



BEYOND BUILDING

AD-0 (2021)

Dynamic Overheating Assessment

Maisonettes at Ratby, Phase 2

Revision 00

Date: 17 April 2025

URN: LA.LA.LE6-2



Revision History

Revision	Issue Date	Description	Issued by	Checked by
00	17/04/2025	Draft Report	MK	MW

This report has been produced by Energist for the private use of the client and solely in relation to the named project. It should neither be reproduced in part or in whole nor distributed to third parties, without the express written permission of both Energist and the Client.

All advice provided by Energist regarding the performance of materials is limited solely to the purposes of demonstrating compliance with the services Energist has been appointed to deliver. The performance of materials under other criteria, including but not limited to fire, structural or acoustics, are not considered in our advice and it is the responsibility of the Client to ensure the wider suitability of materials specified in our assessments.

Calculations contained within this report have been produced based on information supplied to Energist by the Client and the Design Team. Any alterations to the technical specification on which this report is based will invalidate its findings.

This document acts as an explanation guide for how compliance can be proven against the new Approved Document Part O in England. The contents will be useful for those who have not dealt with overheating assessments for Building Regulation purposes before.

Energist, Suite 210, Watermoor Point, Cirencester, GL7 1LF

08458 386 387

info@energistuk.co.uk



Contents

1. EXECUTIVE SUMMARY	5
1.1 REVIEW OF THIS DOCUMENT.....	5
1.2 ADDITIONAL RISKS	5
1.3 ADDITIONAL DOCUMENTATION.....	6
2. APPROVED DOCUMENT O (2021).....	7
3. INTRODUCTION.....	8
3.1 SITE DESCRIPTION.....	8
3.2 SITE CONSTRAINTS	9
4. OVERHEATING CRITERIA.....	11
4.1 OVERHEATING CRITERIA FOR HOUSES.....	11
5. METHODOLOGY.....	12
5.1 DYNAMIC SIMULATION SOFTWARE	12
5.2 APPROVED STRATEGIES.....	12
5.3 CLARIFICATIONS.....	14
6. MODELLING INPUT DATA	15
6.1 DRAWINGS	15
6.2 SAMPLES	15
6.3 BUILDING CATEGORY.....	16
6.4 LOCATION AND WEATHER FILE	17
6.5 BUILDING FABRIC SPECIFICATIONS.....	19
6.6 M&E STRATEGY.....	20
6.7 INTERNAL GAINS	20
6.8 VENTILATION STRATEGY.....	21
7. RESULTS.....	27
8. CONCLUSIONS.....	28
APPENDICES	29
APPENDIX 1: OCCUPANT WELLBEING	29
APPENDIX 2: INTERNAL GAINS.....	32



APPENDIX 3: MODELLED WINDOW OPENING ANGLES IN LINE WITH THE RELEVANT NOISE ASSESSMENT RECOMMENDATIONS.....	34
---	-----------

APPENDIX 4: MODELLED VENTILATION AND DESIGN STRATEGIES.....	36
--	-----------

APPENDIX 5: TM59 CRITERIA COMPLIANCE RESULTS.....	37
--	-----------



1. EXECUTIVE SUMMARY

1.1 Review of this document

This Dynamic Overheating Assessment has been produced by Energist UK on behalf of Lagan Homes Ltd. ('the Applicant').

This assessment shows how the design of the maisonettes (covering plots 44, 45, 51 and 52, as indicated in the provided site layout) at Ratby, Phase 2 ('the Development') will meet the requirements of [Approved Document O](#) (AD-O, 2021) for overheating in England.

This report confirms that the modelled plots comply with the AD-O requirements, following the [TM59 Design Methodology for the Assessment of Overheating Risk in Homes \(2017\)](#).

The design adheres to the cooling hierarchy by initially implementing passive measures before incorporating active interventions:

- **Natural Ventilation:** Enhancement of natural airflow is achieved through the strategic use of openable windows when possible.
- **Mechanical Ventilation**, in the background: After implementing passive options, purge ventilation has been introduced in the ground floor bedrooms to support effective night-time temperature control.

These measures ensure comprehensive compliance with regulatory standards, thus no further modifications to the design specification are necessary.

1.2 Additional risks

In some cases, the opening of windows to assist with the free movement of air during hot spells may be detrimental to the wellbeing of occupants.

This review has also considered the following points which may be valid reasons for restricting the opening of windows. Please refer to Appendix 1 of this document for more information and refer to Section 2 for the full guidance on these matters.



Noise: RSKA carried out a noise assessment for the proposed development. The report identifies significant noise levels across parts of the site, including the plots under assessment.

Pollution: There is no known risk that the development is located near to significant local pollution sources.

Security: The windows in the ground floor rooms cannot be left open overnight unless additional security measures are considered. This may include louvred shutters, window grilles or railings.

Protection from falling: The openings on upper levels which are at 1.1 metres above the floor finish. These openings should not pose a risk of falling.

Protection from entrapment: There is no known risk of shutters, railings or grilles posing a risk of entrapment.

1.3 Additional documentation

Results are shown in section 7 of this report.

This report acts as an explanation guide for how compliance is proven against the targets outlined in the new Approved Document Part O.



2. APPROVED DOCUMENT O (2021)

Since [June 15th, 2022](#), an additional volume of Building Regulations has been applied to new building works in England. This overheating assessment ensures newly built dwellings and dwelling-like buildings are comfortable for occupants to use during summer months without reliance on comfort cooling systems.

[Approved Document O \(AD-O, 2021\)](#) considers solar gains, the incorporation of shading into the design, and the free area of air movement within buildings. It also includes guidance to protect against external noise and air pollution, security, and to ensure changes to the design for overheating purposes do not increase the risk of falling from height.

The aim of AD-O is to protect the health and welfare of building occupants by reducing the occurrence of uncomfortably high indoor temperatures. As per the approved document, following this guidance does not guarantee the comfort of building occupants. This is a standardised approach to predicting overheating risk for new residential building designs using dynamic thermal analysis.

As the Ratby, Phase 2 development was registered after June 15th, AD-O compliance is mandatory. Lagan Homes Ltd. has engaged Energist UK to conduct the necessary calculations to demonstrate the performance of the design in accordance with the new targets.

As well as presenting results, this report also guides the reader through the process of AD-O, and how to recognise when a dwelling is meeting compliance.

The launch of AD-O ties in with rewrites for [Approved Document F \(Ventilation\)](#) and [Approved Document L \(Conservation of Fuel and Power\)](#). These updates are collectively referred to as phase one of the Future Homes Standard.

Sites registered with [Building Control](#) before June 15th, 2022, are exempt from AD-O, providing work has commenced on every individual building before June 15th, 2023. Any unstarted buildings after this date will need to prove AD-O compliance.

Work to existing buildings, including renovations and extensions, are exempt from AD-O.

3.1 Site Description

This overheating assessment focuses specifically on the maisonettes, which comprise plots 44, 45, 51, and 52 as shown on the masterplan.



[Source: McBains Ltd, Drawing Ref.: LWRAT-MCB-ZZ-ZZ-DR-A-0230 (P3), provided by Lagan Homes]



3.2 Site Constraints

RSK Acoustics (RSKA) has been appointed by Lagan Homes Ltd to undertake a noise assessment for the proposed development.

Although the northern boundary of the site adjoins open fields, the southern area comprises agricultural land, while the western edge borders Pear Tree Wood and Burroughs Wood. The M1 motorway is located approximately 500 metres to the north and east of the site, running in a north-west to south-east direction.

The noise assessment, titled "*Noise Mitigation Scheme – Land South of Markfield Road, Ratby – Phase 2*", was prepared by RSKA in February 2025. It identifies significant noise levels across parts of the site, including the plots under assessment. Relevant night-time noise contour maps are provided below for both ground and first-floor levels.

