Building Services
Environmental Engineering
Building Acoustics
Lighting Design

6 Gracechurch Street
London
EC3V 0AT

020 7183 5235
info@orconsult.co.uk
orconsult.co.uk

JOB:	William Ellis School	**CIRC:**	
NUMBER:	00357		
DATE:	November 2018		
SUBJECT:	Overheating Risk Assessment – Hall	**REVISION:**	Rev02

1. INTRODUCTION

This design note seeks to understand the opportunity to reduce the overheating experienced within existing hall from the proposed plans to upgrade the windows and the external hallway.

An assessment has been undertaken to establish the reduction in overheating between the existing and proposed configurations.

The Requirements of *TM52: The Limits of Thermal Comfort* will be used to assess overheating risk.

2. METHODOLOGY

A thermal simulation has been undertaken using Design Builder (v.5.4.0.021) with Energy+. The simulation has been directly assessed against the criteria of TM52.

Appendix A contains a list off all assumptions made when modelling the hall.

3. BEST PRACTICE GUIDANCE

3.1. TM52 – LIMITS OF THERMAL COMFORT

Criteria for the assessment of overheating risk have been specified by the Charted Institute of Building Services Engineers (CIBSE) in *CIBSE TM52: The Limits of Thermal Comfort*.

This document recommends three criteria are assessed, as follows:

- Criteria 1: Hours of Exceedance - maximum allowance of 3%
- Criteria 2: Daily Weighted Exceedance – maximum allowance of 6
- Criteria 3: Upper Limit Temperature – maximum allowance of 4K

The change in performance of each of these criteria has been assessed within this study.

4. SITE EXTERNAL WEATHER CONDITIONS

External temperatures and incidental solar gains are greatest during summer months, coinciding with periods of lower wind speed. However, solar altitude is highest during summer months.

External weather conditions are crucial to effective overheating analysis as they influence:

- Solar heat gains (a function of incident direct & diffuse solar radiation)
- Calculated natural ventilation (utilising external temperature, wind speed and directions).

The nearest weather station data is selected as LONDON/GATWICK ARPT and the corresponding Design Builder weather data file is therefore LONDON/GATWICK – GBR IWEC 037760.

Figure 1 opposite shows the external dry bulb temperature for Gatwick annually according to Design Builder.

5. DESIGN BUILDER MODEL

The dynamic thermal modelling software, Design Builder, has been utilised to assess the school. Figure 2 shows the model used in Design Builder.

6. SIMULATION RESULTS

The following section outlines the results of the Design Builder Energy+ analysis and discusses the conclusions drawn from such.

6.1. TM52 ASSESSMENT RESULTS – AS EXISTING

The performance of the existing hall has been assessed against the three criteria outlined in *TM52: The Limits of Thermal Comfort.* As previously discussed, for a space to pass and the risk of overheating to be considered acceptable, it must pass at least two of the three TM52 criteria. Table 1 below contains the results from the simulation.

