

OVERHEATING ASSESSMENT
MODULAR CLASSROOM BUILDING
For
HIGHGATE SCHOOL

CESGROUPGLOBAL.COM

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1. Executive Summary

This report outlines the process undertaken to simulate thermal performance, during the summertime within the occupied areas of the proposed development.

The thermal modelling has been carried out using software selected and applied in accordance with CIBSE AM11 Building Performance Modelling. A fully dynamic thermal model of the proposed building was created using IES Virtual Environment software version 2022.1.2.0.

The model was simulated using VE ApacheSIM dynamic thermal modelling software over the summer season and internal thermal conditions recorded at one-hour intervals. CIBSE Weather files stated in the 'Weather Data' section of this report have been used in this calculation in line with the recommendations of CIBSE.

The focus of the proposed scheme is to ensure that all the heat gains are dissipated, and fresh air is supplied to the occupants so that each area can comply with BB101 thermal comfort & indoor air quality criteria.

The predicted internal temperature and CO2 levels within the modelled areas have been computed and evaluated. The IES VE model was prepared in accordance with the drawings, ref: 3970-XX-XX-DR-A-1000 – Rev5 & 03970-XX-XX-DR-A-2001 – Rev2, prepared by Modular Building Consultants, with internal gains and load profiles, based upon BB101 guidelines.

This report details the Hybrid ventilation strategy for the Teaching Spaces. The strategy employs a Hybrid Ventilation (HVR) system with heat recovery and room heating/cooling coils, working in conjunction with part openable windows.

The assessment of the proposed scheme has indicated that, under the modelling conditions, these systems are predicted to provide necessary heat gain dissipation and adequate ventilation rates to meet the design criteria set out within BB101.

2. Design Brief

2.1 Assessment Criteria

The modelled rooms are proposed to be ventilated by a Hybrid Ventilation (HVR) system with heat recovery and room heating/cooling coils and will be evaluated against Building Bulletin 101 criteria.

2.2 BB101 Design Criteria

The performance standards stipulated in BB101 require three criteria, taken together, to be used to assess the risk of overheating of the building in the UK, using the geographically closest CIBSE Design Summer Year (DSY) Future 2020_High_50 weather file. A room or building should comply to Criteria 1, with Criteria 2 & 3 to be reported for information only:

- **Criteria 1- Hours of Exceedance:** During the occupied hours of the non-heating season (1st May to 30th September), the predicted operative temperature should not exceed the maximum adaptive temperature by 1°K or more, for more than 40 hours. A reduced figure of 18 hours is to be used for Sports Halls that are also to be used for summer exams.
- **Criteria 2- Daily Weighted Exceedance:** For the severity of overheating, which can be as important as its frequency, the weighted exceedance of the temperature rise, and its duration should be less than or equal to 6 during any occupied day of the non-heating season.
- **Criteria 3- Upper Limit Temperature:** The absolute maximum daily operative temperature for a room, beyond which the level of overheating is unacceptable, should not be greater than 4°K, than the maximum adaptive temperature ($T_{op} - T_{max}$), at any time.

With regards to internal air quality, BB101 criteria specifies that for natural ventilation or hybrid systems operating in natural mode:

- In all teaching and learning spaces when measured at seated head height, during the continuous period between the start and finish of teaching on any day, the average CO2 concentration of carbon dioxide should not exceed 1500 ppm.
- The maximum CO2 concentration should not exceed 2000 parts per million (ppm) for more than 20 minutes each day.

For mechanical ventilation or hybrid systems operating in mechanical mode, BB101 criteria specifies that:

- In all teaching and learning spaces when measured at seated head height, during the continuous period between the start and finish of teaching on any day, the average CO2 concentration of carbon dioxide should not exceed 1000 ppm.
- The maximum CO2 concentration should not exceed 1500 parts per million (ppm) for more than 20 minutes each day.

2.3 Heat Gain Dissipation

A dynamic model of all modelled areas has been prepared using the IES Virtual Environment building performance simulation package, considering all aspects of occupancy, solar gain, and

sensible & latent heat gains. A suitable CIBSE weather file provides expected local environmental conditions for the building being modelled.

CES's standard approach is to consider the total heat gains within all modelled areas and provide a natural ventilation strategy to dissipate these heat gains. Furthermore, the aim is to provide sufficient fresh air to the occupants of each area so that indoor air quality and thermal comfort are maintained. This report will examine the effect of the proposed Hybrid Ventilation (HVR) systems, however, please note that this analysis has been conducted using various assumptions (detailed later in the report) regarding the building.

CES modelled the internal temperature conditions and took sample extracts of this data to provide a visual representation of the outcome of the proposed schemes, were they to be installed in the respective areas. The input parameters for all the assessed areas are shown in Tables 3.2 & 3.

