FUTURA BRIGHT
SHAPING A SUSTAINABLE FUTURE

# Navigating
# **Approved Document O**
# **Overheating Regulations**
# e-Guide

# Contents





**Approved Document O**

Overheating

# Introduction

Over the past few decades, regulations in the UK have heavily focussed on the emissions associated with heating and conditioning of buildings as part of the roadmap to Net Zero Carbon by 2050. This has predominantly been through gradual improvements to Part L of the Building Regulations.

This requirement for lowering emissions associated with heating, lighting, ventilation and the provision of hot water has resulted in a substantial increase in the level of insulation installed and a reduction in the level of air infiltration within conditioned spaces.

As a consequence, this caused many buildings to suffer from overheating during the summer months due to the increase in heat retention, and the ability for this to be purged to outside.

Previously a 'nice to have' item, Building Regulations Approved Document O has been brought in to make this a mandatory compliance requirement.

The Approved Document requires house builders to take steps to reduce overheating in new homes to protect the health and welfare of occupants and this should be addressed through the adoption of maximum window and opening sizes, or through dynamic modelling.

Developers are advised to consider overheating and energy advice early in the design process, ideally before planning submission, because it can impact the appearance of façades, especially glazing.

This e-Guide covers the key features of the newly introduced Part O.

## Key problems

- Dwellings have become more insulated, more airtight, and more densely packed
- The installation of communal heating is more prominently resulting in additional heat gains
- The rise in single aspect dwellings means no cross ventilation
- With the insulation requirements increasing, overheating needed to be addressed too
- For dwellings, these have been historically assessed under SAP (Part L) modelling with a simple calculation

# Our expertise

**As a leading provider of sustainability services, Futura Bright partners with its sister company Cooper Homewood, a firm of Building Services Engineering Consultants, to deliver comprehensive guidance on compliance with Part O of the Building Regulations.**

**Our team of Building Physics Consultants is equipped with deep expertise in thermal comfort, energy efficiency, and indoor environmental quality, crucial for addressing overheating issues in modern building design.**

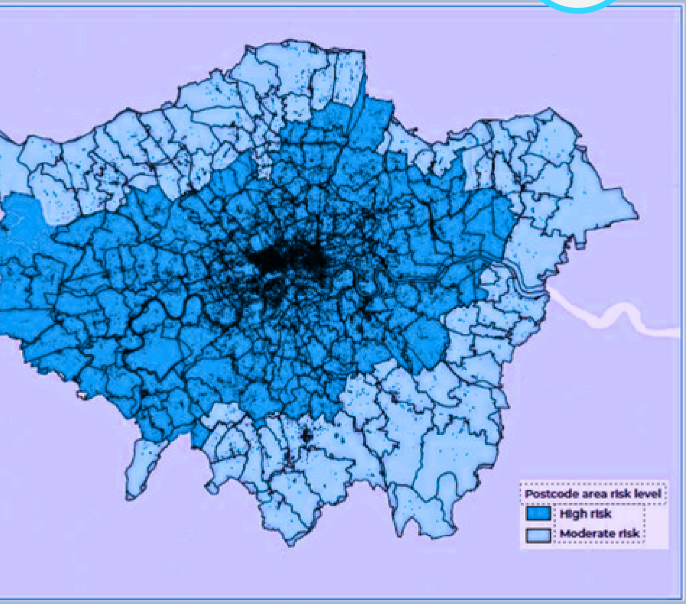
**With access to specialised tools and resources, we ensure that our advice is both practical and aligned with the latest standards, providing our clients with actionable solutions to meet regulatory requirements effectively.**

# Routes to compliance Simple Assessment

This assessment type is expected to be undertaken within the new SAP software (although not available at present) and will be based on window opening sizes and orientation. There will be two key criteria in this assessment, namely the opening size and the free opening area.

Geographical areas have been split into high risk and moderate risk areas and have been further divided into buildings with cross-ventilation, or without cross-ventilation. Corner apartments or dwellings would fall under buildings without cross ventilation.

