

Land adjacent to Windhover Roundabout, Bursledon

BREEAM ENE04 Passive Design Analysis



Land adjacent to Windhover Roundabout, Bursledon



BREEAM ENE 04 – Passive Design Analysis

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Executive Summary



This document has been prepared by Ramboll on behalf of Wates to support the outline planning application (all matters reserved except for access) for employment development (Use Class B2/B8) of up to 18,580 square metres together with ancillary offices (Use Class E(g)(iii)) and other ancillary buildings, structures, parking, servicing and manoeuvring areas, landscaping and sustainable urban drainage features, following demolition of existing buildings. Hereafter referred as the ‘Proposed Development’.

This report demonstrates the energy demand reduction generated through the adoption of passive design measures to satisfy the requirements of the BREEAM UK NC V6.1.

The Proposed Development has incorporated a sustainable design and construction philosophy that meets best practice levels for science-based facilities, by developing a strategy of passive design features, consideration of energy efficient building services and low carbon technologies that have been demonstrated via IES Virtual Environment energy modelling.

The passive design study has been carried out at the ‘Concept Design’ stage of the project. This study compares the heating, cooling, mechanical ventilation, and lighting energy consumption of a ‘standard building’ specification with the ‘proposed building’ design.

This study compares the passive design measures of the ‘proposed building’ design with notional building HVAC and lighting specification against a ‘standard building’ specification aligned to the Part L 2021 notional building.

For Ene 04 Low carbon design, one credit is achieved through this Passive design analysis.

This report covers the following points:

- The project team analysed the proposed building design during the Concept Design phase to identify opportunities for incorporating passive design measures.
- Proposed passive design measures have been implemented to reduce total heating, cooling, mechanical ventilation, lighting loads, and energy consumption, according to the findings of the passive design analysis.
- The reductions in total energy demand and carbon dioxide (CO₂) emissions resulting from the proposed passive design measures that have been quantified.

The latest illustrative proposed architectural drawings provided by TOR were used for this study (276504 -TOR-XX-ZZ-DR-A-P102 – D) .

A summary of the proposed building’s passive performance improvements can be seen in the Table 1 below.

Table 1 – Standard and Proposed buildings - Passive Measures

Passive Measure	‘Standard Building’	‘Proposed Building’
Shading	As Notional	As designed ⁽¹⁾ - proposed shading strategy
Fabric performance	As Notional	As designed ⁽¹⁾
Glazing performance	As Notional	As designed ⁽¹⁾
⁽¹⁾ Illustrative proposed Unit 1 and Unit 2 drawings by TOR, dated 23/05/2025 and illustrative Masterplan dated 10/06/2025.		

The Building Emission Rate (BER) value with the implementation of the passive design measures is shown to reduce carbon emissions by 4.82% when comparing the ‘standard buildings’ to the ‘proposed buildings’ – see Table 2 and Figure 1. In addition, the passive design measures have also been shown to reduce the heating and cooling demand load by 9.29% - see Table 3 and Figure 2.

Therefore, the implementation of the proposed passive design measures would have a positive impact in the reduction of the building’s overall energy demands and carbon emissions.

Table 2 – BER results for ‘Standard’ and ‘Proposed’ buildings

	‘Standard Building’ BER (KgCO2/m2)	‘Proposed Building’ BER (KgCO2/m2)	Passive Design improvement
Unit 1	2.11	1.97	6.64%
Unit 2	2.45	2.37	3.27%
Total	2.23	2.17	4.82%

Table 3 – Heating + Cooling demand results for ‘Standard’ and ‘Proposed’ buildings

	‘Standard Building’ Heating + Cooling Demand (MJ/m2)	‘Proposed Building’ Heating + Cooling Demand (MJ/m2)	Passive Design improvement
Unit 1	61.34	52.86	13.82%
Unit 2	80.25	75.57	5.83%
Total	70.80	64.22	9.29%

The Passive Design Analysis aims to inform the building design process at an early stage so that any measures can be implemented during detailed planning or reserved matters application stage, thus removing the need for more expensive, energy intensive solutions to be implemented later in the design process. By taking advantage of the specific site conditions, buildings can be drastically improved when compared to a building that does not consider passive design optimisation at the early stages of the project design.

It can be concluded that 1 credit has been achieved under BREEAM Ene 04 passive design analysis criteria, when based on illustrative drawings for Unit 1 and Unit 2.

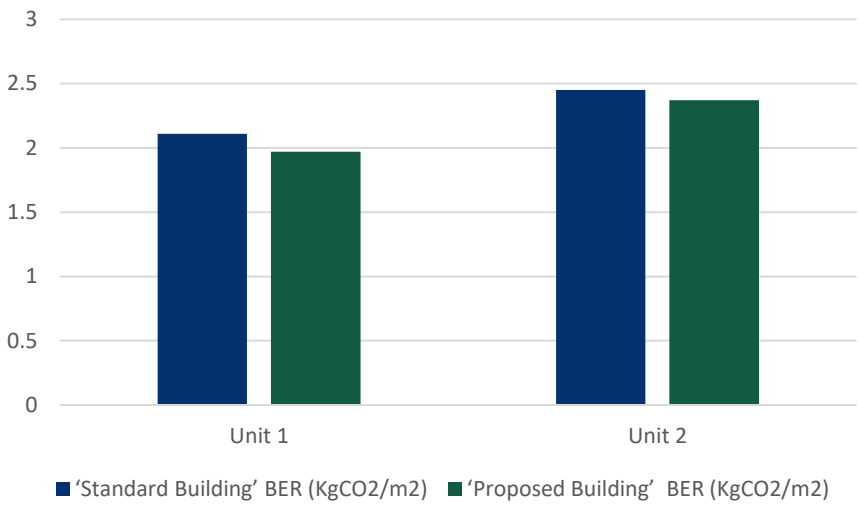


Figure 1 – Graphs including BER results for ‘Standard’ and ‘Proposed’ buildings

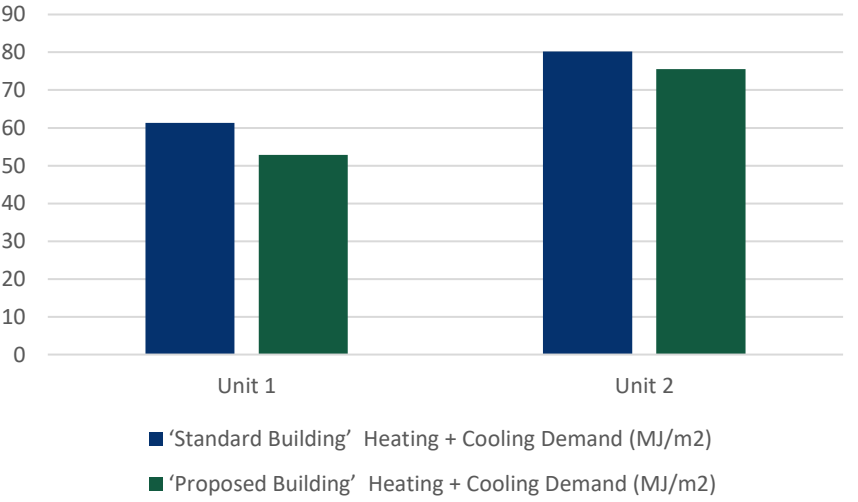


Figure 2 – Graphs including heating and cooling demand results

1.0 Introduction

1.1 BREEAM ENE 04 Passive Design

This report illustrates the Passive Design Analysis (PDA) undertaken to assess the impact that a number of potential saving measures may have on the proposed B2/B8 scheme, of the Land adjacent to Windhover Roundabout, Bursledon.

The energy demand reduction obtained as a result of the adoption of proposed passive design measures specified in this document is reported against the requirements to meet the first Ene 04 Passive Design Analysis credit under BREEAM UK New Construction (NC) V6.1. Sections 1.1.1 and 1.1.2 below include credit requirements and methodology for the passive design analysis.

1.1.1 Ene 04 Passive Design credits under BREEAM

One credit - Passive design analysis

1. Achieve the first credit HEA 04 Thermal comfort: One credit - Thermal modelling on page 103 of BREEAM UK NC V6.1 Technical Manual to demonstrate that the building design delivers appropriate thermal comfort levels in occupied spaces.
2. The project team analyses the proposed building design and development during Concept Design to identify opportunities for the implementation of passive design measures
3. Implement proposed passive design measures to reduce the total heating, cooling, mechanical ventilation, lighting loads and energy consumption in line with the passive design analysis findings.
4. Quantify the reduced total energy demand and carbon dioxide (CO₂-eq) emissions resulting from the passive design measures.

1.1.2 Methodology

Passive Design Analysis

This assessment encourages the adoption of passive design measures, which reduce building energy consumption and associated carbon emissions and minimise reliance on active building services systems.

As a minimum, the passive design analysis should cover all of the below:

1. Site location
2. Site weather
3. Microclimate
4. Building layout
5. Building orientation
6. Building form
7. Building fabric
8. Thermal mass or other fabric thermal storage
9. Building occupancy type
10. Daylighting strategy
11. Ventilation strategy
12. Adaptation to climate change

Any savings resulting from the incorporation of passive design measures should be demonstrated by comparing the energy demand and CO₂-eq emissions for the building with and without the proposed passive design measures adopted.

To enable a baseline for comparison to be established, a 'standard building' should be modelled with fabric performance equivalent to that of the local building regulations notional building and without the passive design measures (where feasible, i.e. building orientation is likely to be fixed). The glazing areas specified in the 'standard building' should be the same as those required by the Building Regulations 'Notional Building'.

Any savings in energy demand or CO₂-eq emissions should then be calculated by comparing the respective Building Emission Rate (BER) outputs from two building models representing the 'Proposed Building' specification (fixed at a point as agreed by the project team and assessor), and the 'Standard Building' specification.

1.0 Introduction

Site location and description of the Proposed Development

1.1 Site location and description

The Site is located at the Land adjacent to Windhover Roundabout and between Bursledon Road (A3024) and West End Road (A27), Bursledon, Hants, SO31 8BN, close to Junction 8 of the M27 motorway as seen in Figure 1.1.

The Site is circa 4.63 ha (11.4 acres) and comprises predominantly undeveloped agricultural pastureland, but with potential for some Made Ground to be present in limited areas of the Site. The Site takes the form of two connected grassland fields with a patch of tall ruderals and a wet flush along its eastern edge. The Site also includes a small collection of agricultural-type buildings sited on an area of hard standing within its southeastern part. Topographically the Site falls to its south-west towards Bursledon Road and rises north-east towards West End Road.

The surrounding context is a mixture of agricultural fields, woodland, residential and commercial development.

The Site is adjacent to new residential development and a Tesco Extra store to the south. To the north and north-east of the Site is deciduous woodland as well as open grassland. To the east is a row of detached and semi-detached houses interspersed with fields and woodland.

The Site does not form part of any Conversation Area, and no Listed Buildings are located on Site. The nearest designated heritage assets are the Grade II* Bursledon Windmill and Grade II Granary, which form part of the Bursledon Windmill Conservation Area, located approximately 300 m south-east of the Site.

