

NHS Property Services
Hawthorn Medical Centre

Energy Statement
Places for Everyone (JP-S2)

September 2025
Rev P01

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Revision	Description	Date	Approved
P01	Stage 4 Issue	26/09/2025	DM

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0. Executive Summary

0.1 Project Overview

The project is the Hawthorn Primary Care Health Centre, located at Moseley Road, Fallowfield, Manchester. It comprises a single-storey primary healthcare facility with a Gross Internal Area (GIA) of approximately 838 m² (Minor Development). The facility includes consulting/examination rooms, administration offices, welfare areas, and patient waiting areas.

PfE Policy JP-S2 requires developments to support Greater Manchester's goal of becoming carbon neutral by 2038, through minimising energy demand, maximising efficiency, using renewable and low carbon energy, and reducing whole life cycle emissions.

This report sets out the requirements of JP-S2 and demonstrates how the Hawthorn Primary Care Health Centre complies with each element of the policy.

0.2 Energy & Carbon Proforma

A completed Non-Residential Minor Energy and Carbon Proforma has been prepared to accompany this submission. This document provides a summary of the predicted operational energy performance, carbon emissions, and compliance with the PfE JP-S2 policy. A copy of the completed proforma is included in Appendix A.

1.0 Building fabric and ventilation

1.1 Building form, and heat loss envelope

The building form is simple in rectangular shape, with a simple flat roof, simple facades and single storey.

PfE JP-S2 requires developments to minimise energy demand through efficient building form and reduced heat loss surfaces.

For a Non-Residential Minor Development, this should be less than or equal to 2.

Perimeter: 120m
Elevation: 3.75m
Envelope Area: 450m
GIA: 838m2

Form factor: 838 / 450 = 1.86

1.2 Elevation design and window proportions

PfE JP-S2 requires that elevation design and glazing proportions balance daylight access and control of solar gains.

Window-to-wall ratios (WWR) have been calculated as below;

North: 17%
East: 5%
South: 12%
West: 14%

1.3 Heated and unheated spaces

All occupied spaces including consultation, treatment, circulation and staff areas are heated/cooled. All areas within the building have been accounted for within the heat loss assessment for the building – Where losses to individual spaces are minimal, the loss has been included in the heating demand of adjacent spaces. I.e. Small WC area losses are provided within the adjacent circulation space.

The only explicitly unheated space within the building is the main plantroom.
Due to the plant equipment gains within this space, no heating is proposed.

Refer to Appendix B for thermal envelope plan & sections (Indicated by the dashed red line).

1.4 Building fabric specifications and airtightness

PfE JP-S2 requires developments to minimise energy demand and maximise energy efficiency.

This scheme complies by adopting a fabric-first approach with high-performance envelope design as below. The U-Values have been developed with the architect to specify U-values significantly better than the baseline Building Regulations (Approved Document Part L 2021).

The proposed construction achieves:

- Air Tightness: **5 m³/h·m² @ 50 Pa** (improved from the notional 8 m³/h·m² @ 50 Pa)
- Floors: **0.12 W/m²K** (improved from 0.18 W/m²K)
- Walls: **0.14 W/m²K** (improved from Part L notional 0.26 W/m²K)
- Roof: **0.12 W/m²K** (improved from 0.16 W/m²K)
- Windows: **1.42 W/m²K** (improved from 1.6 W/m²K)
- Doors: **1.28 W/m²K** (improved from 1.6 W/m²K)

It is acknowledged that the Air Permeability target of <1 as set by the Energy & Carbon Proforma for Non-Residential Minor developments is not met. However, it should be noted that the contractor should aim to construct the building with the aim of minimising the air permeability of the building.

A target of 5 **m³/h·m² @ 50 Pa** is seen as attainable, and provides a reasonable value to be used within all other MEP services calculations to ensure plant is sized adequately without any risk of over sizing.

For further detail, reference should be made to the Passive Design Assessment report (Appendix C).

1.5 Ventilation system

The building, where suitable shall be naturally ventilated. This is generally to the consult rooms with lower occupancies and with openable windows away from any sources of pollution such as roads.

The free area to the windows has been assessed to provide sufficient levels of fresh air ventilation to the spaces.

Mechanical ventilation with heat recovery (MVHR) is provided to higher occupancy and specialist areas such as treatment rooms. Systems are designed for low Specific Fan Power and specified with high efficiency heat recovery.

1.6 Space heating demand

Based on TM54 "central" results, predicted annual space heating demand is approximately 6.6 MWh/yr (~7.9 kWh/m²/yr) and cooling demand approximately 4.2 MWh/yr (~5.0 kWh/m²/yr).

2.0 Maximise energy efficiency

2.1 Energy use intensity

Predictive energy modelling undertaken using CIBSE TM54 methodology gives a predicted Energy Use Intensity (EUI) of 73.5 kWh/m²/yr, equivalent to 61.6 MWh/yr total.

For further detail, reference should be made to the TM54 Assessment Report (Appendix D).

2.2 Efforts to reduce energy use of equipment

Unregulated loads, primarily small power and IT equipment, have been derived from benchmark data and design team input, with conservative allowances applied where information was unavailable. Management factors such as hours of operation, control strategies, and commissioning have been agreed with the design team to reflect the intended facilities management approach.

This has been assessed to provide an approximate Unregulated load of ~20 W/m² with 5% overnight setback. The building operator shall be responsible for ensuring that profile settings and equipment procurement are carried out with energy efficiency as a primary consideration.

3.0 Renewable energy generation

3.1 Proposed renewable energy generation system

Solar photovoltaic (PV) panels are proposed, generating approximately 23,368 kWh annually (27.89kWh/m²).

Refer to Appendix E for PV footprint layout.

The below table summarises the proposed system:

Description	Solar PV
Orientation	West 270°
Tilt	10° (Horizontal)
Peak output (kWp)	30.80kWp
Panel (maximum output, type of inverters)	440 W panels, string inverters
PV area as a percentage of ground floor area	16.7%
Expected annual renewable energy generation	23,368 kWh/yr
Annual renewable energy generation per m² GIA	27.89 kWh/yr/m²
Annual renewable energy generation per m² building footprint	27.89 kWh/yr/m²
Balance between total energy use and renewable energy generation	31.75%
Shading constraints?	14.9% Yield Reduction
Data source	Meteonorm 8.2(i)

3.2 Renewable energy balance

Predicted annual demand (TM54 central case):	73,600 kWh
PV output:	23,368 kWh/yr
Balance:	~31% of total demand met by PV.

4.0 Low carbon heating

4.1 Fossil fuel free

The building is fossil-fuel free with no reliance on natural gas.

4.2 Proposed system for heating and hot water

Heating and hot water will be provided by high efficiency heat pump VRF system.

Other LZC technologies were considered but found unfeasible for this site (Refer to LZC Assessment Report – Appendix F).

District heating was considered to the site, but discounted on the basis of excessive costs associated with a new connection in relation to a relatively small building with low heating demand. The heating systems proposed offers high efficiency and is able to provide an energy efficient method of hot water generation, whilst also providing cooling to areas of the building.

4.3 Proposed system for cooling

Cooling is provided by the VRF system.

5.0 Overheating risk

5.1 Natural ventilation

All windows to the building are openable. The consult rooms are naturally ventilated and the openable area of the windows has been specified to ensure adequate ventilation to the spaces.

Design measures include solar-control glazing, openable windows for purge cooling

5.2 Overheating risk assessment

A Thermal Comfort Assessment has been appended to this report (Appendix G).

6.0 Materials

6.1 Efforts made to minimise embodied carbon

An embodied carbon assessment (BREEAM MAT01) has been produced as appended (Appendix H).

7.0 - Appendices

7.1 Appendix A – Non-Residential Minor Energy and Carbon Proforma

Energy and Carbon Proforma
Non-residential

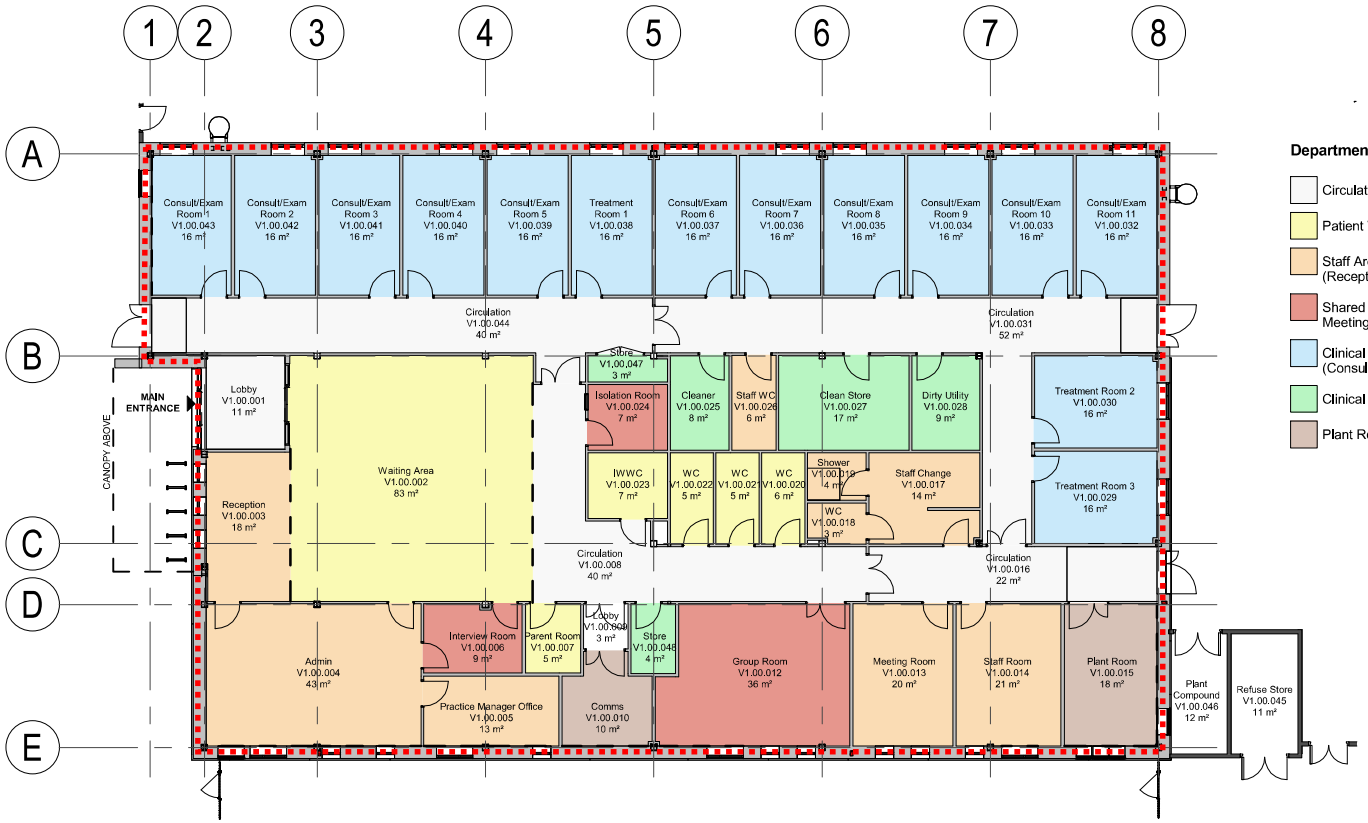
Minor development *(100-999m^2)*
Version 1.0

GMCA GREATER MANCHESTER COMBINED AUTHORITY

Project Name: Hawthorn Primary Care Facility
Application ref: -
Date: 26/09/2025

		Ref. name	-					
		Area (m^2 GIA)	838					
		Target values	**Building 1**	**Building 2**	**Building 3**	**Building 4**	**Building 5**	**+**
Minimise energy demand	**Space heating demand (kWh/m^{2}GIA/yr)**	***≤ 15***	7.9					
	Space cooling demand (kWh/m^{2}GIA/yr)	***≤ 15***	5					
	Calculation methodology used to calculate space heating demand and confirmation that this covers all homes/blocks	*Predictive energy model*	TM54					
	Form factor per building	*≤ 2*	1.86					
	Average external wall U-value (W/m^{2}K)	*≤ 0.15*	0.14					
	Average window U-value (W/m^{2}K)	*≤ 1 (triple)*	1.42					
	Air permeability rate (m^3/h/m^2 @ 50 Pa)	*≤ 1*	5					
Maximise energy efficiency	**BREEAM Ene 01 rating**	***Excellent***	Excellent					
	Energy use intensity (kWh/m^{2}GIA/yr)	-	73.5					
	Calculation methodology used to calculate energy use intensity and confirmation that this covers all homes/blocks	*Predictive energy model*	TM54					
Use renewable energy	**PV footprint area (% of ground floor space)**	**-**	16.7					
	Annual renewable energy generation (kWh/m^2 building footprint/yr)	-	27.89					
	Renewable energy balance (%)	-	31.75					
	Total energy used (kWh/yr)	-	73600					
	Total energy generated on-site (kWh/yr)	-	23368					
Use low carbon energy	**Fossil fuel free (yes/no)**	***Yes***	Yes					
	Heat source - *Where the system for generating space heating and hot water is a heat pump and it achieves a SCOP of 3.5 or higher (then a Low Carbon Heat Appraisal not required)*	*Electric*	Electric / Heat Pump					
Reduce overheating risk	**Has CIBSE TM52 been used to calculate overheating and does the building pass?**	***Yes***	Yes					
	What percentage of spaces are cooled? (% of GIA)	-	63					
Minimise embodied carbon	**Confirmation** that a summary of the efforts made to design a lean, low carbon structure and building design has been submitted?	***Yes***	Yes					

7.2 Appendix B – Thermal Envelope Plan & Sections



Department Legend

- Circulation
- Patient Waiting Area/WCs
- Staff Areas (Reception/Admin/Rest/WCs)
- Shared Spaces (Interview/Group Meeting Room)
- Clinical Spaces (Consult-Exam/Treatment Room)
- Clinical Support (Stores/Utility Rooms)
- Plant Rooms

Room Schedule		
Number	Name	Area
V1.00.001	Lobby	11 m²
V1.00.002	Waiting Area	83 m²
V1.00.003	Reception	18 m²
V1.00.004	Admin	43 m²
V1.00.005	Practice Manager Office	13 m²
V1.00.006	Interview Room	9 m²
V1.00.007	Parent Room	5 m²
V1.00.008	Circulation	40 m²
V1.00.009	Lobby	3 m²
V1.00.010	Comms	10 m²
V1.00.012	Group Room	36 m²
V1.00.013	Meeting Room	20 m²
V1.00.014	Staff Room	21 m²
V1.00.015	Plant Room	18 m²
V1.00.016	Circulation	22 m²
V1.00.017	Staff Change	14 m²
V1.00.018	WC	3 m²
V1.00.019	Shower	4 m²
V1.00.020	WC	6 m²
V1.00.021	WC	5 m²
V1.00.022	WC	5 m²
V1.00.023	IWWC	7 m²
V1.00.024	Isolation Room	7 m²
V1.00.025	Cleaner	8 m²
V1.00.026	Staff WC	6 m²
V1.00.027	Clean Store	17 m²
V1.00.028	Dirty Utility	9 m²
V1.00.029	Treatment Room 3	16 m²
V1.00.030	Treatment Room 2	16 m²

Room Schedule		
Number	Name	Area
V1.00.031	Circulation	52 m²
V1.00.032	Consult/Exam Room 11	16 m²
V1.00.033	Consult/Exam Room 10	16 m²
V1.00.034	Consult/Exam Room 9	16 m²
V1.00.035	Consult/Exam Room 8	16 m²
V1.00.036	Consult/Exam Room 7	16 m²
V1.00.037	Consult/Exam Room 6	16 m²
V1.00.038	Treatment Room 1	16 m²
V1.00.039	Consult/Exam Room 5	16 m²
V1.00.040	Consult/Exam Room 4	16 m²
V1.00.041	Consult/Exam Room 3	16 m²
V1.00.042	Consult/Exam Room 2	16 m²
V1.00.043	Consult/Exam Room 1	16 m²
V1.00.044	Circulation	40 m²
V1.00.045	Refuse Store	11 m²
V1.00.046	Plant Compound	12 m²
V1.00.047	Store	3 m²
V1.00.048	Store	4 m²

GIFA: 801sqm
GEFA: 860sqm

Note: Figures do not include uncovered Plant Compund & External Refuse Store

NOTES:

All relevant Mechanical, Electrical and Structural Engineer's details to be referred to where relevant.

Drawing to be read in conjunction with Stage 4 drawing pack & details.

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P08	MB	Issued as part of LCA Report	15/08/2025
P07	MB	Stage 3 Issue	16/06/2025
P06	MB	Updated with GIA and GIFA	20/05/2025
P05	MB	Draft Stage 3 Issue	14/05/2025
P04	CR	Layout and external windows updated. Sliding doors added to entrance lobby.	03/03/2025
P03	CR	Layout revised following comments received from NHS Property Services on 3rd February 2025.	11/02/2025
P02	CR	WC numbers increased, Clean Utility changed to Pantry and Staff Change area updated following NHS Property Services comments on 16/01/2025.	16/01/2025
P01	CR	First Issue	15/01/2025

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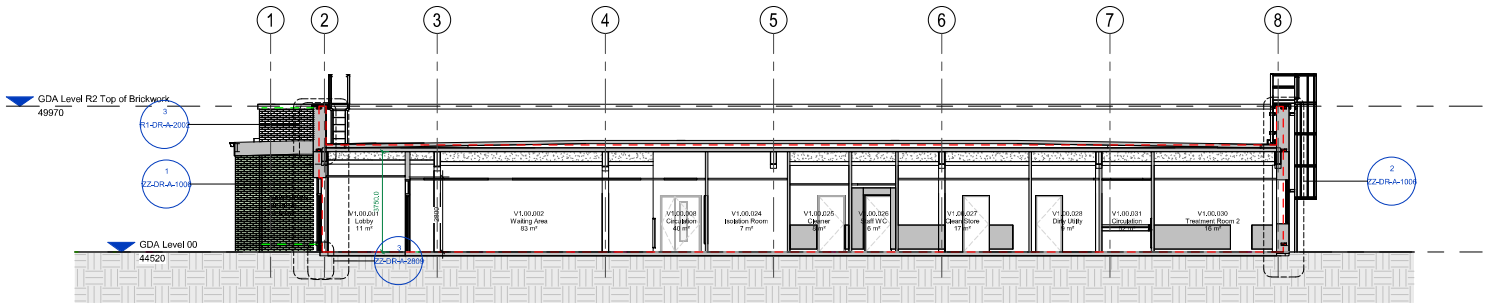
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Moseley Road, Fallowfield, Manchester, M14 6PD

Project Name:
Hawthorn Medical Centre

Drawing Title:
Proposed Ground Floor Plan

Project No:	Sheet Size:	Scale:	
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MB	CLS	CLS	P09

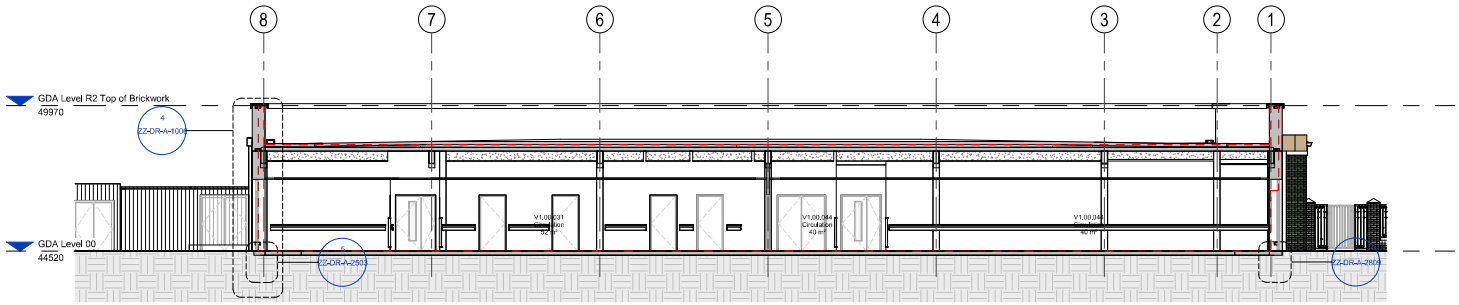
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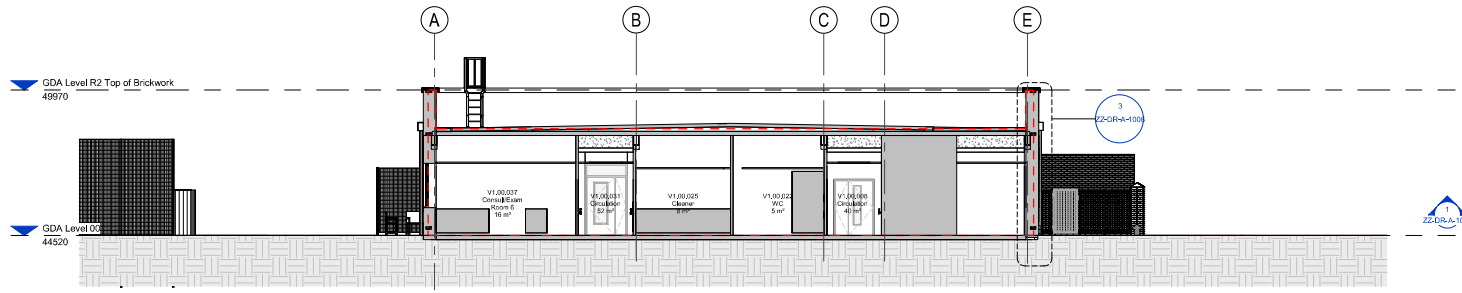
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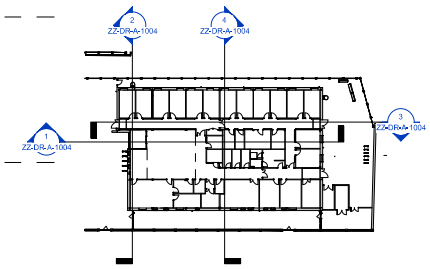
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3 Section 3
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4 Section 4
1 : 100



Section Key Plan

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— — — — Line of Air Tightness

Drawing to be read in conjunction with:
HMCNMC-GDA-V1-00-DR-A-1010-Proposed Ground Floor Plan
HMCNMC-GDA-V1-01-DR-A-1002-Proposed Site Plan
HMCNMC-GDA-V1-ZZ-DR-A-1005-Proposed Elevations
HMCNMC-GDA-V1-ZZ-DR-A-1006-Proposed Strip Sections

Rev	By	Description	Date
P04	MB	Stage 4 Issue	29/08/2025
P03	MB	Issued as part of LCA Report	15/08/2025
P02	MB	Stage 3 Issue	16/06/2025
P01	MB	Draft Stage 3 Issue	14/05/2025

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Client Name:
NHS Property Services

Site Name:
Moseley Road, Fallowfield, Manchester, M14 6PD

Project Name:
Hawthorn Medical Centre

Drawing Title:
Proposed GA Sections

Project No:	Sheet Size:	Scale:	
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HMCNMC-GDA-V1-ZZ-DR-A-1004

7.3 Appendix C – Passive Design Report



Hawthorn Primary Care Health Centre

Ene04: Passive Design Analysis

August 2025

Project Ref: 3280460

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We are **thermal comfort** experts

We are **life cycle analysis** experts

We are **sustainability** experts

We are **building physics** experts

We are **zero carbon** experts

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checked by:	Miquel Garcia – Senior Building Physics Engineer	date: 06 08 25	sig: M Garcia
revision:	00 - initial issue	date: 06 08 25	sig: JTurner

abbreviations

AHU	-	Air Handling Unit
APR	-	Air Permeability Rate
ASHP	-	Air Source Heat Pump
BREEAM	-	Building Research Establishment Environmental Assessment Method
BRUKL	-	Building Regulations UK, Part L
CHP	-	Combined Heat & Power
COP	-	Coefficient Of Performance
DHW	-	Domestic Hot Water
EER	-	Energy Efficiency Ratio
LED	-	Light Emitting Diode
LZC	-	Low and Zero Carbon
NCM	-	National Calculation Methodology
PV	-	Photo Voltaic (panels)
SCOP	-	Seasonal Coefficient of Performance
SEER	-	Seasonal Energy Efficiency Ratio
SFP	-	Specific Fan Power
TRY	-	Test Reference Year
VRF	-	Variable Refrigerant Flow

executive summary



executive summary

This assessment shows that passive design measures result in a reduction in predicted energy consumption and associated CO_2 emissions.

