# Part O – Overheating Assessment

**20 Crediton Hill**
Prepared for Scenario Architecture
March 2023

envision

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# CONTENTS

# EXECUTIVE SUMMARY

1. This Overheating Assessment has been prepared by Envision on Scenario Architecture's behalf and is submitted in support of a full planning application for the demolition of an existing residential dwelling to construct a 3 storey, 4 bedroom house.

2. The primary purpose of this document is to explain how the scheme can meet the Part O of the Building Regulations 2010 (2021 Edition) which deals with the growing issue of buildings being designed and constructed without due considerations to potential internal temperature gains during our warmest months. Envision has undertaken a review of the proposed development against the criteria set by the Approved Document Part O to consider the risks of overheating and how these can be mitigated.

## Summary of Overheating Strategy

3. This overheating assessment has been undertaken using the CIBSE TM59 methodology. It is noted that the scheme passes the overheating criteria set under Part O of the Building Regulations by following this methodology. The table below summarises the cooling / shading methodology employed to prevent summertime overheating.

| Cooling Method | Measures Employed |
|---|---|
| **Reducing the amount of heat entering the building in summer** | • The g-value of all installed glazing will be as low as feasibly possible (currently assumed as 0.25) in order to reduce internal solar gain.<br>• An elevation plan has been provided detailing the percentage of openable window available within the bedroom and living areas this can be seen within the appendix I.<br>• External shading has been provided by the architect on the east facade to reduce overheating. |
| **Passive Design** | • Solar shading and louvres on the façade helps in obstructing the direct solar rays and helps in minimise the solar gain. |
| **Mechanical ventilation** | • MVHR system is proposed to provide fresh air into the zones to allow movement of stagnant air which will help in lowering the overall indoor air temperature. |

# 1. INTRODUCTION

Envision has been appointed on behalf of the client, Sendi & Daniel Young, and is submitted in support of a full planning application for the demolition of an existing residential dwelling to undertake an Overheating Assessment for the construction of a new 4 bedroom, 3 storey house.

## Scope

The primary purpose of this Overheating Assessment report is to explain how best practice design measures and construction measures would be incorporated in the proposed development to ensure alignment with Building Regulations Part O.

Section 3 lays out a comprehensive analysis and measures based on the CIBSE TM59 methodology and demonstrates how the dwelling can comply with the Part O of the Buildings Regulations.

## Site Location and Existing Situation

The site comprises of an existing 2 storey residential dwelling situated off Crediton Hill. The site also consists of a reasonably sized communal garden with a number of medium to large trees and hedgerows.


**Figure 1.1 – Site Location**

## The Proposed Development

The proposed development involves the demolition of the existing building onsite to construct a new, 3 storey, 4 bedroom residential dwelling. The development will include a new driveway and a roof top amenity space. The large trees will be retained on the site.