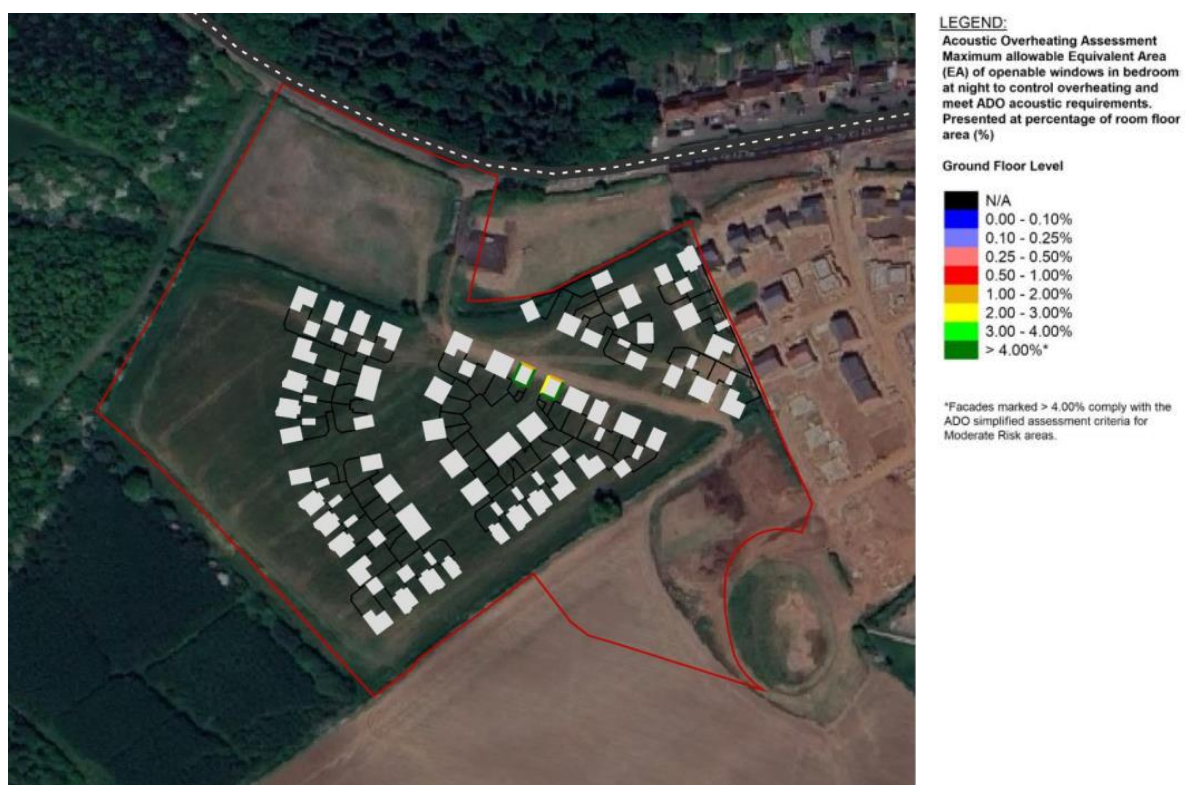


Figure 2 – The overheating noise assessment for the ground floor of the Ratby Phase 2 development, at night.

[Source: RSKA, Noise Mitigation Scheme – Land South of Markfield Road, Ratby – Phase 2, February 2025; Report Ref.: 2062442-RSKA-RP-002-(01), provided by Lagan Homes]

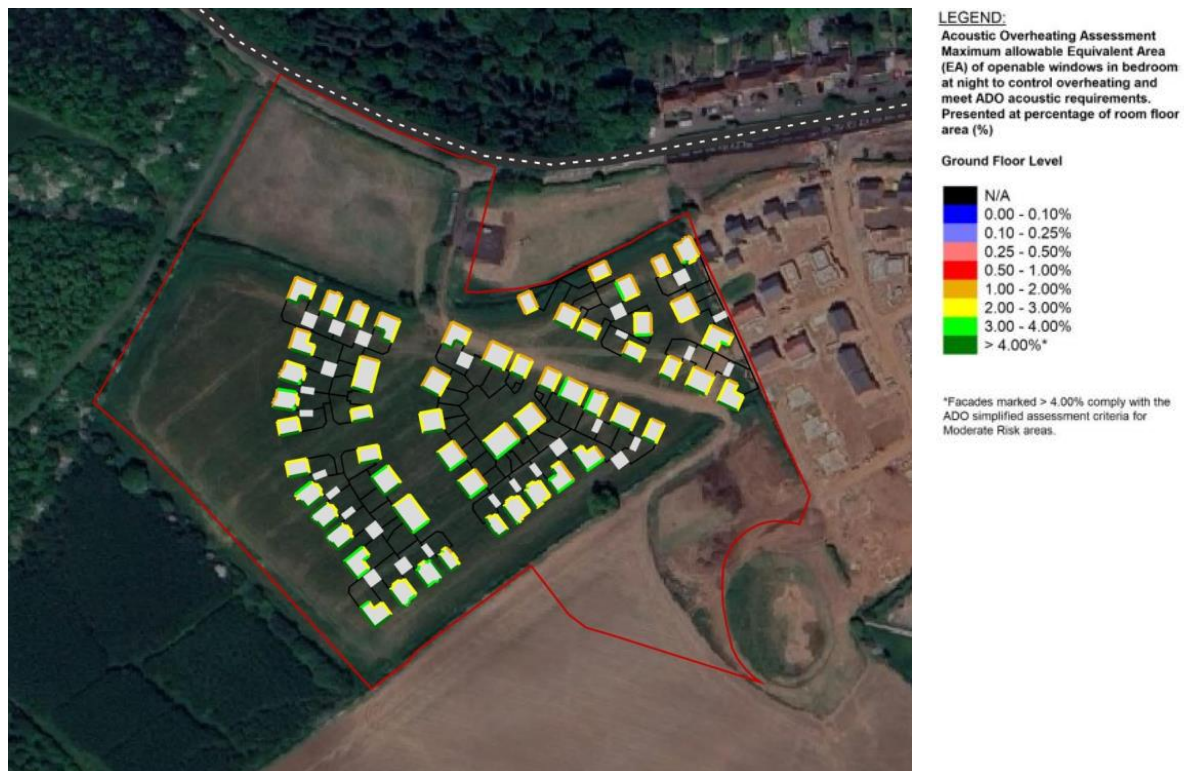


Figure 3 – The overheating noise assessment for the first floor of the Ratby Phase 2 development, at night.

[Source: RSKA, Noise Mitigation Scheme – Land South of Markfield Road, Ratby – Phase 2, February 2025; Report Ref.: 2062442-RSKA-RP-002-(01), provided by Lagan Homes]

The *Overheating Noise Assessment* prepared by RSKA advises that windows on the front and side façades of the maisonettes should remain closed at night. However, it permits windows on the rear façade to be opened during night-time hours, with an openable area exceeding 4% of the room's floor area.

This applies specifically to window WF04, which serves the first-floor bedroom — the only night-time occupied room not subject to security-related restrictions.

For further details, please refer to *Section 6.8: Ventilation Strategy*.



4. OVERHEATING CRITERIA

This overheating assessment is based on the [CIBSE TM59 Design Methodology for the Assessment of Overheating Risk in Homes \(2017\)](#).

4.1 Overheating Criteria for Houses

Targets for houses which are [predominantly naturally ventilated](#):

A) In living rooms, kitchens and bedrooms, the number of occupied hours when the internal temperature is at least one °C hotter than the external temperature should not exceed 3%. This is calculated from 1st May until 30th September. This requirement is also known as [CIBSE TM52 Criterion 1: Hours of exceedance](#).

B) To guarantee comfort during sleeping hours, between 10pm and 7am, the temperature of bedrooms shall not exceed 26°C. Compliance is achieved with a result below 1%, or 33 hours, annually.

Target for houses which are predominantly [mechanically ventilated](#):

C) All occupied rooms should not exceed an operative temperature of 26°C for more than 3% of the annual occupied hours. This requirement is in line with [CIBSE Guide A \(2015\)](#).

The maisonettes at Ratby, Phase 2 were assessed to meet the targets for predominantly naturally ventilated houses. All bedrooms were evaluated against Criteria A and B, while kitchens and living rooms were assessed solely against Criterion A.



5. METHODOLOGY

5.1 Dynamic Simulation Software

The proposed development has been assessed through dynamic thermal modelling by using [Integrated Solutions Virtual Environment \(IES VE\) 2024 v1.0.0](#) which complies with [CIBSE AM11: Building performance modelling \(2015b\)](#). IES VE is used by sustainable design experts around the globe as it is an in-depth suite of integrated analysis tools for the design and retrofit of buildings. The platform leverages a world-leading simulation engine to allow designers to test different options, identify passive solutions, compare low-carbon and renewable technologies, and draw conclusions on energy use, CO₂ emissions and occupant comfort.

5.2 Approved Strategies

Once the required buildings have been modelled into IES VE, then the building specifications, M&E strategy, internal gains, weather data and windows' strategy are being implemented as per section 6. The results are then compared against the CIBSE TM59 criteria (Section 4) to assess the risk of overheating.

