

OVERHEATING RISK ASSESSMENT

9.543 – 30-36 CLARENDON ROAD, LONDON, N8 0DJ

07/10/2022 by AM, reviewed by LW

All habitable residential rooms assessed at the proposed development at 30-36 Clarendon Road were found to meet the Part O overheating risk criteria for the London Weather Centre DSY1 future weather data set (2020 High 50 Percentile) when incorporating a combination of natural ventilation and solar control techniques in the design. Due to noise restrictions, an analysis has also been undertaken assuming windows are not able to open overnight. As a result, the provision of trim cooling as part of the MVHR system is recommended to mitigate overheating risk in bedrooms. The non-residential spaces were found to require an element of comfort cooling due to lack of natural ventilation at basement. The design incorporates natural ventilation, solar control glazing, external shading and efficient lighting to ensure cooling need only be used during the hottest periods.

EXECUTIVE SUMMARY

An overheating risk analysis has been conducted for the proposed development at 30-36 Clarendon Road at the old Jessica Buttons factory, located in the London Borough (LB) of Haringey. The purpose of this analysis is to test the design of the proposed scheme and ensure the mitigation of overheating risk as far as possible within the occupied zones across the development. This will ensure the comfort of the occupants as well as future-proof the scheme by taking into account projected increased ambient air temperatures resulting from climate change.

In order to assess the thermal performance of the development, models were constructed using thermal simulation software. The internal temperature was estimated for all the habitable internal spaces. Lighting, occupancy and ventilation conditions were input based on Part O methodology.

With the aim of giving the most robust consideration, performance of the various occupied rooms was compared with Approved Document Part O of the Building Regulations, which relies on the CIBSE Technical Memorandum 59¹ performance recommendations, with some further added restrictions. These are rigorous targets that determine the acceptability of overheating based on the temperature differential between the internal and the external environment (ΔT), considering the frequency of high temperature difference beyond which the level of overheating is considered unacceptable. Specifically, for bedrooms, the methodology further aims to evaluate comfort during the sleeping hours by setting a maximum number of hours for which the operative temperature can exceed 26°C. Part O is part of the Building Regulations 2021 and is currently the most appropriate assessment methodology for assessing overheating risk in residential properties in the UK.

¹ CIBSE TM59:2017 – Design Methodology for the assessment of overheating risk in homes

CIBSE Technical Memorandum (TM52) is the recommended methodology assessing overheating risk in non-domestic developments. Guidance from LB Haringey's Key Overheating Planning Application Requirements was followed as well.

The thermal simulations indicate that the dwellings are predicted to satisfy the overheating risk criteria for the probabilistic Design Summer Year (DSY1 – 2020 High emissions 50 Percentile) for the London Centre weather file through a combination of natural ventilation, solar control strategies and external shading across the scheme.

As confirmed by the acoustic assessment, all bedrooms are expected to experience increased risk of noise, and the proposed solution for these has been to test a scenario where bedroom windows are closed, and the mechanical ventilation from the proposed MVHR with a proportion of pre-tempered intake air is applied as per the specification. This does not amount to full comfort cooling, rather it is a 'trim cooling' provision, expected to be capable to reducing the incoming air temperature by approx. 8°C. A test of the sample units against the 'predominantly mechanically ventilated' criterion confirm that the bedrooms are expected to meet the Part O criteria with the as-designed MVHR running in cooling mode. XCO2 would also recommend that:

- It should be ensured that all residential windows and glazed doors can be fully openable (side hung by 90 degrees) and provide minimum equivalent free areas as described in the 'Ventilation section' within this report;
- It should be ensured that all external windows can be open inwards;
- For solar control, glass of low g-value (0.50) for all residential windows and glazed doors will be specified to avoid solar transmittance during summer, but allow for passive heating in the winter;
- Use of internal shading devices e.g., curtains or blinds of low shading coefficient will be recommended to the future tenants for controlling solar gains. The impact of internal shading devices is not accepted by the Part O methodology, thus, is not included in our assessment;
- On Level 1, provision of external vertical fins on top of full height openable glazing behind will be recommended for controlling solar gains, for protection from falling and for privacy (please refer to window types WT9 and WT12 in the ventilation section), and;
- MVHR with integrated cooling coil is required for all bedrooms' compliance due to noise restrictions stated by the Part O methodology and confirmed by the acoustic analysis. Detailed information can be found in the 'Ventilation section' within this report.
- In case of overheating, residents are encouraged to make use of their private amenities, in the form of balconies, provided to all residential units across the scheme. A communal outdoor space (e.g., play space/communal terrace) has also been provided at level 6 for the residents to cool down during extreme weather conditions.

The proposed non-residential spaces are predicted to satisfy the overheating risk criteria for the probabilistic Design Summer Year (DSY1) 2020's weather data for London Weather Centre through the use of mechanical cooling, after passive design measures have been maximised (energy efficient lighting, insulated pipework, deeper window reveals for shading, and solar control glazing with g-value of 0.5).

The above measures incorporated as part of the proposed scheme are not seen to suffice for compliance with the 2050's weather file. While it is aspired to, but not a requirement that Part O risk criteria is met for future weather files, the below measures are being considered for future retrofit plans.

- For better overheating risk mitigation performance, 800mm deep external shading (to achieve 1m depth in conjunction with the window reveals) to enable compliance in the future due to the rising temperatures. The shading device is proposed as a horizontal feature directly above south and southwest facing glazing and as a vertical for the full height of the glazing (on the southern edge) of all east and west facing window assemblies. This option provides solar shading without relying on occupants to control shading devices and the shading does not interfere with the air flow. It does of course have aesthetic and cost implications however.
- A lower g-value of 0.4 would be recommended to reduce solar gains if this can be accommodated whilst also meeting light transmittance targets for the daylight analysis. It is expected such a reduction would reduce energy and carbon emission reductions slightly due to a loss of beneficial solar gains in winter.
- Due to the acoustics restrictions on the opening of windows at night, higher flow rates from the MVHR with incorporated cooling coil would be required in bedrooms and KLDs. Based on the limits and constraints from the trim cooling provided by the MVHR, apartments with 3 bedrooms may have to consider active cooling to provide sufficiently comfortable conditions in these more extreme weather situations, and comply with the Part O requirements.

The retrofit plan for more onerous weather files such as 2080's period or for more severe weather types such DSY2 and DSY3, or for more resilience to climate change could also include (in addition to the measures outline above for the 2050's retrofit plan):

- Provision of Juliet balconies with railing and replacement of any fixed glazing (e.g., at their end of life) with openable windows throughout the scheme.
- For better integration with architecture, external automated blinds could also be installed in the future to provide additional shading. These could potentially integrate better with the architectural design of the façade but would interfere with the air flow, depending on how and when they are operated.
- Under the 2080 climate scenario the dwellings are expected to require active cooling in order to meet Part O criteria. To reduce the energy consumption, the cooling system is recommended to be limited to providing trim cooling to a reasonable set reduction in temperature, rather than unlimited comfort cooling.

NON-RESIDENTIAL – COMMERCIAL (RETAIL) UNITS

The three commercial units located at ground were tested as a free-running building for the purpose of this report against the TM52 risk criteria. The thermal simulations indicate the following:

- The commercial units are predicted to satisfy the overheating risk criteria using the weather data DSY1 (2020s, high emissions, 50% percentile scenario) for the London Weather Centre through a combination of energy efficient lighting, natural ventilation, reduced g-value and comfort cooling via cooling coils in the MVHR unit to the basement areas to prevent overheating only during the hottest periods. The cooling system is recommended to be limited to providing trim cooling to a reasonable set reduction in temperature, rather than unlimited comfort cooling.

While it is aspired to, but not a requirement that TM52 risk criteria is met for future weather files, the below measures are being considered for future retrofit plans. The assessment indicates:

- Under the 2050 climate scenario the space is demonstrating compliance through the cooling coil system with a higher flow rate through the MVHR unit.
- Under the 2080 climate scenario the space will require a higher flow rate through the MVHR unit however will still be able to utilise the cooling coil rather than requiring future active cooling measures.

Based on the method of assessment adopted, XCO2 recommend the design team consider incorporating the features that allow compliance with the Part O criteria for the London Centre DSY1 2020s weather data.

A future retrofit plan has been outlined and it is recommended that the future building management is made aware of the proposals that should be reviewed in the future to assess if local environmental conditions have changed and new design/technological innovations are available.

It should be noted that the findings of this assessment are related to planning stage design only and are based on a sample of flats, in line with the methodology. Any changes to the design, ventilation strategy, façade opening areas, window specifications, operation and shading elements would impact the performance of the building and would void the results of the current assessment. In that case, it is recommended that additional modelling is undertaken to ensure compliance with the LB Haringey and London Plan Policy requirements and building regulations.

METHODOLOGY

3D thermal models of the proposed scheme, which comprises a mix of residential units, have been developed based on the planning architectural drawings received from Stockwool, dated on 16 September 2022.

The assessment has identified those dwellings that are at higher risk of overheating and a sample of units representing these dwellings have been assessed against the Part O overheating criteria, and in line with the Haringey's key overheating planning application requirements. To give a fair representation of the residential development, 16 residential units (including their 22 Double bedrooms, 4 Single bedrooms and 16 Kitchen/Living/Dining areas (KLD)) were analysed to provide a representative sample of the space and dwelling typologies within the development. These include units with larger glazing area, units-with windows facing all directions, especially those south or south-west aspect, top floor units that receive higher solar gains, units where cross ventilation is not possible, and units where openings cannot be left open at night for acoustic reasons.

