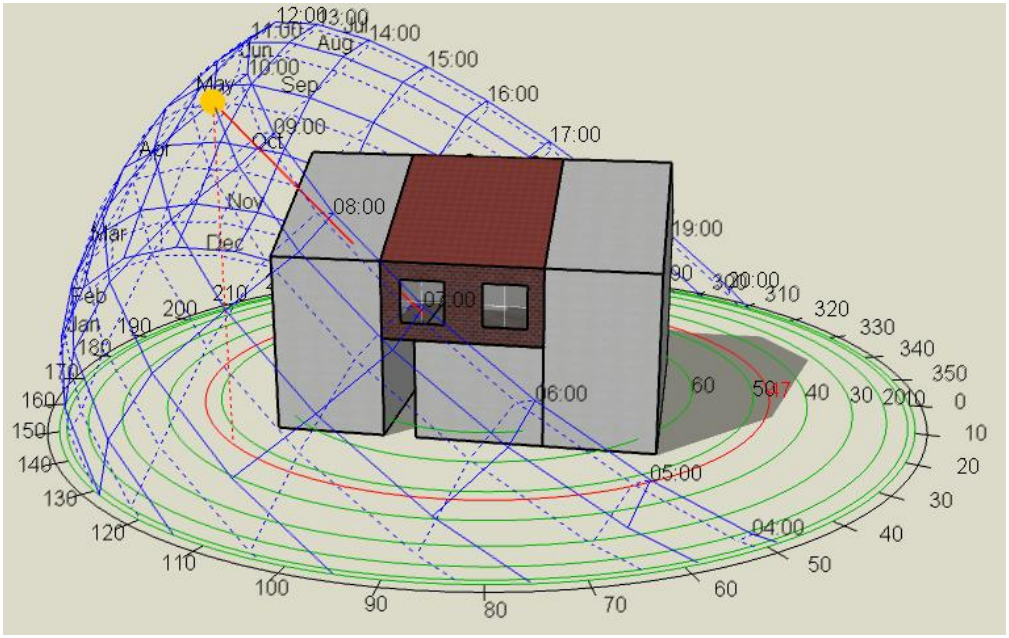
BASEENERGY
Building Assessments for a Sustainable Environment



Domestic Overheating Assessment
Part O - Dynamic Thermal Modelling

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31st July 2024

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Document Status

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Proposals: The conversion of the upper floors into a self-contained flat

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Document Control Record:

Prepared by	Checked by	Date	Job	Revision
MH	PK	31.07.2024	12251	Rev0

1 Scope

This report has been prepared to assess the likelihood of overheating for the proposed self-contained flat at 130 Withington Road, Manchester.

The intention is that this study helps inform and verify the design proposals, thereby providing the basis for mitigating overheating risk and producing houses that provide comfortable environmental conditions for occupants.

It is important to note that with any modelling exercise there are assumptions and approximations that must be made. As far as possible, details of all assumptions and approximations are supplied within the report. These were predominantly informed by information provided 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 demonstrates that the proposed development complies with the relevant current guidance CIBSE TM59: Design Methodology for the Assessment of Overheating Risk in Homes (2017) and the requirements of the Dynamic Simulation of the building regulation in England setting standards for overheating in new residential buildings: Overheating: Approved Document Part O.

