# Thermal Comfort Analysis

Britannia Street Car Park

January 2025

ensphere

# Thermal Comfort Analysis

## Britannia Street Car Park

| | |
|---|---|
| **Client Name:** | Curlew Developments London Limited |
| **Produced:** | Ensphere Group Ltd |
| **Document Reference:** | 23-E049-012 |

## Quality Assurance Approval Status

This document has been prepared and checked in accordance with Ensphere Group Ltd.'s Quality Management System.

| Issue: | Version: | Prepared: | Reviewed: | Approved: | Date: |
|---|---|---|---|---|---|
| Final | V1 | Aura Tache | Pete Jeavons | Pete Jeavons | January 2025 |

# Report Outline

## Contents

# Executive Summary

This report presents the Thermal Comfort Analysis for the proposed development at Britannia Street Car Park, London, WC1X 9BP.

The proposals are for the redevelopment of an existing brownfield site for Purpose-Built Student Accommodation in addition to community floorspace.

The main purpose of this report is to investigate how the proposed building performs against the criteria set out in *CIBSE TM59:2017: Design methodology for the assessment of overheating risk in homes*, the *Approved Document Part O (2021)*, and *CIBSETM52:2013 The limits of thermal comfort: avoiding overheating in European buildings*. Consideration has also been given to the methodology presented in *CIBSE AM11 Building Energy and Environmental Modelling*. Dynamic thermal modelling has been undertaken and approved software IES VE 2024 was used for the purpose of the analysis.

The report demonstrates compliance with the cooling hierarchy outlined in *Policy SI 4 (Managing Heat Risk)* of the London Plan, following the Greater London Authority's *Energy Assessment Guidance* (June 2022).

The report demonstrates that the cooling hierarchy *Policy SI 4 (Managing Heat Risk)* of the *London Plan*, as per Greater London Authority's Energy Assessment Guidance (June 2022) has been followed and includes information describing the steps and the strategies applied to mitigate the risk of overheating following the measures established in the cooling hierarchy as summarised in Table ES.1.

The passive measures have been prioritised and maximised with an adequate orientation on site, implementing optimum fenestration and shading elements, good fabric properties, and thermal mass factors.

The analysis includes all the occupied spaces within the building such as bedrooms, kitchens, living areas for the CIBSE TM59 assessment and the amenity spaces (amenity spaces, reception, offices, laundry areas) under the CIBSE TM52 assessment.

The thermal comfort assessment has been conducted in line with the associated site limitations as dictated by the acoustic report *Britannia Street, London Summary of Noise and Vibration Survey* (November 2024) provided by *WSP* consultants where it is suggested that the acoustic impacts around the site exceed the standard limits during both daytime and nighttime due to the nearby train lines. The acoustic strategy therefore requires windows to remain closed, which is relevant to the potential available measures to control overheating. The modelling undertake for thermal comfort therefore assumes fixed window panels, however as part of the thermal comfort assessment, and to demonstrate passive design performance, two additional series of simulations have been run, to demonstrate performance without the noise or security restrictions.

As a minimum requirement to achieve compliance all occupied space need to pass the relevant CIBSE criteria under the current weather normal conditions (London_LWC_DSY1_2020). To achieve compliance comfort cooling is required in all residential living spaces (studios, living/kitchen areas) and in the occupied amenity spaces, and mechanical ventilation with 3 ACH for the communal corridors.

Additionally, when assessed under the more extreme weather scenarios with harsh summer types (London_LWC_DSY2_2020 and London_LWC_DSY3_2020) comfort cooling is required in all spaces.

Finally, there is an expectation that with climate change, the UK will experience warmer weather (future weather file London_LWC_DSY1_2050) in the future. This too, demonstrated a need for comfort cooling on the majority of spaces to address future climate.

Table ES. 1 – Design Measures Implemented into the PBSA Block Development in accordance with the London Plan Cooling Hierarchy

| Cooling Hierarchy Step | Design Measure | Details | |
|---|---|---|---|
| 1. Reduce solar heat gain through orientation, shading, fenestration, and insulation. | Building orientation optimised to suit the site's location specifics. | As presented in the architectural design. | ✓ |
| | Efficient building fabric U-Values and air tightness standards proposed. | In line with the Energy Statement report (Document reference: 23-E049-009 Britannia Street - Energy Statement v1)<br><br>Model inputs provided in Chapter 5. Input Data. | ✓ |
| | Solar control glazing with G-Value of 0.4 (frame factor 0.8). | A low G-Value minimizes solar heat gain but impacts $CO_2$ emissions, fabric energy efficiency, and internal daylight levels.<br><br>Consequently, it has been carefully optimized to achieve a balanced performance across these aspects. | ✓ |
| | Optimum Fenestration Ratios. | Early Passive Design assessments have been run to determine optimum fenestration ratios from a reduced cooling demand point of view (details included in Chapter 6 under the Passive Measures section). | ✓ |
| | Shading Elements Provision. | Implementation of optimised shading devices (architectural grid acting as overhangs and vertical fins attached to the windows) following early passive design tests ((details included in | ✓ |

| | | | |
|---|---|---|---|
| | | Chapter 6 under the Passive Measures section)). | |
| **2. Minimise internal heat generation through energy efficient design**: efficient heat distribution infrastructure adopting pipe configurations which minimise heat loss e.g. twin pipes. | Energy efficient design of building services. | In line with the Energy Statement report (Document reference: 23-E049-009 Britannia Street - Energy Statement v1) and the M&E proposed design.<br><br>Insulation to distribution pipework, HIUs and storage vessels.<br><br>Efficient control strategies.<br><br>Minimising pipe runs, particularly in enclosed areas such as hallways, corridors, storages. | ✓ |
| **3. Manage the heat within the building through exposed internal thermal mass** and high ceilings: Increasing the amount of exposed thermal mass can help to absorb excess heat within the building. Efficient thermal mass should be coupled with nighttime purge ventilation | Proposed concrete floor slabs and blockwork can factor in the thermal mass effect. | The high thermal mass construction elements absorb heat, slowing its penetration into internal spaces and thereby reducing the risk of overheating.<br><br>The stored heat is released during the night when the outdoor temperatures drop. | ✓ |
| **4. Provide passive ventilation:** For example, through the use of openable windows, shallow floorplates, dual aspect units (in line with ADO) maximising cross-ventilation or designing in the ‘stack effect ‘where possible. | The use of openable windows to mitigate overheating risks is not possible due to the noise restrictions during both nighttime and daytime highlighted in the Acoustic Report provided by WSP. | However, a scenario with side-hung 90% openable windows at 90° angle was run to demonstrate the effectiveness of the passive design measures showing that with no noise or security restrictions, the majority of spaces pass the relevant CIBSE thermal comfort criteria<br><br>The windows were set to open when the operative internal temperature exceeds 22°C, in line with *ADO 2.6 a,b.* opening profiles. | ✗ |
| **5. Provide mechanical ventilation:** | Under the conditions of noise restrictions requiring windows to remain closed at all times, the effectiveness of implementing a mechanical ventilation system has been tested. | Mechanical ventilation system with 2 air changes per hour (2ACH) and 3 air changes per hour (3ACH) have been tested.<br><br>The results suggested that the implementation of 3ACH is effective only in the communal corridors under the current normal weather conditions (London_LWC_DSY1_2020) | ✓ |
| **6. Provide active cooling systems:** | Comfort cooling system implementation.<br><br>Efficient active cooling systems to be installed preferably with heat recovery incorporated. | The results showed that the use of mechanical ventilation is not sufficient to mitigate the overheating risks in the occupied spaces.<br><br>Consequently, active cooling has been implemented as the final solution to ensure compliance in the majority of areas, including both residential and amenity spaces. | ✓ |

# 1. Introduction

Ensphere Group Ltd was commissioned by Curlew Developments London Limited to produce an energy Statement for a proposed development at Britannia Car Park, London, WC1X 9BP.

## Site and Surroundings

The application site (the 'Site'), which is 0.1 hectares in size, is located in the Kings Cross Ward of the London Borough of Camden, bounded by Britannia Street to the north; the three storey 'Help Musicians Building' and six storey Derby Lodge buildings to the east; Wicklow Street to the south; and by London Underground railway lines (in a cutting) to the west. The Thames Link railway line also runs in a shallow tunnel beneath the western half of the Site.

The Site comprises undeveloped hardstanding in use as a public car park and includes a ventilation shaft linked to the Thames Link railway tunnel running below the Site.

The area surrounding the Site was historically industrial and residential in nature with the Site itself having previously been occupied by a 3-storey warehouse. While the area generally retains its historic built from, forming part of the Kings Cross St Pancras Conservation Area, over time the area's industrial uses have been replaced by office, creative and additional residential uses (including student accommodation).

Building heights in the area generally range from two to six storeys, while the consented redevelopment of the nearby Royal National Throat, Nose and Ear Hospital (located to the south-west of the Site) permits the delivery of building up to 13 storeys tall.

The Site benefits from a high PTAL rating of 6b ('Excellent'), Kings Cross and St Pancras Railway and Underground Stations are located within 370 metres / 7-minute walk from the Site. There are also a number of bus stops within close proximity, with bus stops located at Gray's Inn Road and Kings Cross Road.

Given the Sites proximity to various Universities including Central Saint Martins, Aga Khan University Institute, University of London & UCL within short walking and cycling distance of the Site, and its location within the 'Knowledge Quarter', the Site is an ideal location for students.

## Proposed Development

The proposals are for the redevelopment of an existing brownfield site for Purpose-Built Student Accommodation in addition to community floorspace.

## Report Objective

The objective of this analysis is to determine whether the proposed development can achieve appropriate thermal comfort levels and maintain a thermally comfortable environment for the building's occupants. This is assessed in accordance with CIBSE TM59:2017 (*Design Methodology for the Assessment of Overheating Risk in Homes*) and Approved Document Part O for the residential living spaces, as well as CIBSE TM52:2013 (*The Limits of Thermal Comfort: Avoiding Overheating in European Buildings*) for amenity spaces. Additionally, the analysis aims to identify a strategy for mitigating overheating risks.

The report seeks to illustrate how the cooling hierarchy, as outlined in Policy SI 4 (Managing Heat Risk) of the London Plan and following the Greater London Authority's *Energy Assessment Guidance* (June 2022), has been adhered to. The aim is to evaluate and present how each design measure supports and aligns with the principles of the cooling hierarchy.

## Dynamic Modelling Methodology

A thermal modelling exercise was undertaken using the dynamic simulation software IES VE 2024 v.0.1.0 in accordance with CIBSE AM 11. The entire residential block was assessed.

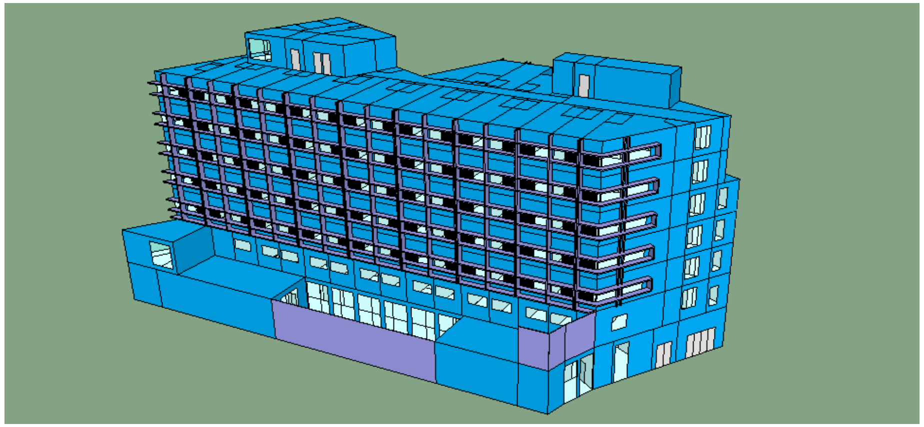


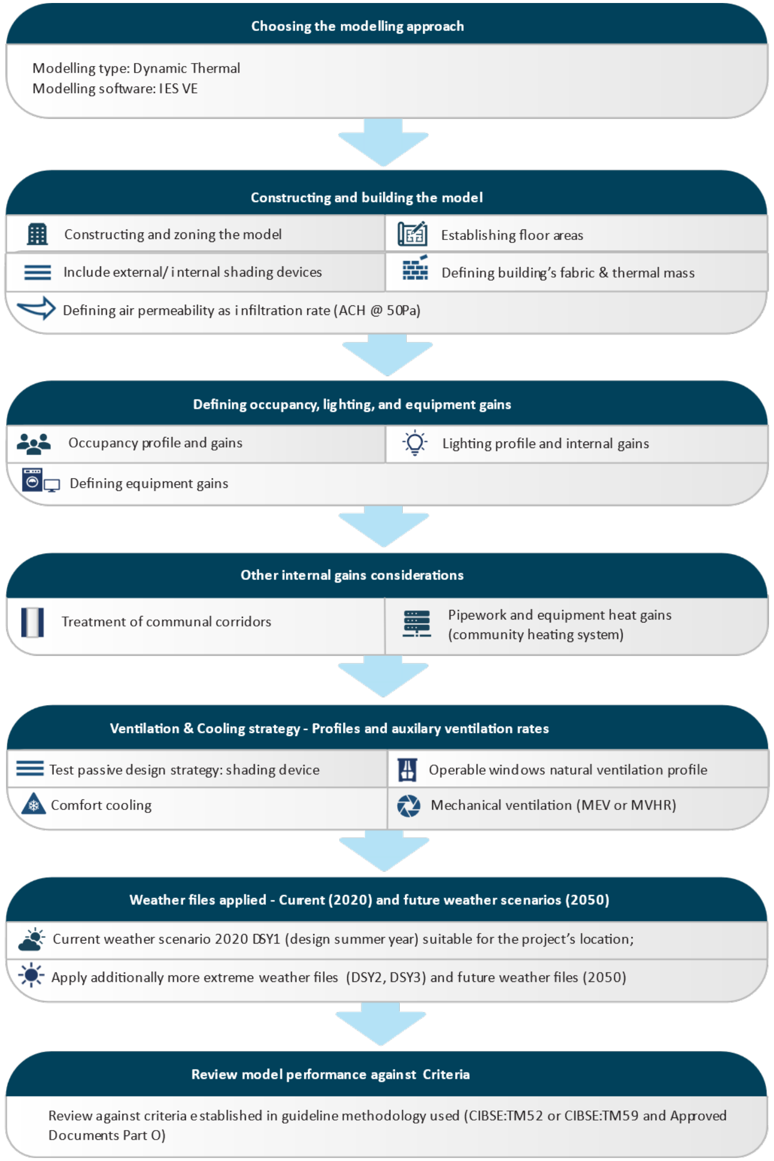
Figure1.1 – IES VE Indicative 3D Model of the Proposed Purpose-built Student Accommodation (PBSA) Block

The analysis follows the thermal comfort requirements set out in CIBSE Guides TM59 and TM52 methodologies with consideration to the CIBSE AM11 Building Energy and Environmental Modelling.

Consideration has primarily been given to the cooling hierarchy in Policy SI 4 of the London Plan to the development, as per the GLA Energy Assessment Guidance (June 2022).

The assessment criteria are described in greater detail in the sections below. The results of the analysis are presented in the appendices.

The thermal comfort methodology involves the following steps shown in the following diagram.



## Clarifications

The Thermal Comfort Analysis serves as an evaluation to determine the likelihood of overheating in the building. It strictly functions as a risk assessment and should not be misconstrued as an assurance of whether the building will or will not overheat. The report is to be perceived as an application of reasonable skill and care, undertaken to assist the design team in identifying and mitigating potential risk areas.

The outcomes rely on data generated by computer modelling software and should be considered indicative of the probable final scenario. However, these conditions cannot be assured. Meeting the assessment criteria does not guarantee year-round comfort in the spaces; instead, it signifies that the risk of overheating is constrained to an acceptable level.

This report analyses the buildings with the design features provided to Ensphere at the time of writing the report. The assessment also includes anticipated building usage based on the template provided by CIBSE TM59 for the residential spaces and the NCM profiles for the amenities and communal areas.

The results will only be valid if the parameters used match those of the final building. Design assumptions therefore need to be followed all the way through procurement to installation (e.g. performance and quality of pipework insulation, façade performance, aerodynamic areas of openable windows, blind/external shading performance etc).

All assumptions and mitigations must form part of the construction contract, or the model will need to be re-run to prove compliance of any changes. Furthermore, factors such as (a) variations in the weather from the weather files selected; or (b) variations in the operation of the building; may deviate performance away from the modelled results.

Ensphere will not be liable for work undertaken by other parties and associated with the data used to populate the model (including, but not limited to, architectural design, mechanical & electrical design, construction assumptions and assumptions concerning building operation).

A thermal modelling exercise was undertaken using the dynamic simulation software IES VE 2024 v.0.1.0 in accordance with CIBSE AM 11. The entire residential block was assessed.

# 2. Planning Policy

Planning policies relevant to overheating and energy are considered below:


Figure 2.1 – Tiers of Relevant Planning Policy

## National Context

### National Planning Policy Framework (2024)

The National Planning Policy Framework (NPPF) was updated in December 2024. Paragraph 7 of the revised NPPF includes reference to a strong emphasis on promoting sustainable development covering objectives economic, social and environmental objectives.

