TAYLOR PROJECT SERVICES LLP
BUILDING SERVICES CONSULTANTS

Natural Ventilation (CIBSE TM52) Overheating Assessment

32 Percy Street

Prepared for Hale Brown Architects

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Stage 3 Design Assessment

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1.0 EXECUTIVE SUMMARY

This report assesses the risk of summertime overheating for the proposed office refurbishment project at 32 Percy Street, London, W1. The proposal sees the refurbishment of an existing Georgian office across 5 floors (including lower ground and ground floor). This report has been prepared to support the BREEAM Non-Domestic Refurbishment and Fitout 2014 assessment and will look into thermal comfort and the application of natural ventilation measures within the building.

Simulations have been carried out using the current TAS DSM modelling software to accurately simulate the indoor temperatures and conditions for the purpose of identifying areas of potential overheating.

Note: CIBSE TM52 is used as a design benchmark to demonstrate the performance of the building. The development does not commit to meeting these standards.

Where information has not been available, reference figures have been used based on the National Calculation Methodology (NCM) document.

2.0 CIBSE TM52: LIMITS OF THERMAL COMFORT

In order to assess the overheating risk at 32 Percy Street, the CIBSE TM52 methodology has been followed. The memorandum states:

"Overheating has become a key problem for building design. The need to reduce energy consumption whilst dealing with global climate change has reduced the options available for building comfortable, low-energy buildings. Research has been directed towards methods for increasing indoor winter temperatures but this can lead to lightweight, highly insulated buildings that respond poorly in the summer.

one problem for designers has been the absence of an adequate definition of overheating in naturally ventilated buildings. In the past overheating has been defined as a number of hours over a particular temperature, irrespective of conditions outside the building. Recent work embodied in European standards suggests that the temperature that occupants will find uncomfortable changes with the outdoor conditions in a predictable way. This research informs the CIBSE guidance presented in this Technical Memorandum (TM). The meaning of the research and the link with overheating are explained and a series of criteria by which the risk of overheating can be assessed or identified are suggested.

The CIBSE Technical Memorandum 52 sets out the definition and compliance with limiting overheating.

The standard introduces three categories of building:

1. Category I – buildings whose occupants are sensitive or fragile
2. Category II – normal expectation, recommended for new build or renovations
3. Category III – moderate expectation, mainly applicable in existing buildings

The standard provides a robust, yet balanced, assessment of the risk of overheating of buildings in the UK and Europe. A room or building that fails any two of the three following criteria is classed as overheating:

Criterion 1 sets a limit of 3% for the number of hours that the operative temperature can exceed the threshold comfort temperature (upper limit of the range of comfort temperature) by one degree or more during the occupied hours of a typical non-heating season (1st May to the 30th September) temperature. The number of hours where ΔT is greater than or equal to one degree (ºK) during the period of May to September inclusive shall not last more than 3% of occupied hours. ΔT is defined as operative temperature less the maximum acceptable temperature.

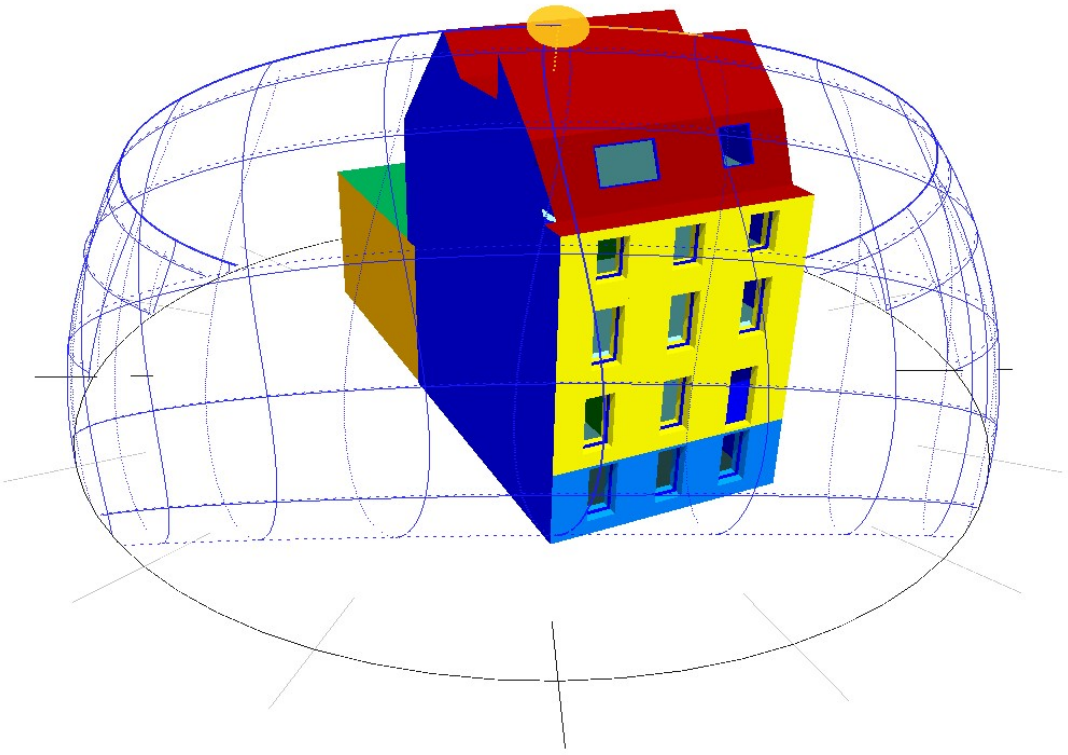
Criterion 2 deals with the severity of overheating within any one day, which can be as important as its frequency. This is a function of both temperature above maximum temperature and its duration. This criterion sets a daily limit for acceptability. If each hour (or part-hour) in which the temperature exceeds max temperature by at least 1ºK is multiplied by the number of degrees by which it is exceeded, then this 'excess' should not be more than six degree-hours.