Surroundings have been modelled based on the current site layouts. The scheme at 30-36 Clarendon Road is part of a masterplan and future redevelopment of the area that includes taller buildings across the site. This cumulative scenario of the future surroundings has not currently been modelled; however overheating risk results would be expected to perform better once future redevelopment is erected due to the taller buildings providing additional shade to the proposed scheme. This assessment is therefore considered to be a worst-case scenario in terms of surrounding context as far as the overheating risk assessment is concerned.

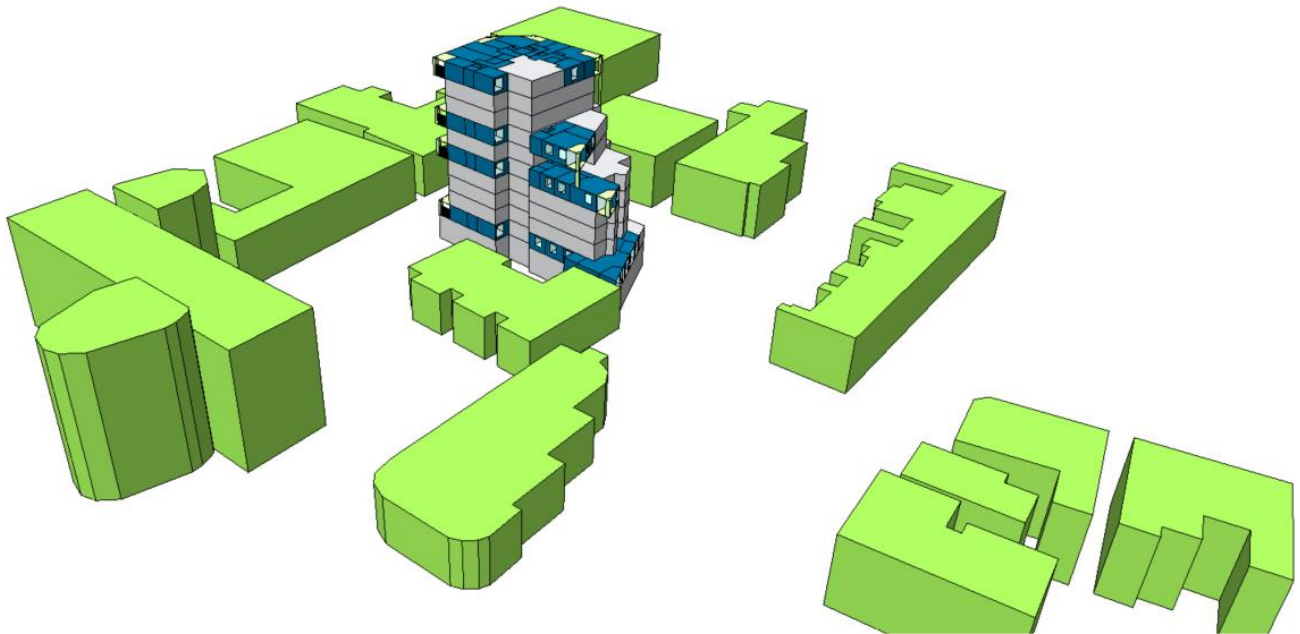


Figure 1: An axonometric view of 30-36 Clarendon Road scheme.

The overheating risks of the spaces were assessed for current and future climate scenarios. Following the methodology set out in CIBSE TM49 Design Summer Years for London, the following three years were selected to form the set of probabilistic design summer years for the future weather scenarios:

- DSY1 (1989) for the 2020s, high emissions, 50% percentile scenario;
- DSY2 (2003) for the 2020s, high emissions, 50% percentile scenario;
- DSY3 (1976) for the 2020s, high emissions, 50% percentile scenario.

These files are climate-change adjusted versions of the current DSY. The first of these years, 1989, is the current DSY and represents a moderately warm summer, as is interpreted in current CIBSE guidance. The years 1976 and 2003 were chosen as more extreme years with different types of summer: the former is a year with a long period of persistent warmth, whereas the latter has a more intense single warm spell. The 2020 period is of particular interest as this relates to the period 2011-2040, which is the period we have now entered. For the 50% percentile changes, which may be viewed as the 'best guess' level of change.

The buildings have been modelled using dynamic thermal simulation software which is fully compliant with CIBSE Applications Manual AM11. The software can compute operative temperatures using CIBSE weather data sets, building fabric specification, window areas and opening, all aspects of solar and internal gains as well as natural ventilation flows within buildings. Compliance of the design with the CIBSE TM59 criteria has been sought and recommendations for future occupancy have been also presented.

NOISE AND OVERHEATING RISK ALIGNMENT

An assessment of noise risk has been undertaken for the development. It is expected that a strategy of using openable windows during the day will be acceptable for the development, however the acoustic/noise assessment has highlighted that there may be a risk of excessive noise overnight. Therefore, the total 42 modelled occupied units (26 bedrooms and 16 KLDs) would not be able to rely solely on openable windows as a means of mitigating high internal temperatures, and therefore this would not be recommended from an acoustic point of view for these dwellings.

The strategy for mitigating overheating risk in bedrooms will therefore differ to the remainder of rooms across the development, and this is set out in this report.

ASSESSMENT CRITERIA

RESIDENTIAL

The performance standards set out within Part O (referenced from CIBSE TM59) have been used to assess the overheating risk within the proposed development.

Considering the dwellings within the development will use natural ventilation as the primary mechanism to mitigate overheating risk, the following two criteria must be met:

1) For living rooms, kitchens and bedrooms:

The number of hours during which ΔT (the difference between operative and threshold comfort temperatures) is greater than or equal to one degree (K), during the period of May to September inclusive, shall not be more than 3 per cent of occupied hours. (CIBSE TM52 Criterion 1: Hours of exceedance).

2) For bedrooms only:

To evaluate comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26°C for more than 1% of annual hours. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26°C will be recorded as a fail).

The first criterion is evaluated in terms of the ΔT , which is the difference between the operative temperature T_{op} and the limiting maximum temperature T_{max} , $\Delta T = T_{op} - T_{max}$ ³. In order to estimate T_{op} , dynamic thermal modelling is carried out to compute the predicted temperature distribution in the different thermal zones of the building. The maximum acceptable temperature is a function of the outdoor temperature and the design limits, which are shown below. The table details the suggested acceptability in terms of the temperature range of naturally ventilated buildings. For the purpose of the assessment, we have used Category II limits, as recommended within CIBSE TM52.

Table 1: CIBSE TM52 – Suggested applicability of the category and the associated acceptable temperature range for a free running building

Category	Explanation	Acceptable Range (°C)
II	Normal expectation (for new buildings and renovations)	±3

CIBSE TM59 also recommends assessment criteria for overheating risk in corridors based on exceeding an operative temperature of 28°C. Whilst there is no mandatory target, corridors should aim to comply with the following criteria:

1) For corridors:

If an operative temperature of 28°C is exceeded for more than 3% of total annual hours, this should be flagged as a significant risk within the report.

NON-RESIDENTIAL

The performance standards set out within CIBSE TM52 have been used to assess the overheating risk within the commercial elements of the scheme. At least two of the following must be met:

1) Hours of exceedance (H_e): $H_e < 3\%$ of occupied hours

² Operative temperature models the combined effect of convective and radiant heat transfer. It accounts for the combined of the temperature of the air, the temperature of the surfaces and air speed.

³ T_{max} is the maximum acceptable temperature and is dependent on the outdoor running mean temperature and the building category with each associated acceptability range.

As per criterion 1 above.

2) Daily weighted exceedance (W_e): $W_e < 6$

The second criterion 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 temperature rise and duration. This criterion sets a daily limit for acceptability.

3) Upper limit temperature (T_{upp}): $T_{op} - T_{max} < 4^{\circ}\text{C}$

The third criterion sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable.

Table 2: CIBSE TM52 – Suggested applicability of the category and the associated acceptable temperature range for a free running building.

Category	Explanation	Acceptable Range ($^{\circ}\text{C}$)
II	Normal expectation (for new buildings and renovations)	± 3

MODELLING ASSUMPTIONS

FABRIC PERFORMANCE

The specification of the fabric is aligned with the proposals at planning stage as these are outlined in the Energy Statement for the scheme and summarised in Table 3:

Table 3: Building fabric assumptions.

Element	Specification	
	U-value [$\text{W}/\text{m}^2.\text{K}$]	
External Walls	0.15	
Ground Floor	0.10	
Roof	0.10	
	U-value [$\text{W}/\text{m}^2.\text{K}$]	g-value
Window	1.20	0.50
	Air permeability (@50Pa)	
	3 $\text{m}^3/\text{m}^2.\text{h}$ (residential)	
	4 $\text{m}^3/\text{m}^2.\text{h}$ (non-residential)	

OCCUPANCY

RESIDENTIAL

The TM59 methodology in which Part O is referenced specifies the hours during which spaces are anticipated to be occupied and these have been used within the overheating assessment calculations. Table 4 sets out the predicted occupancy patterns for the assessed rooms within the dwellings in line with the Part O requirements; these are programmed into the dynamic software model to calculate the relative occupancy gains for the designated spaces.

