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TAYLOR PROJECT SERVICES LLP
BUILDING SERVICES CONSULTANTS

# CIBSE TM59 Overheating Assessment

Lupin House,

11-13 Macklin Street,

London

WC2B 5NH

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**Produced by Taylor Project Services LLP**
Second Floor, Hunter House
150 Hutton Road
Shenfield, Essex
CM15 8NL
01277 225 709

**Prepared for Elleric UK Ltd**
Covent Garden
London
07734 115116
info@elleric.com

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# 1.0 EXECUTIVE SUMMARY

The following TM59 overheating study, undertaken by Taylor Project Services has been prepared to support the planning application for the renovation of an existing building at Lupin House, 11-13 Macklin Street with the proposal of a mixed-use redevelopment.

The proposal is for 12 residential apartments over 4 floors from levels 2 to 5 with retained commercial office uses on the lowest 3 floors – ground floor/mezzanine floor (partially) and first floor level.

Dynamic simulation modelling (DSM) has been utilised, to highlight the risk of the building to overheating and design solutions reviewed to mitigate overheating.

Originally, the TM52 methodology assessed non-domestic overheating and considers the consistent, standing mean temperature. As a result of this, the benchmark temperature has unrealistic low and high-temperature points. This means that at times, the target temperature will be lower than the external temperature and the criteria therefore cannot be met in some instances. TM59 is the new standardised approach to predicting overheating risk for residential building designs (new-build or major refurbishment) using dynamic thermal analysis.

The aim of TM59 is to produce a test that encourages good design that is comfortable within sensible limits, without being so stringent that it over-promotes the use of mechanical cooling. The test needs to be simple to ensure it is used.

The results of this model should be cross-referenced with the assumed building design and service figures. Any amendments to these assumptions should be reviewed as TPS cannot guarantee compliance, should there be any changes.

# 2.0 THE LONDON PLAN: POLICY 5.9

## Strategic

The Mayor seeks to reduce the impact of the urban heat island effect in London and encourages the design of places and spaces to avoid overheating and excessive heat generation, and to reduce overheating due to the impacts of climate change and the urban heat island effect on an area wide basis.

## Planning decisions

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 orientation, 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).

Major development proposals should demonstrate how the design, materials, construction and operation of the development would minimise overheating and also meet its cooling needs. New development in London should also be designed to avoid the need for energy intensive air conditioning systems as much as possible. Further details and guidance regarding overheating and cooling are outlined in the London Climate Change Adaptation Strategy.

## LDF preparation

Within LDFs boroughs should develop more detailed policies and proposals to support the avoidance of overheating and to support the cooling hierarchy.

# 3.0 CIBSE TM59: DESIGN METHODOLOGY FOR THE ASSESSMENT OF OVERHEATING RISK IN HOMES

In order to assess the Overheating, TM59 methodology has been followed. The memorandum states:

*“Recent evidence has shown that overheating risk needs to be taken seriously in the residential sector. Many new or refurbished homes have designs that contribute to overheating risk by, for example, having high proportions of glazing (resulting in excessive solar heat gains), inadequate natural ventilation strategies or mechanical ventilation systems that are not delivering intended air change rates. Overheating risk is also affecting existing homes, especially in buildings that do not have adequate methods for dissipating heat gains and are less resilient to climate change.*

*The health and wellbeing impacts of overheating can be significant for residents, resulting in stress, anxiety, sleep deprivation and even early deaths in heat waves, especially for vulnerable occupants. The situation is predicted to get worse. The Committee on Climate Change has estimated that mortality rates arising from overheating could rise from 2000 per year in 2015 to 7000 per year by the 2050s. Assessing overheating risk in homes is a complex issue and not adequately assessed by building regulations. Indeed, it would be wrong to assume that a home that complies with building regulations that were designed to focus on energy conservation also gives sufficient assurance of avoidance of overheating. Hence the recommendation that comfort conditions are separately assessed if it is felt that there could be a risk. Many factors influence overheating in homes, including the intensity of heat gains, occupancy patterns, orientation, dwelling layout, shading strategy and ventilation method. Dynamic thermal modelling can be used to simulate the internal temperature conditions and will therefore help establish whether threshold conditions of discomfort will be reached. Given the complexity of the factors influencing overheating it is important that a standardised methodology is used to assess risk and hence the need for this technical memorandum. It can be applied to dwellings, care homes and student residences. Early analysis of overheating risk is recommended so that mitigation strategies can be reviewed in design proposals. In summary, the application of this technical memorandum, by standardising the assessment methodology, should play a key role in limiting overheating risk in new and refurbished homes.”*

The CIBSE Technical Memorandum 59 sets out the definition and compliance with limiting overheating.