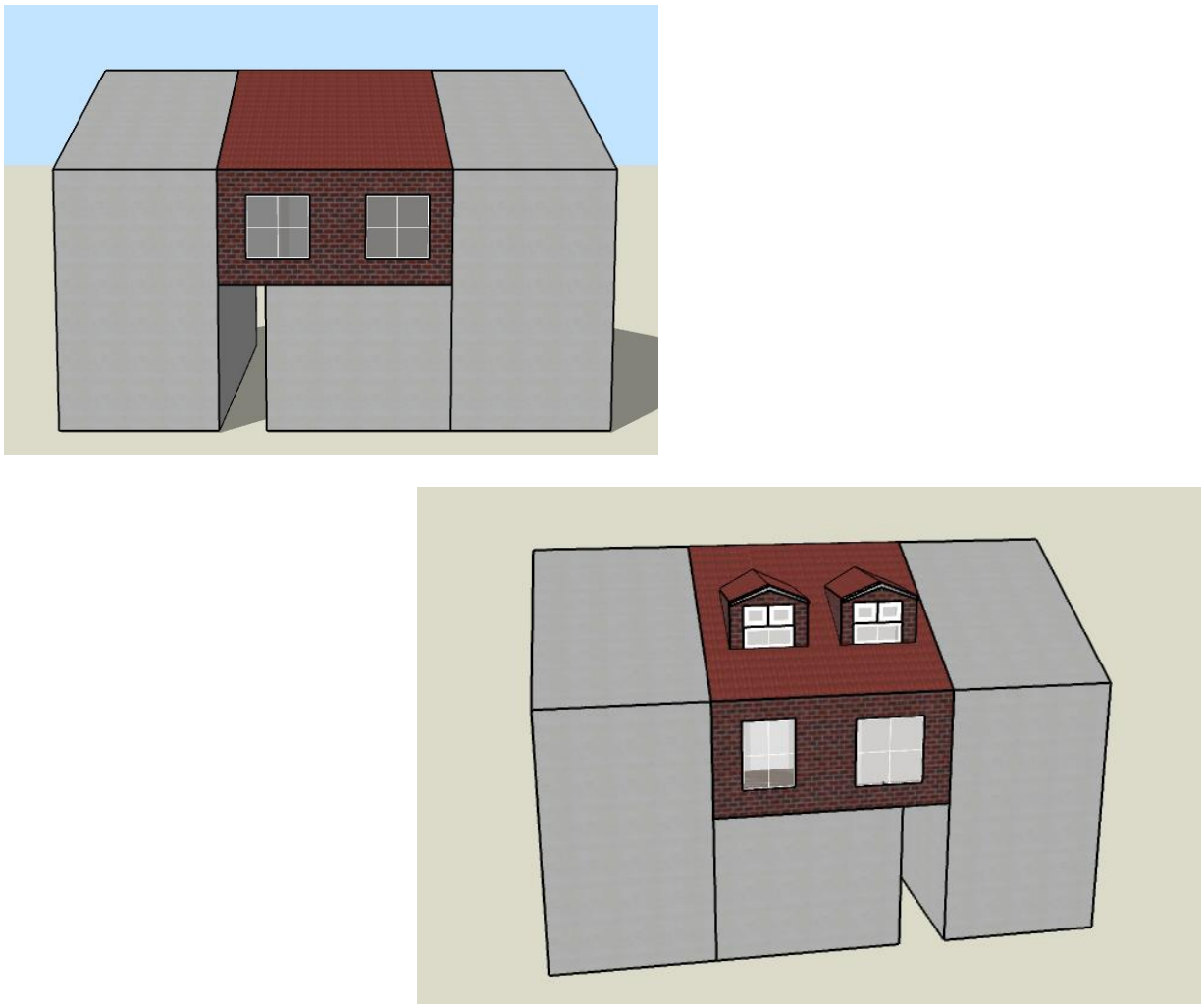


Figure 01.- *DesignBuilder Rendered visuals of the proposed development*

2 Executive Summary

An overheating assessment has been carried out to demonstrate the potential conditions and risk of overheating for the proposed development.

The overheating mitigation strategy below, which results in a pass, includes measures to ensure compliance with Approved Document Part O. This includes a glazing specification with a g-value of 0.40 for the new windows and an hybrid MVHR system to provide fresh air and cooling to the dwelling.