1.2 Proposed Development

In accordance with this description of development, an illustrative masterplan has been prepared which shows the following elements:

- (Unit 1) Warehousing unit totalling 9,586 SqM (103,188 SqFt) comprising Use Class B2/B8 space and ancillary Use Class E office space;
- (Unit 2) Warehousing unit totalling 7,209 SqM (77,599 SqFt) comprising Use Class B2/B8 space and ancillary Use Class E office space;
- Provision of up to circa 175 car parking spaces and up to circa 41 HGV spaces, together with service yards and HGV loading spaces;
- Provision of ancillary external structures such as sprinkler tanks;
- Creation of site access from A3024 Bursledon Road and A27 West End Road, together with provision of signals and other works to the existing highway; and
- Provision of site landscaping, including new planting and provision of swales and other sustainable urban drainage features.

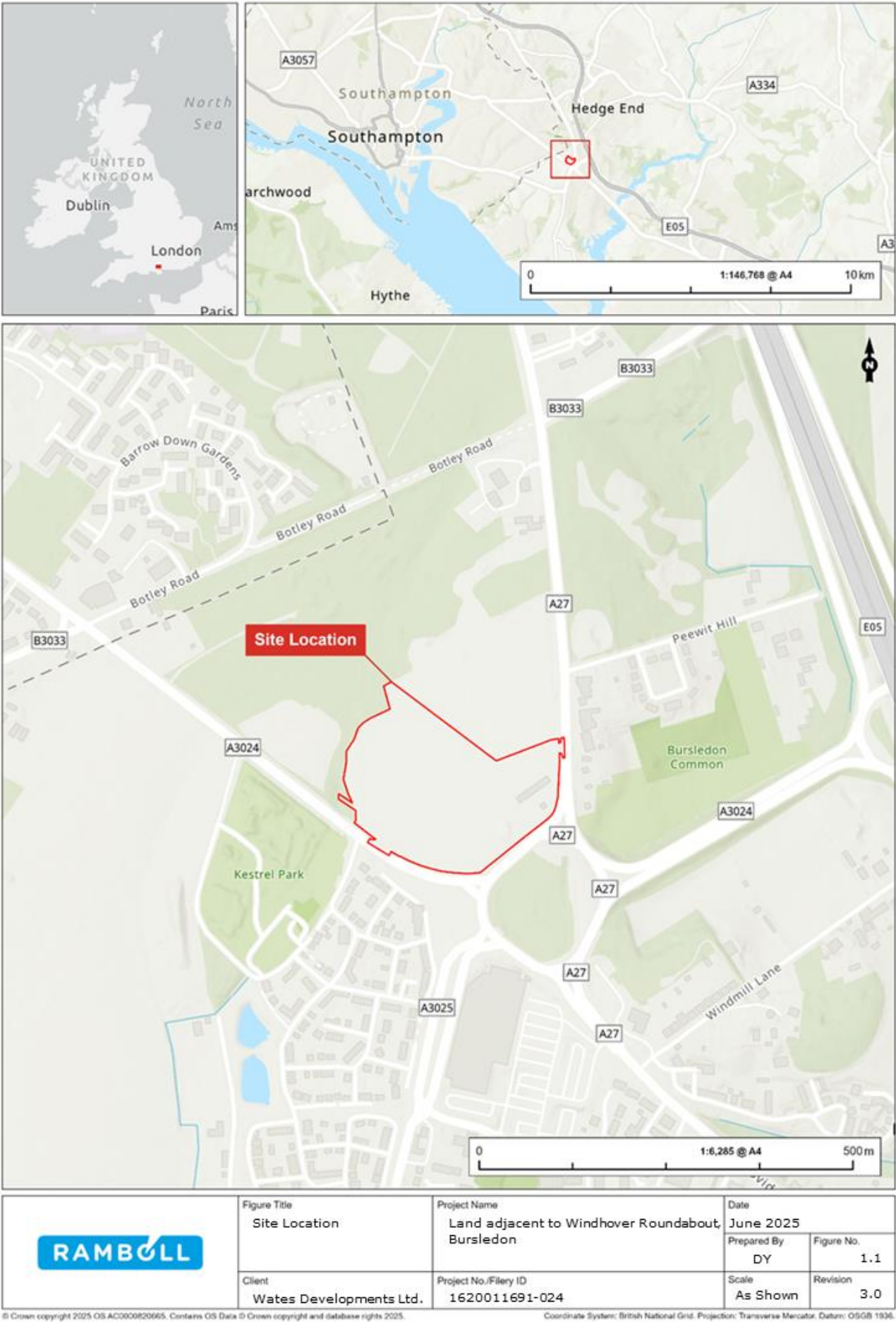


Figure 1.1 – Site location

2.0 Site and Building Analysis



Site Location and Site Weather

2.1 Site Location

The site is located at the Land adjacent to Windhover Roundabout and between Bursledon Road (A3024) and West End Road (A27), Bursledon, Hants, SO31 8BN, close to Junction 8 of the M27 motorway. The site is located in Bursledon, Hampshire, UK.

2.2 Site Weather

The site conditions and microclimate were analysed to identify the potential of passive strategies. The nearest and most suitable climate file for the Site is in Southampton, which is approx. 8.1 miles from the Site. The Southampton_TRY_epw weather file has been used with dynamic simulations.

Location: Southampton, UK

- Longitude: -1.835
- Latitude: 50.779
- Elevation above sea level: 10 m
- This file is based on data collected between 1980 and 2020
- Average yearly temperature: 10.5 °C
- Hottest yearly temperature (99%): 23.0 °C
- Coldest yearly temperature (1%): -3.0 °C
- Annual cumulative horizontal solar radiation: 1015.95 kWh/m2
- Percentage of diffuse horizontal solar radiation: 56.7 %

The annual temperature and relative humidity profiles are shown in Figure 2.1 and Figure 2.2.

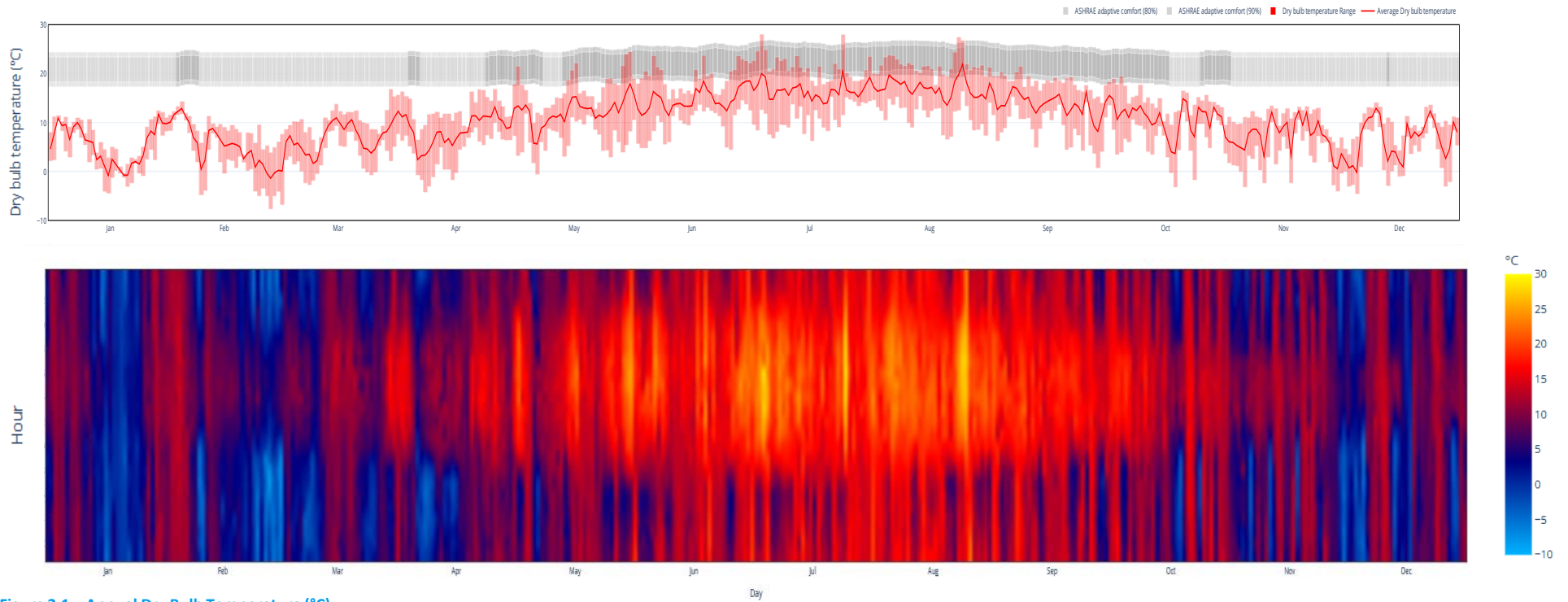


Figure 2.1 – Annual Dry Bulb Temperature (°C)

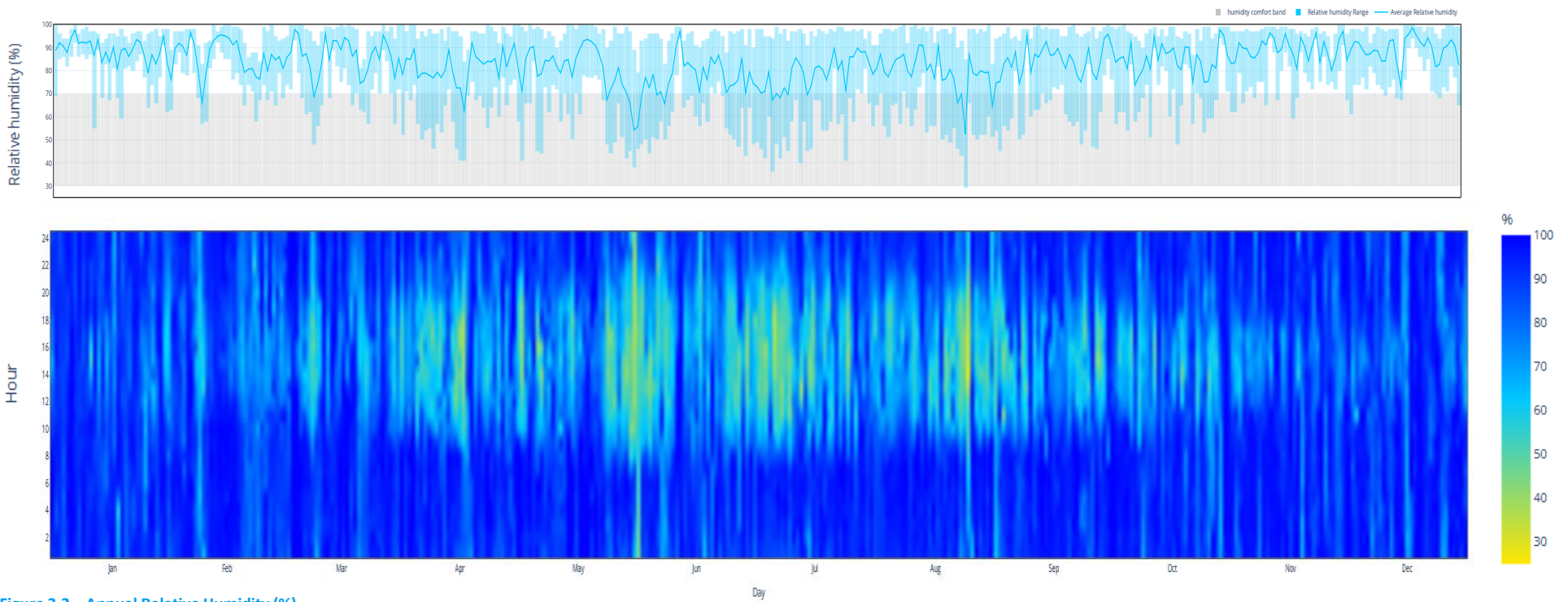


Figure 2.2 – Annual Relative Humidity (%)

2.0 Site and Building Analysis

2.2 Site Weather

The variation of Dry Bulb Temperature (DBT) and Relative Humidity (RH) during day and night is shown in Figure 2.3. For 75% of the year, the DBT is less than 12°C, which suggests that this is a heating dominated climate. The maximum annual temperature is around 28.1°C with the minimum temperature typically around -7.1°C. The average daily temperature sits around 12°C with relative humidity between 75-80%.