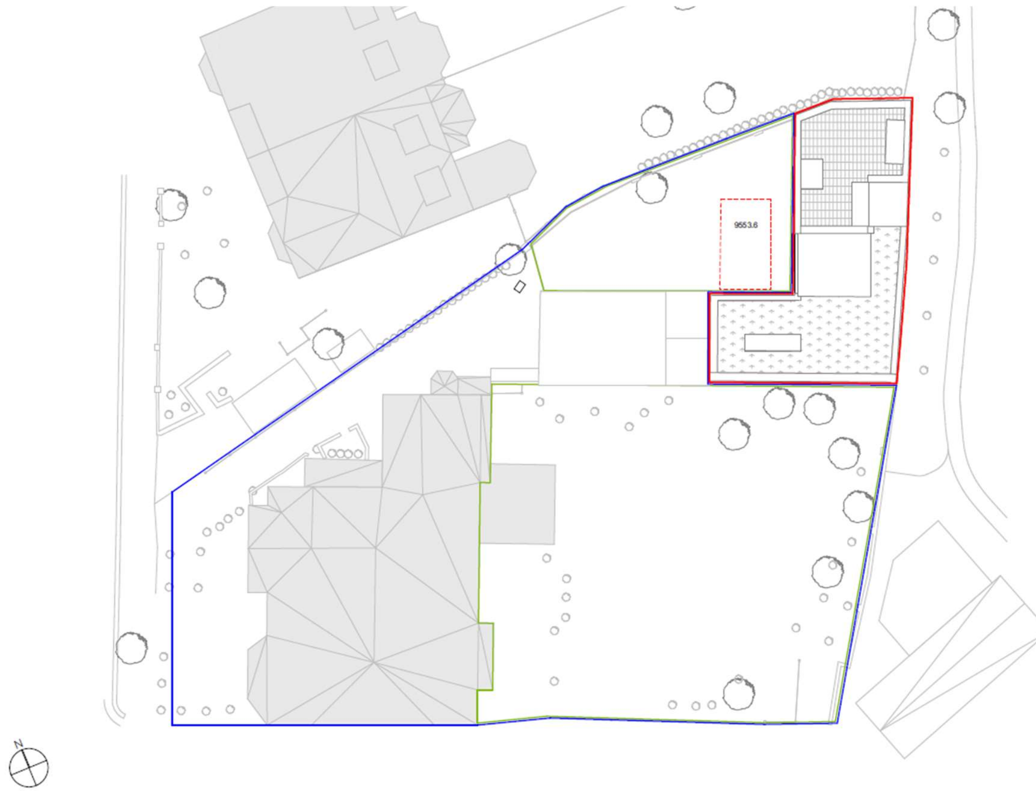


**Figure 1.2 – Proposed Site Layout**

# 2. OVERHEATING CONTEXT

2.1 Overheating is subjective, but the term 'Overheating' refers to *discomfort to occupants caused by the accumulation of warmth within a building*. It is considered to be a growing problem in the UK due to climate change, the urban heat island effect, electronic equipment and increasing amounts of glazing as part of building styles.

## PART O

2.2 Part O of the Building Regulations 2010 (2021 edition) is the new Overheating legal requirement for the buildings to comply with section O1 of schedule 1 to the Building Regulations 2010 which came into effect on June 15th 2022 as a part of the government's plan to deliver net zero. It deals with the growing issue of buildings being designed and constructed without due consideration to the buildings potential internal temperature, during our warmest months.

2.3 The requirements of *O1 Overheating Mitigation (*Part O schedule 1) of the Building Regulation 2010 states that;

1) *Reasonable provision must be made in respect of a dwelling, institution or any other building containing one or more rooms for residential purposes, other than a room in a hotel ("residences") to:*
    a. *limit unwanted solar gains in summer;*
    b. *provide an adequate means to remove heat from the indoor environment.*
2) *In meeting the obligations in paragraph (1)*
    c. *account must be taken of the safety of any occupant, and their reasonable enjoyment of the residence; and*
    d. *mechanical cooling may only be used where insufficient heat is capable of being removed from the indoor environment without it.*

2.4 The aim of the requirement O1 is to protect the 'Health and Welfare of the Occupants of the building by reducing the occurrence of high indoor temperatures

2.5 Approved Document O gives two approaches; a simplified method and dynamic thermal modelling method. For this overheating study we have chosen the 2nd route by following the dynamic thermal comfort modelling (DTM) method, since it offers the designer additional flexibility over the solutions. Under this approach, it prescribes us to follow the CIBSE TM 59 methodology for predicting overheating. However, certain limits on TM59 methodology alongside the acceptable strategies for reducing overheating risk are laid out.

### Limits on CIBSE TM 59 Methodology

2.6 CIBSE TM 59 requires the modeller to make choices. The dynamic thermal modelling method in this section applies limits to these choices, which are detailed in section 2.7. These limits should be applied when following the guidance in CIBSE's TM59.

2.7 All of the following limits on CIBSE's TM59, section 3.3, apply.

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.

2.8 Although internal blinds and curtains provide some reduction in solar gains, they should not be taken into account when considering if requirement O1 has been met.

2.9 Foliage, such as tree cover, can provide some reduction in solar gains, however, it should not be taken into account when considering whether requirement O1 has been met.