According to Part O Regulations (2021), the acceptable strategies for reducing overheating risk are:

✓ **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:

- Shutters.
- External blinds.
- Overhangs.
- Awnings.

b) Glazing design, involving any of the following solutions:

- Size.
- Orientation.



- g-value.
- Depth of the window reveal.

c) Building design – for example, the placement of balconies.

d) Shading provided by adjacent permanent buildings, structures or landscaping.

Although internal blinds, curtains and foliage (e.g. tree cover) provide some reduction in solar gains, they should not be taken into account when considering whether requirement O1 has been met.

✓ **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.

The methodology requires the demonstration that passive means have been taken into consideration as far as reasonably practicable, to limit the unwanted solar gains and remove excess heat before introducing mechanical cooling.

A system for purge ventilation should be provided in each habitable room to demonstrate compliance with Part F of the Building Regulations.

Finally, the building's overheating mitigation strategy should take into account the following:

- a) Noise at night
- b) Pollution
- c) Security
- d) Protection from falling
- e) Protection from entrapment



5.3 Clarifications

As mentioned in CIBSE TM59 (2017), this methodology:

- i) Allows different designs to be compared with a common approach, based on reasonable assumptions.
- ii) Supports design decisions that improve comfort without cooling.
- iii) Provides consistency across the industry as all consultants will be using the same methodology for overheating risk prediction.

However, this methodology will not:

- i) Guarantee that people will always be comfortable in compliant spaces, however they act.
- ii) Consider unusual use.



6. MODELLING INPUT DATA

6.1 Drawings

The drawings used to create the IES VE model for the project were provided by Lagan Homes Ltd, and further details are shown in the table below.

Table 1 – Drawings used for the IES VE model.

Drawings	Name / Reference	Date Received	Comments
Floor Plans	2311-CR-MAR-00-DR-A-04-P03 2311-CR-MAR-01-DR-A-05-P03	02/04/2025	-
Elevations	2311-CR-MAR-ZZ-DR-A-08-P03	02/04/2025	-
Sections	2311-CR-MAR-ZZ-DR-A-09-P03	02/04/2025	-
Site Plan	LWRAT-MCB-ZZ-ZZ-DR-A-0230	13/02/2025	-

6.2 Samples

The TM59 assessment approach allows for a sample of dwellings to be modelled, typically selecting those most susceptible to overheating. This may include units that:

- Have large areas of glazing on the southern façade.
- Have limited shading.
- Are single aspect.
- Have restricted or limited window openings.
- Have security-related ventilation constraints.

However, the sample-based approach is only partially applicable in this case, as the maisonette house type is limited to plots 44, 45, 51, and 52. Energist UK were appointed to model two sample units — therefore, **plots 44 and 45 have been selected for assessment**. Plots 51 and 52 appear to be mirrored versions of these units and may experience greater shading from surrounding buildings.



Figure 2 below illustrates plots 44 (ground floor) and 45 (first floor), as modelled in IES VE.

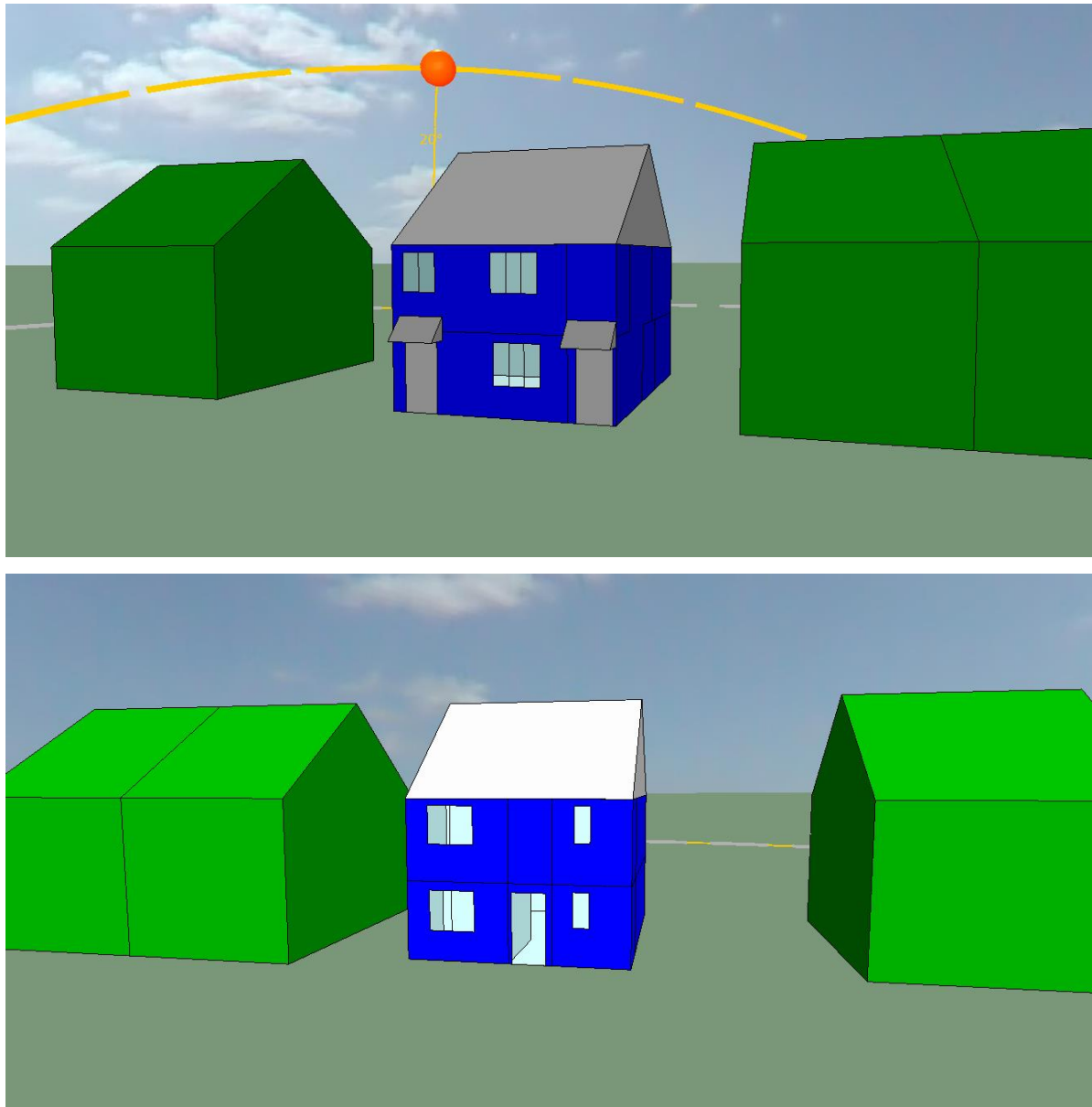


Figure 4 – The front (*top*) and rear (*bottom*) elevations of the maisonettes (plots 44 and 45) at Ratby, Phase 2, as modelled in IES VE.

6.3 Building Category

The appropriate building category for the overheating assessment has been selected, as shown in the table below.



Table 2 – Building Category.

Building Category	Description	Category Selected
Category I	New buildings for vulnerable residents	
Category II	New buildings	✓

6.4 Location and Weather File

The proposed development is located on Markfield Road in Ratby, Leicestershire, LE6 0LS (see Figure 3 below).



Figure 5 – Aerial view indicating the area next to the site extracted from Google Maps (access: 11/04/2025).

The **Dynamic Thermal Model** considers how site-specific weather patterns will affect the internal temperature of the building. **Design Summer Years** models (DSY) are used in line with TM59 requirements. More extreme weather files can be used if specifically requested. This will make compliance more difficult and should only be considered on buildings of particular concern. The available DSY weather files are described in Table 3.



Table 3 – The DSY weather files description.

Design Summer Years (DSY) models	Description of weather files	Compliance
DSY-1	Represents a moderately warm summer year	Mandatory for AD-O compliance
DSY-2	2003 - a year with a very intense single warm spell	Voluntary – compliance not required
DSY-3	1976 – a year with a prolonged period of sustained warmth	

The "Nottingham" weather file is the most appropriate for Ratby, Leicestershire, LE6 0LS. Nottingham is located to the northeast of Ratby, roughly 30 miles away. The terrain between Ratby and Nottingham is relatively uniform, primarily consisting of rural and suburban landscapes. The climate conditions are likely to be similar, such as temperature, precipitation, and solar radiation, making the "Nottingham" weather file a reasonable choice. Additionally, it provides reliable and comprehensive data required for building performance simulations, ensuring accurate and contextually relevant assessments.