Criterion 3 sets an absolute maximum temperature of (Tmax + 4) °C for a room (Tupp), beyond which the level of overheating is unacceptable. To set an absolute maximum value for the indoor operative temperature, the value of (ºK) shall not exceed 4 ºK.

The weather file for the TM52 analysis is the London Design Summer Year (DSY) 2016, obtained by CIBSE data.

The following spaces were assessed using TM52 methodology:

All office areas
Entrance lobby
Reception
Circulations areas
Rear Extension
Kitchen



4.0 MODEL INPUTS

Geometry

The geometry for the building has been modelled using EDSL TAS 9.5. The building has been modelled from drawings provided by Hale Brown Architecture.

Weather

The weather file used for the CIBSE TM52 assessment is the CIBSE London Design Summer Year (DSY).

Modelling Inputs

Unless specified, the following data has been assumed, based on NCM (National Calculation Methodology). The methodology states:

1. In order to facilitate estimating energy performance on a consistent basis, a key part of the NCM is an Activity database that defines the activities in various types of space in different classes of building (which closely align with the Town and Country Planning (TCP) Use Classes). One of these standard activities must be assigned to each space in the building
2. The database provides standard occupancy, temperature set-points, outdoor air rates and heat gain profiles for each type of space in the building so that buildings with the same mix of activities will differ only in terms of their geometry, construction, building services, and weather location. Thus, it is possible for the Building Regulation 26 compliance test and EPCs to compare buildings on the basis of their intrinsic potential performance, regardless of how they may actually be used in practice.
3. The fields of information in the database are as follows:
    a. Occupancy times and density; total metabolic rate and percentage which is latent (water vapour)
    b. Set-point temperature and humidity in heating and cooling modes; DSM software will use air temperature as the basis for temperature set-points for the Actual, Notional, and Reference buildings
    c. Set-back conditions for unoccupied periods
    d. Sensible and latent heat gain from other sources
    e. Outside air requirement
    f. Level of illuminance for general lighting and the power density for display lighting
    g. Hot water demand
    h. Type of space for glazing, lighting, and ventilation classification within Building Regulations compliance
    i. A marker indicating whether the activity requires high efficiency filtration, thereby justifying an increased SFP allowance for that space to account for the increased pressure drop.

External Design Criteria

External Design Criteria	
Summer Dry Bulb Temperature	+30 degrees Celsius
Winter	-4 degrees Celsius

Building Fabric

Fabric Criteria	**Notional Part L2 Values**	**Existing Element U values**	**New Element U Values**
External Walls	0.35W/m^2k	1.60 W/m^2k	0.25 W/m^2k
Floors	0.25 W/m^2k	0.58 W/m^2k	0.12 W/m^2k
Roofs	0.25 W/m^2k	2.80 W/m^2k	0.12 W/m^2k
Door (<30% Glazing)	2.20 W/m^2k	3.00 W/m^2k	1.50 W/m^2k
Door (30-60% Glazing)	2.20 W/m^2k	3.00W/m^2k	1.50 W/m^2k
Windows	2.20 W/m^2k	6.34 W/m^2k	1.40 W/m^2k
Air Permeability	10.00 m^3/h.m^2	25.00 m^3/h.m^2	10.00 m^3/h.m^2
Thermal Bridging	-	Accredited Construction Details where possible	