The proposed overheating mitigation measures are listed below:

Dwelling	Overheating Strategy	TM59 / Part O Compliance	Notes
130 Withington Road	▪ Natural Ventilation via openable windows (where possible) ▪ Hybrid MVHR Ventilation with cooling ▪ Glazing g value 0.40 for new glazing	☑	Overheating strategy sufficient

The window openings have been taken from architectural drawings and applied to the model, with each openable window assumed to open to the maximum opening angle (as permitted to by Approved Documents Part O and Part K).

There are no assumed acoustical limitations to windows being opened during both day and night times (Part O window opening schedules are detailed within this report).

3 Part O: Dynamic Thermal Modelling Method

In order to demonstrate compliance with the requirements settled by the requirement O1 of the Approved document Part O, this report has used the Dynamic thermal modelling method approved by the aforementioned document.

To demonstrate compliance using the dynamic thermal modelling method, all of the following have been followed:

a) CIBSE TM59 methodology for predicting overheating risk
b) The limits on the use of CIBSE TM59 methodology set out below
c) The acceptable strategies for reducing overheating risk

Limits on CIBSE's TM59 modelling

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 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 of 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.

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

Acceptable strategies for reducing overheating risk

Limiting solar gains

Solar gains in summer should be limited by any of the following means:

a) Fixed shading devices, comprising any of the following.
   i. Shutters
   ii. External blinds
   iii. Overhangs
   iv. Awnings

b) Glazing design, involving any of the following solutions
   v. Size
   vi. Orientation
   vii. g-value
   viii. Depth of the window reveal
c) Building design – for example, the placement of balconies
d) Shading provided by adjacent permanent buildings, structures, or landscaping.

Removing excess heat

Excess heat should be removed from the residential building by any of the following means.

a) Opening windows (the effectiveness of this method is improved by cross-ventilation)
b) Ventilation louvres in external walls
c) A mechanical ventilation system
d) A mechanical cooling system

4 CIBSE TM59 Assessment Criteria

This report includes only occupied spaces such as the Kitchen/Living Room and Bedrooms. The analysis has been based on CIBSE Technical Memorandum 59 (TM59) 'Design methodology for the assessment of overheating risk in homes', that states:

Compliance is based on passing both of the following criteria:

a) For living rooms, kitchens and bedrooms: the number of hours during which DT 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).

5 The Model

The building was modelled using DesignBuilder Energyplus software. 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 dwelling..

Geometry

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

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.