New developments are to prioritise prioritize minimizing climate change vulnerability, particularly in high-risk areas, by integrating adaptive measures like green infrastructure. Additionally, they should focus on reducing greenhouse gas emissions through careful planning of location, orientation, and design.

### Planning Practice Guidance (2016; updated 2024)

- Climate Change – Advises how planning can identify suitable mitigation and adaption measures in plan-making and the application process to address the potential for climate change.
- Renewable and Low Carbon Energy – The guidance is intended to assist local councils in developing policies for renewable energy in local plans and identifies the planning considerations for a range of renewable sources.

## London Context

### London Plan (2021)

The Mayor has declared a climate emergency and has set a target for London to be net zero by 2030. This puts London at the forefront of global cities and UK action on climate change. The London Plan ensures that the planning system is playing its part in achieving this target. Policies considered related to overheating are presented below:

- Policy SI 2 (Minimising greenhouse gas emissions) – Major development should be net zero-carbon. This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand.
- Policy SI 4 (Managing heat risk) – Major development proposals should demonstrate, through an energy strategy, how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:
  - Reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation, and the provision of green infrastructure.
  - Minimise internal heat generation through energy efficient design.
  - Manage the heat within the building through exposed internal thermal mass and high ceilings.
  - Provide passive ventilation.
  - Provide mechanical ventilation.
  - Provide active cooling systems.

### Energy Assessment Guidance (2022)

This guidance document explains how to prepare an energy assessment to accompany strategic planning applications referred to the Mayor as set out in London Plan Policy SI 2. It states that the purpose of an energy assessment is to demonstrate that the proposed climate change mitigation measures comply with London Plan energy policies, including the energy and cooling hierarchies.

Although primarily aimed at strategic planning applications, London boroughs are encouraged to apply the same structure for energy assessments related to non-referable applications and adapt it for relevant scales of development.

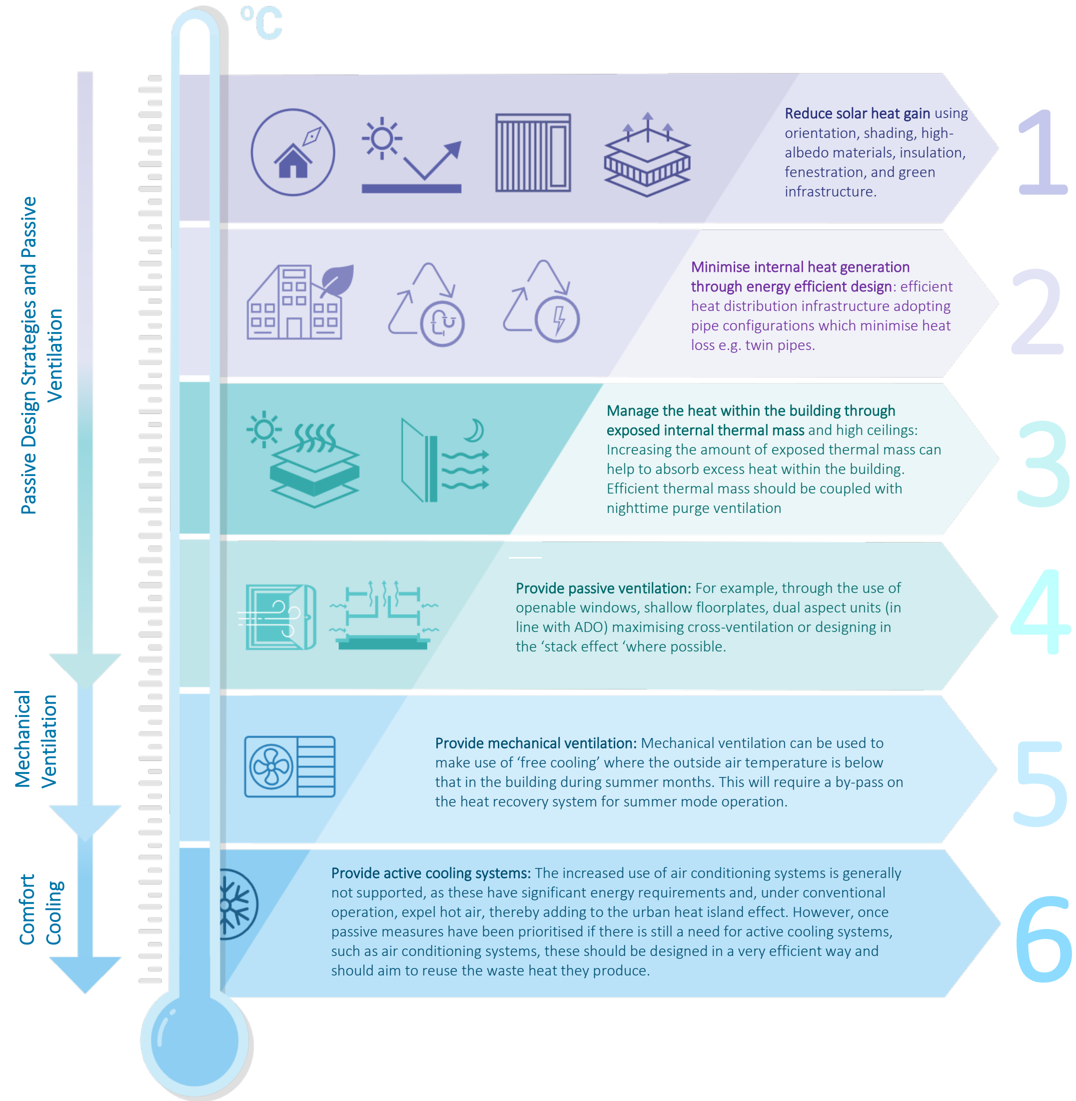



Figure 2.2 – Cooling Hierarchy as per the London Plan (2021) and GLA Energy Assessment Guidance (June 2022)

## Local Context

### Camden Local Plan (July 2017)

The Local Plan sets out the planning policies, site allocations and land designations Borough-wide and is the central document in the Borough’s Development Plan.

The following policies are considered relevant to this report:

- Policy G1 (Delivery and Location of Growth) – promotes sustainability with regards to the efficient use of land and buildings.
- Policy D1 (Design) – includes a requirement for development to be sustainable with regards to design and construction.
- Policy CC1 (Climate Change Mitigation) – promotes zero carbon development with consideration of the Energy Hierarchy
- Policy CC2 (Adapting to Climate Change) – requires development to seek to protect existing green space, use of SUDS, incorporating biodiverse roofs, consideration of overheating risks, encourages the use of the Home Quality Mark and Passivhaus Standards along with BREEAM “excellent” for non-domestic and refurbishment developments >500sqm and/or five or more dwellings.
- Policy CC4 (Air quality) – Air Quality Assessments (AQAs) are required where development is likely to expose residents to high levels of air pollution, with recommended measures adopted. In locations of poor air quality, developments that introduce sensitive receptors (i.e. housing, schools) will also need to be designed to mitigate the impact.

### Camden Planning Guidance – Energy Efficiency & Adaptation (January 2021)

This document was adopted on 15 January 2021 following statutory consultation and replaces the Energy efficiency and adaptations CPG (March 2019), which replaced the CPG3 Sustainability (July 2015).

This guidance provides information on key energy and resource issues within the borough and supports Local Plan Policies CC1 Climate change mitigation and CC2 Adapting to climate change.

Where developments are likely to be at risk of overheating applicants will be required to complete dynamic thermal modelling to demonstrate that any risk to overheating has been mitigated.

Assessment tools, such as Passivhaus and Home Quality Mark are “encouraged”.

# 3. Building Regulations – Approved Documents (2021)

On 15 June 2022, National Building Regulations were updated to enhance energy performance standards for new buildings through *Part L 2021* and ventilation requirements through *Part F 2021*. A new *Approved Document Part O (2021)* was also introduced, updating requirements to tackle overheating.

## Approved Document Part L (2021)

The Approved Document Part L1 provides compliance guidelines on energy efficiency standards, detailing requirements for thermal performance, carbon emission targets, and energy conservation measures. It outlines compliance methods and strategies to ensure buildings achieve sustainable energy use while reducing environmental impact.

## Approved Document Part F (2021)

The Approved Document Part F provides regulatory guidance on ventilation provision, outlining compliant strategies, minimum airflow rates, and system-specific requirements to ensure optimal indoor comfort.

## Approved Document Part O (2021)

Consideration has been given to The Approved Document Part O: Overheating (2021) regulations for assessing the thermal comfort compliance for residential developments demonstrating that the building passes the CIBSE's TM59 methodology for predicting overheating risk.

The following requirements are considered:

- O1 (1) Overheating mitigation – The aim of requirement O1 is to protect the health and welfare of occupants of the building by reducing the occurrence of high indoor temperatures by limiting unwanted solar gains in summer and providing an adequate means of removing excess heat from indoor environment.

(a) Solar gains in summer should be limited by implementing fixed shading devices (louvres, recesses, overhangs etc.), glazing design consideration (size, orientation, g-value and window reveal), building design (placement of balconies), shading provided by adjacent buildings.

Internal blinds and nearby foliage are not considered

(b) Excess heat should be removed from the residential building by any of the following means:

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

- O2 (2) Overheating mitigation – The aim of requirement O2 is to ensure occupant safety and implement mechanical ventilation if heat cannot be sufficiently removed by other means.

(a) This requirement is met in a new residential if account is taken for to the safety and comfort of any occupant with consideration to the following aspects:

- Noise at night – addressed by an Acoustic Report provided by appointed consultants.
- Pollution – addressed by an Air Quality Report conducted by appointed consultants.
- Security – with reference to the Approved Document Part K: Protection from falling
- Protection from entrapment

(b) Mechanical cooling may only be used where insufficient heat is capable of being removed from the indoor environment without it.

With the new Approved Document Part O (2021) the opening profiles for the openable windows are required to me modelled as per the following limitations when following the CIBSE's TM59 methodology:

### Overheating Mitigation Limits on the Opening Profiles

2.6 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.
d. An entrance door should be included, which should be shut all the time.

### Acoustics, Ventilation and Overheating Residential Design Guide (January 2020)

The AVO Guide aims to assist designers to adopt an integrated approach to the acoustic design within the context of the ventilation and thermal comfort requirements keeping both the noise restrictions aligned with the overheating measures.

# 4. CIBSE Technical Guides

## CIBSE Guidance

### CIBSE Guide A: Environmental Design (2015, updated 2021)

CIBSE Guide A provides a comprehensive guidance on design criteria and calculation methodologies, including fabric performance, heating and ventilation system sizing, methods for thermal comfort evaluation and energy demand.

Consideration is given to *Table 1.5 Recommended comfort criteria for specific applications* of the *Environmental criteria for design* section to define the comfort parameters such as optimum summer and winter operative temperatures and activity and clothing levels. general guidance and recommendations on suitable summer operative temperature ranges and comfort criteria for specific applications.

*CIBSE Guide A: Environmental design (2015a)* includes advice regarding sleep quality (that may be compromised at temperatures above 24 °C), and recommends that peak bedroom temperatures should not exceed an absolute threshold of 26 °C.

Table4.1 – Benchmark Operative Temperature Benchmarks as per Table 1.5 of CIBSE Guide A

| Type of use of space | Customary winter operative temperatures | Customary summer operative temperature (in air-conditioned buildings) |
|---|---|---|
| Bathroom | 20-22 | 23-25 |
| Bedrooms | 17-19 | 23-25 |
| Hall/ Stairs/ Landings | 19-24 | 21-25 |
| Kitchen | 17-19 | 21-25 |
| Living Rooms | 22-23 | 23-25 |
| Toilets | 19-21 | 21-25 |

### CIBSE TM52: The Limits of Thermal Comfort Avoiding Overheating (2013)

This CIBSE Technical Memorandum focuses on predicting overheating in buildings and serves as a resource for designers, developers, and other stakeholders responsible for defining indoor environmental conditions.

The CIBSE TM52 assessment criteria apply to free-running buildings, where a room or building that fails any two of the three specified criteria is classified as overheating.

- Criterion 1: Hours of Exceedance (He) - sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature by 1ºK or more during the occupied hours of a typical non-heating season (1 May to 30 September). The exceedance shall not be more than 3 per cent of occupied hours.

$$\Delta\ \Delta T = T_{op} - T_{max}$$

- Criterion 2: Daily Weighted Exceedance (We) - deals with the severity of overheating within any one day, which can be as important as its frequency, the level of which is a function of both temperatures rise and its duration. This criterion sets a daily limit for acceptability, which should be less than or equal to 6 in any one day.

- Criterion 3: Upper Limit Temperature ($T_{upp}$)- sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable. To set an absolute maximum value for the indoor operative temperature the value of ΔT, which is the difference between the actual operative temperature in the room at any time ($T_{op}$) and $T_{max}$ the limiting maximum acceptable temperature, shall not exceed 4K.

The aforementioned criteria provide a robust and balanced assessment of the risk of overheating and in order for a room to be classified as compliant, it will need to meet at least two out of the three criteria.

It has been assumed that the analysed building falls under Category II of CIBSE recommendations (Table 4.2 CIBSE suggested applicability of the categories and their associated acceptable temperature range).

Additionally, the guide details on the prediction of conditions for optimal comfort defined by the predicted mean vote (PMV) predicted percentage dissatisfied (PPD) where the metabolic rates, humidity and air movements are considered.

For air-conditioned buildings, the PMV and PPD indices may be reported in the Thermal Comfort Assessment for certain sustainability certifications (BREEAM/ LEED).

Table4.2 – CIBSE Suggested Applicability of the Categories and their Associated Acceptable Temperature Range

| Category | Explanation | Suggested acceptable range (K) | Suggested acceptable limits PMV |
|---|---|---|---|
| I | High level of expectation only used for spaces occupied by very sensitive and fragile persons | ± 2 | ± 0.2 |
| II | Normal expectation (for new buildings and renovations) | ± 3 | ± 0.5 |
| III | A moderate expectation | ± 4 | ± 0.7 |
| IV | Values outside the criteria for the above categories (only acceptable for a limited period) | > 4 | > 0.7 |

## CIBSE TM59: Design Methodology for the Assessment of Overheating Risk in Homes (2017)

### Naturally Ventilated Buildings

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 ($T_{op} – T_{max}$) 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 TM52 Criterion 1: Hours of exceedance) (where Top is the operative temperature of the room and $T_{max}$ is the limiting maximum acceptable temperature).
- Criterion (b) - For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10pm to 7am shall not exceed 26°C for more than 1% of annual hours.
- Bedrooms must pass both criteria (a) and (b).

Table 4.3 – Table Benchmarks Summer Peak Temperatures and Overheating Criteria

| **Table Text Bold** | Benchmark Summer Peak | **Overheating Criterion** |
|---|---|---|
| Bedrooms | 26°C | Maximum 1% annual occupied hours over operative temperature of 26°C |
| Kitchen/ Living areas | 26°C | Maximum 3% annual occupied hours over operative temperature of 26°C |

### Mechanically Ventilated Buildings

CIBSE TM59 overheating methodology for predominantly mechanically ventilated applies the following criteria:

- For homes with restricted window openings, the CIBSE fixed temperature test must be followed, i.e., all occupied rooms should not exceed an operative temperature of 26 ºC for more than 3% of the annual occupied annual hours (CIBSE Guide A(2015a)).

### Communal Corridors

The inclusion of corridors in the overheating analysis is mandatory where community heating pipework runs through them.

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

## Approved Document Part O (ADO) Limits on the CIBSE TM59 Methodology

With the release of the new Approved Document Part O in June 2021 a new approach has been established for the thermal comfort analysis by imposing a series of limitation to the CIBSE TM59 methodology such as specific opening profiles restrictions associated with the safety of the users aforementioned in Chapter 2 under the ADO section.

ADO 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).

Additionally, the building's overheating mitigation strategy for use by occupants requires accounting for the following:

- Noise at night
- Pollution
- Security
- Protection from falling
- Protection from entrapment

Excess heat should be removed from the residential building by any of the following means as per the Approved Document Part O:

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

The acceptable strategies for reducing overheating risk include the implementation of fixed shading devices, adjusting the glazing design (size, orientation, g-value, depth of the window reveal), optimising the placement of balconies, glazing, and accounting for surrounding shading.

According to Part O requirements, internal blinds and surrounding foliage are not considered overheating risk mitigation measures anymore.

# 5. Input Data

## Background

### Early-Stage Overheating Risk Tool – Good Homes Alliance (2019)

The Good Homes Alliance (GHA) has created an overheating risk assessment tool and guidance to address overheating risks in new homes. Designed for early design stages, the tool uses a 14-question scoresheet to classify overheating risk levels from low to high and includes guidance notes with scoring examples and interpretation advice.

The *"Overheating in New Homes: Tool and Guidance for Identifying and Mitigating Early-Stage Overheating Risks in New Homes" (July 2019)* has been followed and the scoresheet completed for the proposed purpose-built student accommodation development during the early design stage. The scoresheet, along with the details outlining the key overheating risk factors and the corresponding mitigation measures that informed the score, is attached in Appendix E of the report.

### Dynamic Thermal Modelling

An assessment of thermal comfort has been undertaken on the proposed purpose-built student accommodation block consisting of 121 studio spaces, a communal kitchenette, and a lounge space, as well as amenity spaces (study spaces, reception, communal areas, community hall, and laundry) totalling of 17 spaces.