3. Modelling Data

3.1 Project Weather File

Table 3.1 – Weather Data

Item	Project Specific Data
Weather File	London Weather Centre DSY1 2020 High 50

3.2 Building Construction Inputs

Table 3.2a – Building Construction Data

Item	Construction Data	
U-Values & Thermal Mass (Cm)	External Walls	0.12 W/m2.K
	Floor	0.10 W/m2.K
	Roof	0.10 W/m2.K
	Glazing	1.4 W/m2.K
g-Value	Glazing	0.4
Infiltration Rate	0.25 ac/hr	

Table 3.2b – Room Construction Data

Room	Area (m2)	Internal Height (m)	Volume (m3)	External Glazing Area (m2)	Ext. Window Orifice Area (m2)
B Prep	51.48	2.8	144.14	2.80	1.152
B1 Lab	77.22	2.8	216.22	3.15	1.296
B2 Lab	77.22	2.8	216.22	3.15	1.296
B3 Lab	51.48	2.8	144.14	2.80	1.152
B4 Lab	77.22	2.8	216.22	3.15	1.296
C1 Lab	77.22	2.8	216.22	3.15	1.296
C2 Lab	77.22	2.8	216.22	3.15	1.296
C3 Lab	51.48	2.8	144.14	2.80	1.152
C4 Lab	77.22	2.8	216.22	3.15	1.296
Gen Class	51.48	2.8	144.14	2.80	1.152
Gen Lab 1	77.22	2.8	216.22	3.15	1.296
Gen Lab 2	77.22	2.8	216.22	3.15	1.296
MFL 1	38.61	2.8	108.11	1.93	0.792
MFL 2	38.61	2.8	108.11	1.93	0.792
MFL 3	38.61	2.8	108.11	1.93	0.792
MFL 4	38.61	2.8	108.11	1.93	0.792
MFL 5	38.61	2.8	108.11	1.93	0.792
MFL 6	38.61	2.8	108.11	1.93	0.792

MFL Office 1	38.61	2.8	108.11	1.93	0.792
MFL Office 2	38.61	2.8	108.11	1.40	0.576
P1 Lab	77.22	2.8	216.22	3.15	1.296
P2 Lab	77.22	2.8	216.22	3.15	1.296
P3 Lab	51.48	2.8	144.14	2.80	1.152
P4 Lab	77.22	2.8	216.22	3.15	1.296
Sc Office 1	38.61	2.8	108.11	1.93	0.792
Sc Office 2	38.61	2.8	108.11	1.93	0.792
Staff Room	78.78	2.8	220.58	2.80	1.152

3.3 Building Thermal Inputs

Table 3.3 – Thermal Modelling Inputs for Areas to be Assessed.

Room	Occupants (No.)	Sensible Gain (w/person)	Latent Gain (w/person)	Occupancy Hours	Lighting (w/m ²)	Equipment (w/m ²)
B Prep	2	70	55	09:00-12:00 @100% 12:00-16:00 @100%	7.2	10.0
B1 Lab	25	70	55		7.2	10.0
B2 Lab	25	70	55		7.2	10.0
B3 Lab	25	70	55		7.2	10.0
B4 Lab	25	70	55		7.2	10.0
C1 Lab	25	70	55		7.2	10.0
C2 Lab	25	70	55		7.2	10.0
C3 Lab	25	70	55		7.2	10.0
C4 Lab	25	70	55		7.2	10.0
Gen Class	25	70	55		7.2	10.0
Gen Lab 1	25	70	55		7.2	10.0
Gen Lab 2	25	70	55		7.2	10.0
MFL 1	25	70	55		7.2	10.0
MFL 2	25	70	55		7.2	10.0
MFL 3	25	70	55		7.2	10.0
MFL 4	25	70	55		7.2	10.0
MFL 5	25	70	55		7.2	10.0
MFL 6	25	70	55		7.2	10.0
MFL Office 1	9	90	60	08:00-09:00 @100% 09:00-12:00 @100%	7.2	10.0
MFL Office 2	9	90	60	12:00-13:00 @100% 13:00-16:00 @100%	7.2	10.0

16:00-17:00 @100%						
P1 Lab	25	70	55		7.2	10.0
P2 Lab	25	70	55	09:00-12:00 @100%	7.2	10.0
P3 Lab	25	70	55	12:00-16:00 @100%	7.2	10.0
P4 Lab	25	70	55		7.2	10.0
Sc Office 1	9	90	60	08:00-09:00 @100%	7.2	10.0
				09:00-12:00 @100%		
Sc Office 2	9	90	60	12:00-13:00 @100%	7.2	10.0
				13:00-16:00 @100%		
Staff Room	30	90	60	16:00-17:00 @100%	7.2	10.0

4. Proposed Systems

4.1 Hybrid Ventilation (HVR) System and Ventilation Strategy

The hybrid ventilation strategy proposed for the project comprises of the Monodraught HVR XC+ system with heat recovery exchanger and room heating/cooling coils, working in conjunction with part opening windows to each room.