# 3. OVERHEATING ASSESSMENT

3.1 The latest criteria for the assessment of overheating risk have been specified by the Chartered Institute of Building Services Engineers (CIBSE) in CIBSE TM59: Design methodology for the assessment of overheating risk in homes (2017). CIBSE TM59 is based on CIBSE TM52 and CIBSE Guide A guidance documents and provides a standardised approach to predicting overheating risk for both naturally and mechanically ventilated residential buildings.

3.2 The new CIBSE TM59 guidance requires the following two criteria must be met in order to demonstrate compliance:

a. For living rooms, kitchens and bedrooms: the number of hours during which the operative temperature exceeds the comfort threshold temperature 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 TM59 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. (CIBSE Guide A Fixed temperature threshold).

(Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32.85 hours, so 33 or more hours above 26 °C will be recorded as a fail).

## Modelling Methodology

3.3 Whilst The performance of the units has been assessed under CIBSE TM59 adaptive comfort model for a primarily natural ventilated scenario through the Energy Plus engine using Design Builder v7.1.4.005

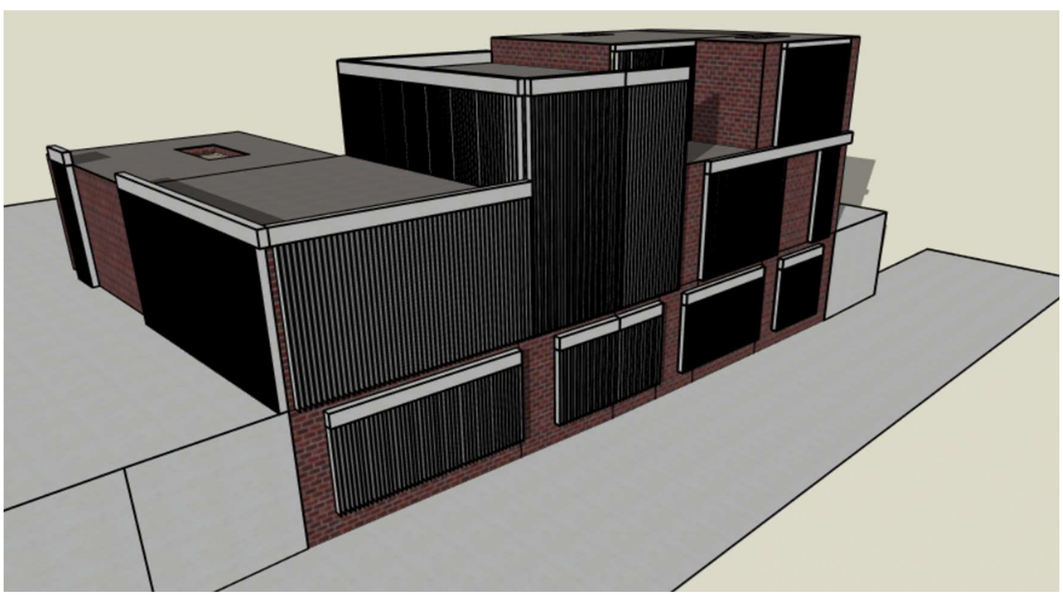

**Fig 3.1 – Model Image (not aesthetical representation)**

3.4 For the purposes of the assessment, a number of rooms as well as worst performing zones were selected based the TM59 methodology, including:

a. East facing 2-Bed Bedroom 1 on lower ground floor

b. East facing 2-Bed Bedroom 2 on lower ground floor

c. East facing Master Bedroom on ground floor

d. East and South facing Dining Room on the ground floor

e. East and West Facing Living room on the ground

### Site External Weather Conditions

3.5 The effects of external conditions are vital in an overheating assessment as, in particular, they influence:

a. Solar heat gains (a function of incident direct & diffuse solar radiation and solar altitude);

b. Calculated natural ventilation rates (a function of external temperature, wind directions and speeds).

3.6 CIBSE Design Summer Year weather data for London Heathrow has been used for the 2020s, high emissions, 50% percentile scenario as required by CIBSE TM59 guidance and as the most relevant to the location of the proposed development site.

