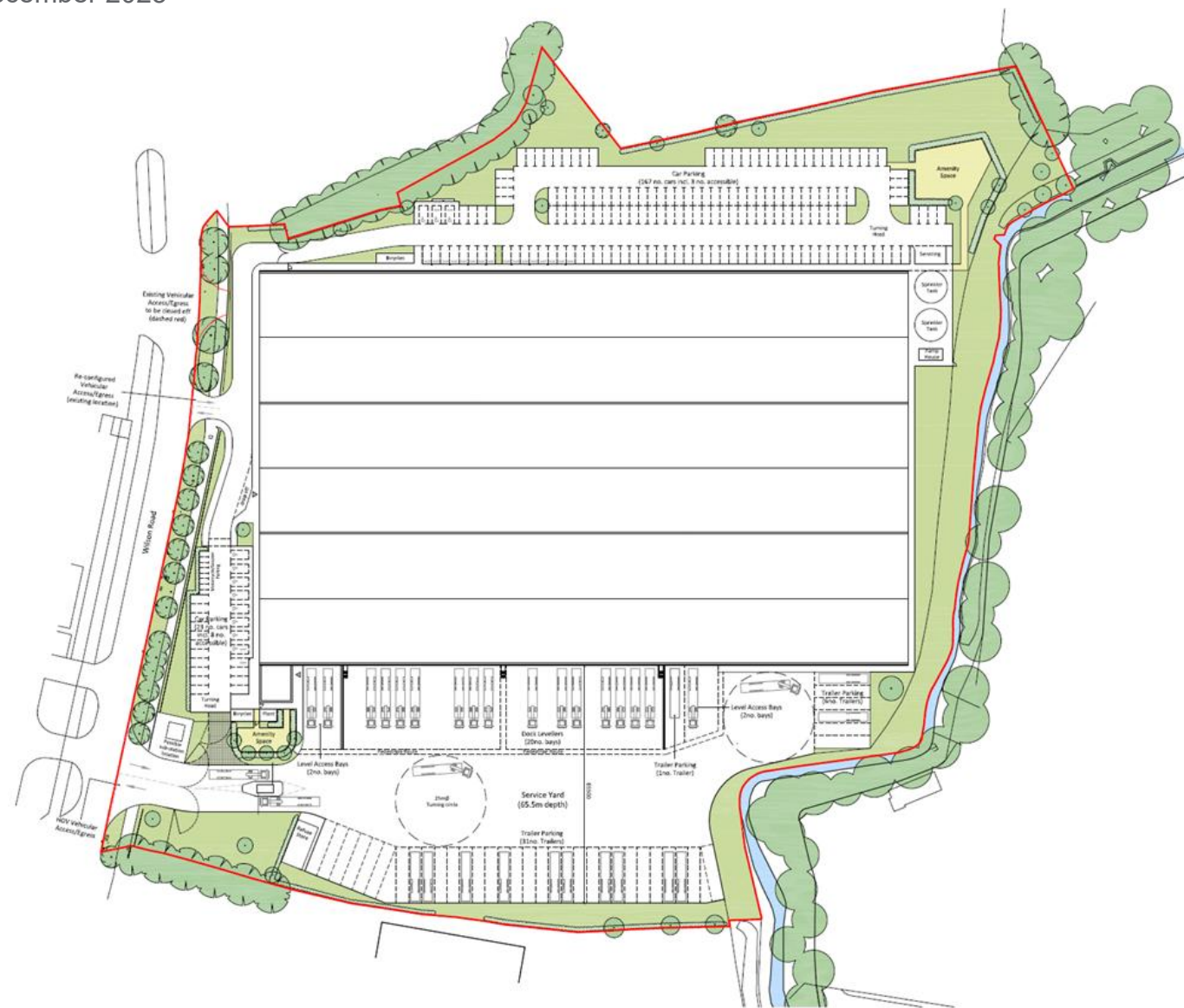


Jones Lang LaSalle Incorporated

Linden Hill, 35 Wilson Road

JLL Sustainable Asset Services
December 2025



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Record of Revisions

Revision	Reason for Issue	Issue Date	Prepared By	Reviewed By	Authorised By
01	Client Review	01/12/25	Matt Hails	Hamad Yoonus	Areti Makantasi
02	Response to comments	10/12/25	Matt Hails	Hamad Yoonus	Areti Makantasi

Executive Summary

This Passive Design Analysis has been prepared by JLL’s Sustainable Asset Services team for a proposed development at 35 Wilson Road, United Kingdom.