The HVR Zero sets a new benchmark for the future generation of low energy hybrid ventilation systems that integrate heat exchange ventilation strategies. It provides natural ventilation, hybrid mixing ventilation and low energy mechanical heat recovery ventilation in one compact unit. The system operates completely autonomously to ensure optimum indoor air quality with the lowest possible energy use - in terms of both the energy consumption of the ventilation system and overall building energy usage.

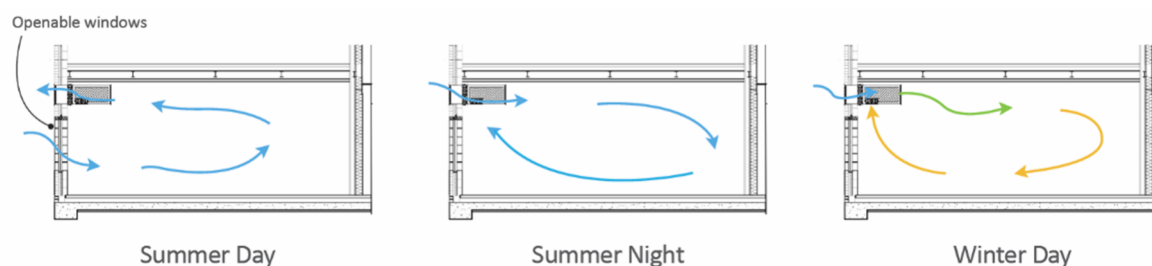
Using the manufacturing advantages of the Zero model, the XC+ model integrates an aluminum cross flow heat exchanger and a backward curved EC exhaust fan, allowing it to provide mechanical heat recovery ventilation during winter periods. This additional mode enables the system to provide the lowest energy balance point with the lowest energy use for power consumption. The XC+ model includes a heating coil that can provide the primary heating needed for a room, using the lower water flow temperatures provided through renewable heating solutions like heat pumps. The XC+ model lowers the overall power consumption of buildings by combining ventilation, heat recovery and heating in a highly efficient, integrated solution with a harmonious control strategy.

The system comprises of an intelligent and fully automatic control system coupled with a low energy ventilation system which switches between operational modes dependent on season, external/internal temperature conditions and indoor air quality (IAQ). At all times the system will utilize natural ventilation as its primary mode, then as the internal room temperatures or CO2 concentration increases, the low energy internal fan will operate to provide fan assisted natural ventilation at variable speeds dependent on the internal room conditions. The system automatically provides secure nighttime cooling through natural ventilation opening or fan assisted if required. Winter ventilation automatically modulates dampers to mix re-circulated air with external air to ensure optimum ventilation temperatures.



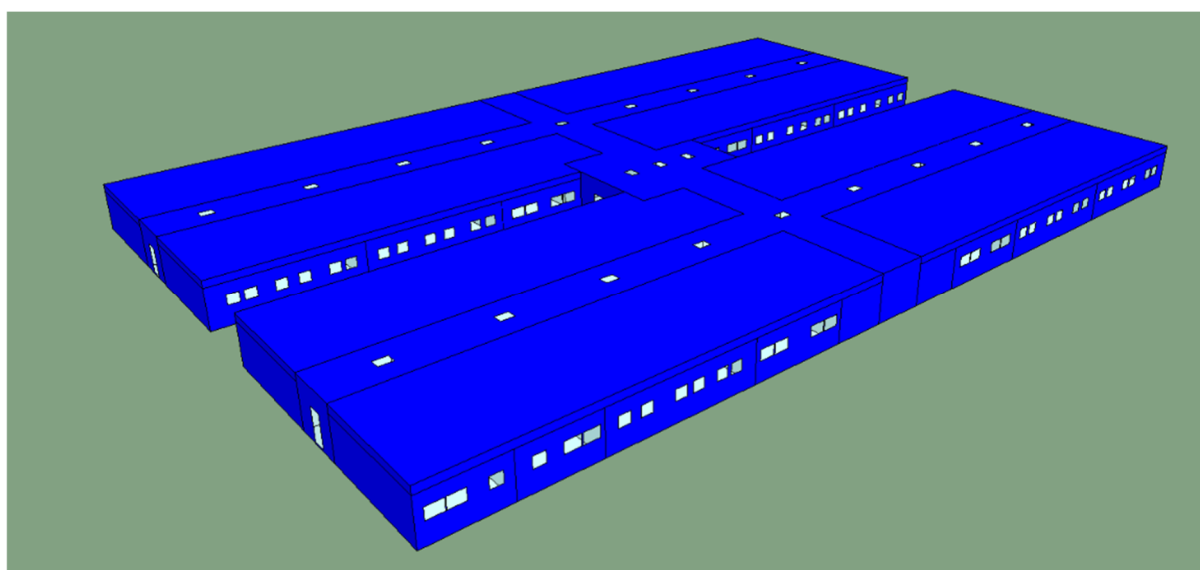
Picture 1 – Typical HVR System

Standard Operation



4.2 Proposed Units

Image 4.2a and Table 4.2b detailed below, illustrate the systems and locations of the proposed ventilation systems to the desired areas of the building.