Table 4: Occupancy assumptions for a 3-bedroom dwelling room type assessed.

Area	Part O Predicted occupation pattern
Bedroom	24 hours a day
Open Plan Kitchen/Living/Dining (KLD)	08:00 – 23:00 (3 people, 100% gains)

NON-RESIDENTIAL

CIBSE TM52 does not specify the exact hours the commercial spaces are expected to be occupied, and as a result BRE estimates, inherited from the National Calculation Methodology (NCM), are often used as a basis for a prediction of the occupied hours of different areas. The table below sets out the occupancy times included within the model.

Table 5: Occupancy assumptions for each non-domestic room type assessed.

Area	NCM Predicted Occupation Pattern
Commercial - Retail	09:00 – 18:00

INTERNAL GAINS**RESIDENTIAL**

Similar to the predicted occupancy hours, the internal gains (lighting, equipment, people) for occupied areas are incorporated within the model in line with the guidance set out in Part O.

Table 6 sets out the various internal gains for the assessed rooms within the dwellings. Non-occupied spaces such as circulation, bathrooms and storage were modelled based on the typical internal gains specified within the Part O methodology.

Table 6: Internal Gains modelled for each room type assessed.

Area	Predicted Internal Gains		
	Lighting [W/m ²]	People [peak W]	Equipment [peak W]
Double Bedroom	2.0 W/m ²	150 W sensible, 110 W latent	80 W
Single Bedroom	2.0 W/m ²	75 W sensible, 55 W latent	80 W
1Bed Kitchen/Living area	2.0 W/m ²	75 W sensible, 55 W latent	450 W
2Bed Kitchen/Living area	2.0 W/m ²	150 W sensible, 110 W latent	450 W
3Bed Kitchen/Living area	2.0 W/m ²	225 W sensible, 165 W latent	450 W
HIU cupboards	-	-	31 W

TM59 requires the inclusion of corridors in the overheating risk analysis where community heating pipework runs through them. A sample circulation area has been included in the assessment to verify the compliance with TM59 guidance and to ensure the design is robust and overheating risk is mitigated in all areas of the dwelling. The assessment takes into account heating pipework distribution gains on communal corridors in accordance with CIBSE Guide C. The model accounts for 12.19 W/m heat loss per metre run of pipe.

Table 7: Internal Gains modelled for corridor areas.

Area	Predicted Internal Gains		
	Lighting [W/m ²]	People [peak W]	Equipment [peak W]
Corridor	2.0 W/m ²	-	500 W

NON-RESIDENTIAL

Table 8: Internal gains for commercial spaces.

Area	Predicted Internal Gains		
	Lighting [W/m ²]	People [m ² /person]	Equipment [W/m ²]
Commercial - Retail	31.2	8.5	5.2

VENTILATION

The proposed ventilation strategy for the development will be led by mechanical ventilation to all residential units. The mechanical ventilation system will include heat recovery to achieve ventilation in the most energy efficient way. Therefore, the estimated auxiliary ventilation flow rates have been included in the model in line with Part F requirements for background ventilation. The MVHR will automatically divert outgoing air around the heat recovery cell by a summer bypass.

For the purpose of this assessment natural ventilation was modelled as a baseline using equivalent free areas calculated from the elevations in the architectural drawings received from Stockwool on 16 September 2022. Detailed description of the modelled window types, and their equivalent free areas, can be seen below.

In line with the Part O methodology:

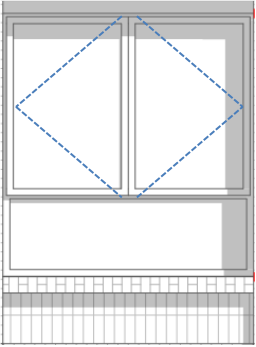
- It is assumed that windows will start to open when internal dry bulb temperature exceeds 22 °C for occupied hours (08:00 to 23:00);
- Be fully open when the internal dry bulb temperature exceeds 26 °C;
- Start to close when the internal dry bulb temperature falls below 26 °C;
- Be fully closed when the internal dry bulb temperature falls below 22 °C;
- For the baseline case, at night (23:00 to 08:00), bedroom openings are assumed fully open if the openings are on the first floor or above and the internal dry bulb temperature exceeds 23 °C. KLD windows are assumed closed overnight.

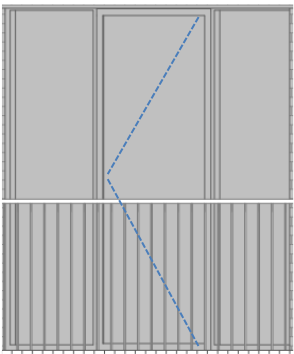
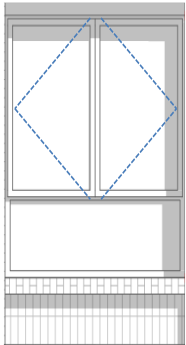
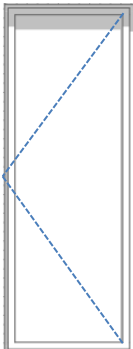
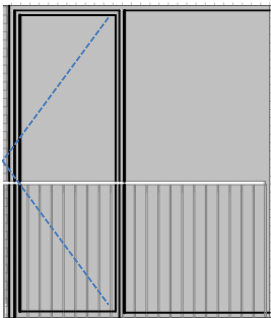
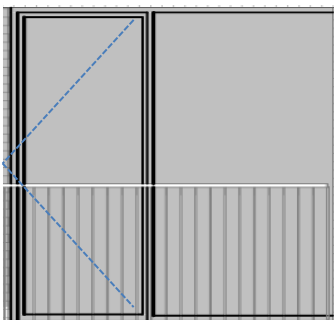
The methodology outlined in Appendix D of Approved Document O was used to calculate the equivalent area of each window types proposed across the scheme. The level of exposure and associated coefficients of discharge are set up in accordance with the relative position of each window in relation to building massing. The table below shows the detail of the minimum equivalent free area and the openable pattern of the windows in order to comply with Part O. Please refer to Appendix A for window types' location.

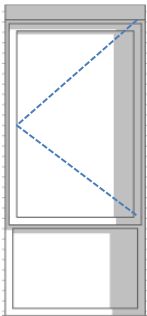
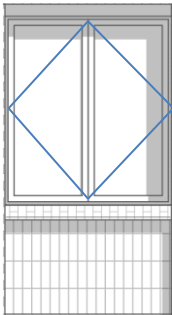
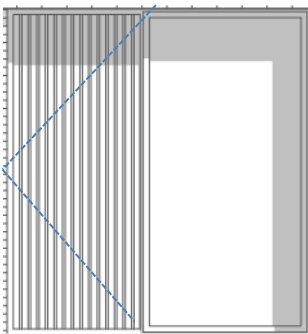
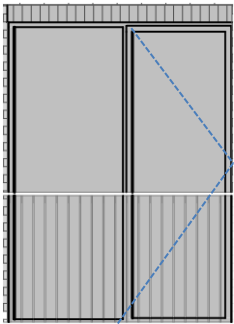
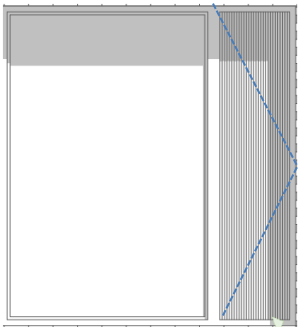
Internal doors in bedrooms and KLD areas have been included and assumed to be open during daytime but closed overnight. Location of the selected window types can be found in the Appendix A.

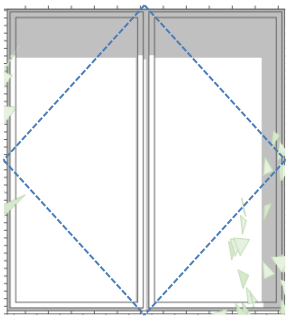
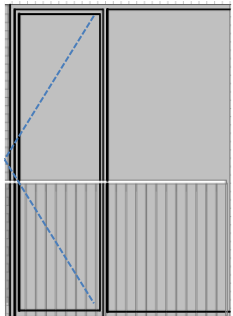
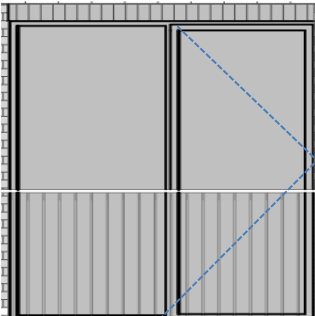
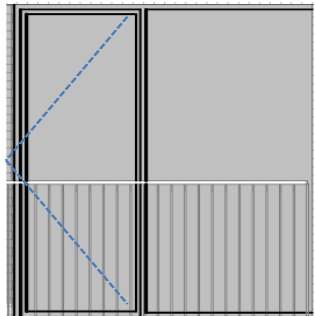
In case of overheating, residents are encouraged to make use of their private amenities, in the form of balconies, provided to all residential units across the scheme. A communal outdoor space (e.g., play space/communal terrace) has also been provided at level 6 for the residents to cool down during extreme weather conditions.

Table 9: Opening types as modelled in IES VE.

