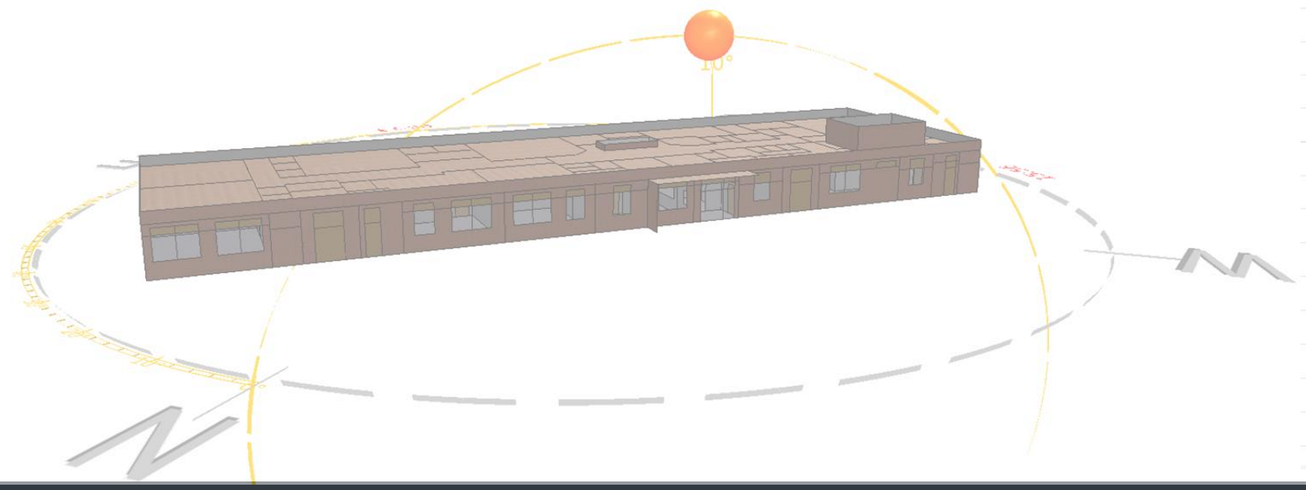
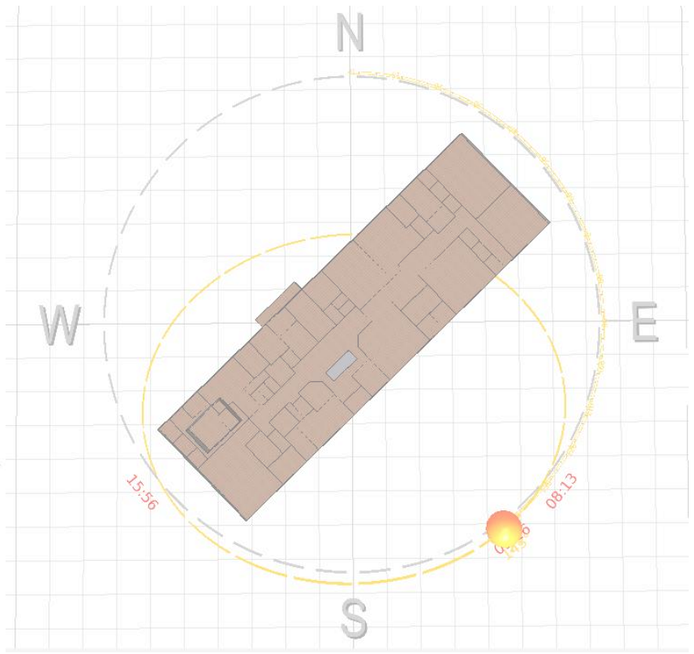
design MEP

Bexley Road Transitional Learning Centre

Thermal comfort & Indoor Air Quality Report

BTLC-MEP-XX-XX-RP-ME-3002





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Executive Summary

Design MEP was appointed by Galliford Try to produce a **Thermal Comfort & IAQ report** for **Bexley Road Transitional Learning Centre** to achieve their target of NZCiO.

Report Type	Thermal Comfort & IAQ
Building Name	Bexley Road Transitional Learning Centre
Building Location	77 Bexley Road, Eltham
Building GIFA	1,116 m^2
Company	Galliford Try
Proposed Works	Demolition; Newbuild School
RIBA Stage	Stage 3

Dynamic Simulation Modelling using IESVE 2025 was conducted for overheating analysis as per **CIBSE AM11: Building Energy & Performance Modelling** & assessed against the following standards/guides:

- **CIBSE TM52 –** Adaptive Thermal Comfort
- **Building Bulletin BB101 –** Ventilation, Thermal Comfort & IAQ
- **GDB_Annex_2F_MechanicalServicesAndPublicHealth-A-C12**

Key Design Features:

The following passive and active design measures have been integrated to minimise overheating risk in line with **DfE Technical Annex 2F MechanicalServicesAndPublicHealth-A-C12.**

- **Natural ventilation** restricted to 3x Office rooms and 1x Advice and Family room. Acoustic survey identifies noise to be too high for other room types.
- **Hybrid NVHR units (Monodraught HVR Zero APX)** providing low-energy tempered air supply, CO_2-controlled boost, and automated night purge using the building's exposed thermal mass.
- **Mechanical ventilation with heat recovery (MVHRs)** serving acoustically sensitive and internal zones, with BMS-controlled operation and summer free-cooling capability.
- **Optimised glazing and shading:** low-g-value glazing (g = 0.36) combined with recessed windows and fixed external louvres for solar control.

These integrated measures ensure compliance with Annex_2F criteria while maintaining acoustic and thermal comfort.

Results

Results indicate that the proposed ventilation strategy for **Bexley Road Transitional Learning Centre** provides adequate thermal comfort and indoor air quality under the 2°C climate scenario (CIBSE DSY1 50 Low Emission 2080), in line with **DfE Technical Annex 2F**. See summary of overheating results below:

Scenario	Weather File	Result	Comments
2°C Global Warming	London (LWC) DSY1 2080 Low Emissions (50th percentile)	Cat. I: P Cat II: P	All rooms meet IAQ and overheating criteria. Overheating hours reduced as far as practically possible.
4°C Global Warming	London (LWC) DSY1 2080 High Emissions (50th percentile)	Cat. I: F Cat. I: F	On NW façade, all rooms pass except for (Advice and Family) and (Reception Desk and Admin). All SE façade rooms except for (Vocational Base 02) fail to meet more severe overheating limits represented by the 4°C scenario. Requires future adaptation in line with DfE cooling hierarchy.

IAQ results showed **all rooms IAQP pass** minimum requirements, see Indoor Air Quality Results for more information.

Contents

Glossary of Terms

DfE	Department for Education	**SEND**	Special Educational Needs and Disabilities
BB101	Building Bulletin 101 – guidance on ventilation, thermal comfort & IAQ	**NVHR**	Natural Ventilation with Heat Recovery
IAQ	Indoor Air Quality	**MVHR**	Mechanical Ventilation with Heat Recovery
TM52	CIBSE Technical Memorandum 52 – Adaptive Thermal Comfort	**UHI**	Urban Heat Island – elevated temperatures in urban areas
DSM	Dynamic Simulation Modelling	**ACH**	Air Changes per Hour – measure of building airtightness
IES VE	Integrated Environmental Solutions Virtual Environment (modelling software)	**G-Value**	Solar gain coefficient of glazing
AM11	CIBSE Application Manual 11 – Building Energy & Performance Modelling	**LT Value**	Light Transmission value of glazing
He	Hours of Exceedance – overheating criterion	**BMS**	Building Management System – controls HVAC and environmental systems
We	Daily Weighted Exceedance – short-term discomfort measure	**LTHW**	Low Temperature Hot Water – used in heating systems
ΔT	Temperature difference from comfort threshold	**MFSV900**	Model reference for hybrid roof ventilation unit
Tupp	Upper Limit Temperature – maximum allowable temperature deviation	**ppm**	Parts per million – unit for measuring CO_2 concentration
Trm	Running Mean Temperature – average outdoor temperature over time	**Tmax**	Maximum acceptable indoor temperature based on adaptive comfort

1. Introduction

Design MEP was appointed by Galliford Try to produce a **Thermal Comfort & IAQ** report for **Bexley Road Transitional Learning Centre** to achieve their target of NZCiO. This report adheres to the Department for Education's (DfE) School Output Specification Technical Annex 2F (Nov 2022) and the Building Bulletin 101 (BB101) guidelines on ventilation, thermal comfort, & indoor air quality (IAQ) (Aug 2018).