**Overheating risk at postcode level in high risk part of London.** Darker colours represent higher risk




## Risk of overheating

- Moderate Risk include all parts of England, excluding those listed as 'high'
- High Risk include areas of Central London and Manchester
- Specific postcodes are given within Approved Document O

High Risk locations must provide shading to glazed areas between north-east and north-west (via south) through either of the following:

- External Shutters with means of ventilation
- Glazing with max G-Value 0.4, Min. LT of 0.7, or
- Overhangs with 50 degrees cut-off on due south facades only

Based upon whether the dwelling is considered moderate or high risk, glazing areas are restricted as follows:

| Limiting solar gains for buildings or parts of buildings with cross-ventilation | | | | |
|---|---|---|---|---|
| High risk | | | Moderate risk | |
| Largest glazed facade orientation | Max area of glazing (% FA of dwelling) | Max area of glazing in most glazed room (% FA of room) | Max area of glazing (% FA of dwelling) | Max area of glazing in most glazed room (% FA of room) |
| North | 15 | 37 | 18 | 37 |
| East | 18 | 37 | 18 | 37 |
| South | 15 | 22 | 15 | 30 |
| West | 18 | 37 | 11 | 22 |

| Limiting solar gains for buildings or parts of buildings without cross-ventilation | | | | |
|---|---|---|---|---|
| Largest glazed facade orientation | Max area of glazing (% FA of dwelling) | Max area of glazing in most glazed room (% FA of room) | Max area of glazing (% FA of dwelling) | Max area of glazing in most glazed room (% FA of room) |
| North | 15 | 25 | 18 | 26 |
| East | 11 | 18 | 18 | 26 |
| South | 11 | 11 | 15 | 15 |
| West | 11 | 18 | 11 | 11 |

Cross ventilation defined as having openings on opposite elevations. Corner apartments will not meet this criteria.

Similar restrictions are imposed on minimum opening areas as follows:

**Minimum free areas for buildings or parts of buildings with cross-ventilation**

| | High risk | Moderate risk |
|---|---|---|
| Total minimum free area | The greater of the following:<br>• 6% of floor area<br>• 70% of glazing area | The greater of the following:<br>• 9% of floor area<br>• 55% of glazing ara |
| Bedroom minimum free area | 13% of floor area of the room | 4% of floor area of the room |

**Minimum free areas for buildings or parts of buildings without cross-ventilation**

| | High risk | Moderate risk |
|---|---|---|
| Total minimum free area | The greater of the following:<br>• 10% of floor area<br>• 95% of glazing area | The greater of the following:<br>• 9% of floor area<br>• 55% of glazing area |
| Bedroom minimum free area | 13% of the floor area of the room | 4% of the floor area of the room |

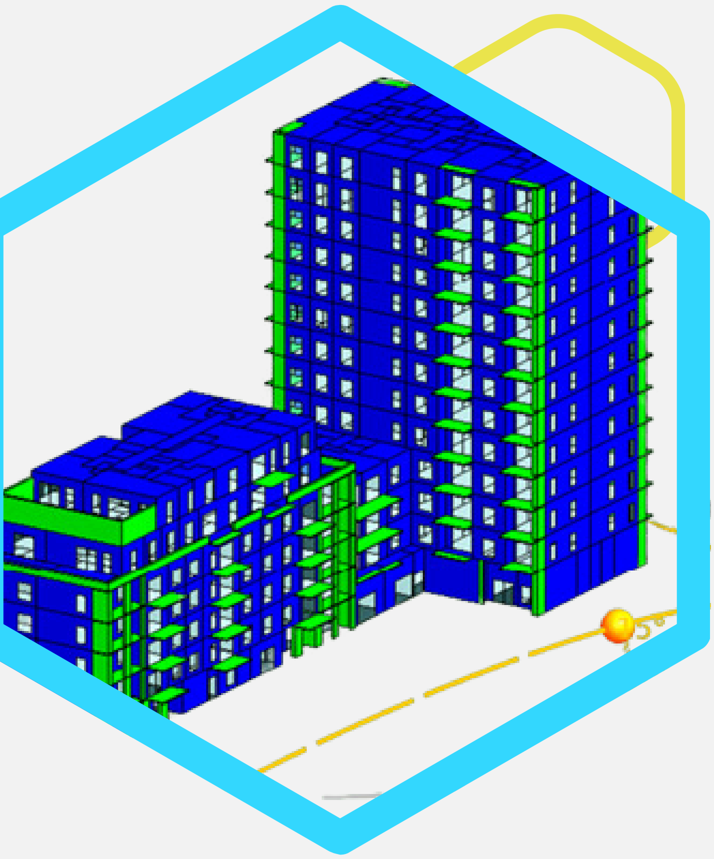
'Free opening area' is clearly defined within **Approved Document O**

# Routes to compliance

## Dynamic Assessment

Upon initial review it appears the simplified method is extremely restrictive on window sizes and opening areas.