The standard introduces three categories of building:

1. Category I – buildings whose occupants are sensitive or fragile
2. Category II – normal expectation, recommended for new build or renovations
3. Category III – moderate expectation, mainly applicable in existing buildings

The standard provides a robust, yet balanced, assessment of the risk of overheating of buildings in the UK and Europe. Within TM59, the criteria for naturally and mechanically ventilated dwellings change are slightly different

### Criteria for Homes Predominantly Ventilated

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 percent 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).

Criteria 2 and 3 of CIBSE TM52 may fail to be met, but both (a) and (b) above must be passed for all relevant rooms.

### Criteria for Homes 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)).

## Living Spaces Assessed

### Living Rooms, Bedrooms, Kitchens

The number of hours during which ΔT is greater than, or equal to one degree (K) during May-September (September included) shall not be more than 3% of total occupied hours. (This falls in line with CIBSE TM:52 Criterion 1)

### Bedrooms Only

To guarantee comfort during the sleeping hours, the operative temperatures in the bedroom from 10pm-7am shall NOT exceed 26 degrees ºC for more than 1% of annual hours. (1% of the annual hours between 10pm-7am for bedroom is 32 hours. Therefore, 33 or more hours above 26 degrees ºC will be recorded as a fail.)

## Weather Files

Where the Greater London Authority (GLA) recommended that the CIBSE TM49 weather files are used as a benchmark for the TM52 analysis, TM59 should be modelled using the latest Design Summer Year (DSY) weather files. The units will be required to pass using the DSY1 year that is the most appropriate to the site location, for the 2020, high emission, 50% percentile scenario.

## Assessment Methodology Route

- Identify ALL likely, problematic units. This should be reflected and justified in the report
- Pipework and equipment from communal heating to be considered. This is due to the system being constantly primed/heated.
- Within the home itself, standing gains should be based on primary side (domestic hot water) pipework length up to the Hot water cylinder in accordance with guidance in CIBSE Guide C (2007). Standing gains from the Hot Water Cylinder should be based on manufacturers' Recommendations.
- Heat maintenance tape to reduce hot water wait times on the secondary side domestic hot water pipework within the apartment, if included, shall be modelled as 8 W/m of pipe, or as calculated according to design.
- Internal and external shading is to be considered within the model
- Mechanical ventilation values should be used. Mechanical boost should NOT be considered within the design
- Air speed to be set at 0.1m/s. An exception to this is where ceiling fans are installed, in which case, 0.8m/s will be accepted
- DSY1 summer year weather figures are to be used in the model
- Hourly DSM modelling is to be used for the report

# 4.0 MODEL INPUTS

## Geometry

The building has been modelled using the following drawings submitted as part of the planning application:

- PL_P_100 Level 00
- PL_P_101 Mezzanine Level
- PL_P_102 Level 01
- PL_P_103 Level 02
- PL_P_104 Level 03

- PL_P_105 Level 04
- PL_P_106 Level 05
- PL_P_107 Roof Level
- PL_P_200 Section AA
- PL_P_201 Section BB
- PL_P_202 Section CC
- PL_P_203 Section DD
- PL_P_300 Elevation - West – Proposed
- PL_P_301 Elevation - East – Proposed
- PL_P_302 Context Section and Elevation - Proposed

A dynamic simulation model (DSM) was created using DesignBuilder EnergyPlus to setup and simulate the internal conditions in each of the occupied spaces within the sample units.

The building design and building services design have been designed to ensure a reduction in the amount of heat entering the building, with a large benefit owing to the thermal mass of the building. The building has also been designed to passively and mechanically ventilate the dwellings in line with the London Plan cooling hierarchy.

Unless specified, the following data has been assumed, based on the TM59 values, found Section 5 of the document.