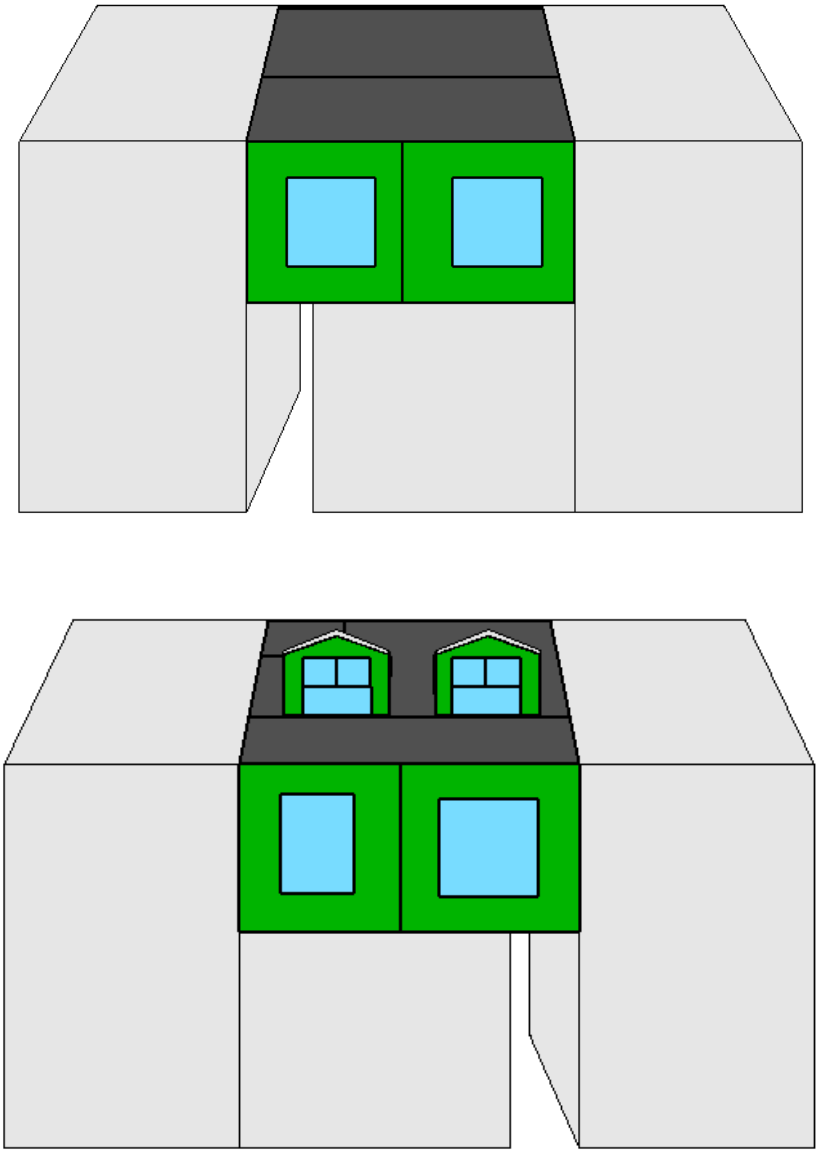


Figure 02.- Thermal *Model images*

Site Location and Climate Data

The CIBSE DSY weather file for Manchester (Manchester DSY1 2020 High 50) has been selected as this is the closest weather file available for the site location.

The weather file contains hourly data for air temperatures (wet bulb and dry bulb), wind speed and direction, atmospheric pressure, solar irradiation and cloud cover.

DSY (Design Summer Year) is the industry standard weather file for use in overheating assessments. It should be noted that the current DSY was used, and future weather files based on various predicted climate change scenarios are available. Usage of these future weather files would result in higher predicted internal temperatures than reported here as the climate is predicted to encounter more prolonged warm spells and higher peak temperatures as time progresses.