Site Context	
Name	Bexley Road Transitional Learning Centre
Building Location	77 Bexley Road, Eltham
Post Code	SE9 2PE
Company	Galliford Try
Building GIFA	1,116 m^2
No. of Storeys	1
Site Type	Suburban
Proposed Works	Demolition; Newbuild School
RIBA Stage	Stage 3

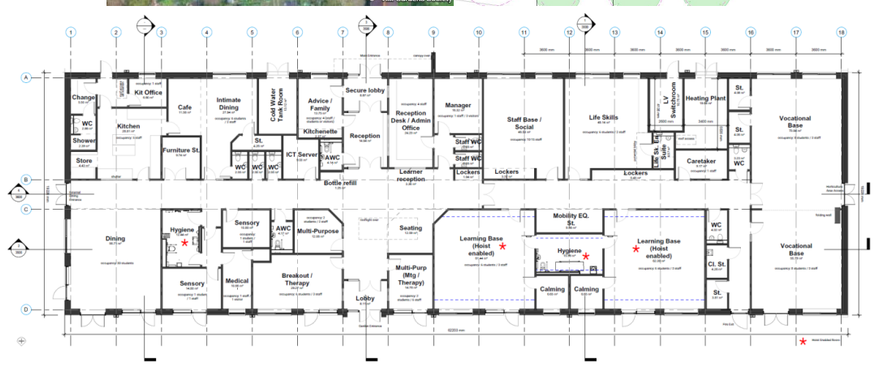

Figure 1. Site Plan.

Section	Description
Methodology	**Compliance Standards**: Evaluations based on DfE Technical Annex 2F, BB101, and CIBSE TM52, focusing on overheating limits, CO_2 thresholds, and adaptive thermal comfort. **Thermal Modelling**: Simulations using IES VE 2025 software. **Climate Resilience**: Future climate scenarios (2°C and 4°C warming by 2080) were used to test overheating risk. **Occupant Criteria**: Normal Occupant & Special comfort thresholds were applied for very young (infant) occupants. **Model Inputs**: The model used architectural data from Pozzoni, standard occupancy schedules, and assumptions about user behaviour.
Building Information	**Site Constraints & Opportunities**: Site location and orientation affect overheating risk, ventilation potential, and shading options. Opportunities include passive cooling and climate-resilient design. **Occupancy**: Room-specific occupancy profiles influencing internal heat gains. **Construction Details**: Lists thermal performance (U-values) for opaque and glazed elements, plus airtightness metrics. **Ventilation Strategy**: Combines {natural/hybrid/mechanical} systems tailored to room types, supported by noise surveys and IES modelling. **Opening Types**: Specifies window and shading configurations, their operational profiles, and airflow characteristics
Thermal Comfort Results	This section presents overheating analysis for Category I (SEN) & Category II (normal) spaces under 2°C 2080 low-emission & 4°C 2080 high-emission climate scenarios. It evaluates compliance with CIBSE TM52 criteria, including: • **Hours of Exceedance** (≤ 40 hrs) • **Daily Weighted Exceedance** (We ≤ 6) • **Upper Temperature Limit** (ΔT ≤ 4K)
Indoor Air Quality Results	This section evaluates CO_2 levels in occupied spaces under future climate scenarios. It compares results against standards for mechanical and natural ventilation: • **Mechanical spaces**: CO_2 ≤ 1000 ppm • **Natural/hybrid spaces**: Daily average ≤ 1500 ppm; short-term peaks allowed

2. Methodology

2.1. Standards & Specifications

The building has been assessed against the following standards and guidance documents:

Department for Education (DfE) School Output Specification: Technical Annex 2F: Mechanical Services and Public Health Engineering (Nov 2022) – sets performance standards for the avoidance of overheating in schools.

- **Criterion 1: Hours of Exceedance (He)** – the number of hours that ΔT ≥ 1 K from 1 May to 30 September during defined hours shall not exceed 40 hours.
- **Criterion 2: Daily Weighted Exceedance (We)** – the weighted exceedance shall not exceed 6 in any one day (short-term discomfort measure, non-mandatory).
- **Criterion 3: Upper Limit Temperature (Tupp)** – ΔT shall not exceed 4 K (non-mandatory).
- These criteria are applied from 09:00–16:00, Monday to Friday, including the summer holiday period, with a lunchbreak period (12:00–13:00) modelled with no internal gains in classrooms.

Building Bulletin 101 (BB101), August 2018 – provides further guidance on ventilation, thermal comfort, and indoor air quality (IAQ) in schools, which is not considered in Technical Annex 2F.

Indoor Air Quality:

- **Natural or hybrid ventilation in natural mode: Daily average CO_2 < 1,500 ppm; maximum < 2,000 ppm for no more than 20 consecutive minutes.**
- **Mechanical or hybrid ventilation in mechanical mode: Daily average CO_2 < 1,000 ppm; maximum < 1,500 ppm for no more than 20 consecutive minutes.**

CIBSE TM52 Adaptive Thermal Comfort – used to define maximum indoor temperature based on adaptive comfort principles for different room categories:

Category	Application	Acceptable Range, ΔT
Category I	High level of expectation. Also recommended for spaces occupied by very sensitive and fragile persons with special requirements like some disabilities, sick, very young children, and elderly persons, to increase accessibility.	+2/-3 °C
Category II	Normal expectation	+3/-4 °C
Category III	An acceptable moderate level of expectation	+4/-5 °C
Category IV	Low level of expectation. This category should only be accepted for a limited part of the year	>+4/<-5 °C

The formula used to calculate the maximum indoor temperature based on TM52, is as follows:

$$T_{max} = 0.33 \times T_{rm} + 18.8 + \Delta T$$

Where the symbols relate to the following:

- T_{max} is the maximum comfort temperature acceptable for the group. For example, for the 2K weather file scenario in London, T max equates to approximately, 28.5 °C.
- T_{rm} is the exponentially weighted running mean of the daily mean outdoor air temperature. This can be taken as the mean outdoor air temperature during the summer from May to September

This maximum acceptable temperature differs depending on the category above (i.e. occupant type). Category I (A) was used for all the teaching spaces where pupils are likely to be. However Category II was used for the admin spaces.

Standard/Guidance	Version	Requirement
DfE Technical Annex 2F	Nov 2022	Overheating criteria: • H_e ≤ 40 hours • W_e ≤ 6/day (informative) • ΔT ≤ 4 K (informative)
BB101: Ventilation, Thermal Comfort & IAQ	Aug 2018	CO_2 thresholds for natural/hybrid and mechanical ventilation • Natural: Daily avg < 1,500 ppm; Max < 2,000 ppm ≤ 20 min • Mechanical: Daily avg < 1,000 ppm; Max < 1,500 ppm ≤ 20 min
CIBSE TM52	2013	Adaptive thermal comfort categories for different room types

2.2. Thermal Modelling Approach & Inputs

Thermal comfort analysis was undertaken using **IES Virtual Environment (VE) 2025**, in accordance with **CIBSE AM11: Building Performance Modelling (2020)** and the requirements of **DfE Technical Annex 2F**, **BB101**, and **CIBSE TM52**.

The simulations followed a dynamic hourly method (DSM) to assess both **overheating** and **indoor air quality** criteria for all occupied spaces.

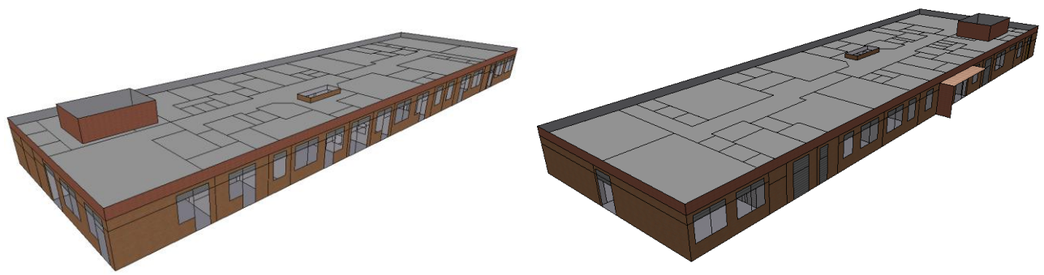

Figure 2. IES VE (2025) Model.