1. The document provides standard occupancy, temperature set-points, outdoor air rates and heat gain profiles for each type of space in the building so that buildings with the same mix of activities will differ only in terms of their geometry, construction, building services, and weather location.

## Window and Door Openings

- Windows in each room should be controlled separately and modelled as open when both the internal dry bulb temperature exceeds 22 °C and the room is occupied. If additional security and rain protection details are included in the design then the opening hours during the night could be extended.
- Open areas should be based on the architecturally designed windows including any restrictors that are required. The guidance in CIBSE Guide A (2015a) and CIBSE AM10: Natural ventilation in non-domestic buildings (2005) should be followed for calculation of free areas.
- Opening areas assumed should take into account any security, acoustic or air quality issues that limit opening area (e.g. on ground floors).
- If blinds are to be included in the modelling, they must not interfere with the opening of windows, or the reduction in free area when they are operating should be taken into account in the model.
- Internal doors can be included and left open in the model in the daytime, but should be assumed to be closed when the occupants are sleeping.

## Exposure Type

- Models should be set up with the appropriate exposure type for the site location and façade orientation, based on the software definitions, and justified in the compliance report.

## Infiltration and Mechanical Ventilation

- The infiltration and the mechanical ventilation rate should be set for every zone based on what is specifically designed for normal, acoustically compliant modes of operation.
- Mechanical boost mode (included for occasional use with louder fan noise) should not be assumed in the overheating risk analysis.

## Air Speed Assumptions

- The modelled air speed in a space must be set at 0.1 m/s where the software provides this option unless there is a ceiling fan or other means of reliably generating air movement.
- Where fixed ceiling fans are installed as part of the new build or refurbishment the assumed elevated air speed assumptions must be reported. Typically, this should not exceed 0.8 m/s.

## Blinds and shading devices

- Blinds and shading devices can be used for the analysis only if specifically included in the design, provided in the base build and explained within associated home user guidance.
- Blinds cannot be used properly if they clash with the opening of windows. If blinds are used to pass the overheating test, the report must either demonstrate that there are no clashes with the opening of windows, or the reduction in air flow due to the clashes must also be calculated

## Building Fabric

The building fabric parameters have been based on the Planning stage energy strategy and follows the build-up details, provided by Innes Associates. Please refer to this document for further assumptions. A summary of these values are as follows:

| Elements | | Pre-Refurb Thermal Elements | Post Refurb Upgraded Thermal Elements (Refurb Dwellings) | New Thermal Elements (Extension to Refurb Dwellings and New Dwellings) |
|---|---|---|---|---|
| External walls | U-Value ($W/m^2K$) | 1.7 | 0.55 | 0.15 |
| Floors | U-Value ($W/m^2K$) | 1.2 | 0.25 | 0.15 |
| Roofs | U-Value ($W/m^2K$) | 2.3 | 0.18 | 0.13 |
| Windows / Glazed Doors | U-Value ($W/m^2K$) | 4.80 (Single glazed)<br>2.00 (Double glazed) | 1.40 (double glazing) | 1.40 (double glazing) |
| | g-value | 0.85 (Single glazed)<br>0.72 (Double glazed) | 0.35 | 0.35 |
| | Light transmittance | - | 0.65 | 0.65 |
| Party walls | U-Value ($W/m^2K$) | 0.75 | Solid or fully filled cavity with effective sealing at all exposed edges (0.00) | |
| Air permeability | $m^3/(h.m^2)$ at 50 Pa | 15 | 10 | 3 |
| Thermal mass | - | 250 | Calculated (250 if not) | Calculated (175 if not) |
| Thermal bridging | - | default | default | Accredited psi value (new dwellings) |

# 5.0 INTERNAL GAINS

## Occupancy

Occupancy gains are associated with people within the assessed space. Using CIBSE Guide A as guidance, a maximum sensible heat gain of 75W/person and a maximum latent heat gain of 55 W/person are assumed within the living spaces. During sleeping periods, a 30% reduction in these figures is based on the ANSI/ASHRAE Addendum G standard (Table 5.2.1.2). The following values have been assumed within this assessment.

| Gains | Living/Kitchen Value (W per person) | Bedroom Value (W per person) |
|---|---|---|
| Sensible | 75 | 52.5 |
| Latent | 55 | 38.5 |