The Thermal Comfort model is based upon information current at the time of the assessment (December 2024).

The thermal comfort analysis was conducted under Category II in line with CIBSE TM52, with the associated acceptable temperature range. Category I would only be used in the instances of vulnerable residents.

Where security, air quality or noise concerns pose limitations to the use of openable windows, it is demonstrated that the passive design measures have been investigated, and optimum measures have been implemented.

Internal blinds have not been accounted for in the simulation following the Approved Document Part O limitations.

The following table presents the key input data to the model. Other input data is presented in the appendices.

Table 5.1 – Table Summarising Key Input Data for the Model

| Key Aspects | Details |
|---|---|
| Dynamic Overheating Analysis Software Used | IES VE 2024 |
| Site Location | Britannia Car Park, London, WC1X 9BP |
| Site Orientation (°from North) | -25° |
| Weather Files Applied | London_LWC_DSY1_2020High50<br>London_LWC_DSY2_2020High50<br>London_LWC_DSY3_2020High50<br>London_LWC_DSY1_2050High50 |
| Internal Gains | In line with the CIBSE TM59 profiles for the living spaces (studio, ensuites, kitchenette, lounge) and the NCM Methodology and Database for the associated amenities. |
| Equipment Gains | |
| Occupancy Gains | |
| Fabric Thermal Performance Properties (U-Values and Glazing G-Value) | Properties aligned with the Energy Statement ref. no: 23-E049-009 Britannia Street |
| Shading features (e.g. louvres, overhangs etc.) | As per the latest architectural drawings from Architects |
| Thermal mass | Assumptions have been made as per the latest architectural drawings. |
| Ventilation/ Cooling Strategies Tested | Simulations have been run following the cooling hierarchy with the aim to identify and optimum ventilation strategy for overheating risk mitigation purposes.<br>Infiltration rate: 0.15ACH<br>Passive Design measures tested.<br>Variations of mechanical ventilation with 2 or 3 air changes (MVHR 2ACH and 3ACH). Addition of cooling booster enhancement tested.<br>Comfort cooling |

## Assessment Limitations

### Noise Restrictions

The site is located in Central London and is above Thameslink and London Underground train lines.

The Noise and Vibration Assessment Report provided by WSP UK Ltd (Document reference number: 11. 70075739 RP AC 01 Britannia St) recommends avoiding the use of openable windows to alleviate overheating due to noise concerns during both nighttime and daytime.

Consequently, the majority of the windows are designed as fixed panels. Given the noise restriction considerations and the proposed design, the ventilation strategy is expected to rely on mechanical ventilation or comfort cooling, as determined by the detailed assessment in the Thermal Comfort Analysis conducted by Ensphere Group Ltd

### Pollution Restrictions

Local pollution sources should be minimized by implementing an efficient design that incorporates effective ventilation, in accordance with the requirements outlined in Approved Document Part F: Volume 1.

### Security Restrictions

In accordance with Approved Document Part O (ADO), openings that present security or safety concerns are generally restricted from use for passive natural ventilation during nighttime hours and are designated as operable only during daytime. Such openings typically include those situated at ground level or in easily accessible areas.

Openable windows and doors can be secured through architectural interventions, such as fixed or lockable louvered shutters, window grilles, or railings.

However, due to the noise restrictions outlined above, the proposed design does not rely on openable windows to mitigate overheating risks under all conditions.

### Protection from Falling

Openings intended for prolonged use to reduce overheating risks must minimize the risk of falls from height. Falling safety measures may be included such as 100mm opening restrictors.

Where openings can open wider than 100mm they can be used as overheating mitigation strategy where they meet all of the following conditions as per ADO:

- Window handles on outwards opening windows are not more than 650mm from the inside face of the wall when the window is at maximum opening angle
- Shutters or guarding provision of at least 1.1m or in line with the Approved Document Part K; Horizontal bars to be generally avoided.

Due to the noise assessment limitations, the use of openable windows is not feasible, hence the falling risk may be avoided.

### Protection from Entrapment

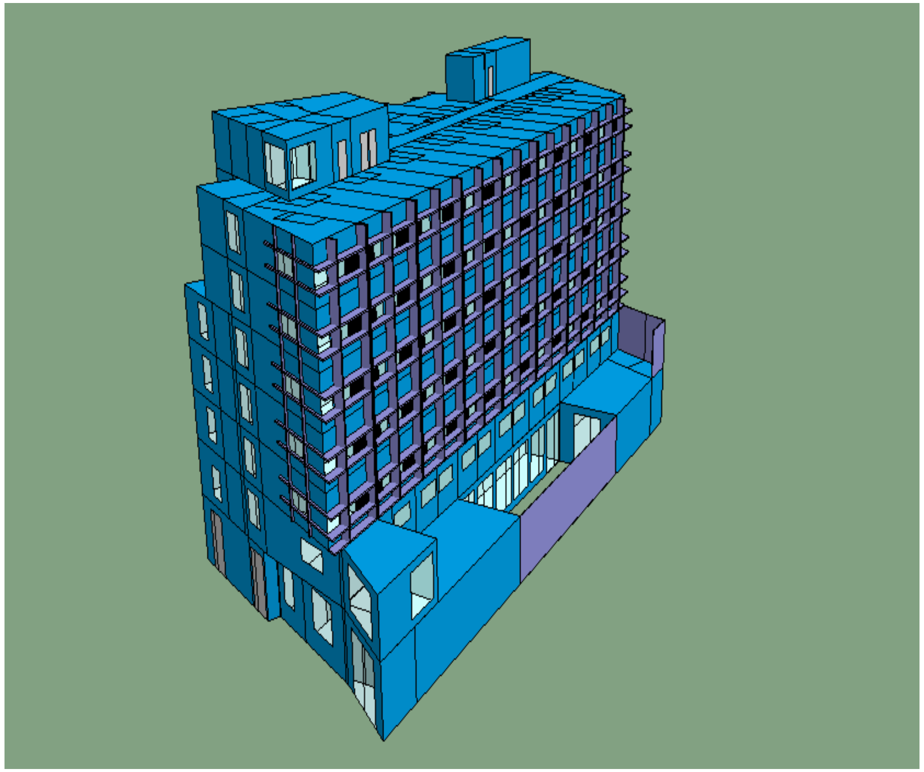
Louvered shutters, window railings, and ventilation grilles, where installed, should be designed with health and safety considerations, ensuring gaps do not exceed 100 mm, prevent any potential entrapment risks and ensure child safety measures.

## Geometry Modelling

A 3D model of the proposed indicative building was developed using IES VE 2024 software. The model was created based on information provided by the architects and design team at the time of writing this report (December 2024). The drawings used for the building model are detailed in Table 5.2.

The orientation from the true North is set in ModelIT as -25° based on the architectural drawings for the proposed site.

The geometry includes all occupied and unoccupied spaces for both the residential areas and the associated PBSA amenities as well as the proposed architectural shading elements.



Proposed Building    Shading Device Elements

Figure 5.1 – IES VE Indicative 3D Model of the Proposed Purpose-built Student Accommodation (PBSA) Block

Table 5.2 – Architectural Drawings Considered for the Building 3D Modelling

| Drawings Number/ Name | Revision | Date |
|---|---|---|
| 6910-SRA-ZZ-00-DR-A-20210 - General Arrangement Ground Floor Plan P02 24/11/2023 | S2 | 27/11/2024 |
| 6910-SRA-ZZ-02-DR-A-20212 - General Arrangement Second Floor | S2 | 27/11/2024 |
| 6910-SRA-ZZ-03-DR-A-20213 – General Arrangement Third Floor Plan | S2 | 27/11/2024 |
| 6910-SRA-ZZ-03-DR-A-20213 – General Arrangement Fourth Floor Plan | S2 | 27/11/2024 |
| 6910-SRA-ZZ-03-DR-A-20213 – General Arrangement Fifth Floor Plan | S2 | 27/11/2024 |
| 6910-SRA-ZZ-03-DR-A-20213 – General Arrangement Sixth Floor Plan | S2 | 27/11/2024 |
| 6910-SRA-ZZ-03-DR-A-20213 – General Arrangement Seventh Floor Plan | S2 | 27/11/2024 |
| 6910-SRA-ZZ-03-DR-A-20213 – General Arrangement Eighth Floor Plan | S2 | 27/11/2024 |
| 6910-SRA-ZZ-ZZ-DR-A-20400 – Elevations | S2 | 27/11/2024 |
| 6910-SRA-ZZ-ZZ-DR-A-20300 - General Arrangement East-West | S2 | 27/11/2024 |
| 6910-SRA-ZZ-ZZ-M3-A-00010 - Massing - Envelope Model | S2 | 27/11/2024 |

## Weather Data

The area of the development is considered to be under the category of high-density urban areas of London, hence the most suitable weather files used for the simulations is London Weather Centre data associated with the Central Activity Zone (CAZ).

The CIBSE weather data files used for the analysis are as follows:

- Current weather scenario: Design Summer Year 1 for the 2020s, high emissions, 50% percentile scenario (London_LWC_DSY1_2020High50).
- Extreme summer year 2003 with a very intense single warm spell: Design Summer Year 2 for the 2020s, high emissions, 50% percentile scenario (London_LWC_DSY2_2020High50).
- Extreme summer year 1976, a year with a prolonged period of sustained warmth: Design Summer Year 3 for the 2020s, high emissions, 50% percentile scenario (London_LWC_DSY3_2020High50).
- Future weather scenario: Design Summer Year 1 for the 2050s, high emissions, 50% percentile scenario (London_LWC_DSY1_2050High50).

The simulations run aim to identify an overheating mitigation solution for the current weather scenario (London_LWC_DSY1_2020High50) for compliance with CIBSE TM52:2013 and CIBSE TM59: 2017 criteria.

Additional testing is conducted using the 2020 versions of the more extreme design weather years (DSY2 and DSY3). It is acknowledged that meeting the CIBSE compliance criteria is challenging for the DSY2 and DSY3 weather files, although it is expected that in the majority of cases a significant proportion of spaces will be able to achieve compliance via following the cooling hierarchy.

Solutions for the more extreme summer year scenarios (DSY2, DSY3) are reported as well as a strategy for residents to cope in extreme weather events and under future weather files in the context of climate change run under the London_LWC_DSY1_2050High50 weather file.

## External Gains - Solar Radiation Analysis

To assist with the identification of areas at greatest risk of overheating an analysis was undertaken to establish the solar gains projected on the building envelope by applying the London_LWC_DSY1_2020High50 current weather data file associated with London Weather Centre area identified as the most suitable for the project's location.

The image from *Figure 5.2* indicates the area of the building which is exposed to the solar radiation and hence more susceptible to increased heat gains.

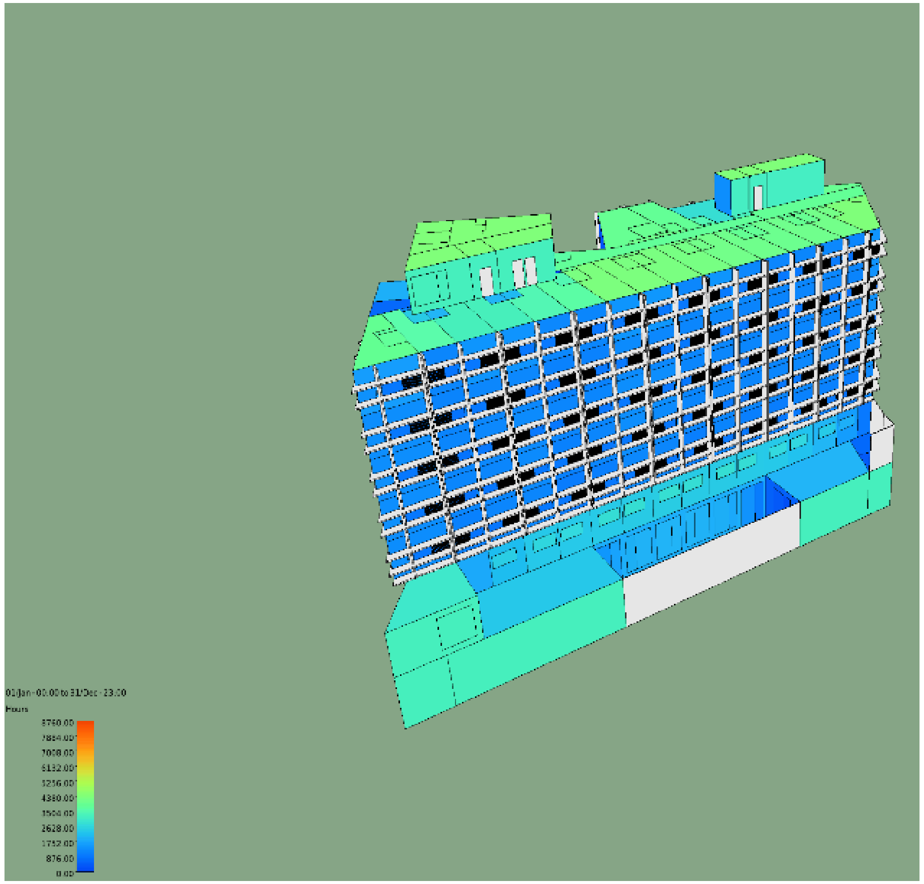


Figure 5.1 – 3D model of the Britannia PBSA Block Development Showing Solar Gain Exposure – Simulation Run in SunCast

## Building Fabric Properties

### Building Fabric Thermal Performance

The building fabric is set in line with the energy strategy established in the Energy Statement Report (Document reference: 23-E049-009 Britannia - Energy Statement v1).

The following table summarises the thermal properties (U-values and air permeability) of the building elements applied in the model. The windows are modelled as double-glazed with a G-Value of 0.4 and a frame factor of circa 0.8. The reduced G-Value of 0.4 ensures minimising the solar gain levels through the windows.

Table 5.3 – Proposed Building Fabric U-values

| Fabric Element | Part L2 Limiting Standards (W/m² ·K) | Proposed (W/m² ·K) |
|---|---|---|
| External Wall | 0.26 | 0.15 |
| Roof | 0.18 | 0.10 |
| Ground Floor | 0.18 | 0.10 |
| Door | 1.60 | 1.6 |
| Windows (double-glazed with G-Value of 0.4 and Frame Factor of 0.8) | 1.60 | 1.40 |
| Air permeability (m³/h/m²) | 8 m³/h/m² @50Pa | 3 m³/h/m² @50Pa |

Good thermal properties (u-values, air permeability) were assumed to minimise the heat losses through the fabric in line with the proposed energy strategy for the purposes of an efficient energy use.

### Infiltration Rate

The air permeability of 3 m³/(h·m²) @50Pa is input as infiltration rate in the air exchange section of the IES VE thermal template for all modelled spaces (AP = ~ 0.15ACH @50Pa).

### Thermal Mass

Thermal mass refers to the capacity of a building material to absorb, store, and subsequently release heat, providing a buffer against temperature fluctuations within a building. Thermal lag is the rate at which a material releases stored heat. Typically, for most building materials, an increase in thermal mass results in a longer thermal lag, meaning materials with higher thermal mass take longer to change temperature, thereby stabilizing the indoor climate by reducing the impact of external temperature changes. Using thermal mass appropriately can improve the thermal performance of the building reducing cooling demands and hence the overheating risk.

The construction was defined based on reasonable assumptions in line with the energy strategy and the architectural design, with concrete slabs between the storeys and cavity wall blockwork construction with brickwork finish. The table below summarises the thermal masses defined in the model based on construction assumptions.

Table 5.4 – Proposed Building Construction Thermal Mass

| Building Element | Thermal Mass Cm (kJ/m²K) | Thermal Mass |
|---|---|---|
| External Walls | 160.0000 | Mediumweight |
| Exposed Floor | 190.0000 | Mediumweight |
| Roof | 94.5000 | Very lightweight |
| Internal floors | 91.00 | Very lightweight |
| Partition walls | 122.5000 | Lightweight |

### Window Type Details

The indicative model for the overheating assessment was produced following the elevations provided by Sheppard Robson architects at the time of writing the report showing fixed panels and openable glazed doors. The proposed windows for the indicative model have been set as double-glazed windows with a U-Value of 1.4 W/m²K with frame factor of 0.8, and a G- Value of circa 0.4.

A low G-Value minimizes the solar heat gain but impacts $CO_2$ emissions, fabric energy efficiency, and internal daylight levels. Consequently, it has been carefully optimized to achieve a balanced performance across these aspects.

Consideration has been given to the Approved Document Part O (ADO) opening profiles limitations from section 2.6 for the simulations with openable windows under the passive measure scenarios. The efficiency of natural ventilation was assessed with consideration of the Part O limits for residential spaces. Accordingly, the openable window profiles were configured in the MacroFlo tool of the IES VE software, following the guidelines outlined in Section 2.6 of ADO noted in Chapter 2 under the Approved Document Part O (2021) overview.

The noise limitations have been applied gradually in three separate simulation sets: the first with no noise restrictions, the second with partial noise limitations applied during nighttime hours (11 PM to 7 AM), and the final simulation reflecting the proposed design, in which fixed glazed panels remain closed at all times.

As part of the passive design strategies simulations, the windows have been modelled as side-hung 90% inwards openable windows at a maximum angle of 90° in line with the ADO profiles for the purposes of testing the impact of noise restrictions. The assumptions of the IES simulations are detailed in Appendix G.