The modelling procedure comprised the following key steps:

1. **Model Setup** – A detailed 3D thermal model was created in IES *ModelIT* using the Stage 3 DXF plans.
2. **Thermal Templates & Internal Conditions** – DfE thermal templates were assigned to all room types, including occupancy profiles, internal gains (people, equipment, lighting), and operational hours (typically 09:00–16:00, Monday–Friday, including summer term). A lunchbreak period (12:00–13:00) was modelled with no internal gains, in line with DfE Annex 2F requirements. The use of Suncast and Radiance modules provided key data on solar shading and daylight harvesting. These additional modules captured the impact of solar heat gains and lighting heat gains (in photocell dimming areas) in to the overheating model.
3. **Constructions & Fabric Properties** – Envelope U-values, glazing g-values, and thermal mass parameters were applied from the Stage 3 design data.
4. **Ventilation & Controls** – Ventilation systems were modelled in accordance with Stage 3 design.
5. **Weather Data** – Simulations were run using future weather files to assess both compliance and resilience:

Scenario	Weather File	Location	Emission Scenario	Percentile	Year	Notes
2°C	DSY1 2080	London Weather Centre	Low	50th	2080	Primary compliance scenario
4°C	DSY1 2080	London Weather Centre	High	50th	2080	Resilience check (Cooling Hierarchy)

6. **Adaptive Comfort Calculation (TM52)** – The model calculates hourly **operative temperatures (T_{op})** for each occupied space. These are compared against the **adaptive comfort threshold (T_{max})**, determined from the running mean external temperature (T_{rm}) using the equation on the previous page. The project is a primary school with very young children (infant), requiring more stringent comfort thresholds than standard in some spaces (i.e. Category I - +/- 2/-3°C). The relevant **TM52 criteria** are then evaluated:
   - *Criterion 1:* Hours of Exceedance (He ≤ 40 h).
   - *Criterion 2:* Daily Weighted Exceedance (We ≤ 6 per day).
   - *Criterion 3:* Upper Limit Temperature (ΔT ≤ 4 K).
7. **Indoor Air Quality (BB101)** – CO_2 concentration was modelled in accordance with BB101 thresholds:
   - Natural / Hybrid mode: average < 1,500 ppm; max < 2,000 ppm for < 20 minutes.
   - Mechanical mode: average < 1,000 ppm; max < 1,500 ppm for < 20 minutes.
8. **Results & Evaluation** – Post-processing was carried out in *IES VistaPro* to generate plots of operative temperature, CO_2 concentration, and comfort exceedances. Spaces were assessed against TM52 and Annex 2F criteria to determine compliance and identify any zones requiring mitigation using Category I(A) for infants rooms, Category II(B) and Category III (C) for other rooms.

Figure 3. Architectural Plans: Ground Floor (top), Site Plan (bottom).

Further images such as elevations may be found in Appendix A: Architect's Layouts & Elevations.

Full IES Modelling Inputs can be found on the next page.

2.3. Modelling Data Inputs

CONSTRUCTION	U-VALUES	HEATING		VENTILATION		MANAGEMENT AND CONTROL FEATURES	
External walls	0.15	NVHR (hybrid units) (ASHP to LTHW heating coil)	SCOP = 3.8 Radiant Fraction = 0	MVHR SFP MVHR Thermal Efficiency	1.50 80%	Power factor (PFC)	0.9<=PF<=0.95
Internal walls	As per architects drawings	Wet Radiators (ASHP to LTHW)	SCOP = 3.8 Radiant Fraction = 0.20	NVHR low SFP (W/l/s) NVHR Thermal efficiency	0.09 50.10%	Metering for HVAC and Lighting system	Yes
Ground floor	0.12	Radiant Heating Panels (ASHP to LTHW)	SCOP = 3.8 Radiant Fraction = 0.67	Zonal Extract Fans SFP (W/l/s)	0.50	BMS- With out-of-range alarms For Lighting system	No
Flat Roof	0.12			Kitchen's fan supply SFP Kitchen's cooker hood extract SFP	0.70 0.60	BMS- With out-of-range alarms For HVAC	Yes
Solid doors	1.10	**DHW**				DCV ventilation Speed drives to pumps and fans	Yes
Roof lights	1.10	ASHP Storage (2x 300L) (Food prep),	SCOP = 3.2	CEN leakage classification Ductwork, AHUs	B, L2	**LZCs**	
Windows	U =1.10, g=0.36, LT=0.66	Storage Cleaners' cub.	30L	Demand Control Ventilation (DCV) used for NVHRs	CO_2 and temperature sensors	On site zero or low carbon technology	ASHP
Internal ceiling/floors	As per architects drawings	Storage losses (kWh/day/L) Food prep	0.048			District Heating	n/a
Internal blinds	No	Storage losses (kWh/day/L) Cleaners' cupboard	0.022	**VRFs and DX**		Other on site zero or low carbon technology CHP, PVs, Biomass, etc.	PVs
		Secondary circulation Circulation losses (W/m) (Food prep.)	9	DX cooling (IT server room) SEER, EER	7.25, 3.5	**Planning Class**	
Fabric air permeability	3	Secondary circulation Pump power (W) (Food prep.)	20			Main Planning class	D1: Learning Centre
		Secondary circulation DHW pipework (m) (food prep.)	5				

3. Building Information

3.1. Site Constraints & Opportunities

Site constraints are features of the building which may determine or prevent certain design choices within this report and further into the project.

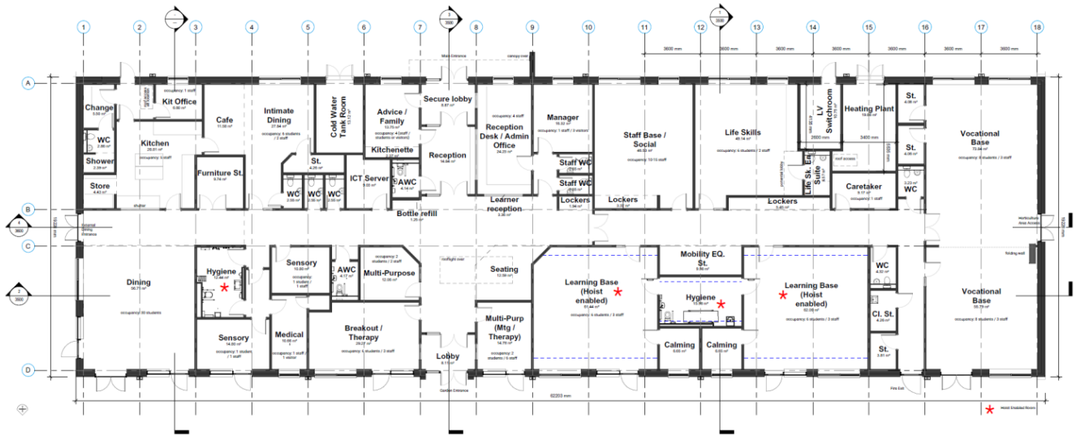

Figure 4. Site Location.

Constraints	
Orientation/Plot	Southeast & Southwest facing spaces have greater overheating risk.
Location Type	Suburban – Urban Heat Island (UHI) effect likely due to local weather file
Weather/Airflow	Predictive weather files & airflow conditions are location-dependent with more extreme temperatures in the South & higher airflow in the west.
External Air Quality	Busy roads nearby can restrict natural ventilation due to air & noise pollution.

Opportunities	
Orientation/Plot	South-facing facades allow for controlled daylighting & solar gains when balanced with shading. North-facing facades for even daylight & low overheating risks.
Natural Ventilation	Prevailing wind direct can support effective passive ventilation e.g. cross-ventilation and night cooling.
Shading	Opportunity to integrate planting, trees, etc on large site area to provide shading & improve air quality.

3.2. Building Occupancy

The total estimated number of people within the building is 60 including students and staff. Different room types are categorised by occupancy levels which impacts the internal heat gains (people, lighting, cooking etc) assumed for that room. Occupancies are set as per the following:

Unoccupied	Stores, Circulation, Plant Rooms, WCs, risers, voids.
Occupied	Classrooms, Offices, Therapy, Staff Rooms, Reception Areas, Kitchen food prep

Occupancy & internal gains profiles for different room types are shown in the figures below:

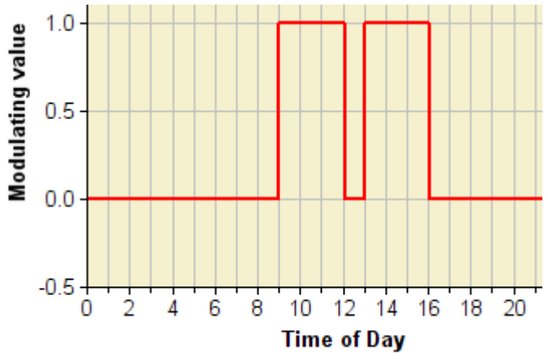

Figure 5: School occupancy profile.

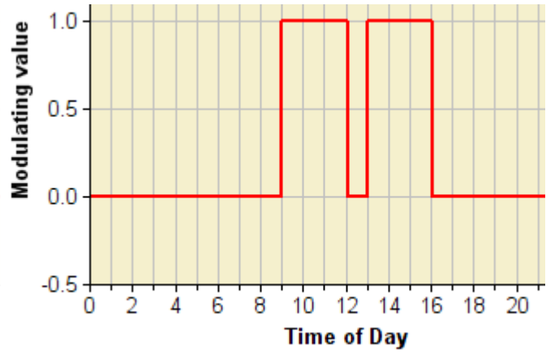

Figure 6: Internal heat gains profile.