## Occupancy Levels

| Unit/ room type | Occupancy |
|---|---|
| 1-bedroom apartment: living room/kitchen | 1 person from 9 am to 10 pm; room is unoccupied 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 |
| 3-bedroom apartment: living room | 3 people at 5% gains from 9 am to 10 pm; room is unoccupied for the rest of the day |
| 3-bedroom apartment: kitchen | 3 people at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day |
| Double bedroom | 2 people at 70% gains from 11 pm to 8 am<br>2 people at full gains from 8 am to 9 am and from 10 pm to 11 pm<br>1 person at full gain in the bedroom from 9 am to 10 pm |
| Communal corridors | Assumed to be zero |

## Lighting

For the purposes of the assessment, lighting energy is assumed to be proportional to floor area, and lighting loads are measured in W/m². From 6 pm to 11 pm, 2 W/m² should be assumed as the default for an efficient new-build home. This assumes that good daylight levels are available.

For existing buildings, or specialist lighting designs, a calculated higher value should be used. For communal corridors, use 2 W/m²; this may be assumed

## Equipment Gains

| Unit/ room type | Equipment load |
|---|---|
| 1-bedroom apartment: living room/kitchen | Peak load of 450 W from 6 pm to 8 pm<br>200 W from 8 pm to 10 pm<br>110 W from 9 am to 6 pm and from 10 pm to 12 pm<br>Base load of 85 W for the rest of the day |
| 2-bedroom apartment: living room/kitchen | Peak load of 450 W from 6 pm to 8 pm<br>200 W from 8 pm to 10 pm<br>110 W from 9 am to 6 pm and from 10 pm to 12 pm<br>Base load of 85 W for the rest of the day |
| 3-bedroom apartment: living room | Peak load of 150 W from 6 pm to 10 pm<br>60 W from 9 am to 6 pm and from 10 pm to 12 pm<br>Base load of 35 W for the rest of the day |
| 3-bedroom apartment: kitchen | Peak load of 300 W from 6 pm to 8 pm<br>base load of 50 W for the rest of the day |
| Double bedroom | Peak load of 80 W from 8 am to 11 pm<br>Base load of 10 W during the sleeping hours |
| Communal corridors | Pipework heat loss only |

# Aperture Control

## Openable Windows

Openable windows have been modelled based on Apt architects and are assumed to be openable to 30%**.** Window openings have been modelled based on the limits set out in Overheating: Approved Document O as follows:

a. When a room is occupied during the day (8am to 11pm), openings should be modelled to do all of the following.

i. Start to open when the internal temperature exceeds 22°C.

ii. Be fully open when the internal temperature exceeds 26°C.

iii. Start to close when the internal temperature falls below 26°C.

iv. Be fully closed when the internal temperature falls below 22°C.

b. At night (11pm to 8am), openings should be modelled as fully open if both of the following apply.

i. The opening is on the first floor or above and not easily accessible.

ii. The internal temperature exceeds 23°C at 11pm.

c. When a ground floor or easily accessible room is unoccupied, both of the following apply.

i. In the day, windows, patio doors and balcony doors should be modelled as open, if this can be done securely, following the guidance in paragraph 3.7 below.

ii. At night, windows, patio doors and balcony doors should be modelled as closed.

d. An entrance door should be included, which should be shut all the time.

## Mechanical Ventilation

Background mechanical ventilation will be provided by Mechanical Ventilation with Heat Recovery (MVHR) units, as required by AD Part F of the Building Regulations. The ventilation rate included in the model is 13l/s for living and kitchen areas and 8l/s for the bedroom areas. Mechanical boost has not been included in the overheating assessment, as detailed in section 3.5 of the TM59 document.