Window Reference (Total width)	Recommended free area for Part O compliance	Proposed openable design and modelled opening pattern	Minimum Equivalent Free Area
WT1 (w=1.81m)		Top panes: Side-hung 90° - Open daytime for all Upper floor KLD windows. - Open all day for Upper Floor Bedroom windows.	67%

Window Reference (Total width)	Recommended free area for Part O compliance	Proposed openable design and modelled opening pattern	Minimum Equivalent Free Area
WT2 (w=2.3m) (window to balcony)		Central pane: Side-hung 90° - Open daytime for all Upper floor KLD windows. - Open all day for Upper Floor Bedroom windows.	40%
WT3 (w=1.36m)		Top panes: Side-hung 90° - Open daytime for all Upper floor KLD windows. - Open all day for Upper Floor Bedroom windows.	67%
WT4 (w=0.91m) (window to balcony)		Side-hung 90° - Open daytime for all Upper floor KLD windows.	96%
WT5 (w=2.3m) (window to balcony)		Left pane: Side-hung 90° - Open daytime for all Upper floor KLD windows. - Open all day for Upper Floor Bedroom windows.	40%
WT6 (w=2.9m) (window to balcony)		Left pane: Side-hung 90° - Open daytime for all Upper floor KLD windows.	30%

Window Reference (Total width)	Recommended free area for Part O compliance	Proposed openable design and modelled opening pattern	Minimum Equivalent Free Area
WT7 (w=0.91m)		Top pane: Side-hung 90° - Open daytime for all Upper floor KLD windows. - Open all day for Upper Floor Bedroom windows.	67%
WT8 (w=1.36m)		Top panes: Side-hung 90° - Open daytime for all Upper floor KLD windows. - Open all day for Upper Floor Bedroom windows.	96%
WT9 (w=2.47m)		Left pane: Side-hung 90° - Open daytime for Upper floor KLD windows at Level 1. - External fins in front of glass openable window pane.	90% glazed element (Equivalent area to be reduced to 45% due to external fins)
WT10 (w=1.9m) (window to balcony)		Right pane: Side-hung 90° - Open all day for Upper Floor Bedroom windows.	45%
WT12 (w=2.47m)		Right pane: Side-hung 90° - Open daytime for Upper floor KLD windows at Level 1. - External fins in front of glass openable window pane.	90% glazed element (Equivalent area to be reduced to 45% due to external fins)

Window Reference (Total width)	Recommended free area for Part O compliance	Proposed openable design and modelled opening pattern	Minimum Equivalent Free Area
WT13 (w=2.47m) Winter Garden external windows		External windows in winter gardens at Level 1 Both panes: Side-hung 90° - Open daytime for windows to KLD only. - Open all day for windows to Bedroom.	96% (For protection and security reasons these windows require Juliet balconies or provision for external elements)
WT14 (w=1.8m) (internal window to winter garden)		Left pane: Side-hung 90° - Open daytime for Level 1 KLD window to winter garden.	57%
WT15 (w=2.5m) (internal window to winter garden)		Right pane: Side-hung 90° - Open daytime for Level 1 KLD window to winter garden.	57%
WT16 (w=2.5m) (internal window to winter garden)		Left pane: Side-hung 90° - Open all day for Level 1 Bedroom window to winter garden.	57%

The impact of using internal shading devices on reducing the risk of overheating has not been assessed, in line with GLA's guidance. Tenants will be advised to install curtains or blinds of low shading coefficient to allow for manual control of solar gains during summer, thus reducing the risk of overheating further. Venetian blinds in particular are highly recommended as they provide internal shading without interfering with natural ventilation.

In order to ensure the overheating mitigation strategy is usable, in addition to the restrictions on the opening of panes outlined previously, Part O includes further restrictions related to protection from pollution, noise and entrapment. A summary of the requirements and how compliance can be demonstrated for the proposed development, at this stage, has been provided below.

Noise

Part O notes that in locations where external noise may be an issue in accordance with the noise limits specified, the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am). Due to the high noise levels on the 30-36 Clarendon Road site, additional modelling was completed where passive ventilation through windows is not suitable. For these units, XCO2 recommend the design team to consider providing MVHR with incorporated cooling coil for all bedrooms. These rooms are initially above the required targets by Part O in terms of the number of hours during which overheating can be exceeded.

Pollution

Buildings located near to significant local pollution sources should be designed to minimise the intake of external air pollutants. **An Air Quality Assessment has been undertaken for the proposed development and has not identified any pollution risk for the future residents.**

Protection from Falling

Part O outlines specific requirements to minimise the risk of falling associated with the use of a natural ventilation strategy. Requirements are based on the degree of opening possible and guarding heights when windows open outwards. Windows above ground floor level with a change in floor level between inside and outside of more than 600 mm have a guarding height of 1.1 m or greater.

It is recommended that for the 30-36 Clarendon Road design all external openings across the scheme to open inwards.

Protection from Entrapment

Where louvred shutters, window rails and ventilation grilles are specified in line with security and noise requirements, these must comply with criteria to protect from entrapment related to the size of the openings and the presence of child safety devices in line with the following criteria.

- 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.

RESULTS

This section presents the results summary for each of the tests carried out for the proposed development. In total 42no. habitable spaces were included in the assessment (22no. double bedroom, 4no. single bedroom, 7no. 1-bed KLDs, 8no. 2-bed KLDs and 1no. 3-bed KLDs). Non-habitable spaces such as bathrooms, storage rooms and circulation areas have also been included in the assessment; and their internal gains have been accounted for in the model.

Table 10 shows the modelling undertaken under for London Centre Weather DSY1 2020s weather data and the number of rooms that were not found to meet the Part O criteria for each of the modelling iterations. The purpose of the improvement measures proposed is to minimise the number of rooms that fail the Part O criteria to the extent possible, taking into consideration viability, feasibility and other design constraints.

Table 10: Overheating assessment results for London Centre Weather DSY1 2020s weather file.

ID	Design change	Bedrooms	Other rooms	Corridors	Bedrooms TM59 night-time 26°C criterion	Bedrooms TM52 Criterion 1	Other rooms (KLDs) TM52 Criterion 1	Corridors TM59 hours above 28°C criterion
		Window opening area and profile			No. of rooms not meeting criteria			
N1	All windows open as per proposed design. g-value=0.5	(See Table 9). windows to open all day.	(See Table 9) Windows to open day time only.	10 L/s mechanical exhaust fan in AOV and	0/26	0/26	0/16	0/1

				openable windows.				
--	--	--	--	-------------------	--	--	--	--

The following observations can be made from the results, and are recommended to comply with the overheating criteria:

- All of the assessed habitable rooms at the proposed development at 30-36 Clarendon Road were found to meet the Part O overheating risk criteria when assessed with openable windows as the main means of mitigating high internal temperatures (iteration N1);
- It should be ensured a minimum opening equivalent area of the windows as describes in Table 9;
- For solar control, glass of low g-value (0.50) for all residential windows and glazed doors will be specified to avoid solar transmittance during summer but allow for passive heating in the winter;
- Use of internal shading devices e.g., curtains or blinds of low shading coefficient will be recommended to the future tenants for controlling solar gains. The impact of internal shading devices is not accepted by the Part O methodology, thus, is not included in our assessment;
- Provision of external fins at level 1 have been included within the architectural design for controlling solar gains and it will be required to comply with the overheating criteria;
- The corridors were modelled with a continuous mechanical extract fan in the AOV riser which was found to be sufficient in allowing them to meet Part O criteria and therefore they are not considered to be a risk for overheating.

As described above, bedrooms are expected to experience increased risk of noise, and the proposed solution for these has been to test a scenario where windows are closed, and the mechanical ventilation is applied. Two options have been tested, with and without an additional cooling capacity incorporated. This cooling capacity is available for the proposed MVHR in all apartments. This does not amount to full comfort cooling, rather it is a 'trim cooling' provision, expected to be capable of reducing the incoming air temperature by approx. 8°C. All tested flats against the 'predominantly mechanically ventilated' criterion confirms that all bedrooms are expected to meet Part O criteria with the MVHR running in trim cooling mode.

Table 11: Overheating assessment results for the mechanical ventilation scenario under DSY1.

ID	Design change	Bedrooms	Kitchen / Living / Dining rooms	TM59 'predominantly mechanically ventilated' 26°C criterion
		Ventilation profile		No. of bedrooms not meeting criteria
M1	Frozen scheme design	All bedroom windows closed due to noise restrictions. Mechanical ventilation, no cooling capacity.		26/26
M2	With cooling coil capacity	All bedroom windows closed due to noise restrictions. Cooling coil capacity in ventilation air aligned to running the MVHR in cooling mode, reducing the incoming air temperature by approx. 6°C.		0/26

MVHR with integrated cooling coil is required for all bedrooms' compliance due to noise restrictions stated by the Part O methodology and confirmed by the acoustic analysis.

Furthermore, the last iterations (combined N1 & M2) were applied with DSY2 and DSY3 weather files, which are more severe weather types. The results for these years are shown in the table below.

Table 12: Overheating assessment results for the London Centre Weather, 1976 and 2003 for 2020 weather data.

Future Weather File – London Centre Weather Data				
Iteration	Glazing g-value	Glazing percentage	No. of rooms not meeting criteria	
			2003 (DSY2)	1976 (DSY3)
Based on iteration M2 above (DSY2 & DSY3 weather files)	0.5	As per proposed design (see Table 9)	42/42	42/42

M3 based on iteration above, plus: - Reducing g-value	0.4	As per proposed design (see Table 9)	42/42	42/42
--	-----	--------------------------------------	-------	-------

The nature of the DSY2 and DSY3 weather files are such that it becomes particularly difficult to fully mitigate overheating risk in accordance with Part O criteria owing to their onerous conditions. In essence, they are representative of a period where overheating is an intrinsic risk within the environment itself, rather than a risk imposed by inappropriate design.