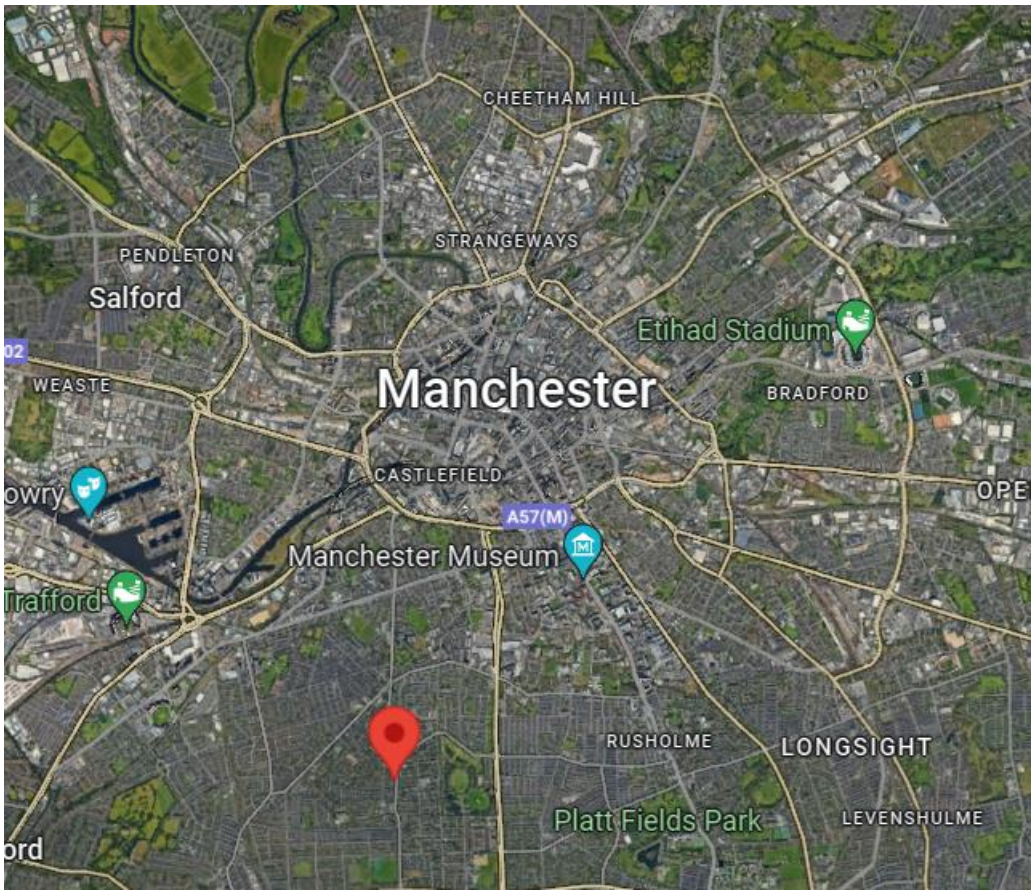


Figure 03.- Site Location

The site is located in Whalley Range in Manchester.

Building Construction and U-Values

Drawings have been provided by the architect which were used to create the thermal model.

Table 1 shows the construction U-values and air infiltration used in the thermal model.

Table 02: *U Values applied to the Dynamic Simulation Model*

Element	Modelled U Value (W/m^2K)
Existing External Wall*	0.70
New External Dormer Wall	0.18
Existing Roof*	0.35
New Dormer Roof	0.15
Existing Glazing*	2.20
New Glazing	1.40
Internal Floors	1.00
Air Leakage ($m^3(h.m^2)$ @ 50Pa*	15
Existing Glazing g Value*	50%
New Glazing g Value	40%

**Existing elements assumed based on Part L1 and age of the building*

Internal Gains

The internal heat gains and operating profiles that are applied to each occupied space have been taken from the prescriptive templates outlined in CIBSE TM59 (Design methodology for the assessment of overheating risk in homes).

Window Opening Schedule

The window opening schedules for dwelling can be seen in the below table.

Assessed Space	Total Window Glazing (m^2)	Total Window Glazing that opens (m^2)	Glazing Opening Type	Total Floor Area (m^2)	Opening Schedule
Kitchen	1.92	0.56	Top Hung Window	8.32	Daytime & Night-time
Lounge	2.25	0.50	Top Hung Window	12.74	Daytime
Bedroom 1	2.25	0.50	Top Hung Window	12.48	Daytime
Bedroom 2	2.36	1.18	Top Hung Window	17.00	Daytime & Night-time
Bedroom 3	0.51	0.51	Rooflight	14.85	Daytime
Bathrooms	Assumed windows in unoccupied areas can be continuously opened.				

As stated on the residential noise assessment carried out by Infinity Acoustics, the windows along the rear of the site can be used for ventilation. However, due to noise resulting from the road and adjacent properties, the windows to the front of the property should remain closed to ensure indoor noise levels are achieved and therefore have been modelled as closed during sleeping hours (11pm to 7am) as part of the overheating mitigation strategy, in accordance with Part O guidance section 3.2.

It is assumed that internal doors are left open during the day.

Opening Schedules:

- Night Closed: Glazing can be opened between the hours of 08:00-23:00 but is shut out of these hours. The Part O document stipulates any window which can be easily accessed must be closed or secured resulting in a reduced opening area (such as ground floor doors/windows where openings may be vulnerable to intrusion by a casual or opportunistic burglar).
- Night Open: Glazing can be open 24/7 if necessary as these openings are not vulnerable (such as first floor and above windows etc).