Internal Temperatures

The following internal temperatures have been input into the DSM model. These have been specified

	Cooling	Heating
Office Areas	21 ºc	18 ºc
Entrance lobby	21 ºc	18 ºc
Reception	21 ºc	18 ºc
Circulations areas	N/A	18 ºc
Rear Extension Area	21 ºc	18 ºc
Kitchens	N/A	18 ºc

Internal Gains (NCM)

Lighting		Power (Sensible Gain)	
Office Areas	15.0 W/m^2	Office Areas	11.68 W/m^2
Entrance lobby	19.4 W/m^2	Entrance lobby	6.19 W/m^2
Reception	19.4 W/m^2	Reception	6.19 W/m^2
Circulations areas	5.2W/m^2	Circulations areas	1.85 W/m^2
Rear Extension Area	15.0W/m^2 *	Rear Extension Area	11.68 W/m^2
Kitchens	26.0 W/m^2	Kitchens	28.72 W/m^2
Toilets/Showers	10.4 W/m^2	Toilets/Showers	5.48 W/m^2

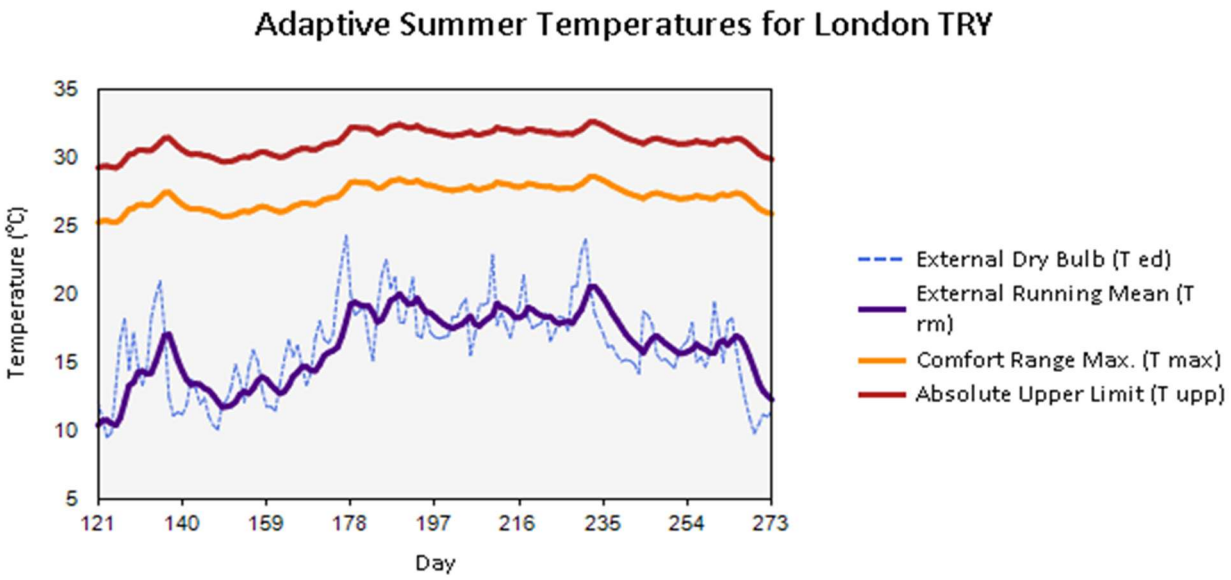
Occupancy (NCM)

Space	Watts per m^2 person latent/sensible
Offices	5.30/7.74
Entrance lobby	5.51/8.61
Reception	5.51/8.61
Circulations areas	8.21/8.21
Rear Extension Area	5.30/7.74
Kitchen Areas	12.64/6.81
Toilets/Showers	7.87/7.87

5.0 OVERHEATING ANALYSIS AND RESULTS

5.1 TM52 RESULTS

Adaptive Overheating Report (CIBSE TM52)



The adaptive overheating assessment tests rooms against three criteria. If a room fails any two of the three criteria then it is said to overheat.
1. The first criterion sets a limit for the number of hours that the operative temperature exceeds the comfort temperature by 1°C or more during the occupied hours over the summer period (1st May to 30th September).
2. The second criterion deals with the severity of the overheating within any one day. This sets a daily limit for acceptability.
3. The third criterion sets an absolute maximum daily temperature for the room.