The scheme involves the development of 21,110m² warehouse at Huyton business park and is assessed against BREEAM UK New Construction (NC) Version 6.1.

This report presents the outcomes of the Passive Design Analysis carried out to demonstrate compliance with ENE04 Low Carbon Design (1 Credit – Passive Design Analysis).

The analysis concluded that the following passive design measures are feasible for the site, and they will be incorporated into the proposed design:

- Thermal performance of the floor construction

The energy modelling results indicate that these proposed passive design measures would result in a 2% reduction in CO₂ emissions over the standard building,

Table 1: Energy Modelling Results – CO₂ Emissions

Energy Modelling Results	
Standard Building (kg of CO ₂ /m ² /year)	1.33
Proposed Design (kg of CO ₂ /m ² /year)	1.3
Percentage Reduction over the Standard Building	2%

Table 2: Energy Modelling Results – Energy Demand

Energy Modelling Results	
Standard Building (kWh/m ² / year)	12.61
Proposed Design (kWh/m ² / year)	12.37
Percentage Reduction over the Standard Building	2%

*Energy used by equipment does not count towards the total consumption for calculating emissions.

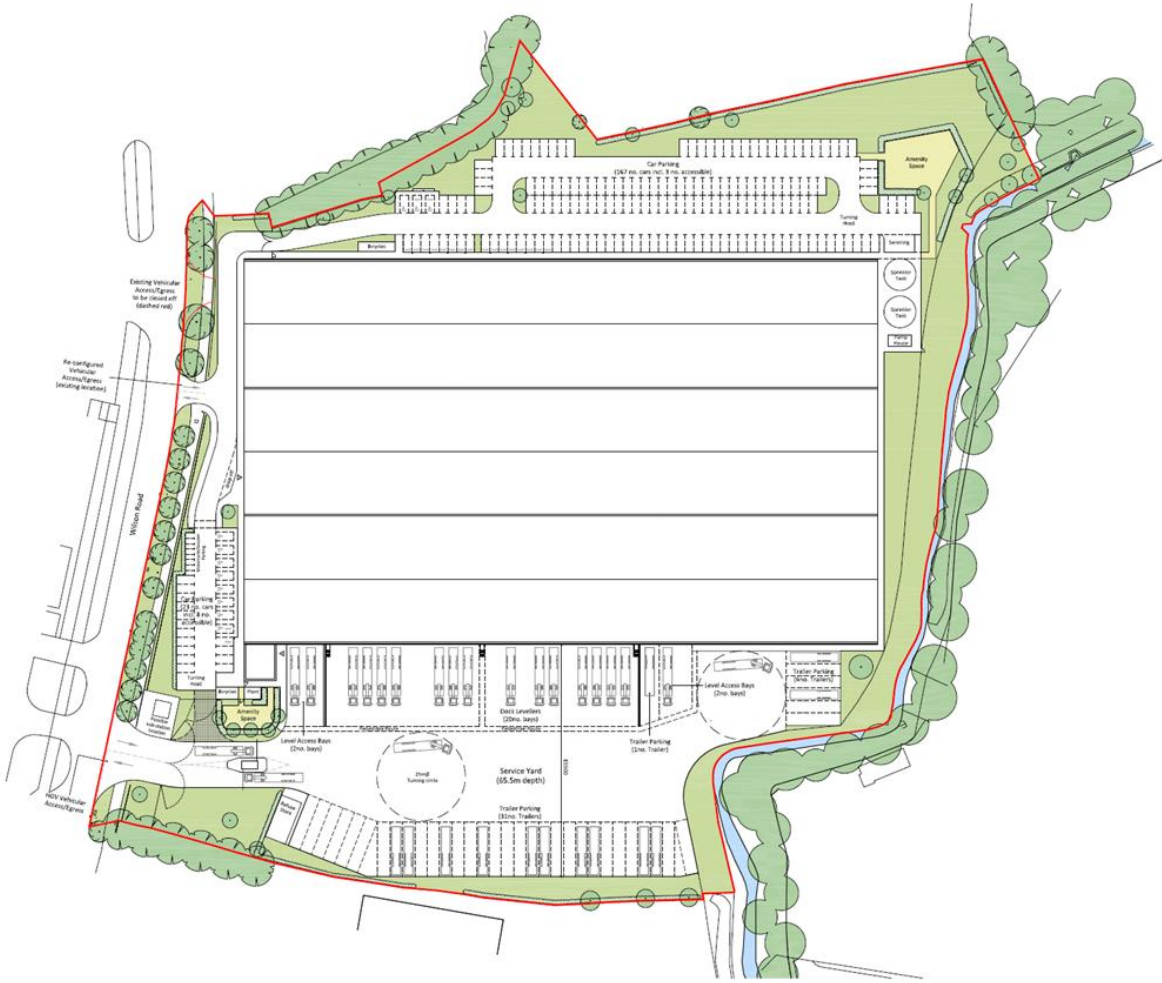


Figure 1: Site Proposed Plan

Assessment Criteria & Methodology

Assessment Criteria

Compliance with the requirements of BREEAM UKNC Version 6.1 – ENE04 Passive Design Analysis is assessed under the following criteria:

- Achieve the first credit Hea 04 Thermal Comfort: One Credit – Thermal modelling to demonstrate the building design delivers appropriate thermal comfort levels in occupied spaces.
NOTE: Thermal Comfort analysis does not sit within the scope of this report. This report presents the outcomes of the Passive Design Analysis for compliance with the below criteria.
- The project team analyses the proposed building design and development during Concept Design to identify opportunities for the implementation of passive design measures.
- Implement passive design measures to reduce the total heating, cooling, mechanical ventilation, lighting loads and energy consumption in line with the passive design analysis findings.