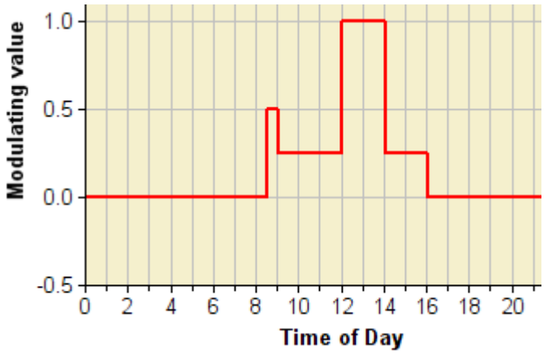

Figure 7: Dining occupancy

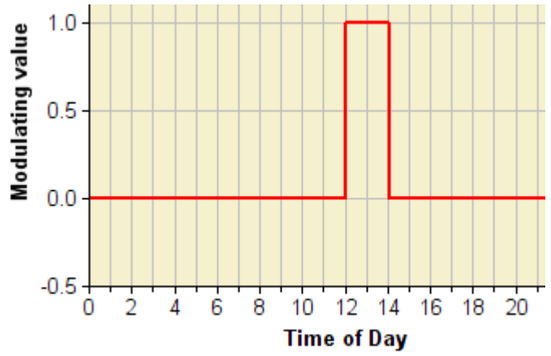

Figure 8: Kitchen operating profile (heat gains only).

3.3. Opaque Constructions

Opaque Construction	Actual Building	
	U-Value (W/m^2K)	Thermal Mass ($kJ/(m^2K)$
External Wall(s)	0.15	12
Ground Floor	0.12	240
Flat Roof	0.12	186.30
Glazing	1.10	-
Rooflights	1.10	-
Metal Louvres	1.10	53.00
External Doors	1.10	21.72
Internal Ceiling(s)	2.30	2.50
Internal Wall(s)	0.63	10.00

Air Permeability	3.00 m³/m²·hr	≈0.15 ach

The **brick façade** contributes to durability and improved thermal stability. Moderate–high thermal mass reinforced concrete floors and substructure help smooth internal temperature swings, storing daytime gains for release during cooler evening periods.

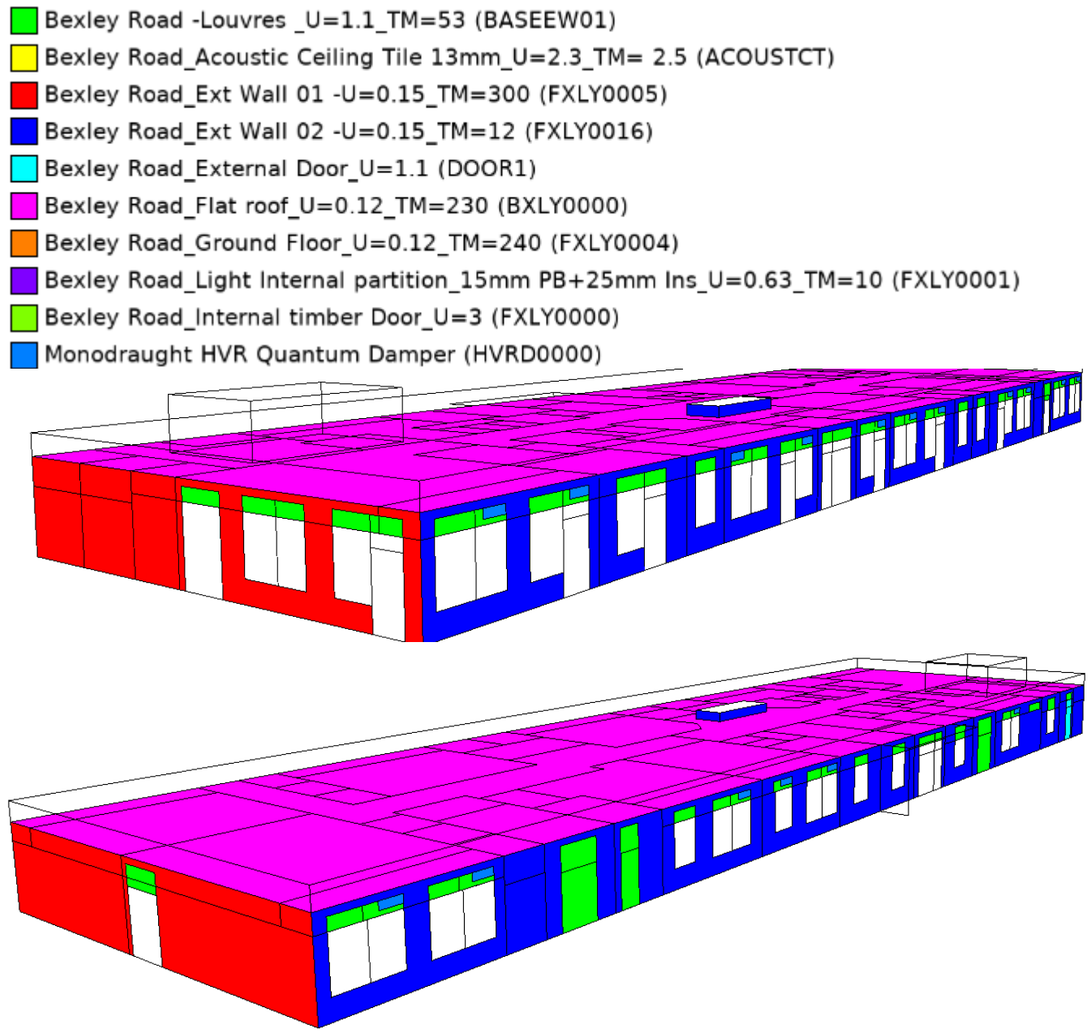

Figure 9. IES Model Building Constructions.

3.4. Glazed Constructions

Glazed Construction	Actual Building		
	G-Value	LT Value	Shading
All Elevations	0.36	0.66	Louvres

Local shades due to windows recesses have been included in the construction data to consider local shading benefits in mitigating risks of summer overheating. Internal blinds have also been used.

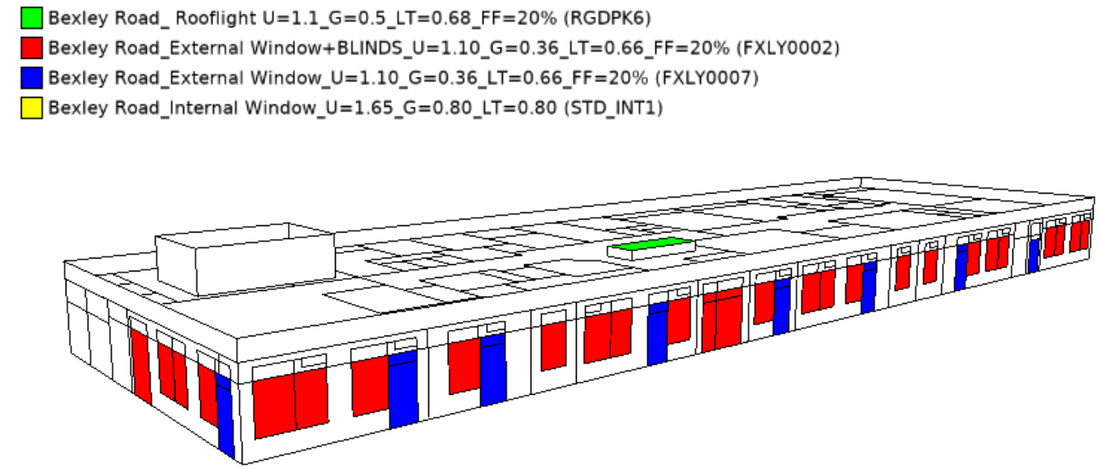

Figure 10. IES Model Glazed Constructions.

3.5. HVAC Strategy

The HVAC design for **Bexley Road Transitional Learning Centre** provides high levels of comfort, air quality, and energy efficiency consistent with **DfE Technical Annex 2F**. The Stage 3 design adopts a mixed-mode approach, combining a **air-source heat pump (ASHP)**, **low-temperature hot-water (LTHW)** distribution, and a hierarchy of natural, hybrid, and mechanical ventilation systems controlled via the central **BMS**.