An alternative method is to perform a dynamic assessment using a methodology defined by the Chartered Institute of Building Services Engineers (CIBSE) known as TM 59/52 modelling.



Specific software packages are able to perform the dynamic simulation modelling and assess CIBSE compliance.

This is considered to provide greater flexibility, with a design led and less prescriptive approach than the simplified method.

Overheating assessments will play a key role in defining the form of a building so should be considered pre-planning and maintained throughout all stages of design.

# Secondary considerations

In addition to the considerations required to reduce internal temperatures during the summer, the overheating strategy for any building will also need to consider the following:

## Noise

External noise will impact the ability to use windows as a means of ventilation, especially at night. This is not a physical restriction in the owner/occupiers ability in opening windows, it is a limit that must be set within the dynamic simulation modelling.

Where external noise levels during the sleeping period (11pm – 8am) averages over 40dB, or exceeds 55dB more than 10 times, then the use of openable windows to provide overheating mitigation is prohibited.

Through on site noise testing, if the above threshold limits are exceeded then windows are modelled as closed and in most cases will result in the bedroom spaces failing to meet the overheating limits set by Part O.

## Intrusion

Likewise, where a window is accessible – such as for a ground floor apartment bedroom – this too has to be modelled as closed at night.

The only acceptable security measures outlined within Approved Document O, which would allow accessible windows to open, are fixed or lockable bars or louvres.

## Protection from falling

Appropriate guarding must also be put in place for windows being used to mitigate overheating, to minimise the risk of falling from height. This could involve the inclusion of fixed or lockable guarding, or the changing of window types and number to provide more, smaller openings.

## Pollution

Local sources of pollution can also limit the use of windows to limit overheating. This will need to be analysed on a site-by-site basis but could also result in windows requiring to be closed.

Any mechanical ventilation systems will also need to take this into consideration within their design with filtration and in-take locations carefully designed.

## Entrapment

Louvered shutters, window railings and ventilation grilles should not allow body parts to become trapped. They should comply with all of the following:

- Not allow the passage of a 100mm diameter sphere.
- Any hole which allows the passage of an 8mm diameter rod should also allow the passage of a 25mm diameter rod (such holes should not taper in a way that allows finger entrapment).
- Any looped cords must be fitted with child safety devices.

# Understanding Overheating Constraints in Part O Modelling

As part of the new planning regulations legislation, Part O addresses the critical issue of overheating in residential buildings. Accurate modelling is essential to ensure compliance with these regulations and to provide comfortable living environments year-round. However, several constraints can impact the effectiveness of these models, particularly regarding window openings and other passive cooling strategies.

## Window Opening Assumptions

**Occupant Behavior**
Models often assume that occupants will open windows during periods of high indoor temperature. However, actual behavior can vary widely due to security concerns, noise pollution, or personal preferences.

**Ventilation Rates**
The effectiveness of natural ventilation depends on the size, placement, and operability of windows. Inaccurate assumptions about ventilation rates can lead to misleading results in the model.

## External Factors

### Climate Variability

Local climate conditions, including variations in temperature, humidity, and wind patterns, must be accurately reflected in the model. Failure to account for these factors can result in an underestimation or overestimation of overheating risk.

### Urban Heat Island Effect

Buildings in densely populated urban areas may experience higher temperatures than their rural counterparts. This effect should be included in the modelling to avoid underestimating the risk of overheating.

## Building Design Elements

### Shading Devices

The presence and effectiveness of shading devices, such as overhangs, louvers, and trees, need to be accurately represented in the model. Inadequate shading can significantly increase overheating risk.

### Thermal Mass

The ability of building materials to absorb, store, and release heat (thermal mass) impacts the indoor temperature profile. Incorrect assumptions about thermal mass can skew the modelling results.

## Mechanical systems

### HVAC Systems

The performance of heating, ventilation, and air conditioning systems must be accurately modelled. Assumptions about system efficiency, capacity, and operational schedules can influence the assessment of overheating risk.

# Top tips
## for effective overheating modelling

By understanding and addressing the constraints on modelling for Part O overheating assessments, designers and architects can create more accurate and effective strategies to mitigate overheating risks, ensuring comfortable and sustainable living environments for residents.

Here are our top tips!