Zed has compiled the following report on behalf of Silcock Leedham Consulting Engineers in support of the BREEAM credit 'Ene04 - Passive Design Analysis' for the proposed Hawthorn Primary Care Health Centre, Manchester.

The assessment was undertaken at the concept design stage using information provided prior to the end of RIBA Stage 2.

Works have been undertaken by Jordan Turner, a Senior Building Physics & Sustainability Engineer and CIBSE registered Energy Assessor and Low Carbon Consultant (LCEA206448). Thermal modelling has been carried out using Government approved IES - VE dynamic simulation software in accordance with CIBSE AM11. Calculated energy and CO_2 savings are expressed against baseline 'Standard' building performance as defined within the BREEAM 2018 technical guide. For the purpose of this assessment, current regulatory CO_2 factors are used.

A full thermal comfort assessment is currently being undertaken in accordance with BREEAM credit issue Hea04. However, all occupied areas are to be fully mechanically conditioned and initial plant sizing has been based upon achieving the recommended operative temperatures set out within CIBSE Guide A Table 1.5, therefore achieving thermal comfort by default.

Building	Regulated Energy (kWh/m²/yr)	Regulated CO_2 tonnes.CO_2/m²/yr)
Standard	22.94	3.36
Actual	22.56 (-1.66%)	3.29 (-2.23%)

Table 1. Result summary

introduction



introduction

Passive energy savings have been calculated using dynamic thermal modelling using IES - VE software.

This report sets out the approach and results of the Passive Design Analysis undertaken for the proposed Hawthorn Primary Care Health Centre. Each consideration listed within BREEAM technical guidance for credit issue Ene04 is addressed in turn.

A computational model has been constructed from the architectural drawings and design specification using the latest IES - VE software by a CIBSE accredited Low Carbon Consultant and Energy Assessor. Building servicing is based on the current design strategy and initial performance data available at this stage. The building comprises a high - performance sealed envelope and with full (primarily air source heat pumps) mechanical conditioning.

Passive savings are measured against a 'Standard' baseline building as defined within BREEAM guidance:

Measure	'Standard Building'	'Proposed Building'
External shading devices	As Notional	As Designed
Fabric performance	As Notional	As Designed
Fabric proportions	As Notional	As Designed
Measure	**'Standard Building'**	**'Proposed Building'**
Thermal mass	As Notional	As Designed
Daylighting	As Notional	As Designed
Ventilation	As Notional	As Designed

Table 2. Basis of modelling for BREEAM 'Standard' and 'Proposed' buildings

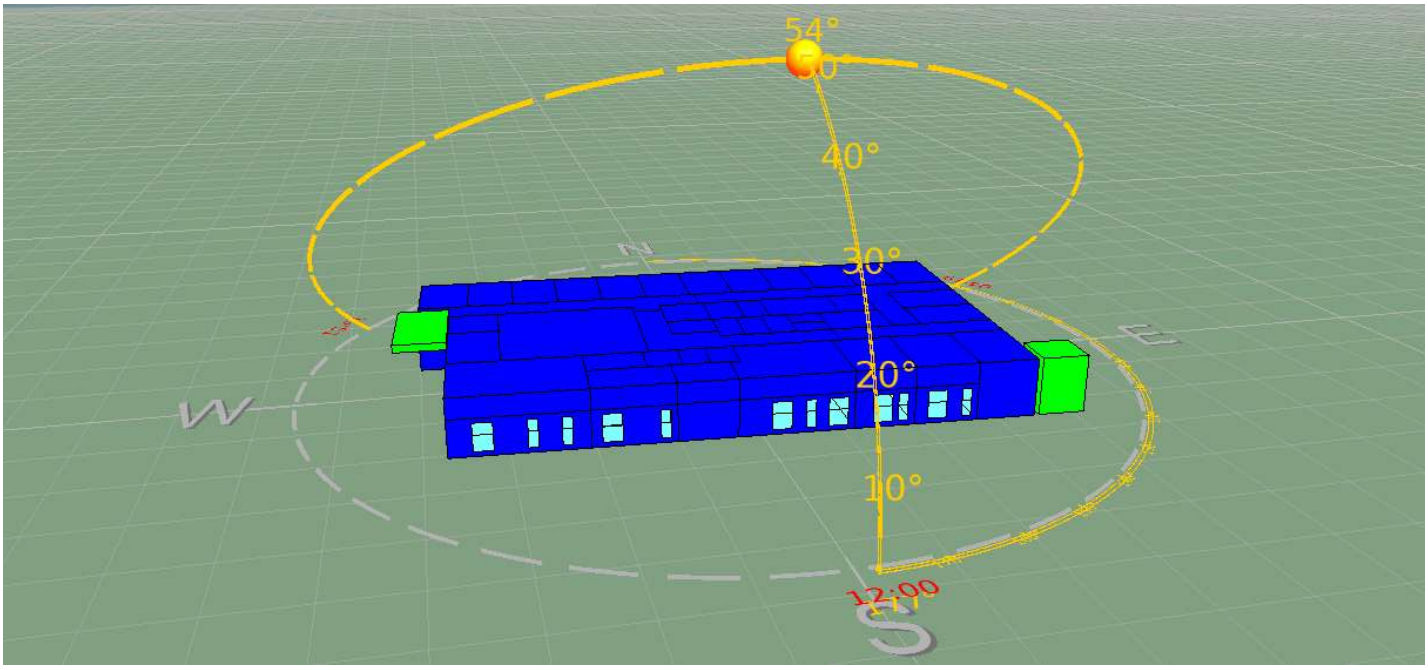


Figure 1. IES - VE thermal model

introduction

The development is located in Fallowfield, Manchester.

The development compromises the construction of a single-story primary health centre in Fallowfield, Manchester. The facility consists of several consultant/examination rooms, admin offices and welfare facilities.

A fabric-first approach to design has been taken, comprising of low thermal U-values to reduce heat loss in winter and solar-control glazing to reduce heat gain in summer. High efficiency LED luminaires and low Specific Fan Powers (SFPs) on the ventilation systems will minimise the energy consumption associated with the fixed building services.

The feasibility for incorporating recognised LZC technologies has been undertaken in two stages. An initial high level desktop appraisal has been carried out to establish if a technology is technically viable considering the site opportunities and constraints in context with the building use.



Figure 2. Site Location

microclimate



microclimate

Annual air temperature taken from the current regional CIBSE TRY (Test Reference Year).

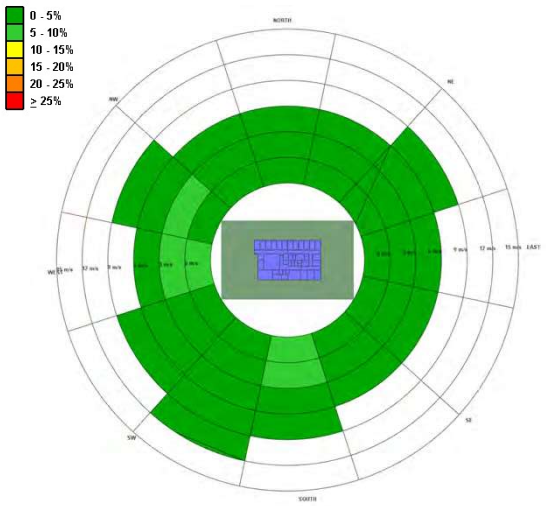


Figure 3. Manchester TRY weather data – wind rose (May to September)

The development site is located south of Manchester city centre in Fallowfield. The chart below shows the annual air temperature of the current CIBSE Test Reference Year weather file for the nearest location.

The minimum, maximum and average air temperatures are – 6.9°C, 28.2°C and 9.82°C respectively. Heat recovery will be included on the ventilation systems to reduce the load during the coldest periods. Conversely, relatively low ambient temperatures in mid - season months will enable free - cooling potential in offsetting high internal heat gains.

Prevailing wind during the summer months should only be partially sheltered by adjacent buildings to the west of the site boundary

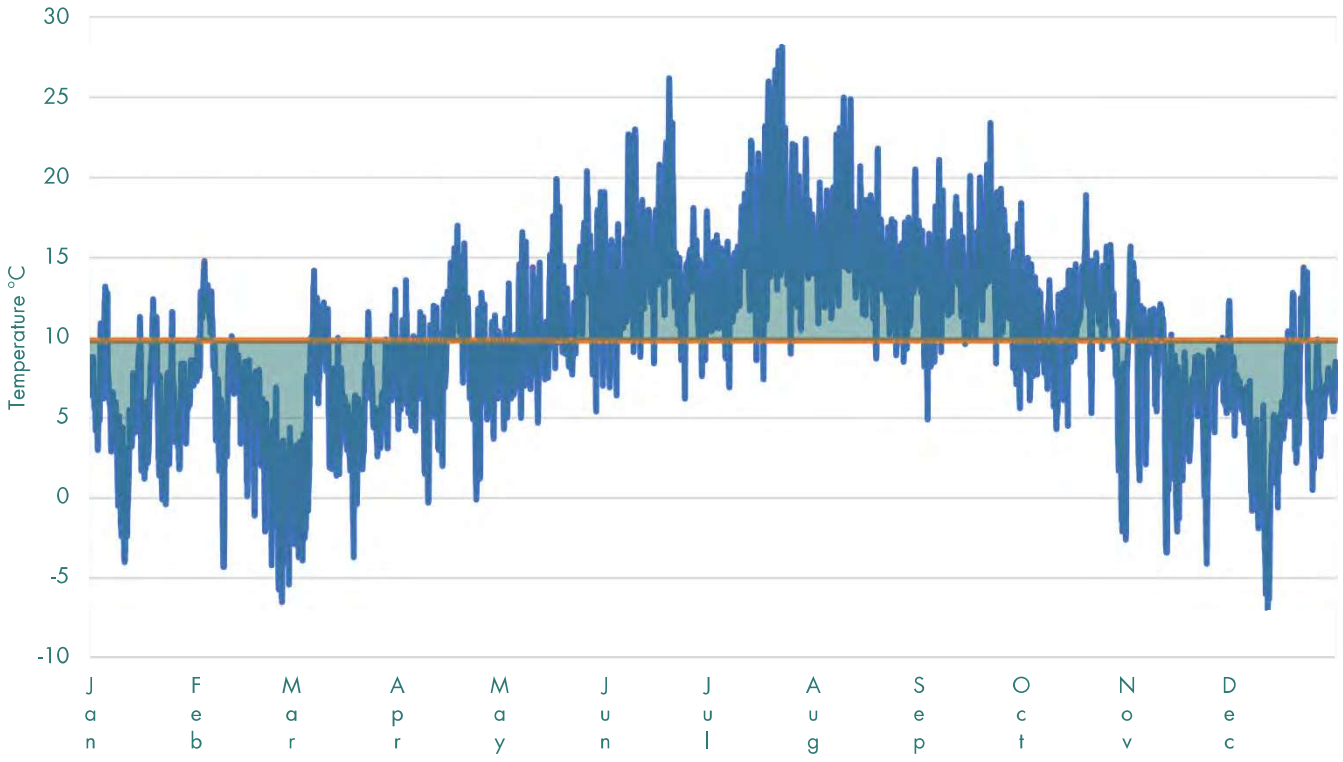


Figure 4. Manchester TRY weather data - external air temperature

layout & orientation



layout & orientation

The development compromises the construction of a single-story primary health centre in Fallowfield, Manchester. The facility consists of several consultant/examination rooms, admin offices and welfare facilities.

The development compromises the construction of a single-story primary health centre in Fallowfield, Manchester. The facility consists of several consultant/examination rooms, admin offices and welfare facilities.

The internal layout has been carefully coordinated to ensure efficient workflows between waiting areas, consultation rooms, welfare facilities, and administration offices. Consultation rooms are positioned along the north-facing façade to minimise solar gain and reduce cooling loads.

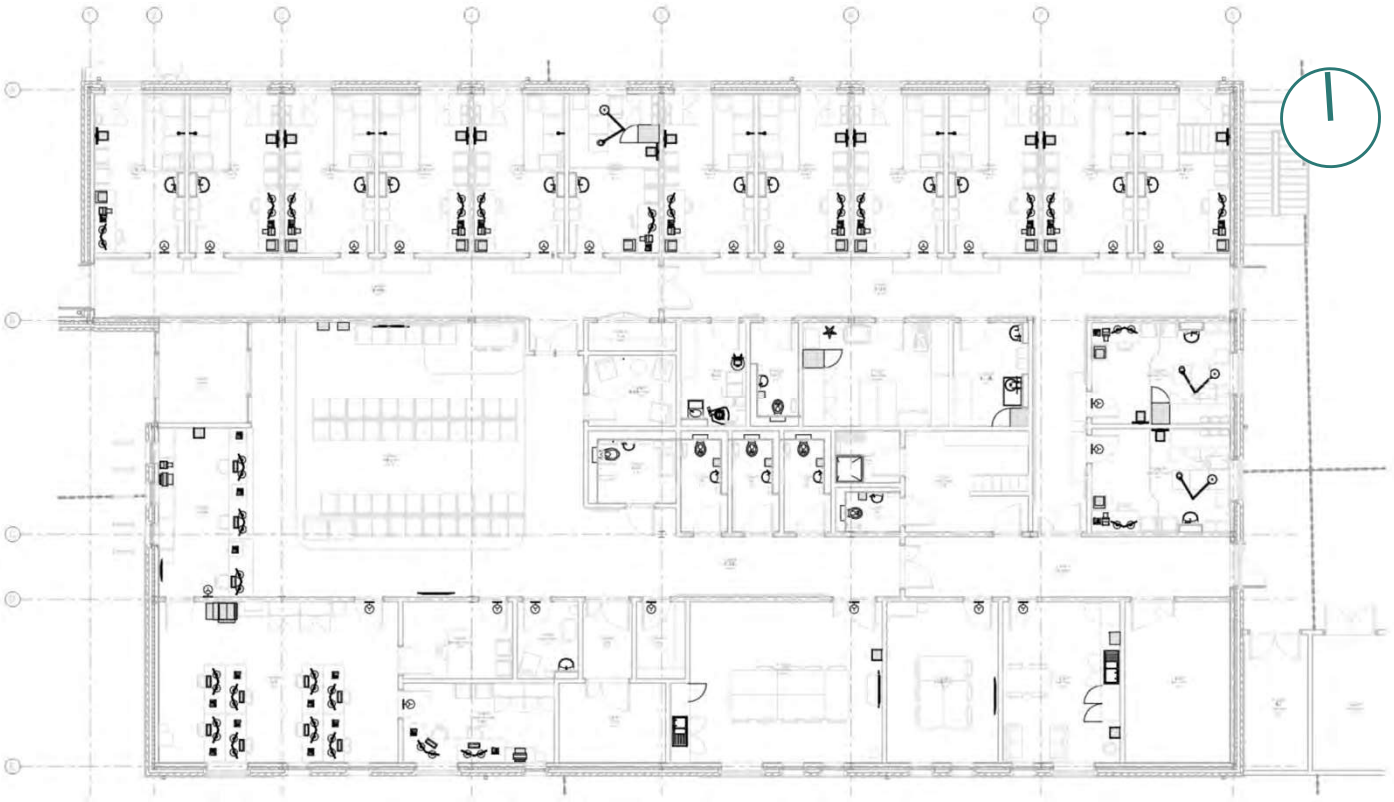


Figure 5. Ground floor arrangement

materials & design



materials & design

A high performance thermal envelope is specified at this stage to maximise thermal comfort and minimise conditioning loads.

Element	U - value (W/m².K)	
	'Standard' Benchmark	Proposed
Ground/exposed floor	0.15	0.12 (-20%)
External walls	0.18	0.14 (-22%)
Roof	0.15	0.12 (-20%)
Windows	1.40	1.42 (1.42%)
Doors	1.60	1.28 (-20%)
Area		
	'Standard' Benchmark	Proposed
Entire	3.0	5.0

Table 3. Envelope specification

Form

The Architects have designed the building to fit within the constraints of the existing site and surroundings.

Building fabric & thermal mass

The proposed thermal envelope specification is set out in the table below. The average building U - value of 0.17W/m².K is 23% less than the comparative Standard building derived from current Part L Notional standards.

In development of the elevations though the following design stage, the proportion of glazing and glass specification will be developed to balance heat loss, heat gain and natural light.

Thermal mass will be utilised where possible to promote thermal stability and resistance the effects of solar gains in summertime.

Building occupancy

For the purpose of the assessment, building occupancy is based upon NCM template data for planning category D1: Primary Health Care Building. This template data aims to represent typical building use and in this case generally comprising 7am to 7pm, 5 day/week occupancy.

materials & design

The building will be sealed and fully mechanically conditioned to maintain internal environmental conditions.

Daylight strategy

As referred earlier in the report, a consideration for natural light has been made throughout the development of the internal layouts, with occupied rooms located on the building perimeter.

High efficacy luminaires with automatic control will be installed to adjust lighting levels with respect to both occupancy and the availability of daylight when possible. This approach helps maintain consistent illuminance whilst at the same time reducing the demand for energy and prolonging the service life of the luminaires.

Ventilation strategy

Natural ventilation is considered within the main sports hall with the inclusion of two roof mounted natural ventilators. Remaining occupied areas will be fully mechanically conditioned. Building services will be located centrally and include both air handling unit with heat recovery and reversible heat pump technology.
The M&E designers have specified the specific supply and extract air rates within each space.
The potential for natural ventilation could be explored at the next design stage when greater detail in known regarding room data and specific requirements but this would require changes on the elevations and external openings.

Adaptation to Climate Change

In accordance with available Environment Agency data, the site is located in a 'very low risk' area of flooding from rivers and 'low risk' area for surface water run off.

The robustness of material selections will be considered by the Architect together with solar absorption and transmittance in mitigating the risks of summertime overheating and increased use of mechanical cooling. At RIBA Stage 3 a full thermal comfort assessment will be undertaken for both current and future weather data in accordance with BREEAM Hea04. Building load calculations will be undertaken in respect of achieving the recommended operative temperatures set out in CIBSE Guide A Table 1.5.

results



results

Baseline regulated energy consumption and CO_2 emissions are taken from the Standard building as defined within BREEAM 2018 technical guidance.

Dynamic simulation modelling (DSM) has been undertaken using the regulatory National Calculation Methodology (NCM) to determine the impact of passive design measures.

Energy savings are shown below, comprising the cumulative effects of passive design measures at this stage.

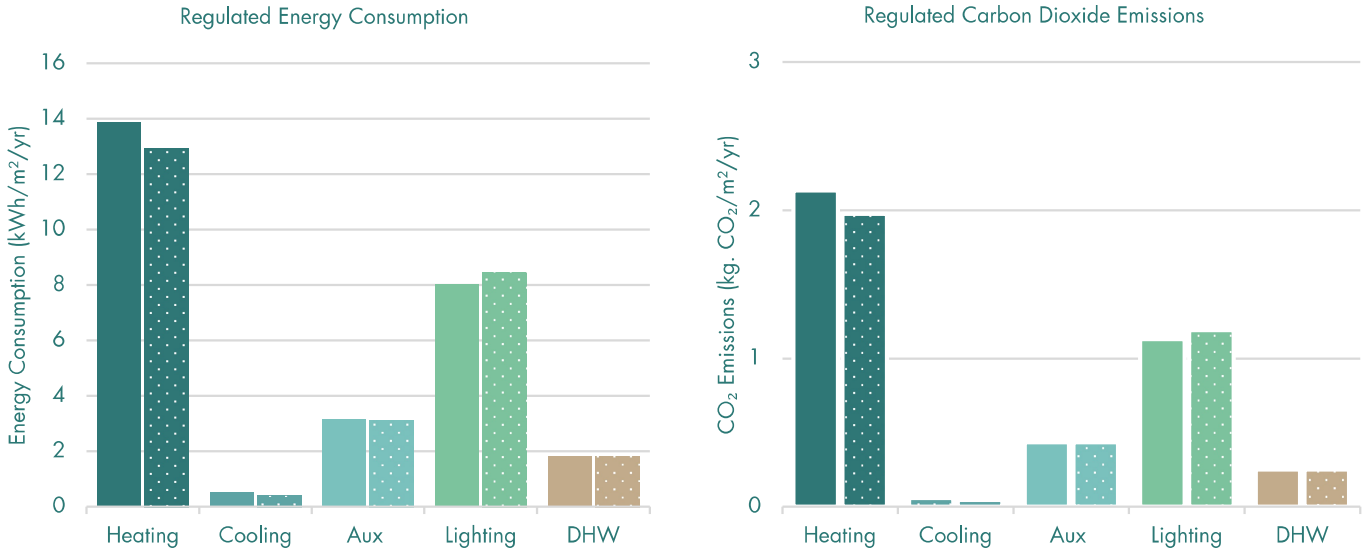


Figure 6. Predicted energy and CO_2 emissions – Standard vs. Actual

Building	Regulated Energy ($kWh/m^2/yr$)	Regulated CO_2 tonnes.$CO_2/m^2/yr$)
Standard	22.94	3.36
Actual	22.56 (-1.66%)	3.29 (-2.23%)

Table 4. Result summary

conclusion



conclusion

Results show that passive design measures results in energy and CO_2 savings.

This assessment has been undertaken in accordance with BREEAM 2018 credit issue Ene04 – 'Passive Design Analysis'. Thermal modelling has been undertaken by a CIBSE registered Energy Assessor in accordance with the NCM using Government approved IES - VE dynamic simulation software.

Owing to the specific operational demands and existing site infrastructure, there is limited opportunity to significantly vary built form and orientation.

Simulation results show that savings in both predicted energy and CO_2 emissions are achieved through passive measures.

Predicted regulated energy consumption = 22.56MWh/yr (-1.66%)

Predicted regulated CO_2 emissions = 3.29 tonnes. CO_2 /yr (-2.23%)

Further to passive savings, a reduction in energy demand and CO_2 emissions will continue to be explored through the efficient use of energy and on - site LZC technologies.

drawing register



drawing register

The thermal model has been constructed using the following drawings.

drawing title	drawing reference	issued by	revision
Proposed Ground Floor Plan	HMCNMC-GDA-V1-00-DR-A-1010_P03	Gilling Dod	P05
Proposed Site Plan	HMCNMC-GDA-V1-ZZ-DR-A-1002	Gilling Dod	P06
Proposed Elevations	HMCNMC-GDA-V1-ZZ-DR-A-1005_P01	Gilling Dod	P01

Table 5. Drawing Register

Appendix BRUKL Standard Building



BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Hawthorn Primary Care Health Centre - Standard

As designed

Date: Fri Aug 15 13:55:44 2025

Administrative information

Building Details

Address: Moseley Road, Manchester, M14 6HD

Certifier details

Name: Jordan Turner

Telephone number: 0113 393 3329

Address: Upperbank House Stoneythorpe, Leeds, LS18 4BN

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.29

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.29

BRUKL compliance module version: v6.1.e.1

Foundation area [m^2]: 743.47

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	2.78	
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	2.21	
Target primary energy rate (TPER), kWh_{PE}/m^2.annum	28.75	
Building primary energy rate (BPER), kWh_{PE}/m^2.annum	21.07	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.18	0.18	V100004C:Surf[1]
Floors	0.18	0.15	0.15	V100000E:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.15	0.15	V100004C:Surf[0]
Windows** and roof windows	1.6	1.4	1.4	V100000E:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.6	1.6	V1000029:Surf[1]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check.

*** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	3

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	838.2	838.2
External area [m^2]	2134	2134
Weather	MAN	MAN
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	466.85	0
Average U-value [W/m^2K]	0.22	0
Alpha value* [%]	30.97	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
100	**Non-residential Institutions: Primary Health Care Building**
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	13.88	11.45
Cooling	0.51	0.92
Auxiliary	3.14	1.29
Lighting	8.02	10.94
Hot water	1.82	0.62
Equipment*	30.04	30.04
TOTAL**	**27.37**	**25.21**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	14.54	6.13
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*14.54*	*6.13*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	129.94	108.11
Primary energy [kWh_{PE}/m^2]	21.07	28.75
Total emissions [kg/m^2]	2.21	2.78

Appendix BRUKL Proposed Building

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Hawthorn Primary Care Health Centre - Proposed

As designed

Date: Fri Aug 15 14:16:19 2025

Administrative information

Building Details

Address: Moseley Road, Manchester, M14 6HD

Certifier details

Name: Jordan Turner

Telephone number: 0113 393 3329

Address: Upperbank House Stoneythorpe, Leeds, LS18 4BN

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.29

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.29

BRUKL compliance module version: v6.1.e.1

Foundation area [m^2]: 743.47

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	3.01	
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	2.13	
Target primary energy rate (TPER), kWh_{PE}/m^2.annum	31.16	
Building primary energy rate (BPER), kWh_{PE}/m^2.annum	20.29	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.14	0.14	V100004C:Surf[1]
Floors	0.18	0.12	0.12	V100000E:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.12	0.12	V100004C:Surf[0]
Windows** and roof windows	1.6	1.42	1.42	V1000055:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.28	1.28	V1000029:Surf[1]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check.

*** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	5

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	838.2	838.2
External area [m^2]	2134	2134
Weather	MAN	MAN
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	355	0
Average U-value [W/m^2K]	0.17	0
Alpha value* [%]	30.05	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
100	**Non-residential Institutions: Primary Health Care Building**
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	12.75	13.29
Cooling	0.36	0.66
Auxiliary	3.14	1.29
Lighting	8.84	11.28
Hot water	1.82	0.62
Equipment*	30.04	30.04
TOTAL**	**26.91**	**27.13**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	14.54	6.44
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*14.54*	*6.44*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	115.41	119.47
Primary energy [kWh_{PE}/m^2]	20.29	31.16
Total emissions [kg/m^2]	2.13	3.01

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7.4 Appendix D – TM54 Assessment Report



Hawthorn Primary Care Health Centre

Ene01: TM54 Operational Energy Consumption Report

August 2025

Project Ref: 3280460

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We are **daylighting** experts

We are **thermal comfort** experts

We are **life cycle analysis** experts

We are **sustainability** experts

We are **building physics** experts

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zero carbon
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prepared by:	Jordan Turner – Senior Building Physics & Sustainability Engineer	date: 28 08 25	sig:
checked by:	Miquel Garcia– Senior Building Physics Engineer	date: 28 08 25	sig:
revision:	01 – BREEAM comments incorporated	date: 15 09 25	sig:

abbreviations

ACH	-	Air Changes per Hour
APR	-	Air Permeability Rate
ASHP	-	Air Source Heat Pump
BREEAM	-	Building Research Establishment Environmental Assessment Method
COP	-	Coefficient of Performance
DHW	-	Domestic Hot Water
DSM	-	Dynamic Simulation Modelling
EUI	-	Energy Use Intensity
HVAC	-	Heating, Ventilation & Air Conditioning
NCM	-	National Calculation Methodology
PV	-	Photo Voltaic (panels)
SCOP	-	Seasonal Coefficient of Performance
SFP	-	Specific Fan Power
TRY	-	Test Reference Year
VLT	-	Visible Light Transmittance

executive summary



executive summary

This report has been compiled by zed., on behalf of Silcock Leedham Consulting Engineers, to detail the results of a TM54 Energy Assessment for the proposed Hawthorn Primary Care Health Centre, Manchester.

This report supports BREEAM 2018 credit issue *Ene01: predicted operational energy consumption.*

zed. have undertaken an energy audit for the proposed Hawthorn Primary Care Health Centre, Manchester.

All inputs into this assessment have been agreed with the project design team.

The assessment has been completed by Jordan Turner, a Senior Building Physics & Sustainability Engineer and CIBSE registered Energy Assessor and Low Carbon Consultant (LCEA206448). The thermal modelling has been carried out using IES Virtual Environment software version 2025.0.0.0 in accordance with CIBSE TM54:2022 (Evaluating Operational Energy Use at the Design Stage).

Predicted energy demand is reported for a range of scenarios on a monthly basis and broken down in respect of end use, and the M&E arrangement, to enable direct comparison with sub-meter data.

A summary of the scenarios is given in the scope and scenarios section, with full results for each scenario given in the results section and the appendix. Monthly energy demand for the central and worst cases are given in table 1.

Figure 1. illustrates the extent of the differences between the outputs from Part L and the more detailed Apache calculation methodologies

	energy consumption (kWh/yr)	
month	**central case**	**worst case**
Jan	5,159	6,145
Feb	4,843	5,691
Mar	5,535	6,296
Apr	5,085	5,963
May	4,863	5,675
Jun	5,093	5,917
July	5,180	6,011
Aug	5,184	6,202
Sep	5,125	5,956
Oct	4,932	5,802
Nov	5,243	6,076
Dec	5,398	6,256
Total	**61,639**	**71,989**

Table 1. predicted monthly energy consumption

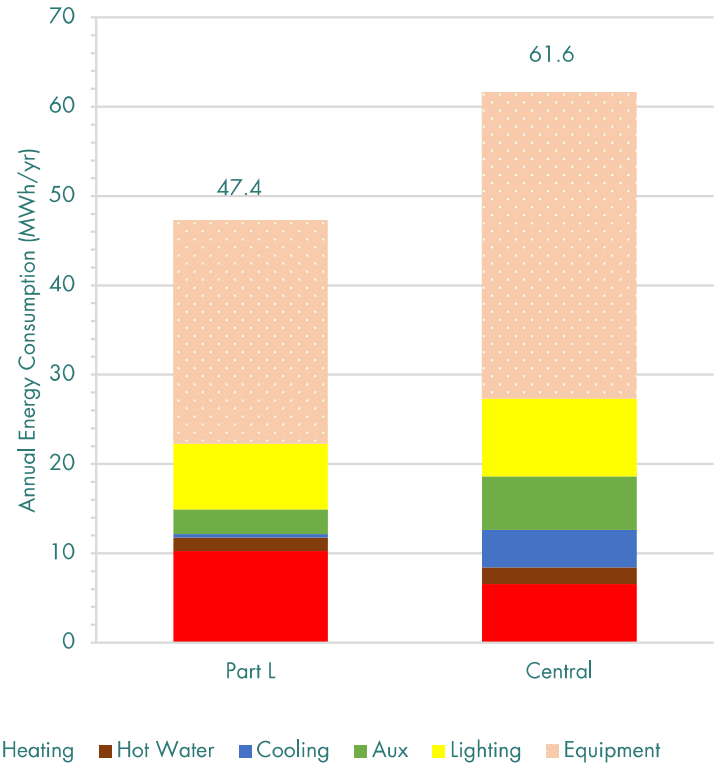


Figure 1. annual energy consumption, central and Part L scenarios

introduction



introduction

The development is located in Fallowfield, Manchester.

The development compromises the construction of a single-story primary health centre in Fallowfield, Manchester. The facility consists of several consultant/examination rooms, admin offices and welfare facilities.

A fabric-first approach to design has been taken, comprising of low thermal U-values to reduce heat loss in winter and solar-control glazing to reduce heat gain in summer. High efficiency LED luminaires. An efficient VRF system and low Specific Fan Powers (SFPs) on the ventilation systems will minimise the energy consumption associated with the fixed building services.

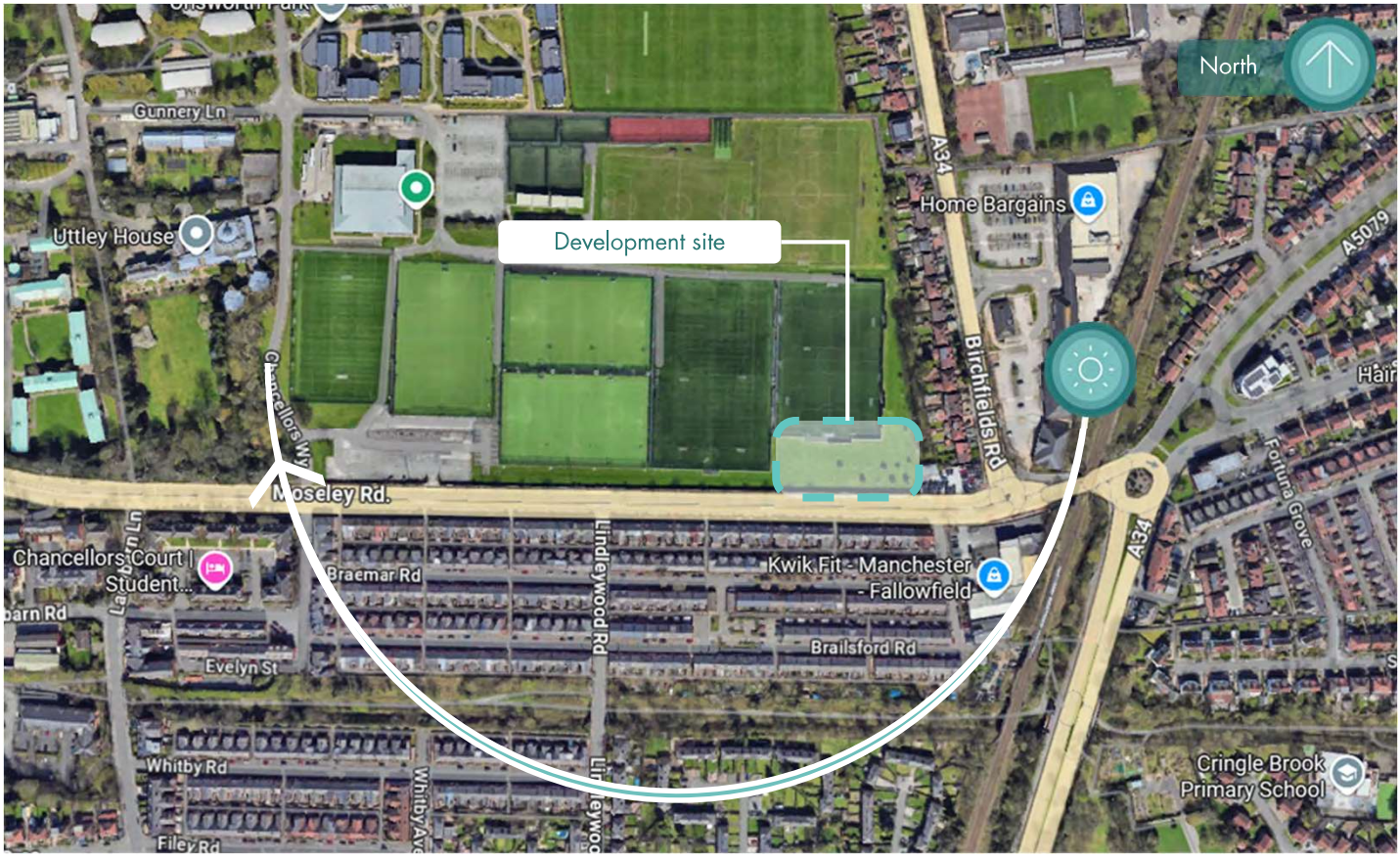


Figure 2. site location

methodology



methodology

TM54: 2022 (Evaluating operational energy use at the design stage) gives guidance on how to accurately estimate operational energy use for a project, based on design stage information.

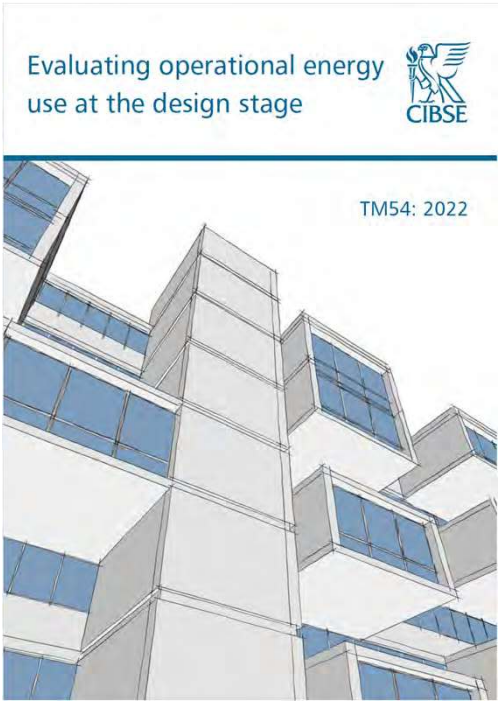


Figure 3. TM54: 2022

Building energy estimations made at the design stage are often found to be significantly different from the actual energy use during operation. This is commonly referred to as the performance gap.

TM54: 2022 outlines the best approach to estimating the operational energy use for a proposed development, in order to reduce this gap. Guidance is given on best modelling practice, reporting and quality checks.

Operational energy assessments take a step beyond simple compliance modelling, which should only be used to determine whether the proposed building meets a minimum compliance standard, in a repeatable manner using prescribed templates for operating conditions and by comparison with a notional reference building of the same shape and size.

A more accurate energy estimation is achieved by:

- Establishing a clear dialogue between designers, future occupiers and building owners, with a TM54 interview to establish behaviour of occupants and the building in the future
- Modelling to an appropriate level of detail to reliably estimate energy uses for heating, cooling, fans and pumps, using more realistic profiles and inputs
- Including all anticipated energy uses in buildings, rather than just central plant and equipment
- Breaking down energy use by end-use, allowing comparison to benchmarks to allow in use evaluation to sub metered energy uses

It is important to recognise, however, the limitations of design stage modelling. This includes the basis on how the building will be used and the simplifications that exist within dynamic simulation modelling (DSM) tools. There is a resulting band of uncertainty with any energy prediction, with a mid-range given as a baseline energy prediction.

BREEAM Ene01

"The aim of the Ene01 methodology is to incentivise better understanding of energy modelling techniques and reward more accurate predictions of energy use at early stages to support better design and construction of new buildings."

This assessment has been carried out at design stage to determine a range for the predicted monthly energy consumption for the proposed Hawthorn Primary Care Health Centre, Manchester. The process intends to address the performance gap that exists between Part L Compliance modelling outputs and actual building performance. Although intended as a compliance tool, the Part L methodology is often used to provide insight to anticipated energy consumption. However, due to the need for a standard approach for fair regulatory assessment, assumptions are made against a number of variables which can vastly differ from actual building conditions, including:

- Occupancy and plant operational hours.
- Heating and cooling setpoint temperatures.
- Domestic hot water demand.
- Ventilation rates.
- Weather conditions.
- Plant efficiency, operation and control.

A risk assessment has been undertaken to determine the key factors that could impact the buildings demand for energy. The output of this has been used to inform a process of dynamic simulation modelling.

Energy forecasts are inclusive of both regulated and unregulated demand and are reported on a monthly basis for comparison with in-use data when available.

risk assessment



risk assessment

Energy demand is influenced by a large number of variables including human, environmental and physical building factors.

A risk assessment has been carried out to identify potential causes of increased energy consumption. The outcomes of the below risk assessment has informed the energy modelling process. Severity and Likelihood are measured on a 5-point semantic scale where 1 represents 'very low' and 5 represents 'very high'.

	risk	impact	likelihood	level of risk	control & mitigation	residual risk
Human	Change in operating hours	5	1	5	Building operation is antipicated to be 7am – 7pm Monday – Friday, this is not expected to change.	2
	Change in number of occupants	2	1	2	Current modelling assumes maximum occupancy for the building.	1
	Poor building energy management	3	2	6	Appropriate training and guidance will be given to building operators. Equipment will be sub-metered and connected to a BMS (Building Management System) for centralised monitoring and review.	3
Environmental	Extreme weather, comprising increasing summer temperatures	2	4	8	The potential effects of extreme winter conditions mitigated though low thermal U-values and potential high air recirculation rates. Effects of extreme summer conditions mitigated through solar control glass and constant air volume and recirculation rates.	2
Building	Inefficient building servicing strategy	4	1	4	The building services strategy is designed by Silcock Leedham Consulting Engineers who have considerable experience in the specific requirements of NHS facilities. Plant will be specified to meet the required energy loads and enable suitable control.	1
	Poor plant commissioning and reactive-only maintenance	5	2	10	All plant is commissioned upon installation in accordance with the design specification. A post occupancy evaluation and seasonal commissioning process will be undertaken where required. Inevitably there are long periods where small adjustments can have a high overall impact.	4
	Building services operation efficiency below design	3	2	6	Over complex servicing and control is to be avoided. All equipment will be provided by long-serving and reputable manufacturers with historic in-use performance records available.	2

Table 2. risk assessment

model input data



model input data

Thermal modelling has been undertaken by Jordan Turner, a Senior Building Physics & Sustainability Engineer and CIBSE registered Energy Assessor and Low Carbon Consultant (LCEA206448). Government approved IES-VE (v2025.0.0.0) dynamic thermal modelling software has been used in accordance with CIBSE AM11 & CIBSE TM54.

Building typology and geometry

A thermal model has been created from the design team drawings provided by Gilling Todd Architecture. The development compromises the construction of a single-story primary health centre in Fallowfield, Manchester. The facility consists of several consultant/examination rooms, admin offices and welfare facilities.

Building surroundings

Surrounding structures or canopies are included within the model as appropriate.

Climate data

The model has been coordinated for solar access and simulated against the CIBSE Manchester TRY (Test Reference Year) weather file. The weather data used for simulations was sourced from CIBSE (Chartered Institute of Building Services Engineers), an industry recognised organisation.

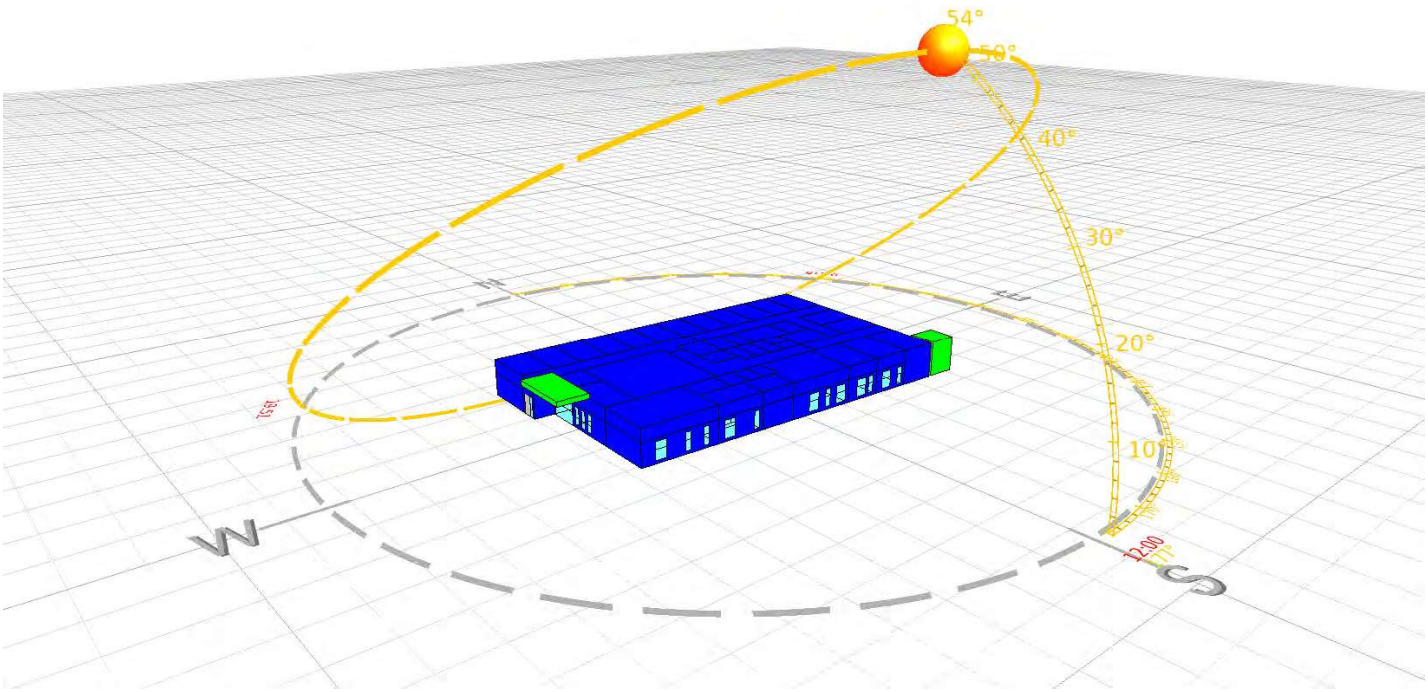


Figure 4. IES thermal model

model input data

The thermal envelope performance has been taken from the information provided by Gilling Todd Architecture.

Any amendments from these inputs will result in changes to the results of the energy assessment.

model data

The input data detailed within this report represents the proposed use of the building in terms of occupancy, equipment, lighting, and system operation. Assumptions have been developed with the design team, using a combination of project-specific information and published benchmarks (e.g. CIBSE TM54, Guide F).

Unregulated loads, primarily small power and IT equipment, have been derived from benchmark data and design team input, with conservative allowances applied where information was unavailable. Management factors such as hours of operation, control strategies, and commissioning have been agreed with the design team to reflect the intended facilities management approach.

zed. are not responsible for ensuring these assumptions reflect the building in use, nor for any differences arising from inputs such as weather data.The total useful internal floor area is taken from the model to be 838m^2.

fabric & openings	U-Value (W/m^2.K)	notes
Ground floor	0.12	
External walls	0.14	
Roof	0.12	
Windows	1.42	Solar g-value = 0.40, visible light transmittance = 0.71
Doors	1.28	
air permeability	**infiltration (ach^{-1})**	**notes**
entire building	0.25	Equivalent to the design target APR of 5.0m^3(hr.m^2)@50Pa.

Table 3. building envelope specification

model input data

design criteria

Temperature set points for each space type are set as per the table below.

room type	heating setpoint (°C) (Occupied/Set back)	cooling setpoint (°C)
Circulation Spaces	19/12	n/a
WCs/Showers	21/12	n/a
Offices/Meeting/Admin Spaces	21/12	24
Consultant/Examination Rooms	21/12	24
Treatment Rooms	21/12	24
Staff Change	22/12	n/a

Table 4. heating and cooling set points

occupancy

Occupancies are taken from the Gilling Todd Architecture FF&E drawings and internal heat gains associated with each occupancy is taken from the SLCE Design Specification.

room type	max occupancy (people)	heat gain (sensible /latent) (W)	profile	notes
Consultant/Examination/ Treatment room	3	90/60	0700-1900 Mon - Fri	Occupancy level varies throughout the day as per NCM template
Interview Room	3	90/60	0700-1900 Mon - Fri	Occupancy level varies throughout the day as per NCM template
Isolation Room	3	90/60	0700-1900 Mon - Fri	Occupancy level varies throughout the day as per NCM template
Staff Room	6	90/60	0700-1900 Mon - Fri	Occupancy level varies throughout the day as per NCM template
Admin Office	8	90/60	0700-1900 Mon - Fri	Occupancy level varies throughout the day as per NCM template
Meeting Room	8	90/60	0700-1900 Mon - Fri	Occupancy level varies throughout the day as per NCM template
Group Room	10	90/60	0700-1900 Mon - Fri	Occupancy level varies throughout the day as per NCM template
Reception	3	90/60	0700-1900 Mon - Fri	Occupancy level varies throughout the day as per NCM template
Waiting Area	50	90/60	0700-1900 Mon - Fri	Occupancy level varies throughout the day as per NCM template

Table 5. occupancy gains and profiles

model input data

equipment loads

The below table summarises the equipment loads assigned within the TM54 model for all room types.

room type	equipment loads (W/m^2)	profile	notes
Consultant/Examination/Treatment room	20.0	0700-1900 Mon - Fri	100% in occupied hours, 5% overnight setback
Interview Room	20.0	0700-1900 Mon - Fri	100% in occupied hours, 5% overnight setback
Isolation Room	20.0	0700-1900 Mon - Fri	100% in occupied hours, 5% overnight setback
Staff Room	20.0	0700-1900 Mon - Fri	100% in occupied hours, 5% overnight setback
Admin Office	20.0	0700-1900 Mon - Fri	100% in occupied hours, 5% overnight setback
Meeting Room	20.0	0700-1900 Mon - Fri	100% in occupied hours, 5% overnight setback
Group Room	20.0	0700-1900 Mon - Fri	100% in occupied hours, 5% overnight setback
Reception	20.0	0700-1900 Mon - Fri	100% in occupied hours, 5% overnight setback
Waiting Area	5.0	0700-1900 Mon - Fri	100% in occupied hours, 5% overnight setback
WC/Shower/Change	2.0	0700-1900 Mon - Fri	100% in occupied hours, 5% overnight setback
Circulation/Stores	2.0	0700-1900 Mon - Fri	100% in occupied hours, 5% overnight setback

Table 6. equipment loads and profiles

model input data

lighting gains

The below table summarises the lighting gains assigned within the TM54 model for all spaces. Sitewide lighting has been proposed as high efficiency LED lighting. Optimal controls have been proposed.