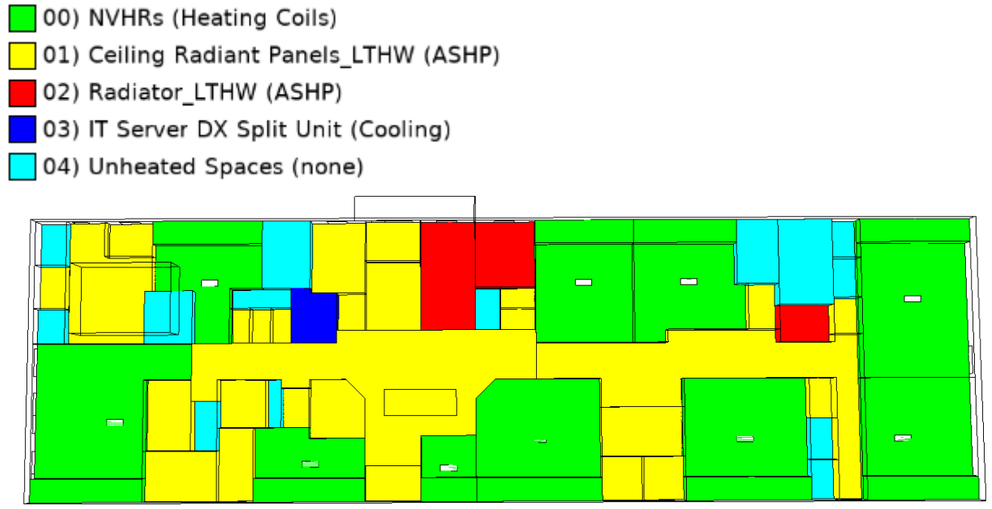

Figure 11. NCM Heating & Cooling Systems.

3.5.1. Heating

- **Air Source Heat Pump (ASHP)** – closed-loop water-to-water system.
- **Seasonal Coefficient of Performance (SCoP):** 3.8
- Supplies LTHW to NVHR coils, MVHR coils, radiant panels, and radiators.
- Nominal flow temperature ≈ 45 °C.

Space Type	Heating Emitters	Notes
Classrooms. Dining, and Breakout Rooms	LTHW coil within NVHR (Monodraught HVRZero APX)	Provides heated air in winter
Admin/Office	Wall-mounted LTHW radiators	ASHP-fed
Circulation & Kitchen	Ceiling radiant panels	ASHP-fed
Plant Rooms	Electric frost-protection panels	Local only
Storage	None	None

3.5.2. Cooling

Active cooling is limited to essential IT server equipment load only. No comfort cooling is provided to other occupied spaces.

Space	Cooling Type	Equipment	Efficiency
IT Server Room	Single-split DX (active mechanical cooling)	Wall-mounted indoor + outdoor condenser	SEER = 7.25, EER = 3.5
All other spaces	None (passive cooling)	Windows / NVHR	-

No comfort cooling is provided elsewhere; thermal comfort is maintained through exposed thermal mass, hybrid ventilation operation, external shading, low g-value and Windows's natural ventilation

3.5.3. DHW

- Electric POU heaters to Cleaners Storage (30L) ≈ 0.05 kWh/day/l.
- ASHP electric (2x 300 L) immersion calorifier serving kitchen food prep with estimated storage loss ≈ 0.05 kWh/day/l.
- Minimum DHW Secondary circulation loss ≈ 9 W/m

3.5.4. Ventilation

The ventilation design maximises passive and hybrid systems where site noise levels (< 60 dB per E3P survey) allow window opening. Mechanical ventilation with heat recovery serves enclosed or acoustically sensitive zones. Demand controlled ventilation (DCV) using CO_2 sensors, is present in NVHR Hybrid ventilation spaces only including classrooms, the library, and the assembly hall (Cd = 0.95).

Figure 12. NCM Part L Ventilation Systems.

System	Typical Application	Max Flow (L/s)	SFP (W/l·s)	Heat Recovery (%)	Model / Supplier
NVHR	Teaching spaces, Dining	180/unit	**0.09**	**51%**	Monodraught HVRZero APX
MVHR	Calming, Sensory and Caretaker rooms	120	**1.5**	**80%**	Nuaire XBC+ Series
Natural Ventilation only	Offices, Advice and family room	-	**-**	**-**	-
Extract fans	WCs, Showers, Stores	18	**0.5**	-	Nuaire DE/XS Series
Extract fans	Hygiene	120	**0.5**		
Supply fan Extract fan (incl. cooker hood)	Kitchen,	165	**0.7, 0.6**	-	Specialist design

Natural Ventilation (Openable Windows)

- Limited to only occupied Office spaces and the Advice and family room.
- **Large windows**: lower sills starting at 1100 mm
- **Acoustic restrictions** on all Southwest and Southeast facades.
- **Operation modelled in IES:**
  Large & small windows: **09:00–16:00 (occupied hours)**.

NVHRs, Louvres & Passive Stack

- Louvres of ground floor windows enable airflow across teaching spaces
- NVHRs include **low-energy fans** (temperature & CO_2 controlled) for boost and night purge.
- LTHW heating coils for winter efficiency to boost the heat recovery exchanges from the classrooms' internal heat gains.

Figure 13: Illustration of NVHRs type HVR APX unit.

1.4.5. Mechanical Ventilation

Figure 14. MVHR_01-XBC25-120.

- Balanced supply & extract with heat recovery.
- Controlled by BMS.
- Night purge cooling during hot weather.
- Energy recovery (heat, cooling, moisture).
- Free cooling when outdoor temp < indoor temp.
- Reduced energy consumption with DC fan motors.
- Demand-controlled ventilation with optional CO_2 sensors.

Reference model: *Nuaire XBC25HA/55HA/15HA*.

3.6. Opening Types

Ref. ID	Exposure Type	Opening	Gross Area (%)	Opening Profile
XTRN0000	Openings closed	-	0	Off continuously
XTRN0001	Openable Window	Top-hung (max 10°)	31	Open during occupied hours (09:00–16:00, weekdays) only when T. room ≥ 21 °C (summer) or CO_2 ≥ 1400 ppm (winter). No Night Time Purge allowance.
XTRN0013	NVHR Integrated Louvre	Louvre (C.d = 0.120)	19	Monodraught HVR Exhaust & Intake Louvre – All-year seasonal CO_2 & temperature control as per Monodraught integrated control logic.

XTRN0000 (Default Closed Windows)
XTRN0001 (Operable Windows)
XTRN0013 (HVR® Integrated Louvre (2))

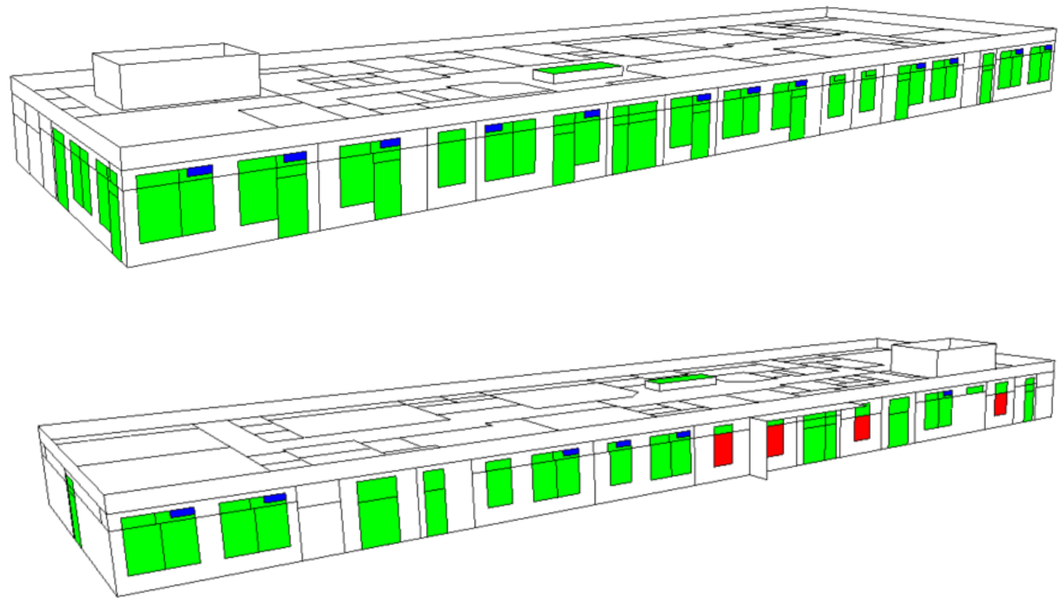

Figure 15. IES Model Opening Types

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3.7. Noise Impact Assessment

A **Noise Impact Assessment** was undertaken by **Acoustic Consultants LTD** (report ref. **11849_Bexley_Road_BB93_Stage 3_30012026_JA**). The purpose of the study was to quantify existing ambient noise levels across the **Bexley Road Transitional Learning Centre** site and to confirm the suitability of natural and hybrid ventilation strategies.

Survey Summary

Noise mapping in *Figure 16* indicates that daytime noise levels are predominantly influenced by local road traffic. The results show that:

- **No facades experience daytime levels above 60 dB LAeq,T**, and
- **Standard specification double glazing is sufficient to achieve internal ambient noise targets** (≤ 35 dB LAeq) across all teaching and occupied spaces.

The report further concludes that **all spaces are to be ventilated via fresh air louvres** as "**open window ventilation is likely to mean that indoor ambient noise level criteria is exceeded** in sensitive spaces at all elevations and is **not advised**".