## No Openable windows

Criteria for predominantly naturally ventilated homes

| Block | Zone | Criterion A (%) | Criterion B (hr) | Pass/Fail |
|---|---|---|---|---|
| Z4XSecondFloor | F1Bedroom | 90.83 | 1354.83 | Fail |
| Z4XSecondFloor | F1KitchenXLiving | 88.16 | N/A | Fail |
| Z4XSecondFloor | F2Bedroom | 84.95 | 1305.17 | Fail |
| Z4XSecondFloor | F2KitchenXLiving | 81.14 | N/A | Fail |
| Z4XSecondFloor | F3Bedroom1 | 4.97 | 626.83 | Fail |
| Z4XSecondFloor | F3Bedroom2 | 7.3 | 688.5 | Fail |
| Z4XSecondFloor | F3KitchenXLiving | 36.88 | N/A | Fail |
| Z4XSecondFloor | F4Bedroom1 | 41.28 | 914 | Fail |
| Z4XSecondFloor | F4Bedroom2 | 36.25 | 893.33 | Fail |
| Z4XSecondFloor | F4KitchenXLiving | 41.96 | N/A | Fail |
| Z5XThirdFloor | F5Bedroom | 88.49 | 1338.83 | Fail |
| Z5XThirdFloor | F5KitchenXLiving | 85.34 | N/A | Fail |
| Z5XThirdFloor | F6Bedroom | 84.32 | 1303.33 | Fail |
| Z5XThirdFloor | F6KitchenXLiving | 80.31 | N/A | Fail |
| Z5XThirdFloor | F7Bedroom1 | 6.52 | 669.17 | Fail |
| Z5XThirdFloor | F7Bedroom2 | 9.27 | 701 | Fail |
| Z5XThirdFloor | F7KitchenXLiving | 31.82 | N/A | Fail |
| Z5XThirdFloor | F8Bedroom1 | 35.1 | 857.5 | Fail |
| Z5XThirdFloor | F8Bedroom2 | 32.53 | 859.17 | Fail |
| Z5XThirdFloor | F8KitchenXLiving | 36.19 | N/A | Fail |
| Z6XFourthFloor | F10Bedroom | 83.66 | 1284 | Fail |
| Z6XFourthFloor | F10KitchenXLiving | 78.77 | N/A | Fail |
| Z6XFourthFloor | F11KitchenXLiving | 12.71 | N/A | Fail |
| Z6XFourthFloor | F12KitchenXLiving | 14.58 | N/A | Fail |
| Z6XFourthFloor | F9Bedroom | 85.21 | 1280 | Fail |
| Z6XFourthFloor | F9KitchenXLiving | 83.89 | N/A | Fail |
| Z7XFifthFloor | F11Bedroom1 | 77.33 | 1166.33 | Fail |
| Z7XFifthFloor | F11Bedroom2 | 36.92 | 865.67 | Fail |
| Z7XFifthFloor | F11Bedroom3 | 35.99 | 873.5 | Fail |
| Z7XFifthFloor | Z12Bedroom1 | 86.03 | 1248.83 | Fail |
| Z7XFifthFloor | Z12Bedroom2 | 44.79 | 966.17 | Fail |
| Z7XFifthFloor | Z12Bedroom3 | 57.29 | 1013.67 | Fail |