Lighting is profiled as per occupancy hours detailed in table 5.

room type	lighting efficacy (lm/W)	occupancy control	diversity factor	daylight dimming	daylight dimming profile
Consultant/Examination /Treatment room	131.48	Man-On-Auto-Off	0.82	Yes	300 lux ramp
Interview Room	113.80	Man-On-Auto-Off	0.82	Yes	300 lux ramp
Isolation Room	113.80	Man-On-Auto-Off	0.82	Yes	300 lux ramp
Staff Room	131.63	Man-On-Auto-Off	0.82	Yes	300 lux ramp
Admin Office	131.40	Man-On-Auto-Off	0.82	Yes	300 lux ramp
Meeting Room	131.63	Man-On-Auto-Off	0.82	Yes	300 lux ramp
Group Room	131.40	Man-On-Auto-Off	0.82	Yes	300 lux ramp
Reception	131.48	Man-On-Auto-Off	0.82	Yes	300 lux ramp
Waiting Area	113.80	Auto-On-Auto-Off	0.90	Yes	300 lux ramp
WC/Shower/Change	113.80	Auto-On-Auto-Off	0.90	No	n/a
Circulation	106.23	Auto-On-Auto-Off	0.90	Yes	n/a
Plant/Stores	147.55	Auto-On-Auto-Off	0.90	No	n/a

Table 7. lighting gains, controls and profiles

daylight dimming

Areas in the building with access to daylight diversities have been given installed lighting power to account for daylight control. A dimming profile has been applied to modulate as a function of available daylight, as shown in figure 5 below. The illuminance has been completed using the link to IES Radiance software.

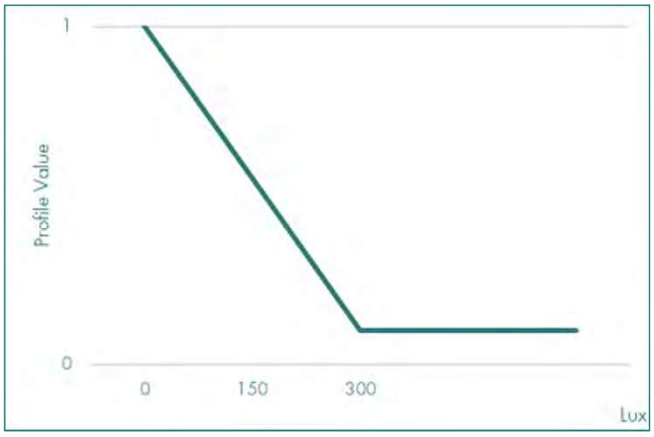


Figure 5. typical dimming profile (for a 300-lux ramp)

model input data

building services

The energy strategy and building services performance has been taken from final design information by SLCE (Silcock Leedham Consulting Engineers) and approved equipment suppliers.

Heating and cooling will be provided via local low carbon technology Variable Refrigerant Flow (VRF) Air Conditioning systems. WCs, and circulation areas will be provided with heating by direct electric panel heaters. The primary method of ventilation to the building will be natural ventilation. Areas with high occupancy or specific mechanical ventilation requirements will be served by high-efficiency heat recovery ventilation units. Toilets, changing areas, cleaners store and dirty utilities will be served from various dirty extract systems.

system reference	efficiencies			ventilation		
	heating SCOP (kW/kW)	cooling EER (kW/kW)	cooling SEER (kW/kW)	heat recovery (%)	SFP (W/l/s)	notes
VRF w/ Nat Vent	4.10	2.50	6.40	n/a	n/a	
VRF w/ MVHR	4.10	2.50	6.40	88.00	1.50	
Elec Rads w/ Nat Vent	1.00	n/a	n/a	n/a	n/a	
Elec Rads w/ Extract	1.00	n/a	n/a	n/a	0.30	
DHW	4.10	n/a	n/a	n/a	n/a	

Table 8. M&E specification – space conditioning

model input data

ventilation

The following room specific ventilation strategies have been used in the TM54 model:

room type	mechanical/natural ventilation	mechanical ventilation rate	natural ventilation notes
Consultant/Examination	Natural	n/a	Windows set to open based on both temperature and CO_2 levels
Treatment room	Mechanical	10 ACH	
Interview Room	Mechanical	10 l/s/p	
Isolation Room	Mechanical	10 l/s/p	
Staff Room	Mechanical	10 l/s/p	
Admin Office	Mechanical	10 l/s/p	
Meeting Room	Mechanical	10 l/s/p	
Group Room	Mechanical	10 l/s/p	
Reception	Mechanical	10 l/s/p	
Waiting Area	Mechanical	10 l/s/p	
WC/Shower	Mechanical	6 ACH (extract only)	
Changing	Mechanical	6 ACH (extract only)	

Table 9. ventilation strategy

scope and scenarios



scope and scenarios

Further to Part L Compliance assessment, several variables have been modelled to determine their impact on energy performance, both individually and cumulatively.

It was established through a risk assessment and during design meetings, that measures are in place to promote good design, comprehensive commissioning and proactive ongoing building management. The following scenarios have been modelled to determine their impact upon predicted energy consumption.

Scenario N°	Scenario Title	Variable changes
1	Central	None, the model is based upon the proposed design and control and the expectation of relatively good management (Factor 1.05)
2	Good Management	Management Factor 1.0.
3	Poor Management	Management Factor 1.15.
4	Extreme Weather	Weather file: Manchester 2016DSY1.
5	Poor commissioning	• 25% increase to SFPs (Specific Fan Powers). • Reduction in lighting control factor for poor PIR time settings. • Reduction in cooling setpoint from 23-24°C to 22°C.
6	Worst case	Cumulative effects of scenarios 3 + 4 + 5.

Table 10. scenarios assessed

results



results

The predicted energy use intensity for Hawthorn Primary Care Health Centre is 77.0 $kWh_e/m^2/yr$.

Results illustrate the extent of the differences between the outputs from Part L and the more detailed Apache calculation methodologies. Total predicted energy consumption using the CIBSE TM54 approach is 26.06% greater than the Part L2: 2021 figures.

The following table and figure demonstrates this difference, with further breakdown of results by scenario and energy end use given in the proceeding pages.

A detailed, month by month, TM54 results table broken down by energy end use for each scenario can be found in the appendix.

Category	Consumption (MWh/yr)	
	Part L	Apache
Heating	10.3	6.6
Hot Water	1.5	1.9
Cooling	0.4	4.2
Aux	2.8	6.0
Lighting	7.4	8.7
Equipment	25.1	34.3
Total	**47.4**	**61.6**

Table 11. TM54 energy results compared to Part L

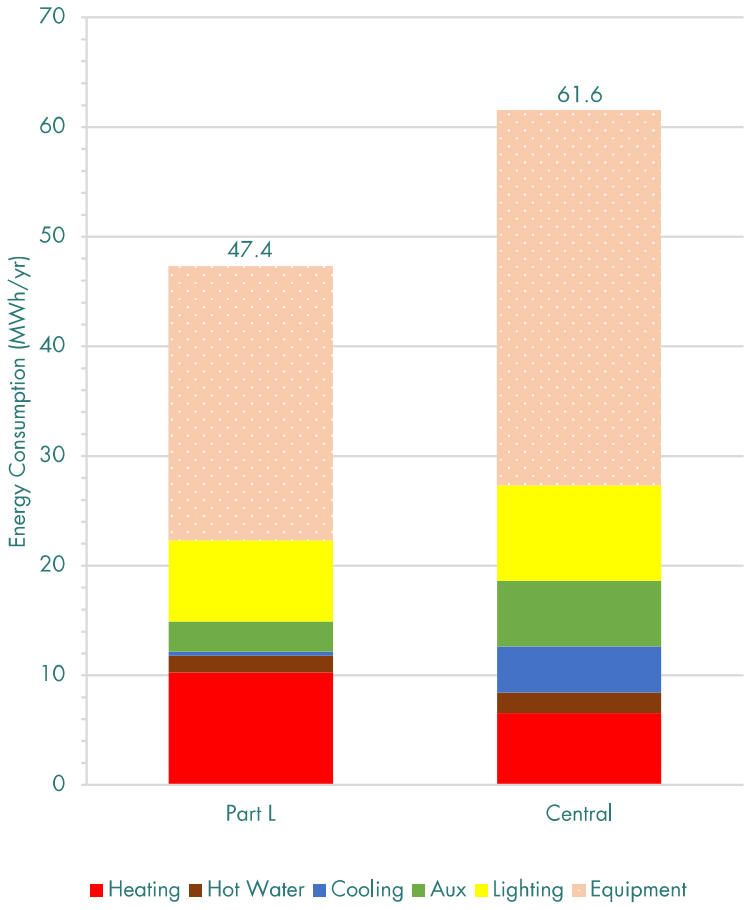


Figure 6. TM54 energy results compared to Part L

results

This page summarises energy performance predictions for the different scenarios considered at Hawthorn Primary Care Health Centre.

Category	Consumption (MWh/yr)					
	1) Central	2) Good Management	3) Poor Management	4) Extreme Weather	5) Poor Commissioning	6) Worst Case
Heating	6.6	6.2	7.2	6.2	6.2	6.4
Hot Water	1.9	1.8	2.1	1.9	1.9	2.1
Cooling	4.2	4.0	4.6	4.6	6.2	7.4
Aux	6.0	5.7	6.6	6.0	7.3	8.0
Lighting	8.7	8.3	9.5	8.7	9.7	10.6
Equipment	34.3	32.7	37.6	34.3	34.3	37.6
Total	**61.6**	**58.7**	**67.5**	**61.7**	**65.6**	**72.0**

Table 12 TM54 energy results for each scenario

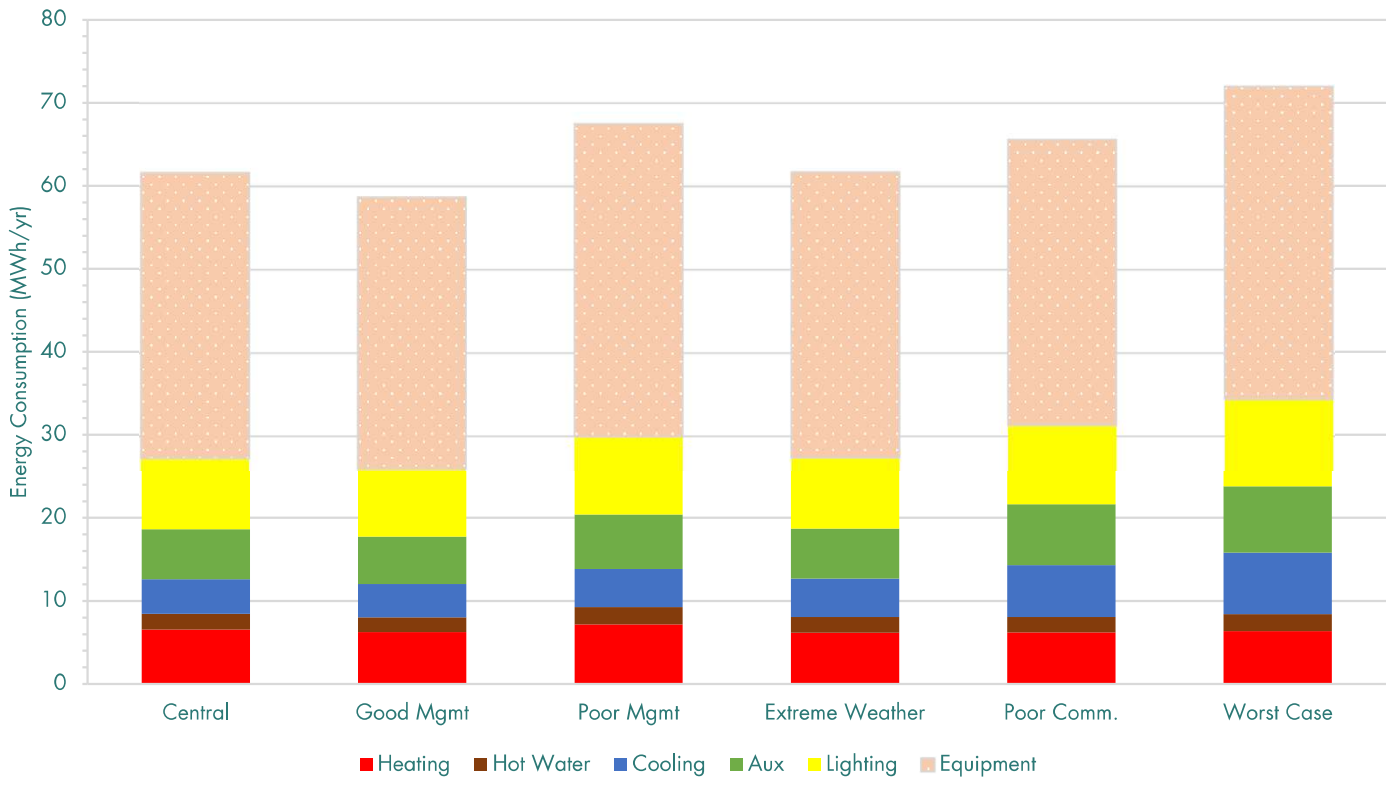


Figure 7. TM54 energy results for each scenario

conclusion



conclusion

This sections concludes the outcome of the TM54:2022 Energy Assessment for the proposed Hawthorn Primary Care Health Centre, Manchester.

This report supports BREEAM 2018 credit issue *Ene01: predicted operational energy consumption.*

Scenario	EUI kWh/m²/yr
Central	73.6
Good Mgmt	70.1
Poor Mgmt	80.6
Extreme Weather	73.6
Poor Comm.	78.3
Worst Case	85.9
Target (mean value)	**77.0**

Table 13. TM54 EUI results

zed. have undertaken an energy audit for the proposed Hawthorn Primary Care Health Centre, Manchester.

The thermal modelling and energy assessment has been carried out using IES Virtual Environment software version 2025.0.0.0 in accordance with CIBSE TM54:2022 (Evaluating operational energy use at the design stage). The IES model has been metered, with meters for different buildings and energy uses, allowing for detailed analysis of energy use within the building.

The assessment has established potential areas of risk for energy efficiency and the anticipated monthly energy consumption. Through this assessment the baseline predicted energy consumption for Hawthorn Primary Care Health Centre has been established as 61.6 MWh/yr. These findings have been used to inform enhancements to the building services design, including optimisation of system sizing, controls, and zoning strategies to mitigate identified risks. In addition, the outputs provide the basis for operational and maintenance planning, such as implementing seasonal commissioning, focused sub-metering of high-load systems, and maintenance schedules prioritised around key energy-consuming plant. The results will also guide the handover process, with clear operational setpoints, control strategies, and user training included within the building manual to support efficient performance in use.

Based on the outcomes of the scenario modelling, the operational energy use for the building is predicted to lie in the range of 70.1–85.9 kWh/m²/yr. Taking the mean across all scenarios, a realistic operational energy target has been set at 77 kWh/m²/yr. This central target reflects the most likely performance of the building in use, while acknowledging the potential variability associated with occupancy patterns, system operation, and environmental conditions.

drawing register



drawing register

The thermal model has been constructed using the following drawings.

drawing title	drawing reference	issued by	revision
Proposed Ground Floor Plan	HMCNMC-GDA-V1-00-DR-A-1010_P03	Gilling Dod	P05
Proposed Site Plan	HMCNMC-GDA-V1-ZZ-DR-A-1002	Gilling Dod	P06
Proposed Elevations	HMCNMC-GDA-V1-ZZ-DR-A-1005_P01	Gilling Dod	P01

Table 14. drawing register

appendix A1: TM54 detailed results

TM54 detailed results

Month	Energy Consumption (kWh)						
	Heating	Hot Water	Cooling	Aux	Lighting	Equipment	Total
Jan	776	153	125	484	771	2,851	**5,159**
Feb	723	145	145	461	700	2,670	**4,843**
Mar	900	166	144	530	774	3,021	**5,535**
Apr	587	159	238	507	716	2,879	**5,085**
May	425	153	354	484	665	2,782	**4,863**
Jun	315	159	578	507	685	2,850	**5,093**
Jul	264	159	714	507	674	2,862	**5,180**
Aug	278	159	679	507	690	2,872	**5,184**
Sep	331	159	551	507	708	2,869	**5,125**
Oct	414	153	339	484	720	2,821	**4,932**
Nov	672	159	195	507	802	2,908	**5,243**
Dec	875	159	121	507	809	2,927	**5,398**
Total	**6,561**	**1,880**	**4,183**	**5,990**	**8,714**	**34,312**	**61,639**

Table 15. predicted monthly energy consumption – 1) Central Case

Month	Energy Consumption (kWh)						
	Heating	Hot Water	Cooling	Aux	Lighting	Equipment	Total
Jan	739	146	119	461	734	2,716	**4,914**
Feb	689	138	138	439	666	2,543	**4,613**
Mar	858	158	137	505	737	2,878	**5,272**
Apr	559	151	226	483	682	2,742	**4,843**
May	405	146	337	461	633	2,649	**4,631**
Jun	300	151	550	483	652	2,714	**4,850**
Jul	252	152	680	483	642	2,725	**4,933**
Aug	265	152	647	483	657	2,735	**4,938**
Sep	315	151	525	483	675	2,733	**4,881**
Oct	394	146	323	461	686	2,687	**4,697**
Nov	640	151	186	483	764	2,769	**4,993**
Dec	833	151	115	483	771	2,788	**5,141**
Total	**6,248**	**1,790**	**3,984**	**5,705**	**8,299**	**32,678**	**58,704**

Table 16. predicted monthly energy consumption – 2) Good Management

TM54 detailed results

Month	Energy Consumption (kWh)						
	Heating	Hot Water	Cooling	Aux	Lighting	Equipment	Total
Jan	850	167	137	530	844	3,123	**5,651**
Feb	792	158	159	505	766	2,924	**5,304**
Mar	986	181	157	580	848	3,309	**6,062**
Apr	643	174	260	555	785	3,153	**5,569**
May	466	167	388	530	728	3,046	**5,326**
Jun	345	174	633	555	750	3,121	**5,578**
Jul	289	174	782	555	738	3,134	**5,673**
Aug	304	174	744	555	755	3,145	**5,678**
Sep	363	174	603	555	776	3,142	**5,613**
Oct	453	167	372	530	789	3,090	**5,401**
Nov	736	174	214	555	879	3,185	**5,742**
Dec	958	174	132	555	887	3,206	**5,912**
Total	**7,185**	**2,059**	**4,581**	**6,561**	**9,544**	**37,580**	**67,510**

Table 17. predicted monthly energy consumption – 3) Poor Management

Month	Energy Consumption (kWh)						
	Heating	Hot Water	Cooling	Aux	Lighting	Equipment	Total
Jan	937	153	88	484	767	2,851	**5,280**
Feb	748	145	125	461	715	2,670	**4,864**
Mar	653	166	235	530	769	3,021	**5,374**
Apr	548	159	273	507	723	2,879	**5,088**
May	388	153	411	484	637	2,782	**4,854**
Jun	319	159	580	507	696	2,850	**5,111**
Jul	232	159	768	507	649	2,862	**5,177**
Aug	197	159	913	507	697	2,872	**5,344**
Sep	330	159	555	507	724	2,869	**5,144**
Oct	445	153	345	484	712	2,821	**4,960**
Nov	591	159	207	507	805	2,908	**5,176**
Dec	807	159	130	507	815	2,927	**5,345**
Total	**6,195**	**1,880**	**4,631**	**5,990**	**8,710**	**34,312**	**61,717**

Table 18. predicted monthly energy consumption – 4) Extreme Weather

TM54 detailed results

Month	Energy Consumption (kWh)						
	Heating	Hot Water	Cooling	Aux	Lighting	Equipment	Total
Jan	788	153	265	592	858	2,851	**5,507**
Feb	732	145	280	563	778	2,670	**5,168**
Mar	911	166	294	648	860	3,021	**5,900**
Apr	572	159	421	620	794	2,879	**5,444**
May	384	153	540	592	736	2,782	**5,186**
Jun	230	159	775	620	758	2,850	**5,392**
Jul	177	159	919	620	745	2,862	**5,482**
Aug	184	159	873	620	763	2,872	**5,470**
Sep	253	159	740	620	786	2,869	**5,426**
Oct	386	153	518	592	800	2,821	**5,270**
Nov	687	159	350	620	893	2,908	**5,617**
Dec	892	159	256	620	901	2,927	**5,755**
Total	**6,195**	**1,880**	**6,231**	**7,324**	**9,674**	**34,312**	**65,616**

Table 19. predicted monthly energy consumption – 5) Poor Commissioning

Month	Energy Consumption (kWh)						
	Heating	Hot Water	Cooling	Aux	Lighting	Equipment	Total
Jan	1,042	167	229	648	935	3,123	**6,145**
Feb	831	158	290	617	871	2,924	**5,691**
Mar	701	181	459	710	935	3,309	**6,296**
Apr	577	174	502	679	878	3,153	**5,963**
May	381	167	661	648	772	3,046	**5,675**
Jun	252	174	846	679	845	3,121	**5,917**
Jul	163	174	1,076	679	785	3,134	**6,011**
Aug	118	174	1,240	679	846	3,145	**6,202**
Sep	272	174	809	679	880	3,142	**5,956**
Oct	464	167	565	648	867	3,090	**5,802**
Nov	648	174	409	679	982	3,185	**6,076**
Dec	906	174	298	679	994	3,206	**6,256**
Total	**6,356**	**2,059**	**7,382**	**8,021**	**10,590**	**37,580**	**71,989**

Table 20. predicted monthly energy consumption – 6) Worst Case

Our Services

We offer a wide range of high-quality building performance advice and evaluation,
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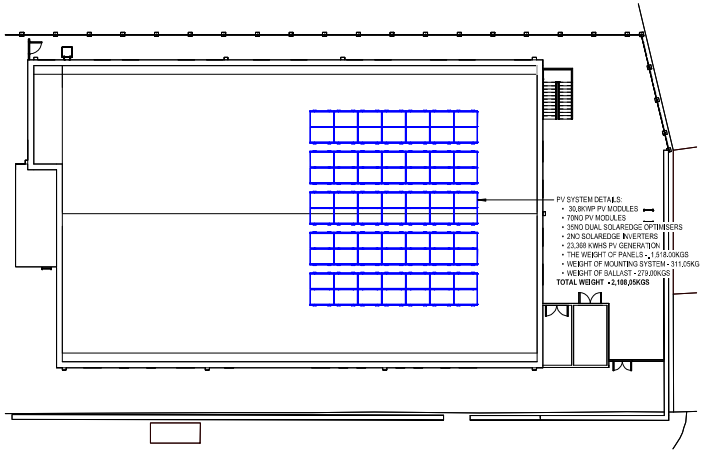
Planning Support

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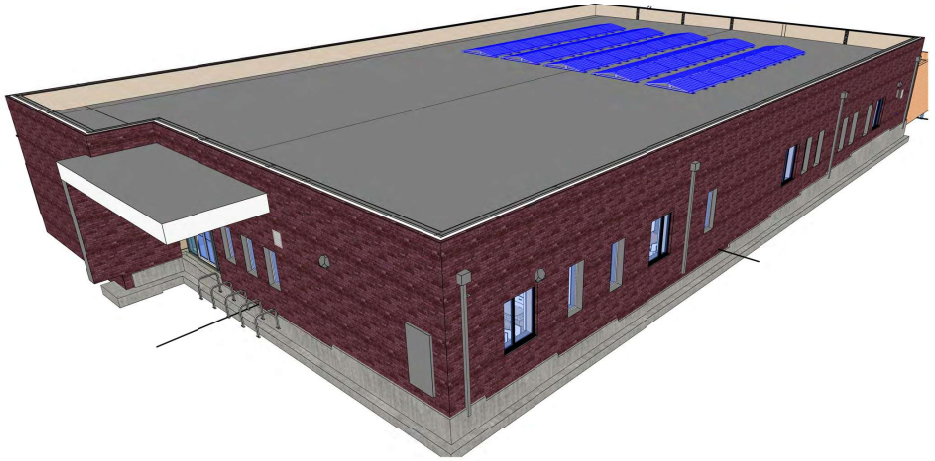
As a company we are working towards being more sustainable, therefore we do not recommend printing our reports. If you require a printable version, please contact one of the team.