Picture 2 – IES VE model of the Building

Table 4.2 – Proposed Ventilation Systems

Floor	Room	System
Ground Floor	B Prep	2No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	B1 Lab	3No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	B2 Lab	3No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	B3 Lab	2No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	B4 Lab	3No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	C1 Lab	3No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	C2 Lab	3No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling

Ground Floor	C3 Lab	2No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	C4 Lab	3No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	Gen Class	3No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	Gen Lab 1	3No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	Gen Lab 2	3No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	MFL 1	2No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	MFL 2	2No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	MFL 3	2No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	MFL 4	2No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	MFL 5	2No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	MFL 6	2No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	MFL Office 1	1No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	MFL Office 2	1No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	P1 Lab	3No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	P2 Lab	3No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	P3 Lab	2No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	P4 Lab	3No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	Sc Office 1	1No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	Sc Office 2	1No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling
Ground Floor	Staff Room	2No. HVR XC+ Hybrid Ventilation Systems with Heat Recovery & Room Heating/Cooling

5. Results

5.1 BB101 Adaptive Thermal Comfort Criteria Predictions

The analysis within this section of the results illustrates the overheating criteria of the modelled rooms in accordance with the three BB101 Design Criteria's (Hours of exceedance, daily weighted exceedance, and Upper Limit Temperature).

Criteria 1 – Hours of Exceedance: B2 Lab -

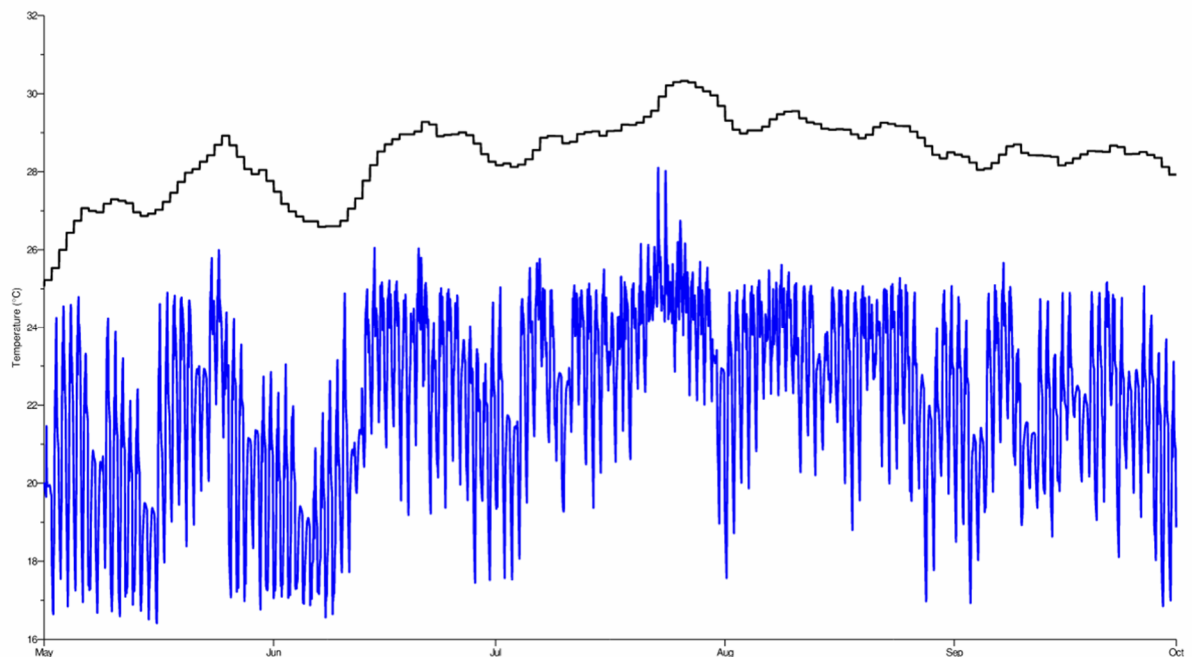


Figure 5.1a – Graph for the Maximum Adaptive Temperature and the Predicted internal Operative Temperature for the Room with Proposed Systems

Observations from 5.1a:

- During the non-heating season, 1st May - 30th Sept, the internal operative temperature of the room is not predicted to exceed the maximum adaptive temperature during the occupied hours.