Following assessment of the model with the DSY2 and DSY3 weather files, it can be observed in Table 12 that the criteria cannot be met, and the overheating risk cannot be mitigated through the currently implemented passive measures alone given the onerous nature of the more severe weather.

It can also be seen from the results that reducing g-values can have a minor beneficial impact on mitigating overheating risks when the proposed scheme incorporates a g-value of 0.4. Further reductions to g-value are not recommended as they would compromise Be Lean Stage savings, the proposed scheme's daylight levels as well as would increase the heating demand and fuel costs for residents. Low g-values are also not deemed the optimum design solution for residential buildings but were incorporated as part of the scheme with a view of adding external shading in the future based on the design team's preference and feedback.

Please note that the results for DSY2 and DSY3 for 2020's period are for informative purpose only. The scheme has sought to comply with DSY1 as per GLA's policy by including solar control glazing with g-value of 0.5 throughout as well as generous Free Areas and has sought to go as far as feasible in terms of performance with 2020's DSY2 and DSY3 weather files. Design discussions have taken place with the team on increasing the Free Areas of the windows further and openable panes have been maximised where glazed doors provide access to balconies while the remaining window assemblies have sought to incorporate side-hung windows which can provide sufficient Free Area for compliance with DSY1 2020's. A future retrofit plan for overheating mitigation with more onerous weather files could include the incorporation of Juliet balconies and installation of openable windows throughout the development.

Future Weather Scenario and Retrofit Plan – 2050's weather data

Based on the results from the DSY1 2020's weather file, worst case scenario rooms were tested using the London Weather Centre DSY1 2050's weather file, this included 21 rooms across on level 1 and top floor of the residential building (13no. bedrooms and 8no. KLDs). The results, the sequential improvement measures that are proposed to be incorporated for each iteration and recommendations are shown below.

Table 13: Overheating assessment results for dwellings for London Weather Centre DSY1 2050's.

Iteration	Glazing Equivalent Free Area %	g-value	External shading	Bedrooms TM59 night-time 26°C criterion	Bedrooms TM52 Criterion 1	Other rooms (KLDs) TM52 Criterion 1	Total rooms Part O Compliance
				No. of rooms not meeting criteria			
1 (Based on M2 iteration)	(See Table 9)	0.5	As per original design	0 of 13	8 of 8	13 of 13	21 of 21
2	(See Table 9)	0.5	E/W facing glazing with a vertical fin 800mm deep (+200mm window reveals). S and SW facing glazing 800mm deep overhang (+200mm window reveal).	0 of 13	7 of 8	13 of 13	20 of 21

3	(See Table 9)	0.4	As per iteration above	0 of 13	7 of 8	12 of 13	19 of 21
4 Increasing the MVHR flow rate with inc. cooling coil	(See Table 9)	0.4	As per iteration above	0 of 13	0 of 8	0 of 13	0 of 21

The results indicate that in order for the development to pass the future weather scenario of DSY1 2050, external shading devices and a reduction in the g-value of the windows are required as stated above and illustrated in the image below. The provision of MVHR with incorporated cooling coil is kept from the original design, however, a booster in the delivered flow rate is required to meet compliance with Part O.

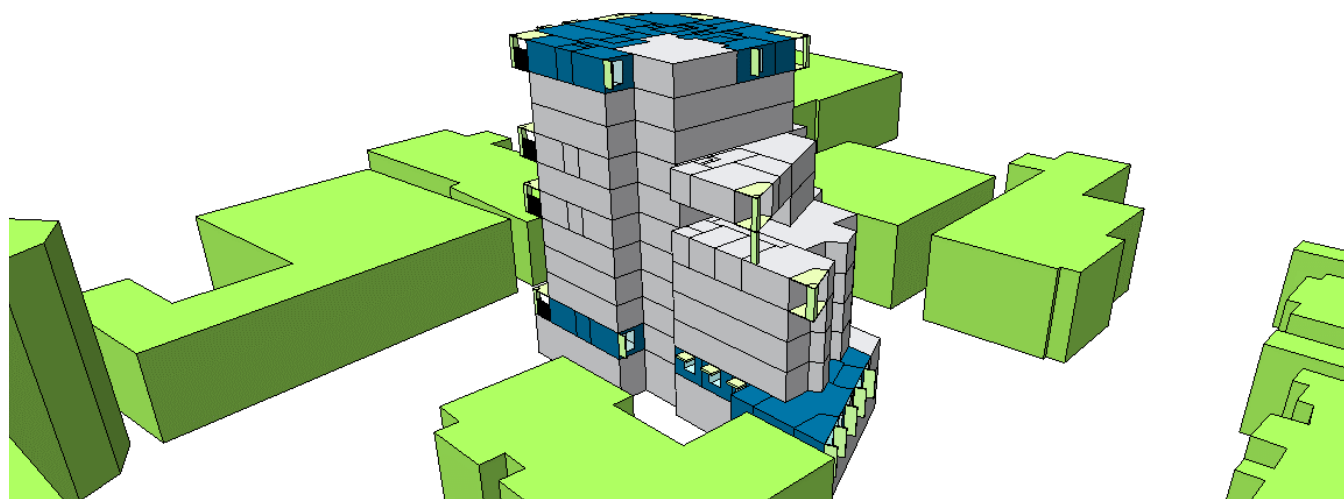


Figure 2: External shading devices required for compliance with 2050's DSY1 weather file – Axonometric view from SE.

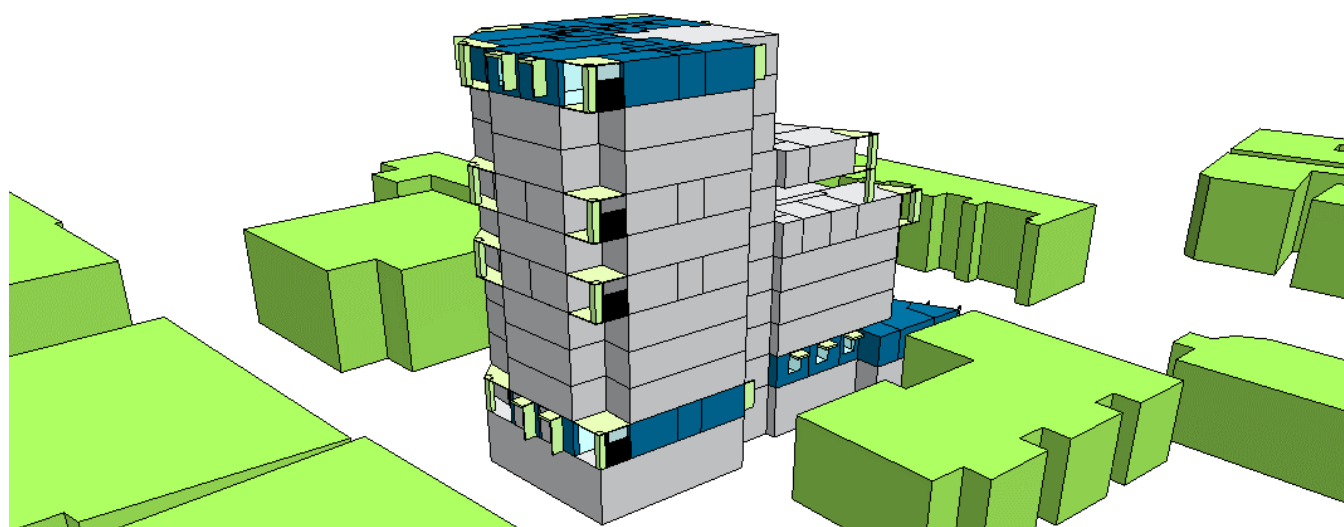


Figure 3: External shading devices required for compliance with 2050's DSY1 weather file – Axonometric view from SW.

2080's weather data

The selected units were also tested against the London Weather Centre DSY1 2080's weather file using iteration 4 from Table 13 in the previous page as a baseline. The following table shows the iterations undertaken to gain an understanding of the measures that can be incorporated into the building design to prevent overheating against the 2080 London Weather Centre DSY1 weather file.

Table 14: Overheating assessment results for dwellings for London Weather Centre DSY1 2080's weather file.

Iteration	Glazing Equivalent Free Area %	g-value	External shading	Bedrooms TM59 night-time 26°C criterion	Bedrooms TM52 Criterion 1	Other rooms (KLDs) TM52 Criterion 1	Total rooms Part O Compliance
				No. of rooms not meeting criteria			
1 (Based on 2050's weather data iteration 4) Includes MVHR with inc. cooling coil	(See Table 9)	0.4	E/W facing glazing with a vertical fin 800mm deep (+200mm window reveals). S and SW facing glazing 800mm deep overhang (+200mm window reveal).	5 of 13	7 of 8	13 of 13	20 of 21
2	(See Table 9)	0.4	Providing external automated blinds (50% opaque element / 50% clear ventilated area)	0 of 13	7 of 8	13 of 13	20 of 21
3 Providing Active Cooling limited to 1kW capacity	(See Table 9)	0.4	As per iteration above	0 of 13	0 of 8	0 of 13	0 of 21

The results show that the above passive measures incorporated as part of the proposed scheme and of the 2050's weather file are not seen to suffice for compliance with 2080's weather file. The provision of external automated blinds delivers significant reductions in the number of overheating hours, however, most of the rooms do not comply with the Part O methodology. As a result, under the 2080 climate scenario the dwellings will require active cooling in order to meet Part O risk criteria. To reduce the energy consumption, the cooling system is recommended to be limited to 1kW cooling unit.