Project Details

Building Designer File (.tbd): 220310 - Percy Street TAS TM52 Model.tbd
Simulation Results File (.tsd): 220310 - TM52 Report.tsd
Date: March 2022
Building Category: Category II
Report Criteria: TM52

Results

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
Z1-01 - Reception Room	1272	38	58	15.0	5	Fail
Z1-02 Reception	1272	38	9	12.0	0	Pass
Z1-03 Meeting Room	1272	38	17	18.0	0	Pass
Z1-04 Rear Office	1166	34	785	23.0	517	Fail
Z0-01 Informal Meeting & Breakout Space	1272	38	7	8.0	0	Pass
Z0-02 2WC	1272	38	0	0.0	0	Pass

Z0-03 Bike Store	1272	38	0	0.0	0	Pass
Z0-04 Store	1272	38	0	0.0	0	Pass
Z2-01 Circulation	1272	38	8	12.0	0	Pass
Z2-02 Front Office	1272	38	163	22.0	12	Fail
Z2-03 Rear Office	1272	38	252	25.0	26	Fail
Z3-01 Front Office	1272	38	17	18.0	0	Pass
Z3-02 WC	1272	38	7	10.0	0	Pass
Z4-01 Office	1272	38	102	20.0	6	Fail
Z2-02 Circulation	1272	38	222	24.0	24	Fail
Z2-03 WC	1272	38	186	20.0	19	Fail

Overall	
Passed	9/16
Failed	7/16

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
Z1-01 - Reception Room	1272	38	58	15.0	5	Fail
Z1-04 Rear Office	1166	34	785	23.0	517	Fail
Z2-02 Front Office	1272	38	163	22.0	12	Fail
Z2-03 Rear Office	1272	38	252	25.0	26	Fail
Z4-01 Office	1272	38	102	20.0	6	Fail
Z2-02 Circulation	1272	38	222	24.0	24	Fail
Z2-03 WC	1272	38	186	20.0	19	Fail

From the results, the majority of the office areas fail the TM52 criterion, with an exceedance in temperature limits and will therefore require treatment to remedy this. The results are based on naturally ventilated zones and the heat pump cooling capability will therefore treat the overheated zones.

The circulation, WC and shower areas have been assessed and do not pose an overheating risk due to a smaller occupancy and lighting/small power gain.

5.2 TM52 UPDATED RESULTS

Results

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
Z1-01 - Reception Room	1272	38	2	0.0	0	Pass
Z1-02 Reception	1272	38	0	0.0	0	Pass
Z1-03 Meeting Room	1272	38	2	0.0	0	Pass
Z1-04 Rear Office	1166	34	2	0.0	2	Pass
Z0-01 Informal Meeting & Breakout Space	1272	38	0	0.0	0	Pass
Z0-02 2WC	1272	38	0	0.0	0	Pass
Z0-03 Bike Store	1272	38	0	0.0	0	Pass
Z0-04 Store	1272	38	0	0.0	0	Pass
Z2-01 Circulation	1272	38	0	0.0	0	Pass
Z2-02 Front Office	1272	38	2	0.0	0	Pass
Z2-03 Rear Office	1272	38	2	0.0	0	Pass
Z3-01 Front Office	1272	38	0	0.0	0	Pass
Z3-02 WC	1272	38	0	0.0	0	Pass
Z4-01 Office	1272	38	3	0.0	0	Pass
Z2-02 Circulation	1272	38	0	0.0	0	Pass
Z2-03 WC	1272	38	3	0.0	0	Pass

6.0 CONCLUSIONS AND RECOMMENDATIONS

The full results of the CIBSE TM52 analysis summarises the overall results with regards to the three criteria (explained in the previous section).

This analysis is carried out for occupied spaces and where there are no occupants (for more than 30 minutes of the day), these spaces have not been considered.

Out of the zones assessed, the majority of the offices failed the TM52 criteria, by a medium to large margin (in criterion 1). This is due to the internal conditions namely the occupancy, small power, infiltration, ventilation and lighting gains when using natural ventilation in the model.

The circulation areas, WC and shower rooms did not pose an overheating risk, however should any of the assumed figures be altered, a further simulation should be carried out with the updated figures, to ensure there are no overheating issues.

The areas that overheat will serviced via a highly efficient heat pump system. The system will provide heating and cooling to the zones.

Summary Conclusion

- Office Areas overheat when naturally ventilated
- Common areas show no overheating risk, due to low internal conditions
- Heat pumps will be used to heat and cool the problem areas.
- Glazing will be assessed (new), to identify the feasibility of introducing low G glazing, especially with the rooflights at the rear extension.