Edward Pearce LLP
Old School House
35 Ewell Road
Surbiton, Surrey KT6 6AF

Tel: 020 8390 6244
Fax: 020 8390 1329
www.edwardpearce.com

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Private

**PROJECT**

# Overheating Report

2 Elsworthy Terrace
London NW3 3DR

**Project No.:** 23/093
**Date:** February 2024
**Revision:** 00

# Contents

# 1 Project Background

2 Elsworthy Terrace is an existing building located in Greater London. The refurbished dwelling will comprise of 4 bedrooms and communal living areas.


Figure 1: 2 Elsworthy Terrace, London

This report assesses the scheme at 2 Elsworthy Terrace for its overheating risk and compliance with Part O 2021 of the UK Building Regulations.

1.1 Part O: Overheating

The aim of Part O is to protect the health and welfare of occupants by reducing the occurrence of high indoor temperatures.


Figure 2: Front Cover of Building Regulations Part O

In the Secretary of State's view, Part O is met by designing and constructing the building to achieve both of the following:

a) Limiting unwanted solar gains in Summer.
b) Providing an adequate means of removing excess heat from the indoor environment.

In the Secretary of State's view, compliance with Part O can be demonstrated by using one of the following methods:

a) The simplified method for limiting solar gains and providing a means of removing excess heat.
b) The dynamic thermal modelling method.

This analysis will utilise the dynamic thermal modelling method. For the building to be deemed compliant with Part O, the result of the thermal modelling needs to pass the CIBSE TM 59 assessment of overheating.

## 1.2 CIBSE TM 59

CIBSE TM 59 is a design methodology for assessing the overheating risk in homes. If rooms in the building fail the criterion stipulated in CIBSE TM 59, there is a high risk of overheating. The criterion assesses the risk of overheating as follows:

- Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which $\Delta T$ is greater than or equal to 1K from May to September shall not exceed 3% of occupied hours. $\Delta T$ is defined as the difference between the max operative temperature and the max allowable temperature in the room.

- Criterion (b) states that the operative temperature of the bedrooms from 22:00-07:00 shall not exceed 26°C for more than 1% of annual hours.

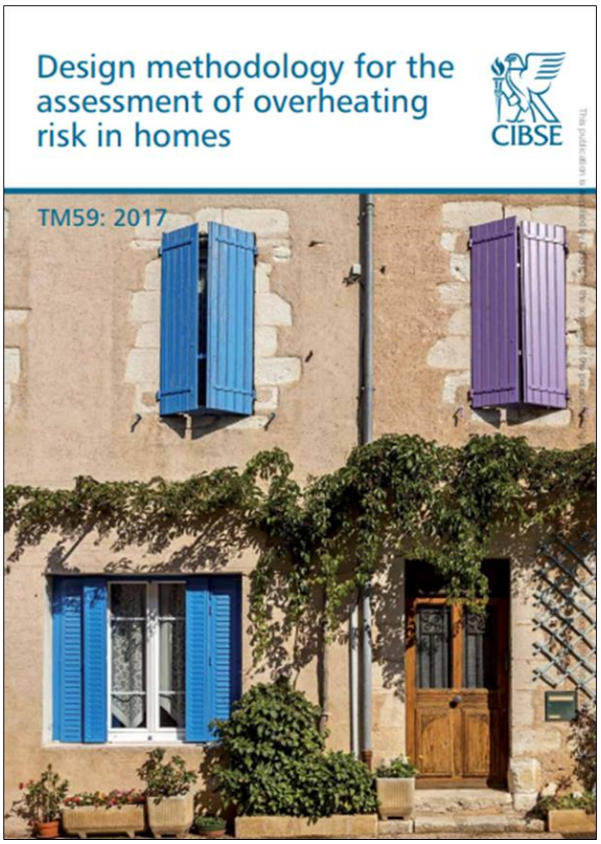


Figure 3: Front Cover of CIBSE TM 59

# 2 Dynamic Thermal Modelling

## 2.1 Software

To undertake the dynamic thermal modelling method, the IES Virtual Environment software was utilised. This software allows for a detailed dynamic thermal analysis of the property in line with Part O and CIBSE TM 59.

