15	6.00	Pass

Proposed AC Installation (TM59 results DSY3)

Room	Criterion a (%)	Criterion b (Hr)	Pass/Fail
Bedroom 2	2.38	17.00	Pass
Bedroom 3	1.60	5.50	Pass

Appendix C: 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
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