Table 5.5 – Window Types to be Tested under Noise Restriction Variations and Opening Profiles under Passive Design Scenarios

| Noise Restrictions Applied | Window Type Applied | Opening Profile |
|---|---|---|
| None | Side-hung 90% openable windows at 90° angle. | Opening profile as per ADO section 2.6.a + b. definition (windows modelled as open during both daytime and nighttime when the ambient temperature exceeds 22°C) |
| Noise restrictions applied during the nighttime only | Side-hung 90% openable windows at 90° angle. | Opening profile as per ADO section 2.6.a. definition (windows modelled as open only during the daytime between 7AM and 11PM when the ambient temperature exceeds 22°C; windows shut during the nighttime between 11PM and 7AM) |
| Noise restrictions applied during both nighttime and daytime as per WSP acoustic report recommendations. | Fixed glazed windows | Windows shut at all times applying the ADO opening profile 2.6.d. |

The assumptions of the overheating model, with windows closed at all times, are consistent with the proposed architectural design and the noise restrictions outlined in the Acoustic Report provided by WSP WK Ltd. As a result, the windows have been modelled as fixed in accordance with these constraints as reflected in Figures 5.3-5.6.

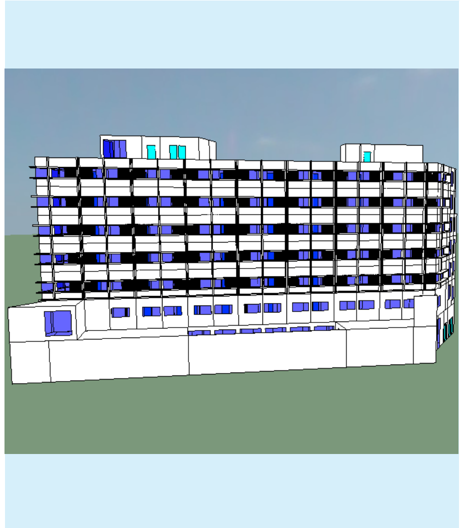


Figure 5.3 – West Elevation Opening Types

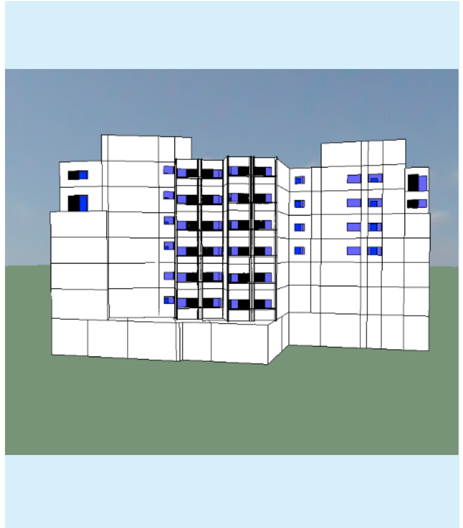


Figure 5.2 – East Elevation Opening Types

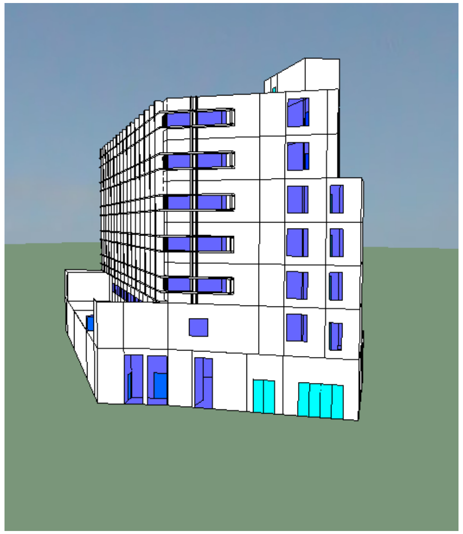


Figure 5.3 – South Elevation Opening Types

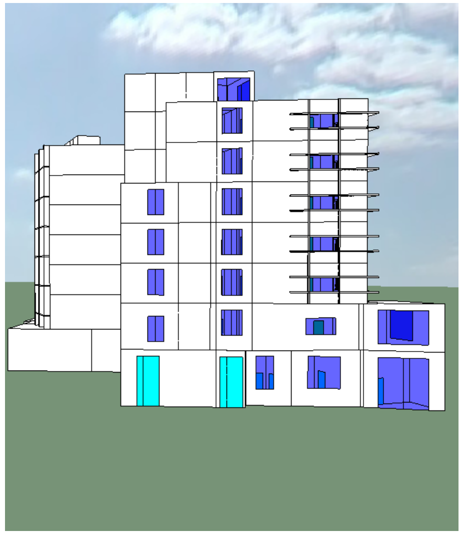


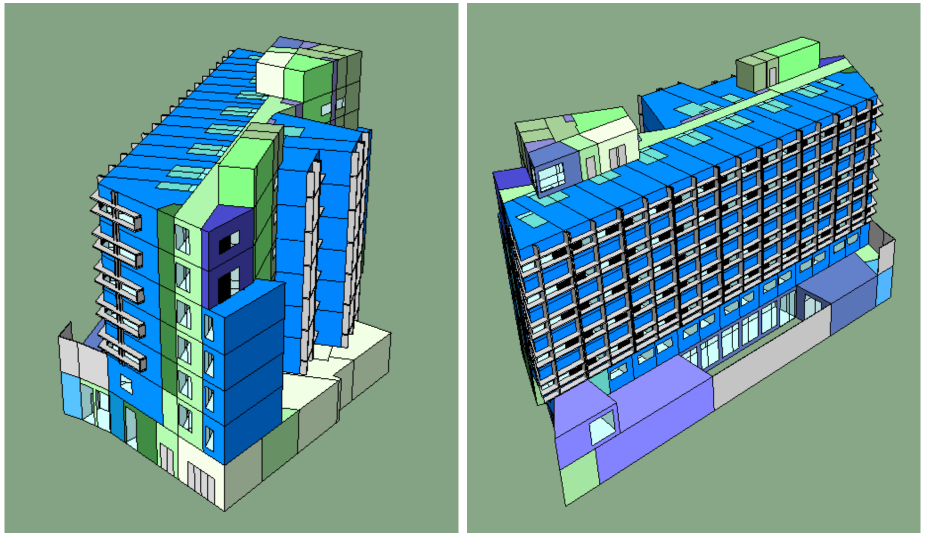
Figure 5.4 – North Elevation Opening Types

Glazed Panels (Remain Shut at All Times)

External Doors

## Thermal Templates

The thermal templates were defined based on activity type, in accordance with the CIBSE TM59 methodology for living spaces within the residential areas, and by applying the NCM Activity Database for the associated amenity spaces.



Studios | Riser (No Heat Gains) | Amenity Space | Light Plant
Ensuite | Riser (With Heat Gains) | Office/ Study Area | WC
Kitchenette | Reception | Laundry | Stairs
Living | Corridors | Store | Lifts
Shading Device Elements

Figure 5.7 – Figure Showing the Thermal Templates Defined within the Model as per Specific Activity Uses

## Internal Gains

Internal heat gains are generated by the activity of occupants as metabolic heat, by utilization of electrical devices, or by thermal emission of artificial lighting.

The thermal templates used, and any assumptions made were based on the guidelines provided by CIBSE TM59:2017 and the NCM predefined profiles.

The internal gains were input into the model by defining thermal templates specific to each type of space and associated activity.

The dynamic overheating analysis adheres to the additional requirements highlighted in section 8.10 of the GLA Energy Assessment Guidance (June 2022) which consists in the inclusion of the following considerations:

- Communal heating systems – including heat losses from pipework and heat interface units (HIUs) within the model where applicable.
- Communal corridors are included in the overheating analysis where community heating pipework runs through them as per Paragraph 3.9 of the CIBSE TM59 guidance.

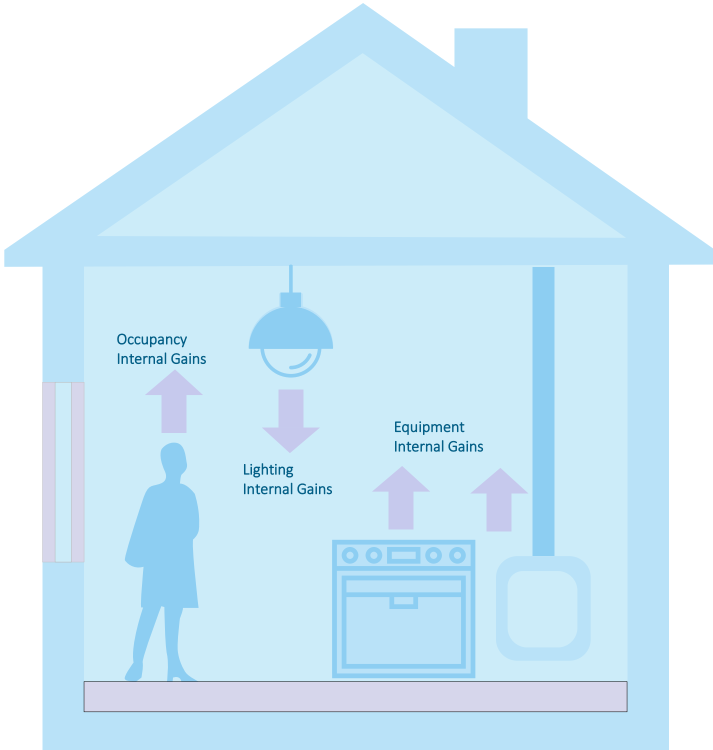



Figure 5.8 – Figure Showing a Breakdown for the Internal Gains Sources

### Occupancy Gains

The modelled studios have an occupancy profile defined based on a 24-hour schedule in line with the CIBSE TM59 profiles. For the studios, the same principle as per a single bedroom is applied, with the assumption of having one person present in the space at 70% gains from 11 pm to 8 am and at full gains from 8 am to 11 pm.

Kitchens/living room spaces are set as unoccupied during the sleeping hours and occupied during the rest of the day. This is the worst-case scenario since the room is modelled as occupied only during the hottest hours of the day.

The communal corridors and the bathrooms (ensuites) are assumed as unoccupied in line with the CIBSE TM59 methodology.

The heat gains associated with the occupants within the amenity spaces, reception, study areas, and laundry follow the maximum sensible gains and maximum latent gains from the predefined NCM database profiles.

The occupancy profiles for all occupied spaces are provided in Appendix F, Table F1, while the associated internal gains are specified for both the TM59-defined and NCM-predefined templates in Tables F2 and F3, respectively.

### Lighting Gains

In the context of this assessment, it is presumed that the energy consumption for lighting is directly related to the floor area, with the energy demand for lighting being quantified in watts per square meter (W/m²). For an efficient new-build residence, a default value of 2 W/m² is to be assumed for the time period from 6 pm to 11 pm.

This presupposes the availability of adequate daylight, and it is important to note that the assessment periods covered by CIBSE TM52 and CIBSE TM59 are limited to the months from May to September. For communal corridors, this value may be assumed as zero if passive infrared (PIR) sensors are present.

The non-residential spaces are defined following the NCM predefined defaults which are presented in Table F4 of the Appendices section.

### Equipment Gains

Equipment gains in a building refer to the heat generated by electrical or mechanical equipment during operation, including devices such as computers, mechanical systems, and appliances. This heat contributes to the internal temperature of the building and influences its overall cooling or heating requirements. These gains are an important factor in designing HVAC systems, as they impact on the cooling and heating demands required to maintain thermal comfort and energy efficiency, particularly during peak operational hours.

Centralised heating systems (e.g. per block or scheme) can contribute to overheating risks through a range of factors including the lack of individual controls, heat gains from distribution pipework and Heat Interface Units (HIUs). The heat is often released 24/7 and, when emitted into poorly ventilated internal spaces, such as corridors, it can accumulate and significantly contribute to overheating in these areas as well as in adjacent occupied spaces.

The heat gains associated with the distribution pipework were incorporated into the model. For risers containing supply and return pipework, internal heat gains have been accounted for at a rate of 72 W/m².

Within corridors, the average heat loss from the domestic hot water (DHW) supply and return pipework is assumed to be 12 W/m for both supply and return combined. For a typical corridor width, the resulting heat gain from the pipework has been calculated to be 500 W.

All the equipment gains per each spaces type associated with specific activity are tabulated in the Appendix F – Tables 5-6.

## Comfort Parameters

The comfort parameters are addressed in CIBSE’s Guide A: Environmental Design (2015, updated 2021) in Table 1.5 Recommended Comfort Criteria for specific applications, which provides standards and recommendations for creating comfortable and sustainable indoor environments.

The comfort parameters defined in the model as per the CIBSE Guide A are summarised in Table F7 of the Input Appendix F.

# 6. Overheating Mitigation Strategies

The cooling hierarchy is followed in testing, identifying, and defining the proposed overheating risk mitigation strategy in compliance with CIBSE TM59 and CIBSE TM52.

## Passive Measures

### Reduce Solar Heat Gains

The amount of heat entering the building has been reduced through an adequate proposed orientation on site, optimised shading elements, fenestration design, good insulation levels and air tightness.

High Albedo materials and provision of green infrastructure are aspects that may be considered as well within the first set of measures of the cooling hierarchy.

Early design assessments were conducted to evaluate the impact of passive design strategies on overheating risks and thermal comfort levels within the building. These assessments focused on optimising fenestration and maximising the implementation of shading elements, as investigated in two early studies: *"23-E049-007 Britannia Street – Early Design Thermal Comfort Analysis – Window Types_V01"* and *"23-E049-008 Britannia Street – Early Design Thermal Comfort Analysis – Shading Device_V04"*. The early design results assisted in identifying optimum window and shading device configurations based on the associated cooling demand reductions.

The initial assessments were carried out on the preliminary scheme design. However, the principles established—such as window ratios and shading devices, including the architectural shading grid (serving as both a recess and overhang element) and the vertical fins applied to the glazing—have been incorporated into the current proposed design. These design measures contribute to the solar gains reduction and consequently minimising the overheating risks to a certain degree.

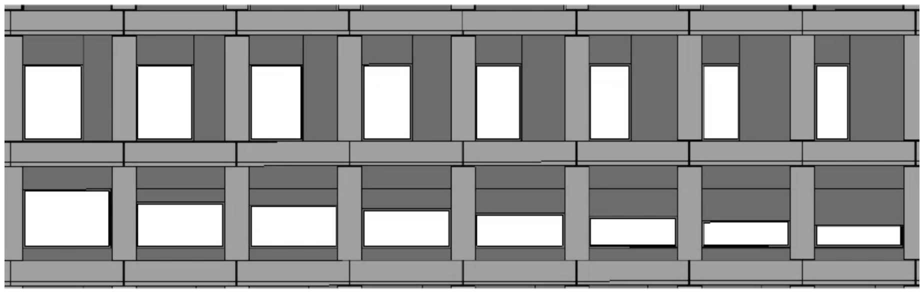


Figure 6.1 – Illustration of the Range of Windows with Varying scales and Orientations Analysed as part of the Early Passive Design Window Configuration Report by Ensphere (Source: Sheppard Robson)

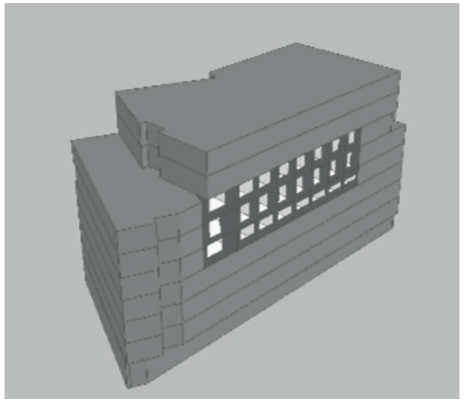


Figure 4.2 – Early Passive Design Analysis with No Shading Devices

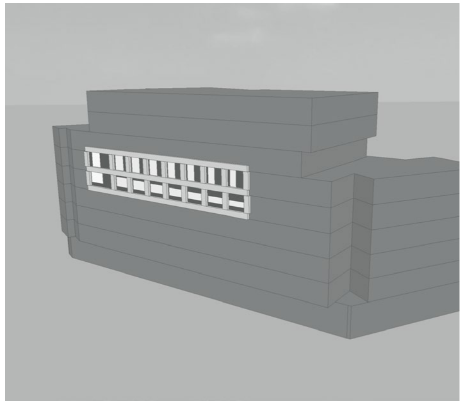


Figure 4.3 – Early Passive Design Analysis with Architectural Grid Feature

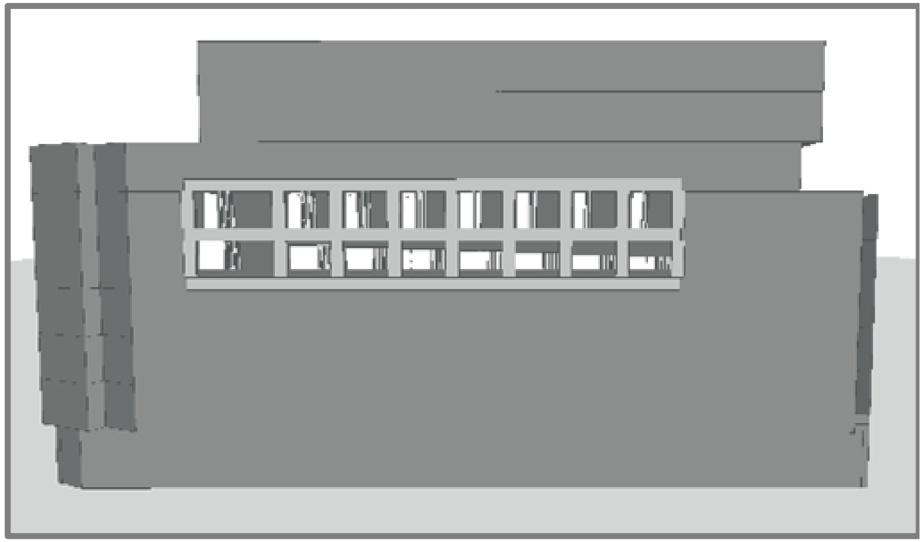


Figure 4.4 – Early Passive Design Analysis with Architectural Grid Feature and Vertical Fins Variations

### Minimise Internal Heat Generation through Energy Efficient Design

Internal heat generation should be minimized through energy-efficient building services design, in alignment with the proposed energy strategy and subsequent mechanical and electrical (M&E) design. The development should incorporate an efficient infrastructure with reduced pipe lengths and adopt configurations that minimize heat loss, particularly in enclosed areas such as hallways, corridors, storages.