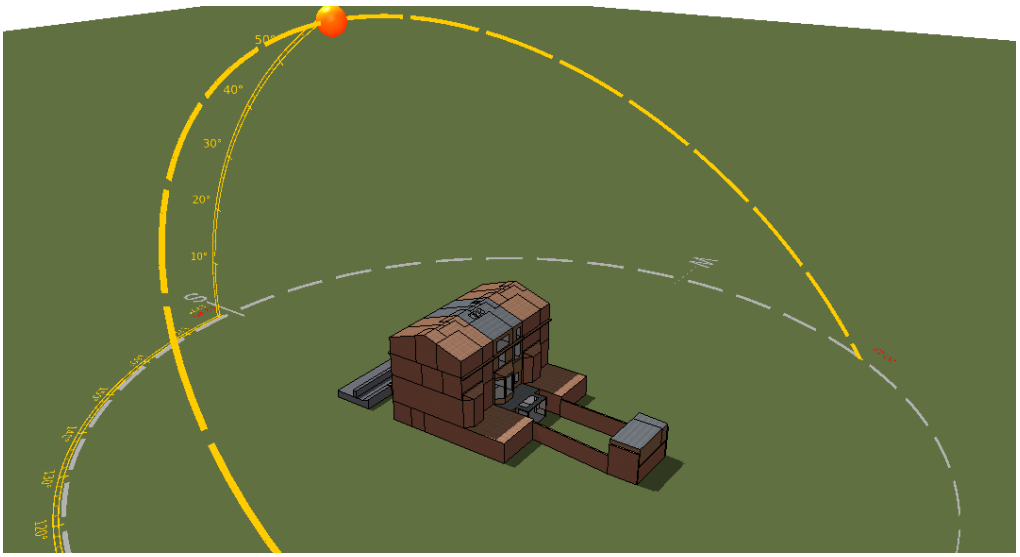


Figure 4: IES Model of 2 Elsworthy Terrace

## 2.2 Weather File

CIBSE TM 59 recommends the latest CIBSE design summer year (DSY) weather file to be used for the dynamic thermal modelling. A London DSY weather file was used for the purposes of this project.

- London LHR DSY1, 2020's, high emissions, 50% percentile.

2.3 Building Fabric

The building has been model in IES VE using the ModelIT extension. The dimensions and form of the building were based of the drawings provided by Wolff Architects.

The U-values use in the model are as follows:

| Element | Proposed (U-value) |
|---|---|
| External Walls | 0.17 |
| Exposed Floor | 0.14 |
| External Roof | 0.14 |
| External Windows | 1.4 |
| French Doors/Entrance Door | 1.4 |
| Extension Bi-fold Doors | 1.5 |
| Velux Roof Lights | 1.1 |
| Walk-on Rooflight | 1.5 |

2.4 Air Infiltration

An air infiltration rate of 0.15 ACH has been allowed for in the model. This is equivalent to an air permeability between 3 – 5 $m^3$/ hr / $m^2$ @ 50 Pa.

2.5 Operable Windows / Natural Ventilation

The operability of the windows was modelled using the Macroflo extension in the IES VE. It was assumed that the windows have an average openable area of 50%.

CIBSE TM59 proposes the following limits on window operability.

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.

   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.

2.6 Mechanical Ventilation

The dwelling will be fitted with mechanical ventilation to meet the requirements of Building Regulations Part F. An allowance of 0.8 l/(s.$m^2$) was made for the bedrooms and living areas.

2.7 Thermal Profiles

CIBSE TM 59 strongly recommends the below thermal profiles are utilised to assess the overheating risks in homes.

| Room Type | Occupancy | Lighting Load | Equipment Load |
|---|---|---|---|
| Single Bedroom | 1 person at 70% gains from 11pm to 8am.<br><br>1 person at full gains from 9am to 11pm. | 2 W/$m^2$ from 6pm to 11pm. | Peak load of 80W from 8am to 11pm.<br><br>Base load of 10W during sleeping hours. |
| Double Bedroom | 2 people at 70% gains from 11 pm to 8 am.<br><br>2 people at full gains from 8am to 9am and from 10 pm to 11 pm.<br><br>1 person at full gain in the bedroom from 9am to 10pm. | 2 W/$m^2$ from 6pm to 11pm. | Peak load of 80W from 8am to 11pm.<br><br>Base load of 10W during the sleeping hours. |
| Living Areas | 6 person 9am to 10pm; room is unoccupied for the rest of the day. | 2 W/$m^2$ from 6pm to 11pm. | Peak load of 450W from 6pm to 8pm.<br><br>200W from 8pm to 10pm.<br><br>110W from 9am to 6pm and 10pm to 12pm.<br><br>Base load of 85W for the rest of the day. |

| Room Type | Occupancy | Lighting Load | Equipment Load |
|---|---|---|---|
| Study/ Staff Room/ Playroom | 1 person 9am to 10pm; room is unoccupied for the rest of the day. | 2 W/$m^2$ from 6pm to 11pm. | Peak load of 450W from 6pm to 8pm.<br><br>200W from 8pm to 10pm.<br><br>110W from 9am to 6pm and 10pm to 12pm.<br><br>Base load of 85W for the rest of the day. |
| Corridors | Assumed to be 0. | 2 W/$m^2$ from 6pm to 11pm. | Pipework heat losses only. |

# 3 Results

The CIBSE TM59 thermal modelling results for the scheme are shown in the below table.

| Room | TM59 Criterion A<br><br>% Hours of Exceedance | TM Criterion B (Bedrooms Only)<br><br>Number of Overnight Hours > 26°C | TM 59 Compliant |
|---|---|---|---|
| Staff Room | 2.6 | N/A | Compliant |
| Utility Room | 8.0 | N/A | Fail |
| Master Bedroom | 0.8 | 75 | Fail |
| Master Dressing | 1.0 | 131 | Fail |
| Study | 3.0 | N/A | Compliant |
| Lounge/Reception | 1.7 | N/A | Compliant |
| Bedroom 1 | 2.3 | 79 | Fail |
| Bedroom 2 | 2.4 | 75 | Fail |
| Bedroom 3 | 2.7 | 78 | Fail |
| Playroom | 2.8 | N/A | Compliant |
| Living/Kitchen/Dining | 3.3 | N/A | Fail |