2.2.1 Comfort Data

The psychrometric analysis for Southampton indicates that approximately 35–40% of the annual climate conditions fall within the defined thermal comfort zone, as illustrated by the cluster of blue data points within the green shaded area of the chart.

This zone, ranging between 19°C to 27°C dry bulb temperature and 30% to 65% relative humidity, represents conditions where indoor thermal comfort can be achieved without mechanical heating or cooling.

The mean annual temperature is around 12.2°C with an average relative humidity of 81.1%, reflecting a predominantly cool and humid climate.

Outside the comfort zone, the climate tends to be cooler and damper, indicating the need for heating and humidity control in colder months. Conversely, a smaller proportion of the year may benefit from natural ventilation or dehumidification, especially during warmer periods.

These findings suggest that passive design strategies such as improved insulation, controlled solar gain, and natural ventilation could significantly enhance indoor comfort and reduce energy demands in buildings located in the Proposed Development site, Bursledon.

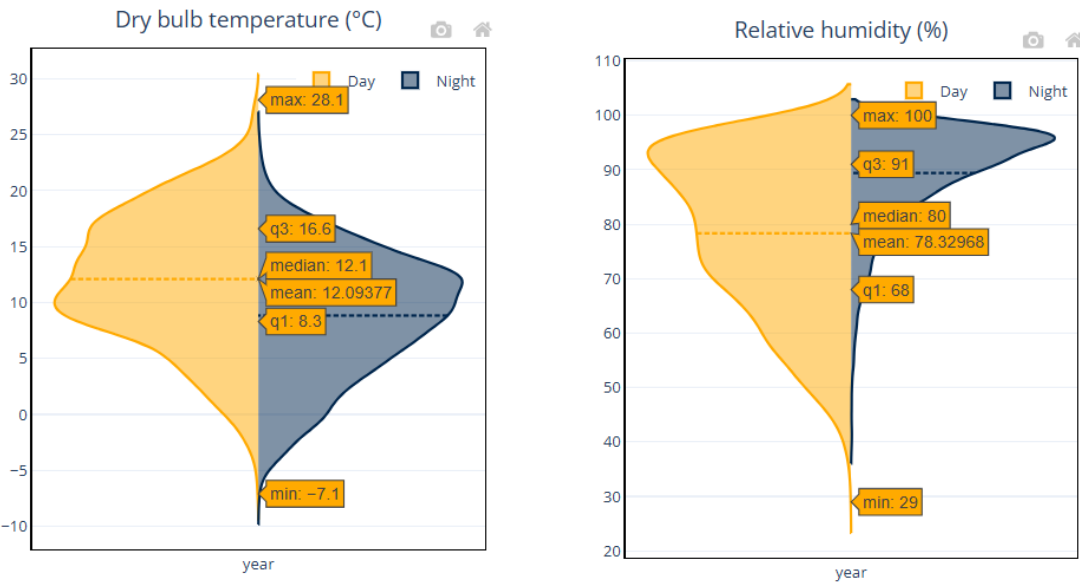


Figure 2.3: Violin plot for DBT and RH for Southampton weather file

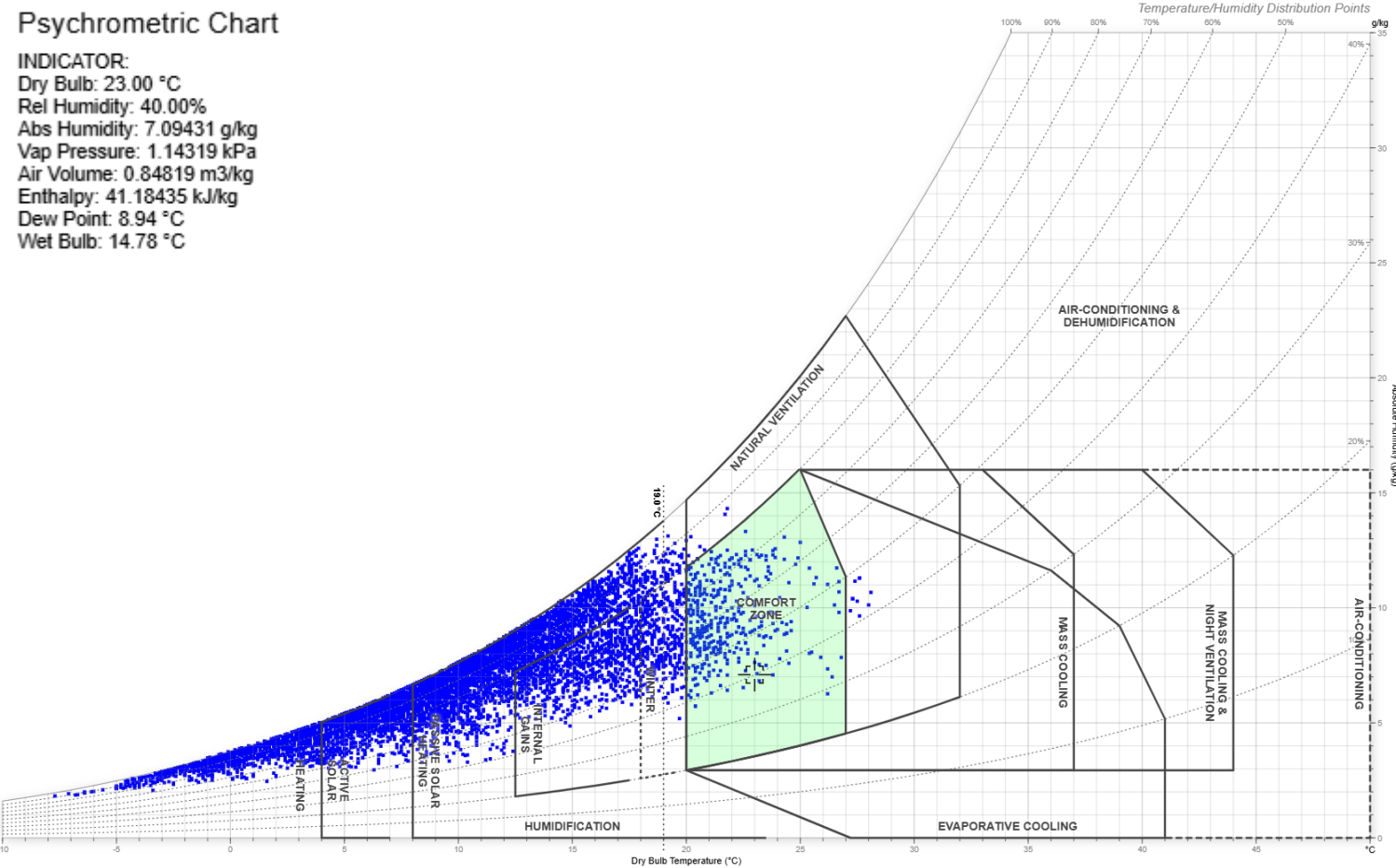


Figure 2.4: Givoni Bioclimatic chart for Southampton weather file

2.0 Site and Building Analysis

2.2 Site Weather

2.2.3 Universal Thermal Climate Index

The Universal Thermal Climate Index (UTCI) heatmap highlights that thermal comfort is maximized between May and September, except for short periods of heat stress. Cold stress is a dominant concern during winter months (Dec–Feb), especially in the early mornings and late evenings. This data, and Figures 2.5-2.7, have come from the same Southampton weather file (Southampton_TRY_epw).

This climate provides a relatively favourable thermal environment for much of the year, with only brief periods of thermal discomfort due to heat or cold.

Temperature bands of 1°C intervals for each hour of the year are presented in Figure 2.6. This highlights that peak design cooling and heating conditions occur for only few hours during the year. Although extreme design conditions will provide a safety factor against uncertainty and overheating risk, equipment selected using the peak load will work at part load conditions for most of the year. This will likely lead to equipment working less efficiently; hence equipment should be selected based on the annual load profile to work at maximum efficiency.