Mechanical Ventilation

As there are limitations for natural ventilation due to window opening restrictions, it is proposed that MVHR hybrid cooling ventilation units will provide the necessary ventilation and cooling requirements. A unit such as Nuaire MRXBOX which is capable of delivering enhanced flow rates of 90 l/s or more (to the total dwelling) is required to overcome the overheating risk and satisfy the TM59 assessment criteria.

During the heating season, the Nuaire MRXBOX (or equivalent) acts as conventional MVHR unit, supplying air to habitable rooms (such as bedrooms and living spaces), while extracting from kitchen, WC and bathroom spaces at the minimum requirements as per Approved Document F, and recovering as much as 90% of the heat from the extracted air.

During summer months and periods of warm external conditions, a summer bypass allows the incoming air to avoid the heat exchanger and supply air at external conditions to the dwelling, taking advantage of the 'cooler' outdoor air (free cooling) to maintain comfortable internal conditions.

However, when external temperatures exceed internal, the cooling coil will become active and begin to temper the incoming air – offsetting the incoming external condition supply air by between 10°C-15°C (dependant on external air temperature and desired flow rates). During cooling mode, air has been modelled at supply rates of 20l/s for bedrooms and 30l/s for living areas.

Ensuring the Overheating Strategy is Usable

Approved Document O lists a number of measures to ensure the overheating mitigation strategy can be feasibly implemented in reality, as well as complying with overlapping building codes. The full literature can be found in *Section 3: Ensuring the overheating mitigation strategy is usable* of Approved Document O. A summary of these standards has been compiled below:

1.1 Noise

- **3.2)** In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).

- **3.3)** Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits: A) 40dB LAeq,T, averaged over 8 hours (between 11pm and 7am). & b) 55dB LAFmax, more than 10 times a night (between 11pm and 7am).

1.2 Pollution

- **3.5)** Buildings located near to significant local pollution sources should be designed to minimise the intake of external air pollutants. Guidance is given in Section 2 of Approved Document F, Volume 1: Dwellings.

1.3 Security

- **3.6)** When determining the free area available for ventilation during sleeping hours, only the proportion of openings that can be opened securely should be considered to provide useful ventilation. This particularly applies in the following locations, where openings may be vulnerable to intrusion by a casual or opportunistic burglar.

a) Ground floor bedrooms
b) Easily accessible bedrooms

1.4 Protection from Falling

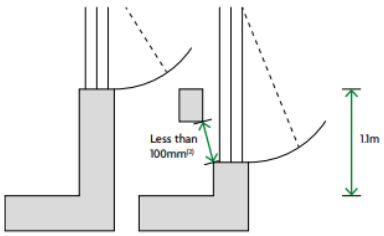
- **3.8)** Openings which are intended to be open for long periods to reduce overheating risk might pose a higher risk of falls from height. Only the proportion of openings which can be opened with a very low risk of occupants falling from height should be considered to form part of the overheating mitigation strategy.
- **3.9)** Openings that can be opened wider than 100mm may form part of the overheating mitigation strategy where they meet all of the following conditions:

a) Window handles on windows that open outwards are not more than 650mm from the inside face of the wall when the window is at its maximum openable angle.
b) Guarding meets the minimum standards in Table 3.1
c) Guarding does not allow children to easily climb it. For example, horizontal bars should generally be avoided.

For more information, please refer to *Approved Document K.*

Table 3.1 Guarding heights

Change in floor level between inside and outside	Guarding height[1]
Less than 600mm	See Approved Document K
More than 600mm	1.1m



NOTES:
1. This approved document has increased levels of protection from falling compared to Approved Document K. Where applicable, the higher standard applies.
2. Guarding should be sized to prevent the passage of a 100mm sphere.

6 Results

A full set of results can be seen in Appendix A of this report.

The following table presents an overheating mitigation strategy to ensure compliance with Part O.