Mitigation measures to be implemented where suitable such as installation of insulation to the distribution pipework, HIUs and storage vessels, and employment of efficient control strategies.

### Manage Heat using Thermal Mass

The thermal mass, defined as the capacity of materials to absorb, store, and release heat, acts as a buffer against temperature fluctuations. High thermal mass elements increase thermal lag, thereby reducing the impact of excessive solar gains.

This concept was included into the simulations and the overheating strategy, as detailed in Chapter 4: Input Data, through reasonable assumptions aligned with the architectural design. The model includes concrete slabs between storeys and solid blockwork for external walls.

### Passive Ventilation Testing

The potential for natural ventilation through openable windows is restricted by noise regulations at the site, as outlined in the Noise and Vibration Assessment Report prepared by WSP WK Ltd (Document Reference No. 11.70075739 RP AC 01, Britannia Street). According to the acoustic report, the use of openable windows for natural ventilation to mitigate overheating risks should be avoided, as noise levels exceed permissible thresholds during both daytime and nighttime. As a result, the proposed facade design incorporates fixed glazed panels, which serve to mitigate excessive noise from the nearby train lines.

However, two separate analyses have been conducted as part of the model simulations: one assuming openable windows and the other with closed windows. This approach was undertaken to highlight the effectiveness of the passive measures implemented to mitigate overheating risks, irrespective of the constraints posed by the site's location.

To maximise the effect of cross-ventilation the internal doors that do not pose security or safety concerns have been modelled as open as part of the natural ventilation simulations.

The simulations for openable windows under passive ventilation scenarios consider the opening profile limitations outlined in Section 2.6 of the Approved Document Part O (ADO), referenced in Chapter 3 of the report. The efficiency of natural ventilation was assessed in line with these limits for residential spaces, with window profiles configured in the MacroFlo tool of the IES VE software.

Noise limitations were applied across three simulation sets: the first with no restrictions, the second with partial restrictions during nighttime hours (11 PM to 7 AM), and the third reflecting the proposed design, where fixed glazed panels remain closed at all times in line with WSP recommendations. The window types and corresponding opening profiles for each noise restriction level are summarized in Table 5.5 in Chapter 5, Window Type Details.

Under no noise restrictions, the windows are modelled as side-hung, 90% openable inwards opening, at a maximum angle of 90° remaining open day and night (ADO a.b profile) when indoor temperatures exceed 22°C. With partial noise restrictions applied during sleeping hours, the windows are defined as closed between 11PM and 7AM, and as open between 7AM and 11PM when the indoor temperature exceeds 22°C.

The purpose of these tests is to evaluate the effectiveness of the passive measures alone.

The final cooling and ventilation strategies are to be determined with all windows closed at all times in line with the acoustic report provided by WSP.

## Mechanical Ventilation Testing

Generally, where the passive measures are not sufficient to mitigate the overheating risks under the current weather scenario - 2020DSY1 (for compliance), and other weather variations (reported for the GLA requirements), the next step to explore is the implementation of mechanical ventilation.

Due to the noise restrictions, which prevent the use of natural ventilation through operable windows, mechanical ventilation and potential cooling solutions are necessary.

### Mechanical Ventilation with Heat Recovery

Mechanical ventilation with heat recovery has been tested in line with the Energy Strategy where mechanical ventilation with heat recovery and cooling have been proposed.

A series of simulations were conducted to assess the effectiveness of mechanical ventilation, testing incremental air change rates of two air changes per hour (2 ACH) and three air changes per hour (3 ACH). The ventilation flow rate was capped at a maximum of 3 ACH to mitigate potential internal noise issues, as higher rates would pose additional acoustic challenges.

Mechanical ventilation flow rates have been implemented in line with the Approved Document Part F. A continuous flow rate of 8L/s has been set for the ensuite spaces and other WCs.

### Mechanical Ventilation with Cooling Booster Enhancement

The mechanical ventilation with an integrated cooling booster unit has been tested as well as an overheating mitigation measure for the scenarios with closed windows due to acoustic limitations.

The cooling booster is activated during periods of peak heat, when the indoor operative temperature exceeds the optimum threshold.

The system has been modelled with the standard operational flow rates (2ACH and 3ACH) acting as a standard mechanical ventilation system while the indoor temperature is below 21°C. Once the temperature surpasses the optimal value of 22°C, the cooling booster module is engaged, applying the associated boost rate. The adjacent condition is defined as the 'external air + offset temperature,' with the offset typically ranging from -8°C to -12°C, activating when the outdoor temperature (ta) exceeds 22°C. In general, the cooling booster is assumed to offset the external temperature by 10°C.

The profiles for both the cooling booster and mechanical ventilation were defined using the Apache profile creator within the IES VE tool, where daily and weekly profiles are specified and assigned to each ventilation and cooling mode accordingly.

## Comfort Cooling System Provision

Once passive measures were explored and maximised as well as the mechanical ventilation system options, if the results suggest that there is still need for additional measures, comfort cooling may be implemented.

The air conditioning systems implemented to be designed in an efficient way and ideally with waste heat incorporated.

# 7. Scenarios Results

## Passive Ventilation Simulation Results

The use of natural ventilation is not feasible due to the opening limitations posed by the noise restrictions for both daytime and nighttime as outlined by the acoustic report provide by WSP.

However, there have been included two separate overheating analyses: one with openable windows and one with closed windows to show the efficiency levels of the passive design measures.

Without applying noise or security restrictions and shading elements, a significant proportion of spaces meet the CIBSE TM59 criteria, with only five out of 123 residential spaces failing. When shading elements, such as the architectural grid projection and vertical window fins, are incorporated as per the proposed architectural design, the majority of spaces comply with CIBSE assessment criteria, with only two rooms failing.

Under the CIBSE TM52 criteria, the amenity spaces fail to meet the required standards due to the limited number of openable windows, a consequence of the architectural design and the use of fixed curtain wall systems. As a result, most of these spaces do not comply with the criteria when relying solely on natural ventilation.

When partial noise restrictions are applied (with windows open during the day and shut during the sleeping hours) the majority of spaces fail to achieve optimal indoor temperatures, resulting in elevated overheating risks.

Furthermore, when the noise restrictions outlined in the acoustic report conducted by WSP are applied, no spaces achieve compliance under either assessment, as anticipated.

These simulations are detailed in Appendix G with Iterations 1A-4A under Table G1 for spaces subject to the CIBSE TM59 assessment, and Iterations 1B-3B under Table G2 for spaces subject to the CIBSE TM52 assessment.

The key simulations and outcomes of the passive ventilation simulations stage are summarised in the following table.

Table 7.1 – Passive Ventilation Simulation Results under London_LWC_2020_DSY1

| Building Space Type | Number of Analysed Spaces | Assessment Applied | Conditions | Fail | Pass |
|---|---|---|---|---|---|
| Residential Spaces | 123 Residential Spaces<br><br>24 Corridors | CIBSE TM59 | No Noise or Security Restrictions | | |
| | | | Natural ventilation<br>No Shading Devices | 5<br>3 Corridors | 118<br>21 Corridors |
| | | | Natural ventilation<br>With Shading Devices | 2<br>2 Corridors | 121<br>22 Corridors |
| | | | Noise Restriction for Nighttime | | |
| | | | Natural ventilation during daytime only<br>With Shading Devices | 121<br>16 Corridors | 2<br>8 Corridors |
| | | | Noise Restrictions for both Nighttime and daytime as per WSP acoustic report | | |
| | | | Windows shut at all times<br>With Shading Devices | 123<br>24 Corridors | 0<br>0 Corridors |
| Amenity Spaces | 17 Occupied Spaces | CIBSE TM52 | No Noise Restrictions | | |
| | | | Natural ventilation where the architectural design allows<br>Security measures applied; Doors closed during nighttime<br>No Shading Devices | 17 | 0 |
| | | | Conditions as above<br>With Shading Device | 15 | 2 |
| | | | Noise Restrictions Applied as per WSP acoustic report | | |
| | | | Openings shut at all times<br>With Shading Device | 17 | 0 |

## Mechanical Ventilation Simulation Results

The results of simulations with mechanical ventilation and windows closed at all times, under the current weather conditions, indicate that airflows of 2 air changes per hour (2 ACH) or 3 air changes per hour (3 ACH) fail to fully mitigate overheating in all residential spaces, with a significant proportion of spaces failing to meet the CIBSE criteria, as presented in the table below.

When a cooling booster is added to the mechanical ventilation system with 3 ACH for the residential living spaces, more than 50% of the assessed spaces still fail to achieve compliance with the CIBSE TM59 criteria.

For the amenity spaces, some areas may achieve optimal thermal comfort with an airflow of 3 ACH. When enhanced with a cooling booster, only three spaces fail to meet the TM52 criteria (00_Amenity_01, 00_Laundry_01, 01_Reception_01)."

Table 7.2 – Mechanical Ventilation Simulation Results under London_LWC_2020_DSY1

| Building Space Type | Number of Analysed Spaces | Assessment Applied | Conditions | Fail | Pass |
|---|---|---|---|---|---|
| Residential Spaces | 123 Residential Spaces<br>24 Corridors | CIBSE TM59 | Noise Restrictions for both Nighttime and Daytime as per WSP Acoustic Report (Windows Shut at All Times) and with Shading Devices | | |
| | | | Mechanical Ventilation 2ACH in studios, kitchen/living areas, and communal corridors | 118<br>16 Corridors | 5<br>8 Corridors |
| | | | Mechanical Ventilation 3ACH in studios, kitchen/living areas, and communal corridors | 116<br>0 Corridors | 7<br>24 Corridors |
| | | | Mechanical Ventilation 3ACH in the communal corridors.<br>MEV 3ACH with cooling booster in studios, kitchen/living areas, and communal corridors | 78<br>0 Corridors | 45<br>24 Corridors |
| Amenity Spaces | 17 Occupied Spaces | CIBSE TM52 | Noise Restrictions for both Nighttime and Daytime as per WSP Acoustic Report (Windows Shut at All Times) and with Shading Devices | | |
| | | | Mechanical ventilation with 2ACH applied in all occupied spaces. | 12 | 5 |
| | | | Mechanical ventilation with 3ACH applied in all occupied spaces. | 5 | 12 |
| | | | Mechanical ventilation with 3ACH with cooling booster applied in all occupied spaces. | 3 | 14 |
| | | | Comfort cooling in all occupied spaces | 0 | 17 |

Mechanical ventilation is to be implemented in all spaces with comfort colling systems where required.

## Comfort Cooling Simulation Results

To achieve compliance, the spaces must pass the thermal comfort assessments (CIBSE TM59 and CIBSE TM52) under typical current weather conditions (London_LWC_2020_DSY1). The results indicate that the compliance strategy involves implementing comfort cooling in all residential living spaces (studios, kitchen/living areas) and in all occupied amenity spaces. The communal corridor can meet the assessment criteria with mechanical ventilation at 3 ACH.

Table 7.3 –Active Cooling Simulation Results under London_LWC_2020_DSY1

| Building Space Type | Number of Analysed Spaces | Assessment Applied | Conditions | Fail | Pass |
|---|---|---|---|---|---|
| Residential Spaces | 123 Residential Spaces<br>24 Corridors | CIBSE TM59 | Noise Restrictions for both Nighttime and Daytime as per WSP Acoustic Report (Windows Shut at All Times) and with Shading Devices | | |
| | | | Comfort Cooling in all studios, kitchen/ living areas<br>MEV with 3ACH in the communal corridors | 0<br>0 Corridors | 123<br>24 Corridors |
| Amenity Spaces | 17 Occupied Spaces | CIBSE TM52 | Noise Restrictions for both Nighttime and Daytime as per WSP Acoustic Report (Windows Shut at All Times) and with Shading Devices | | |
| | | | Comfort cooling in all occupied spaces | 0 | 17 |

When applying more extreme weather files with harsher summers (London_LWC_2020_DSY2 and London_LWC_2020_DSY3) as well as under the future weather files (London_LWC_2050_DSY1) comfort cooling is required to eliminate the overheating risk and ensure that all spaces pass under CIBSE TM59 and TM52 criteria.

The details of all the simulations and results are reported in Appendix G under Tables G1 and G2 for all weather file types.

## Proposed Ventilation/ Cooling Strategy

The following design measures are proposed to mitigate overheating risks for the scheme, in accordance with the cooling hierarchy and the relevant CIBSE methodologies (CIBSE TM59 and CIBSE TM52), as the final strategy to ensuring compliance:

- Maximising the passive design measures
  - Adequate orientation of the building on site.
  - Good fabric thermal properties, optimum fenestration ratio and G-Value of 0.4.
  - Implementation of shading devices as architectural elements: projected architectural grid and vertical fins to the windows.
  - Energy efficient design.
  - Thermal mass factor.
- Mechanical Ventilation of 3ACH to the communal corridors within the residential spaces (or comfort cooling if 3ACH is not considered feasible).
- Comfort cooling for all residential spaces (studios, living/kitchen areas) and the amenity spaces (amenity spaces, reception, office/study areas, laundry).

When applying more extreme weather files and future weather files in the context of Climate Change, comfort cooling is required in all occupied spaces.

All strategies to ensure that all spaces pass in all weather conditions are summarised in table below. However, as minimum for compliance only the strategy under the normal current weather conditions (London_LWC_2020_DSY1) is necessary.

Table 4.4 – Proposed Strategies Based on the Weather File Applied

| | Residential Spaces | Amenity Spaces |
|---|---|---|
| Strategy Applied | London_LWC_2020_DSY1 (For Compliance) | |
| | Comfort cooling for all residential living spaces (studios, Kitchen/Living Areas)<br>Mechanical Ventilation with 3ACH for the communal corridors | MEV and Comfort cooling for all Amenity Spaces |
| | London_LWC_2020_DSY2 (Extreme Summer Type 1) | |
| | Comfort cooling for all residential living spaces (studios, Kitchen/Living Areas) and communal corridors. | Comfort cooling for all Amenity Spaces |
| | London_LWC_2020_DSY3 (Extreme Summer Type 2) | |
| | Comfort cooling for all residential living spaces (studios, Kitchen/Living Areas) and communal corridors. | Comfort cooling for all Amenity Spaces |
| | London_LWC_2050_DSY1 (Future Weather File) | |
| | Comfort cooling for all residential living spaces (studios, Kitchen/Living Areas) and communal corridors. | Comfort cooling for all Amenity Spaces |

# 8. Summary

This report presents the Thermal Comfort Analysis for the proposed development at Britannia Street Car Park, London, WC1X 9BP.

The proposals are for the redevelopment of an existing brownfield site for Purpose-Built Student Accommodation in addition to community floorspace.

The main purpose of this report is to investigate how the proposed building performs against the criteria set out in *CIBSE TM59:2017: Design methodology for the assessment of overheating risk in homes*, the *Approved Document Part O (2021)* and *CIBSETM52:2013 The limits of thermal comfort: avoiding overheating in European buildings*. Consideration has also been given to the methodology presented in *CIBSE AM11 Building Energy and Environmental Modelling*. Dynamic thermal modelling has been undertaken and approved software IES VE 2024 was used for the purpose of the analysis.

The report demonstrates that the cooling hierarchy *Policy SI 4 (Managing Heat Risk)* of the *London Plan*, as per Greater London Authority's Energy Assessment Guidance (June 2022). has been followed.

Passive design measures have been prioritized and optimized, incorporating appropriate site orientation, optimal fenestration and shading elements, high-performance building fabric, and thermal mass factors.

The analysis includes all occupied spaces within the building, such as bedrooms, kitchens, and living areas, assessed according to the CIBSE TM59 standard, as well as amenity spaces—including reception areas, offices, laundry rooms, and other communal areas—evaluated under the CIBSE TM52 criteria.

The thermal comfort assessment has been conducted within the constraints identified in the *Britannia Street, London: Summary of Noise and Vibration Survey* (November 2024), provided by WSP consultants. The acoustic report indicates that noise pollution from nearby train lines exceeds standard limits during both daytime and nighttime hours. Consequently, the report recommends restricting the use of openable windows as an overheating mitigation strategy.