### 1. Accurate Data Collection

- Use reliable local climate data and consider the specific microclimate of the building site.
- Collect detailed information on building materials, window specifications, and shading devices.

### 2. Realistic Occupant Behavior

- Incorporate a range of occupant behaviors and preferences regarding window opening and use of shading devices.
- Consider scenarios with different levels of window operability and ventilation rates.

### 3. Advanced Simulation Tools

- Utilise advanced building simulation software that can model complex interactions between various factors influencing overheating.
- Conduct dynamic thermal simulations to capture the temporal variations in temperature and cooling loads.

## 4. Mitigation Strategies

The mitigation strategies are explored using a hierarchical design approach, prioritising passive designs, followed by natural and mechanical ventilation, before considering mechanical cooling solutions. Key passive measures include low-G-value glazing, external shading, along with natural ventilation methods and mechanical ventilation strategies.

The DSM modelling assesses the effectiveness of measures to reduce overheating and tests mitigation strategies needed to pass the overheating assessment.

Based on this evaluation and the design, the following measures could be considered:

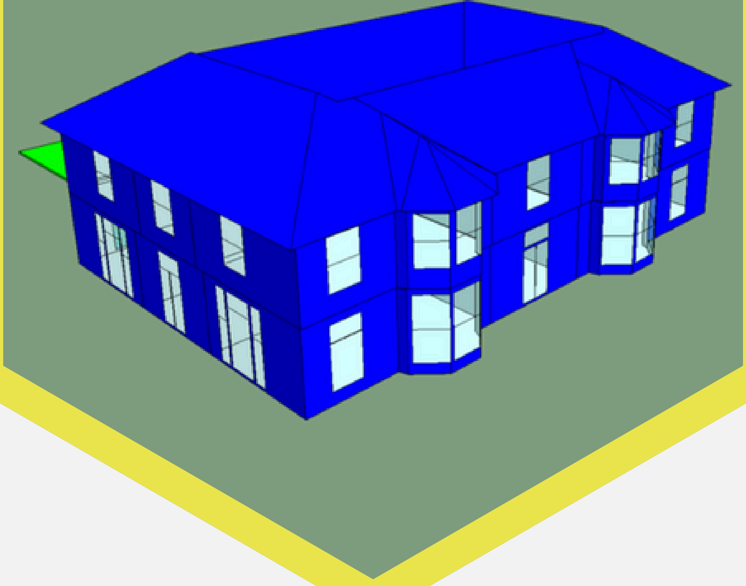
- Optimised orientation and window placement
- Enhanced glazing (Low G-value)
- Shading devices
- High-performance insulation
- High thermal mass materials
- Natural ventilation strategies:
- Cross-ventilation design
- Night purge ventilation
- Stack ventilation
- Trickle ventilators
- Mechanical ventilation and cooling
- Ceiling fans
- Mechanical ventilation (MVHR)
- Mechanical ventilation with cooling element
- Active cooling solutions

## 5. Regular Updates and Reviews

- Regularly update the model with new data and insights from post-occupancy evaluations to improve its accuracy.

- Review and validate the model assumptions and results with experienced professionals to ensure compliance and reliability.

Case Study



# Large detached property

The proposed development consisted of the replacement of an existing rural dwelling with a Georgian style new dwelling with a modern and efficient design. The design aimed to create a residence that was both architecturally timeless and environmentally sustainable, aligning with current building standards and regulatory requirements.

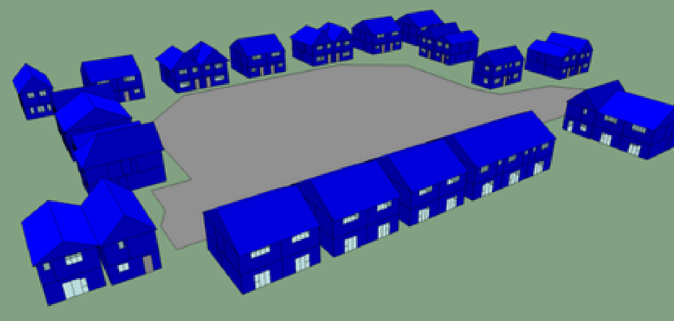
The primary challenge for this development was addressing the safety requirements outlined in Part O. Since the windows on this site are positioned below a sill height of 1100mm, it is necessary to implement guarding measures. To maintain aesthetic appeal, we proposed that the lower section of the sash windows be equipped with a lockable child-safe mechanism, allowing the upper section to remain openable and positioned above the 1100mm requirement set by the guidelines.