### Dynamic Simulation Modelling Inputs

3.7 All fabric and M&E inputs to the EnergyPlus model are in line with the measures outlined in this report. Design Inputs specific to the TM59 analysis have been detailed below:

**Table 3.1 – Summary of Dynamic Simulation inputs & Part O Checklist**

| Input<br><br>Modelling details | Parameters | Comment |
|---|---|---|
| **Dynamic software name and version** | Design Builder v7.1.4.005 | As per AM 11 |
| **Weather file location used, including any additional, more extreme weather files** | CIBSE Design Summer Year weather data for Southampton 2020s, high emissions, 50% percentile; as detailed in section 3.7, 3.8 | As per TM59 Methodology |

| Input | Parameters | Comment |
|---|---|---|
| **Modelling details** | | |
| **Number of sample units modelled, including an explanation of why the size/selection has been chosen** | As explained in section 3.6 | As per TM59 Methodology |
| **Modelled occupancy & details**<br><br>The project passed the assessment prescribed in CIBSE TM59 taking into accounts the limits detailed in section 2.6 & 2.7 | | |
| **Building Fabric & Construction ( U value)** | External wall – 0.13<br><br>Floors – 0.11<br><br>Roof – 0.11 | - |
| **Windows U value & G value** | Glazed Windows – 1.0<br>G Value - 0.25 | As designed |
| **Free Areas** | An elevation plan has been provided detailing the percentage of openable window available within the bedroom and living areas this can be seen within the appendix I.<br><br>All windows to operate in accordance with Part O schedules | As per TM59 Methodology with Part O rules |
| **Infiltration and Mechanical Flow rates** | -As explained in section 3.6<br>-Air permeability of 2.0<br>-Mechanical ventilation based on minimum fresh air per person | As per TM59 Methodology |
| **Shading strategy** | Overhangs provided and Louvres as per design | Windows have been included in detail design. |
| **Mechanical cooling** | No cooling | |
| **The overall overheating strategy (i.e. design features are key to the project passing)** | • The g-value of all installed glazing will be as low as feasibly possible (currently assumed as 0.25) in order to reduce internal solar gain.<br><br>• The Windows openings are side hung and doors are sliding with greater opening percentage allowing ventilation. A detailed elevation plan | |

| Input | Parameters | Comment |
| --- | --- | --- |
| Modelling details | | |
| | | marking the opening areas has been provided by the architect.<br>• MVHR system is proposed to provide fresh air into the zones to allow movement of stagnant air which will help in lowering the overall indoor air temperature.<br>• The design has a louvre incorporated to the external faced. It is proposed that additional overhangs are added / modified to a minimum of 2m to obstruct the direct sunlight from impacting the space. |

## Internal Gains

3.8 The following internal gains assumptions (Table 5.3) have been made in the DesignBuilder EnergyPlus model, in line with the CIBSE TM59 guidance and mechanical calculations undertaken by the applicant:

**Table 3.2 – Internal Gains Assumptions**

| Unit/Room Type | Occupancy | Equipment Load |
|---|---|---|
| **3 Bed Apartment: Living/ Kitchen** | 3 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<br>200W 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 |
| **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 | Peak load of 80 W from 8 am to 11 pm<br>Base load of 10 W during the sleeping hours |
| **All Rooms – Lighting** | n/a | Lighting assumed 2.5 W/m² from 6pm to 11pm |
| **Internal DHW** | n/a | A standing loss of 66 W for the DHW cylinder has been assumed for the cylinder. |

## Part O Results – Dwellings (DSY 1)

3.9 The table below summarises the results given by running dynamic thermal simulations for the buildings under the current design summer year (1989) for the 2020s high emission, 50% percentile scenario, as required by CIBSE TM59.

**Table 3.3 – Energy Plus TM59 Output (DSY 1)**

| Floor | Zone | Criterion A (%) | Criterion B (hr) | Pass/Fail |
|---|---|---|---|---|
| **Lower Ground** | Bedroom2 | 0.16 | 20.67 | Pass |
| **Lower Ground** | Guest Bedroom | 0.05 | 20 | Pass |
| **Ground** | Dining Room | 8.29 | N/A | Fail |
| **Ground** | Living Room | 48.68 | N/A | Fail |
| **Ground** | Master Bedroom | 0.18 | 28.17 | Pass |

3.10 Following the initial analysis, results present have identified that based on the current building design and assumptions, the area identified have failed the TM59 Part O standard.