To address these constraints, the proposed design incorporates fixed window panels. However, as part of the thermal comfort assessment, two sets of simulations were conducted: one without noise or security restrictions and another with the noise restrictions recommended by WSP applied, to evaluate the efficiency of the passive design measures.

As a minimum requirement to achieve compliance an overheating mitigation strategy was identified and applied to show that all occupied spaces pass the relevant CIBSE criteria under the current weather normal conditions (London_LWC_DSY1_2020).

To achieve compliance, the following strategies are proposed to mitigate the overheating risks following the cooling hierarchy and the relevant CIBSE methodologies (CIBSE TM59 and CIBSE TM52):

- Maximising the passive design measures
  - Adequate orientation of the building on site
  - Good fabric thermal properties, optimum fenestration ratio and G-Value of 0.4
  - Implementation of shading devices as architectural elements: projected architectural grid and vertical fins to the windows.
  - Energy efficient design.
  - Thermal mass factor
- Mechanical Ventilation of 3ACH to the communal corridors within the residential spaces.
- Comfort cooling for all residential spaces (studios, living/kitchen areas) and the amenity spaces (amenity spaces, reception, office/study areas, laundry)

Therefore, to achieve compliance under the normal current weather files, comfort cooling is required in all residential living spaces (studios, living/kitchen areas) and in the occupied amenity spaces, and mechanical ventilation with 3 ACH for the communal corridors.

Additionally, when assessed under the more extreme weather scenarios with harsh summer types (London_LWC_DSY2_2020 and London_LWC_DSY3_2020) comfort cooling is required in all spaces.

Finally, there is an expectation that with climate change, the UK will experience warmer weather (future weather file London_LWC_DSY1_2050). This will likely lead to increased temperatures being experienced within the building, and this scenario will also require comfort cooling in the majority of spaces.

# Appendices

# A. General Information

Table Appendix A.1 – Key Term

| Policy Reference | Details |
|---|---|
| Thermal Comfort and Operative Temperatures | The provision of thermal comfort for building occupants involves designing the internal conditions so that the heat loss and heat gain from occupants lie within the bounds that are generally accepted as comfortable. Thermal comfort is defined in the ISO 7730 as "That condition of mind which expresses satisfaction with the thermal environment". This is a definition most people can agree on but also a definition that is not easily converted into physical parameters.<br><br>The human body can be crudely regarded as a heat engine that converts fuel (food) into energy for its function and creates waste heat that must be dissipated by the body to ensure proper "thermoregulation". The greater the amount of activity, the greater the amount of heat to be dissipated. Typical office work generates up to 110-130W of heat. Heat dissipation from the body takes place by several modes of heat transfer — radiation and convection from the outer surface, evaporation from both the surface and inner parts of the body and respiration involving both sensible and latent heat transfer. To maintain thermal equilibrium, the amount of heat produced or absorbed must equal the heat dissipated. The perception of thermal comfort is based on a range of variables: |
| Dry bulb air temperature | Is the most commonly quoted factor in relation to thermal comfort. In a 'traditional" building, if the air temperature is within reasonable limits, it is likely that there is a reasonable degree of thermal comfort. This simple relationship between air temperature and comfort is less reliable in lighter weight modern buildings |
| Moisture content | Humans will experience discomfort if the moisture content of the air in the room is either too dry, causing drying of the respiratory tract and eyes or too moist so that the body is unable to lose heat through evaporation (sweating) from the skin. |
| Air movement | The movement of air across the surface of the body affects the convective heat transfer from both the bare and clothed parts; over the exposed skin surfaces the flow of air is a factor in determining the transmission rate of moisture from the surface. If the combined effect of temperature and movement is too great, then too much heat is removed and a subjective feeling of chill or draught results. Conversely, a high air temperature with little air movement will produce a subjective sensation of warmth that, although acceptable locally near a heating unit, is not tolerable throughout the general area of a room. |
| Operative Temperatures | The CIBSE standard adopted in the UK for the assessment of comfort in an internal space is known as operative temperature (formerly known as dry resultant temperature);<br><br>$T_{operative} = (0.5xTair) + (0.5x\ T_{radiant})$<br><br>This is in effect a simple average and so an increasing air temperature requires a corresponding reduction in radiant temperature if comfort is to be maintained. This can be achieved through reduced areas of glass, external shading, exposed concrete soffits and radiant cooling systems. |
| Sensible heat | When an object is heated, its temperature arises as heat is added. The increase in heat is called sensible heat. Similarly, when heat is removed from an object and its temperature falls, the heat removed is also called sensible heat. Heat that causes a change in temperature in an object is called sensible heat. |
| Latent heat | All pure substances in nature are able to change their state. Solids can become liquids and liquids can become gases but changes such as these require the addition of removal of heat. The heat that causes these changes is called latent heat. |

# B. Proposed Site Plan


Figure Appendix B.1 – Site Plan (produced by Sheppard Robson Architects)

# C. Key Local Planning Policy Requirements

## London Planning Policy Framework

Table Appendix C.1 – London Plan (2021)

| Policy Reference | Details |
|---|---|
| Policy SI 1 Improving air quality [extract] | […]<br>B. To tackle poor air quality, protect health and meet legal obligations the following criteria should be addressed:<br>1) Development proposals should not:<br>a) lead to further deterioration of existing poor air quality<br>b) create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits<br>c) create unacceptable risk of high levels of exposure to poor air quality.<br>2) In order to meet the requirements in Part 1, as a minimum:<br>a) development proposals must be at least Air Quality Neutral<br>b) development proposals should use design solutions to prevent or minimise increased exposure to existing air pollution and make provision to address local problems of air quality in preference to post-design or retro-fitted mitigation measures<br>c) major development proposals must be submitted with an Air Quality Assessment. Air quality assessments should show how the development will meet the requirements of B1<br>d) development proposals in Air Quality Focus Areas or that are likely to be used by large numbers of people particularly vulnerable to poor air quality, such as children or older people should demonstrate that design measures have been used to minimise exposure.<br>[…] |
| Policy SI 2 Minimising greenhouse gas emissions | A. Major development should be net zero-carbon. This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy:<br>1) be lean: use less energy and manage demand during operation<br>2) be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly<br>3) be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site<br>4) be seen: monitor, verify and report on energy performance.<br>B. Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy.<br>C. A minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either:<br>1) through a cash in lieu contribution to the borough's carbon offset fund, or<br>2) off-site provided that an alternative proposal is identified and delivery is certain.<br>D. Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ring-fenced to implement projects that deliver carbon reductions. The operation of offset funds should be monitored and reported on annually.<br>E. Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.<br>F. Development proposals referable to the Mayor should calculate whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions. |
| Policy SI 4 Managing heat risk | A. Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure.<br>B. Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:<br>1) reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure<br>2) minimise internal heat generation through energy efficient design<br>3) manage the heat within the building through exposed internal thermal mass and high ceilings<br>4) provide passive ventilation<br>5) provide mechanical ventilation<br>6) provide active cooling systems. |

## Local Policy

Table Appendix C.2 – Camden Local Plan (July 2017)

| Policy Reference | Details |
|---|---|
| Policy G1 Delivery and Location of Growth [extract] | The Council will create the conditions for growth to deliver the homes, jobs, infrastructure and facilities to meet Camden's identified needs and harness the benefits for those who live and work in the borough.<br><br><u>Delivery of Growth</u><br><br>The Council will deliver growth by securing high quality development and promoting the most efficient use of land and buildings in Camden by:<br><br>a. Supporting development that makes best use of its site, taking into account quality of design, its surroundings, sustainability, amenity, heritage, transport accessibility and any other considerations relevant to the site;<br><br>[…] |
| Policy D1 Design [extract] | The Council will seek to secure high quality design in development. The Council will require that development:<br><br>[…]<br><br>a. respects local context and character;<br><br>b. preserves or enhances the historic environment and heritage assets in accordance with Policy D2 Heritage;<br><br>c. is sustainable in design and construction, incorporating best practice in resource management and climate change mitigation and adaptation;<br><br>d. is of sustainable and durable construction and adaptable to different activities and land uses;<br><br>e. comprises details and materials that are of high quality and complement the local character;<br><br>f. integrates well with the surrounding streets and open spaces, improving movement through the site and wider area with direct, accessible and easily recognisable routes and contributes positively to the street frontage;<br><br>g. is inclusive and accessible for all;<br><br>h. promotes health;<br><br>i. is secure and designed to minimise crime and antisocial behaviour;<br><br>j. responds to natural features and preserves gardens and other open space;<br><br>k. incorporates high quality landscape design (including public art, where appropriate) and maximises opportunities for greening for example through planting of trees and other soft landscaping,<br><br>l. incorporates outdoor amenity space;<br><br>m. preserves strategic and local views;<br><br>n. for housing, provides a high standard of accommodation; and<br><br>o. carefully integrates building services equipment.is of sustainable and durable construction and adaptable to different activities and land uses;<br><br>[…] |
| Policy CC1 Climate Change Mitigation | The Council will require all development to minimise the effects of climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation.<br><br>We will:<br><br>a. Promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;<br><br>b. Require all major development to demonstrate how London Plan targets for carbon dioxide have been met;<br><br>c. Ensure that the location of the development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks;<br><br>d. Support and encourage sensitive energy efficiency improvements to existing buildings;<br><br>e. Require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and<br><br>f. Expect all developments to optimise resource efficiency.<br><br>For decentralised energy networks, we will promote decentralised energy by:<br><br>g. Working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them;<br><br>h. Protecting existing decentralised energy networks (e.g. at Gower Street Bloomsbury, Kings Cross, Gospel Oak, and Somers Town) and safeguarding potential network routes; and<br><br>i. Requiring all major developments to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network.<br><br>To ensure that the Council can monitor the effectiveness of renewable and low carbon technologies, major developments will be required to install appropriate monitoring equipment. |
| Policy CC2 Adapting to Climate Change | The Council will require development to be resilient to climate change.<br><br>All development should adopt appropriate climate change adaptation measures such as:<br><br>a. The protection of existing green spaces and promoting new appropriate green infrastructure;<br><br>b. Not increasing, and wherever possible reducing, surface water run-off through increasing permeable surfaces and use of Sustainable Drainage Systems;<br><br>c. Incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and |

| | |
|---|---|
| | d. Measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.<br><br>Any development involving 5 or more residential units of 500sqm or more of any additional floorspace is required to demonstrate the above in a Sustainability Statement.<br><br>Sustainable Design and Construction Measures<br><br>The Council will promote and measure sustainable design and construction by:<br><br>e. Ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation;<br><br>f. Encourage new build residential development to use the Home Quality Mark and Passivhaus design standards;<br><br>g. Encouraging conversions and extensions of 500 sqm of residential floorspace or above or five or more dwellings to achieve "excellent" in BREEAM domestic refurbishment; and<br><br>h. Expecting non-domestic developments of 500sqm of floorspace or above to achieve "excellent" in BREEAM assessments and encouraging zero carbon in new developments from 2019. |

| | |
|---|---|
| Policy CC4 Air quality | The Council will ensure that the impact of development on air quality is mitigated and ensure that exposure to poor air quality is reduced in the borough.<br><br>The Council will take into account the impact of air quality when assessing development proposals, through the consideration of both the exposure of occupants to air pollution and the effect of the development on air quality. Consideration must be taken to the actions identified in the Council's Air Quality Action Plan.<br><br>Air Quality Assessments (AQAs) are required where development is likely to expose residents to high levels of air pollution. Where the AQA shows that a development would cause harm to air quality, the Council will not grant planning permission unless measures are adopted to mitigate the impact. Similarly, developments that introduce sensitive receptors (i.e. housing, schools) in locations of poor air quality will not be acceptable unless designed to mitigate the impact.<br><br>Development that involves significant demolition, construction or earthworks will also be required to assess the risk of dust and emissions impacts in an AQA and include appropriate mitigation measures to be secured in a Construction Management Plan. |

# D. Key Building Regulations Requirements

## Approved Documents 2021

Table Appendix D.1 – Approved Document Part O (2021)

| Document Reference | Details |
|---|---|
| Requirement O1 Overheating mitigation | (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:<br>(a) limit unwanted solar gains in summer<br>(b) provide an adequate means to remove heat from the indoor environment.<br>(2) In meeting the obligations in paragraph (1):<br>(a) limit unwanted solar gains in summer<br>(b) provide an adequate means to remove heat from the indoor environment. |
| Requirement O1(2) (a) Overheating mitigation | (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:<br>(a) limit unwanted solar gains in summer<br>(b) provide an adequate means to remove heat from the indoor environment.<br>(2) In meeting the obligations in paragraph (1):<br>(a) account must be taken of the safety of any occupant, and their reasonable enjoyment of the residence; and<br>(b) mechanical cooling may only be used where insufficient heat is capable of being removed from the indoor environment without it. |
| O1 Section 2: Dynamic thermal modelling | 2.3 To demonstrate compliance using the dynamic thermal modelling method, all of the following guidance should be followed.<br>(a) CIBSE's TM59 methodology for predicting overheating risk<br>(b) The limits on the use of CIBSE's TM59 methodology set out in paragraphs 2.5 and 2.6<br>(c) The acceptable strategies for reducing overheating risk in paragraphs 2.7 to 2.11<br>2.4 The building control body should be provided with a report that demonstrates that the residential building passes CIBSE's TM59 assessment of overheating. This report should contain the details in CIBSE's TM59, section 2.3.<br>2.5 CIBSE's TM59 method requires the modeller to make choices. The dynamic thermal modelling method in this section applies limits to these choices, which are detailed in paragraph 2.6. These limits should be applied when following the guidance in CIBSE's TM59. |
| | 2.6 All of the following limits on CIBSE's TM59, section 3.3, apply.<br>(a) When a room is occupied during the day (8am to 11pm), openings should be modelled to do all of the following:<br>i. Start to open when the internal temperature exceeds 22°C<br>ii. Be fully open when the internal temperature exceeds 26°C<br>iii. Start to close when the internal temperature falls below 26°C<br>iv. Be fully closed when the internal temperature falls below 22°C<br>(b) At night (11pm to 8am), openings should be modelled as fully open if both of the following apply.<br>i. The opening is on the first floor or above and not easily accessible.<br>ii. The internal temperature exceeds 23°C at 11pm.<br>(c) When a ground floor or easily accessible room is unoccupied, both of the following apply.<br>(d) An entrance door should be included, which should be shut all the time. |

# E. The Good Homes Alliance (GHA) "Early-Stage Overheating Risk Tool"

Table Appendix E.1 – Britannia Car Park Development GHA Early-Stage Overheating Risk Tool

## EARLY STAGE OVERHEATING RISK TOOL

Version 1.0, July 2019

This tool provides guidance on how to assess overheating risk in residential schemes at the early stages of design. It is specifically a pre-detail design assessment intended to help identify factors that could contribute to or mitigate the likelihood of overheating.

The questions can be answered for an overall scheme or for individual units. Score zero wherever the question does not apply. Additional information is provided in the accompanying guidance, with examples of scoring and advice on next steps.

Find out more information and download accompanying guidance at goodhomes.org.uk/overheating-in-new-homes.