The overheating assessment has been carried out using the most appropriate CIBSE Nottingham DSY1 for the 2020s, high emissions, 50% percentile (please refer to Figure 4 below).

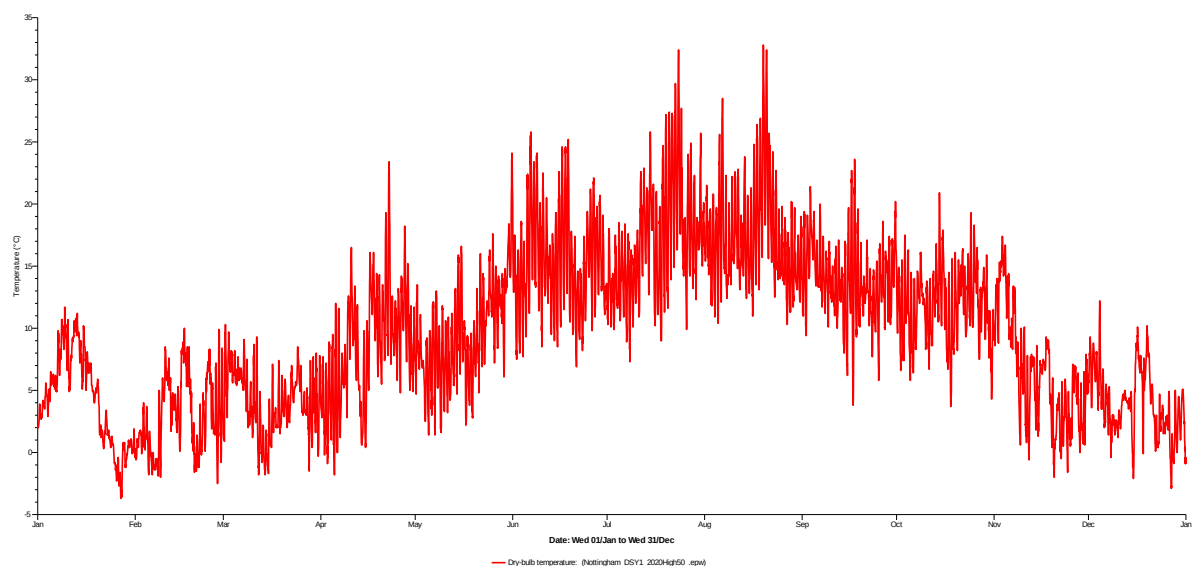


Figure 6 – Annual external dry-bulb temperature of the DSY1 2020s, high emissions, 50% percentile weather file for Nottingham.



6.5 Building Fabric Specifications

Details of the building fabric specification have been taken from the SAP calculations¹, and are summarised below.

Table 4 – Building fabric specifications.

Element	Location	U-Value [W/m ² ·K]	G-Value	Thermal Mass ² [kJ/(m ² ·K)]
Ground Floor	Throughout	0.12	-	110
External Wall (brick)	Throughout	0.24	-	60
Roof (insulated at ceiling)	Throughout	0.08	-	9
Glazing (including frame)	Throughout	0.80	0.63	-
External Door (solid)	Throughout	1.20	-	-
External Door (half glazed)	Throughout	1.00	0.63	-
Design Air Permeability (m ³ /m ² /h @ 50 Pa)	Throughout	5.0		

¹ SAP Calculations are completed for AD-L compliance and are separate to the assessments within this document. The SAP assessor can provide a Developer Statement or similar summary document to confirm the specification details used in their calculations.

² The thermal mass has been determined based on the provided drawings and construction details, aligned with the typical thermal mass parameters outlined in SAP Appendix R for the respective construction types.



6.6 M&E Strategy

The initial M&E specifications are outlined in Table 5 below.

Table 5 – M&E specifications.

M&E Specifications	Description
Heating	Individual gas-fired boilers (Ideal Logic+ Combi 30) for space heating and domestic hot water (with a 200 L cylinder for hot water)
Cooling	N/A
Mechanical ventilation	Continuous extract Greenwood CV2.1 in wet rooms
Lighting	100% low energy
Internal air speed	0.10 l/s

6.7 Internal Gains

As well as considering the impact of solar gains and the movement of air through the building during summer months, the TM59 calculation also considers three internal gains (occupancy, lighting and equipment).

These are heat sources from within the building which can add to the problem of high internal temperatures.

Details on the exact figures used for all the aforementioned internal gains are located at Appendix 2.



6.8 Ventilation Strategy

Natural ventilation strategy (via openable windows)

The opening strategy of the windows in accordance with the Part O Regulations and are shown the table below.

Table 6 – Windows opening strategy.

Time	Description
8am to 11pm	Windows start to open only when the internal temperature is more than 22°C
8am to 11pm	Windows are fully open only when the internal temperature is more than 26°C
11pm to 8am	Windows are fully open if: – they are on the first floor or above and not easily accessible – the internal temperature exceeds 23°C at 11pm
8am to 11pm	When a ground floor or easily accessible room is unoccupied, then windows, patio doors and balcony doors should be modelled open, if this can be done securely.
11pm to 8am	When a ground floor or easily accessible room is unoccupied, then windows, patio doors and balcony doors should be modelled as closed.
Throughout the day	When a ground floor or easily accessible room is unoccupied, then windows, patio doors and balcony doors should be modelled open, if this can be done securely.

Section 3.9 of Approved Document O sets out the requirements for window opening angles. It specifies that for outward-opening windows, the handle must not extend more than 650 mm from the internal face of the wall when the window is fully open.

Table 7 summarises the various window configurations across the development, all of which have been designed in accordance with this requirement. For narrower windows, where achieving a 650 mm opening would require an angle greater than 90 degrees, a maximum opening angle of 90 degrees has been assumed.



Table 7 – Opening characteristics, in line with Section 3.9 of the AD-O document.

Opening reference	Opening type	Openable area [%]	Opening angle [°]	Equivalent orifice area [%]
WG01	Side-hung window (middle mullion fixed)	84	90 (assumed to be open to 594mm)	88.1
WG02	Side-hung window	75	90 (assumed to be open to 537mm)	78.6
WG03	Side-hung window	87	61 (assumed to be open to 650mm)	84.4
WF01	Side-hung window	86	90 (assumed to be open to 594mm)	90.2
WF02	Side-hung window	85	89 (assumed to be open to 645mm)	82.3
WF03	Side-hung window	75	90 (assumed to be open to 537mm)	78.6
WF04	Side-hung window	87	61 (assumed to be open to 650mm)	84.4

Due to the narrow width of certain windows, achieving a 650 mm opening would, in some cases, require the sash to open to a full 90°, which is not practical for daily use and may introduce safety concerns. A more conservative opening angle of 60° has therefore been applied consistently throughout the modelling. Energist have prioritised practical usability in the window opening strategy, applying the corresponding opening angles and equivalent orifice areas as detailed in Table 8 below.

Furthermore, the *Overheating Noise Assessment* prepared by RSKA permits windows on the rear façade to be opened during night-time hours, with an openable area exceeding 4% of the room's floor area. This applies specifically to window WF04, which serves the first-floor bedroom — the only night-time occupied room not subject to security-related restrictions.

For the purposes of the assessment, Energist have modelled this window as open during the day and at night to exactly 4% of the room's floor area, corresponding to an estimated opening angle of 41°. The detailed opening angle calculation is provided in Appendix 3.



As demonstrated in Appendix 5, these assumptions have no significant impact on either the results or the proposed ventilation strategy.

Table 8 – Opening characteristics, applied to the IES model.

Opening reference	Opening type	Openable area [%]	Opening angle [°]	Equivalent orifice area [%]
WG01	Side-hung window (middle mullion fixed)	84	60	81.3
WG02	Side-hung window	75	60	72.6
WG03	Side-hung window	87	60	84.2
WF01	Side-hung window	86	60	83.2
WF02	Side-hung window	85	60	82.3
WF03	Side-hung window	75	60	72.6
WF04	Side-hung window	87	41	71.7

It is worth noting that the scripted profiles integrated within IESVE — designed to support compliance with Approved Document O — have been applied in the model as summarised in the table below.

Table 9 – Opening profiles applied to the IES model.

Opening reference	The window opening profile used
WG01	<i>ADO.Section_26a</i>
WG02	<i>ADO.Section_26c</i>
WG03	<i>ADO.Section_26a</i>
WF01	<i>ADO.Section_26a</i>
WF02	<i>ADO.Section_26a</i>
WF03	<i>ADO.Section_26c</i>
WF04	<i>ADO.Section_26ab</i>



The openings are assigned as indicated in the provided figures below (please see Figure 5 below).