## Openable windows

Criteria for predominantly naturally ventilated homes

| Block | Zone | Criterion A (%) | Criterion B (hr) | Pass/Fail |
|---|---|---|---|---|
| Z4XSecondFloor | F1Bedroom | 0.33 | 88 | Fail |
| Z4XSecondFloor | F1KitchenXLiving | 1.84 | N/A | Pass |
| Z4XSecondFloor | F2Bedroom | 0 | 155.33 | Fail |
| Z4XSecondFloor | F2KitchenXLiving | 1.27 | N/A | Pass |
| Z4XSecondFloor | F3Bedroom1 | 0.05 | 23.17 | Pass |
| Z4XSecondFloor | F3Bedroom2 | 0.03 | 27 | Pass |
| Z4XSecondFloor | F3KitchenXLiving | 0 | N/A | Pass |
| Z4XSecondFloor | F4Bedroom1 | 0.2 | 40.67 | Fail |
| Z4XSecondFloor | F4Bedroom2 | 0.15 | 46.83 | Fail |
| Z4XSecondFloor | F4KitchenXLiving | 0.17 | N/A | Pass |
| Z5XThirdFloor | F5Bedroom | 0.96 | 344.83 | Fail |
| Z5XThirdFloor | F5KitchenXLiving | 1.86 | N/A | Pass |
| Z5XThirdFloor | F6Bedroom | 0.57 | 311.67 | Fail |
| Z5XThirdFloor | F6KitchenXLiving | 1.24 | N/A | Pass |
| Z5XThirdFloor | F7Bedroom1 | 0.1 | 28.17 | Pass |
| Z5XThirdFloor | F7Bedroom2 | 0.08 | 33.33 | Fail |
| Z5XThirdFloor | F7KitchenXLiving | 0.09 | N/A | Pass |
| Z5XThirdFloor | F8Bedroom1 | 0.47 | 49.83 | Fail |
| Z5XThirdFloor | F8Bedroom2 | 0.32 | 60.5 | Fail |
| Z5XThirdFloor | F8KitchenXLiving | 0.32 | N/A | Pass |
| Z6XFourthFloor | F10Bedroom | 0.47 | 105.83 | Fail |
| Z6XFourthFloor | F10KitchenXLiving | 1.9 | N/A | Pass |
| Z6XFourthFloor | F11KitchenXLiving | 0 | N/A | Pass |
| Z6XFourthFloor | F12KitchenXLiving | 1.79 | N/A | Pass |
| Z6XFourthFloor | F9Bedroom | 0.86 | 130.17 | Fail |
| Z6XFourthFloor | F9KitchenXLiving | 2.58 | N/A | Pass |
| Z7XFifthFloor | F11Bedroom1 | 0.83 | 50.17 | Fail |
| Z7XFifthFloor | F11Bedroom2 | 0.23 | 28.83 | Pass |
| Z7XFifthFloor | F11Bedroom3 | 0.54 | 288 | Fail |
| Z7XFifthFloor | Z12Bedroom1 | 1.51 | 60.67 | Fail |
| Z7XFifthFloor | Z12Bedroom2 | 0.42 | 44.33 | Fail |
| Z7XFifthFloor | Z12Bedroom3 | 18.62 | 622.83 | Fail |

# Openable Windows with MVHR

Criteria for predominantly naturally ventilated homes

| Block | Zone | Criterion A (%) | Criterion B (hr) | Pass/Fail |
|---|---|---|---|---|
| Z4XSecondFloor | F1Bedroom | 0.15 | 31 | Pass |
| Z4XSecondFloor | F1KitchenXLiving | 0.72 | N/A | Pass |
| Z4XSecondFloor | F2Bedroom | 0.05 | 30.5 | Pass |
| Z4XSecondFloor | F2KitchenXLiving | 0.49 | N/A | Pass |
| Z4XSecondFloor | F3Bedroom1 | 0.11 | 18.5 | Pass |
| Z4XSecondFloor | F3Bedroom2 | 0.14 | 18.83 | Pass |
| Z4XSecondFloor | F3KitchenXLiving | 0.31 | N/A | Pass |
| Z4XSecondFloor | F4Bedroom1 | 0.26 | 24.67 | Pass |
| Z4XSecondFloor | F4Bedroom2 | 0.17 | 24.33 | Pass |
| Z4XSecondFloor | F4KitchenXLiving | 0.34 | N/A | Pass |
| Z5XThirdFloor | F5Bedroom | 0.15 | 39.5 | Fail |
| Z5XThirdFloor | F5KitchenXLiving | 0.7 | N/A | Pass |
| Z5XThirdFloor | F6Bedroom | 0.13 | 36.17 | Fail |
| Z5XThirdFloor | F6KitchenXLiving | 0.55 | N/A | Pass |
| Z5XThirdFloor | F7Bedroom1 | 0.15 | 21.67 | Pass |
| Z5XThirdFloor | F7Bedroom2 | 0.16 | 21.33 | Pass |
| Z5XThirdFloor | F7KitchenXLiving | 0.32 | N/A | Pass |
| Z5XThirdFloor | F8Bedroom1 | 0.32 | 28.67 | Pass |
| Z5XThirdFloor | F8Bedroom2 | 0.31 | 28.83 | Pass |
| Z5XThirdFloor | F8KitchenXLiving | 0.49 | N/A | Pass |
| Z6XFourthFloor | F10Bedroom | 0.18 | 33.17 | Fail |
| Z6XFourthFloor | F10KitchenXLiving | 0.89 | N/A | Pass |
| Z6XFourthFloor | F11KitchenXLiving | 0.3 | N/A | Pass |
| Z6XFourthFloor | F12KitchenXLiving | 1.25 | N/A | Pass |
| Z6XFourthFloor | F9Bedroom | 0.2 | 39.33 | Fail |
| Z6XFourthFloor | F9KitchenXLiving | 0.99 | N/A | Pass |
| Z7XFifthFloor | F11Bedroom1 | 0.45 | 30 | Pass |
| Z7XFifthFloor | F11Bedroom2 | 0.23 | 22 | Pass |
| Z7XFifthFloor | F11Bedroom3 | 0.15 | 33.33 | Fail |
| Z7XFifthFloor | Z12Bedroom1 | 0.78 | 35 | Fail |
| Z7XFifthFloor | Z12Bedroom2 | 0.29 | 26.17 | Pass |
| Z7XFifthFloor | Z12Bedroom3 | 1.68 | 56 | Fail |