3.11 This is due to the large percentage of glazing in these areas and the orientation of the space. Discussions with the architect around potential glazing reductions and additional window openings have been investigated to try and reduce over heating within the communal areas. The updated results are as follows.

**Table 3.3 – Energy Plus TM59 Output (DSY 1)**

| Floor | Zone | Criterion A (%) | Criterion B (hr) | Pass/Fail |
|---|---|---|---|---|
| **Lower Ground** | Bedroom2 | 0.14 | 27.67 | Pass |
| **Lower Ground** | Guest Bedroom | 0.09 | 24.83 | Pass |
| **Ground** | Dining Room | 4.41 | N/A | Fail |
| **Ground** | Living Room | 3.00 | N/A | Pass |
| **Ground** | Master Bedroom | 0.27 | 27.67 | Pass |

3.12 Results presented above demonstrate that, based on the improved design, overheating within the communal areas has been further mitigated, removing the risk of overheating within the living room.

## Part O Results – Dwellings (DSY 2 & 3)

3.13 Following analysis against the DSY1 high emissions 50 %, further analysis has been conducted to assess the development against future weather years to assess the likely hood overheating occurring due to climate change.

**Table 3.4 – Energy Plus TM59 Output (DSY 2)**

| Floor | Zone | Criterion A (%) | Criterion B (hr) | Pass/Fail |
|---|---|---|---|---|
| **Lower Ground** | Bedroom2 | 0.97 | 29.33 | Pass |
| **Lower Ground** | Guest Bedroom | 0.72 | 27.33 | Pass |
| **Ground** | Dining Room | 7.12 | N/A | Fail |
| **Ground** | Living Room | 5.38 | N/A | Fail |
| **Ground** | Master Bedroom | 1.26 | 30.50 | Pass |

**Table 3.4 – Energy Plus TM59 Output (DSY 2)**

| Floor | Zone | Criterion A (%) | Criterion B (hr) | Pass/Fail |
|---|---|---|---|---|
| **Lower Ground** | Bedroom2 | 1.06 | 47 | Fail |
| **Lower Ground** | Guest Bedroom | 0.72 | 43.5 | Fail |
| **Ground** | Dining Room | 11.38 | N/A | Fail |
| **Ground** | Living Room | 9.21 | N/A | Fail |
| **Ground** | Master Bedroom | 1.57 | 47.0 | Fail |

3.14 The applicant has therefore determined that the design has demonstrated an acceptable level of overheating risk. After following the cooling hierarchy, a need for active cooling to be provided for the open plan communal area to remove the overheating risk.

3.15 The future weather analysis using DSY2 and DSY3 has shown further instances of overheating occurring. The client should be aware of the implications and the future need to instal active cooling.

# 4. CONCLUSION

4. This overheating assessment has been produced on Scenario Architecture's behalf and is submitted in support of a full planning application for the demolition of an existing residential dwelling to construct a 3 storey, 4 bedroom house located on Crediton Hill, NW6 1HP.

4.1 The risk of overheating in buildings is anticipated to rise as a result of climate change. The statement demonstrates how the proposed dwelling can comply with Part O of the Building Regulations 2010 (2021 edition), which concerns itself with the risk of overheating in residential buildings.

4.2 A dynamic thermal model (DTM) of the dwelling was undertaken using the energy plus engine in Design Builder v7.1.4.005 to analyze the performance of the dwelling. The assessment has been made applying a CIBSE TM59 adaptive comfort model based on a primarily natural ventilated scenario.

4.3 The Overheating Assessment presented in this report explains the approach which has been undertaken to minimise overheating. Compliance to Part O as per TM59 analysis has been achieved through design interventions . The internal layout and orientation of the development, as well as the specification of low emissivity windows have been specified to reduce the risk of overheating.

4.4 The analysis has shown that the dining space will over heat due to the large percentage of glazed areas. With limits on the property boundary preventing the installation of any overhangs, and all other passive measures being explored to reduce the overheating, it is proposed that active cooling is installed in this area to negate the risk of overheating.

# APPENDIX I – ARCHITECTURAL DRAWINGS