Good Homes Alliance

### Geographical and local context

| KEY FACTORS INCREASING THE LIKELIHOOD OF OVERHEATING | Option | Score |
|---|---|---|
| **#1 Where is the scheme in the UK?** See guidance for map | South east | 4 |
| | Northern England, Scotland & NI | 0 |
| | Rest of England and Wales | 0 |
| **#2 Is the site likely to see an Urban Heat Island effect?** See guidance for details | Central London (see guidance) | 3 |
| | Grtr London, Manchester, B'ham | 0 |
| | Other cities, towns & dense sub-urban areas | 0 |

| KEY FACTORS REDUCING THE LIKELIHOOD OF OVERHEATING | Score |
|---|---|
| **#8 Do the site surroundings feature significant blue/green infrastructure?** Proximity to green spaces and large water bodies has beneficial effects on local temperatures; as guidance, this would require at least 50% of surroundings within a 100m radius to be blue/green, or a rural context | 0 |

### Site characteristics

| KEY FACTORS INCREASING THE LIKELIHOOD OF OVERHEATING | Option | Score |
|---|---|---|
| **#3 Does the site have barriers to windows opening?** - Noise/Acoustic risks - Poor air quality/smells e.g. near factory or car park or very busy road - Security risks/crime - Adjacent to heat rejection plant | **Day** - reasons to keep all windows closed | 8 |
| | **Day** - barriers some of the time, or for some windows e.g. on quiet side | 0 |
| | **Night** - reasons to keep all windows closed | 8 |
| | **Night** - bedroom windows OK to open, but other windows are likely to stay closed | 0 |

| KEY FACTORS REDUCING THE LIKELIHOOD OF OVERHEATING | Score |
|---|---|
| **#9 Are immediate surrounding surfaces in majority pale in colour, or blue/green?** Lighter surfaces reflect more heat and absorb less so their temperatures remain lower; consider horizontal and vertical surfaces within 10m of the scheme | 1 |
| **#10 Does the site have existing tall trees or buildings that will shade solar-exposed glazed areas?** Shading onto east, south and west facing areas can reduce solar gains, but may also reduce daylight levels | 1 |

### Scheme characteristics and dwelling design

| KEY FACTORS INCREASING THE LIKELIHOOD OF OVERHEATING | Score |
|---|---|
| **#4 Are the dwellings flats?** Flats often combine a number of factors contributing to overheating risk e.g. dwelling size, heat gains from surrounding areas; other dense and enclosed dwellings may be similarly affected - see guidance for examples | 3 |
| **#5 Does the scheme have community heating?** i.e. with hot pipework operating during summer, especially in internal areas, leading to heat gains and higher temperatures | 3 |

| KEY FACTORS REDUCING THE LIKELIHOOD OF OVERHEATING | Option | Score |
|---|---|---|
| **#11 Do dwellings have high exposed thermal mass AND a means for secure and quiet night ventilation?** Thermal mass can help slow down temperature rises, but it can also cause properties to be slower to cool, so needs to be used with care - see guidance | | 1 |
| **#12 Do floor-to-ceiling heights allow ceiling fans, now or in the future?** Higher ceilings increase stratification and air movement, and offer the potential for ceiling fans | >2.8m and fan installed | 0 |
| | > 2.8m | 0 |

### Solar heat gains and ventilation

| KEY FACTORS INCREASING THE LIKELIHOOD OF OVERHEATING | Option | Score |
|---|---|---|
| **#6 What is the estimated average glazing ratio for the dwellings?** (as a proportion of the facade on solar-exposed areas i.e. orientations facing east, south, west, and anything in between). Higher proportions of glazing allow higher heat gains into the space | >65% | 0 |
| | >50% | 0 |
| | >35% | 0 |
| **#7 Are the dwellings single aspect?** Single aspect dwellings have all openings on the same facade. This reduces the potential for ventilation | Single-aspect | 3 |
| | Dual aspect | 0 |

| KEY FACTORS REDUCING THE LIKELIHOOD OF OVERHEATING | Option | Full | Part |
|---|---|---|---|
| **#13 Is there useful external shading?** Shading should apply to solar exposed (E/S/W) glazing. It may include shading devices, balconies above, facade articulation etc. See guidance on "full" and "part". Scoring depends on glazing proportions as per **#6** | >65% | 6 | 0 |
| | >50% | 0 | 0 |
| | >35% | 0 | 0 |

| KEY FACTORS REDUCING THE LIKELIHOOD OF OVERHEATING | Openings compared to Part F purge rates | = Part F | +50% | +100% |
|---|---|---|---|---|
| **#14 Do windows & openings support effective ventilation?** Larger, effective and secure openings will help dissipate heat - see guidance | Single-aspect | minimum required | 0 | 0 |
| | Dual aspect | minimum required | 0 | 0 |

| TOTAL SCORE | | Sum of contributing factors: | | Sum of mitigating factors: |
|---|---|---|---|---|
| 23 | = | 32 | minus | 9 |

High — 12 — Medium — 8 — Low

| score >12: | score between 8 and 12: | score <8: |
|---|---|---|
| Incorporate design changes to reduce risk factors and increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59) | Seek design changes to reduce risk factors and/or increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59) | Ensure the mitigating measures are retained, and that risk factors do not increase (e.g. in planning conditions) |

This tool is intended for use at the early design stages of new residential development in order to identify key factors contributing to overheating risk, and possible mitigation measures.

The scoresheet consists of 14 questions split into two categories of 7 key overheating risks and 7 possible mitigation measures.

1. Where is the scheme in the UK?

The site is located in London, Southeast England with an associated risk score of 4 points.

2. Is the site likely to see an urban heat island effect?

The site is subject to the urban heat island effect according to the Overheating in New Homes Guidance provided by GHA. The scoring of 3 points has been assigned accordingly to the Borough (Camden) associated with term of "central London".

3. Does the site have barriers to windows opening?

The nearby train lines represent an increased exposure to noise levels. An acoustic report carried out by WSP highlights that the noise limits are exceeded during both nighttime and daytime. Hence the score associated with the window restrictions is 8 for both day and night.

4. Are the dwellings flats?

The "dwellings" of this scheme are associated with purpose-built student accommodation studios. The smaller size, denser occupation, and fewer opportunities for cross ventilation makes them more prone to overheating. Subsequently the scheme has been awarded 3 points.

5. Does the scheme have community heating?

The scheme has a centralised heating system for both space and domestic hot water. The centralised systems contribute to the overheating risks through heat gains associated with the distribution pipework, potential heat interface units and lack of individual controls. Hence the

For simplicity and because this tool is used at the early design stages, an overall risk factor of 3 is attributed; however, risks will vary depending on the configuration of the heating distribution and building; in particular, they will be higher if distribution pipework runs in internal spaces.

6. What is the estimated average glazing ratio for the dwellings? (as a proportion of the façade)

For the purposes of analysing the overheating risks to the residential living spaces (studios, living/ kitchen areas), the ground floor facades have been excluded from the measurement.

Table Appendix E.2 – Estimated Percentages of Glazing (01-Top Floor)

| Elevation Type Required | Total Wall Area (m$^2$) | Total Glazing Area | Percentage |
|---|---|---|---|
| West Elevation | 924 | 220 | 24% |
| South Elevation | 270 | 47 | 17% |
| East Elevation | 231 | 55 | 24% |
| Average Percentage | | | 22% (less than 35%) |

7. Are the dwellings single aspect?

The majority of studios have all windows on the same façade; hence 3 risk points are allocated.

8. Do the site surroundings feature significant blue/green infrastructure?

There is less than 50% green/blue infrastructure present within an 100m radius on the proposed site, therefore no mitigation scoring can be attributed.

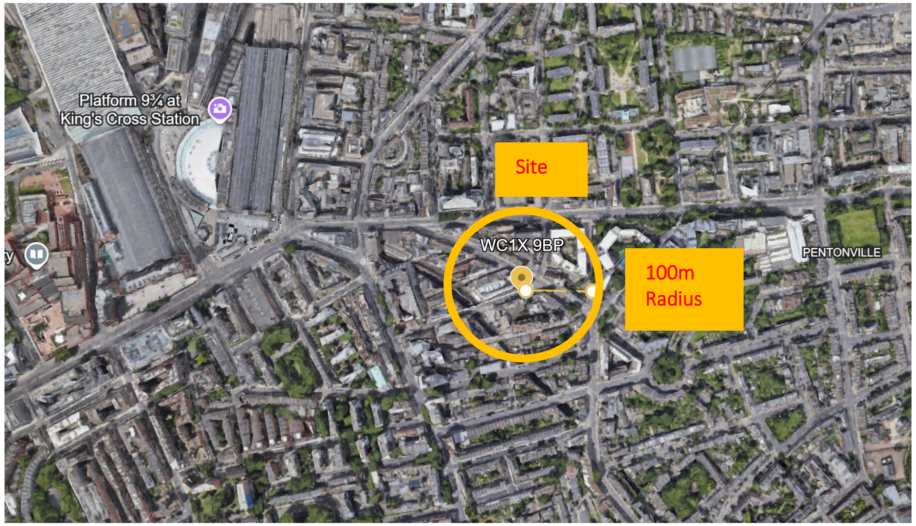



Figure E.1 – Satellite View (Google Earth) Image to Help Score Question 8

9. Are immediate surrounding surfaces in majority light in colour or blue/ green?

Figure E.2 – Satellite View (Google Earth) Images Showing Hard Surfaces and Cladding Within 10m of the Proposed Building to Help Score Question 9

The surrounding hard surfaces within 10m of the proposed building have pale colours scoring one point for question 9.

10. Does the site have existing tall trees or buildings that will shade solar exposed glazing areas?

On the site there are buildings that are at least the same height varying between circa 20 -40m height as the glazed areas of the residential spaces assessed, scoring one additional mitigation point.

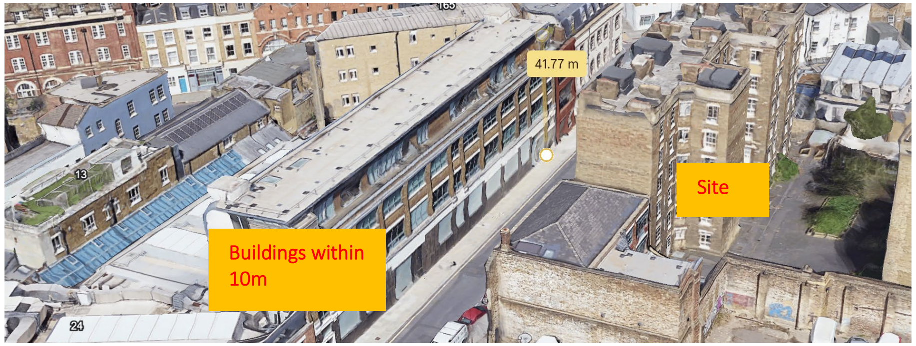



Figure E.3 – Satellite View (Google Earth) Image Showing Surrounding Buildings' Heights to Help Score Question 10

11. Do dwellings have high exposed thermal mass and a means for secure and quiet night ventilation?

The proposed construction contains high thermal mass elements such as concrete slabs and external wall blockwork.

12. Do floor-to-ceiling heights allow ceiling fans, now or in the future?

The floor to ceiling height is circa 2.5 lower than the minimum value of 2.8 m to ensure scoring under this section.


Figure E.1 – Early Design Section Showing Floor-to-ceiling Heights Produced by Sheppard Robson Architects

13. Is there useful external shading?

The proposed shading devices (architectural grid and vertical fins) are assumed to provide full shading as they affect all windows.

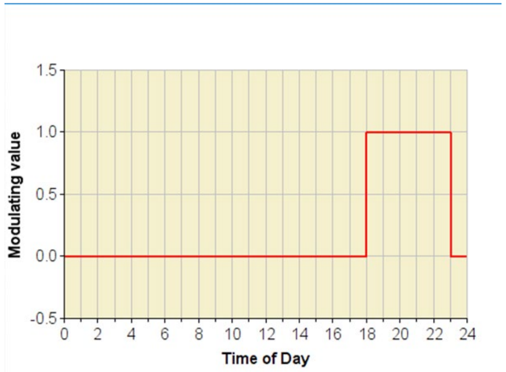
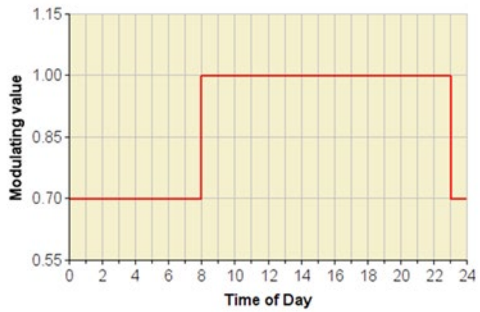
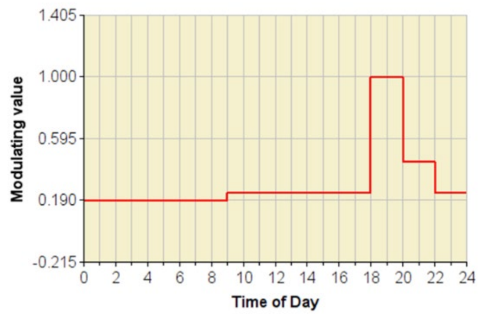
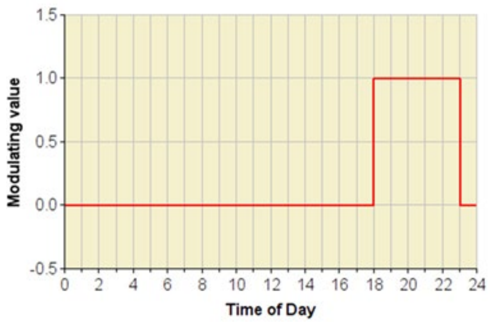
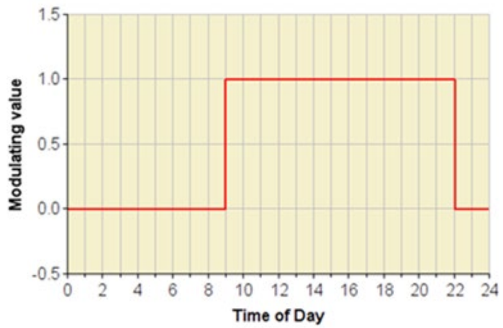
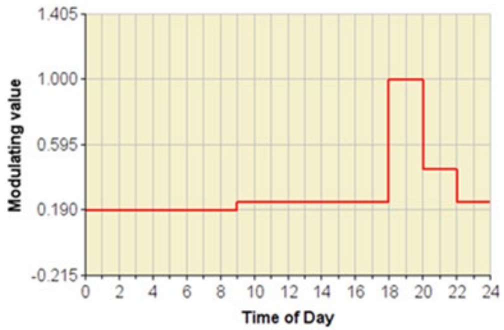
14. Do windows and openings support effective ventilation?

The noise restrictions do not support the use of natural ventilation via openable windows.

# F. Input Data

## Internal Gains

Table Appendix F.1 – IES Lighting, Occupancy and Equipment Profiles Operational Schedules

| Thermal Templates | Lighting Weekly Profile | Occupancy Weekly Profile | Equipment Weekly Profile |
|---|---|---|---|
| Studio |  |  |  |
| 3-Bedroom Apartment: Living Room/Kitchen |  |  |  |

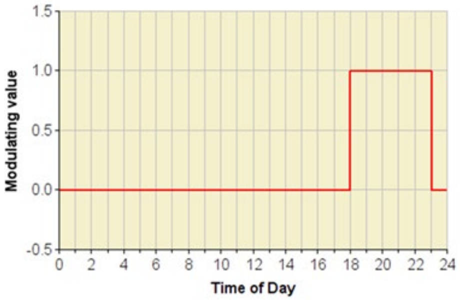
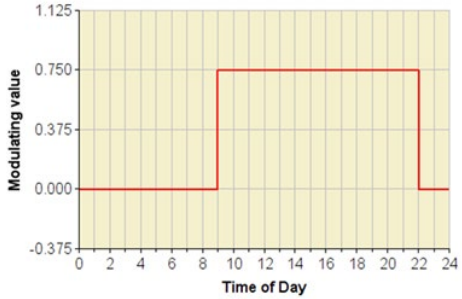
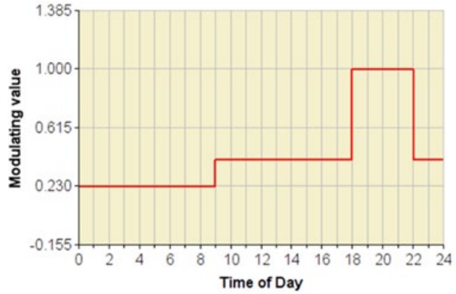
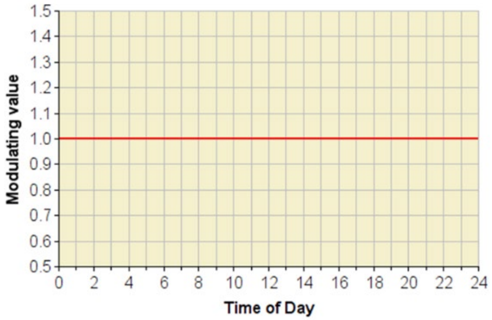
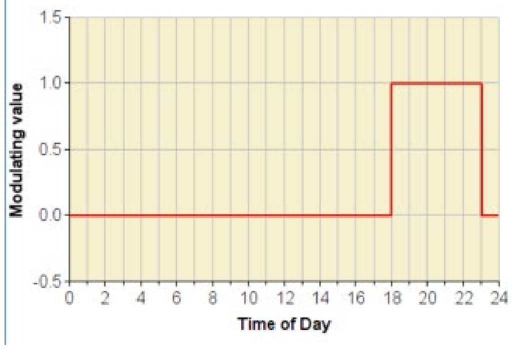
| | | | |
|---|---|---|---|
| 3-Bedroom Apartment: Living Room |  |  |  |
| Communal Corridors |  | N/A | N/A |
| Bathroom |  | | |
| Amenity Space, Reception, Study Spaces, Laundry | As per NCM Database predefined profiles | | |

Table Appendix F.2 – IES Occupancy Internal Gains as per CIBSE TM59 Methodology (For the Residential Living Spaces)

| Thermal Template Space Type | Maximum Sensible Gain (W/person) | Maximum Latent Gain (W/person) | Occupancy Density |
|---|---|---|---|
| Studio | 75 | 55 | 1 person at 70% gains from 11 pm to 8 am |
| 3-Bedroom Apartment: Living Room/Kitchen | 75 | 55 | 3 people from 9 am to 10 pm; room is unoccupied for the rest of the day |
| 3-Bedroom Apartment: Living Room | 75 | 55 | 3 people at 5% gains from 9 am to 10 pm; room is |
| 3-Bedroom Apartment: Kitchen | 75 | 55 | 3 people at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day |
| Communal Corridors | Assumed to be zero | | Pipework heat gains and lighting heat gains only (At least one corridor should be included in the assessment if the corridors contain community heating distribution pipework.) |

Table Appendix F.3 – IES Occupancy Internal Gains as per the NCM Profiles (For the Amenities)

| Thermal Template Space Type | Maximum Sensible Gain (W/person) | Maximum Latent Gain (W/person) | Occupancy Density |
|---|---|---|---|
| Plant Room | 90 | 90 | 9.091$m^2$/ person |
| Study Spaces/ Office (x7) | 73 | 50 | 9.709 $m^2$ / person |
| Reception (x2) | 85.4 | 54.6 | 8.658$m^2$/ person |
| Laundry (x1) | 90 | 90 | 8.264$m^2$/ person |
| Amenities (x7) | 61 | 39 | 8.759$m^2$/ person |