The room is therefore predicted to comply with the first adaptive thermal comfort criterion specified within BB101 Design Criteria, whereby the internal operative temperature should not exceed the maximum adaptive temperature for more than 40 hours of the occupied hours, during the non-heating season.

Criteria 1 – Hours of Exceedance: Gen Class -

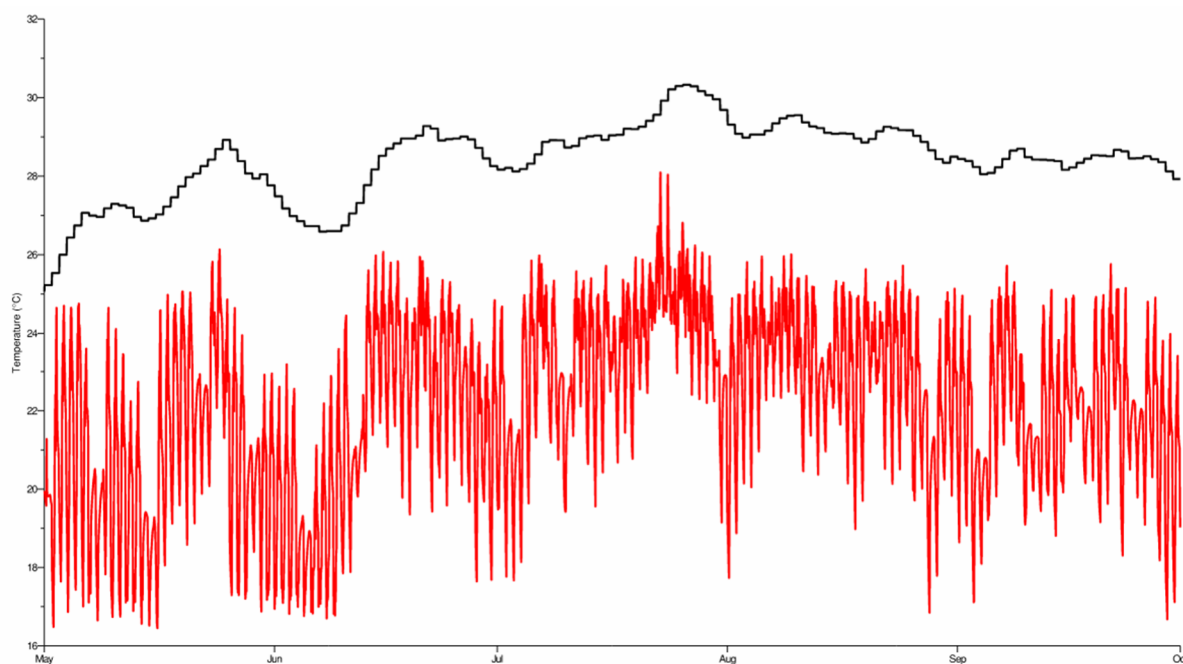


Figure 5.1b – Graph for the Maximum Adaptive Temperature and the Predicted internal Operative Temperature for the Room with Proposed Systems

Observations from 5.1b:

- During the non-heating season, 1st May - 30th Sept, the internal operative temperature of the room is not predicted to exceed the maximum adaptive temperature during the occupied hours.

The room is therefore predicted to comply with the first adaptive thermal comfort criterion specified within BB101 Design Criteria, whereby the internal operative temperature should not exceed the maximum adaptive temperature for more than 40 hours of the occupied hours, during the non-heating season.

BB101 Adaptive Thermal Comfort Criteria Summary Table

Room	Criteria 1: Less than 40	Criteria 2: Less than 7 (Infor Only)	Criteria 3: Less than 5 (Infor Only)	Compliance Pass/Fail
B Prep	0	0	0	Pass
B1 Lab	0	0	0	Pass
B2 Lab	0	0	0	Pass
B3 Lab	0	0	0	Pass
B4 Lab	0	0	0	Pass
C1 Lab	0	0	0	Pass
C2 Lab	0	0	0	Pass
C3 Lab	0	0	0	Pass
C4 Lab	0	0	0	Pass
Gen Class	0	0	0	Pass

Gen Lab 1	0	0	0	Pass
Gen Lab 2	0	0	0	Pass
MFL 1	0	0	0	Pass
MFL 2	0	0	0	Pass
MFL 3	0	0	0	Pass
MFL 4	0	0	0	Pass
MFL 5	0	0	0	Pass
MFL 6	0	0	0	Pass
MFL Office 1	0	0	0	Pass
MFL Office 2	0	0	0	Pass
P1 Lab	0	0	0	Pass
P2 Lab	0	0	0	Pass
P3 Lab	0	0	0	Pass
P4 Lab	0	0	0	Pass
Sc Office 1	0	0	0	Pass
Sc Office 2	0	0	0	Pass
Staff Room	0	0	0	Pass

The analysis within this section of the results illustrates the summary results table for the BB101 adaptive thermal comfort design criteria (Hours of exceedance, daily weighted exceedance and Upper Limit Temperature), for the modelled rooms, based upon Future Climate Scenario modelling.