As a result, all overheating modelling has been conducted with window openings non-openable with the exception of:

- Reception desk and admin office
- Managers office
- Kitchen office
- Advice and family space

These spaces have been identified as to allow windows openable due to the results of the acoustic report and their non-sensitive noise catergories. All four of the rooms with openable windows are on the Northwest façade of the building

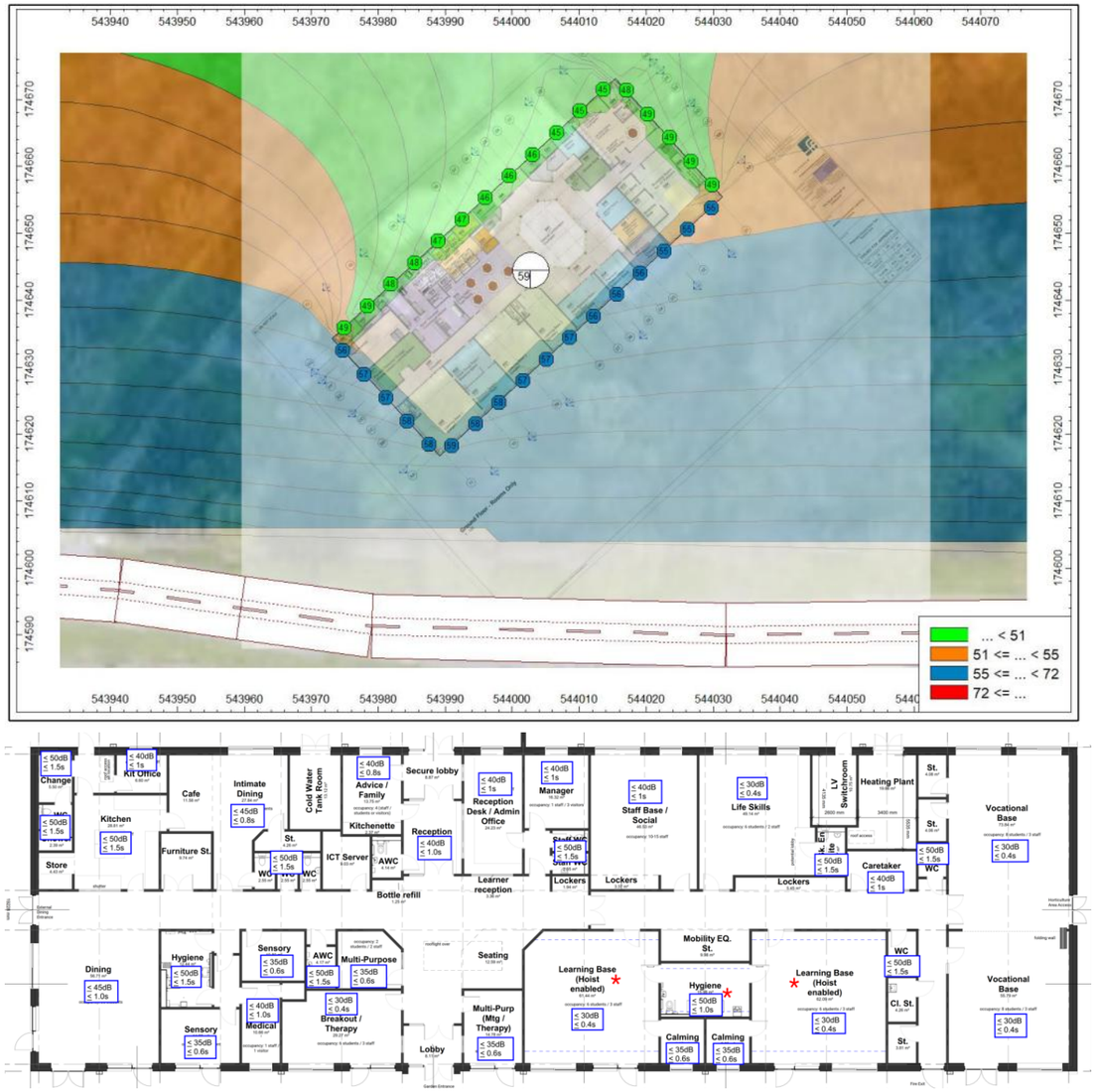

Figure 16. Bexley Road Transitional Learning Centre predicted acoustic results sound map (top) and Internal acoustic room results (bottom) Source: {Acoustic Consultants LTD, 11849_Bexley_Road_BB93_Stage 3_30012026_JA}

4. Thermal Comfort Results

4.1. Weather Scenario: 2°C 2080 Low Emission

Category I Spaces					
Room Name	**Criterion 1: Hrs of Exceedance <= Max 40hrs**	**Criterion 1: % in Range**	**Criterion 2: We <= 6 Degree Hours**	**Criterion 3: ΔTupp <= Max 4K**	**PASS/FAIL**
00_Multi-Purpose/Therapy	21	3%	8	3	Pass
00_Breakout / therapy 02	13	2%	10	3	Pass
00_Learning Base 01	11	2%	9	3	Pass
00_Life skills	5	1%	5	2	Pass
00_Medical	0	0%	0	0	Pass
00_Sensory 02	9	1%	9	3	Pass
00_Sensory 01	5	1%	4	2	Pass
00_Vocational Base 01	7	1%	5	2	Pass
00_Learning Base 02	12	2%	9	3	Pass
00_Multi-Purpose -Room	38	6%	16	5	Pass
00_Calming 02	8	1%	5	2	Pass
00_Calming 01	7	1%	4	2	Pass
00_Vocational Base 02	8	1%	6	2	Pass
00_Dining	24	3%	11	3	Pass

Category II Spaces					
Room Name	**Criterion 1: Hrs of Exceedance <= Max 40hrs**	**Criterion 1: % in Range**	**Criterion 2: We <= 6 Degree Hours**	**Criterion 3: ΔTupp <= Max 4K**	**PASS/FAIL**
00_Kitchen	3	0%	3	2	Pass
00_Advice and Family	15	2%	7	3	Pass
00_Caretaker	0	0%	0	0	Pass
00_Kitchen office	6	1%	5	2	Pass
00_Managers office	9	1%	6	3	Pass
00_Reception Desk and Admin office	9	1%	4	2	Pass
00_Staff Base / Social	5	1%	5	2	Pass
00_Intimate Dining	0	0%	0	0	Pass

4.2. Weather Scenario: 4°C 2080 High Emission

Category I Spaces					
Room Name	**Criterion 1: Hrs of Exceedance <= Max 40hrs**	**Criterion 1: % in Range**	**Criterion 2: We <= 6 Degree Hours**	**Criterion 3: ΔTupp <= Max 4K**	**PASS/FAIL**
00_Multi-Purpose/Therapy	76	12%	14	4	Fail
00_Breakout / therapy 02	45	7%	18	5	Fail
00_Learning Base 01	50	8%	14	4	Fail
00_Life skills	35	5%	9	3	Pass
00_Medical	100	15%	7	2	Fail
00_Sensory 02	43	7%	16	5	Fail
00_Sensory 01	32	5%	9	3	Pass
00_Vocational Base 01	31	5%	13	4	Pass
00_Learning Base 02	58	9%	15	4	Fail
00_Multi-Purpose -Room	105	16%	24	6	Fail
00_Calming 02	78	12%	12	3	Fail
00_Calming 01	74	11%	11	3	Fail
00_Vocational Base 02	37	6%	14	4	Pass
00_Dining	97	13%	20	5	Fail

Category II Spaces					
Room Name	**Criterion 1: Hrs of Exceedance <= Max 40hrs**	**Criterion 1: % in Range**	**Criterion 2: We <= 6 Degree Hours**	**Criterion 3: ΔTupp <= Max 4K**	**PASS/FAIL**
00_Kitchen	13	2%	8	4	Pass
00_Advice and Family	52	8%	14	4	Fail
00_Caretaker	0	0%	0	0	Pass
00_Kitchen office	19	3%	12	4	Pass
00_Managers office	40	6%	14	4	Pass
00_Reception Desk and Admin office	65	10%	10	3	Fail
00_Staff Base / Social	18	3%	12	4	Pass
00_Intimate Dining	4	1%	3	1	Pass

5. Indoor Air Quality Results

Indoor Air Quality for this appraisal is assessed based on **CO_2 concentration** within occupied spaces (teaching spaces, therapy/ multipurpose rooms and admin rooms).

Ventilation Type	Maximum Allowable CO_2	Additional Notes
Mechanically ventilated spaces (MVHR)	≤ 1000 ppm	Continuous limit during occupancy
Natural or Hybrid (in natural mode)	≤ 1500 ppm (daily average)	Allowed to exceed 1500 ppm for ≤ 20 minutes during occupied hours

When natural ventilation is used, or when hybrid systems operate in natural mode:

- Outdoor air supply must be sufficient to achieve a daily average CO_2 concentration <1500 ppm.
- This applies when the number of occupants is equal to or less than the design occupancy.