Table Appendix F.4 – IES Lighting Internal Gains as per the NCM Profiles (For the Amenities)

| Thermal template space type | Minimum-Maximum Illuminance (Lux) | Maximum Sensible Gain ($W/m^2$) | Maximum Power Consumption ($W/m^2$) |
|---|---|---|---|
| Plant Room | 200 | 7.5 | 7.5 |
| Study Spaces/ Office (x7) | 300 | 11.250 | 11.250 |
| Reception (x2) | 300 | 15.6 | 15.6 |
| | Display Light | 9 | 9 |
| Laundry (x1) | 300 | 15.6 | 15.6 |
| Amenities (x7) | 200 | 10.4 | 10.4 |

Table Appendix F.5 – IES – Equipment Internal Gains as per CIBSE TM59 Methodology (For the Residential Living Spaces)

| Thermal Template Space Type | Maximum Sensible Gain (Watts) | Maximum Power Consumption (Watts) |
|---|---|---|
| Studio | 450 | 450 |
| 3-Bedroom Apartment: Living Room/Kitchen | 450 | 450 |
| 3-Bedroom Apartment: Living Room | 150 | 150 |
| 3-Bedroom Apartment: Kitchen | 300 | 300 |

Table Appendix F.6 – IES Equipment Internal Gains as per the NCM Profiles (For the Amenities)

| Thermal Template Space Type | Maximum Sensible Gain ($W/m^2$) | Maximum Power Consumption |
|---|---|---|
| Plant Room | 50 | 50 |
| Study Spaces/ Office (x7) | 11.90 | 11.90 |
| Reception (x2) | 5.59 | 5.59 |
| Laundry (x1) | 52.01 | 54.75 |
| Amenities (x7) | 5.27 | 5.27 |

## Comfort Parameters

Table Appendix F.7 – Comfort Parameters Input as per CIBSE Guide A

| Thermal Template Space Type | Metabolic Rate (MET) Description | Metabolic Rate Value (MET) Winter | Metabolic Rate Value (MET) Summer | **Minimum Clothing Winter (Min. CLO)** | **Maximum Clothing Summer (Max. CLO)** | Nominal Air Supply Rate |
|---|---|---|---|---|---|---|
| Studio | Sleeping/ Seated at rest | 0.9 | 0.9 | 2.5 | 1.2 | 0.4-1 ACH |
| 3-Bedroom Apartment: Living Room/Kitchen | Very light work | 1.1 | 1.1 | 1 | 0.6 | 0.4-1 ACH |
| 3-Bedroom Apartment: Living Room | Seated/ at rest | 1.1 | 1.1 | 1 | 0.6 | 0.4-1 ACH |
| 3-Bedroom Apartment: Kitchen | Very light work | 1.6 | 1.5 | 1 | 0.5 | 60L/s |
| Circulation Area | Very light movement | 1.4 | 1.3 | 1 | 0.6 | 10L/s |
| Plant Room | | | | | | |
| Study Spaces/ Office (x7) | Seated/ at rest | 1.2 | 1.2 | 0.9 | 0.7 | 10L/s |
| Reception (x2) | Very light movement | 1.3 | 1.4 | 1 | 0.6 | 10L/s |
| Laundry (x1) | Very light movement | 1.6 | 1.4 | 1.2 | 0.6- | 10L/s |
| Amenities (x7) | - | - | - | - | - | 10L/s |

# G. Results

## CIBSE TM59 Assessment Results

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 DT 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). 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.

Table Appendix G.1 – CIBSE TM59 Assessment Results for the Residential Spaces (Studios, Living Rooms, and Kitchenettes)

| Iteration Number | Description | Weather File Applied | Ventilation Strategy | Shading Device | Natural Ventilation Criteria | | Mechanical Ventilation Criteria | Summary Sitewide PASS & FAIL Results | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Total Studios and Living Spaces Analysed = 123 | | Total Corridors Analysed = 24 |
| | | | | | No. of Rooms Failing Criterion (a) | No. of Rooms Failing Criterion (b) | | Total Residential Spaces Sitewide (FAIL) | Total Residential Spaces Sitewide (PASS) | Corridors PASS/ TOTAL |
| **No Noise Restrictions Applied** | | | | | | | | | | |
| Iteration 1A | Baseline – Passive Design Test 1 | London_LWC_2020_DSY1 | Passive ventilation via side hung 90% openable windows at 90 degree opening angle; All windows open during both nighttime and daytime when the operative temperature exceeds 22°C. | None | 5 | 1 | N/A | 5 / 123 | 118 / 123 | 21/ 24 |
| Iteration 2A | Passive Design Test 2 | London_LWC_2020_DSY1 | Passive ventilation via side hung 90% openable windows at 90 degree opening angle; All windows open during both nighttime and daytime when the operative temperature exceeds 22°C. | Architectural shading elements as per the latest proposed architectural drawings (overhangs and fins) | 2 | 1 | N/A | 2 / 123 | 121/123 | 22/24 |
| Partial Noise Restrictions Applied (Noise Restrictions during Nighttime Only between 11PM and 7AM) | | | | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Iteration 3A | Passive Design Test 3 | London_LWC_2020_DSY1 | Passive ventilation via side hung 90% openable windows at 90 degree opening angle; All windows open during only during daytime (between 7AM and 11PM) when the operative temperature exceeds 22°C .and shut during nighttime (between sleeping hours between 11PM and 7AM) | Architectural shading elements as per the latest proposed architectural drawings (overhangs and fins) | 2 | 119 | N/A | 121/ 123 | 2 / 123 | 8 / 24 |
| Noise Restrictions Applied for Both Nighttime and Daytime in line with the Acoustic Report provided by WSP | | | | | | | | | | |
| Iteration 4A | Passive Design Test 4 | London_LWC_2020_DSY1 | Infiltration rate applied; Windows closed at all times. | Architectural shading elements as per the latest architectural drawings (overhangs and fins) | 123 | 122 | N/A | 123 / 123 | 0 / 123 | 0 / 24 |
| Iteration 5A | Mechanical Ventilation Test 1 | London_LWC_2020_DSY1 | Infiltration rate applied; Windows closed at all times.<br>Mechanical ventilation with 2ACH applied in studios, and living/kitchen areas as well as in the communal corridors; Door open between Ensuite and studio | Architectural shading elements as per the latest architectural drawings (overhangs and fins) | N/A | N/A | Applied | 118/ 123 | 5 / 123<br>03_Studio_20, 04_Studio_20, 05_Studio_19, 06_Studio_19, 01_Studio_01 | 8 / 24 |
| Iteration 6A | Mechanical Ventilation Test 2 | London_LWC_2020_DSY1 | Infiltration rate applied; Windows closed at all times.<br>Mechanical ventilation with 3ACH applied in studios, and living/kitchen areas as well as in the communal corridors; Door open between Ensuite and studio | Architectural shading elements as per the latest architectural drawings (overhangs and fins) | N/A | N/A | Applied | 116 / 123 | 7 / 123<br>00_Comms Room_01<br>02_Studio_20; 03_Studio_20, 04_Studio_20, 05_Studio_19, 06_Studio_19, 01_Studio_01 | 24 / 24 |
| Iteration 7A | Mechanical Ventilation Test 3 | London_LWC_2020_DSY1 | Infiltration rate applied; Windows closed at all times.<br>Mechanical ventilation with 3ACH with cooling booster enhancement applied in studios, and living/kitchen areas as well as in the communal corridors; Door open between Ensuite and studio | Architectural shading elements as per the latest architectural drawings (overhangs and fins) | N/A | N/A | Applied | | | |
| Iteration 8A | Active Cooling Test 1 | London_LWC_2020_DSY1 | Infiltration rate applied; Windows closed at all times. | Architectural shading elements as per the latest | N/A | N/A | Applied | 0 /123 | 123 / 123 | 24 / 24 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mechanical ventilation with 3ACH in the communal corridors.<br><br>Comfort cooling applied in studios, and living/kitchen areas. | architectural drawings (overhangs and fins) | | | | | | |
| Iteration 9A | Active Cooling Test 2 | London_LWC_2020_DSY2<br><br>(Extreme Summer DSY2) | Infiltration rate applied; Windows closed at all times.<br><br>Mechanical ventilation with 3ACH in the communal corridors.<br><br>Comfort cooling applied in studios, and living/kitchen areas. | Architectural shading elements as per the latest architectural drawings (overhangs and fins) | N/A | N/A | Applied | 0 /123 | 123 / 123 | 8 / 24 |
| Iteration 10A | Active Cooling Test 3 | London_LWC_2020_DSY2<br><br>(Extreme Summer DSY2) | Infiltration rate applied; Windows closed at all times.<br><br>Comfort cooling applied in studios, and living/kitchen areas as well as in the communal corridors. | Architectural shading elements as per the latest architectural drawings (overhangs and fins) | N/A | N/A | Applied | 0 / 123 | 123 / 123 | 24 / 24 |
| Iteration 11A | Active Cooling Test 4 | London_LWC_2020_DSY3<br><br>(Extreme Summer DSY3) | Infiltration rate applied; Windows closed at all times.<br><br>Comfort cooling applied in studios, and living/kitchen areas as well as in the communal corridors. | Architectural shading elements as per the latest architectural drawings (overhangs and fins) | N/A | N/A | Applied | 0 / 123 | 123 / 123 | 24 / 24 |
| Iteration 12A | Active Cooling Test 5 | London_LWC_2050_DSY1<br><br>(Future Weather File) | Infiltration rate applied; Windows closed at all times.<br><br>Comfort cooling applied in studios, and living/kitchen areas as well as in the communal corridors. | Architectural shading elements as per the latest architectural drawings (overhangs and fins) | N/A | N/A | Applied | 0 / 123 | 123 / 123 | 24 / 24 |

## CIBSE TM52 Assessment

Table Appendix G.2 – CIBSE TM52 CIBSE TM52 Assessment for the Amenity Spaces to the Ground Floor (Amenity Spaces, Reception, Laundry, and Office Spaces)

| Iteration Number | Description | Weather File Applied | Ventilation Strategy | Shading Device | CIBSE TM52 Assessment | | | Natural Ventilation Criteria | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | **No. of Rooms Failing Criterion (1)** | **No. of Rooms Failing Criterion (2)** | **No. of Rooms Failing Criterion (3)** | **Total Amenity Spaces Sitewide (FAIL)** | **Total Amenity Spaces Sitewide (PASS)** |
| **No Noise Restrictions Applied – Safety Measures Applied as per ADO for the Ground Floor Areas** | | | | | | | | | |
| Iteration 1B | Baseline – Passive Design Test 1 | London_LWC_2020_DSY1 | Majority of spaces have fixed panels within the curtain wall as per the architectural drawings.<br><br>The external doors are modelled as open only during the daytime for security reasons when the temperature exceeds 22°C. | None | 14 | 14 | 12 | 17 / 17 | 0 / 17 |
| Iteration 2B | Passive Design Test 2 | London_LWC_2020_DSY1 | Majority of spaces have fixed panels within the curtain wall as per the architectural drawings.<br><br>The external doors are modelled as open only during the daytime for security reasons when the temperature exceeds 22°C. | Architectural shading elements as per the latest proposed architectural drawings (overhangs and fins) | 14 | 12 | 12 | 15 / 17 | 2 /17 |
| Noise Restrictions Applied for Both Nighttime and Daytime in line with the Acoustic Report provided by WSP | | | | | | | | | |
| Iteration 3B | Passive Design Test 4 | London_LWC_2020_DSY1 | Infiltration rate applied; Windows and doors closed at all times. | Architectural shading elements as per the latest architectural drawings (overhangs and fins) | 15 | 15 | 14 | 17 / 17 | 0 / 17 |
| Iteration 4B | Mechanical Ventilation Test 1 | London_LWC_2020_DSY1 | Infiltration rate applied; Windows closed at all times.<br><br>Mechanical ventilation with 2ACH applied in all occupied spaces. | Architectural shading elements as per the latest architectural drawings (overhangs and fins) | 12<br><br>00_Amenity_01<br>00_Laundry_01<br>01_Reception_01<br>05_Study Space_02 | 12<br><br>00_Amenity_01<br>00_Laundry_01<br>01_Reception_01<br>05_Study Space_02 | 8<br><br>00_Amenity_01<br>00_Laundry_01<br>01_Reception_01<br>07_Amenity_01<br>00_Amenity_02<br>00_Amenity_03 | 12 / 17 | 5 / 17 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 05_Study Space_01<br>06_Study Space_01<br>06_Study Space_02<br>07_Amenity_01<br>00_Amenity_02<br>00_Amenity_03<br>00_Amenity_04<br>00_Amenity_05 | 05_Study Space_01<br>06_Study Space_01<br>06_Study Space_02<br>07_Amenity_01<br>00_Amenity_02<br>00_Amenity_03<br>00_Amenity_04<br>00_Amenity_05 | 00_Amenity_04<br>00_Amenity_05 | | |
| Iteration 5 | Mechanical Ventilation Test 2 | London_LWC_2020_DSY1 | Infiltration rate applied; Windows closed at all times.<br>Mechanical ventilation with 3ACH applied in all occupied spaces. | Architectural shading elements as per the latest architectural drawings (overhangs and fins) | 5<br>00_Amenity_01<br>00_Laundry_01<br>01_Reception_01<br>05_Study Space_02<br>07_Amenity_01 | 5<br>00_Amenity_01<br>00_Laundry_01<br>01_Reception_01<br>05_Study Space_02<br>07_Amenity_01 | 4<br>00_Amenity_01<br>00_Laundry_01<br>01_Reception_01<br>07_Amenity_01 | 5 / 17 | 12 / 17 |
| Iteration 7B | Mechanical Ventilation Test 3 | London_LWC_2020_DSY1 | Infiltration rate applied; Windows closed at all times.<br>Mechanical ventilation with 3ACH with cooling booster enhancement applied in all occupied spaces. | Architectural shading elements as per the latest architectural drawings (overhangs and fins) | 3<br>00_Amenity_01<br>00_Laundry_01<br>01_Reception_01 | 3<br>00_Amenity_01<br>00_Laundry_01<br>01_Reception_01 | 3<br>00_Amenity_01<br>00_Laundry_01<br>01_Reception_01 | 3 / 17 | 14 / 17 |
| Iteration 8B | Active Cooling Test 1 | London_LWC_2020_DSY1 | Infiltration rate applied; Windows closed at all times.<br>Comfort cooling applied in all occupied spaces. | Architectural shading elements as per the latest architectural drawings (overhangs and fins) | - | - | - | 0 / 17 | 17 / 17 |
| Iteration 9B | Active Cooling Test 2 | London_LWC_2020_DSY2<br>(Extreme Summer DSY2) | Infiltration rate applied; Windows closed at all times.<br>Comfort cooling applied in all occupied spaces. | Architectural shading elements as per the latest architectural drawings (overhangs and fins) | - | - | - | 0 / 17 | 17 / 17 |
| Iteration 11B | Active Cooling Test 4 | London_LWC_2020_DSY3<br>(Extreme Summer DSY3) | Infiltration rate applied; Windows closed at all times.<br>Comfort cooling applied in all occupied spaces. | Architectural shading elements as per the latest architectural drawings (overhangs and fins) | - | - | - | 0 / 17 | 17 / 17 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Iteration 12B | Active Cooling Test 5 | London_LWC_2050_DSY1<br><br>(Future Weather File) | Infiltration rate applied; Windows closed at all times.<br><br>Comfort cooling applied in all occupied spaces. | Architectural shading elements as per the latest architectural drawings (overhangs and fins) | - | - | - | 0 / 17 | 17 / 17 |

# H. General Notes

The report is based on information available at the time of the writing and discussions with the client during any project meetings. Where any data supplied by the client or from other sources have been used it has been assumed that the information is correct. No responsibility can be accepted by Ensphere Group Ltd for inaccuracies in the data supplied by any other party.

The review of planning policy and other requirements does not constitute a detailed review. Its purpose is as a guide to provide the context for the development and to determine the likely requirements of the Local Authority.

No site visits have been carried out, unless otherwise specified.

This report is prepared and written in the context of an agreed scope of work and should not be used in a different context. Furthermore, new information, improved practices and changes in guidance may necessitate a re-interpretation of the report in whole or in part after its original submission.

The copyright in the written materials shall remain the property of Ensphere Group Ltd but with a royalty-free perpetual licence to the client deemed to be granted on payment in full to Ensphere Group Ltd by the client of the outstanding amounts.

The report is provided for sole use by the Client and is confidential to them and their professional advisors. No responsibility whatsoever for the contents of the report will be accepted to any person other than the client, unless otherwise agreed.

These terms apply in addition to the Ensphere Group Ltd "Standard Terms of Business" (or in addition to another written contract which may be in place instead thereof) unless specifically agreed in writing. (In the event of a conflict between these terms and the said Standard Terms of Business the said Standard Terms of Business shall prevail.). In the absence of such a written contract the Standard Terms of Business will apply.

ensphere

www.enspheregroup.com

+44 (0) 20 7846 9040

United Kingdom | 55A Catherine Place, London, SW1E 6DY

España | Oficina 35, Centro de Negocios Independencia Cn, Paseo de la Independencia, 8 Duplicado, 50004 Zaragoza