BB101 Adaptive Thermal Comfort Criteria: DSY1_2050_High_50_Weather File

Room	Criteria 1: Less than 40	Criteria 2: Less than 7 (Infor Only)	Criteria 3: Less than 5 (Infor Only)	Compliance Pass/Fail
B Prep	0	0	0	Pass
B1 Lab	0	0	0	Pass
B2 Lab	0	0	0	Pass
B3 Lab	0	0	0	Pass
B4 Lab	0	0	0	Pass
C1 Lab	0	0	0	Pass
C2 Lab	0	0	0	Pass
C3 Lab	0	0	0	Pass
C4 Lab	0	0	0	Pass
Gen Class	0	0	0	Pass
Gen Lab 1	0	0	0	Pass
Gen Lab 2	0	0	0	Pass
MFL 1	0	0	0	Pass
MFL 2	0	0	0	Pass

MFL 3	0	0	0	Pass
MFL 4	0	0	0	Pass
MFL 5	0	0	0	Pass
MFL 6	0	0	0	Pass
MFL Office 1	0	0	0	Pass
MFL Office 2	0	0	0	Pass
P1 Lab	0	0	0	Pass
P2 Lab	0	0	0	Pass
P3 Lab	0	0	0	Pass
P4 Lab	0	0	0	Pass
Sc Office 1	0	0	0	Pass
Sc Office 2	0	0	0	Pass
Staff Room	0	0	0	Pass

BB101 Adaptive Thermal Comfort Criteria: DSY1_2050_Low_50_Weather File

Room	Criteria 1: Less than 40	Criteria 2: Less than 7 (Infor Only)	Criteria 3: Less than 5 (Infor Only)	Compliance Pass/Fail
B Prep	0	0	0	Pass
B1 Lab	0	0	0	Pass
B2 Lab	0	0	0	Pass
B3 Lab	0	0	0	Pass
B4 Lab	0	0	0	Pass
C1 Lab	0	0	0	Pass
C2 Lab	0	0	0	Pass
C3 Lab	0	0	0	Pass
C4 Lab	0	0	0	Pass
Gen Class	0	0	0	Pass
Gen Lab 1	0	0	0	Pass
Gen Lab 2	0	0	0	Pass
MFL 1	0	0	0	Pass
MFL 2	0	0	0	Pass
MFL 3	0	0	0	Pass
MFL 4	0	0	0	Pass
MFL 5	0	0	0	Pass
MFL 6	0	0	0	Pass
MFL Office 1	0	0	0	Pass
MFL Office 2	0	0	0	Pass
P1 Lab	0	0	0	Pass

P2 Lab	0	0	0	Pass
P3 Lab	0	0	0	Pass
P4 Lab	0	0	0	Pass
Sc Office 1	0	0	0	Pass
Sc Office 2	0	0	0	Pass
Staff Room	0	0	0	Pass

5.2 Internal CO2 Concentration Predictions

This section of the report focuses on the performance of the systems with regards to the internal air quality criteria, during occupied periods, and evaluates if the proposed scheme complies with BB101 air quality criteria.

Internal Average CO2 Predictions: B2 Lab -

The following area has been selected for the analysis of the predicted CO2 concentration as a typical representative of other similar rooms.

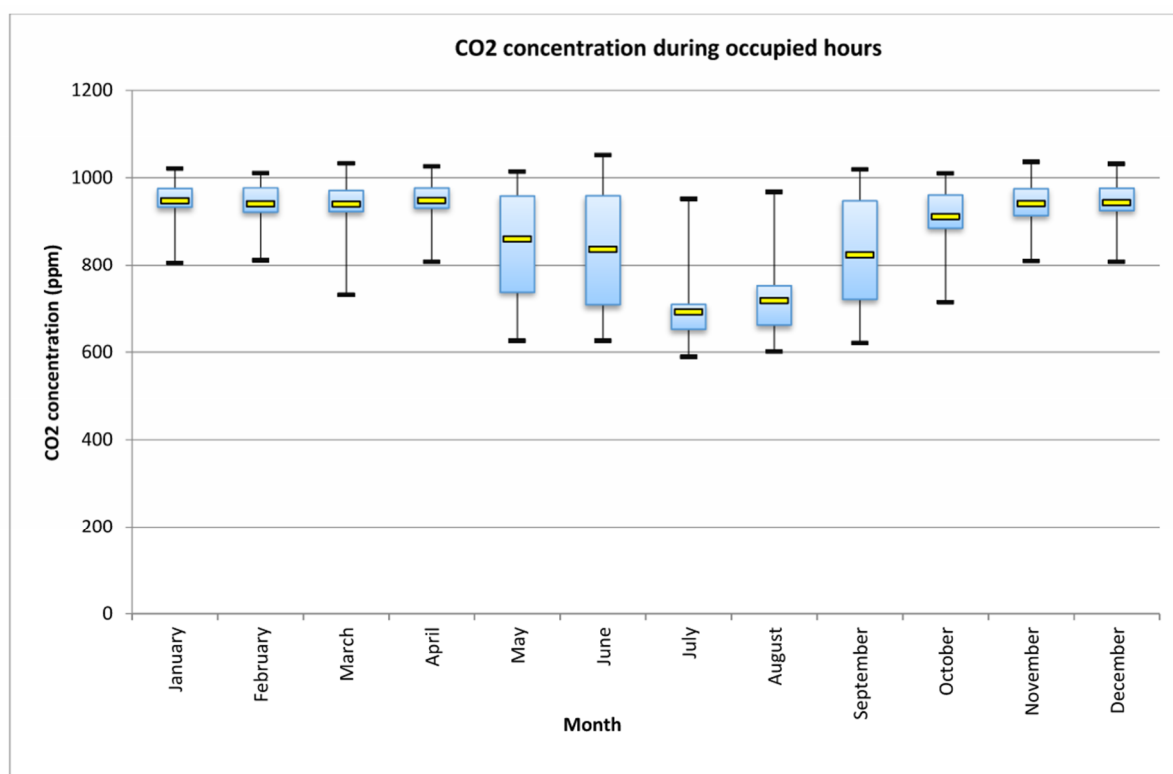


Figure 5.3a – Annual Carbon Dioxide Concentration Levels (PPM) during Occupied Hours within the Area with Proposed Systems

Observations from 5.3a:

- During the occupied hours of day per annum, the daily average CO2 concentration does not exceed 950ppm (indicated by yellow bar), therefore meeting the 1000ppm limit stipulated in BB101 Design Criteria.
- The maximum CO2 concentration within the room is not predicted to exceed 1050ppm (indicated by top T-bar), therefore meeting the maximum limit of 1500 ppm for 20 minutes each day.

The proposed ventilation solution using the proposed system's operating with Monodraught's recommended control strategy satisfies the indoor air quality criteria of BB101 Design Criteria.

Internal Average CO2 Predictions: Gen Class -

The following area has been selected for the analysis of the predicted CO2 concentration as a typical representative of other similar rooms.