Dwelling	Overheating Strategy	TM59 / Part O Compliance	Notes
130 Withington Road	▪ Natural Ventilation via openable windows (where possible) ▪ Hybrid MVHR Ventilation with cooling ▪ Glazing g value 0.40 for new glazing	☑	Overheating strategy sufficient

7 Summary

The assessment has shown that the proposed residential dwelling at 130 Withington Road, Manchester presents a low risk of overheating provided that the overheating mitigation strategy detailed within this report is implemented.

As there are noise related restrictions to the openable windows on the front façade of the building, the opportunities to provide sufficient natural ventilation as part of the overheating mitigation strategy are limited.

This overheating assessment has explored the use of MVHR ventilation to mitigate overheating risk. The results show that at both background supply rates (Part F requirements) and increased supply rates, compliance cannot be achieved with Part O.

It is recommended that a hybrid MVHR unit with small cooling capacity is used to ensure overheating risk is mitigated for extreme weather events and to comply with Part O. An alternative to this would be to install a comfort cooling system in the lounge and bedrooms.

Though the regulations do not permit the use of blinds and curtains in the calculations, if the sun shines directly into a living space, the occupant should consider closing the curtains or blinds to limit solar gains and try and keep rooms as cool as possible.

Mitigating overheating will rely on the end user operation and understanding of overheating. Heat comes into the house in two ways: solar radiation from the sun, and hot air. We need to limit both to prevent overheating, which may require closing both the windows and curtains on the warmest days.

If it's cooler inside than outside, it is advised that occupants should keep their windows closed, to prevent bringing warm air in. If it reaches a point where the temperature inside the house is equal to that outside, then you should open the windows, keeping the curtains closed.

Appendix A: Dynamic Thermal Modelling TM59 Results

Scenario 1: MVHR background rates

Room	Criterion 1 (%)	Criterion 2 (Hr)	Pass/Fail
Kitchen	4.24	N/A	Fail
Lounge	4.92	N/A	Fail
Bedroom 1	2.66	222.50	Fail
Bedroom 2	4.14	168.50	Fail
Bedroom 3	18.98	443.00	Fail

Scenario 2: MVHR (20 l/s bedrooms, 30 l/s lounge)

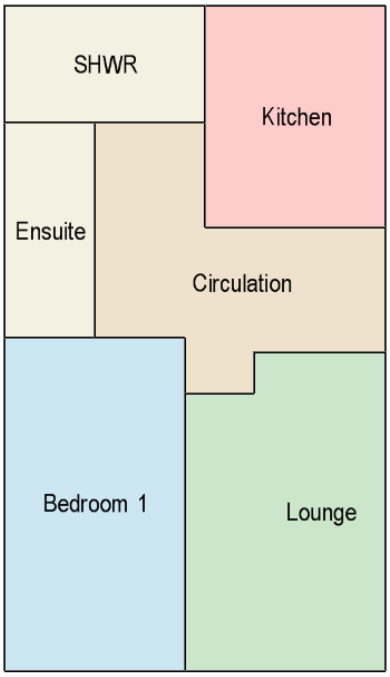
Room	Criterion 1 (%)	Criterion 2 (Hr)	Pass/Fail
Kitchen	3.40	N/A	Fail
Lounge	1.62	N/A	Pass
Bedroom 1	0.57	115.50	Fail
Bedroom 2	1.40	95.00	Fail
Bedroom 3	3.08	159.00	Fail

Scenario 3: Hybrid MVHR with cooling

Room	Criterion 1 (%)	Criterion 2 (Hr)	Pass/Fail
Kitchen	2.75	N/A	Pass
Lounge	0.03	N/A	Pass
Bedroom 1	0.30	18.50	Pass
Bedroom 2	0.67	22.00	Pass
Bedroom 3	1.20	23.00	Pass

Appendix B: Designbuilder Zone Plan

First Floor:



Second Floor:

