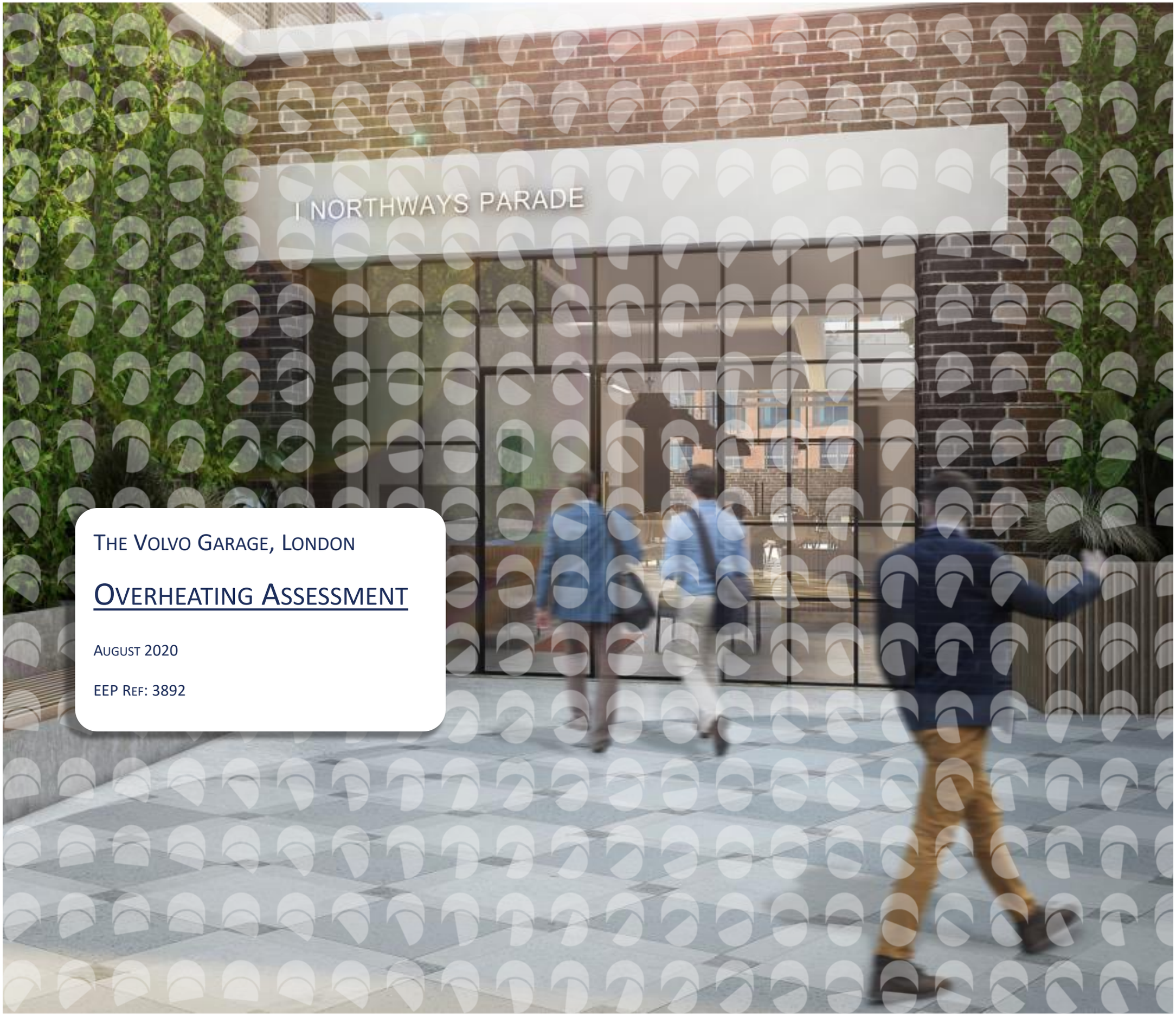

THE VOLVO GARAGE, LONDON

OVERHEATING ASSESSMENT

AUGUST 2020

EEP REF: 3892

ENVIRONMENTAL ENGINEERING PARTNERSHIP

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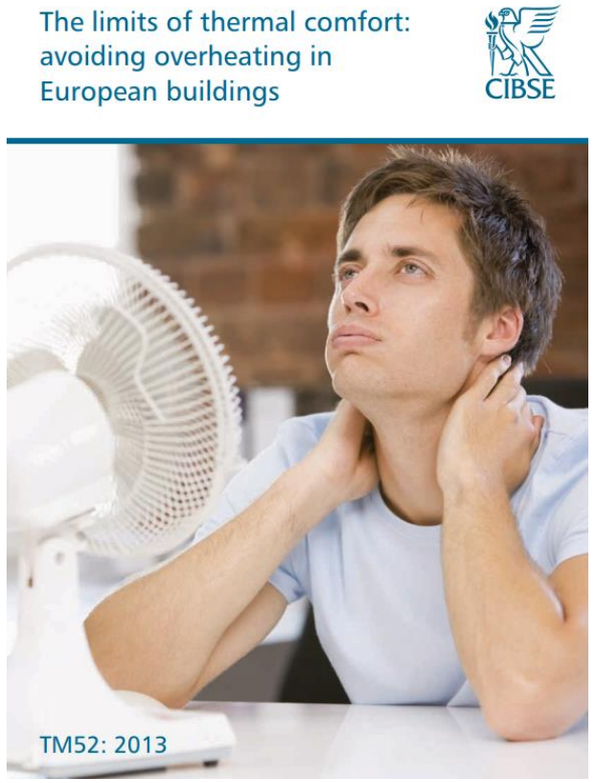
INTRODUCTION

Overheating is a widely used term but is not precisely defined or understood. It implies that building occupants feel uncomfortably hot and that this discomfort is caused by the indoor environment.

Thermal comfort is a complex topic quantified by a subjective response of an occupant's interaction with the environment around them and it is difficult to predict one occupants experience from another, and it is common for personal comfort to vary between occupants with varying degrees.

It is proposed for the ground floor area to change its usage from a car workshop/garage to an office. There is to be a small extension to allow for pedestrian access from College Crescent. Air source heat pumps VRF systems will provide space heating and cooling, an air handling unit with heat recovery capability will provide fresh air to the offices.

This report assesses the likelihood that the building is going to overheat via the methodology set out in CIBSE Guide A: Environmental Design and TM52: The Limits of Thermal Comfort.



CIBSE Guide A – Environmental Design

CIBSE Guide A states that the indoor environment should be designed and controlled so that occupants' comfort and health are assured. There are individual difference in perception and subjective evaluation, resulting in a base level of dissatisfaction within the building population. This dissatisfaction may be with a specific aspect of the environment or may be general and non-specific. The aim of design should be to minimise the dissatisfaction as far as is reasonably practicable.

TM52: The limits of Thermal Comfort, Avoiding Overheating in European Buildings

The CIBSE "TM52 – The limits of thermal comfort: avoiding overheating in European buildings" provides a methodology for predicting overheating in buildings and is intended to ensure comfort conditions can be maintained for the given building design.

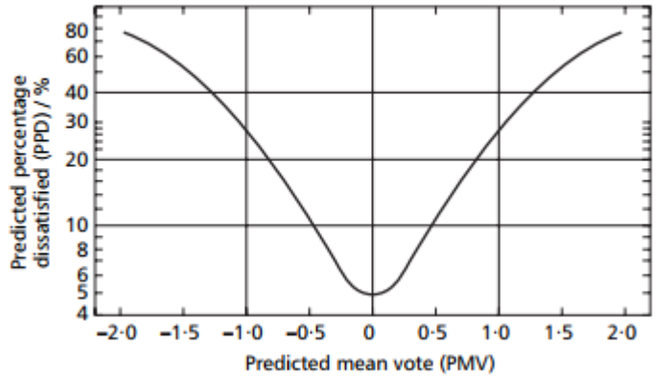
In an attempt to measure/predict thermal comfort metrics called PMV (Predicted mean vote) and PPD (Predicted percentage dissatisfied) have been created and assume that the sensation experienced by an occupant is a function of heat production (metabolism) and heat loss (clothing, sweat, environment etc.).

The 'predicted mean vote' (PMV) combines the influence of air temperature, mean radiant temperature, air movement and humidity with that of clothing and activity level into one value on a thermal sensation, see table 1.1. The PMV is the predicted mean value of 'votes' of a large group of persons, exposed to the same environment with identical clothing and activity.

Individual thermal sensation votes will be scattered around the PMV, it is useful also to predict the percentage of people who would be dissatisfied. The predicted percentage dissatisfied (PPD) attempts to do this and is a function of the PMV. The PPD is the notional probability that a randomly chosen person, having that clothing and activity, would experience discomfort in that thermal environment.

Table 1.1 Thermal sensation scale[1]

Index value	Thermal sensation
+3	Hot
+2	Warm
+1	Slightly warm
0	Neutral
–1	Slightly cool
–2	Cool
–3	Cold



Policy and Context

The London Plan, Policy 5.9 Overheating and cooling

The London Plan requires all new developments to submit a statement describing how the project has applied The London Plan's cooling hierarchy and shall demonstrate how the risk of overheating has been mitigated.

The cooling hierarchy includes the following:

1. Minimise internal heat gains
2. Reduce external heat gains through consideration of; orientation, shading, fenestration, insulation etc.
3. Manage internal heat through exposed thermal mass and high ceilings
4. Passive ventilation
5. Mechanical ventilation
6. Active cooling

View 1 of existing rear entrance

Site Location and key plan

View 2 of existing rear sunken courtyard

View 3 Street view from College Crescent

POLICY 5.9 OVERHEATING AND COOLING

Strategic

A The Mayor seeks to reduce the impact of the urban heat island effect in London and encourages the design of places and spaces to avoid overheating and excessive heat generation, and to reduce overheating due to the impacts of climate change and the urban heat island effect on an area wide basis.

Planning decisions

B Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:

1 minimise internal heat generation through energy efficient design
2 reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls
3 manage the heat within the building through exposed internal thermal mass and high ceilings
4 passive ventilation
5 mechanical ventilation
6 active cooling systems (ensuring they are the lowest carbon options).

C Major development proposals should demonstrate how the design, materials, construction and operation of the development

THE COOLING HIERARCHY

The six stages of the cooling hierarchy have been considered as follows:

1. Minimise internal heat generation through energy efficient design

Through the use of low energy LED light fittings we can provide a 10 fold improvement on the old tungsten and fluorescent fittings meaning significant heat savings can be achieved by optimising the lighting design. Lighting can account for as much as 25% of the building's energy consumption and through design the heat emitted can be reduced.

2. Reduce external heat gains through consideration of; orientation, shading, fenestration, insulation etc.

The building is located below a multi-unit residential building, Northways Parade. The main access is from Finchley Road and shares an access route with the retail units that face the main road. It is bordered on all sides except the shared access route by other properties. The existing typography means the site is set a full storey down from College Crescent at the rear of the property.

As the building is existing, there is limited opportunity to add additional glazing. It is proposed that the glazing within the rooflights will be improved to have a g-value of 0.5 or lower and internal shading will be included.

There is a small section of exposed roof to the north side of Northways Parade, it is proposed that a green roof will be incorporated in this area. In addition, the roof of the small extension which will create the pedestrian entrance from College Crescent will also have a green roof.

3. Manage internal heat through exposed thermal mass and high ceilings

As part of the refurbishment it is proposed to retain the existing exposed concrete shell. By maintaining the exposed shell, which has a high thermal mass, it allows for the design to minimise the buildings requirement for active cooling.

4. Passive ventilation

Due to the location of the building and that it is surrounded by other buildings, it is not possible to ventilate the building using passive measures. Wherever possible the windows will incorporate trickle vents.

5. Mechanical ventilation

To meet the building's proposed ventilation requirements the design shall include a mechanical ventilation system with heat recovery, via a rotary heat wheel as well as natural ventilation provided via trickle vents at windows air volumes will meet higher BCO volume requirements.

6. Active cooling

Due to the limitations of the existing building, it is not possible to mitigate the risk of overheating purely by passive means. Through the use of energy efficient services, maintaining the exposed concrete shell, the incorporation of windows, where possible, with trickle vents and the use of an e

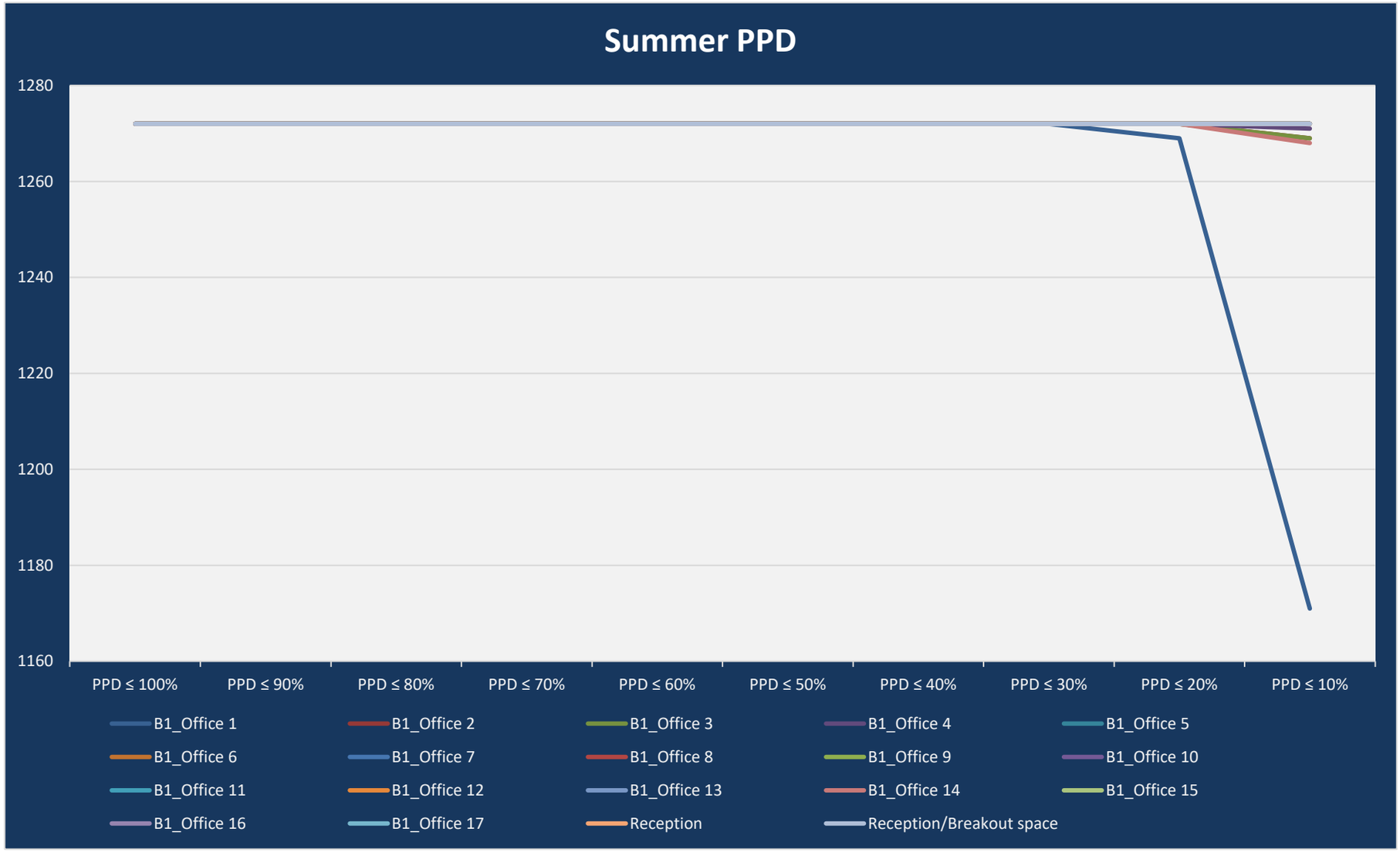
Overheating Analysis

The TM52 guidance can therefore also be used as a design tool that can bring about changes to the building form to introduce/maximise passive cooling measures (such as external shading, building orientation, glazing ratios, thermal properties of building elements etc.).

The publication focusses on overheating that occurs in free-running buildings (i.e. buildings that do not include mechanical cooling), although overheating can still occur in mechanically cooled buildings, so further guidance is provided to test these scenarios.

For the purposes of TM52 and predicting overheating a building is considered to be overheating if the PMV index is above 0.5 (PPD ≥ 10%).