# 4 Cooling Hierarchy

The cooling hierarchy at 2 Elsworthy Terrace has been implemented as follows:

1. Minimise internal heat generation through energy efficient design.
    - Energy efficient lighting will be installed to reduce internal heat gains.
    - Energy efficient appliances and equipment will be utilised to reduced internal heat gains.
    - High ceilings in the stairwell encourages stack ventilation.
2. Reduce the amount of heat entering the building in Summer.
    - Eaves on the façade provide shading to external windows.
    - Windows have been appropriately sized to maximise natural light and minimise solar gain.
    - Shading from natural vegetation and adjacent buildings has been taken into account.
    - Low U-value and G-value glazing have been specified for the dwelling.
3. Manage the heat within the building through exposed thermal mass and high ceilings.
    - Internal partitions and floors will be constructed to maximise thermal mass.
4. Passive Ventilation
    - All living areas are fitting with operable windows. The operability of the windows may be limited due to security risks and noise pollution.
5. Mechanical Ventilation
    - An allowance of 0.8 l/(s.$m^2$) of mechanical ventilation was made for the bedrooms and living areas.
6. Active Cooling
    - Exercising the previous 5 steps still does not reduce the risk of overheating, active cooling is required to maintain internal temperature below 26°C in the bedrooms and living areas.

## 5 Providing Information

Section 4 of Building Regulations Part O states that sufficient information is to be provided to the client on the overheating mitigation in a clear and non-technical manner.

The overheating strategy for 2 Elsworthy is as follows:

a. Windows have been appropriately sized to maximise natural light and to minimise solar gain.

b. The operability of the windows allows for natural ventilation in each room.

c. The operability of the windows may be limited due to security risks, specifically the bedrooms.

d. Windows that are exposed to high solar gain are to be installed with internal shading.

e. Additional ventilation is provided to the rooms via mechanical ventilation.

f. The ventilation strategy for the property relies on the windows being opened when the internal temperature exceeds 22°C.

g. To maximise the effect of internal ventilation in the property, all internal doors should be left open.

h. Where natural and mechanical ventilation is not effective, active cooling is to be utilised to maintain space conditions below 26°C.

## 6 Conclusion

The overheating risk at 2 Elsworthy Terrace was assessed in accordance with Building Regulations Part O and CIBSE TM 59.

It has been shown through dynamic simulation that the passive design steps outlined in the cooling hierarchy are not sufficient to mitigate the risk of overheating.

Due to security issues, it is not feasible for the bedroom windows to be left open overnight. As a result, these rooms regularly exceed an internal temperature of 26°C throughout the Summer months.

It is recommended that active cooling be implemented to achieve compliance with Building Regulation Part O and CIBSE TM 59.

# 7 Appendix A – Approved Document O Compliance Checklist

## 7.1 Part 1

| 1.1 Building and site details | |
|---|---|
| Residential building name/number | 2 Elsworthy Terrace |
| Street | 2 Elsworthy Terrace |
| Town | Greater London |
| County | London |
| Postcode | NW3 3DR |
| Proposed building use/type of building | Residential Dwelling/ Mid Terrace |
| Are there any security, noise or pollution issues? | Bedroom and living area windows easily accessible from road. Possible noise pollution. |
| **1.2 Designer's details** | |
| Designer's name | Theolan Govender |
| Company | Edward Pearce LLP |
| Address Line 1 | The Old School House |
| Address Line 2 | 35 Ewell Rd, Surbiton |
| Postcode | KT6 6AF |
| Telephone number | 020 8390 6244 |
| Email address | govender@edwardpearce.com |

7.2 Part 3

| 2b.1 Modelling details | |
|---|---|
| Dynamic software name and version | IES Virtual Environment (Version 2023.1.0.0) |
| Weather file location used, including any additional, more extreme weather files | London LHR DSY1, 2020, high emissions, 50$^{th}$ percentile |
| Number of sample units modelled, including an explanation of why the size/selection has been chosen | The whole residential dwelling has been modelled including shading of adjacent buildings. |
| 2b.2 Modelled occupancy | |
| Has the project passed the describe in CIBSE's TM59, taking into account the limits detailed in paragraphs 2.5 and 2.6? | No.<br><br>Active cooling is recommended. |
| Details of the occupancy profiles used | See Report |
| Details of the equipment profiles used | See Report |
| Details of the opening profiles | See Report |
| 2b.3 Modelled overheating mitigation strategy | |
| Free areas | See Report |
| Infiltration and mechanical flow rates | Infiltration: 0.15 AC/Hr, Mechanical: 0.8 l/(s.$m^2$) |
| Window g-values | 0.4 |
| Shading strategy | Shading and louvres modelled as per architect drawings |
| Mechanical cooling | Active cooling recommended. |