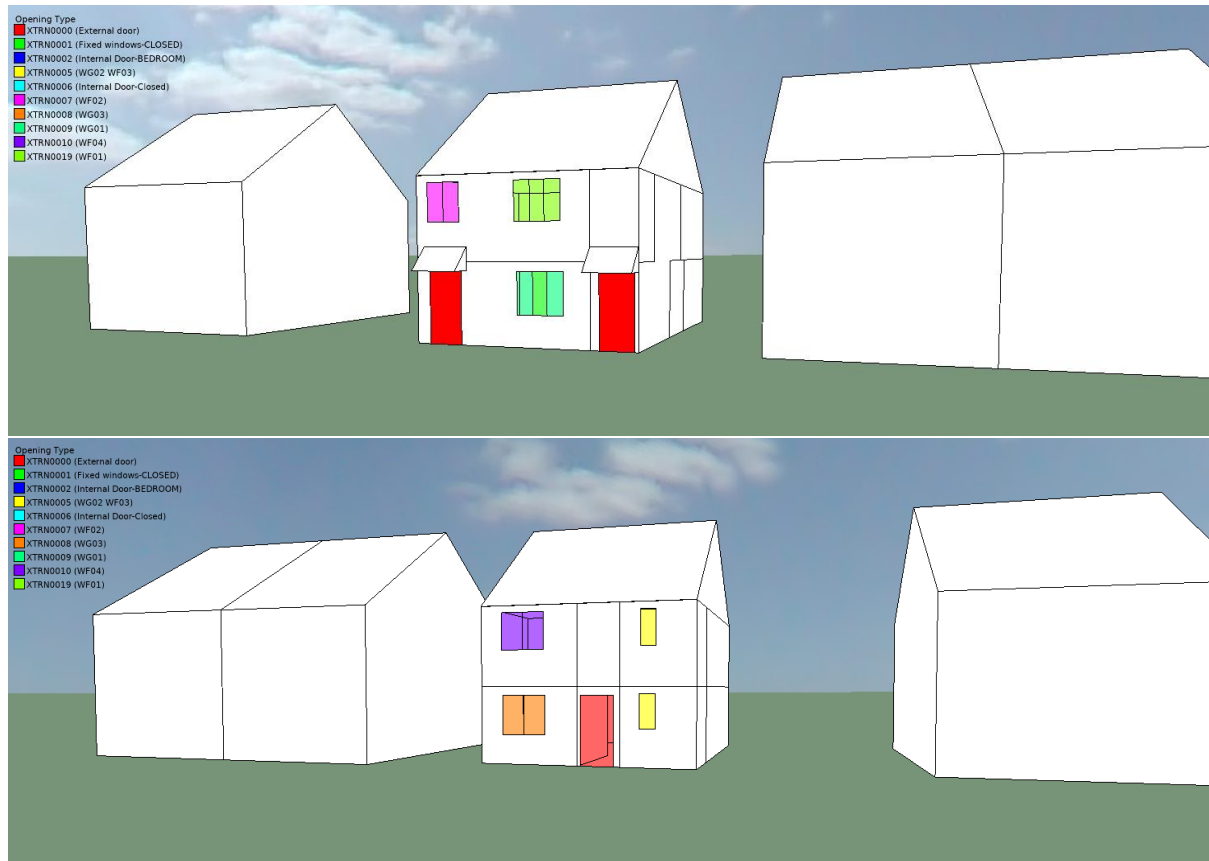


Figure 7 – IES VE MacroFlo image of the front (*top*) and rear (*bottom*) elevations of the maisonettes (plots 44 and 45) at Ratby, Phase 2.

Figure 6 shows the internal operative temperature of the occupied rooms (in plots 44 and 45) during the peak summer day (20th of August).

	Peak Date	Peak Time	Operative temperature (TM 52/CIBSE) (°C)
Ratby-Maisonette-GF-Bedroom 1	20 Aug	16:30	31.81
Ratby-Maisonette-GF-Kitchen_Living	20 Aug	18:30	31.08
Ratby-Maisonette-1F-Bedroom 1	20 Aug	16:30	32.01
Ratby-Maisonette-1F-Kitchen_Living	20 Aug	18:30	31.08

Figure 8 – Internal operative temperatures (in plots 44 and 45) during the peak summer day.

An illustration of the natural flow rates during the overheating peak day (20th of August) is shown below (Figure 7).

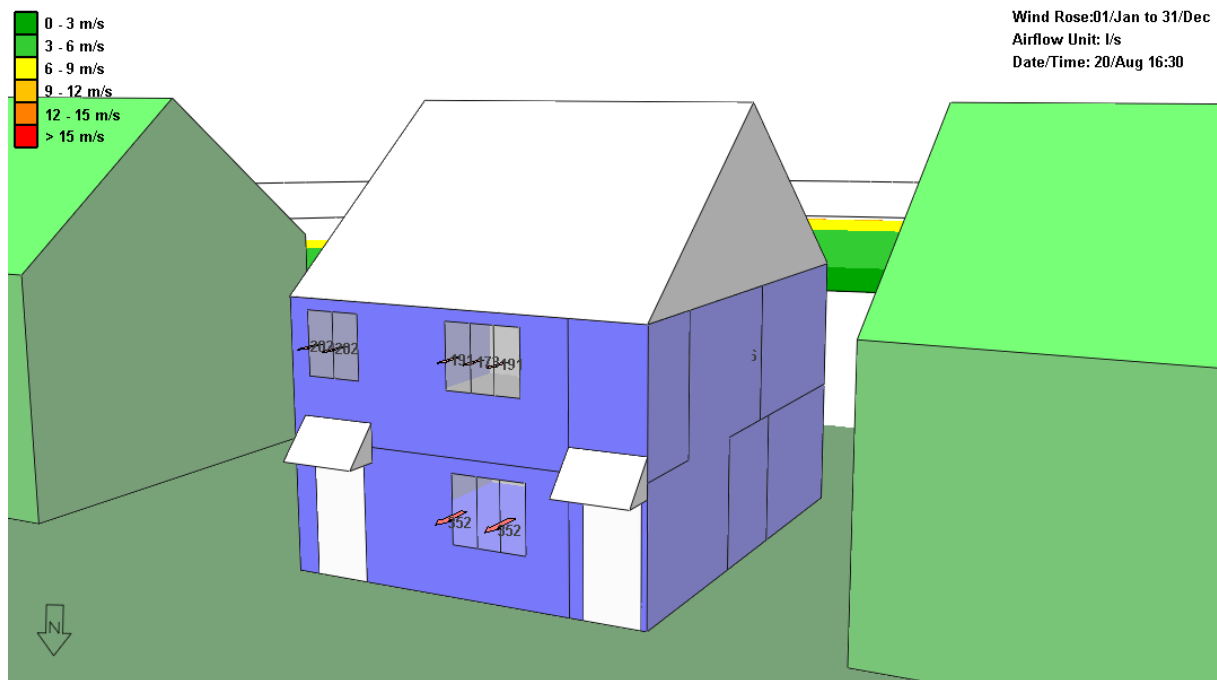


Figure 9 – IES VE 3D visualisation of the natural ventilation during one of the overheating peak days and times (20th of August).

Lastly, Figure 8 shows the wind rose of the building which shows the annual wind directions along with the wind speed (m/s). The wind plays a vital role for the natural ventilation of the rooms, as windows with no or low wind speeds will not be able to provide enough ventilation to mitigate overheating.