The following tables present the hours of CO_2 concentration recorded in occupied spaces:

5.1. Weather Scenario: 2°C 2080 Low Emission

	Category I Spaces			
Room Name	Max daily average (<1500 PPM)	Max 20 min peak (<2000 PPM)	All occupied hours average (<1200 PPM)	Criteria Met (Y/N)
00_Multi-Purpose/Therapy	1201	0	1050	Y
00_Breakout / therapy 02	865	0	724	Y
00_Learning Base 01	937	0	795	Y
00_Life skills	989	0	863	Y
00_Medical	523	0	523	Y
00_Sensory 02	852	0	725	Y
00_Sensory 01	1172	0	982	Y
00_Vocational Base 01	941	0	823	Y
00_Learning Base 02	945	0	791	Y
00_Multi-Purpose -Room	919	0	774	Y
00_Calming 02	1173	0	1032	Y
00_Calming 01	1172	0	1032	Y
00_Vocational Base 02	946	0	825	Y
00_Dining	956	0	845	Y

Category II Spaces				
Room Name	**Max daily average (<1500 PPM)**	**Max 20 min peak (<2000 PPM)**	**All occupied hours average (<1200 PPM)**	**Criteria Met (Y/N)**
00_Kitchen	912	0	815	Y
00_Advice and Family	1341	0	1001	Y
00_Caretaker	1094	0	969	Y
00_Kitchen office	1136	0	841	Y
00_Managers office	1275	0	969	Y
00_Reception Desk and Admin office	889	0	723	Y
00_Staff Base / Social	1004	0	896	Y
00_Intimate Dining	929	0	820	Y

5.2. Weather Scenario: 4°C 2080 High Emission

Category I Spaces				
Room Name	**Max daily average (<1500 PPM)**	**Max 20 min peak (<2000 PPM)**	**All occupied hours average (<1200 PPM)**	**Criteria Met (Y/N)**
00_Multi-Purpose/Therapy	1201	0	1036	Y
00_Breakout / therapy 02	872	0	699	Y
00_Learning Base 01	937	0	761	Y
00_Life skills	988	0	835	Y
00_Medical	523	0	523	Y
00_Sensory 02	854	0	698	Y
00_Sensory 01	1172	0	976	Y
00_Vocational Base 01	947	0	791	Y
00_Learning Base 02	933	0	757	Y
00_Multi-Purpose -Room	918	0	744	Y
00_Calming 02	1173	0	1024	Y
00_Calming 01	1172	0	1025	Y
00_Vocational Base 02	952	0	792	Y
00_Dining	959	0	821	Y

Category II Spaces				
Room Name	**Max daily average (<1500 PPM)**	**Max 20 min peak (<2000 PPM)**	**All occupied hours average (<1200 PPM)**	**Criteria Met (Y/N)**
00_Kitchen	913	0	796	Y
00_Advice and Family	1339	0	996	Y
00_Caretaker	1094	0	968	Y
00_Kitchen office	1129	0	828	Y
00_Managers office	1274	0	958	Y
00_Reception Desk and Admin office	897	0	724	Y
00_Staff Base / Social	1003	0	865	Y
00_Intimate Dining	937	0	785	Y

6. Conclusion

The analysis indicates that the proposed ventilation strategy for **Bexley Road Transitional Learning Centre** provides sufficient ventilation to maintain the required levels of **Indoor Air Quality (IAQ)** and **thermal comfort**, in line with **DfE Technical Annex 2F**.

Thermal Comfort Compliance with DSY1 Weather Files

Scenario	Weather File	Result	Comments
2°C Global Warming	London (LWC) DSY1 2080 Low Emissions (50th percentile)	Cat. I: P Cat II: P	All rooms meet IAQ and overheating criteria. Overheating hours reduced as far as practically possible.
4°C Global Warming	London (LWC) DSY1 2080 High Emissions (50th percentile)	Cat. I: F Cat. I: F	On NW façade, all rooms pass except for (Advice and Family) and (Reception Desk and Admin). All SE façade rooms except for (Vocational Base 02) fail to meet more severe overheating limits represented by the 4°C scenario. Requires future adaptation in line with DfE cooling hierarchy.

The following design features reduce overheating risk:

- **Natural ventilation** via openable windows to promote cross ventilation.
- **Hybrid ventilation (NVHRs)** with nighttime purge capability (low-energy fans).
- **Enhanced cross-ventilation** via NVHRs.
- **Internal blinds** have been modelled on all windows seen in *Figure 10*.
- **Building orientation** has been designed to reduce the amount of glazing facing South
- **Landscaping and trees** while not included in model, current landscape layouts indicate that large shrubs and trees will be along the Southeast façade, reducing overheating risk further.
- **Low g-value (0.36)** glazing to all glazing.
- **External louvres to aid free air flow** when conditions are suitable (using NVHRs temp. and CO_2 sensors).
- **Mechanical ventilation only where required**

Where some rooms are non-compliant under the **4°C global warming scenario**, the design intent is to adapt without structural changes, in line with the **DfE Cooling Hierarchy**:

Step	Adaptation Measure	Purpose
1	Maximise use of exposed **thermal mass** with night purge	Store & release heat effectively Reduce overheating by boosting air change rate
2	Increase **ventilation volume**	
3	Replace high-heat-gain **equipment & lighting**	Reduce internal load
4	Add **solar control measures** (e.g., adjustable external shading)	Reduce solar gain
5	Retrofit **cooling coils in hybrid units**	Last resort cooling without superstructure change