7.5 Appendix E – Solar PV Layout

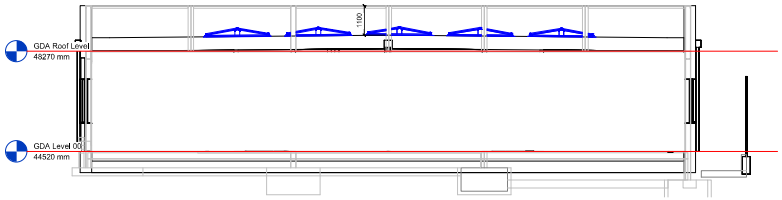


1 ROOF LEVEL SOLAR PANEL ARRAY LAYOUT

1 : 200



2 ROOF LEVEL SOLAR PANEL ARRAY PERSPECTIVE VIEW

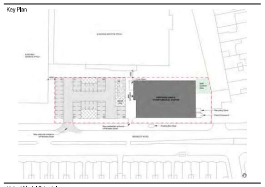


3 ROOF LEVEL SOLAR PANEL ARRAY SECTION

1 : 100

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Key Plan



Linked Model Schedule

RVT Link: Name	RVT Link: Revision	RVT Link: Rev Date
HMCNMC-GDA-V1-ZZ-M3-A-8001_Architectural Model	P05	06.25.2025
HMCNMC-GDA-V1-ZZ-M3-A-8002_J-H-M. Model	P05	06.25.2025
3870-MLEP-DS-XX-M3-E-0001_Structural Model	-	10.24.2025

Scale Bar



Scale 1:50

NOTES:

1. DO NOT SCALE FROM THIS DRAWING
2. ALL DIMENSIONS ARE IN mm UNLESS INDICATED OTHERWISE.
3. DRAWING TO BE READ IN CONJUNCTION WITH SPECIFICATION.

Rev.	Description	DRN	CHK	Date
P01	PRELIMINARY ISSUE	JM	AB	22.07.2025

STAGE 3 PRELIMINARY ISSUE

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Client/Main Contractor
NHS PROPERTY SERVICES

Architect
GILLING DOD

Project
HAWTHORN MEDICAL CENTRE

Drawing Title
ELECTRICAL SERVICES
PROPOSED ROOF LEVEL
SOLAR PANEL ARRAY

Scale @ Paper Size	Project Number	Drawn By	Date Created
SEE DRAWING @ A1	3220231	AD	JULY 2025

Project Status: PRELIMINARY
Issue Status: S3 - FOR REVIEW & COMMENT

Drawing Number: HMCNMC-SLCE-V1-RF-DR-E-6500
Revision: P01

PROJECT - ORIGINATOR - VOLUME - LEVEL - TYPE - ROLE CODE - NUMBER

7.6 Appendix F – LZC Report



Hawthorn Primary Care Health Centre

Ene04: LZC Feasibility Report

August 2025

Project Ref: 3280460

zed.
an RSK company

We are **daylighting** experts

We are **thermal comfort** experts

We are **life cycle analysis** experts

We are **sustainability** experts

We are **building physics** experts

We are **zero carbon** experts

We are **zed.**



zero carbon
building physics
sustainability

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an RSK company

As a company we are working towards being more sustainable, therefore we do not recommend printing our reports. If you require a printable version, please contact one of the team.

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prepared by:	Jordan Turner – Senior Building Physics & Sustainability Engineer	date: 20 08 25	sig:
checked by:	Miquel Garcia– Senior Building Physics Engineer	date: 20 08 25	sig:
revision:	01 – u-values updated	date: 22 08 25	sig:

abbreviations

A/C	-	Air Conditioning
AHU	-	Air Handling Unit
APR	-	Air Permeability Rate
ASHP	-	Air Source Heat Pump
BREEAM	-	Building Research Establishment Environmental Assessment Method
BER	-	Building Emission Rate
BPER	-	Building Primary Energy Rating
BRUKL	-	Building Regulations UK, Part L
CHP	-	Combined Heat & Power
COP	-	Coefficient of Performance
DHW	-	Domestic Hot Water
EER	-	Energy Efficiency Ratio
EPC	-	Energy Performance Certificate
HVAC	-	Heating, Ventilation & Air Conditioning
LED	-	Light Emitting Diode
LZC	-	Low and Zero Carbon
NCM	-	National Calculation Methodology
PV	-	Photo Voltaic (panels)
SEER	-	Seasonal Energy Efficiency Ratio
SFP	-	Specific Fan Power
TER	-	Target Emission Rate
TPER	-	Target Primary Energy Rating
TRY	-	Test Reference Year
VLT	-	Visible Light Transmittance
VRF	-	Variable Refrigerant Flow

executive summary

executive summary

This report has been compiled by zed., on behalf of Silcock Leedham Consulting Engineers, to detail the results of the LZC feasibility assessment undertaken in accordance with BREEAM UK New Construction V6 Ene04.

Jordan Turner

Qualifications	Non-Domestic Energy Assessor (Level 3) Non-Domestic Energy Assessor (Level 4) Non-Domestic Energy Assessor (Level 5)
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Accreditation scheme	CIBSE Certification Limited ▶ More information
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Month	CO_2 Emissions Factor (kg.CO_2/kWh)	
	Grid-supplied electricity	Grid-displaced electricity PV
Jan	0.163	0.196
Feb	0.160	0.190
Mar	0.153	0.175
Apr	0.143	0.153
May	0.132	0.129
Jun	0.120	0.106
Jul	0.111	0.092
Aug	0.112	0.093
Sep	0.122	0.110
Oct	0.136	0.138
Nov	0.151	0.169
Dec	0.163	0.197

Table 1. CO_2 emission factors

zed. have undertaken an LZC feasibility assessment for the proposed Hawthorn Primary Care Health Centre, Manchester, at RIBA Stage 2.

Works have been undertaken by Jordan Turner, a Senior Building Physics & Sustainability Engineer and CIBSE registered Energy Assessor and Low Carbon Consultant (LCEA206448). **zed.** doesn't have any professional connection to a single low and zero carbon technology or manufacturer. Predicted energy consumption and CO_2 emissions have been calculated in accordance with CIBSE AM11. Baseline building performance has been calculated using the Part L (2021) Volume 2 approach with room templates taken from the NCM database.

The feasibility and impact of LZC technologies has been undertaken in accordance with BREEAM New Construction V6 Ene04 guidance using the regulatory CO_2 emissions factors of the Building Regulations Part L (2021) Volume 2 edition. The regulatory CO_2 emissions factors have been updated in the latest Buildings Regulation Part L 2021 version to account for the decarbonisation of the electricity grid. The emission factors now vary according to monthly profiles to reflect variability of grid generation mix as shown in adjacent Table 1. The feasibility and impact of LZC technologies has been undertaken in the context of these revised emission factors.

This assessment shows that the following LZC technologies are feasible for integration into this development, resulting in a total CO_2 emissions reduction of 3.53 tonnes CO_2/yr:

- Solar PV
- Domestic Hot Water (DHW) with combined ASHP & direct-electric heater

Payback calculations are based upon all - inclusive unit rates of 31.70 p/kWh for electricity.

introduction



introduction

The development is located in Fallowfield, Manchester

The development compromises the construction of a single-story primary health centre in Fallowfield, Manchester. The facility consists of several consultant/examination rooms, admin offices and welfare facilities.

A fabric-first approach to design has been taken, comprising of low thermal U-values to reduce heat loss in winter and solar-control glazing to reduce heat gain in summer. High efficiency LED luminaires and low Specific Fan Powers (SFPs) on the ventilation systems will minimise the energy consumption associated with the fixed building services.

The feasibility for incorporating recognised LZC technologies has been undertaken in two stages. An initial high level desktop appraisal has been carried out to establish if a technology is technically viable considering the site opportunities and constraints in context with the building use. The second stage then considers each of the technologies taken forward against the scope described in BREEAM V6 guidance, including; payback period, the feasibility of energy export and any available grants.

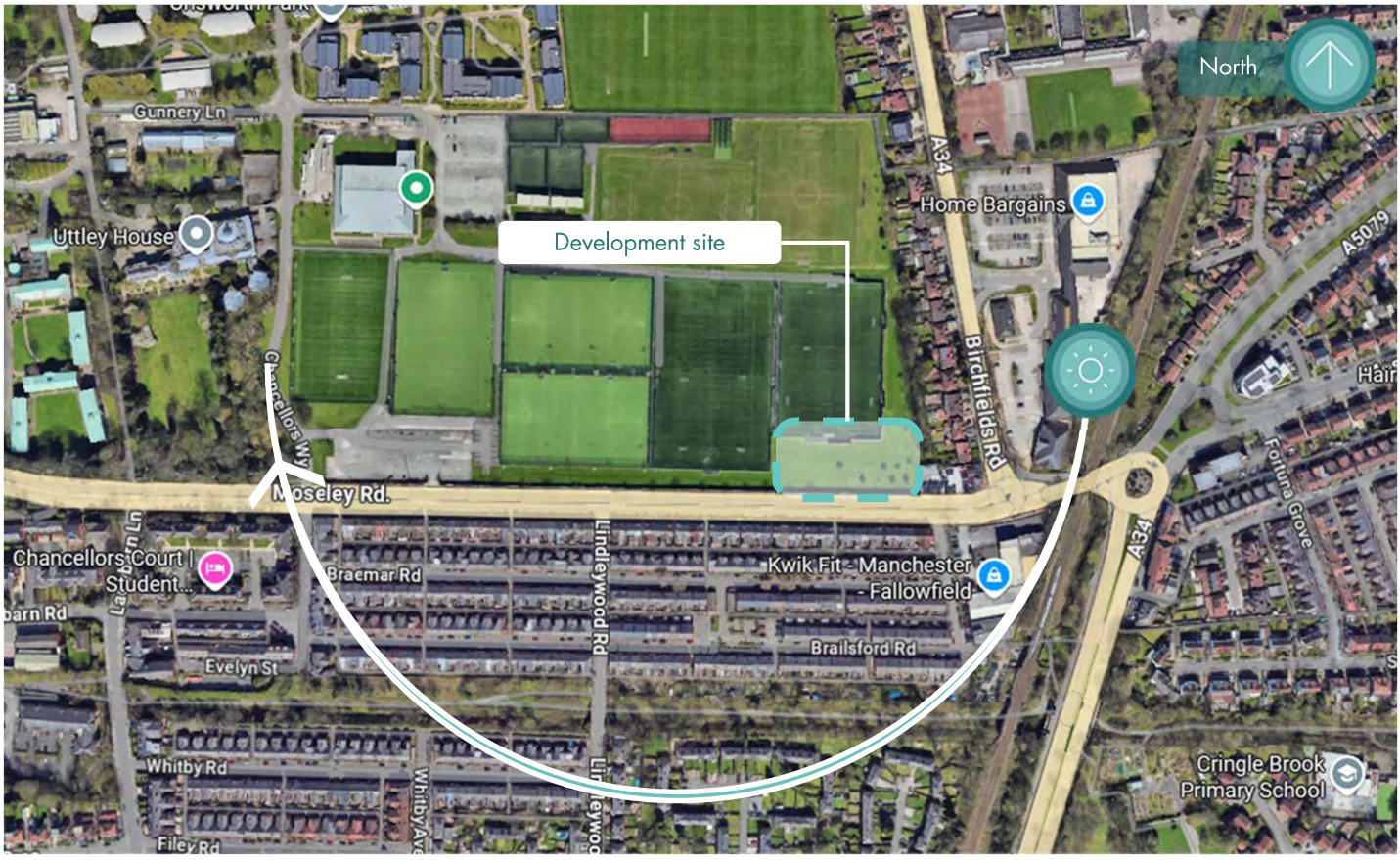


Figure 1. Site Location

initial review



initial review

Prior to detailed analysis, a high-level appraisal has been undertaken to determine broad potential.

technology	justification summary	consider
Building-mounted wind turbine	The Global Wind Atlas wind speed database shows an average wind speed of 2.94m/s at 10m above ground level for the site region, therefore below the recommended threshold of 6m/s for economic operation. Maximum turbine height must be no more than 3m above the top of the building of 15m above the ground risking a clash with rooftop plant and plant access routes. There may also be noise and planning issues.	✗
Pole-mounted wind turbine	The Global Wind Atlas wind speed database shows an average wind speed of 2.94m/s at 10m above ground level for the site region, therefore below the recommended threshold of 6m/s for economic operation. As maximum turbine height must be no more than 11.1m above the ground, average wind speed is anticipated to be further impeded by shelter from the building and associated landscaping. There may also be noise and planning issues.	✗
Solar thermal water	The development site has excellent solar access and a notable demand for domestic hot water. However, as hot water is likely to be drawn off at a relatively steady rate over the course of sunlight hours, a 'recovery period' doesn't exist when solar thermal energy could be harnessed and accumulated to make a meaningful contribution.	✗
Solar Photovoltaics (PV)	The development site benefits from adequate solar access and a relatively consistent electricity demand during opening hours. A roof-mounted PV panel system could significantly offset grid demand, with any surplus electricity sold back to the grid when generation exceeds onsite consumption. There is no noise impact associated with Solar PV.	✓
Tidal/hydro	The are no significant water courses within the vicinity of the development site.	✗
Ground source heat pumps	Due to the size of the development site, the source for ground-coupled heat pumps would be limited to vertical bore holes. Ground investigation and the required drilling to satisfy the building load is expected to make this technology economically unfeasible.	✗
Air source heat pumps	Low-grade heat from an air source heat pump could be used to provide pre-heating of domestic hot water. Outdoor units could be installed onto the rooftop plant deck. There would be no noise impact, subject to the attenuation of the plant and equipment.	✓
Biomass heating	Due to the level of hard landscaping and customer movement around the perimeter building, there is inadequate space for bulk fuel storage. In addition, burning biomass/biofuel may cause a negative impact upon local air quality for nearby residents.	✗
Combined Heat and Power (CHP)	A small, commercially-available CHP unit (12kWth) operating at minimum turn-down would operate for 3100 hours per annum to meet the total DHW demand, therefore below the recommended 4500-5000 hours to be economically viable.	✗
District heating	There are no known existing heat networks within the vicinity of the development.	✗

Table 2. initial LZC technology review

model input data



model input data

Thermal modelling has been undertaken by a CIBSE registered Energy Assessor and Low Carbon Consultant, Jordan Turner (LCEA206448).

Government approved IES-VE (v2025.0.0.0) dynamic thermal modelling software has been used in accordance with CIBSE AM11 & CIBSE TM54.

building typology and geometry

A thermal model has been created from the design team drawings provided by Gilling Dod Architects. Building envelope performance has also been taken from Gilling Dod Architects.

climate data

The model has been coordinated for solar access and simulated against the CIBSE Manchester TRY (Test Reference Year) weather file. The weather data used for simulations was sourced from CIBSE (Chartered Institute of Building Services Engineers), an industry recognised organisation.

fabric & openings	U-value ($W/m^2.K$)	notes
Ground floor	0.12	
External walls	0.14	
Roof	0.12	
Windows	1.42	Solar g-value = 0.40, visible light transmittance = 0.71
Doors	1.28	
air permeability	**APR ($m^3/h.m^2$ @ 50Pa)**	**notes**
Entire building	5.00	To be tested on completion.

Table 3. building envelope specification

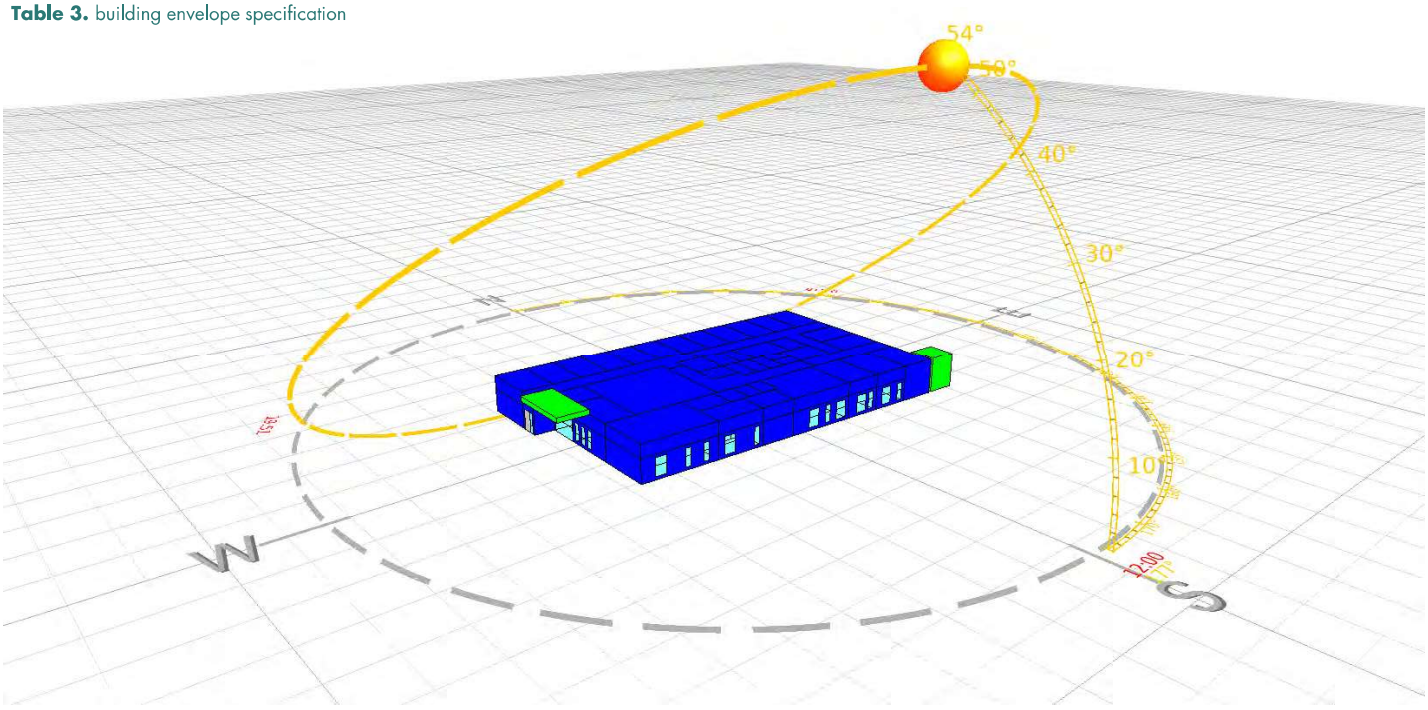


Figure 2. IES-VE thermal model

model input data

building services

The energy strategy and building services performance has been taken from Stage 2 design information by Silcock Leedham Consulting Engineers.

space conditioning

building area	system reference	efficiencies			ventilation		
		heating SCOP (kW/kW)	cooling EER (kW/kW)	cooling SEER (kW/kW)	heat recovery (%)	SFP (W/l/s)	notes
Consult/Exam Rooms	VRF w/ Nat Vent	4.10	2.50	6.4	n/a	n/a	
Waiting/Admin/ Offices/Treatment /Staff Room	VRF w/ MVHR	4.10	2.50	6.4	88.0	1.50	MVHR Casing L2. Duct Class A
Circulation Spaces	Elec Rads w/ Nat Vent	1.0	n/a	n/a	n/a	n/a	
Staff Change/Shower*	Elec Rads w/ Extract	1.0	n/a	n/a	n/a	0.30	Duct Class A

Table 4. M&E specification – space conditioning

* Toilets and changing rooms to be indirectly heated by adjacent space.

domestic hot water

building area	source	storage	distribution	notes
All areas	Direct-electric water heater	300 litres	Loop Length – 130m Circulation Losses – 8 W/m	Heater efficiency – 100%

Table 5. M&E specification – domestic hot water

internal lighting

building area	input method	performance	automatic control	notes
All areas	Inference	110 lm/W	Occupancy sensing	Daylight diming in relevant spaces

Table 6. M&E specification – internal lighting

energy demand



energy demand

The building energy profile has been derived from initial Part L (2021) Volume 2 modelling undertaken at RIBA Stage 2.

The chart below shows the predicted energy and CO_2 for the baseline model. Results show energy attributable to heating and DHW to be dominant, with cooling demand being significantly lower partly due to the incorporation of energy-efficient VRF and packaged heat pump technology.

Predicted CO_2 emissions follow the same pattern with most emissions attributable to Heating and DHW, with internal lighting also being significant. Conversely, CO_2 emissions attributable to cooling remain low due to the reduced electricity demand.

Total regulated energy consumption = 27.0 MWh/yr.
Total emissions = 3.90 tonnes.CO_2/yr.

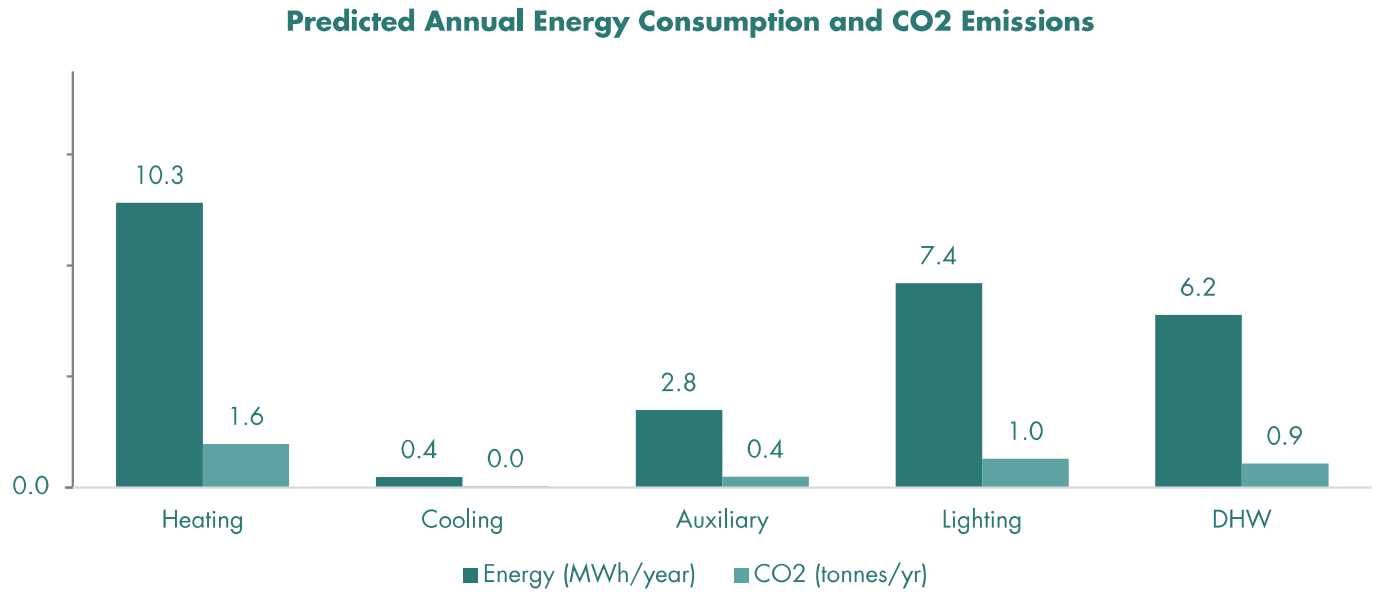


Figure 3. predicted baseline energy consumption and CO_2 emissions based on Part L (2021) Volume 2 modelling

feasibility



feasibility

Desktop feasibility has been based upon a combination of industry guidance and dynamic simulation modelling.