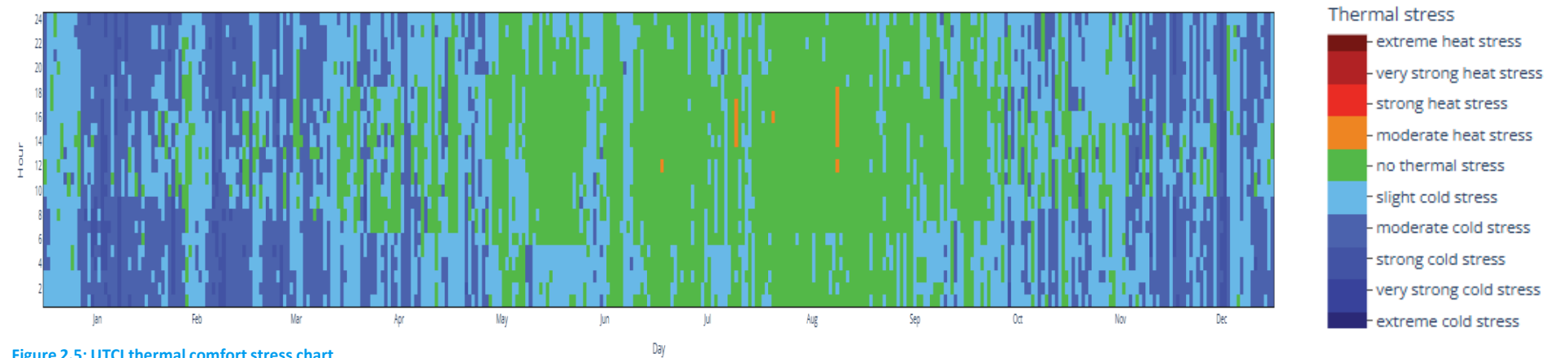


Figure 2.5: UTCI thermal comfort stress chart

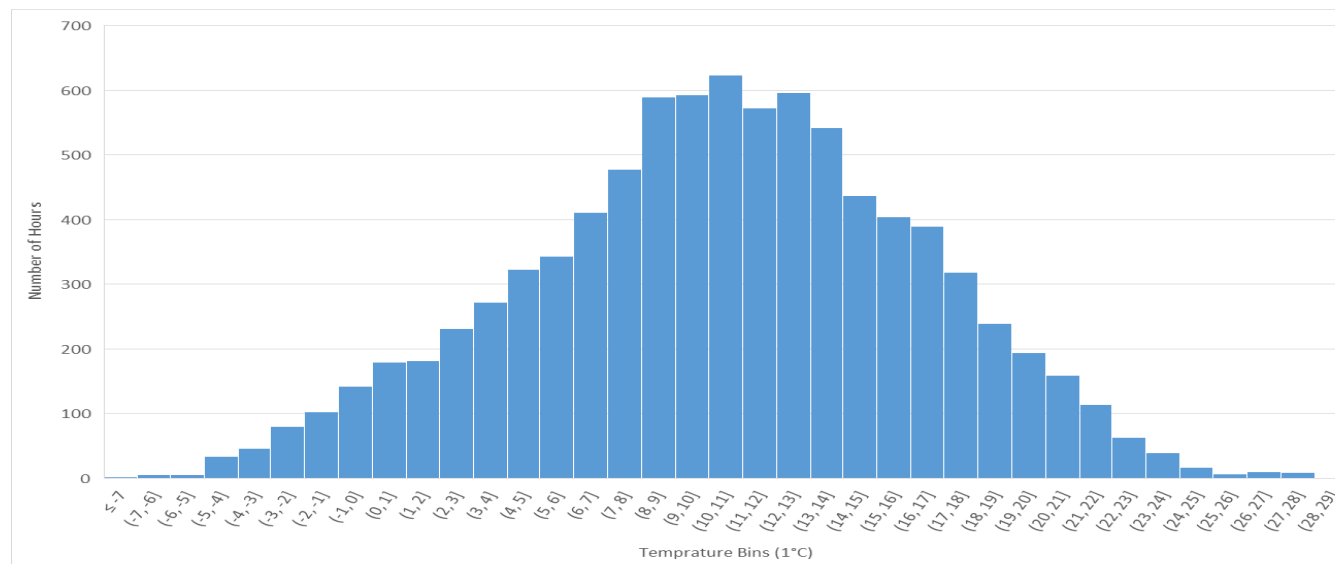


Figure 2.6: Outdoor DBT histogram of 1°C bands

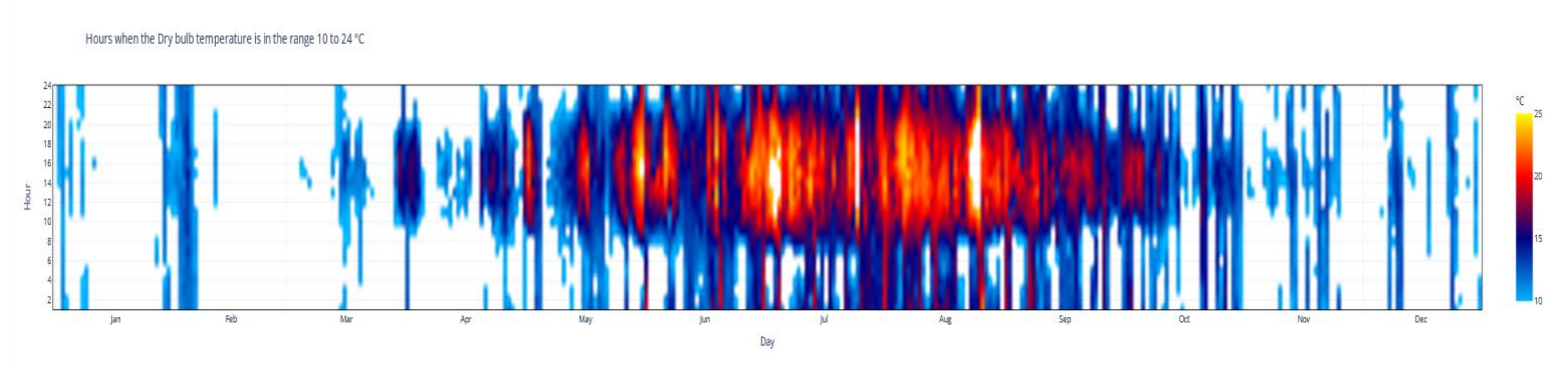


Figure 2.7: Hours when DBT is in the range 10 to 24 °C

2.0 Site and Building Analysis

Site Weather

2.2.4 Wind Rose

Throughout the year, the prevailing winds come from the west/southwest (Figure 2.8).

The maximum wind speed is ~17 m/s. In spring, dominant winds are from the south-west directions (Figure 2.9).

During summer, the prevailing wind is from the west/southwest with average speed of 4m/sec, whereas in winter, prevailing wind direction is west and southwest with max wind speed is ~17 m/s (Figures 2.10 and 2.11).

In autumn, average wind speeds are shown to be 5.5m/s primarily western direction (Figure 2.12).

Please note the wind data has been sourced from CBR Climate Tool (<https://clima.cbe.berkeley.edu/>).

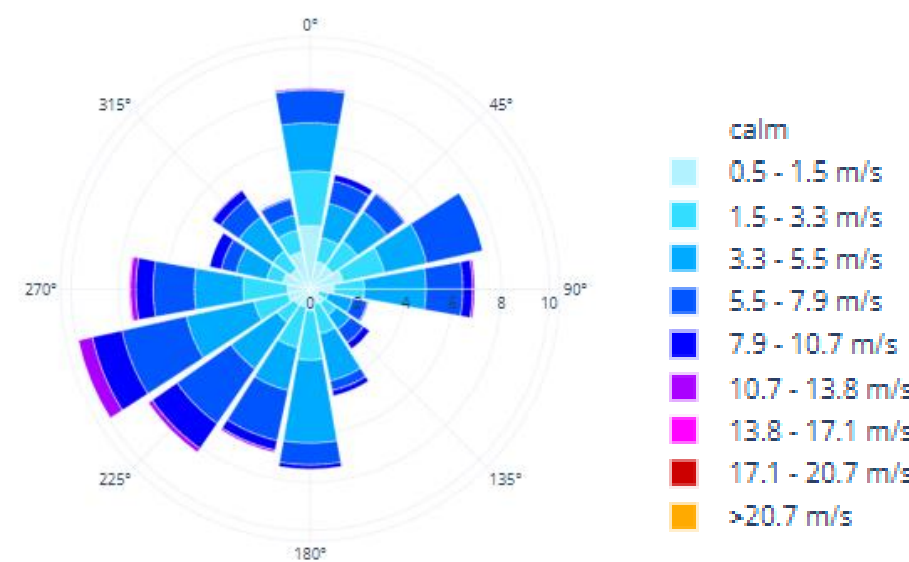


Figure 2.9 - Spring wind rose

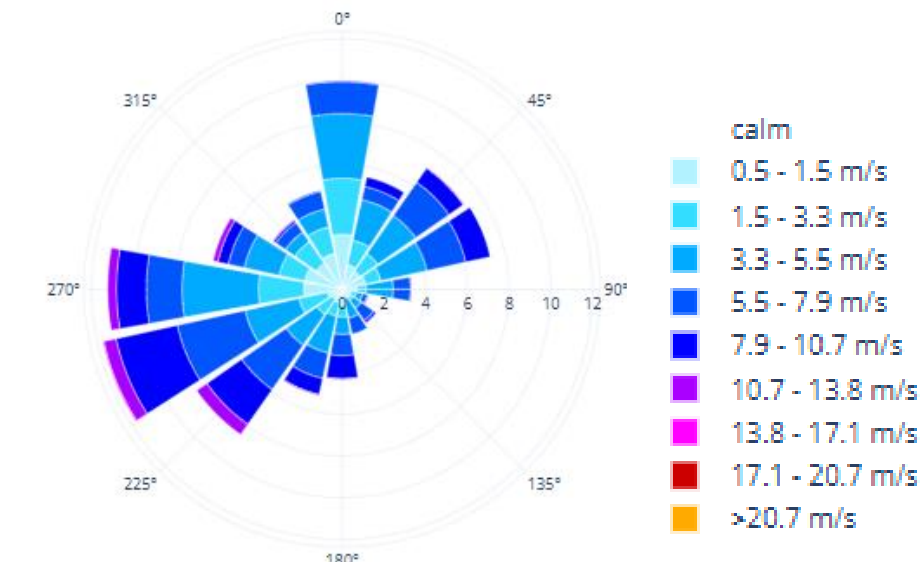


Figure 2.11 – Winter wind rose

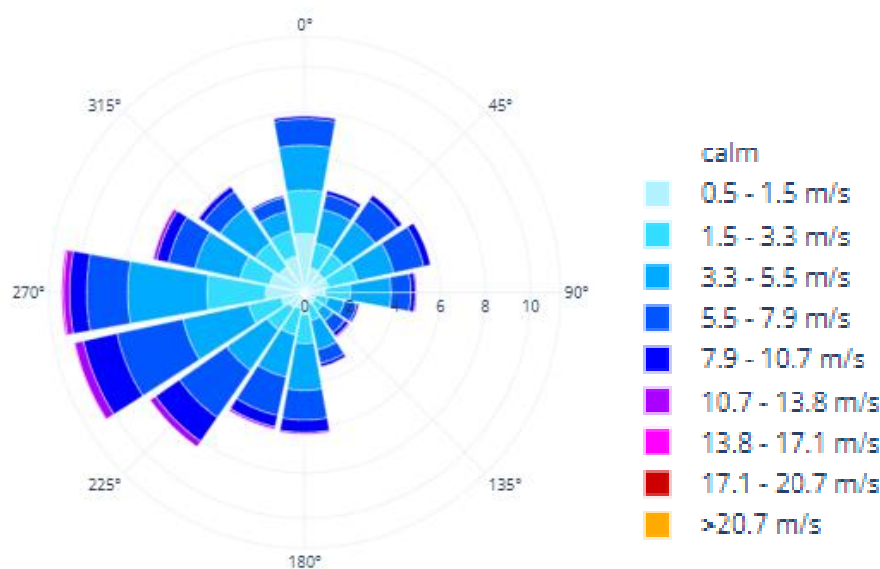


Figure 2.8 - Annual wind rose

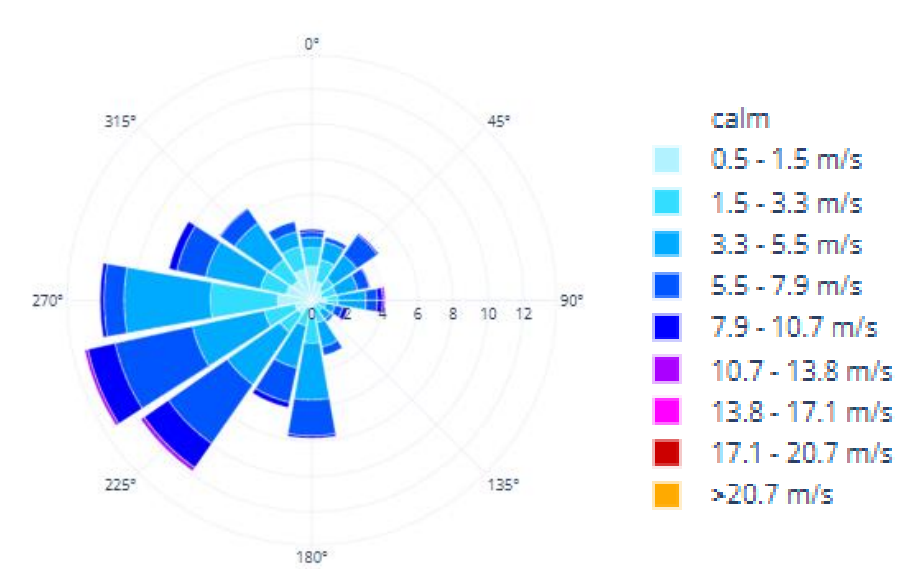


Figure 2.10 - Summer wind rose

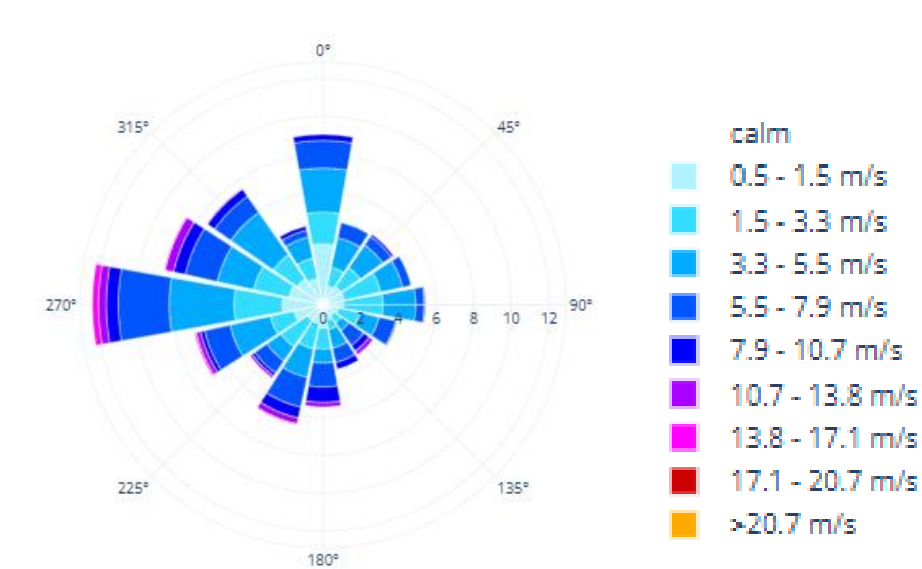


Figure 2.12 - Autumn wind rose

2.0 Site and Building Analysis

Site Weather

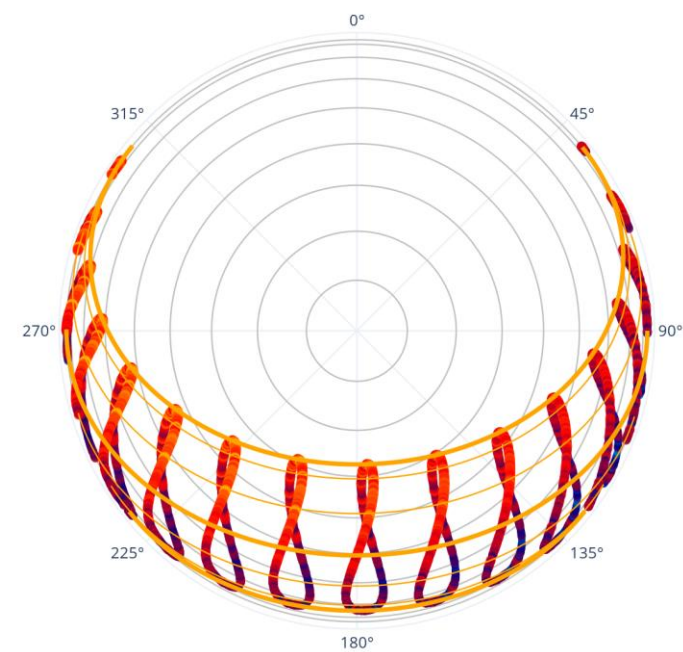
2.2.5 Sun Path

Figure 2.14 illustrates a sun path diagram including DBT for Southampton, while Figure 2.15 illustrates the same but including global horizontal radiation filter.

A global horizontal radiation (GHR) filter is a term commonly used in the context of solar energy and building design. The GHR is a measure of the total amount of solar radiation received per unit area on a horizontal surface. This includes both direct sunlight and diffuse sky radiation. In building engineering and design, a GHR filter might refer to methods or technologies used to manage or mitigate the amount of solar radiation that impacts a structure. Implementing GHR filters can help in controlling heat gains, improving thermal comfort, and reducing cooling loads.

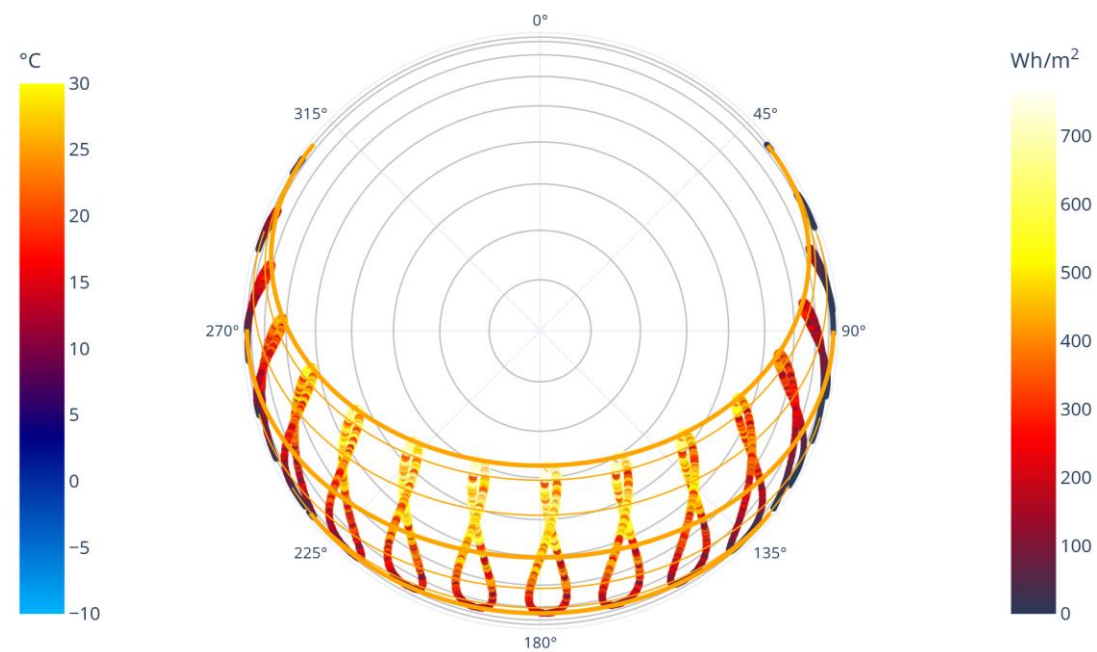
In Figure 2.15, a filter is applied to identify the periods for which shading is required. Periods for which DBT is greater than 20°C and global horizontal radiation is above 300 Wh/m2 has been identified as shading period.

There will be no shading required in the east direction. The south and west façade, however, needs shading for the summer months (Jun to Aug) between 10 am to 4 pm.



Dry Bulb Temperature (°C)
City: Southampton
Country: UK

Figure 2.14: Sun Path Diagram including dry bulb temperature



Global Horizontal Radiation (Wh/m2)
City: Southampton
Country: UK

Figure 2.15: Sun Path Diagram including global horizontal radiation

2.0 Site and Building Analysis



2.3 Layout and Form

2.3.1 Building Layout and Form

The Proposed Development has been designed to efficiently utilize the 3.84 hectares of developable land out of the total 4.630 hectares. The layout will accommodate up to 180,840 square feet of built-up space, primarily designated for warehouse and industrial use (B2, B8 classification).

This includes provision of a warehouse development of up to 200,000ft2 (GIA), together with ancillary offices (Use Class E(g)(i)) and other ancillary building and structures, parking, servicing and manoeuvring areas, landscaping and sustainable drainage features. The building form is expected to prioritize functional, modular design suited for logistical efficiency, with provision of private vehicle car parking spaces and HGV spaces, together with service yards and HGV loading spaces.

2.3.2 Building Orientation

The designed building orientation can be seen in Figure 2.16, with a predominant east-west axis which would take advantage of beneficial solar gains and prevailing winds.

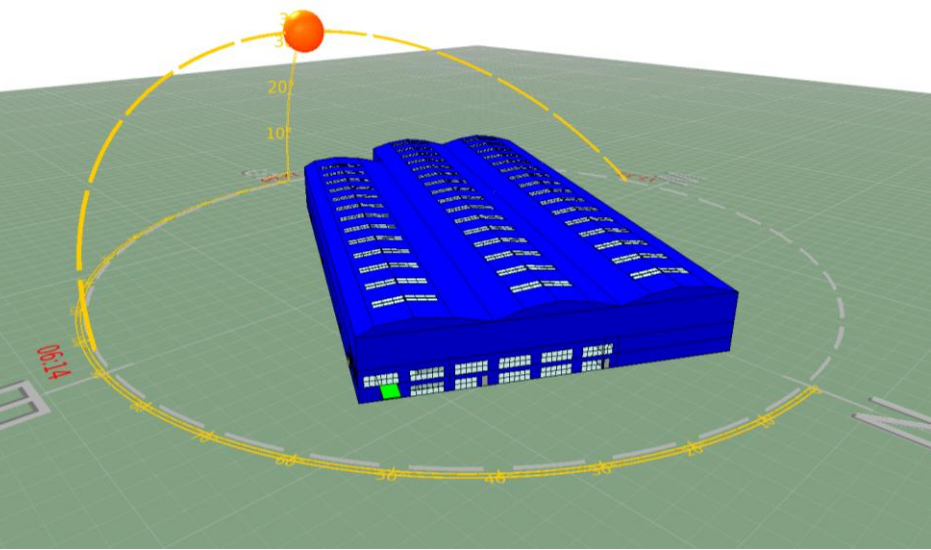


Figure 2.16 - Sun Path Diagram

Figures 2.17 and 2.18 include the illustrative proposed drawings for Unit 1, while Unit 2 illustrative drawings are included in Figures 2.19 and 2.20.

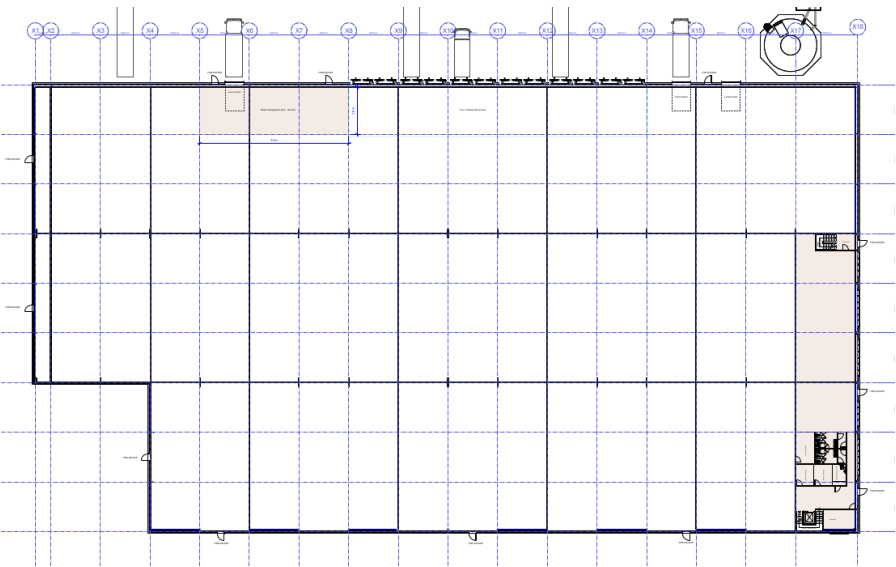


Figure 2.17 - Proposed Layout Unit 1 (276504-TOR-01-00-DR-A-P200-B)

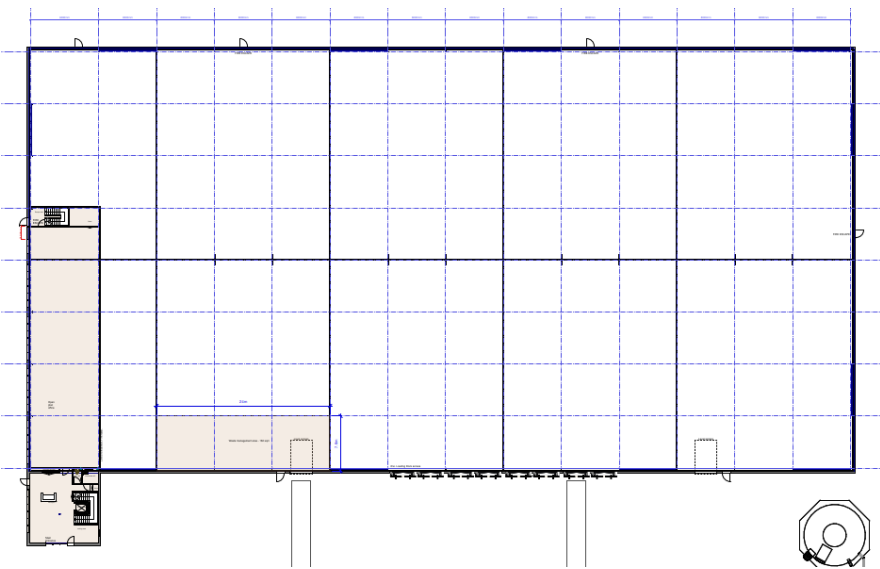


Figure 2.19 - Proposed Layout Unit 2 (276504-TOR-02-00-DR-A-P206-B)

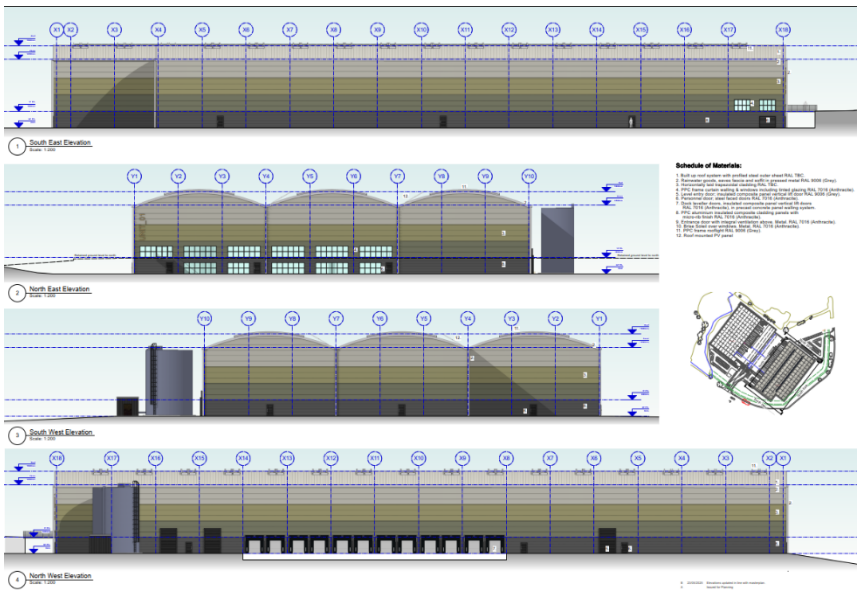


Figure 2.18 - Elevations Unit 1 (276504-TOR-01-ZZ-DR-A-P203-C)

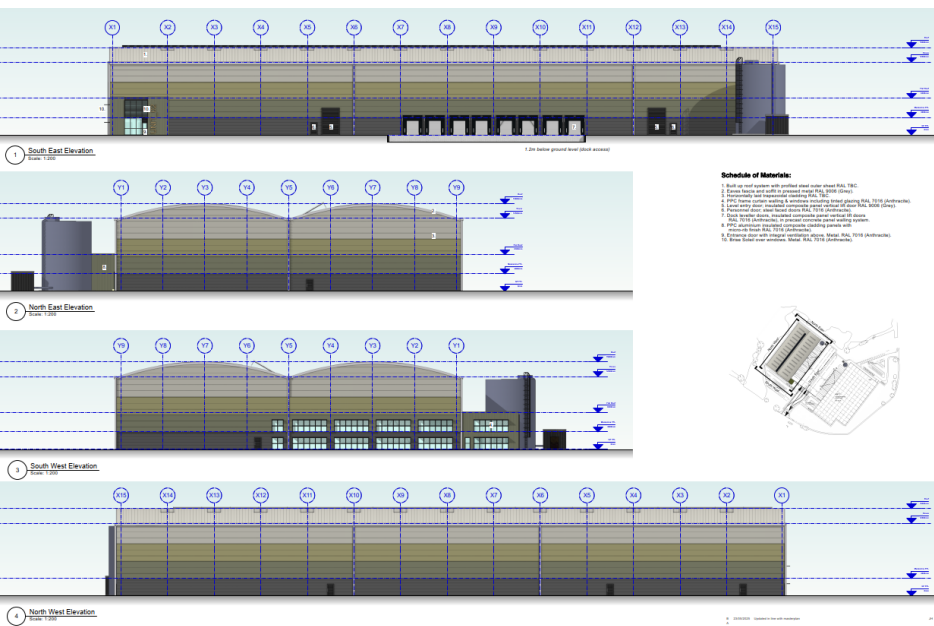


Figure 2.20 - Elevations Unit 2 (276504-TOR-02-ZZ-DR-A-P209-C)

2.0 Site and Building Analysis

2.4 Passive Measures

2.4.1 Building Fabric

Building fabric is the starting point of passive design and some improvements have been made over the Part L2A 2021 standard to suggest how the buildings can incorporate adequate performance building fabric to reduce energy demands of the building uses during detailed planning or reserved matters application stage. Table 2.1 includes building fabric performance, while Table 2.2 includes glazing to wall ratio to illustrative Unit 1 and Unit 2.

Table 2.1 - Building Fabric Performance ‘Standard’ and ‘Proposed’ buildings

Element	Unit	‘Standard Building’	Illustrative Proposed Unit 1	Illustrative Proposed Unit 2
Wall	W/m²K	0.18	0.18	0.18
Window	W/m²K	1.40	1.40	1.40
Floor	W/m²K	0.15	0.15	0.15
Roof	W/m²K	0.15	0.15	0.15
Door (Vehicle)	W/m²K	1.30	1.30	1.30
Door (External)	W/m²K	1.90	1.40	1.40
Air Permeability	m³/(h.m²)@50Pa	3.0	3.0	3.0

Table 2.2: Proposed Glazing Ratios

Façade 0	Glazing To Wall Ratio (%) 'Unit 1'	Glazing To Wall Ratio (%) 'Unit 2'
Northwest Elevation	0.45	0.97
Southwest Elevation	0.26	12.26
Northeast Elevation	17.89	0.32
Southeast Elevation	12.16	9.53

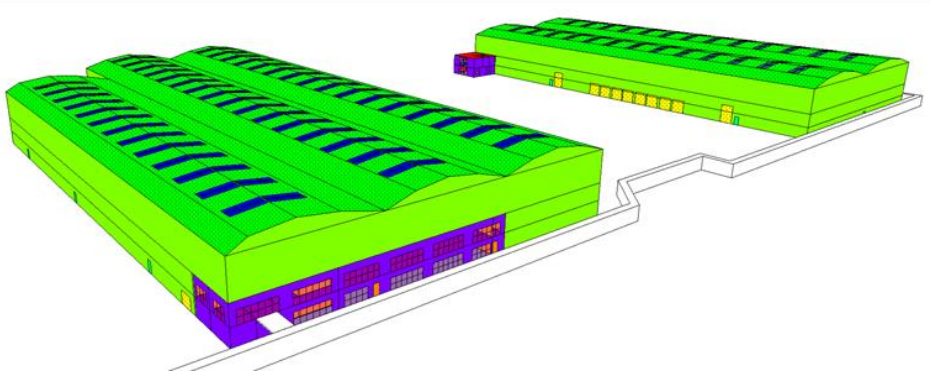


Figure 2.21: U-value assignment in IESVE for the Proposed Building model

- Construction
- 2013 Door (STD_DOOR)
 - 2013 Exposed Floor (STD_FLO1)
 - 2013 Internal Ceiling/Floor (STD_CEIL)
 - 2013 Internal Partition (STD_PART)
 - Burlesdon_Exposed Floor_U0.15 (Office) (STD_FLO5)
 - Burlesdon_Exposed Floor_U0.15 (Warehouse) (STD_FLO4)
 - Burlesdon_External Door_U1.40 (Office) (STD_DOO5)
 - Burlesdon_External Door_U1.40 (Warehouse) (STD_DOO4)
 - Burlesdon_External Wall U0.18 (Office) (STD_WAL5)
 - Burlesdon_External Wall U0.18 (Warehouse) (STD_WAL4)
 - Burlesdon_External Window_U1.40 G0.35 VLT 0.60(Office) with overhangs (STD_EXT4)
 - Burlesdon_External Window_U1.40 G0.35 VLT0.60 (Office) (STD_EXT1)
 - Burlesdon_Roof_U0.15 (Office) (STD_ROO4)
 - Burlesdon_Roof_U0.15 (Warehouse) (STD_ROO3)
 - Burlesdon_Rooflight_U2.00 G0.55 VLT 0.70 (STD_RFL3)
 - Burlesdon_Vehicle Door_U1.30 (Warehouse) (STD_DOO1)

2.4.2 Thermal Mass/Other Fabric Thermal Storage

The implementation of thermal mass is an important consideration. Thermal mass refers to the ability of a building material to absorb, store, and release heat. Materials with high thermal mass, such as concrete, brick, stone, and water, can help to regulate indoor temperatures by absorbing heat during the day and releasing it at night or during cooler periods. Thermal mass can absorb heat during the day when the building is occupied helping to reduce the probability of overheating. This heat can then be released overnight when spaces are unoccupied to pre-cool the thermal mass down to a suitable temperature ready for the next day.

Due to outline planning status of the Proposed Development, there is no information on thermal mass of building elements. Therefore, the effect of thermal mass has been discounted for the proposed analysis.

2.4.3 Building Occupancy Type

Considering its outline planning status, for passive design analysis purposes, the building Use Class B2 has been used. In this case, both illustrative Unit 1 and Unit 2 are made up of warehouse spaces accounting for approximately 95% their total area, while 5% is associated with office spaces. The occupancy profiles used in the thermal model are based on the NCM Building Area Type B8: Warehouse/storage (Warehouse). Please note that this outline planning application is for a warehouse development (Use Classes B2 and B8 applied flexibly). Although building Use Class B8 has been selected for energy strategy modelling purpose, compliance with Policy DM2 is also anticipated when Use Class B2 is selected in the future. This would be achieved by incorporating a combination of low and zero carbon technologies (heat pumps and PV panels on the roof).

2.4.4 Daylighting Strategy

Office spaces within the Illustrative Unit 1 and Unit 2 have been designed to achieve high levels of daylight. All day-lit spaces will be installed with daylight sensing controls to reduce internal gain when adequate daylight is available and to reduce energy demand by only sing artificial lighting when required.

2.4.5 Ventilation Strategy

Illustrative Unit 1 and Unit 2 is mechanically ventilated and have high efficiency heat recovery in all office with balanced supply and extract. The façade would therefore be sealed in areas to be conditioned.

2.4.6 Adaption to Climate Change

With the possibility of global temperatures rising by 2°C or more over the next half century, it is important to understand the effect a changing climate will have on a building’s performance. Through understanding these changes, it highlights potential issues with the design and allows for adaption strategies to be considered and therefore, manages the impact of any increase in environmental temperature.

Good U-values for the thermal line have been considered for Units 1 and Unit 2 at this stage; this should allow for high control of internal thermal conditioning with reduced heat loss or heat gain from the external environment.

Consideration for building space allocation in terms of plant and distribution of services will be required to allow it to adapt to a future change in climate. High performance glazing has been considered to reduce the overall cooling load and provide an element of future proofing should external temperatures increase. Furthermore, the cooling system should be designed with spare capacity which will assist in dealing with any potential changes to the climate.

2.0 Site and Building Analysis

Passive Design Assessment

2.3 Reduction in Energy Demand

The proposed passive design measures have been quantified to demonstrate the reduction in energy demand. These were measured comparing a ‘standard building’ without the passive design measures to the ‘proposed building’ with passive design measures implemented.

The Building Emission Rate (BER) outputs from the two building models with and without the different passive design measures have then been compared.

The ‘standard building’ is assumed with fabric performance equivalent to the notional building standards set by Part L 2021 Volume 2, and 40% glazing areas as per the Notional Building Specifications. The ‘proposed building’ includes the illustrative proposed Unit 1 and Unit 2 drawings by TOR ((276504 -TOR-01-00-DR-A-P200 – B) and (276504 -TOR-02-00-DR-A-P206 – B)) and illustrative Masterplan (276504 -TOR-XX-ZZ-DR-A-P102 – D)

Table 2.3 below summarises the key measures considered feasible for the Proposed Development.

Table 2.3 - Proposed Passive Measures considered feasible for the Proposed Development

Measure	‘Standard Building’	‘Proposed Buildings’
Shading	No Local shade	Proposed shading strategy with fins and oriented panels
Fabric performance	As per Notional Building	As proposed in Table 2.1
Air Permeability	3.0 m³/(h.m²)@50Pa	3.0 m³/(h.m²)@50Pa
Free Cooling	N/A*	N/A*
Glazing performance	As per Notional Building	As proposed in Table 2.1

* No free cooling targeted initially as part of the strategy.

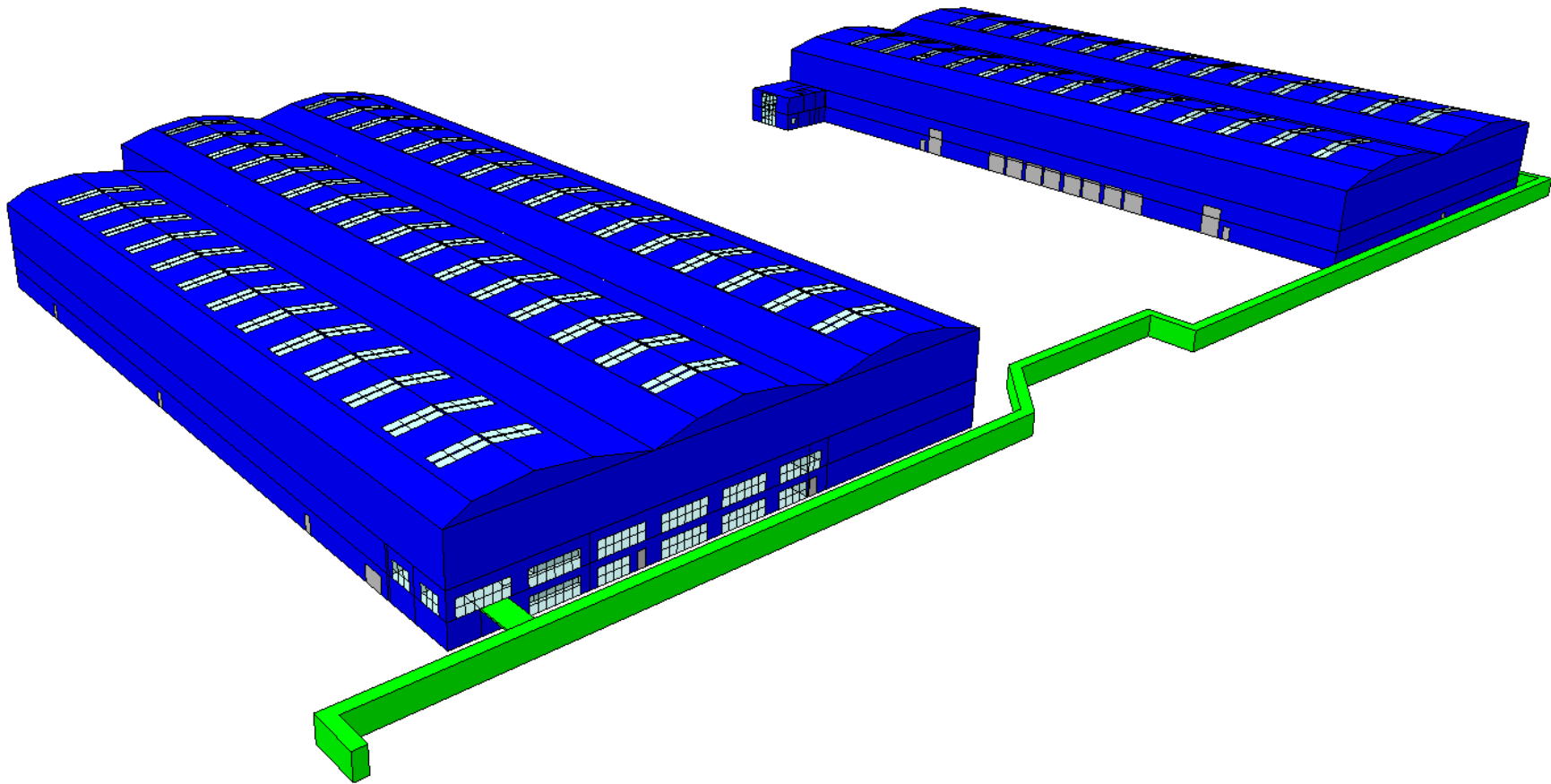


Figure 2.22 - IESVE Model of the illustrative proposed Unit 1 and Unit 2 drawings by TOR

3.0 Results



Reduction in Carbon Emissions and, Heating and Cooling Energy Demand

3.1 Results

Passive Design Analysis has been undertaken, comparing two building models ('Standard' and 'Proposed') with and without the proposed passive design measures in line with BREEAM Ene Passive Design Analysis methodology. After incorporation of passive measures, the 'Proposed Building' results in percentage improvements when compared to the 'Standard Building' are shown in Tables 3.1 and 3.2.

The Building Emission Rate (BER) value with the implementation of the passive design measures is shown to reduce carbon emissions by 4.82% when comparing the 'standard buildings' to the 'proposed buildings' – see Table 3.1 and Figure 3.1.

In addition, the passive design measures have also been shown to reduce the heating and cooling demand load by 9.29% - see Table 3.2 and Figure 3.2.

Table 3.1 – BER results for 'Standard' and 'Proposed' buildings

	'Standard Building' BER (KgCO2/m2)	'Proposed Building' BER (KgCO2/m2)	Passive Design improvement
Unit 1	2.11	1.97	6.64%
Unit 2	2.45	2.37	3.27%
Total	2.23	2.17	4.82%

Table 3.2–Heating + Cooling demand results for 'Standard' and 'Proposed' buildings

	'Standard Building' Heating + Cooling Demand (MJ/m2)	'Proposed Building' Heating + Cooling Demand (MJ/m2)	Passive Design improvement
Unit 1	61.34	52.86	13.82%
Unit 2	80.25	75.57	5.83%
Total	70.80	64.22	9.29%

3.2 Conclusions

The Passive Design Analysis aims to inform the building design process at an early stage so that any measures can be implemented during detailed planning or reserved matters application stage, thus removing the need for more expensive, energy intensive solutions to be implemented later in the design process. By taking advantage of the specific site conditions, buildings can be drastically improved when compared to a building that does not consider passive design optimisation at the early stages of the project design.

The BER value with the implementation of the passive design measures is shown to reduce carbon emissions by 4.82% when comparing a 'standard building' to the 'proposed building'. The passive design measures have also been shown to reduce the heating and cooling demand load by 9.29%. Therefore, it can be demonstrated that the implementation of passive design measures has a positive impact in the reduction of the building's overall energy demands and carbon emissions.

It can be concluded that 1 credit has been achieved under BREEAM Ene 04 passive design analysis criteria. Please note this is based on illustrative proposed Unit 1 and Unit 2 drawings by TOR ((276504 -TOR-01-00-DR-A-P200 – B) and (276504 -TOR-02-00-DR-A-P206 – B)) and illustrative Masterplan (276504 -TOR-XX-ZZ-DR-A-P102 – D).