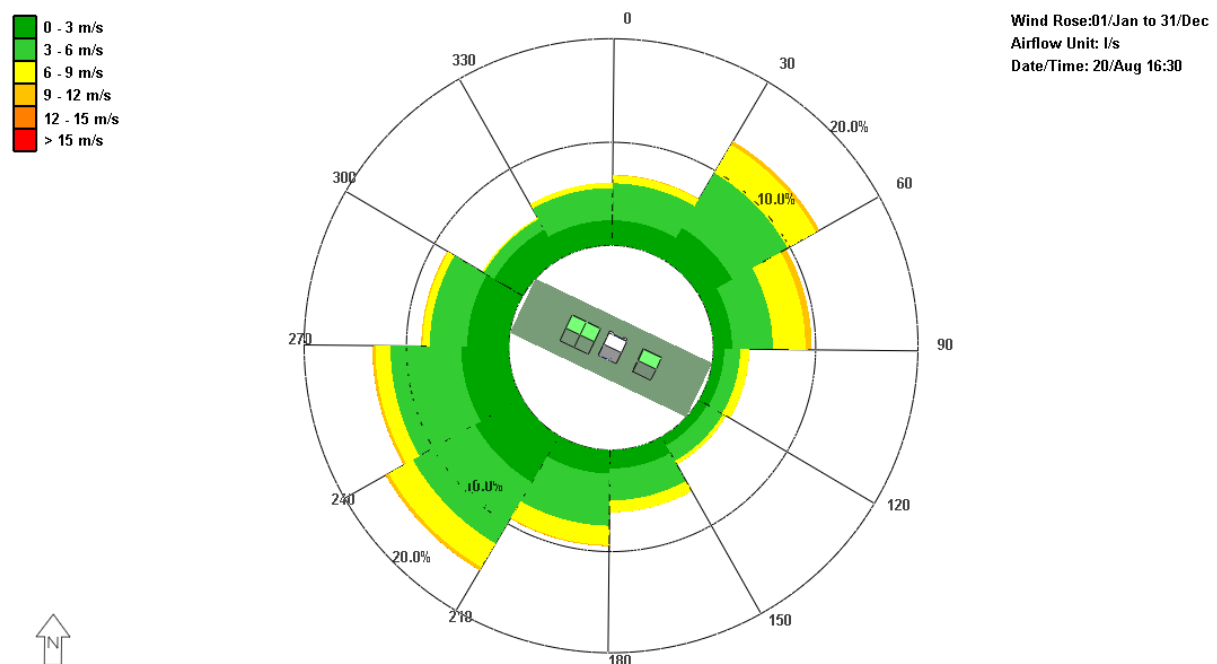


Figure 10 – Annual wind rose from IES VE.



Mechanical ventilation strategy

The modelled upper floor unit (Plot 45) is designed to include continuous extract fans in wet rooms only, with flow rates in line with Approved Document F requirements — 8 l/s for bathrooms and 13 l/s for kitchens. With windows open during the day (and at night in bedrooms), this strategy is expected to provide sufficient ventilation and maintain occupant comfort.

For the ground floor unit (Plot 44), where security considerations may necessitate keeping windows closed at night, a mixed-mode ventilation strategy has been adopted. In addition to continuous extract in wet rooms, background mechanical ventilation has been introduced in the bedroom to ensure a consistent supply of fresh air. Two strategies were evaluated:

- purge fans,
- Mechanical Ventilation with Heat Recovery (MVHR).

Further details on the modelled ventilation strategies and associated supply/extract flow rates can be found in Appendix 4.

While both strategies are capable of delivering effective ventilation and maintaining temperature control in line with overheating mitigation requirements, the Applicant has opted for the purge fan solution. This system is set to operate during night-time hours (23:00–08:00), activating when internal temperatures reach 23°C, and provides a minimum extract rate of 35 l/s.



7. RESULTS

All spaces within this development meet the requirements of AD-O Dynamic and the pertinent TM59 overheating criteria without the need for additional mitigation measures.

Plots 44 and 45 were evaluated against the targets for predominantly naturally ventilated houses. All bedrooms were assessed using Criteria A and B, while kitchens and living rooms were evaluated solely against Criterion A.

Table 10 shows a summary of the pass rates of the 3 sampled occupied spaces (1 no. bedrooms, and 2 no. kitchen and living rooms areas) using only natural ventilation strategy as described within this report.

Table 10 – Natural ventilation strategy results for maisonettes.

Room Type	Criterion A	Criterion B
Bedrooms	1/1	1/1
Kitchens / Living Rooms	2/2	N/A

Table 11 shows a summary of the pass rates of the remaining 1 sampled occupied space (1 no. bedrooms) using mixed ventilation strategy as described within this report.

Table 11 – Mixed mode ventilation strategy results for maisonettes.

Room Type	Criterion A	Criterion B
Bedrooms	1/1	1/1
Kitchens / Living Rooms	-	-

For a comprehensive breakdown of the results, please consult Appendix 5.



8. CONCLUSIONS

This report has assessed the performance of the maisonettes located on Plots 44, 45, 51, and 52 at Ratby Phase 2 against the requirements of [Approved Document O \(2021\)](#) for England.

The TM59 dynamic assessment has confirmed that **both sampled units — Plots 44 and 45 — comply with the AD-O requirements and the relevant TM59 criteria**. All assessed rooms meet the criteria using the DSY1 2020s, high emissions, 50th percentile weather file.

The upper floor unit (Plot 45) achieves compliance through a natural ventilation strategy, supported by continuous extract fans in wet rooms. With windows modelled to open during the day in the living space and both during the day and night in the bedroom, the design provides sufficient airflow to maintain occupant comfort.

For the ground floor unit (Plot 44), where windows may need to remain closed overnight for security reasons, a mixed-mode ventilation strategy has been adopted. This includes background purge ventilation in the form of a minimum 35 l/s extract fan in the bedroom, openable windows in the living area during daytime hours, and continuous mechanical extract in wet rooms. This approach is expected to deliver effective ventilation and maintain thermal comfort for occupants.

On this basis, no further alterations to the current design specifications are required.

Potential adjustments, such as increasing airflow rates in the bedrooms, changing the system type to MVHR with air-tempering — could improve compliance with these more challenging conditions. However, these modifications fall outside the scope of this analysis, which focused on the mandatory DSY-1 conditions. Future assessments could consider these refinements to enhance the building's resilience to more severe heatwave scenarios if required.



APPENDICES

Appendix 1: Occupant Wellbeing

Aside from measuring the overheating performance of the building fabric, AD-O also sets requirements to protect the health and wellbeing of residents.

These topics will not apply in all cases; however, the Developer should action any issues where appropriate as part of the overall overheating mitigation strategy.

- Night-time noise from external sources.
- Local air pollution.
- Building security.
- Protection from falling.
- Protection from entrapment.

Noise

If the construction site is in a location where the local planning authority or developer believes external noise may be an issue for occupants, the overheating strategy should be based on the assumption that all windows will remain closed during sleeping hours (11pm until 7am).

In this scenario, the Dynamic Thermal Model approach should always be used.

If there are no noise concerns with the site, this section can be ignored.

The Developer may wish to commission an in-situ noise survey to obtain a definitive answer as to whether external noise exceeds reasonable levels.

If this survey concludes the decibel readings within bedrooms does not exceed the following targets with open windows during the hours of 11pm and 7am, the assumption of closed windows overnight can be removed.

- An average result of 40 dB.
- And a peak of 55 dB no more than ten times in one evening.



Pollution

If the construction site is in a location where air pollution is considered a concern, the design of the building needs to follow the guidance given in Approved Document F (2021) Section 2.

Reasons for concerns regarding air pollution include (but not limited to) construction sites near the following:

- Busy roads and car parks.
- Combustion plant rooms or industrial activity.
- Where carbon monoxide levels have been tested and exceed an average of 100mg/m² over an 8-hour period.

Security

Windows of ground floor and easily accessible bedrooms are assumed to be closed at night as a good practice security measure.

This assumption has a negative impact on the free area calculation.

The Developer may wish to consider the following additional measures to improve the free area of air movement overnight without increasing the risk of burglary.

- Fixing lockable, louvred shutters to all easily accessible windows.
- Installing lockable window grilles or railings to all easily accessible windows.

Protection from falling

Openings which may be open for long periods to reduce overheating risk may pose a higher risk of falling from height.

Where higher-risk windows can be opened wider than 100mm, the following safety measures must be included.

- Window handles that open outwards are not more than 650mm from the inside face of the wall when the window is at its maximum openable angle.
- Guarding with a height at least 1.1m should be installed.
- Guarding should be designed so children cannot easily climb it.

Approved Document K may also apply in this situation. The higher standard of the two Building Regulations should be followed.



Protection from entrapment

Where louvered shutters, window railing and ventilation grilles are installed, they should not allow body parts to become trapped.

- They should not allow the passage of a 100mm diameter sphere.
- Small holes should allow for a 25mm diameter (to prevent finger entrapment).
- Looped cords must be fitted with child safety devices.



Appendix 2: Internal Gains

Occupancy gains: This is the heat emitted from residents.

For residential areas, the maximum sensible and latent gains are modelled as 75 watts per person and 55 watts per person respectively in all living spaces, as shown in the following table.

For communal corridors, the occupancy gains are assumed as zero. This is because such areas are not treated as living spaces and only experience transient occupancy.