Further to the initial review, the detailed feasibility of the following LZC technologies are considered:

- Solar Photovoltaics (PV)
- DHW with combined heat pump (ASHP) and direct-electric system

Estimated plant and fuels costs are based upon a combination of Government data, industry guidance and supplier quotations.

Fuel costs are based upon published non-domestic price records for Q2 of 2025 from the Department for Business, Energy & Industry Strategy website, taken to be:

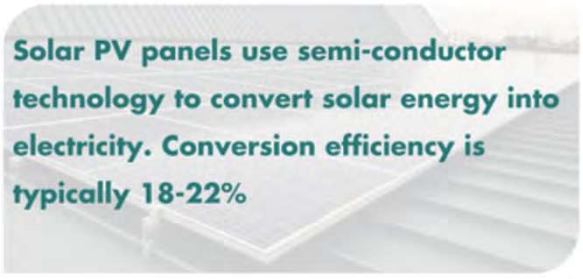
Electricity = 31.70p/kWh, inclusive of VAT and CCL

Fuel price inflation is based on a Consumer Prices Index of 3.58%.

results - solar PV



results - solar PV



year	yield (kWh/yr)	saving (£/yr)	cumulative benefit (£)
1	22,489	£6,232	£6,232
2	22,264	£6,391	£12,623
3	22,041	£6,553	£19,176
4	21,821	£6,720	£25,896
5	21,603	£6,890	£32,786
6	21,387	£7,065	£39,851
7	21,173	£7,245	£47,096
8	20,961	£7,429	£54,525
9	20,752	£7,617	£62,142
10	20,544	£7,811	£69,953
11	20,339	£8,009	£77,963
12	20,135	£8,213	£86,175
13	19,934	£8,421	£94,597
14	19,734	£8,635	£103,232
15	19,537	£8,855	£112,087
16	19,342	£9,080	£121,167
17	19,148	£9,310	£130,477
18	18,957	£9,547	£140,024
19	18,767	£9,789	£149,813
20	18,580	£10,038	£159,851
21	18,394	£10,293	£170,144
22	18,210	£10,554	£180,699
23	18,028	£10,823	£191,522
24	17,848	£11,098	£202,619
25	17,669	£11,379	£213,998

Table 7. projected benefits – solar PV

capacity

A 19.30 kilo-Watt peak array comprising 70no. 440Watt panels could be installed to roof-mounted framework, pitched 10° and rotated to face east and west.

energy generation

In the first year, Part L simulation shows that a total yield of 22,489kWh would be expected, equivalent to 83.3% of the total predicted annual electricity demand through the use of this system. However, during the summer months, PV generation exceeds the building's electricity consumption. During this period, under the government's Smart Export Guarantee (SEG), the energy provider will pay a tariff for any electricity exported to the grid. For the purpose of this assessment, an estimated tariff of 12 p/kWh has been applied to electricity fed back into the grid.

A panel degradation rate of approx.1% per annum is typical.

CO_2 reduction

Using the regulatory emissions factors, annual generation would abate 2.82 tonnes CO_2, equivalent to 72.4% of the total predicted regulated CO_2 emissions.

life cycle cost

the total estimated cost of the system including panel and inverters is £20,790.

On the basis that the payback is achieved through offsetting grid demand and selling the surplus electricity back to the grid, at unit tariffs of 31.7p/kWh and 12p/kWh respectively, simple payback would be achieved within 4 years. Although panel performance degrades over time, the useful lifespan is expected to be over 20 years and therefore exceeding the payback period.

local planning criteria

There are no known local policies that restrict the installation of small scale, building-mounted solar PV, and no associated noise issues.

Solar PV systems and installations should be Microgeneration Certification Scheme (MCS) accredited and adhere to the requirements of the District Network Operator (DNO).

results - solar PV



Figure 4. typical rooftop PV

energy storage

Battery systems are available to enable energy storage for times when supply exceeds demand.

grants

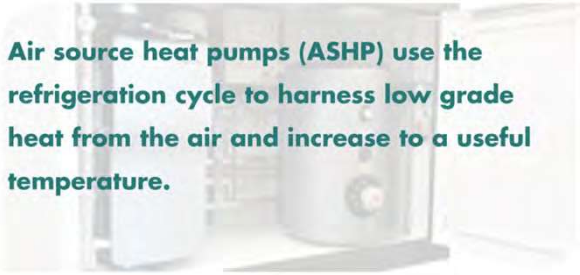
The Governments Smart Export Guarantee (SEG) has replaced the Feed-in-Tariff (FIT) scheme. Subject to an MCS installation and approved energy meter, a tariff will be payable by the energy provider for any electricity exported to grid.

conclusion

Solar PV technology is considered technically and economically feasible for this development. It is therefore recommended that it be installed.

results - ASHP (DHW)

results - ASHP (DHW)



Air source heat pumps (ASHP) use the refrigeration cycle to harness low grade heat from the air and increase to a useful temperature.

year	yield (kWh/yr)	saving (£/yr)	cumulative benefit (£)
1	1,972	£481	£1,491
2	2,042	£498	£3,035
3	2,115	£516	£4,635
4	2,191	£534	£6,291
5	2,269	£554	£8,007
6	2,351	£573	£9,785
7	2,435	£594	£11,626
8	2,522	£615	£13,532
9	2,612	£637	£15,507
10	2,705	£660	£17,553
11	2,802	£683	£19,671
12	2,902	£708	£21,866
13	3,006	£733	£24,139
14	3,114	£759	£26,493
15	3,225	£787	£28,931
16	3,340	£815	£31,457
17	3,460	£844	£34,072
18	3,583	£874	£36,782
19	3,712	£905	£39,588
20	3,844	£938	£42,495

Table 8. projected benefits – ASHP: DHW

capacity

Calculations by VRF system provider (Daikin) show that using the VRF ASHP system to generate domestic hot water is a feasible option instead of the baseline direct-electric water heater. This packaged system would meet the entire DHW demand.

energy generation

Part L simulation shows that the annual DHW demand is reduced by 4,704kWh, equivalent to a reduction of 17.4% of the total regulated predicted electricity demand through the use of this system.

CO_2 reduction

Using the regulatory emissions factors, the annual energy saving would abate 0.71 tonnes of CO_2, equivalent to 18.3% of the total predicted regulated CO_2 emissions.

life cycle cost

Calculations by the design team at concept stage show the uplift to be £3,625 for moving from a direct electric water heater to a VRF fed system.

Simulation results show a reduction in annual fuel cost of £1,491 in the first year, therefore, simple payback will be achieved within 3 years.

Over a 15 year plant service life, the cumulative fuel savings are calculated to be above £28.9k.

results - ASHP (DHW)



Figure 5. typical external packaged ASHP plant room

local planning criteria

There is no known planning policy that would affect the installation of air source heat pumps. Noise assessments will be undertaken to demonstrate compliance with boundary condition stipulations and units will be selected appropriately.

export feasibility

There are no current opportunities to export heat from the system.

energy storage

Pre-heated water from the air-to-water heat pump would be stored within a dedicated indirect cylinder. An additional immersion electric heater would be used to heat and preheat the water as required.

grants

There are currently no known grants available for this technology.

conclusion

The integration of heat pump technology will result in a significant reduction in annual CO_2 emissions and would enable the building to operate exclusively by electricity. This would omit the expense of introducing a gas connection and align with the Governments plan to reduce the consumption and reliance upon fossil fuels.

conclusion



conclusion

This assessment shows that Solar PV and ASHP (DHW) are feasible for integration into this development, resulting in a total CO_2 reduction of 3.53 tonnes CO_2/yr.

Month	CO_2 Emissions Factor (kg.CO_2/kWh)	
	Grid-supplied electricity	Grid-displaced electricity PV
Jan	0.163	0.196
Feb	0.160	0.190
Mar	0.153	0.175
Apr	0.143	0.153
May	0.132	0.129
Jun	0.120	0.106
Jul	0.111	0.092
Aug	0.112	0.093
Sep	0.122	0.110
Oct	0.136	0.138
Nov	0.151	0.169
Dec	0.163	0.197

Table 9. CO_2 emission factors

zed. have undertaken an LZC feasibility assessment for the proposed Hawthorn Primary Care Health Centre, Manchester, at RIBA Stage 2.

The feasibility and impact of LZC technologies has been undertaken in accordance with BREEAM New Construction V6 Ene04 guidance using the regulatory CO_2 emissions factors of the Building Regulations Part L (2021) Volume 2 edition. The regulatory CO_2 emissions factors have been updated in the latest Buildings Regulation Part L 2021 version to account for the decarbonisation of the electricity grid. The emission factors now vary according to monthly profiles to reflect variability of grid generation mix as shown in adjacent Table 9. The feasibility and impact of LZC technologies has been undertaken in the context of these revised emission factors.

This assessment shows that the following LZC technologies are feasible for integration into this development, resulting in a total CO_2 emissions reduction of 3.53 tonnes CO_2/yr:

- Solar PV
- Domestic Hot Water (DHW) with combined ASHP & direct-electric heater

Payback calculations are based upon all - inclusive unit rates of 31.70 p/kWh for electricity.

	energy (kWh/yr)	CO_2 emissions (kg.CO_2/yr)
baseline	27,000	3,895
solar PV	-22,489	-2,820
ASHP (DHW)	-4,704	-712
total	-587	369
saving	27,192	3,532
	102.2%	90.5%

Table 10. calculated energy and CO_2 savings

drawing register



drawing register

The thermal model has been constructed using the following drawings.

drawing title	drawing reference	issued by	revision
Proposed Ground Floor Plan	HMCNMC-GDA-V1-00-DR-A-1010_P03	Gilling Dod	P05
Proposed Site Plan	HMCNMC-GDA-V1-ZZ-DR-A-1002	Gilling Dod	P06
Proposed Elevations	HMCNMC-GDA-V1-ZZ-DR-A-1005_P01	Gilling Dod	P01

Table 11. Drawing Register

Appendix: BRUKL documents

A: BRUKL - baseline

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	838.2	838.2
External area [m²]	2134	2134
Weather	MAN	MAN
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	354.98	485.96
Average U-value [W/m²K]	0.17	0.23
Alpha value* [%]	30.05	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
100	**Non-residential Institutions: Primary Health Care Building**
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	12.24	13.16
Cooling	0.45	0.74
Auxiliary	3.32	1.39
Lighting	8.78	11.22
Hot water	7.42	1.74
Equipment*	29.91	29.91
TOTAL**	**32.21**	**28.24**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	5.77
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*5.77*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	117.14	121.47
Primary energy [kWh_{PE}/m²]	49.4	33.78
Total emissions [kg/m²]	4.65	3.24

Page 6 of 7

A: BRUKL - LZC

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	838.2	838.2
External area [m²]	2134	2134
Weather	MAN	MAN
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Average conductance [W/K]	354.98	485.96
Average U-value [W/m²K]	0.17	0.23
Alpha value* [%]	30.05	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
100	**Non-residential Institutions: Primary Health Care Building**
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	12.24	13.16
Cooling	0.45	0.74
Auxiliary	2.85	0.45
Lighting	8.78	11.22
Hot water	1.81	0.61
Equipment*	29.91	29.91
TOTAL**	**26.13**	**26.17**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	26.83	5.77
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*26.83*	*5.77*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	117.14	121.47
Primary energy [kWh_{PE}/m²]	1.03	30.73
Total emissions [kg/m²]	0.44	2.96

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7.7 Appendix G – Thermal Comfort Report



Hawthorn Primary Care Health Centre

Hea04: Thermal Comfort Report

August 2025

Project Ref: 3280460

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We are **thermal comfort** experts

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prepared by:	Jordan Turner – Senior Building Physics & Sustainability Engineer	date: 20 08 25	sig: JTurner
checked by:	Miquel Garcia – Senior Building Physics Engineer	date: 20 08 25	sig: M Garcia
revision:	02 - CIBSE AM11 reference added	date: 28 08 25	sig: JTurner

abbreviations

ACH	-	Air Changes per Hour
APR	-	Air Permeability Rating
BREEAM	-	Building Research Establishment Environmental Assessment Method
CIBSE	-	Chartered Institution of Building Service Engineers
DSM	-	Dynamic Simulation Modelling
DSY	-	Design Summer Year
L/S	-	Litres per Second
MV	-	Mechanical Ventilation
NCM	-	Notional Calculation Method
PMV	-	Predicted Mean Vote
PPD	-	Percentage Persons Dissatisfied
VLT	-	Visible Light Transmittance

executive summary



executive summary

This report has been compiled by zed., on behalf of Silcock Leedham Consulting Engineers, to detail the results of a thermal comfort assessment for the proposed Hawthorn Primary Health Centre, Manchester.

This report supports BREEAM credit issue *Hea04: Thermal Comfort.*

Jordan Turner

Qualifications	Non-Domestic Energy Assessor (Level 3) Non-Domestic Energy Assessor (Level 4) Non-Domestic Energy Assessor (Level 5)
Telephone	0113 393 3329
Email	jordan@zed-uk.com
Accreditation scheme	CIBSE Certification Limited ▶ More information
Assessor ID	LCEA206448

zed. have undertaken a Thermal Comfort assessment for the proposed Hawthorn Primary Care Health Centre, Manchester.

Results have been derived through dynamic simulation modelling using IES Virtual Environment software version 2025.0.0.0 in accordance with CIBSE AM11 Building Energy and Performance Modelling, by a trained and accredited Level 5 Energy Assessor, Jordan Turner (LCEA206448).

In accordance with *BREEAM UK New construction Version 6.1 Hea04: Thermal Comfort* guidance, thermal comfort has been assessed against the following criteria:

1. *The thermal environment in occupied spaces meet the Category B requirements for PPD, PMV and local discomfort set out in Table A.1 of Annex A of ISO7730:2005.*
2. *in accordance with HTM03-01internal summer temperatures must not exceed 28°C dry bulb for more than 50 hours per year.*

Internal Occupancy and heat gains have been based upon a combination of FF&E drawings, the building specification, and CIBSE guidance. Simulation has been undertaken against the current and future projected CIBSE weather files for the site location as indicated in the BREEAM guidance.

	Weather Data	
Simulation	**Region**	**Variant**
Current	Manchester	2016 DSY1
Future	Manchester	2050 Medium 50th Percentile DSY2 & DSY3

Table 1. Simulation Weather Data

Results show that all occupied spaces meet the requirements for PPD, PMV and local discomfort set out in Table A.1 of Annex A of ISO7730:2005, and that internal summer temperatures do not exceed 28°C for more than 50 hours for both current and future weather data.

introduction



introduction

Thermal comfort has been assessed using dynamic thermal modelling using IES - VE software in accordance with CIBSE AM11 Building Energy and Performance Modelling.
The development is located in Fallowfield, Manchester.

The development compromises the construction of a single-story primary health centre in Fallowfield, Manchester. The facility consists of several consultant/examination rooms, admin offices and welfare facilities.

A fabric-first approach to design has been taken, comprising of low thermal U-values to reduce heat loss in winter and solar-control glazing to reduce heat gain in summer. High efficiency LED luminaires and low Specific Fan Powers (SFPs) on the ventilation systems will minimise the energy consumption associated with the fixed building services.

Heating and cooling will be provided via local low carbon technology Variable Refrigerant Flow (VRF) Air Conditioning systems. Back of house, WCs, and circulation areas will be provided with heating by direct electric panel heaters. The primary method of ventilation to the building will be natural ventilation. Areas with high occupancy or specific mechanical ventilation requirements will be served by high-efficiency heat recovery ventilation units. Toilet and changing areas will be served from various dirty extract systems.

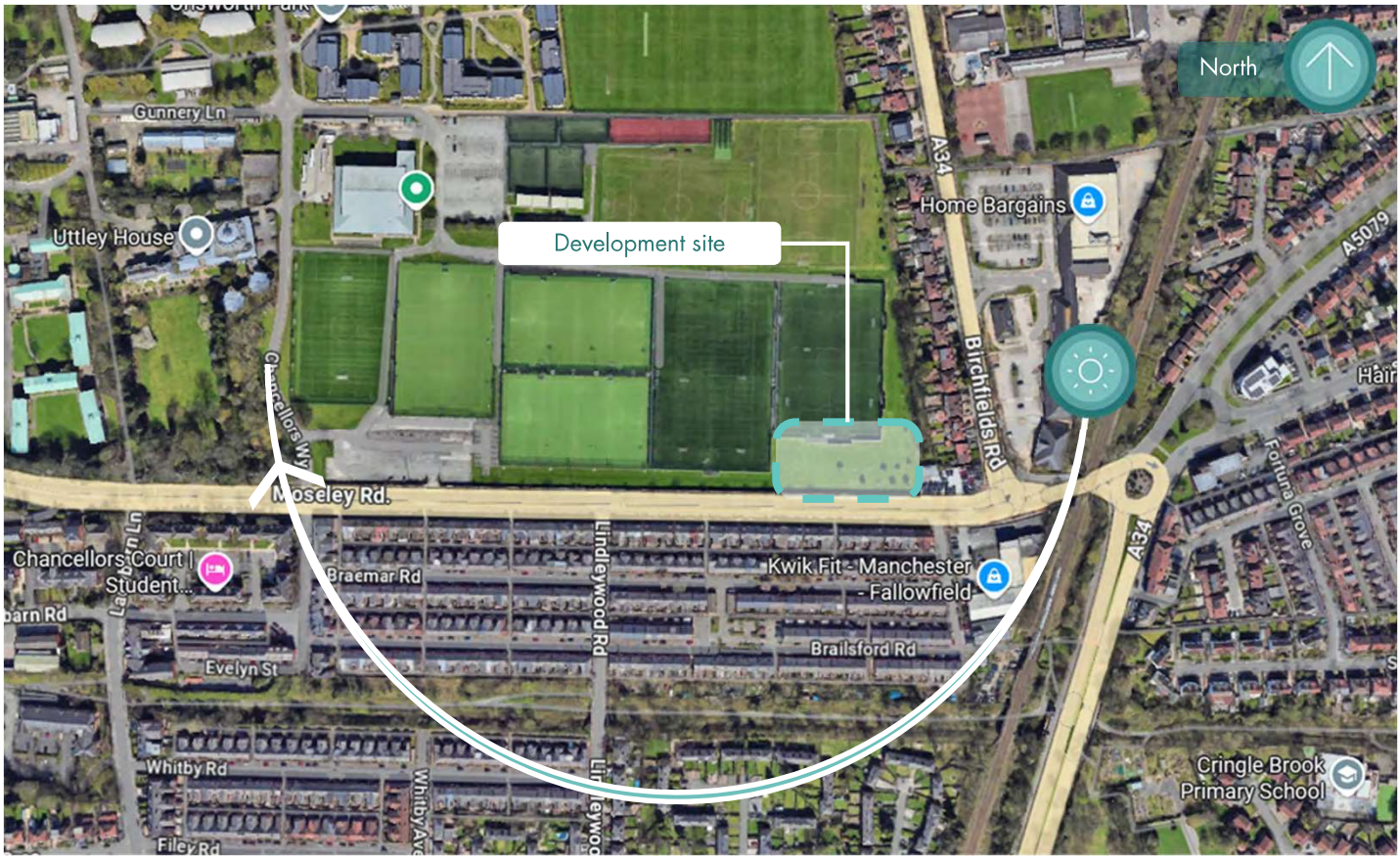


Figure 1. Site Location

methodology



methodology

Occupied areas are comfort cooled and have therefore been assessed against the recommended environmental conditions set out within CIBSE Guide A Table 1.5.

compliance criteria

Anticipated occupant comfort is based upon the Predicted Mean Vote (PMV) and Percentage of People Dissatisfied (PPD) indices. The PMV index, ranging from -3 to +3, *'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 scale'*. For comfort cooled buildings, where the PMV exceeds 0.5 it would it would be considered to be overheating. The Percentage of People Dissatisfied (PPD) is a function of PMV, as shown by the below figure. A PMV of 0.5 equates to a PPD of 10%.

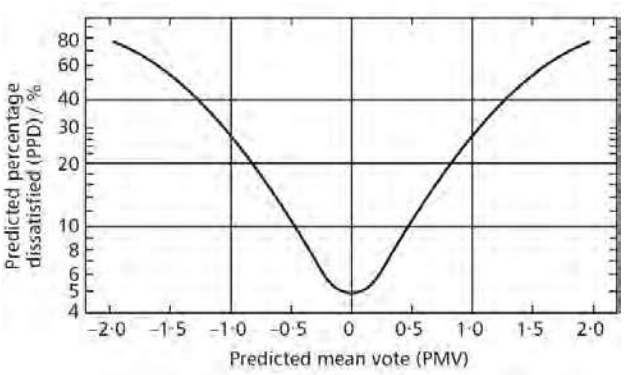


Figure 2. PPD as a function of PMV (CIBSE Guide Figure 1.4)

The recommended temperature ranges within CIBSE Guide A Table 1.5 are based upon maintaining an acceptable PPD. The centre of each range is expected to correspond to a neutral PMV based upon the stated activity rate (met) and clothing (clo).

It is suggested that a variation of ±1K within a day would attract little notice, though a change in temperature of ±2K would be noticed and might cause some complaint. An operative temperature 2K away from the optimum corresponds to approximately 0.6 units of PMV, or a PPD of 12%.

Adjustments can be made to the recommended ranges where the occupant clothing or activity differs from that expressed in CIBSE Guide A Table 1.5, or users are allowed to relax dress codes to suit their comfort. For example, a rise of 0.1met corresponds to a possible reduction in temperature of 0.6K. Conversely, a drop off 0.25clo corresponds to a possible increase in temperature of 1.5K.

thermal model



thermal model

A thermal model has been constructed by a CIBSE registered Energy Assessor and Low Carbon Consultant Jordan Turner (LCEA206448) from the architectural drawings provided, using IES-VE software version 2025.0.0.0.

geometry model

A thermal model has been constructed from the architectural drawings provided by Gilling Dod Architects.

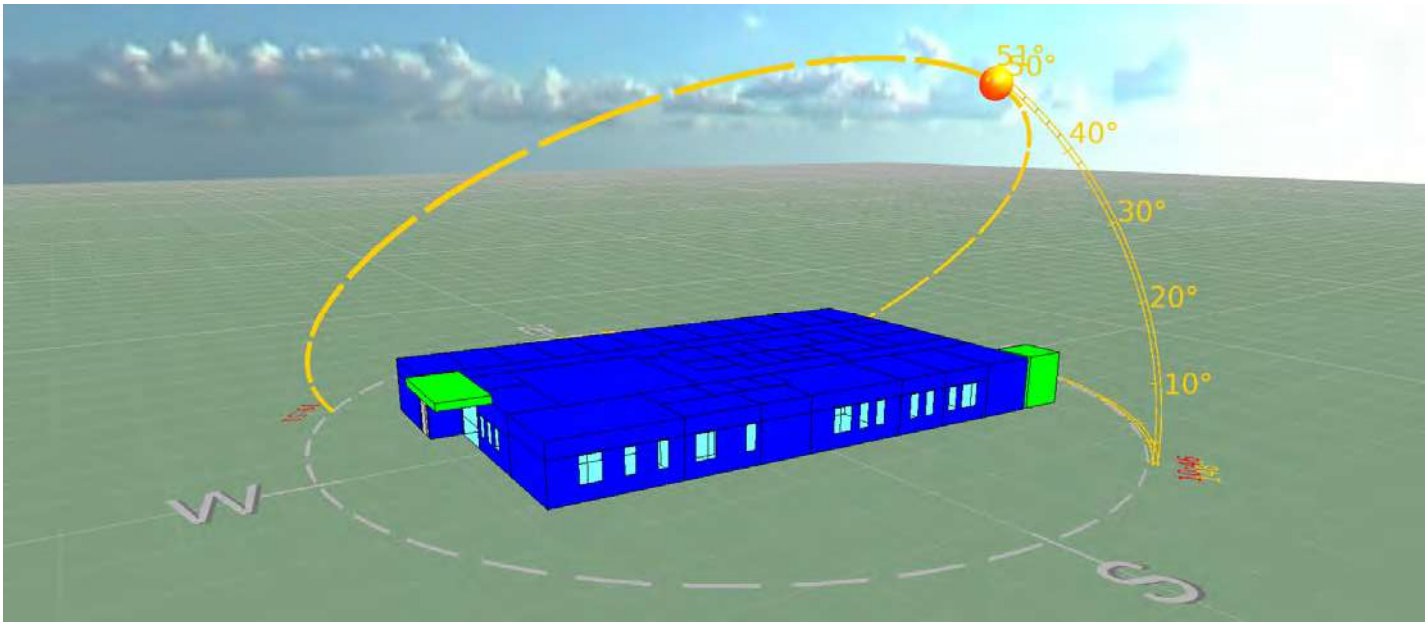


Figure 3. IES-VE thermal model geometry

building envelope

Building envelope performance has been provided by Gilling Dod Architects. The results provided within this report are achieved with the inputs detailed herein. Any amendments from these inputs will result in changes to the results of the thermal comfort assessment.

fabric & openings	U-value ($W/m^2.K$)	notes
Ground floor	0.12	
External walls	0.14	
Roof	0.12	
Windows	1.42	Solar g-value = 0.40, visible light transmittance = 0.71
Doors	1.28	
air permeability	**infiltration (ach^{-1})**	**Notes**
Entire building	0.25	Equivalent to the design target APR of 5.0m^3(hr.m^2)@50Pa.