Criteria for predominantly mechanically ventilated homes

| Block | Zone | % Hours Exceeded | Pass/Fail |
|---|---|---|---|
| Z4XSecondFloor | F1Bedroom | 1.92 | Pass |
| Z4XSecondFloor | F1KitchenXLiving | 5.37 | Fail |
| Z4XSecondFloor | F2Bedroom | 1.37 | Pass |
| Z4XSecondFloor | F2KitchenXLiving | 4.53 | Fail |
| Z4XSecondFloor | F3Bedroom1 | 1.16 | Pass |
| Z4XSecondFloor | F3Bedroom2 | 1.3 | Pass |
| Z4XSecondFloor | F3KitchenXLiving | 3.22 | Fail |
| Z4XSecondFloor | F4Bedroom1 | 1.96 | Pass |
| Z4XSecondFloor | F4Bedroom2 | 1.94 | Pass |
| Z4XSecondFloor | F4KitchenXLiving | 3.5 | Fail |
| Z5XThirdFloor | F5Bedroom | 1.99 | Pass |
| Z5XThirdFloor | F5KitchenXLiving | 5.16 | Fail |
| Z5XThirdFloor | F6Bedroom | 1.73 | Pass |
| Z5XThirdFloor | F6KitchenXLiving | 4.77 | Fail |
| Z5XThirdFloor | F7Bedroom1 | 1.48 | Pass |
| Z5XThirdFloor | F7Bedroom2 | 1.58 | Pass |
| Z5XThirdFloor | F7KitchenXLiving | 3.46 | Fail |
| Z5XThirdFloor | F8Bedroom1 | 2.49 | Pass |
| Z5XThirdFloor | F8Bedroom2 | 2.49 | Pass |
| Z5XThirdFloor | F8KitchenXLiving | 4.11 | Fail |
| Z6XFourthFloor | F10Bedroom | 2.18 | Pass |
| Z6XFourthFloor | F10KitchenXLiving | 5.47 | Fail |
| Z6XFourthFloor | F11KitchenXLiving | 3.42 | Fail |
| Z6XFourthFloor | F12KitchenXLiving | 5.54 | Fail |
| Z6XFourthFloor | F9Bedroom | 2.65 | Pass |
| Z6XFourthFloor | F9KitchenXLiving | 5.89 | Fail |
| Z7XFifthFloor | F11Bedroom1 | 3.7 | Fail |
| Z7XFifthFloor | F11Bedroom2 | 2.16 | Pass |
| Z7XFifthFloor | F11Bedroom3 | 2.18 | Pass |
| Z7XFifthFloor | Z12Bedroom1 | 4.31 | Fail |
| Z7XFifthFloor | Z12Bedroom2 | 2.49 | Pass |
| Z7XFifthFloor | Z12Bedroom3 | 4.85 | Fail |

# Ambient Loop System (Cooling) with MVHR

Criteria for predominantly mechanically ventilated homes

| Block | Zone | % Hours Exceeded | Pass/Fail |
|---|---|---|---|
| Z4XSecondFloor | F1Bedroom | 0 | Pass |
| Z4XSecondFloor | F1KitchenXLiving | 0 | Pass |
| Z4XSecondFloor | F2Bedroom | 0 | Pass |
| Z4XSecondFloor | F2KitchenXLiving | 0 | Pass |
| Z4XSecondFloor | F3Bedroom1 | 0 | Pass |
| Z4XSecondFloor | F3Bedroom2 | 0 | Pass |
| Z4XSecondFloor | F3KitchenXLiving | 0 | Pass |
| Z4XSecondFloor | F4Bedroom1 | 0 | Pass |
| Z4XSecondFloor | F4Bedroom2 | 0 | Pass |
| Z4XSecondFloor | F4KitchenXLiving | 0 | Pass |
| Z5XThirdFloor | F5Bedroom | 0 | Pass |
| Z5XThirdFloor | F5KitchenXLiving | 0 | Pass |
| Z5XThirdFloor | F6Bedroom | 0 | Pass |
| Z5XThirdFloor | F6KitchenXLiving | 0 | Pass |
| Z5XThirdFloor | F7Bedroom1 | 0 | Pass |
| Z5XThirdFloor | F7Bedroom2 | 0 | Pass |
| Z5XThirdFloor | F7KitchenXLiving | 0 | Pass |
| Z5XThirdFloor | F8Bedroom1 | 0 | Pass |
| Z5XThirdFloor | F8Bedroom2 | 0 | Pass |
| Z5XThirdFloor | F8KitchenXLiving | 0 | Pass |
| Z6XFourthFloor | F10Bedroom | 0 | Pass |
| Z6XFourthFloor | F10KitchenXLiving | 0 | Pass |
| Z6XFourthFloor | F11KitchenXLiving | 0 | Pass |
| Z6XFourthFloor | F12KitchenXLiving | 0 | Pass |
| Z6XFourthFloor | F9Bedroom | 0 | Pass |
| Z6XFourthFloor | F9KitchenXLiving | 0 | Pass |
| Z7XFifthFloor | F11Bedroom1 | 0 | Pass |
| Z7XFifthFloor | F11Bedroom2 | 0 | Pass |
| Z7XFifthFloor | F11Bedroom3 | 0 | Pass |
| Z7XFifthFloor | Z12Bedroom1 | 0 | Pass |
| Z7XFifthFloor | Z12Bedroom2 | 0 | Pass |
| Z7XFifthFloor | Z12Bedroom3 | 0 | Pass |

# 7.0 CONCLUSION AND RECOMMENDATIONS

This assessment has demonstrates how the proposed development at the Lupin House, 11-13 Macklin Street has been designed to minimise the risk of overheating, in line with The London Plan; Policy 5.9. the strategy has followed the cooling hierarchy within this policy.

The CIBSE:TM59 document has been utilised within this study as it has now replaced the CIBSE TM52 document for residential dwellings. The new methodology produces an analysis that encourages a design that allows for human comfort, without overusing mechanical ventilation. Based on the size of the scheme all residential units were tested.

DesignBuilder EnergyPlus was used to create a dynamic simulation model (DSM) and was programmed to simulate the internal conditions in line with the TM59 methodology and information gathered from Apt Architects.

The first iteration of the model shows compliance with the TM59 Criteria when the building is only naturally ventilated. This is provided via 30 % openable windows which open based on the temperatures discussed earlier on in the report. The results show that some bedrooms experience overheating which is addressed in further iterations of the model.

As the building is still predicted to be experiencing overheating using natural ventilation only, mechanical ventilation in combination with natural ventilation was proposed and tested. The results of this show that when tested against both the TM59 Natural ventilation criteria and Mechanical ventilation criteria some rooms still experience overheating in the summer. To prevent this, we have proposed that cooling be employed in the building.

Overall, the report demonstrates that an ambient loop system (cooling) with MVHR will enable sufficient cooling in the building to comply with the TM59 criteria and prevent overheating. The proposals have strictly followed the London cooling hierarchy, beginning with design. However, due to the specific and niche site constraints, including the existing parameters of the building (building envelope, orientation, siting, and scale), heritage, amenity, and design, the building does not have the benefit of being able to be entirely re-developed in order to enable greater cooling from non-active means. An ambient loop system which enables cooling is therefore recommended. The building is also located within an air quality management area which means that passive ventilation is restricted to purge ventilation only. Cooling the building via a loop system is considered the most suitable and appropriate solution to cool the building, taking into consideration the entirety of the scheme, and will still ensure a lower carbon footprint compared with other more energy-intensive active cooling devices.