Dynamic Simulation of the Proposed Development

At

Hillingdon Waters Sports & Activity Centre

Uxbridge

Report prepared by

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1.0 Introduction

HIBEC have undertaken a Dynamic Thermal Simulation overheating analysis of the proposed development at Hillingdon Water Sports Facility and Activity Centre.

The Thermal Model has been run to demonstrate that the building design and services strategy can deliver thermal comfort levels in "occupied spaces" in accordance with the criteria set out in 'TM52. In particular, that internal winter and summer operative temperature ranges will be in line with the recommended comfort criteria as detailed in TM52, TM59 and CIBSE Guide A.

In particular, the occupied areas internal summer temperatures do not exceed a "threshold" temperature for more than a reasonable number of hours per year when the building is tested against the CIBSE Design Summer Year.

Also, that the "summer peak" temperatures are not excessive nor do the areas overheating above a maximum temperature due to solar and other gains.

2.0 Design Data

The building has been modelled using the following construction data.

Construction U values

Ground Floor	0.15 W/m^{2}K
External Wall	0.20 W/m^{2}K
Roof	0.15 W/m^{2}K
Windows	1.40 W/m^{2}K
Personnel Doors	1.40 W/m^{2}K

Windows – Reception Glazing
Light Transmittance 70%
Solar Energy Transmittance (G Value) 30%

Windows – All Other Glazing
Light Transmittance 70%
Solar Energy Transmittance (G Value) 40%

Internal Gains

Occupancy Levels:

The occupancy levels have been modelled as follows;

Zone Type	Occupancy	Occupancy Schedule
Accessible Camp Areas	10m^2/person	09.00-17.00 Monday-Friday 10.00-18.00 Saturday & Sunday
Crew/Wellbeing Room	5m^2/person	09.00-17.00 Monday-Friday 10.00-18.00 Saturday & Sunday
Dining Room	5m^2/person*	08.00-09.00 & 18.00-19.00 7 days a week
Lounge	5m^2/person*	08.00-09.00 & 19.00-23.00 7 days a week
Main Office	6 persons*^{2}	09.00-17.00 Monday-Friday 10.00-18.00 Saturday & Sunday
Observation Area	10m^2/person	09.00-17.00 Monday-Friday 10.00-18.00 Saturday & Sunday
Operations Office	4 persons	09.00-17.00 Monday-Friday 10.00-18.00 Saturday & Sunday
Reception	4 person*^{2}	09.00-17.00 Monday-Friday 10.00-18.00 Saturday & Sunday
Training Room	5m^2/person	09.00-17.00 Monday-Friday 10.00-18.00 Saturday & Sunday
Cabins	TM59 Occupancy (Single Bedroom)	TM59 Occupancy (Single Bedroom)

*Dining Room and Lounge in the Staff Accommodation assumes a 75% diversity.

*^{2} Main Office and Reception assume 50% diversity

The occupancy gain for persons at rest is 90Watts/person sensible and 60Watts/person latent.

Occupancy period is only between April and October. The building is assumed empty outside this period.

Lighting gains

The Internal gains have been based on CIBSE TM37:2006 recommendations and are as follows:

The lighting gains for all zones has been assumed at 5W/m² during occupancy times.

Equipment gains:

All equipment gains have been assumed as follows during occupancy times.

Zone Type	Equipment Gains
Crew/Wellbeing Room, Observation Area & Training Room	5 W/m^2
Lounge	5 W/m^2
Main Office	*10 W/m^2
Operations Office	10 W/m^2
Reception	*10 W/m^2

**50% diversity assumed.*

Ventilation:

The ventilation rates to zones containing mechanical ventilation or mechanical extract are as follows;

Zone Type	Ventilation Levels
Observation Area, Operations Office & Training Room	10 l/s/p
Crew & Wellbeing, Main Office & Reception	15 l/s/p
Lounge	10 l/s/p
Changing Rooms & WCs	6ACH
Cabin Ensuites	4ACH

Operational Factors

Opening windows have been assumed for each occupied space are open once internal temperatures exceed 23°C but close if external temperatures exceed internal temperatures.

The minimum free area required for each space has been calculated as follows;

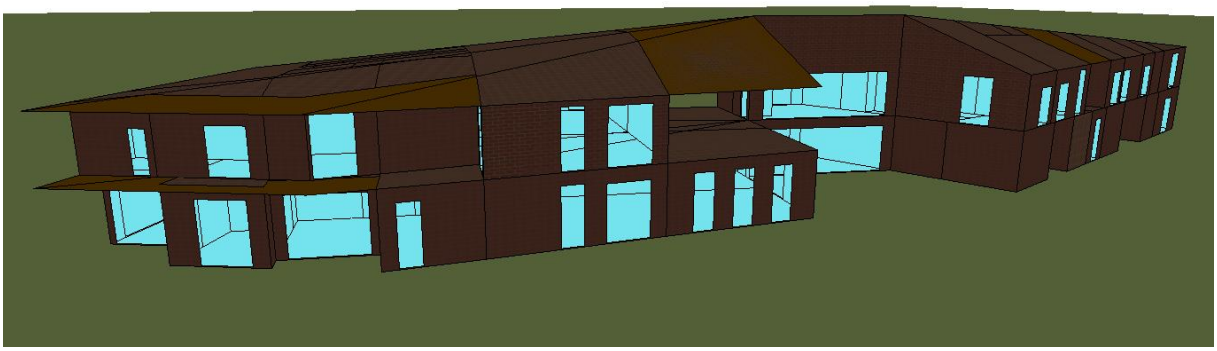
- *Accessible Camp (Support) 8.65m^2
- *Accessible Camp (Activity) 11.85m^2
- Crew/Wellbeing Room 5.75m^2
- **Dining 4.58m^2
- **Lounge 4.73m^2
- *Main Office 3.797m^2
- Observation Area 14.13m^2
- Operations Office 3.00m^2
- Reception 6.53m^2
- Training Room 3.30m^2
- Cabins 0.30m^2

*Personnel doors are open to provide the required free areas in addition to opening windows
**Dining Room & Lounge assumes the External Glazed Doors are open to provide free area in addition to opening windows.

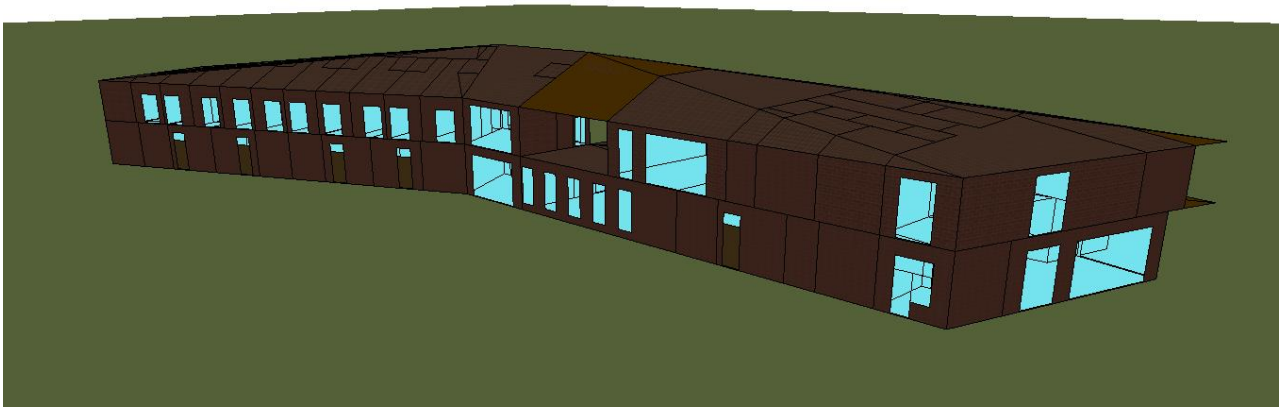
No Blinds have been incorporated into the model. However adjacent trees on the western side of the building have been included to provide shading.

3.0 The Model

The 3D Model was developed using IESVE software version 2024.1.0.0 which is approved by CIBSE AM11, and has been developed in accordance with the architects drawings and design data issued.



3D Model of Proposed Unit 1 (East Elevation)



3D Model of Proposed Unit 1 (South West Elevation)

4.0 Simulation Period and Weather Data

The model is based on the operational hours for the building detailed below;

Hours Occupied	Cabins	TM59 Occupancy
	Cabin Lounge	08.00-09.00 & 19.00-23.00 7 days a week
	Cabin Dining	08.00-09.00 & 18.00-19.00 7 days a week
	Operations Building	09.00-17.00 Monday – Friday
		10.00-18.00 Saturday – Sunday
Simulation Period	1st April - 31 October	
Weather Data	London LHR DSY-2020 High 50% Percentile – obtained from CIBSE	
Reporting Interval	Hourly	

The results are an indication of the buildings likely response to thermal gains based on the information provided for input to the model and CIBSE weather data set for the London Heathrow Region (Design Summer Year).

The simulation has been run to accommodate the operational hours and the results are presented for the entire building.

Each zone modelled and listed in the attached results are based on the above data set and architectural drawings.

5.0 'TM52' Performance Criteria

The performance standards for summertime overheating in compliance with CIBSE TM52 and CIBSE Guide A 2021.

1) The Number of Hours during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of occupied hours. Where $\Delta T = T_{op} - T_{max}$, where T_{op} = actual operative temperature & T_{max} = the limiting maximum acceptable temperature.

2) The severity of overheating with any one day, which is a function of both temperature rise and it's duration. This criterion sets a daily limit for acceptability. To allow for the severity of overheating the weighted exceedance shall be less than or equal to 6.

ie. 1 hour at 1°K over the operative temperature = 1
2 hour at 2°K over the operative temperature = 4

The Maximum allowed exceedance = 6

3) *Maximum indoor operative temperature* - To set an absolute maximum value for indoor operative temperature the value of ΔT shall not exceed 4K

In order to show that the proposed building will not suffer overheating two of these three criteria must be met.

6.0 Results

Zone Name	Criterion 1: % of Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
Accessible Camping & Activity Room	1.4	6	2	Pass
Accessible Camping & Support Room	1.4	6	2	Pass
Crew/Wellbeing Room	2.9	12	3	Pass
Dining	2.0	2	2	Pass
Lounge	2.9	8	2	Pass
Main Office	2.6	11	3	Pass
Observations	2.5	10	3	Pass
Operations Office	2.9	11	3	Pass
Reception	2.9	11	3	Pass
Training Room	2.9	12	4	Pass
Accessible Cabin 1	0	0	0	Pass
Accessible Cabin 2	0	1	1	Pass
Cabin 1	0.6	8	1	Pass
Cabin 2	0.5	8	1	Pass
Cabin 3	0.8	14	2	Pass
Cabin 4	0.8	15	2	Pass
Cabin 5	0.1	2	1	Pass
Cabin 6	2.0	24	3	Pass
Cabin 7	0.7	13	2	Pass
Cabin 8	0.8	14	2	Pass
Cabin 9	0.7	10	2	Pass
Cabin 10	0.5	9	1	Pass
Cabin 11	0.6	9	1	Pass

7.0 Conclusion

All of the occupied zones pass at least 2 of the 3 criteria of TM52.

Therefore, the building is compliant with TM52.