As it would be readily appreciated, DSY2 and DSY3 weather types for the 2050's period as well as weather types DSY2 and DSY3 for the 2080's period are more onerous scenarios to achieve full compliance with natural ventilation performance. Therefore, the proposed building will require of the provision of active cooling to mitigate the risk of overheating under these stricter weather' data. The future retrofit plan could also include the replacement of any fixed glazing (e.g., at their end of life) across the scheme with openable windows (that could be achieved with the incorporation of Juliet balconies) to maximise free areas for ventilation in the future. The design of the building could also consider the incorporation of ceiling fans to improve air movement.

NON-RESIDENTIAL

2020's weather data

The results for the non-domestic elements of the scheme are presented in the tables below using London DSY1 2020's weather data, the sequential improvement measures that are proposed to be incorporated for each iteration and the number of spaces that were not found to meet the CIBSE TM52 criteria.

Table 15: Overheating assessment results for dwellings for London Weather Centre DSY1 2020's weather file.

It No	Design change	Weather file	Occupied Spaces					Mechanical Cooling	Thermal mass	No. of Retail spaces not meeting 2/3 criteria TM52
			F.A.	Window g-value	Lighting density	Mechanical ventilation	Solar shading			
1	Opening windows (Natural ventilation)	London DSY1: 2020 High Emissions 50 percentile	95% F.A. All panes to open side hung by 90 degrees (open daytime)	0.5	15 W/m ²	10l/s/p	-	-	Lightweight	6 of 6
2	Reducing g-value to 0.4	London DSY1: 2020 High Emissions 50 percentile	as per above	0.4	15 W/m ²	10l/s/p	-	-	Lightweight	6 of 6
3	Increase mechanical flow rate to 20 l/s/p	London DSY1: 2020 High Emissions 50 percentile	as per above	0.4	15 W/m ²	20l/s/p	-	-	Lightweight	5 of 6
4	Reducing g-value to 0.3	London DSY1: 2020 High Emissions 50 percentile	as per above	0.3	15 W/m ²	20l/s/p	-	-	Lightweight	3 of 6
5	Trim cooling MVHR with cooling coil to Basement	London DSY1: 2020 High Emissions 50 percentile	as per above	0.3	15 W/m ²	20l/s/p	-	Cooling capacity limited to 1.5kW	Lightweight	0 of 6

The following observations can be made from the results:

- The use of natural ventilation (maximising Free area for windows as proposed by the architectural design) as well as reducing the g-value across the commercial units to 0.3 and increase the MVHR flow rate to 20 l/s/p were found to allow the areas of the retail units at ground to meet the criteria;
- The three commercial units have additional areas at basement level with not enough direct access to natural ventilation to allow these lower areas to meet the TM52 criteria. The provision of trim cooling from the MVHR system with incorporated cooling coils is recommended to meet the overheating criteria. Passive measures including low energy lighting, solar control glazing with g-value of 0.3 and insulated pipework will be maximised for these spaces specifically in order to reduce the demand for cooling whilst maintaining the desirable internal environment in line with industry guidelines and the MEP brief for the project.

The final iteration based on a naturally ventilated scenario has been applied with DSY2 and DSY3 weather types. The results for these weather files are presented in the table below for the London Centre DSY2 and DSY3 for 2020's period. This is mainly for information purposes only for more onerous weather types as explained in the residential results section of the report.

Table 16: Overheating assessment results for dwellings for London Weather Centre DSY2 and DSY3 for the 2020's weather file.

It No	Design change	Weather file	Occupied Spaces					Mechanical Cooling	Thermal mass	No. of Retail spaces not meeting TM52 (DSY2 and DSY3)
			F.A.	Window g-value	Lighting density	Mechanical ventilation	Solar shading			
1 Based on Table 15 it-4	Reducing g-value to 0.3	London DSY2/DSY3: 2020 High Emissions 50 percentile	as per architect's design	0.3	15 W/m2	20l/s/p	-	-	Lightweight	6 of 6
2	Heavyweight thermal mass	London DSY2/DSY3: 2020 High Emissions 50 percentile	as per above	0.3	15 W/m2	20l/s/p	-	-	Heavyweight	6 of 6
3	Reducing g-value to 0.25	London DSY2/DSY3: 2020 High Emissions 50 percentile	as per above	0.25	15 W/m2	20l/s/p	-	-	Heavyweight	6 of 6
4	Adding solar shading	London DSY2/DSY3: 2020 High Emissions 50 percentile	as per above	0.25	15 W/m2	20l/s/p	Adding horizontal shading on S facing windows and vertical shading on E facing windows	-	Heavyweight	6 of 6
5	Trim cooling MVHR with cooling coil	London DSY2/DSY3: 2020 High Emissions 50 percentile	as per above	0.25	15 W/m ²	20l/s/p	Adding horizontal shading on S facing windows and vertical shading on E facing windows	Cooling capacity limited to 1.5kW	Heavyweight	0 of 6

The following observations can be made from the results:

- The results for DSY 2 and 3 show that none of the spaces meet TM52 criteria using mitigation techniques that suffice for the moderately warm summer in the 2020's as presented in iteration 4 of the Table 15.
- Additional passive measures such as lower g-values and external shading elements are recommended to reduce solar gains.
- Trim cooling for the three commercial units at ground and basement is required to mitigate overheating in the more severe weather files, due to their extreme nature.

2050's weather data

For the future weather scenarios, the final iteration of the proposed scheme using the DSY 1 2020's weather data (iteration 5 of Table 15), has been applied against the 2050 and 2080 London Weather Centre DSY1 weather files in the non-residential areas of the building.

The table below present the analysis for DSY1 for 2050's period to evaluate the measures required to be incorporated as part of the retrofit plan for spaces proposed to be naturally ventilated.

Table 17: Overheating assessment results for London Weather Centre DSY1 2050's weather data.

It No	Design change	Weather file	Occupied Spaces					Mechanical Cooling	Thermal mass	No. of Retail spaces not meeting TM52
			F.A.	Window g-value	Lighting density	Mechanical ventilation	Solar shading			
1 Based on Table 15 it-5	Adding solar shading	London DSY2/DSY 3: 2020 High Emissions 50 percentile	as per architect's design	0.3	15 W/m ²	20l/s/p	Adding horizontal shading on S facing windows and vertical shading on E facing windows	-	Heavyweight	6 of 6
2	Trim cooling MVHR with cooling coil	London DSY2/DSY 3: 2020 High Emissions 50 percentile	as per above	0.25	15 W/m ²	20l/s/p	Adding horizontal shading on S facing windows and vertical shading on E facing windows	Cooling capacity limited to 1.5kW	Heavyweight	0 of 6

The results indicated that in order for the commercial units of the development to pass the future weather scenario of DSY1 2050, external shading is required. Vertical shading of 800mm deep (+200mm reveal) is proposed to the east facing windows and horizontal canopies of similar depth to those facing south.

Trim cooling is proposed to be installed for these areas of the scheme currently (in line with Haringey's requirements to provide cooling where required from the outset of the project) and after passive measures have been maximised as far as possible in line with Haringey's and GLA's guidance. For these spaces, energy efficient lighting, insulated pipework and solar control glazing are incorporated as part of the proposed scheme to reduce the demand for cooling.

It was deemed appropriate to consider active cooling in order to prevent overheating under the 2080 scenario in the most effective way. An active cooling system may be more beneficial than a MVHR cooling coil module due to the high levels of efficacy and noise produced by the MVHR under very high flow rates.

CONCLUSIONS AND RECOMMENDATIONS

The results show that all selected flats and commercial units achieve compliance with Part O overheating risk criteria for London Centre DSY1 2020s weather data, provided that adequate design considerations are taken into account.

The results detailed on the previous section demonstrate that a combination of window opening types for natural ventilation and solar control strategies are essential for compliance with the overheating risk criteria.

Generally, a g-value of 0.50 should be the preferred specification to not overly compromise the energy performance and compliance with CO₂ emissions targets.

Table 18 summarises the design recommendations that contribute to reducing overheating risk.