The dynamic modelling confirmed that all assessed rooms met the stringent Part O criteria. The design effectively prevented overheating risks and passed the compliance checks without the need for additional mitigation measures, demonstrating that the initial design was robust against potential overheating risks and suitable for the rural environment.

No additional mitigation measures were required based on the results. However, a series of detailed reports were generated to support the application process, outlining the design's compliance with both Part O and Part L of building regulations. These reports highlighted the sustainability of the project and validated the M&E systems chosen, ensuring both energy efficiency and regulatory compliance.

Case Study

# Suburban housing development



The proposed development involved constructing 38 dwellings of various types. Situated near a busy road and a farm yard, the site was assessed with a noise report that detailed restrictions across different site areas based on noise testing results.

To determine compliance, a 3D dynamic model was developed, allowing for a comprehensive approach that incorporated multiple site-specific factors, including those highlighted in the noise report.

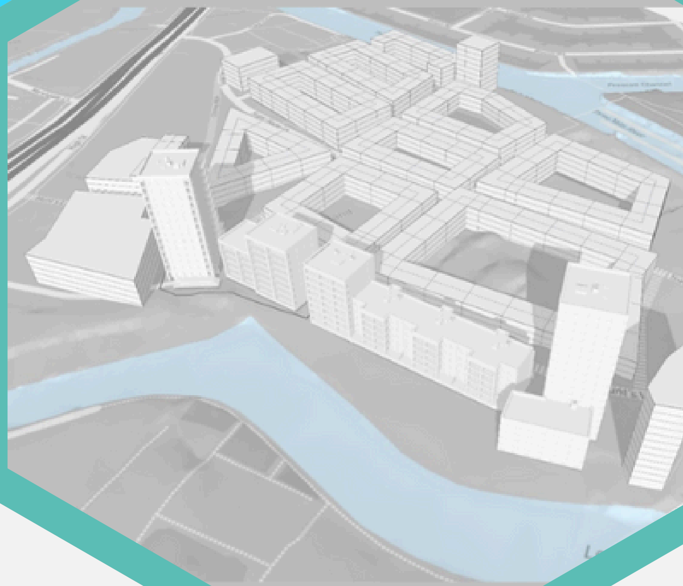
We identified that multiple bedrooms across various unit types failed to achieve compliance, due to the night-time window restrictions caused by the surrounding noise.

To omit the overheating issue, the non-compliant rooms were trialled with revised ventilation strategies. The strategies trialled were implementation of MVHR units or implementation of single extractor fans for greater air change rates, which will ultimately mitigate the overheating issues in the non-compliant bedrooms caused by window restrictions.

Each mitigation measure successfully reduced the overheating issue within the non-compliant bedrooms to acceptable Part O limits, whilst adhering to the supporting noise assessment.

Case Sudy

# Dense urban development



This project is located in London and is a mass density, residential development up to 15 storeys, across multiple blocks.

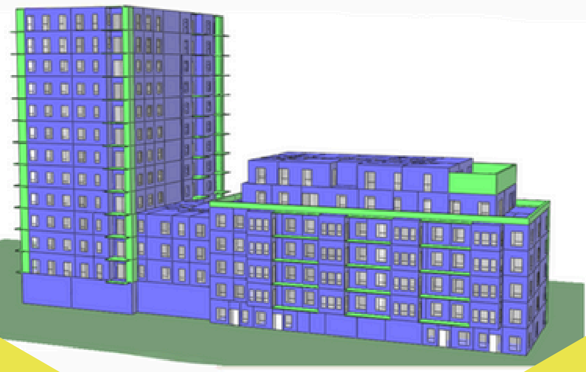
This assessment focused on parcels R7 and R8, which include residential buildings up to 15 floors, spread across four buildings with multiple cores.

A 3D dynamic model was developed to help ensure compliance with the stringent requirements of Building Regulations Part O and the Greater London Authority (GLA). The GLA's requirements mandate that developments be assessed using the cooling hierarchy and future-proofing considerations, including analysing the site using 2050 future climate files.

Given the large glazed façades on the west-facing elevations, we collaborated with the architect to adopt a passive design approach. This involved utilising balconies for shading, which also provided privacy for the occupants, and specifying enhanced glazing with a reduced G-value to minimise solar gains.