Table 2. building envelope specification

internal gains



internal gains

Internal gains are tabulated below.

The occupancy, lighting and equipment, gains and profiles have been taken from a combination of detailed design information and guidance contained within CIBSE Guide A and Part L Volume 2 (2021 edition).

Room	Source of Heat Gain		
	Occupancy	**Lighting**	**Equip./Small Power**
Consulting/Treatment Rooms	3 People (FF&E) $90W_{sens}/60W_{lat}$ per person Diversity: None Profile: 07:00 – 19:00	7.5 W/m² (estimate) Daylight dimming Diversity: 0.82 Profile: 07:00 – 19:00	25 W/m² (estimate) Diversity: None Profile: 07:00 – 19:00
Admin Office	8 People (FF&E) $90W_{sens}/60W_{lat}$ per person Diversity: None Profile: 07:00 – 19:00	7.5 W/m² (estimate) Daylight dimming Diversity: 0.82 Profile: 07:00 – 19:00	25 W/m² (estimate) Diversity: None Profile: 07:00 – 19:00
Waiting Area	50 People (FF&E) $90W_{sens}/60W_{lat}$ per person Diversity: None Profile: 07:00 – 19:00	7.5 W/m² (estimate) Daylight dimming Diversity: 0.82 Profile: 07:00 – 19:00	5 W/m² (estimate) Diversity: None Profile: 07:00 – 19:00
Group Room	10 People (FF&E) $90W_{sens}/60W_{lat}$ per person Diversity: None Profile: 07:00 – 19:00	7.5 W/m² (estimate) Daylight dimming Diversity: 0.82 Profile: 07:00 – 19:00	25 W/m² (estimate) Diversity: None Profile: 07:00 – 19:00
Meeting Room	6 People (FF&E) $90W_{sens}/60W_{lat}$ per person Diversity: None Profile: 07:00 – 19:00	7.5 W/m² (estimate) Daylight dimming Diversity: 0.82 Profile: 07:00 – 19:00	25 W/m² (estimate) Diversity: None Profile: 07:00 – 19:00
Staff Room	8 People (FF&E) $90W_{sens}/60W_{lat}$ per person Diversity: None Profile: 07:00 – 19:00	7.5 W/m² (estimate) Daylight dimming Diversity: 0.82 Profile: 07:00 – 19:00	25 W/m² (estimate) Diversity: None Profile: 07:00 – 19:00
Isolation Room	3 People (FF&E) $90W_{sens}/60W_{lat}$ per person Diversity: None Profile: 07:00 – 19:00	7.5 W/m² (estimate) Daylight dimming Diversity: 0.82 Profile: 07:00 – 19:00	5 W/m² (estimate) Diversity: None Profile: 07:00 – 19:00
Interview Room	3 People (FF&E) $90W_{sens}/60W_{lat}$ per person Diversity: None Profile: 07:00 – 19:00	7.5 W/m² (estimate) Daylight dimming Diversity: 0.82 Profile: 07:00 – 19:00	25 W/m² (estimate) Diversity: None Profile: 07:00 – 19:00

Table 3. internal gains

results – current weather data (2016 DSY1)



results

The following results have been derived through dynamic simulation.

The below results show that occupied spaces meet the Category B requirements for PPD, PMV and local discomfort set out in Table A.1 of Annex A of ISO7730:2005.

Room Name	PMV			PPD		Pass/Fail
	Min	Max	Pass/Fail	PPD	Pass/Fail	
	Limit			Limit		
	>-0.5	<0.5		< 10%		
V1.00.002 Waiting Area	-0.30	0.31	Pass	6.96	Pass	Pass
V1.00.003 Reception	-0.31	0.31	Pass	6.97	Pass	Pass
V1.00.004 Admin	-0.31	0.31	Pass	6.94	Pass	Pass
V1.00.006 Interview Room	-0.31	0.31	Pass	6.94	Pass	Pass
V1.00.009 Interview Room	-0.30	0.31	Pass	6.94	Pass	Pass
V1.00.012 Group Room	-0.30	0.30	Pass	6.91	Pass	Pass
V1.00.013 Meeting Room	-0.30	0.43	Pass	8.79	Pass	Pass
V1.00.014 Staff Room	-0.30	0.31	Pass	6.96	Pass	Pass
V1.00.024 Isolation Room	-0.31	0.31	Pass	6.96	Pass	Pass
V1.00.029 Treatment Room 3	-0.31	0.30	Pass	6.93	Pass	Pass
V1.00.030 Treatment Room 2	-0.30	0.30	Pass	6.92	Pass	Pass
V1.00.032 Consult/Exam Room 11	-0.31	0.31	Pass	7.05	Pass	Pass
V1.00.033 Consult/Exam Room 10	-0.31	0.31	Pass	7.01	Pass	Pass
V1.00.034 Consult/Exam Room 9	-0.31	0.31	Pass	7.04	Pass	Pass
V1.00.035 Consult/Exam Room 8	-0.31	0.31	Pass	7.03	Pass	Pass
V1.00.036 Consult/Exam Room 7	-0.31	0.31	Pass	7.03	Pass	Pass
V1.00.037 Consult/Exam Room 6	-0.31	0.31	Pass	7.02	Pass	Pass
V1.00.038 Treatment Room 1	-0.32	0.32	Pass	7.18	Pass	Pass
V1.00.039 Consult/Exam Room 5	-0.31	0.31	Pass	7.03	Pass	Pass
V1.00.040 Consult/Exam Room 4	-0.31	0.31	Pass	7.01	Pass	Pass
V1.00.041 Consult/Exam Room 3	-0.31	0.31	Pass	7.01	Pass	Pass
V1.00.042 Consult/Exam Room 2	-0.31	0.31	Pass	7.03	Pass	Pass
V1.00.043 Consult/Exam Room 1	-0.31	0.31	Pass	7.06	Pass	Pass

Table 4. 2016 DSY1 PMV, PPD results

results

The following results have been derived through dynamic simulation.

The below results show that in accordance with HTM03-01internal summer temperatures do not exceed 28°C dry bulb for more than 50 hours per year.

Room Name	Dry resultant temperature - hours > 28.00 °C
V1.00.002 Waiting Area	0
V1.00.003 Reception	0
V1.00.004 Admin	0
V1.00.006 Interview Room	0
V1.00.009 Interview Room	0
V1.00.012 Group Room	0
V1.00.013 Meeting Room	0
V1.00.014 Staff Room	0
V1.00.024 Isolation Room	0
V1.00.029 Treatment Room 3	0
V1.00.030 Treatment Room 2	0
V1.00.032 Consult/Exam Room 11	0
V1.00.033 Consult/Exam Room 10	0
V1.00.034 Consult/Exam Room 9	0
V1.00.035 Consult/Exam Room 8	0
V1.00.036 Consult/Exam Room 7	0
V1.00.037 Consult/Exam Room 6	0
V1.00.038 Treatment Room 1	0
V1.00.039 Consult/Exam Room 5	0
V1.00.040 Consult/Exam Room 4	0
V1.00.041 Consult/Exam Room 3	0
V1.00.042 Consult/Exam Room 2	0
V1.00.043 Consult/Exam Room 1	0

Table 5. 2016 DSY1 hours > 28.00 °C results

results – future weather data (2050 Medium50 DSY2)



results

The following results have been derived through dynamic simulation.

The below results show that occupied spaces meet the Category B requirements for PPD, PMV and local discomfort set out in Table A.1 of Annex A of ISO7730:2005.

Room Name	PMV			PPD		Pass/Fail
	Min	Max	Pass/Fail	PPD	Pass/Fail	
	Limit			Limit		
	>-0.5	<0.5		< 10%		
V1.00.002 Waiting Area	-0.30	0.30	Pass	6.91	Pass	Pass
V1.00.003 Reception	-0.31	0.31	Pass	6.95	Pass	Pass
V1.00.004 Admin	-0.30	0.30	Pass	6.91	Pass	Pass
V1.00.006 Interview Room	-0.31	0.30	Pass	6.93	Pass	Pass
V1.00.009 Interview Room	-0.30	0.31	Pass	6.95	Pass	Pass
V1.00.012 Group Room	-0.30	0.31	Pass	6.95	Pass	Pass
V1.00.013 Meeting Room	-0.30	0.49	Pass	9.91	Pass	Pass
V1.00.014 Staff Room	-0.31	0.31	Pass	6.97	Pass	Pass
V1.00.024 Isolation Room	-0.31	0.31	Pass	6.97	Pass	Pass
V1.00.029 Treatment Room 3	-0.31	0.31	Pass	6.94	Pass	Pass
V1.00.030 Treatment Room 2	-0.31	0.31	Pass	6.95	Pass	Pass
V1.00.032 Consult/Exam Room 11	-0.31	0.31	Pass	7.04	Pass	Pass
V1.00.033 Consult/Exam Room 10	-0.31	0.31	Pass	7.02	Pass	Pass
V1.00.034 Consult/Exam Room 9	-0.31	0.31	Pass	7.01	Pass	Pass
V1.00.035 Consult/Exam Room 8	-0.31	0.31	Pass	7.01	Pass	Pass
V1.00.036 Consult/Exam Room 7	-0.31	0.31	Pass	7.01	Pass	Pass
V1.00.037 Consult/Exam Room 6	-0.31	0.31	Pass	7.00	Pass	Pass
V1.00.038 Treatment Room 1	-0.33	0.41	Pass	8.57	Pass	Pass
V1.00.039 Consult/Exam Room 5	-0.31	0.31	Pass	7.00	Pass	Pass
V1.00.040 Consult/Exam Room 4	-0.31	0.31	Pass	7.00	Pass	Pass
V1.00.041 Consult/Exam Room 3	-0.31	0.31	Pass	7.01	Pass	Pass
V1.00.042 Consult/Exam Room 2	-0.31	0.31	Pass	7.03	Pass	Pass
V1.00.043 Consult/Exam Room 1	-0.31	0.31	Pass	7.04	Pass	Pass

Table 6. 2050 DSY2 PMV, PPD results

results

The following results have been derived through dynamic simulation.

The below results show that in accordance with HTM03-01internal summer temperatures do not exceed 28°C dry bulb for more than 50 hours per year.

Room Name	Dry resultant temperature - hours > 28.00 °C
V1.00.002 Waiting Area	0
V1.00.003 Reception	0
V1.00.004 Admin	0
V1.00.006 Interview Room	0
V1.00.009 Interview Room	0
V1.00.012 Group Room	0
V1.00.013 Meeting Room	0
V1.00.014 Staff Room	0
V1.00.024 Isolation Room	0
V1.00.029 Treatment Room 3	0
V1.00.030 Treatment Room 2	0
V1.00.032 Consult/Exam Room 11	0
V1.00.033 Consult/Exam Room 10	0
V1.00.034 Consult/Exam Room 9	0
V1.00.035 Consult/Exam Room 8	0
V1.00.036 Consult/Exam Room 7	0
V1.00.037 Consult/Exam Room 6	0
V1.00.038 Treatment Room 1	0
V1.00.039 Consult/Exam Room 5	0
V1.00.040 Consult/Exam Room 4	0
V1.00.041 Consult/Exam Room 3	0
V1.00.042 Consult/Exam Room 2	0
V1.00.043 Consult/Exam Room 1	0

Table 7. 2050 DSY2 hours > 28.00 °C results

results – future weather data (2050 Medium50 DSY3)



results

The following results have been derived through dynamic simulation.

The below results show that occupied spaces meet the Category B requirements for PPD, PMV and local discomfort set out in Table A.1 of Annex A of ISO7730:2005.

Room Name	PMV			PPD		Pass/Fail
	Min	Max	Pass/Fail	PPD	Pass/Fail	
	Limit			Limit		
	>-0.5	<0.5		< 10%		
V1.00.002 Waiting Area	-0.30	0.42	Pass	8.69	Pass	Pass
V1.00.003 Reception	-0.30	0.31	Pass	6.94	Pass	Pass
V1.00.004 Admin	-0.31	0.33	Pass	7.24	Pass	Pass
V1.00.006 Interview Room	-0.30	0.30	Pass	6.93	Pass	Pass
V1.00.009 Interview Room	-0.30	0.30	Pass	6.93	Pass	Pass
V1.00.012 Group Room	-0.30	0.42	Pass	8.63	Pass	Pass
V1.00.013 Meeting Room	-0.31	0.30	Pass	6.94	Pass	Pass
V1.00.014 Staff Room	-0.31	0.31	Pass	6.96	Pass	Pass
V1.00.024 Isolation Room	-0.31	0.31	Pass	6.97	Pass	Pass
V1.00.029 Treatment Room 3	-0.30	0.30	Pass	6.91	Pass	Pass
V1.00.030 Treatment Room 2	-0.30	0.30	Pass	6.92	Pass	Pass
V1.00.032 Consult/Exam Room 11	-0.31	0.31	Pass	7.06	Pass	Pass
V1.00.033 Consult/Exam Room 10	-0.31	0.31	Pass	7.04	Pass	Pass
V1.00.034 Consult/Exam Room 9	-0.31	0.31	Pass	7.04	Pass	Pass
V1.00.035 Consult/Exam Room 8	-0.31	0.31	Pass	7.06	Pass	Pass
V1.00.036 Consult/Exam Room 7	-0.31	0.31	Pass	7.04	Pass	Pass
V1.00.037 Consult/Exam Room 6	-0.31	0.31	Pass	7.04	Pass	Pass
V1.00.038 Treatment Room 1	-0.44	0.31	Pass	9.01	Pass	Pass
V1.00.039 Consult/Exam Room 5	-0.31	0.31	Pass	7.01	Pass	Pass
V1.00.040 Consult/Exam Room 4	-0.31	0.31	Pass	7.02	Pass	Pass
V1.00.041 Consult/Exam Room 3	-0.31	0.31	Pass	7.01	Pass	Pass
V1.00.042 Consult/Exam Room 2	-0.31	0.31	Pass	7.04	Pass	Pass
V1.00.043 Consult/Exam Room 1	-0.31	0.32	Pass	7.07	Pass	Pass

Table 8. 2050 DSY3 PMV, PPD results

results

The following results have been derived through dynamic simulation.

The below results show that in accordance with HTM03-01internal summer temperatures do not exceed 28°C dry bulb for more than 50 hours per year.

Room Name	Dry resultant temperature - hours > 28.00 °C
V1.00.002 Waiting Area	0
V1.00.003 Reception	0
V1.00.004 Admin	0
V1.00.006 Interview Room	0
V1.00.009 Interview Room	0
V1.00.012 Group Room	0
V1.00.013 Meeting Room	0
V1.00.014 Staff Room	0
V1.00.024 Isolation Room	0
V1.00.029 Treatment Room 3	0
V1.00.030 Treatment Room 2	0
V1.00.032 Consult/Exam Room 11	0
V1.00.033 Consult/Exam Room 10	0
V1.00.034 Consult/Exam Room 9	0
V1.00.035 Consult/Exam Room 8	0
V1.00.036 Consult/Exam Room 7	0
V1.00.037 Consult/Exam Room 6	0
V1.00.038 Treatment Room 1	0
V1.00.039 Consult/Exam Room 5	0
V1.00.040 Consult/Exam Room 4	0
V1.00.041 Consult/Exam Room 3	0
V1.00.042 Consult/Exam Room 2	0
V1.00.043 Consult/Exam Room 1	0

Table 9. 2050 DSY3 hours > 28.00 °C results

conclusion



conclusion

Thermal comfort has been assessed in accordance with BREEAM credit issue *Hea04: Thermal Comfort.*

Results show that all occupied spaces meet the requirements for PPD, PMV and local discomfort set out in Table A.1 of Annex A of ISO7730:2005, and that internal summer temperatures do not exceed 28°C for more than 50 hours for both current and future weather data.

zed. have undertaken a Thermal Comfort assessment for the proposed Hawthorn Primary Care Health Centre, Manchester.

Results have been derived through dynamic simulation modelling using IES Virtual Environment software version 2025.0.0.0 by a trained and accredited Level 5 Energy Assessor, Jordan Turner (LCEA206448).

In accordance with *BREEAM UK New construction Version 6.1 Hea04: Thermal Comfort* guidance, thermal comfort has been assessed against the following criteria:

1. *The thermal environment in occupied spaces meet the Category B requirements for PPD, PMV and local discomfort set out in Table A.1 of Annex A of ISO7730:2005.*
2. *in accordance with HTM03-01internal summer temperatures must not exceed 28°C dry bulb for more than 50 hours per year.*

Internal Occupancy and heat gains have been based upon a combination of FF&E drawings, the building specification, and CIBSE guidance. Simulation has been undertaken against the current and future projected CIBSE weather files for the site location as indicated in the BREEAM guidance.

Results show that all occupied spaces meet the requirements for PPD, PMV and local discomfort set out in Table A.1 of Annex A of ISO7730:2005, and that internal summer temperatures do not exceed 28°C for more than 50 hours for both current and future weather data.

drawing register



drawing register

The thermal model has been constructed using the following drawings.

drawing title	drawing reference	issued by	revision
Proposed Ground Floor Plan	HMCNMC-GDA-V1-00-DR-A-1010_P03	Gilling Dod	P05
Proposed Site Plan	HMCNMC-GDA-V1-ZZ-DR-A-1002	Gilling Dod	P06
Proposed Elevations	HMCNMC-GDA-V1-ZZ-DR-A-1005_P01	Gilling Dod	P01

Table 10. Drawing Register

Our Services

We offer a wide range of high-quality building performance advice and evaluation,
Sustainability & Net Zero Carbon Consultancy.
We work across all construction sectors in the UK, Europe and Worldwide.



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7.8 Appendix H – Embodied Carbon Assessment



Hawthorn Primary Care Health Centre

RIBA Stage 2 Life Cycle Assessment (LCA) for BREEAM Mat 01

September 2025

Project Ref: 3280516

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We are **daylighting** experts

We are **thermal comfort** experts

We are **life cycle analysis** experts

We are **sustainability** experts

We are **building physics** experts

We are **zero carbon** experts

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abbreviations

ACH	-	Air Changes per Hour
ASHP	-	Air Source Heat Pump
CLT	-	Cross Laminated Timber
CIBSE	-	Chartered Institution of Building Services Engineers
COP	-	Coefficient Of Performance
DHW	-	Domestic Hot Water
EPD	-	Type III Environmental Declaration
EUI	-	Energy Use Intensity
GGBS	-	Ground Granulated Blast-furnace Slag
GIFA/GIA	-	Gross Internal Floor Area/Gross Internal Area
GSHP	-	Low Energy Transformation Initiative
GWP	-	Global Warming Potential
LCA	-	Life Cycle Assessment
LETI	-	London Energy Transformation Initiative
MM	-	Mixed Mode (Ventilation)
MVHR	-	Mechanical Ventilation with Heat Recovery
PV	-	Photo Voltaic (panels)
RC	-	Reinforced Concrete
RIBA	-	Royal Institute of British Architects
RICS	-	Royal Institute of Chartered Surveyors
SFS	-	Steel Frame System
SHD	-	Space Heating Demand
WLC	-	Whole Life Carbon

executive summary

executive summary

This report has been compiled by zed. on behalf of Gilling Dod, to provide a summary of inputs and results of the Life Cycle Assessment, at RIBA stage 2, for the proposed Hawthorn Primary Care Health Centre.

LCA provides evidence for BREEAM Mat 01 – superstructure comparison and substructure and hard landscaping comparison, including options appraisals for both. Core building services options have not been included within this assessment as the credit is not being targeted.

The study has been conducted in accordance with ISO 14044 and EN15978. The software used was One Click LCA, an approved software for the BREEAM UK Mat 01 credits by BRE.

zed. have undertaken a component level life cycle assessment at RIBA stage 2 for Hawthorn Primary Care Health Centre as part of the evidence for BREEAM credit Mat 01. This assessment evaluates the life cycle carbon associated with the superstructures only, to reduce the projects' environmental impact at all stages, from construction to building use.

The report outlines the methodology, inputs and results of the LCA, including options appraisals, considering solutions for the buildings' superstructure, substructure and hard landscaping. Building services options have not been included within this assessment.

A total of 3 credits are achieved under BREEAM NC 2018 Mat01. The breakdown of these credits is in Tables 1 & 2 below. Tables 1 - 3 present a summary of the results of this LCA.

This report has been undertaken during Concept Design (RIBA stage 2).

option	group element	$kgCO_2e/m^2$ NIA	credit(s) *
Mat01_CD_SuperS_Opt1 (option 1)	2. superstructure	369.332	**2**
Mat01_CD_SuperS_Opt2 (option 2)	2. superstructure	445.315	-

Table 1 . Hawthorn Primary Care Health Centre total carbon at Concept Design per group element for chosen design option

Option	group element	$kgCO_2e/m^2$ NIA	credit(s) *
Mat01_CD_SubS_HL_Opt1 (option 1)	1. superstructure, 5. external areas and site elements	220.183	**1**
Mat01_CD_SubS_HL_Opt2 (option 2)	1. superstructure, 5. external areas and site elements	261.586	-
Mat01_CD_SubS_HL_Opt3 (option 3)	1. superstructure, 5. external areas and site elements	215.359	-
Mat01_CD_SubS_HL_Opt4 (option 4)	1. superstructure, 5. external areas and site elements	231.474	-
Mat01_CD_SubS_HL_Opt5 (option 5)	1. superstructure, 5. external areas and site elements	213.000	-
Mat01_CD_SubS_HL_Opt6 (option 6)	1. superstructure, 5. external areas and site elements	243.262	-

Table 2 . Hawthorn Primary Care Health Centre total carbon at Concept Design per group element for chosen design option

*3rd party / BREEAM assessor verification required.

executive summary

LCA results	value	unit
operational carbon	**n/a**	$kgCO_2e/m^2$
embodied carbon (whole life)	**589.515**	$kgCO_2e/m^2$
upfront carbon (A1 - A5)	**511.401**	$kgCO_2e/m^2$
energy use – space heating	**n/a**	kWh/m^2 GIA .yr
EUI (exc. renewable energy contribution)	**n/a**	kWh/m^2 GIA .yr
Global Warming Potential (GWP)	**n/a**	$kgCO_2e/m^2$

Table 3. Collective results summary for chosen design option of Hawthorn Primary Care Health Centre at RIBA Stage 2

*3rd party / BREEAM assessor verification required.

introduction

introduction

A Life Cycle Assessment, at RIBA stage 2, for the proposed Hawthorn Primary Care Health Centre is being carried out to provide evidence for UK BREEAM Mat 01 credits.

The development is located in Fallowfield, Manchester.

The development of Hawthorn Primary Care Health Centre involves the construction of a single-storey primary health facility in Fallowfield, Manchester. The building will comprise several consultant and examination rooms, administrative offices, and welfare facilities.

A fabric-first design approach has been adopted, featuring low thermal U-values to reduce heat loss in winter and solar-control glazing to limit heat gain in summer. High-efficiency LED luminaires, an efficient VRF system, and low Specific Fan Powers (SFPs) for the ventilation systems will help minimise the energy consumption associated with the building's fixed services.

At RIBA Stage 2, this assessment aims to ensure that, in addition to reducing operational energy consumption, the building's design considers its full life cycle. This report explores a range of design options, comparing their embodied carbon impacts.