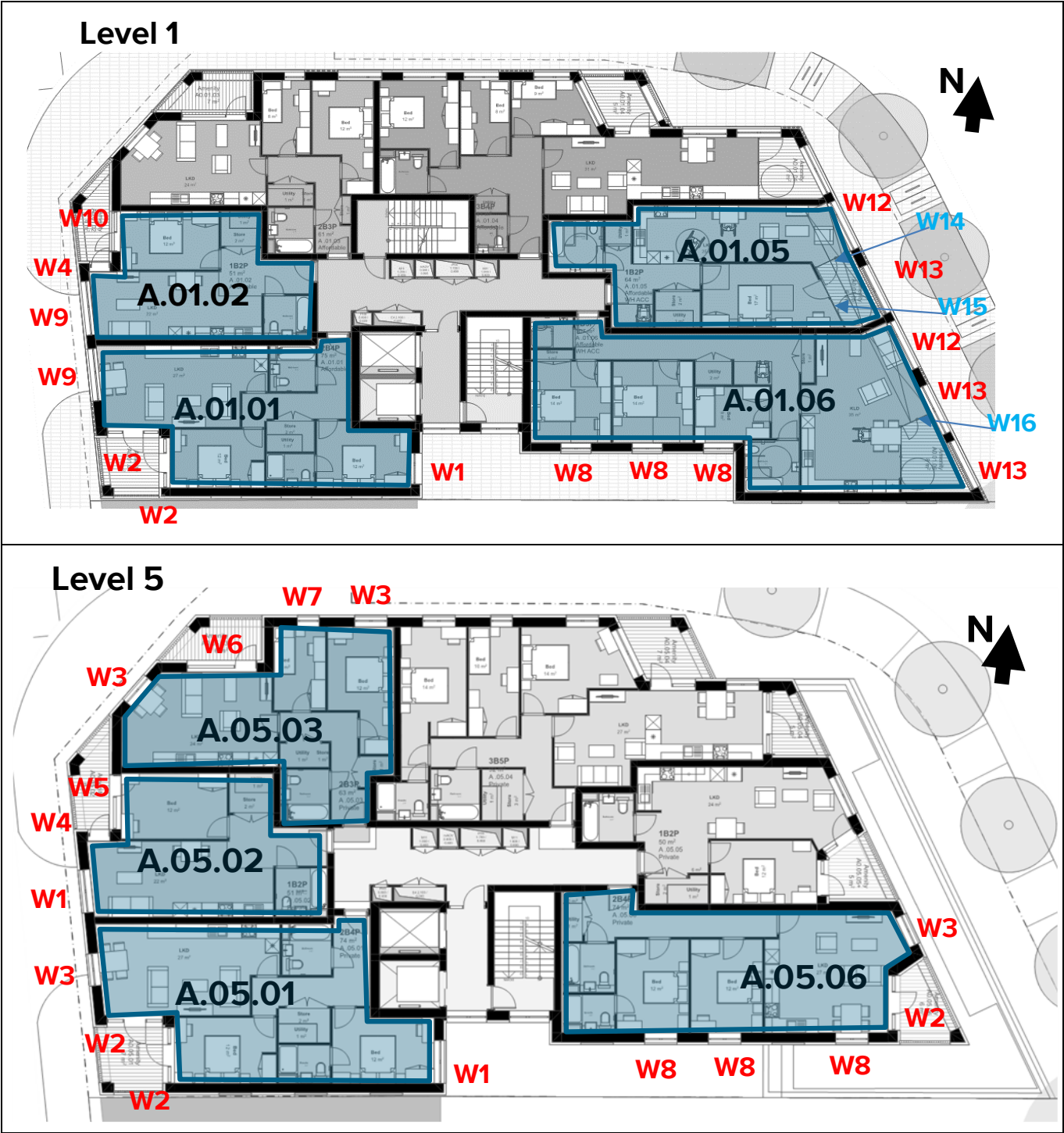
Table 18: Summary of recommendations for the proposed development.

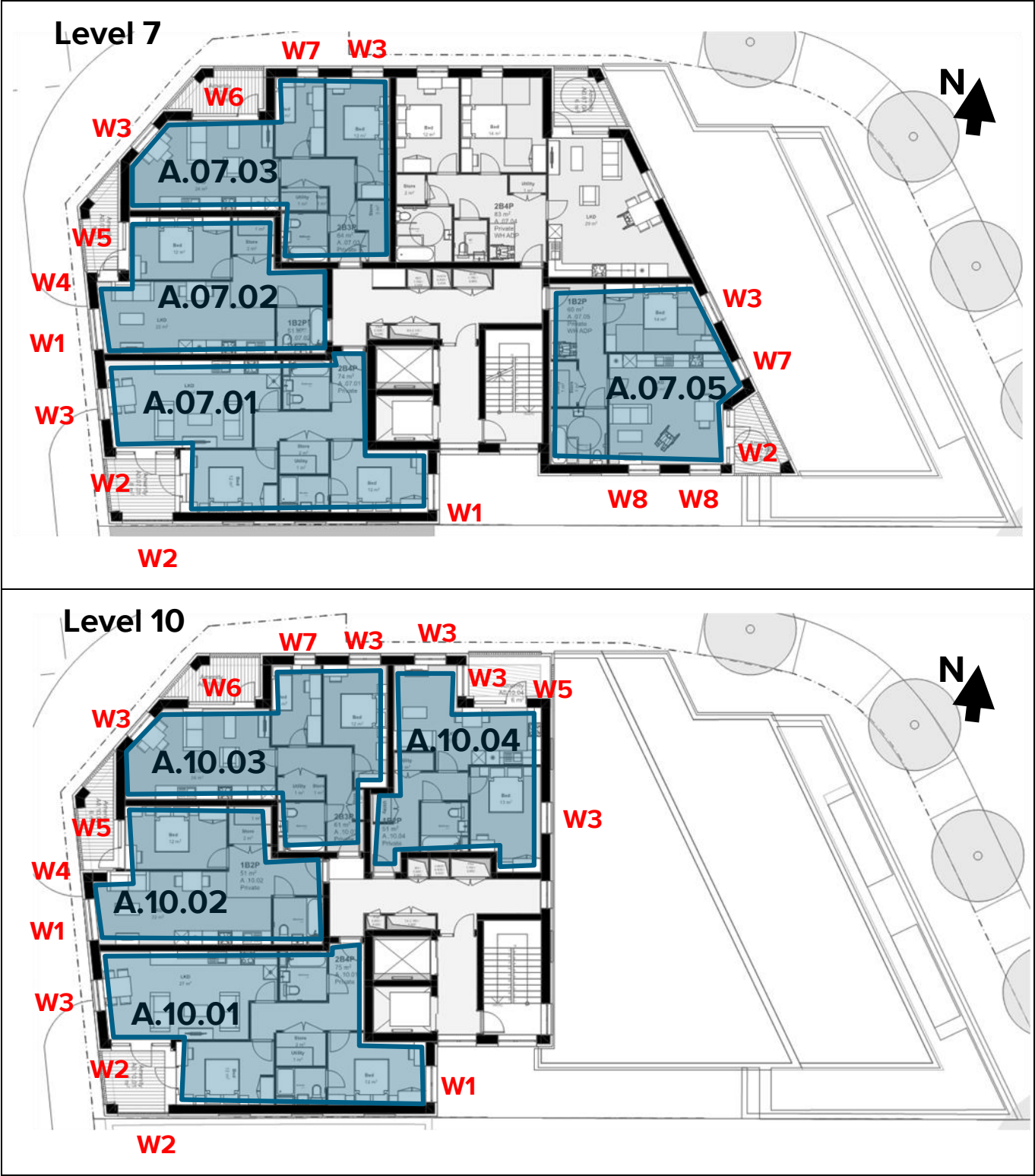
Measure	Implementation
Minimise internal heat generation through energy efficient design	
High efficiency lighting installations (LED)	All spaces: All fixed building elements such as ceiling lights and white goods will be very energy efficient. It is recommended that the occupants also use energy efficient equipment, for example, energy efficient light fittings of LED types and A+ rated electrical appliances such as TVs that consume less energy and promoted to reduce internal heat gains.
Low temperature hot water (LTHW) pipework design and installations (location, configuration and insulation) to minimise heat losses.	LTHW pipework running in corridors and circulation areas to be highly insulated across the whole length; including jackets for valves and junctions. Primary distribution will be vertical rather than horizontal to reduce pipe lengths.
Reduce the amount of heat entering the building	
External shade from balconies and overhangs	Slight recesses included within windows across site and balconies where present. Extensive detailed balcony incorporated and modelled. External fins at Level 1 for safety, privacy and to reduce solar gains in KLDs.
Internal shading via opaque blinds	For lounges and bedrooms: The overheating strategy does not rely on blinds, however, the use of internal shading devices is recommended on sunny and warm days to prevent direct solar gains been transmitted into the rooms. These should be left closed when the rooms are not occupied. When using the curtains/blinds, occupants should make sure that these do not cover the openable area of the windows completely so that the air movement is not blocked.
Solar control glazing (g value ≤0.63)	Solar control glazing on all windows to achieve g-value = 0.50.
Future retrofit plan	Installation of 800mm vertical fins on all east and west facing windows (which are to have 200mm reveals) Installation of 800mm horizontal shading directly above unshaded south facing windows (which are to have 200mm reveals)
Use of thermal mass to manage heat within the building	
Concrete slab providing thermal mass	Not offering a significant beneficial impact and incompatible with other required strategies (e.g., MVHR)
Passive ventilation	
Natural ventilation opening	Openable windows as per proposed equivalent free area for natural ventilation. Occupants should be advised to leave their windows securely open during the night on warm summer days to take advantage of the low external temperatures during the night for cooling down their rooms and remove the excessive heat that builds up throughout the day.