Additionally, we carried out internal daylight and sunlight studies to meet planning requirements, adjusting the glazing specifications to avoid significantly compromising internal daylight levels. As a result, we successfully met both the overheating requirements of approved document Part O and the BRE standards for internal daylighting.

Case Sudy



# Mass density residential development with noise constraints

This project is a development in London and comprises a new construction of two apartment blocks ranging from four to thirteen storeys (Block A and Block B), delivering 125 units in two tenures (shared ownership and London affordable rent) and a 90 sqm (GIA) commercial/community unit (permitted for E and F2 uses), with associated Blue Badge and cycle parking and landscaping.

Acousticians confirmed that various facades experience high levels of noise from road traffic, exceeding the noise criteria specified in Building Regulations Part O. As a result, most windows needed to remain closed at night, or significantly restricted. This necessitated that our modelling consider the effects of closed windows during nighttime hours and evaluate possible overheating mitigation measures.

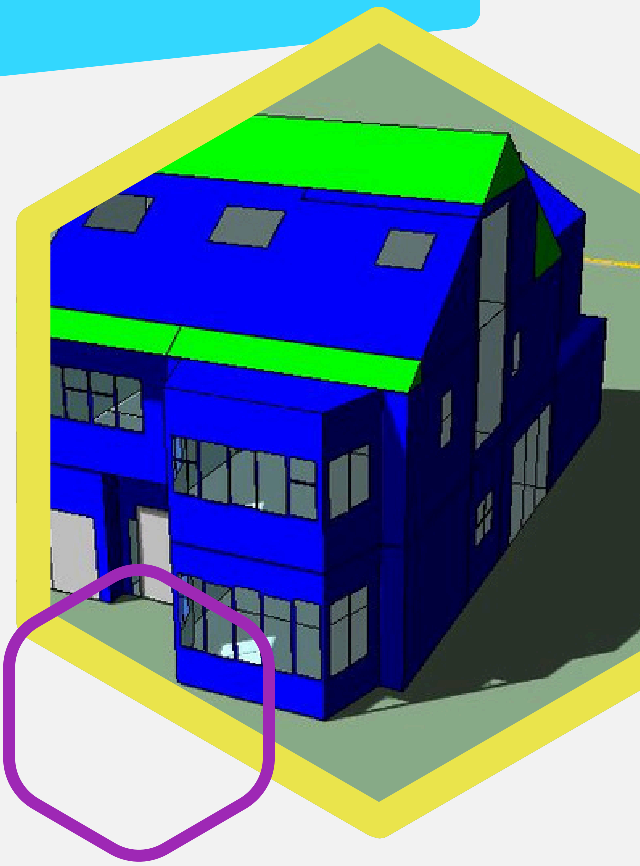
A 3D dynamic model was developed to assess compliance with Building Regulations Part O. Where units failed, due to the need for restricted or closed windows, we tested a range of passive and mechanical solutions. Our initial approach involved reducing solar gains by enhancing the G-value of the glazing.

For units that still did not meet requirements, we explored increased air change rates through MVHR. In higher noise-risk apartments directly facing the Road, a cooling element was also introduced within the MVHR unit to temper the supply air and reduce nighttime temperatures when windows needed to stay closed.

This comprehensive approach successfully achieved compliance with the overheating requirements of Approved Document Part O, whilst also meeting the noise impact assessment criteria for background noise levels.

# Help with Compliance

## What we do



Futura Bright utilises IES VE to dynamically model all plots, or plot types of a development to ensure that the overheating strategy is sufficient to meet the requirements of Part O.

The model will take into consideration local pollution and noise issues where these are identified, and our consultants can expertly advise on the required steps needed to mitigate the overheating risk, taking all information into account.

### Regulatory compliance, and more...

We can advise on, window specification, opening sizes, acoustic openings, mechanical ventilation rates or mechanical cooling.

The team at Futura Bright have the the skills to ensure your solutions meet regulatory requirements, but also works with the architectural elements of the scheme.

Due to the impact on elevational treatments, it is recommended that this modelling is undertaken as early as possible in the design process so that any changes to window openings, positions, glazing types and any additional elevational impacts can be incorporated prior to any final agreement or planning approval.

Internal dwelling layouts can also be impacted by the additional equipment required to provide cooling to the 'fresh' air supplied to the habitable roms. We can provide spatial advice to inform the architects proposals.

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