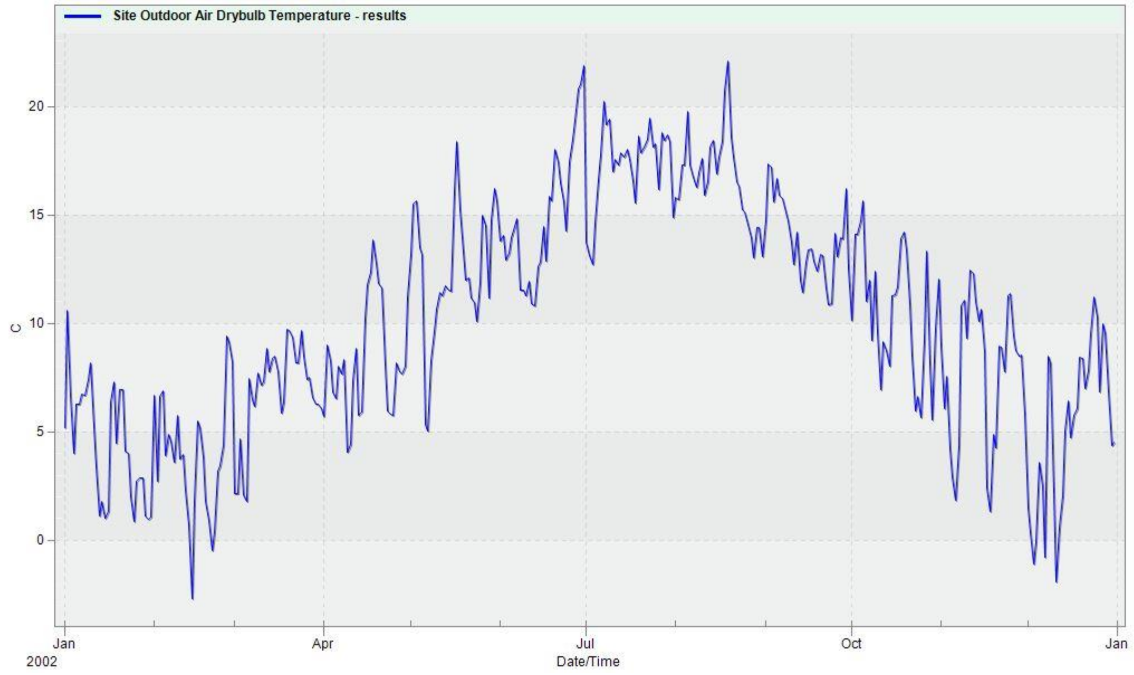

Figure 1 - External Temperature Profile

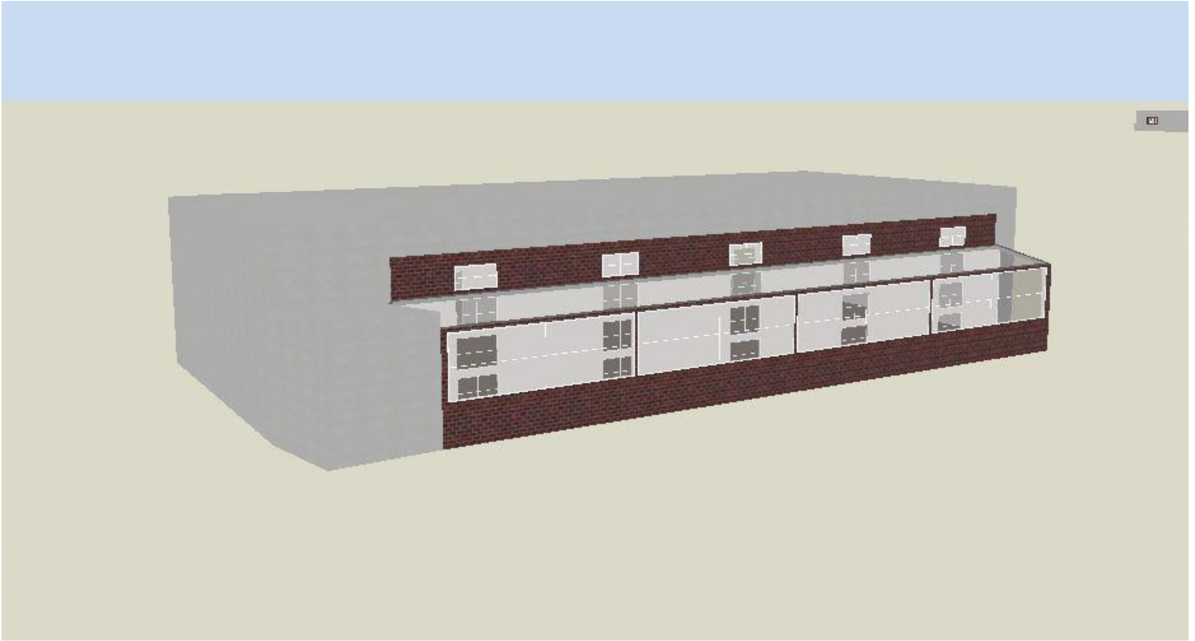

Figure 2 - Rendered Model of the Existing Hall and Walkway

Table 1– TM52 Overheating Results – Existing Hall

	Criteria	Hall
Criteria 1 Hours of Exceedance	3.00%	16.17
Criteria 2 Daily Weighted	6.0	35
Criteria 3 Upper Limit Temperature	4.0K	9.5

6.2. MODEL CHANGES

The model windows in the hall were changed to that of the proposed. The hallway was also modified in the model to that shown in Figure 3. The proposed walkway allows for airflow to circulate in and out of the hall, and the low G-Value canopy reduces solar gains.

To compare, Table 2 show the results with no canopy, and Table 3 shows results as proposed.

6.2.1.TM52 ASSESSMENT RESULTS – NEW WINDOWS, NO HALLWAY CANOPY

Table 2 - TM52 Overheating Results – New windows, no hallway canopy

	Criteria	Hall
Criteria 1 Hours of Exceedance	3.00%	7.14
Criteria 2 Daily Weighted	6.0	20
Criteria 3 Upper Limit Temperature	4.0K	7.5

6.2.2. TM52 ASSESSMENT RESULTS – NEW WINDOWS AND CANOPY

Table 3 - TM52 Overheating Results – New Windows and Canopy

	Criteria	Hall
Criteria 1 Hours of Exceedance	3.00%	0.13
Criteria 2 Daily Weighted	6.0	1
Criteria 3 Upper Limit Temperature	4.0K	0