Future retrofit plan	Replacement of any fixed glazing (e.g., at their end of life) across the co-living and dwellings parts of the scheme with openable glazing which can be achieved with the installation of Juliet balconies (with railing does not influence attainable free areas)
Mechanical ventilation	
Mechanical extract	Communal corridors will require minimum mechanical extract ventilation with a flow rate of 10 L/s per floor to mitigate overheating risk with DSY1 2020's weather.
MVHR with summer boost mode and cooling coils	Recommended for current weather file and with increase flow rates for future retrofit.
Future retrofit plan	Although unlikely to offer significant improvement, ceiling fans on the dwellings can be incorporated to facilitate air movement.
Mechanical cooling	
Cooling	Active mechanical cooling to be specified in the non-residential spaces and future weather scenarios for 2050's and 2080's weather files.

APPENDIX A – WINDOW LAYOUT

The following table shows the window types (and their respective numbering that was assumed) throughout the scheme for the purposes of the overheating preliminary assessment.





APPENDIX B – DETAILED RESULTS: CIBSE 2020S DSY1 WEATHER FILE

The following table presents results in detail for each of the residential assessed rooms in terms of percentage of occupied hours when the internal operative resultant temperature is within the comfort range given by both Part O criteria.

Compliance for bedrooms requires passing both of the following two criteria, whereas compliance for living rooms requires compliance with the first criterion.

Room	CIBSE 2020s DSY1		Part O Compliance
	Criterion 1	Criterion 2	
	≤ 3%	≤ 32hrs	
A.01.01_2B4P_DB1	0.7	26	Pass
A.01.01_2B4P_DB2	0.7	26	Pass
A.01.01_2B4P_KLD	2.2	N/A	Pass
A.01.02_1B2P_DB	0.9	25	Pass
A.01.02_1B2P_KLD	2.5	N/A	Pass
A.01.05_1B2P_DB	0.3	30	Pass
A.01.05_1B2P_KLD	1.2	N/A	Pass
A.01.06_3B5P_DB1	0.5	22	Pass
A.01.06_3B5P_DB2	0.5	21	Pass
A.01.06_3B5P_KLD	1.9	N/A	Pass
A.01.06_3B5P_SB	0.5	11	Pass
A.05.01_2B4P_DB1	0.7	26	Pass
A.05.01_2B4P_DB2	0.7	26	Pass
A.05.01_2B4P_KLD	1.8	N/A	Pass
A.05.02_1B2P_DB	1.1	29	Pass
A.05.02_1B2P_KLD	2.1	N/A	Pass
A.05.03_2B3P_DB	0.4	14	Pass
A.05.03_2B3P_KLD	1.6	N/A	Pass
A.05.03_2B3P_SB	0.4	9	Pass
A.05.06_2B4P_DB1	0.5	19	Pass
A.05.06_2B4P_DB2	0.6	22	Pass
A.05.06_2B4P_KLD	2.0	N/A	Pass
A.07.01_2B4P_DB1	0.7	28	Pass
A.07.01_2B4P_DB2	0.8	26	Pass
A.07.01_2B4P_KLD	1.8	N/A	Pass
A.07.02_1B2P_DB	1.1	28	Pass
A.07.02_1B2P_KLD	2.1	N/A	Pass
A.07.03_2B3P_DB	0.4	14	Pass
A.07.03_2B3P_KLD	1.6	N/A	Pass

A.07.03_2B3P_SB		0.4	9	Pass
A.07.05_1B2P_DB		0.6	27	Pass
A.07.05_1B2P_KLD		2.0	N/A	Pass
A.10.01_2B4P_DB1		0.7	31	Pass
A.10.01_2B4P_DB2		0.8	27	Pass
A.10.01_2B4P_KLD		1.7	N/A	Pass
A.10.02_1B2P_DB		1.1	29	Pass
A.10.02_1B2P_KLD		2.0	N/A	Pass
A.10.03_2B3P_DB		0.5	20	Pass
A.10.03_2B3P_KLD		1.6	N/A	Pass
A.10.03_2B3P_SB		0.4	10	Pass
A.10.04_1B2P_DB		0.7	27	Pass
A.10.04_1B2P_KLD		1.7	N/A	Pass
Total No. Pass	Double Bedrooms	22 / 22	22 / 22	22 / 22
	Single Bedrooms	4 / 4	4 / 4	4 / 4
	Living rooms (KLD)	16 / 16	N/A	16 / 16
Overall compliance				42 / 42
% Pass				100%

APPENDIX B – DETAILED RESULTS: CIBSE 2020S DSY2 AND DSY3 WEATHER FILES

In line with the Part O methodology, the proposed development is required to be assessed against and pass using the CIBSE 2020s DSY1 weather file. Results Section of the report demonstrates that all assessed units comply with both TM59 criteria.

Both TM59 and GLA guidance recommend that in addition to DSY1 the following two additional TM49 design weather years for 2020s should be used to further test the design, even though, a pass against these is not mandatory:

- 1976: a year with a prolonged period of sustained warmth (DSY3);
- 2003: a year with a very intense single warm spell (DSY2).

The final iteration based on a natural ventilated scenario (before trim cooling provision) has been assessed against the more extreme DSY2 and DSY3 weather files for 2020s and results are presented below.

Room	CIBSE 2020s DSY2		Part O Compliance	CIBSE 2020s DSY3		Part O Compliance
	Criterion 1	Criterion 2		Criterion 1	Criterion 2	
	≤ 3%	≤ 32hrs		≤ 3%	≤ 32hrs	
A.01.01_2B4P_DB1	1.6	72	Fail	2.3	79	Fail
A.01.01_2B4P_DB2	1.9	70	Fail	2.6	82	Fail
A.01.01_2B4P_KLD	5.2	N/A	Fail	5.6	N/A	Fail
A.01.02_1B2P_DB	2.2	70	Fail	2.7	74	Fail
A.01.02_1B2P_KLD	4.9	N/A	Fail	5.5	N/A	Fail
A.01.05_1B2P_DB	1	75	Fail	1.4	106	Fail
A.01.05_1B2P_KLD	3.7	N/A	Fail	4.6	N/A	Fail
A.01.06_3B5P_DB1	1.6	71	Fail	2.0	74	Fail
A.01.06_3B5P_DB2	1.6	69	Fail	2.1	71	Fail
A.01.06_3B5P_KLD	4.2	N/A	Fail	5.3	N/A	Fail
A.01.06_3B5P_SB	1.7	52	Fail	2.3	48	Fail
A.05.01_2B4P_DB1	1.6	72	Fail	2.4	86	Fail
A.05.01_2B4P_DB2	1.9	70	Fail	2.3	82	Fail
A.05.01_2B4P_KLD	4.9	N/A	Fail	5.4	N/A	Fail
A.05.02_1B2P_DB	2.3	72	Fail	2.9	89	Fail
A.05.02_1B2P_KLD	4.6	N/A	Fail	5.4	N/A	Fail
A.05.03_2B3P_DB	1.2	53	Fail	1.8	56	Fail
A.05.03_2B3P_KLD	4.6	N/A	Fail	5.4	N/A	Fail
A.05.03_2B3P_SB	1.1	39	Fail	1.6	42	Fail
A.05.06_2B4P_DB1	1.6	66	Fail	2.0	67	Fail
A.05.06_2B4P_DB2	1.7	70	Fail	2.3	74	Fail
A.05.06_2B4P_KLD	4.3	N/A	Fail	5.5	N/A	Fail
A.07.01_2B4P_DB1	1.6	74	Fail	2.5	94	Fail
A.07.01_2B4P_DB2	1.9	70	Fail	2.4	82	Fail
A.07.01_2B4P_KLD	4.8	N/A	Fail	5.4	N/A	Fail

A.07.02_1B2P_DB		2.3	71	Fail	2.9	89	Fail
A.07.02_1B2P_KLD		4.7	N/A	Fail	5.4	N/A	Fail
A.07.03_2B3P_DB		1.3	53	Fail	1.9	56	Fail
A.07.03_2B3P_KLD		4.6	N/A	Fail	5.4	N/A	Fail
A.07.03_2B3P_SB		1.2	38	Fail	1.6	42	Fail
A.07.05_1B2P_DB		1.5	79	Fail	2.3	96	Fail
A.07.05_1B2P_KLD		4.5	N/A	Fail	5.7	N/A	Fail
A.10.01_2B4P_DB1		1.6	78	Fail	2.6	103	Fail
A.10.01_2B4P_DB2		1.9	71	Fail	2.5	84	Fail
A.10.01_2B4P_KLD		4.7	N/A	Fail	5.4	N/A	Fail
A.10.02_1B2P_DB		2.3	73	Fail	2.9	93	Fail
A.10.02_1B2P_KLD		4.5	N/A	Fail	5.3	N/A	Fail
A.10.03_2B3P_DB		1.4	68	Fail	2.0	76	Fail
A.10.03_2B3P_KLD		4.5	N/A	Fail	5.3	N/A	Fail
A.10.03_2B3P_SB		1.2	43	Fail	1.7	43	Fail
A.10.04_1B2P_DB		1.6	72	Fail	2.4	93	Fail
A.10.04_1B2P_KLD		3.9	N/A	Fail	5.1	N/A	Fail
Total No. Pass	Double Bedrooms	22 / 22	0 / 22	0 / 22	22 / 22	0 / 22	0 / 22
	Single Bedrooms	4 / 4	0 / 4	0 / 4	4 / 4	0 / 4	0 / 4
	Living rooms / Kitchens	0 / 16	N/A	0 / 16	0 / 16	N/A	0 / 16
Overall compliance				0 / 42			0 / 42
% Pass				0%			0%