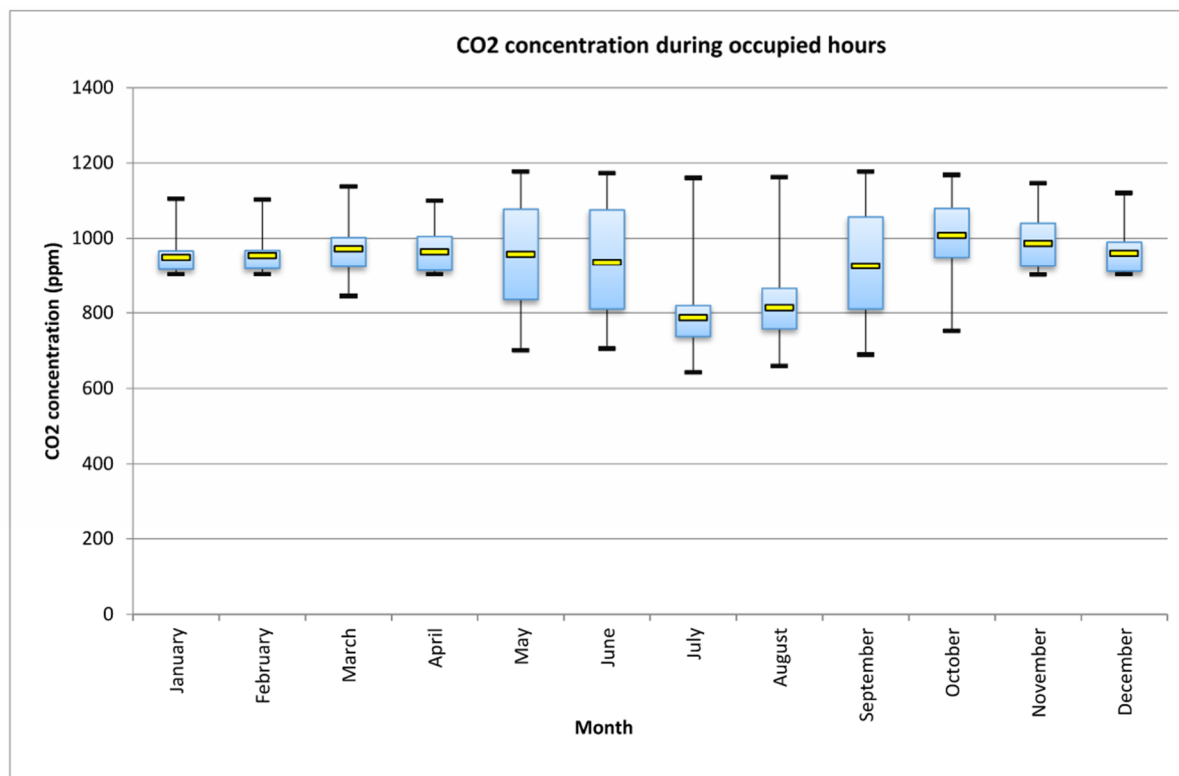


Figure 5.3b – Annual Carbon Dioxide Concentration Levels (PPM) during Occupied Hours within the Area with Proposed Systems

Observations from 5.3b:

- During the occupied hours of day per annum, the daily average CO2 concentration does not exceed 1000ppm (indicated by yellow bar), therefore meeting the 1000ppm limit stipulated in BB101 Design Criteria.
- The maximum CO2 concentration within the room is not predicted to exceed 1050ppm (indicated by top T-bar), therefore meeting the maximum limit of 1500 ppm for 20 minutes each day.

The proposed ventilation solution using the proposed system's operating with Monodraught's recommended control strategy satisfies the indoor air quality criteria of BB101 Design Criteria.

BB101 Internal Room Average CO2 Criteria Summary Table

Room	Occupied Average (PPM)	Occupied Peak (PPM)	Compliance Pass/Fail
B Prep	615	889	Pass
B1 Lab	873	1052	Pass

B2 Lab	874	1052	Pass
B3 Lab	928	1178	Pass
B4 Lab	873	1052	Pass
C1 Lab	875	1052	Pass
C2 Lab	785	1052	Pass
C3 Lab	934	1178	Pass
C4 Lab	877	1052	Pass
Gen Class	934	1178	Pass
Gen Lab 1	877	1052	Pass
Gen Lab 2	874	1052	Pass
MFL 1	971	1275	Pass
MFL 2	970	1278	Pass
MFL 3	970	1275	Pass
MFL 4	979	1291	Pass
MFL 5	978	1291	Pass
MFL 6	978	1291	Pass
MFL Office 1	770	1029	Pass
MFL Office 2	778	1022	Pass
P1 Lab	872	1052	Pass
P2 Lab	871	1052	Pass
P3 Lab	929	1178	Pass
P4 Lab	874	1052	Pass
Sc Office 1	760	1055	Pass
Sc Office 2	760	1030	Pass
Staff Room	819	1148	Pass

6. Conclusion

This report outlines the process undertaken to simulate thermal performance, during the summertime within the occupied areas of the proposed development.

The thermal modelling has been carried out using software selected and applied in accordance with CIBSE AM11 Building Performance Modelling. A fully dynamic thermal model of the proposed building was created using IES Virtual Environment software version 2022.1.2.0.

The model was simulated using VE ApacheSIM dynamic thermal modelling software over the summer season and internal thermal conditions recorded at one-hour intervals. CIBSE Weather files stated in the 'Weather Data' section of this report have been used in this calculation in line with the recommendations of CIBSE.

The focus of the proposed scheme is to ensure that all the heat gains are dissipated, and fresh air is supplied to the occupants so that each area can comply with BB101 thermal comfort & indoor air quality criteria.

The predicted internal temperature and CO2 levels within the modelled areas have been computed and evaluated. The IES VE model was prepared in accordance with the drawings, ref: 3970-XX-XX-DR-A-1000 - Rev3 & 03970-XX-XX-DR-A-2001 – Rev1, prepared by Modular Building Consultants, with internal gains and load profiles, based upon BB101 guidelines.

This report details the Hybrid ventilation strategy for the Teaching Spaces. The strategy employs a Hybrid Ventilation (HVR) system with heat recovery and room heating/cooling coils, working in conjunction with part openable windows.

The assessment of the proposed scheme has indicated that, under the modelling conditions, these systems are predicted to provide necessary heat gain dissipation and adequate ventilation rates to meet the design criteria set out within BB101.

Concluding Remarks

This study has been based on profiles developed by CES Group to simulate actual day to day operation of the proposed building with respect to occupancy, ventilation system operation, lighting etc. and whilst the simulations have been undertaken in good faith using skill and care, CES Group can take no responsibility for differences between the computer simulations and the actual performance of the completed building due to the inherent complexity and variability of the physics in a building and its environment.

The actual summer & winter time temperature for the selected zones may vary from the calculated predictions. These differences will occur due to many variable parameters between the modelled building and the real building. Such differences will include the hours and levels of occupancy, how the space is used, the design criteria with regards to how the zones are environmentally controlled, quality of construction and any unexpected variation in external weather data.

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