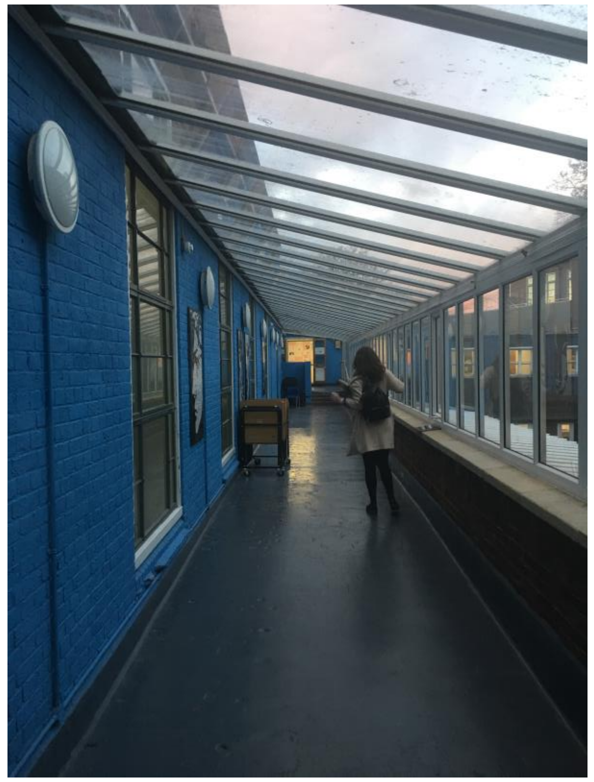

Figure 2 – Existing Hallway

Figure 3 – Proposed Hallway

7. CONCLUSION

From our study the following observations can be made.

- Overheating risk is substantially above the recommended guidelines for the existing hall.
- The frequency of overheating is reduced by replacing the windows and hallway canopy to allow air to flow in and out of the hall
- The percentage of occupied hours exceeding recommended temperate is reduced by 99% by the proposed plans.

It can be observed that the proposed replacement configuration offers value to the school by improving the effectiveness of passive cooling and improving occupancy comfort.

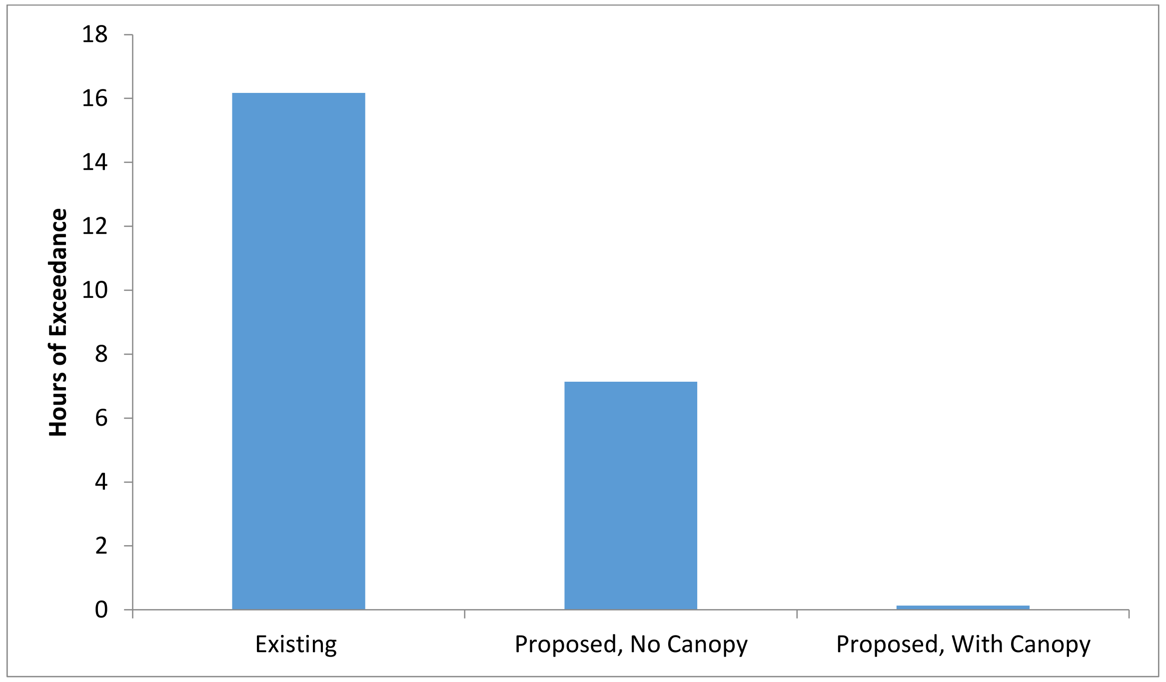

Figure 6 – Comparison of Hours of Exceedance in the Hall

APPENDIX A – EXISTING HALL

			Hall
Construction	External Walls	U Value	2.1 W/m^2.K
	External Roof	U Value	1.55 W/m^2.K
	Ceiling / Floors	U Value	0.35 W/m^2.K
	Partitions	U Value	Adiabatic
	Infiltration	Air Change Per Hour	0.7
Glazing	Window	U Value	6.3 W/m^2.K
		G Value	0.86
	Local Shading		0
Internal Gains	Lighting	Density	12 W/m^2
	Small Power	Density	10 W/m^2
	Occupancy	# Schedule Gains	130 08:00-10:30 (M-SA) 90W (at 26°C)
	Solar		As modelled
Ventilation	Method		Natural S+E
	Openable Area	Windows	As per measurements
	Schedule Open - Close	Windows Doors	With Occupancy With Occupancy