Table 12 – Occupancy gains per room.

Number of occupants	Room	Peak load (W)		Occupancy hours	Fraction of load
		Sensible	Latent		
1	Single bedroom	75	55	23:00 – 08:00	0.70
				08:00 – 23:00	1.00
2	Double bedroom	150	110	23:00 – 08:00	0.70
				08:00 – 09:00	1.00
				09:00 – 22:00	0.50
				22:00 – 23:00	1.00
1	1 Bed Living room / kitchen	75	110	09:00 – 22:00	1.00
	Living room			09:00 – 22:00	0.75
	Kitchen			09:00 – 22:00	0.25
2	2 Bed Living room / kitchen	150	110	09:00 – 22:00	1.00
	Living room			09:00 – 22:00	0.75
	Kitchen			09:00 – 22:00	0.25
3	3 Bed Living room / kitchen	225	165	09:00 – 22:00	1.00
	Living room			09:00 – 22:00	0.75



Number of occupants	Room	Peak load (W)		Occupancy hours	Fraction of load
		Sensible	Latent		
	Kitchen			09:00 – 22:00	0.25

Lighting gains: This is the heat generated from lighting systems. For residential areas, lighting gains are assumed at 5 W/m², during the hours of 6pm until 11pm.

Equipment gains: This is the heat generated from appliances. For residential areas, equipment gains follow the guidance of CIBSE TM59, as summarised in the following table.

Table 13 – Equipment gains per room.

Room	Peak load (W)	Occupancy hours	Fraction of load
Single bedroom	80	23:00 – 08:00	0.13
		08:00 – 23:00	1.00
Double bedroom	80	23:00 – 08:00	0.13
		23:00 – 08:00	1.00
Living room / kitchen	450	00:00 – 09:00	0.19
		09:00 – 18:00	0.24
		18:00 – 20:00	1.00
		20:00 – 22:00	0.44
		22:00 – 00:00	0.24
Living room	150	00:00 – 09:00	0.23
		09:00 – 18:00	0.40
		18:00 – 22:00	1.00
		22:00 – 00:00	0.40
Kitchen	300	00:00 – 18:00	0.17
		18:00 – 20:00	1.00
		20:00 – 00:00	0.17



Appendix 3: Modelled window opening angles in line with the relevant noise assessment recommendations

Modelled window opening strategy at night for rooms on the rear façade with security-related restrictions:

■ Plot 44 (Ground Floor Maisonette):

Bedroom window assumed to remain closed during night-time hours.

Modelled window opening strategy at night for rooms on the rear façade without security-related restrictions:

■ Plot 45 (First Floor Maisonette):

Bedroom window modelled as open to 41°, which is the estimated angle required for the window sash to meet the minimum 4% equivalent area (EA) requirement for night-time ventilation in an 11 m² bedroom.

The calculation below is based on a simplified method for estimating the effective openable area (EA) of a side-hung window, using trigonometric assumptions. This approach is commonly used in building performance modelling for overheating assessments (e.g. under Approved Document O or TM59) and broadly follows BRE and CIBSE-style conventions.

Step 1: Calculate Required Equivalent Area (A_E)

The requirement for night-time purge ventilation is that the effective openable area must be at least 4% of the room's floor area.

For an 11 m² bedroom:

$$A_E = 11\text{m}^2 \times \frac{4}{100} = 0.44\text{ m}^2$$

Step 2: Window Details

- ✓ Type: side-hung window sash
- ✓ Height (h) = 1.05 m
- ✓ Width (w) = 0.64 m

The maximum geometric area (A_{max}) if the window is opened fully to 90° is:

$$A_{max} = h \times w = 1.05 \times 0.64 = 0.672\text{ m}^2$$



Step 3: Estimate Required Opening Angle

Using the simplified equation for the effective free area of a side-hung window:

$$A_{eff} = h \times w \times \sin(\theta)$$

Substituting the known values:

$$A_{eff} = 1.05 \times 0.64 \times \sin(\theta)$$

$$A_{eff} = EA$$

$$A_{eff} = 0.44 = 1.05 \times 0.64 \times \sin(\theta)$$

$$\sin(\theta) = \frac{0.44}{1.05 \times 0.64} = \frac{0.44}{0.672} \approx 0.6548$$

$$\theta \approx \sin^{-1}(0.6548) \approx 41^\circ$$

Therefore, window WF04 needs to open to approximately 41° to meet the minimal 4% EA requirement for night-time ventilation.



Appendix 4: Modelled ventilation and design strategies

Modelled Solutions for plots that require mixed mode ventilation strategy:

- **Plot 44, the ground floor maisonette:**
 - Continuous Part F extract in wet rooms.
- 1. **Purge Fan Option:**
 - Install purge fan extracting minimum **35 l/s** in the bedroom at night as minimum, when the internal temperature reaches 23°C.
- 2. **MVHR Supply (standard, with no air tempering) Option:**
 - Install an MVHR system supplying minimum **35 l/s** in the bedroom at night as minimum, when the internal temperature reaches 23°C.
- **Plot 45, the first floor maisonette:**
 - Continuous Part F extract in wet rooms.



APPENDIX 5: TM59 Criteria Compliance results

Please refer to the next page for the Approved Document O Compliance Reports.

Approved Document O report
Overheating risk in residential buildings
for
LA.LA.LE6: Ratby, Phase 2 - Maisonettes, Plots 44 and
45 - Baseline (windows fully open)

LA.LA.LE6: Ratby, Phase 2 - Maisonettes, Plots 44 and 45

Page 2 of 5

Summary

CIBSE TM59 overheating methodology for predominantly naturally ventilated rooms assesses against two criteria, (a) and (b) (for Category I occupancy, T_{max} is reduced by 1K):

- Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1K from May to September (or November to March for southern hemisphere locations) shall not exceed 3% of occupied hours
- 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 (33 hours is therefore recorded as a fail). Approved document O applies limits to CIBSE TM59 section 3.3 (openings); these requirements are applied by appropriate assignment of MacroFlo types / scripted profiles in the model (see Modelled Openings Section).

CIBSE TM59 overheating methodology for predominantly mechanically ventilated rooms states the operative temperature of all rooms shall not exceed 26°C for more than 3% of annual occupied hours.

CIBSE TM59 also states that the inclusion of corridors in the overheating analysis is mandatory where community heating pipework runs through them. While there is no mandatory target for communal corridors, if an operative temperature of 28°C is exceeded for more than 3% of the total annual hours this should be identified as a significant risk.

Room name	Naturally ventilated Criterion a check	Naturally ventilated Criterion b check	Mechanically ventilated check	Corridor overheating risk check
Ratby-Maisonette-GF-Bedroom 1	Pass	Fail	-	-
Ratby-Maisonette-GF-Kitchen_Living	Pass	N/A	-	-
Ratby-Maisonette-1F-Bedroom 1	Pass	Pass	-	-
Ratby-Maisonette-1F-Kitchen_Living	Pass	N/A	-	-

Naturally ventilated rooms – criterion (a)

Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1K from May to September (or November to March for southern hemisphere locations) shall not exceed 3% of occupied hours.

Room name	Occupied hours	No. hours $\Delta T \geq 1^\circ\text{K}$	% Occupied hours $\Delta T \geq 1^\circ\text{K}$	Criterion a check
Ratby-Maisonette-GF-Bedroom 1	3672	60	1.6	Pass
Ratby-Maisonette-GF-Kitchen_Living	1989	26	1.3	Pass
Ratby-Maisonette-1F-Bedroom 1	3672	29	0.8	Pass
Ratby-Maisonette-1F-Kitchen_Living	1989	26	1.3	Pass

LA.LA.LE6: Ratby, Phase 2 - Maisonettes, Plots 44 and 45

Page 5 of 5

Naturally ventilated rooms – criterion (b)

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 (33 hours is therefore recorded as a fail). Any rooms that are not bedrooms are therefore not assessed, hence the corresponding N/A values.

Room name	No. hours > 26°C 22:00-24:00	No. hours > 26°C 00:00-07:00	Total hours > 26°C	Criterion b check
Ratby-Maisonette-GF-Bedroom 1	14	67	81	Fail
Ratby-Maisonette-GF-Kitchen_Living	N/A	N/A	N/A	N/A
Ratby-Maisonette-1F-Bedroom 1	8	4	12	Pass
Ratby-Maisonette-1F-Kitchen_Living	N/A	N/A	N/A	N/A

Mechanically ventilated rooms

CIBSE TM59 overheating methodology for predominantly mech. vent. rooms states the operative temperature of all rooms shall not exceed 26°C for more than 3% of annual occupied hours.