Figure 1. Site Location

introduction

As buildings become more energy efficient, with low-energy technologies and building systems becoming more commonplace, operational carbon emissions are making up a smaller portion of development's whole life cycle carbon emissions. It is vital to not only minimise operational carbon in new and existing buildings, but to take active steps in reducing carbon emissions associated with other aspects of a development's life cycle, specifically the embodied carbon emissions.

life cycle assessment (LCA)

LCAs offer a comprehensive tool which considers every contributing factor to whole-life carbon values from raw material extraction and construction, to building use and eventual disposal. Carrying out an LCA can assist design teams in taking measures towards minimising the carbon impact a project might have on the built environment.

This LCA for BREEAM Mat 01 explores options for the Superstructure at the concept Design stage (RIBA stage 2), with options appraisals for concrete and steel frames. Substructure, CBS and hard landscaping have not been considered at this stage.

embodied carbon is the carbon within a building, produced from raw material extraction and processing, manufacture, transportation and assembly, to disposal and end-of-life management of all assets and components. Carbon figures associated with the maintenance and replacement of building components are also included.

operational carbon is the CO_2 and equivalent GWP of other gases associated with the operation of a building. This is referred to as 'carbon' and presented in units of CO_2 equivalent ($kgCO_2e$). Operational carbon considers carbon associated with heating, hot water, cooling, ventilation, and lighting systems, and emissions from energy uses such as cooking, equipment, and lifts. The carbon content of the electricity grid is also accounted for.

energy use intensity is a measure of the total energy consumed in a building each year (kWh/m^2 GIA .yr). It is a good indicator of building performance as it solely measures energy use, rather than measuring carbon. EUI can be estimated at the design stage and can be easily monitored in-use, in order to assess how much energy a building consumes.

introduction

This breakdown of a built asset's life cycle reflects the modular approach outlined in the RICS methodology.

One Click LCA only produces data for modules A1-A4, B1-B5, C1-C4 to be included in the Mat 01 submission.

As the concept design for Hawthorn Primary Care Health Centre progresses, components of the building will be defined with increased levels of precision, offering potential for a more accurate LCA reporting.

The modular life cycle stages from the RICS are as follows:

A1 - A3, material impacts up to product stage

A4 - A5, on-site construction, including product transportation

B1 – B7, operational energy and water use, maintenance, replacement and building refurbishment

C1 - C4, end of life, including demolition and disposal processes

D, potential environmental benefits or burdens of materials beyond the life of the project

Table 4 shows the life cycle stages considered for this assessment, in line with the BREEAM requirements.

product stage			construction process stage		use stage							end-of-life stage				benefits and loads beyond the system boundary		
module A			module A		module B							module C				module D		
raw material supply	transport	manufacturing	transport to Building site	installation to building	use/application	maintenance	repair	replacement	refurbishment	operational energy use	operational water use	deconstruction/demolition	transport	waste processing	disposal	reuse	recovery	recycling
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	D	D
✓	✓	✓	✓	×	✓	✓	✓	✓	✓	×	×	✓	✓	✓	✓	×	×	×

Table 4. life-cycle stages included for LCA for Hawthorn Primary Care Health Centre

methodology

methodology

This portion of the report outlines the use of One Click LCA, the input procedure and data used, including limitations of the software and subsequent assessment.

The BREEAM UK New Construction – Mat 01 methodology has been followed for this assessment.

The LCA assessment uses the Royal Institute of Chartered Surveyors (RICS) methodology and adopts a 60-year life cycle.

The methodology followed in preparing this report is in keeping with the RICS professional statement for undertaking detailed carbon assessments, which follows the European standard EN 15978.

The results of the LCA have been exported and have been linked to the BREEAM Mat 01/02 Results Submission Tool and provided as part of the evidence package to achieve the relevant credits.

quality requirements

This assessment has been carried out using material specifications provided by the design team where possible, in line with 'Table 9.4 LCA quality requirements' in Mat 01.

Generic material constructions and systems information has been used where project specific information has not been provided. In cases where more detailed information is available, the closest component in the LCA tool has been selected.

The impacts for building material transportation, construction site operations and end-of-life impacts of each material have been included automatically by the database where appropriate using average scenarios for chosen materials. The LCA has been carried out using EPDs in accordance with BS EN 15804, ISO 14025 and ISO 14040/44.

In line with the requirements of Mat 01 construction site impacts, water use, and operational energy have not been included in the concept design stage assessment.

methodology

The tool used for this assessment is One Click LCA, which follows BS EN 15978 and is IMPACT-compliant and BRE certified. One Click LCA has been used to estimate the WLC values and offers a detailed carbon analysis and life cycle impacts, providing comprehensive results in both numerical and graphical forms.

One Click LCA

Within One Click LCA quantity information is input for each building element/building system based on information provided by the design team. After inputting quantity information for each design option, they can be compared against each other allowing for a robust calculation to be carried out. At the concept design stage (RIBA stage 2) different design options for Superstructure are considered. This assessment also explores substructure and hard landscaping

In line with BREEAM Mat 01 core building services are not assessed as part of this component level options appraisal.

scope of analysis

The LCA for Hawthorn Primary Care Health Centre covers the full life cycle of the building according to EN 15978 and outlines modules A1-A3, A4, B1-B5, and C1-C4 separately – reflecting 'cradle to grave'.

Carbon values associated with clearance of the project site (prior to works beginning for the Hawthorn Primary Care Health Centre) are not considered within this LCA as they are not required for Mat 01. In line with the guidelines for the Mat 01 credits for new build projects, this LCA will consider project commencement on a flat, cleared site.

As well as the six credits targeted for the superstructure analysis, a further credit is being targeted for analysis of the substructure and hard landscaping.

methodology

options analysis

To achieve maximum BREEAM credits, options appraisals have been conducted. These are outlined below and presented fully in the 'design options' section of this report.

An options appraisal has been carried out for two superstructure options and six substructure and hard landscaping options.

superstructure

Option 1: Horizontal steel members (+10% secondary steelwork), vertical steel members (+10% secondary steelwork). Beam and block ground floor construction, insulation and screed. Hollowcore slab roof, insulation, single ply membrane. SFS Studs, weather defence board, rockwool duo slab, brickwork external walls. Double glazed windows.

Option 2: Horizontal steel members (+10% secondary steelwork), vertical steel members (+10% secondary steelwork). Reinforced concrete slab, insulation and screed. Trapezoidal metal deck, in-situ concrete, insulation, single ply membrane roof. Weather defence board, brick and block cavity wall. Double glazed windows.

Substructure and hard landscaping

Option 1: Shallow strip, pad foundations, retaining wall bases, beam and block slab. Asphalt, Tobermore paving blocks, dropped kerb, tactile paving

Option 2: Shallow strip, pad foundations, retaining wall bases, reinforced concrete, 6F2 fill material. Asphalt, cast reinforced concrete, dropped kerb, tactile paving

Option 3: Shallow strip, pad foundations, retaining wall bases, beam and block slab. Asphalt, dropped kerb, tactile paving

Option 4: Shallow strip, pad foundations, retaining wall bases, beam and block slab. Asphalt, cast reinforced concrete, dropped kerb, tactile paving

Option 5: Shallow strip, pad foundations, retaining wall bases, beam and block slab. Asphalt, cast reinforced concrete, dropped kerb, tactile paving

Option 6: Pile foundations, ground beams, retaining wall beam and block slab. Asphalt, paving blocks, dropped kerb, tactile paving

methodology

out of scope elements

For the Mat 01 submission, only component evaluations are reported, excluding any out-of-scope elements input into One Click LCA. Out of scope elements include:

- 2.7 internal walls and partitions
- 5.4 water installations
- 5.8 electrical installations
- 3.2 floor finishes

See BREEAM UK New Construction concept manual for non-domestic buildings (SD5078 – issue 3.0) - Mat 01, table 9.5, 9.6 and 9.7 for a complete list of 'out of scope' elements.

design options

design options

This assessment involves the calculation of the embodied carbon associated with different Superstructure design options. For each option, the materials selected are considered suitable for the building by the design team.

superstructure

Table 5. below outlines details of material and component selections for the Superstructure for each option.

Option 1: Horizontal steel members (+10% secondary steelwork), vertical steel members (+10% secondary steelwork). Beam and block ground floor construction, insulation and screed. Hollowcore slab roof, insulation, single ply membrane. SFS Studs, weather defence board, rockwool duo slab, brickwork external walls. Double glazed windows.

Option 2: Horizontal steel members (+10% secondary steelwork), vertical steel members (+10% secondary steelwork). Reinforced concrete slab, insulation and screed. Trapezoidal metal deck, in-situ concrete, insulation, single ply membrane roof. Weather defence board, brick and block cavity wall. Double glazed windows.

superstructure		
building element	option 1	option 2
	Steel Frame Beam and block slab, insulation, screed Hollowcore roof, insulation, single ply SFS Stud walls, weather defence board, rockwool insulation, brickwork Double glazed windows	Steel Frame (additional steel beams) Reinforced concrete slab, insulation, screed Metal deck, in-situ concrete, insulation Weather board, brick and block cavity wall Double glazed windows
2.1 frame	27 tonnes horizontal steel members (+10% secondary steelwork) 10.8 tonnes vertical steel members (+10% secondary steelwork)	32.4 tonnes horizontal steel members (+10% secondary steelwork) 10.8 tonnes vertical steel members (+10% secondary steelwork)
2.2 floors	Beam and block construction, insulation and screed	Reinforced concrete slab, insulation and screed
2.3 roofs	Hollowcore slab, insulation, single ply membrane	Trapezoidal metal deck, in-situ concrete, insulation, single ply membrane
2.5 external walls	SFS Studs, weather defence board, rockwool duo slab, brickwork	Weather defence board, brick and block cavity wall
2.6 windows & doors	Double glazing (aluminium frame)	Double glazing (aluminium frame)

Table 5. Hawthorn Primary Care Health Centre superstructure specification for design options 1 - 2

design options

This assessment involves the calculation of the embodied carbon associated with different substructure and hard landscaping design options. For each option, the materials selected are considered suitable for the building by the design team.

Substructure and hard landscaping

Table 6. below outlines details of material and component selections for the substructure and hard landscaping for each option.

Option 1: Shallow strip, pad foundations, retaining wall bases, beam and block slab. Asphalt, Tobermore paving blocks, dropped kerb, tactile paving

Option 2: Shallow strip, pad foundations, retaining wall bases, reinforced concrete, 6F2 fill material. Asphalt, cast reinforced concrete, dropped kerb, tactile paving

Option 3: Shallow strip, pad foundations, retaining wall bases, beam and block slab. Asphalt, dropped kerb, tactile paving

Option 4: Shallow strip, pad foundations, retaining wall bases, beam and block slab. Asphalt, cast reinforced concrete, dropped kerb, tactile paving

Option 5: Shallow strip, pad foundations, retaining wall bases, beam and block slab. Asphalt, cast reinforced concrete, dropped kerb, tactile paving

Option 6: Pile foundations, ground beams, retaining wall beam and block slab. Asphalt, paving blocks, dropped kerb, tactile paving

substructure and hard landscaping						
building element	option 1	option 2	option 3	option 4	option 5	option 6
	Strip, pad, retaining wall, beam and block Asphalt and masonry block	Strip, pad, retaining wall, cast concrete floor slab Asphalt and masonry block	Strip, pad, retaining wall, beam and block Asphalt, masonry block and tarmac footpath	Strip, pad, retaining wall, beam and block Asphalt, masonry block and block paving footpath	Strip, pad, retaining wall, beam and block Asphalt and concrete footpath	Pile Foundations, ground beams, retaining wall beam and block Asphalt and masonry block
1.1.1 Foundations and sub-structure	Shallow strip, pad foundations, retaining wall, beam and block slab	Shallow strip, pad foundations, retaining wall bases, reinforced concrete, 6F2 fill material	Shallow strip, pad foundations, retaining wall, beam and block slab	Shallow strip, pad foundations, retaining wall, beam and block slab	Shallow strip, pad foundations, retaining wall, beam and block slab	Pile foundations, ground beams, retaining wall beam and block slab
8.2.1 Roads, paths and pavings	Asphalt, paving blocks, dropped kerb, tactile paving	Asphalt, paving blocks, dropped kerb, tactile paving	Asphalt, dropped kerb, tactile paving	Paving blocks, dropped kerb, tactile paving	Asphalt, cast reinforced concrete, dropped kerb, tactile paving	Asphalt, paving blocks, dropped kerb, tactile paving

Table 6. Hawthorn Primary Care Health Centre superstructure specification for design options 1 - 6

results & appraisal - superstructure

results – superstructure

This section presents the results of the BREEAM Mat 01 Results Submission Tool LCA, showing the carbon values, ecopoints and respective credits output from the tool.

BREEAM Mat01 results

An ecopoint is the unit of measure of the environmental impact of a building. The ecopoint score is a single value obtained from the combined results of a life cycle assessment against the 13 impact categories identified in the BRE Environmental Profile methodology.

BREEAM benchmark

A benchmark comparison cannot be carried out for healthcare buildings.

options appraisals

The following table outlines the total embodied carbon for the chosen option (in $kgCO_2e/m^2$ NIA) and the BREEAM credits awarded by the Mat 01 submission tool.

option	$kgCO_2e/ m^2$ NIA	credit(s) *
Mat01_CD_SuperS_Opt1 (superstructure option 1)	369.332	**2**

Table 7 Hawthorn Primary Care Health Centre total carbon at Concept Design stage per group element for chosen design data.

*3rd party / BREEAM assessor verification required.

results – superstructure

This section outlines the results of the LCA.

upfront & embodied carbon

Upfront carbon covers modules A1-A4.

Total embodied carbon values cover modules A1-A4, B1-B5, C1-C4.

superstructure

Table 8 (below) shows the results for the two superstructure design options, where the chosen option (option 1) has been highlighted in green. Only carbon values associated with in-scope superstructure (group 2 elements) have been included in this figure.

Superstructure option 1 has the lowest embodied and upfront carbon values of the two presented options. It has been considered the most appropriate design choice.

Factors including reduced carbon emissions of a steel frame with fewer members, insulated SFS stud wall with a single layer of brickwork rather than a brick and block cavity wall have influenced the decision by the design team to proceed option 1. The design offers a more practical solution, as well as one with lower life cycle carbon consumption.

superstructure design option	description	upfront carbon A1-A4	total embodied carbon	total - difference against chosen option
option 1 (Chosen)	Steel Frame Beam and block slab, insulation, screed Hollowcore roof, insulation, single ply SFS Stud walls, weather defence board, rockwool insulation, brickwork Double glazed windows	253.086	369.332	**n/a**
option 2	Steel Frame (additional steel beams) Reinforced concrete slab, insulation, screed Metal deck, in-situ concrete, insulation Weather board, brick and block cavity wall Double glazed windows	392.050	445.315	**20.57%**

Table 8. Hawthorn Primary Care Health Centre embodied carbon estimations for superstructure design options (carbon unit - $kgCO_2e/m^2$ GIA)

results & appraisal - substructure and hard landscaping

results – substructure and hard landscaping

This section presents the results of the BREEAM Mat 01 Results Submission Tool LCA, showing the carbon values, ecopoints and respective credits output from the tool.

BREEAM Mat01 results

An ecopoint is the unit of measure of the environmental impact of a building. The ecopoint score is a single value obtained from the combined results of a life cycle assessment against the 13 impact categories identified in the BRE Environmental Profile methodology.

BREEAM benchmark

A benchmark comparison cannot be carried out for healthcare buildings.

options appraisals

The following table outlines the total embodied carbon for the chosen option (in $kgCO_2e/m^2$ NIA) and the BREEAM credits awarded by the Mat 01 submission tool.

option	$kgCO_2e/ m^2$ NIA	credit(s) *
Mat01_CD_SubS_HL_Opt1 (option 1) (substructure and hard landscaping option 1)	220.183	1

Table 9. Hawthorn Primary Care Health Centre total carbon for substructure and hard landscaping at Concept Design stage per group element for chosen design data.

*3rd party / BREEAM assessor verification required.

results – substructure and hard landscaping

This section outlines the results of the LCA.

upfront & embodied carbon

Upfront carbon covers modules A1-A4.

Total embodied carbon values cover modules A1-A4, B1-B5, C1-C4.

substructure and hard landscaping

Table 10 (below) shows the results for the six substructure and hard landscaping design options, where the chosen option (option 1) has been highlighted in green. Only carbon values associated with in-scope substructure and hard landscaping elements have been included in this figure.

Option 1 has the lowest embodied and upfront carbon values of the six presented options. It has been considered the most appropriate design choice.

Factors including reduced carbon emissions of shallow foundations and minimisation of concrete usage have influenced the decision by the design team to proceed option 1. The selected design has required no compromising on aesthetics and functionality of the landscaping.

superstructure design option	description	upfront carbon A1-A4	total embodied carbon	total - difference against chosen option
option 1 (Chosen)	Strip, pad, retaining wall, beam and block Asphalt and masonry block	192.580	220.183	**n/a**
option 2	Strip, pad, retaining wall, cast concrete floor slab Asphalt and masonry block	232.854	261.586	**18.80%**
option 3	Strip, pad, retaining wall, beam and block Asphalt, masonry block and tarmac footpath	177.767	215.359	**-2.19%**
option 4	Strip, pad, retaining wall, beam and block Asphalt, masonry block and block paving footpath	227.250	231.474	**5.13%**
option 5	Strip, pad, retaining wall, beam and block Asphalt and concrete footpath	185.280	213.000	**-3.26%**
option 6	Pile Foundations, ground beams, retaining wall beam and block Asphalt and masonry block	215.478	243.262	**10.48%**

Table 10. Hawthorn Health Centre embodied carbon estimations for substructure and hard landscaping design options (carbon unit - $kgCO_2e/m^2$ GIA)

appendix A1: BREEAM Mat01 tool

Appendix – superstructure

BREEAM Mat01 submission tool - superstructure (Concept Design)

BREEAM UK NC (2018) Mat 01/02 Results Submission Tool

BREEAM UK delivered by bre

Technical Design Sheet | MAT 02 EPD schedule sheet | IMPORTANT NOTE *

Building LCA during Concept Design (and pre detailed planning approval)

Assessment details

BREEAM assessment building use type:	Healthcare
Is the project part new-build, part refurbishment OR defined as a BREEAM 'Simple Building'?	No
Functional quantity 1 during Concept Design (number of bed spaces (hospitals)/consulting rooms (doctors'/dentists' surgeries)):	14
Functional quantity 2 during Concept Design (m2 net internal area):	801.447
Has comparison with the BREEAM benchmark during Concept Design been done? Select tool used or leave blank: Tools	

Has superstructure option appraisal during Concept Design been done?	Yes
Has substructure and hard landscaping options appraisal during Concept Design been done?	Yes
Has core building services options appraisal during Concept Design been done?	No
Tool to use for options appraisal during Concept Design: Tools	One Click LCA (LCA for BREEAM UK)
Range of indicators provided by tool:	CO2e AND other environmental categories.
Tool recognised by BREEAM for superstructure option appraisal during Concept Design:	Yes
Tool recognised by BREEAM for substructure and hard landscaping options appraisal during Concept Design:	Yes
Tool Recognised by BREEAM for core building services options appraisal during Concept Design:	Yes
Environmental impact indicator used for comparisons:	Kg CO2e

Superstructure - Comparison with the BREEAM benchmark

Comparion with the benchmark not done. This section n/a. A blank 'Mat01_CD_SuperS_B' data file shall be saved in the same folder as this file.

Design option ID	Design option Name	Option data file link	m2 net internal area	BRE EN ecopoints/m2 net internal area (60 year study period) 2.1 Frame	2.2 Upper floors	2.3 Roof	2.4 Stairs and ramps	2.5 External walls	2.6 Windows and external	2.7 Internal walls and	Total

Result from tool (BRE EN ecopoints / m2 NIA):	
Benchmark value for this building type (BRE EN ecopoints / m2 NIA):	
Percentage better than benchmark:	
Credits awarded:	

Superstructure - Options appraisal summary table

Complete rows '1D 1' and '1D 2' or more (according to the number of options done) in the following table base on option data files from the 'One Click LCA (LCA for BREEAM UK)' tool. The completed data files shall be saved in the same folder as this file.

Design option ID	Design option Name	Option data file link	number of bed spaces (hospitals)/ consulting rooms (doctors'/d	Kg CO2e/number of bed spaces (hospitals)/consulting rooms (doctors'/dentists' surgeries) (60 year study period) 2.1 Frame	2.2 Upper floors	2.3 Roof	2.4 Stairs and ramps	2.5 External walls	2.6 Windows and external	2.7 Internal walls and	Total	Description of changes sheet link	Option chosen, and summary reasons for not choosing the other options (Further details provided in description of change sheets)	The following is completed for this option: - - The option data file - The Description of changes sheet
1	Mat01_CD_SuperS_Opt1	Link	14	6433.38	8054.83	9589.35	0.00	2412.06	492.54	Not in scope	20982.16	N/A - 1st option	CHOSEN OPTION	Yes
2	Mat01_CD_SuperS_Opt2	Link	14	7353.04	3640.95	10223.31	0.00	3616.08	492.54	Not in scope	25331.92	Link	Prevented another sustainability factor being achieved	Yes
3	Mat01_CD_SuperS_Opt3	Link	14	0.00	0.00	0.00	0.00	0.00	0.00	Not in scope	0.00	Link	Other	No
4	Mat01_CD_SuperS_Opt4	Link	14	0.00	0.00	0.00	0.00	0.00	0.00	Not in scope	0.00	Link	Other	No

Concept Design option ID chosen ('CHOSEN OPTION' selected):	1
Question n/a - leave blank:	Yes

Options appraised	2
Credits awarded	**2.00**

Appendix – substructure and hard landscaping

BREEAM Mat01 submission tool – substructure and hard landscaping (Concept Design)

Substructure and hard landscaping - Options appraisal summary table

Complete rows '10 5' to '10 10' in the following table. The completed data files shall be saved in the same folder as this file.

Design option		Option data file link	number of bed spaces (hospitals)/ consulting rooms (doctors'/d	Kg CO2e/number of bed spaces (hospitals)/consulting rooms (doctors'/dentists' surgeries) (60 year study period)							Description of changes sheet link	Option chosen, and summary reasons for not choosing the other options (Further details provided in description of change sheets)	The following is completed for this option:- - The option data file - The Description of changes sheet
ID	Name			1.0 Substructure	0.2 Roads, paths and pavings	n/a	n/a	n/a	n/a	n/a	Total			
5	Mat01_CD_SubS_HL_Opt1	Link	14	8526.48	4078.15						12604.63	N/A - Substructure 1st option	CHOSEN OPTION	Yes - Substructure
6	Mat01_CD_SubS_HL_Opt2	Link	14	10896.66	4078.15						14974.81	N/A - Hard landscaping 1st option	CHOSEN OPTION	Yes - Hard landscaping
7	Mat01_CD_SubS_HL_Opt3	Link	14	8526.48	3801.99						12328.48	Link	Aesthetic preference for other option	Yes - Hard landscaping
8	Mat01_CD_SubS_HL_Opt4	Link	14	8526.48	4724.51						13250.99	Link	Other	Yes - Hard landscaping
9	Mat01_CD_SubS_HL_Opt5	Link	14	8526.48	3666.95						12193.44	Link	Aesthetic preference for other option	Yes - Hard landscaping
10	Mat01_CD_SubS_HL_Opt6	Link	14	9847.71	4078.15						13925.85	Link	Other	Yes - Substructure

Concept Design option ID chosen ('CHOSEN OPTION' selected):	5
Concept Design hard landscaping option selected:	6
Credits awarded	**1.0**

Concept Design results

Total credit score at Concept Design:	**3**

Submission of the BREEAM MAT 01/02 Results Submission Tool to BREEAM by the end of Concept Design

Confirm the following (which comprise the BREEAM Mat 01/02 Results Submission Tool) are included and that the submission method is understood: -

This file.	Yes
The 'Mat01_CD_SuperS_B.xlsx' data file and all the associated option data files (including files that are not used).	Yes
The method for submission to BREEAM is to upload to BREEAM Projects. It may not be checked by BREEAM (unless and until the assessment undergoes Q.A).	Yes
Date the above sent to BREEAM during Concept Design:	04/01/2023

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