IAQ Compliance

The building is fully compliant under the 2°C and 4°C scenarios

Appendix A: Architect's Layouts & Elevations

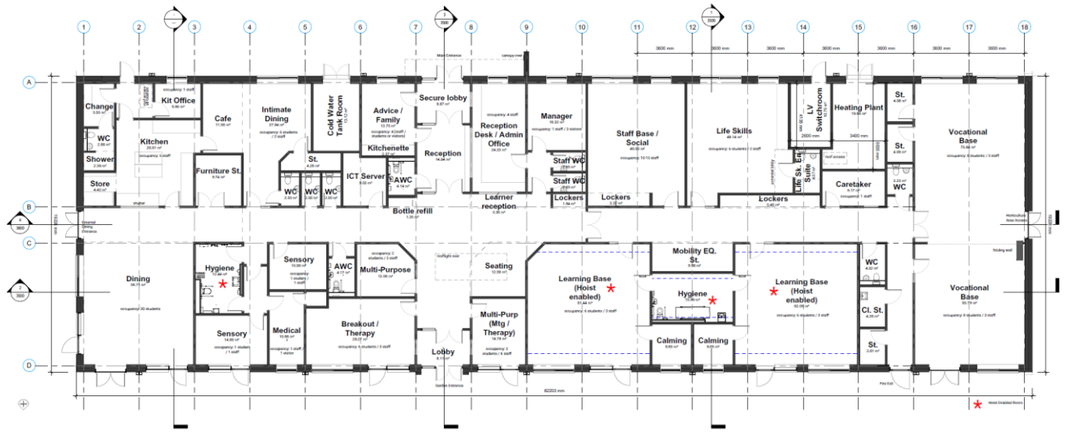

Figure 17. Ground & First Floor Plan. Courtesy: Pozzoni Architects

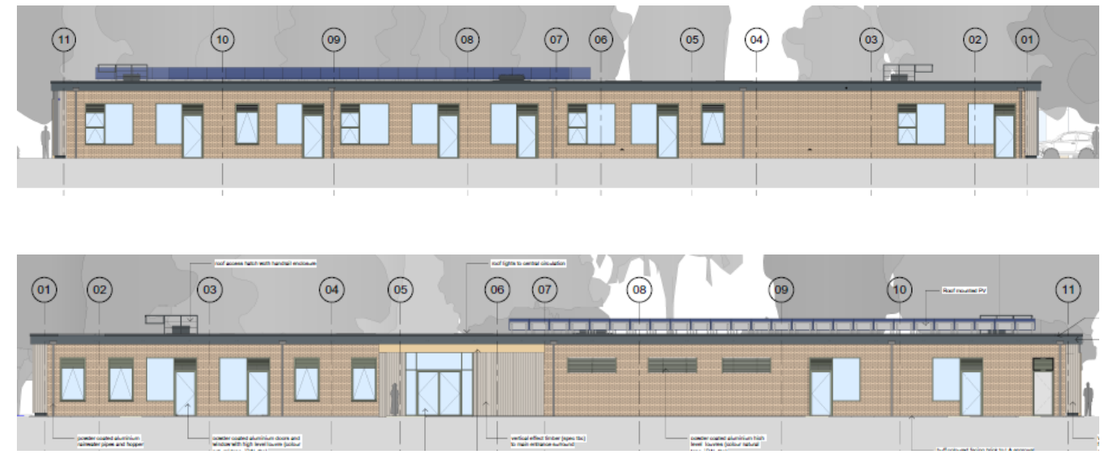

Figure 18. Architectural Elevations. Courtesy: Pozzoni Architects

Appendix B: IES Thermal Model

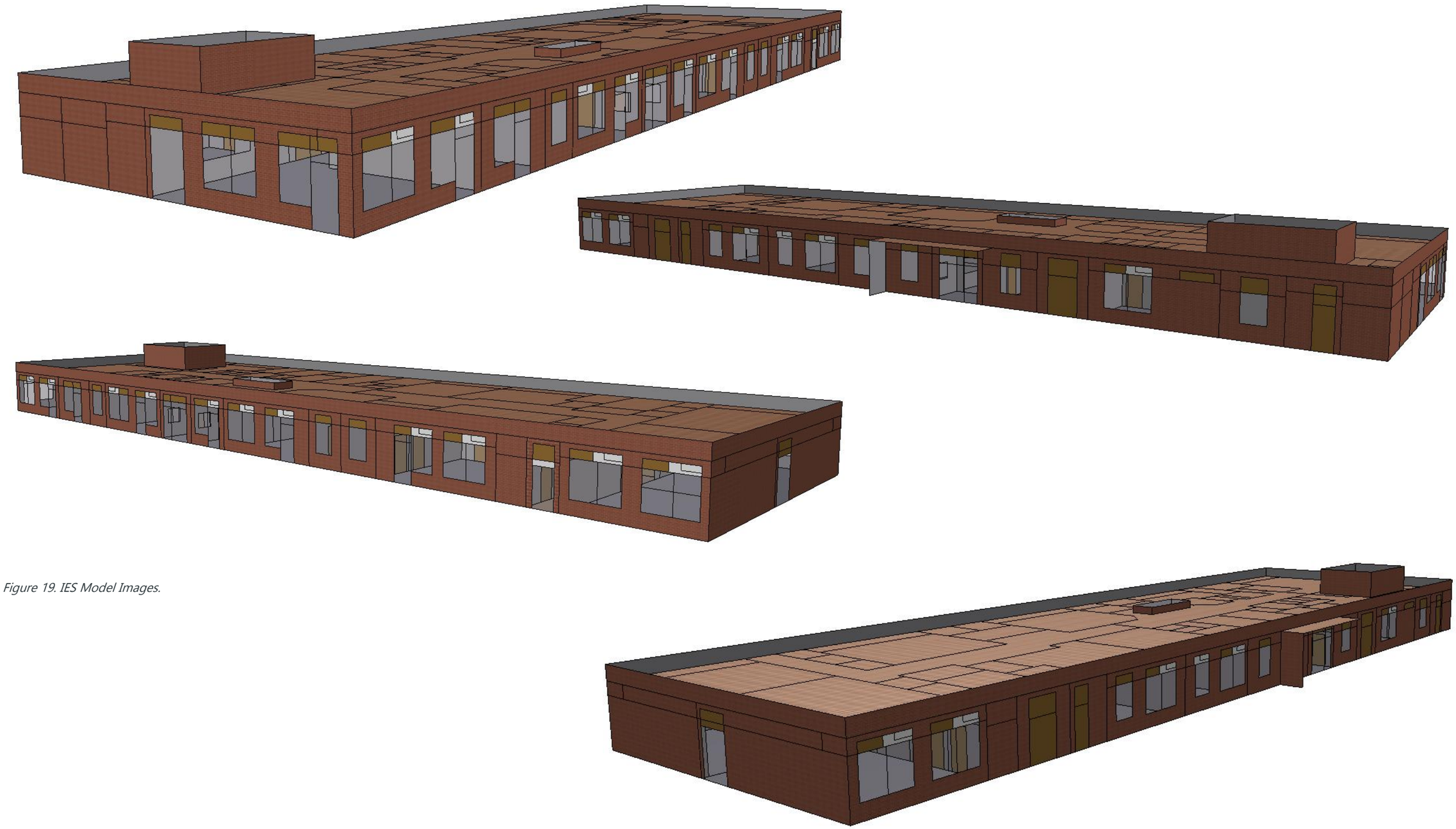

Figure 19. IES Model Images.

Appendix C: Occupancy, Internal Gains, & Airflows

Space Name	Floor Area (m²)	Occupancy (peoples)	Lighting Gains (W/m²)	Equipment Gain (W/m²)
00_Advice and Family	17.08	4	5	170.81
00_AWC 01	4.67	-	5	-
00_AWC 02	4.52	-	5	-
00_Breakout / therapy 02	31.84	9	5	-
00_Calming 01	7.69	2	5	-
00_Calming 02	7.61	2	5	-
00_Caretaker	8.59	1	5	85.88
00_Changing	5.83	-	5	-
00_Cold watertank room	13.91	-	0	-
00_Corridor 01	81.46	-	5	-
00_Corridor 02	101.74	-	5	-
00_Corridor 03	5.44	-	5	-
00_Corridor 04	4.61	-	5	-
00_Dining	81.25	30	5	-
00_Furniture Storage	10.72	0	5	-
00_Heating Plant	19.77	-	0	-
00_Hygiene 01	17.25	1	5	-
00_Hygiene 02	14.33	1	5	-
00_ICT Server	10.08	-	5	-
00_Intimate Dining	40.84	8	5	-
00_Kitchen	36.38	5	5	989.50
00_Kitchen office	7.23	1	5	72.31
00_Learning Base 01	63.72	9	5	637.23
00_Learning Base 02	63.11	9	5	631.10
00_Life skills	52.27	8	5	522.72
00_Lobby Corridor 01	8.28	-	5	-
00_LV Switchroom	11.44	-	0	-
00_Managers office	17.29	4	5	172.87
00_Medical	11.21	2	5	-
00_Multi-Purpose -Room	15.13	8	5	151.31
00_Multi-Purpose/Therapy	13.00	4	5	-
00_Reception Desk and Admin office	25.73	4	5	257.27
00_Reception/circulation	16.39	-	5	-
00_Secure Lobby	9.54	-	5	-
00_Sensory 01	9.83	2	5	-
00_Sensory 02	15.64	2	5	-
00_Staff Base / Social	51.49	15	5	514.91

00_Staff WC 01	3.09	-	5	-
00_Staff WC 02	3.28	-	5	-
00_Staff WC 03	5.80	-	5	-
00_Storage 01	4.64	0	5	-
00_Storage 02	4.82	0	5	-
00_Storage 03 (Cleaners St)	4.75	-	-	-
00_Storage 04	4.60	0	5	-
00_Storage 05	3.10	0	5	-
00_Storage 06	5.21	0	5	-
00_Storage 07	4.67	0	5	-
00_Vocational Base 01	74.34	11	5	743.41
00_Vocational Base 02	56.48	11	5	564.75
00_WC 01	4.38	-	5	-
00_WC 02	3.07	-	5	-
00_WC 03	3.12	-	5	-
00_WC 04	3.00	-	5	-
00_WC 05	4.66	-	5	-
00_WC and Shower	6.07	-	5	-

Ventilation mechanism and rates		
Space Name	**MVHRs (S+E) Max Flow (l/s)**	**MVHRs (S+E) Max Flow (l/s / person)**
00_Calming 01	20	10
00_Calming 02	20	10
00_Caretaker	10	14
00_Multi-Purpose/Therapy	40	10
00_Sensory 01	28	10
Space Name	**Extract Fans only Max Flow (l/s)**	
00_AWC 01	28	
00_AWC 02	28	
00_Hygiene 01	107	
00_Hygiene 02	93	
00_Medical	80	
00_Staff WC 01	19	
00_Staff WC 02	19	
00_Staff WC 03	41	
00_Storage 03 (Cleaners St)	32	
00_WC 01	24	
00_WC 02	19	
00_WC 03	19	
00_WC 04	19	
00_WC 05	32	
00_WC and Shower	34	
Space Name	**S+E Kitchen Max Flow (l/s)**	
00_Kitchen	637	
Space Name	**NVHR Max Flow (l/s)**	**NVHR Max Flow (l/s / person)**
00_Breakout / therapy 02	72	8
00_Dining	240	8
00_Intimate Dining	64	9.25
00_Learning Base 01	72	15.89
00_Learning Base 02	72	15.67
00_Life skills	64	14.13
00_Multi-Purpose -Room	64	8
00_Sensory 02	16	8
00_Staff Base / Social	120	10
00_Vocational Base 01	88	15.45
00_Vocational Base 02	88	11.64
Space Name	**Nat vent louvres (uncontrolled) Max Flow (l/s)**	
00_Cold watertank room	26.2784 (1 ach)	
00_Heating Plant	37.3407(1 ach)	