Room name	No. hours > 26°C	% Annual hours > 26°C	Mechanically ventilated check
No mech vent rooms	N/A	N/A	N/A

Communal corridors

CIBSE TM59 states that whilst there is no mandatory target for communal corridors, if an operative temperature of 28°C is exceeded for more than 3% of annual hours, then this should be identified as a significant risk within the TM59 overheating report.

Room name	No. hours > 28°C	% Annual hours > 28°C	Corridor overheating risk check
No corridors	N/A	N/A	N/A

Approved Document O report
Overheating risk in residential buildings
for
LA.LA.LE6: Ratby, Phase 2 - Maisonettes, Plots 44 and
45 - Proposed (windows fully open)

LA.LA.LE6: Ratby, Phase 2 - Maisonettes, Plots 44 and 45

Page 2 of 5

Summary

CIBSE TM59 overheating methodology for predominantly naturally ventilated rooms assesses against two criteria, (a) and (b) (for Category I occupancy, T_{max} is reduced by 1K):

- Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1K from May to September (or November to March for southern hemisphere locations) shall not exceed 3% of occupied hours
- 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 (33 hours is therefore recorded as a fail). Approved document O applies limits to CIBSE TM59 section 3.3 (openings); these requirements are applied by appropriate assignment of MacroFlo types / scripted profiles in the model (see Modelled Openings Section).

CIBSE TM59 overheating methodology for predominantly mechanically ventilated rooms states the operative temperature of all rooms shall not exceed 26°C for more than 3% of annual occupied hours.

CIBSE TM59 also states that the inclusion of corridors in the overheating analysis is mandatory where community heating pipework runs through them. While there is no mandatory target for communal corridors, if an operative temperature of 28°C is exceeded for more than 3% of the total annual hours this should be identified as a significant risk.

Room name	Naturally ventilated Criterion a check	Naturally ventilated Criterion b check	Mechanically ventilated check	Corridor overheating risk check
Ratby-Maisonette-GF-Bedroom 1	Pass	Pass	-	-
Ratby-Maisonette-GF-Kitchen_Living	Pass	N/A	-	-
Ratby-Maisonette-1F-Bedroom 1	Pass	Pass	-	-
Ratby-Maisonette-1F-Kitchen_Living	Pass	N/A	-	-

Naturally ventilated rooms – criterion (a)

Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1K from May to September (or November to March for southern hemisphere locations) shall not exceed 3% of occupied hours.

Room name	Occupied hours	No. hours $\Delta T \geq 1^\circ\text{K}$	% Occupied hours $\Delta T \geq 1^\circ\text{K}$	Criterion a check
Ratby-Maisonette-GF-Bedroom 1	3672	31	0.8	Pass
Ratby-Maisonette-GF-Kitchen_Living	1989	25	1.3	Pass
Ratby-Maisonette-1F-Bedroom 1	3672	29	0.8	Pass
Ratby-Maisonette-1F-Kitchen_Living	1989	26	1.3	Pass

LA.LA.LE6: Ratby, Phase 2 - Maisonettes, Plots 44 and 45

Page 5 of 5

Naturally ventilated rooms – criterion (b)

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 (33 hours is therefore recorded as a fail). Any rooms that are not bedrooms are therefore not assessed, hence the corresponding N/A values.

Room name	No. hours > 26°C 22:00-24:00	No. hours > 26°C 00:00-07:00	Total hours > 26°C	Criterion b check
Ratby-Maisonette-GF-Bedroom 1	10	21	31	Pass
Ratby-Maisonette-GF-Kitchen_Living	N/A	N/A	N/A	N/A
Ratby-Maisonette-1F-Bedroom 1	8	4	12	Pass
Ratby-Maisonette-1F-Kitchen_Living	N/A	N/A	N/A	N/A

Mechanically ventilated rooms

CIBSE TM59 overheating methodology for predominantly mech. vent. rooms states the operative temperature of all rooms shall not exceed 26°C for more than 3% of annual occupied hours.

Room name	No. hours > 26°C	% Annual hours > 26°C	Mechanically ventilated check
No mech vent rooms	N/A	N/A	N/A

Communal corridors

CIBSE TM59 states that whilst there is no mandatory target for communal corridors, if an operative temperature of 28°C is exceeded for more than 3% of annual hours, then this should be identified as a significant risk within the TM59 overheating report.

Room name	No. hours > 28°C	% Annual hours > 28°C	Corridor overheating risk check
No corridors	N/A	N/A	N/A

Approved Document O report
Overheating risk in residential buildings
for
LA.LA.LE6: Ratby, Phase 2 - Maisonettes, Plots 44 and
45 - Proposed (windows open to 60 degrees, for
practicality; and WF04 to 41deg due to noise issues on
the site)

LA.LA.LE6: Ratby, Phase 2 - Maisonettes, Plots 44 and 45

Page 2 of 5

Summary

CIBSE TM59 overheating methodology for predominantly naturally ventilated rooms assesses against two criteria, (a) and (b) (for Category I occupancy, T_{max} is reduced by 1K):

- Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1K from May to September (or November to March for southern hemisphere locations) shall not exceed 3% of occupied hours
- 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 (33 hours is therefore recorded as a fail). Approved document O applies limits to CIBSE TM59 section 3.3 (openings); these requirements are applied by appropriate assignment of MacroFlo types / scripted profiles in the model (see Modelled Openings Section).

CIBSE TM59 overheating methodology for predominantly mechanically ventilated rooms states the operative temperature of all rooms shall not exceed 26°C for more than 3% of annual occupied hours.

CIBSE TM59 also states that the inclusion of corridors in the overheating analysis is mandatory where community heating pipework runs through them. While there is no mandatory target for communal corridors, if an operative temperature of 28°C is exceeded for more than 3% of the total annual hours this should be identified as a significant risk.

Room name	Naturally ventilated Criterion a check	Naturally ventilated Criterion b check	Mechanically ventilated check	Corridor overheating risk check
Ratby-Maisonette-GF-Bedroom 1	Pass	Pass	-	-
Ratby-Maisonette-GF-Kitchen_Living	Pass	N/A	-	-
Ratby-Maisonette-1F-Bedroom 1	Pass	Pass	-	-
Ratby-Maisonette-1F-Kitchen_Living	Pass	N/A	-	-

Naturally ventilated rooms – criterion (a)

Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1K from May to September (or November to March for southern hemisphere locations) shall not exceed 3% of occupied hours.

Room name	Occupied hours	No. hours $\Delta T \geq 1^\circ\text{K}$	% Occupied hours $\Delta T \geq 1^\circ\text{K}$	Criterion a check
Ratby-Maisonette-GF-Bedroom 1	3672	32	0.9	Pass
Ratby-Maisonette-GF-Kitchen_Living	1989	25	1.3	Pass
Ratby-Maisonette-1F-Bedroom 1	3672	29	0.8	Pass
Ratby-Maisonette-1F-Kitchen_Living	1989	26	1.3	Pass

LA.LA.LE6: Ratby, Phase 2 - Maisonettes, Plots 44 and 45

Page 5 of 5

Naturally ventilated rooms – criterion (b)

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 (33 hours is therefore recorded as a fail). Any rooms that are not bedrooms are therefore not assessed, hence the corresponding N/A values.

Room name	No. hours > 26°C 22:00-24:00	No. hours > 26°C 00:00-07:00	Total hours > 26°C	Criterion b check
Ratby-Maisonette-GF-Bedroom 1	10	21	31	Pass
Ratby-Maisonette-GF-Kitchen_Living	N/A	N/A	N/A	N/A
Ratby-Maisonette-1F-Bedroom 1	9	5	14	Pass
Ratby-Maisonette-1F-Kitchen_Living	N/A	N/A	N/A	N/A

Mechanically ventilated rooms

CIBSE TM59 overheating methodology for predominantly mech. vent. rooms states the operative temperature of all rooms shall not exceed 26°C for more than 3% of annual occupied hours.

Room name	No. hours > 26°C	% Annual hours > 26°C	Mechanically ventilated check
No mech vent rooms	N/A	N/A	N/A

Communal corridors

CIBSE TM59 states that whilst there is no mandatory target for communal corridors, if an operative temperature of 28°C is exceeded for more than 3% of annual hours, then this should be identified as a significant risk within the TM59 overheating report.

Room name	No. hours > 28°C	% Annual hours > 28°C	Corridor overheating risk check
No corridors	N/A	N/A	N/A