Assumptions		
Metabolic Rate	1.20	Met
Air Speed		
Min	0.15	m/s
Max	0.30	
Clothing value		
Summer	0.50	Clo
Winter	1.00	



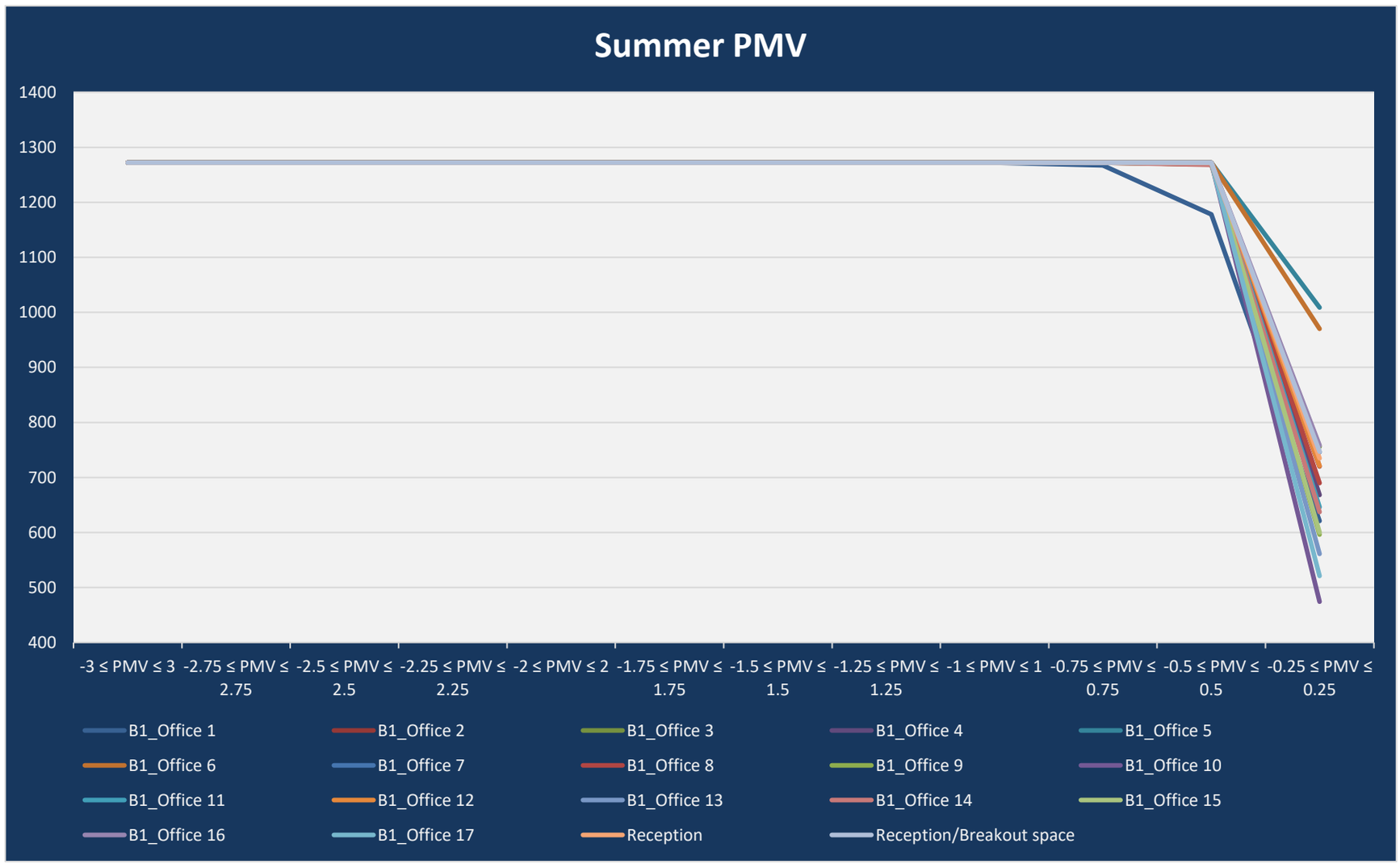
CONCLUSION

The results show, for this mechanically cooled building, that there is very little overheating shown with the small ground floor office, located near the new pedestrian entrance, having the slightly lower results compared with the rest of the building, this is due to the high glazing ratio, caused by the two rooflights, in the office area.

The cumulative results show that the PMV range for the building will be at ± 0.5 PMV or ± 0.25 PMV for most of the year and never exceeding ± 1.0 PMV. There are a small number of hours for a small office where the hours exceed ± 0.75 PMV.

The PMV results show that in terms of PPD the building achieves a 10% PPD value all year for all areas except for the small office with two roof lights. This office space does not exceed 20% PPD.

The results indicated that the small office located near the new pedestrian entrance has a higher chance of overheating than other office spaces. The fan coil unit will be sized to ensure that the additional gains attributed to the high glazing ratios do not cause occupant discomfort.



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