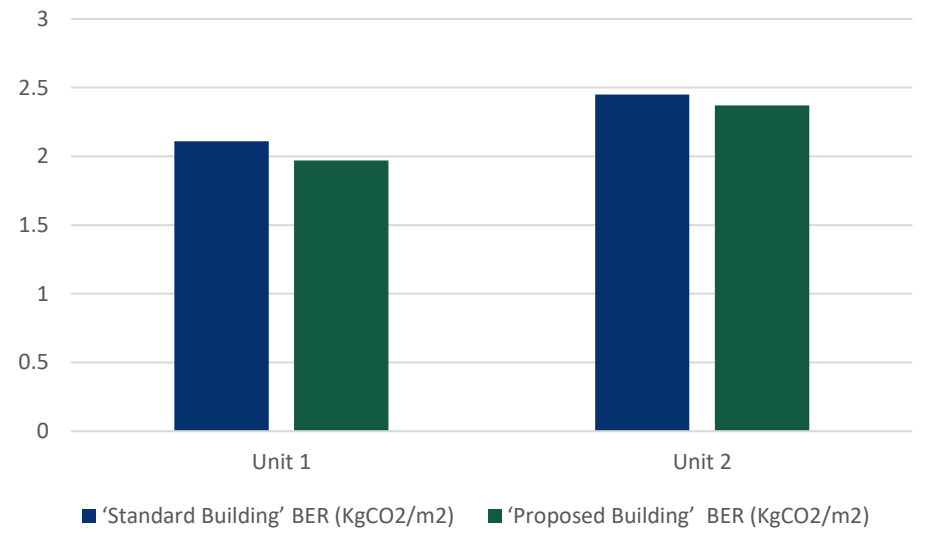


Figure 3.1 – Graphs including BER results for 'Standard' and 'Proposed' buildings

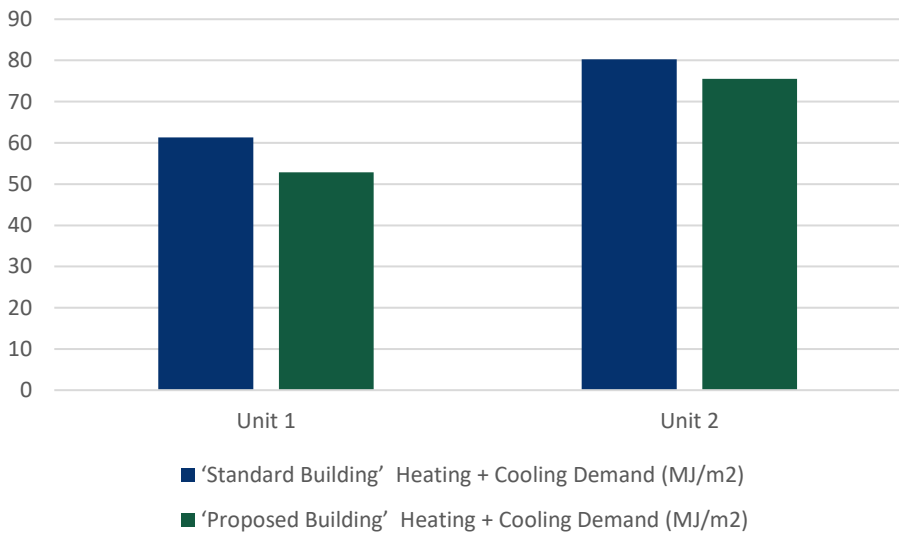


Figure 3.2 – Graphs including heating and cooling demand results

Appendix 01



BRUKL Output Documents - Unit 1 ‘Standard’ and ‘Proposed’ Buildings

‘Proposed Building’ BRUKL

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Burlesdon Unit 1 Option 3 (Be Green)As designed

Date: Thu Jun 05 01:15:12 2025

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.28

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.28

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

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m²]: 4761.71

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m²annum	3.75
Building CO ₂ emission rate (BER), kgCO ₂ /m²annum	1.97
Target primary energy rate (TPER), kWh _{eq} /m²annum	40.26
Building primary energy rate (BPER), kWh _{eq} /m²annum	19.88
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 Limit	U _a Calc	U _i Calc	First surface with maximum value
Walls*	0.26	0.18	0.18	NT000000:Surf[3]
Floors	0.18	0.15	0.15	NT000000:Surf[0]
Pitched roofs	0.16	0.15	0.15	NT00002E:Surf[81]
Flat roofs	0.18	0.15	0.15	NT00002E:Surf[80]
Windows** and roof windows	1.6	1.4	1.4	NT00000E:Surf[0]
Rooflights***	2.2	2.01	2.01	NT00002E:Surf[2]
Personnel doors^	1.6	1.4	1.4	NT000000:Surf[1]
Vehicle access & similar large doors	1.3	1.3	1.3	NT000000:Surf[10]
High usage entrance doors	3	-	-	No high usage entrance doors in building

U_a Limit = Limiting area-weighted average U-values [W/(m²K)]

U_a Calc = Calculated area-weighted average U-values [W/(m²K)]

U_i Calc = Calculated maximum individual element U-values [W/(m²K)]

* 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/m²K

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
m³/(h.m²) at 50 Pa	8	3

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	52.86	53.35
Primary energy [kWh _{eq} /m²]	19.88	40.26
Total emissions [kg/m²]	1.97	3.75

‘Standard Building’ BRUKL

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Burlesdon Unit 1 Option 3 (Be Green)-Standard BuildingAs designed

Date: Thu Jun 05 17:03:19 2025

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.28

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.28

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

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m²]: 4761.71

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m²annum	3.75
Building CO ₂ emission rate (BER), kgCO ₂ /m²annum	2.11
Target primary energy rate (TPER), kWh _{eq} /m²annum	40.26
Building primary energy rate (BPER), kWh _{eq} /m²annum	21.27
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 Limit	U _a Calc	U _i Calc	First surface with maximum value
Walls*	0.26	0.18	0.18	NT000000:Surf[3]
Floors	0.18	0.15	0.15	NT000000:Surf[0]
Pitched roofs	0.16	0.15	0.15	NT00002E:Surf[81]
Flat roofs	0.18	0.15	0.15	NT00002E:Surf[80]
Windows** and roof windows	1.6	1.4	1.4	NT00000E:Surf[1]
Rooflights***	2.2	2.1	2.1	NT00002E:Surf[2]
Personnel doors^	1.6	1.9	1.9	NT000000:Surf[1]
Vehicle access & similar large doors	1.3	1.3	1.3	NT000000:Surf[10]
High usage entrance doors	3	-	-	No high usage entrance doors in building

U_a Limit = Limiting area-weighted average U-values [W/(m²K)]

U_a Calc = Calculated area-weighted average U-values [W/(m²K)]

U_i Calc = Calculated maximum individual element U-values [W/(m²K)]

* 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/m²K

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
m³/(h.m²) at 50 Pa	8	3

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	61.34	53.35
Primary energy [kWh _{eq} /m²]	21.27	40.26
Total emissions [kg/m²]	2.11	3.75

Appendix 02



BRUKL Output Documents - Unit 2 ‘Standard’ and ‘Proposed’ Buildings

‘Proposed Building’ BRUKL

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Burlesdon Unit 2 Option 3 (Be Green)

As designed

Date: Thu Jun 05 01:05:00 2025

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache
Calculation engine version: 7.0.28
Interface to calculation engine: IES Virtual Environment
Interface to calculation engine version: 7.0.28
BRUKL compliance module version: v6.1.e.1

Certifier details

Name: Name
Telephone number: Phone
Address: Street Address, City, Postcode

Foundation area [m²]: 3556.95

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m²annum	3.42
Building CO ₂ emission rate (BER), kgCO ₂ /m²annum	2.37
Target primary energy rate (TPER), kWh _{tp} /m²annum	36.56
Building primary energy rate (BPER), kWh _{tp} /m²annum	24.46
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 Limit	U _a Calc	U _i Calc	First surface with maximum value
Walls*	0.26	0.18	0.18	NT000006:Surf[1]
Floors	0.18	0.15	0.15	NT000006:Surf[0]
Pitched roofs	0.16	0.15	0.15	NT000052:Surf[55]
Flat roofs	0.18	0.15	0.15	NT00001C:Surf[0]
Windows** and roof windows	1.6	1.4	1.4	NT000004:Surf[1]
Rooflights***	2.2	2.01	2.01	NT000052:Surf[2]
Personnel doors^	1.6	1.44	2.2	NT00005B:Surf[23]
Vehicle access & similar large doors	1.3	1.3	1.3	NT000003:Surf[9]
High usage entrance doors	3	-	-	No high usage entrance doors in building

U_a Limit = Limiting area-weighted average U-values [W/(m²K)]
U_a Calc = Calculated area-weighted average U-values [W/(m²K)]
U_i Calc = Calculated maximum individual element U-values [W/(m²K)]
* 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/m²K
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
m³/(h.m²) at 50 Pa	8	3

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	75.57	69.59
Primary energy [kWh _{tp} /m²]	24.46	36.56
Total emissions [kg/m²]	2.37	3.42

‘Standard Building’ BRUKL

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Burlesdon Unit 2 Option 3 (Be Green)-
Standard Building

As designed

Date: Thu Jun 05 16:52:26 2025

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache
Calculation engine version: 7.0.28
Interface to calculation engine: IES Virtual Environment
Interface to calculation engine version: 7.0.28
BRUKL compliance module version: v6.1.e.1

Certifier details

Name: Name
Telephone number: Phone
Address: Street Address, City, Postcode

Foundation area [m²]: 3556.95

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m²annum	3.42
Building CO ₂ emission rate (BER), kgCO ₂ /m²annum	2.45
Target primary energy rate (TPER), kWh _{tp} /m²annum	36.56
Building primary energy rate (BPER), kWh _{tp} /m²annum	25.23
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 Limit	U _a Calc	U _i Calc	First surface with maximum value
Walls*	0.26	0.18	0.18	NT000006:Surf[1]
Floors	0.18	0.15	0.15	NT000006:Surf[0]
Pitched roofs	0.16	0.15	0.15	NT000052:Surf[55]
Flat roofs	0.18	0.15	0.15	NT00001C:Surf[0]
Windows** and roof windows	1.6	1.41	1.6	NT00000B:Surf[1]
Rooflights***	2.2	2.1	2.1	NT000052:Surf[2]
Personnel doors^	1.6	1.9	1.9	NT000005:Surf[1]
Vehicle access & similar large doors	1.3	1.3	1.3	NT000003:Surf[9]
High usage entrance doors	3	-	-	No high usage entrance doors in building

U_a Limit = Limiting area-weighted average U-values [W/(m²K)]
U_a Calc = Calculated area-weighted average U-values [W/(m²K)]
U_i Calc = Calculated maximum individual element U-values [W/(m²K)]
* 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/m²K
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
m³/(h.m²) at 50 Pa	8	3

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	80.25	69.59
Primary energy [kWh _{tp} /m²]	25.23	36.56
Total emissions [kg/m²]	2.45	3.42

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