- Quantify the reduced total energy demand and carbon dioxide (CO₂-eq) emissions resulting from the passive design measures.

Methodology

This study adheres to the methodology stipulated by BREEAM UKNC Version 6.1, and covers the following:

- Site Location
- Site Weather
- Microclimate
- Building Layout
- Building Orientation
- Building Form
- Building Fabric
- Thermal Mass or fabric thermal storage
- Building Occupancy Type
- Daylighting Strategy

- Ventilation Strategy
- Adaptation to Climate Change

Any savings resulting from the incorporation of passive design measures have been demonstrated by comparing the energy demand and CO₂-eq emissions for the building with and without the proposed passive design measures adopted, as identified in the passive design analysis.

To enable a baseline for comparison to be established, a ‘standard building’ has been modelled with fabric performance equivalent to that of the building regulations notional building for the space activity type and without the passive design measures. The glazing areas specified in the ‘standard building’ are the same as those required by the building regulations notional building for the space activity type.

This ‘standard building’ has been modelled as equivalent to the proposed building with the exception of any changes to account for passive design measures and fabric performance as seen in the table below:

Table 3: Characteristics of the Standard Building against those of the Proposed Building Design

	Standard Building	Proposed Building
External Shading Devices	As Notional	As Designed
Fabric Performance	As Notional	As Designed
Fabric Proportions	As Notional	As Designed
Thermal Mass	As Notional	As Designed
Daylighting	As Notional	As Designed
Ventilation	As Notional	As Designed

Passive Design Analysis

Site Location

The site of the development is located on the south bank of the 35 Wilson Road, in the northwest of England. The area comprises an industrial warehouse, adjacent to Huyton business park and bordering the residential town of Huyton. The density and height of surrounding buildings varies with orientation.

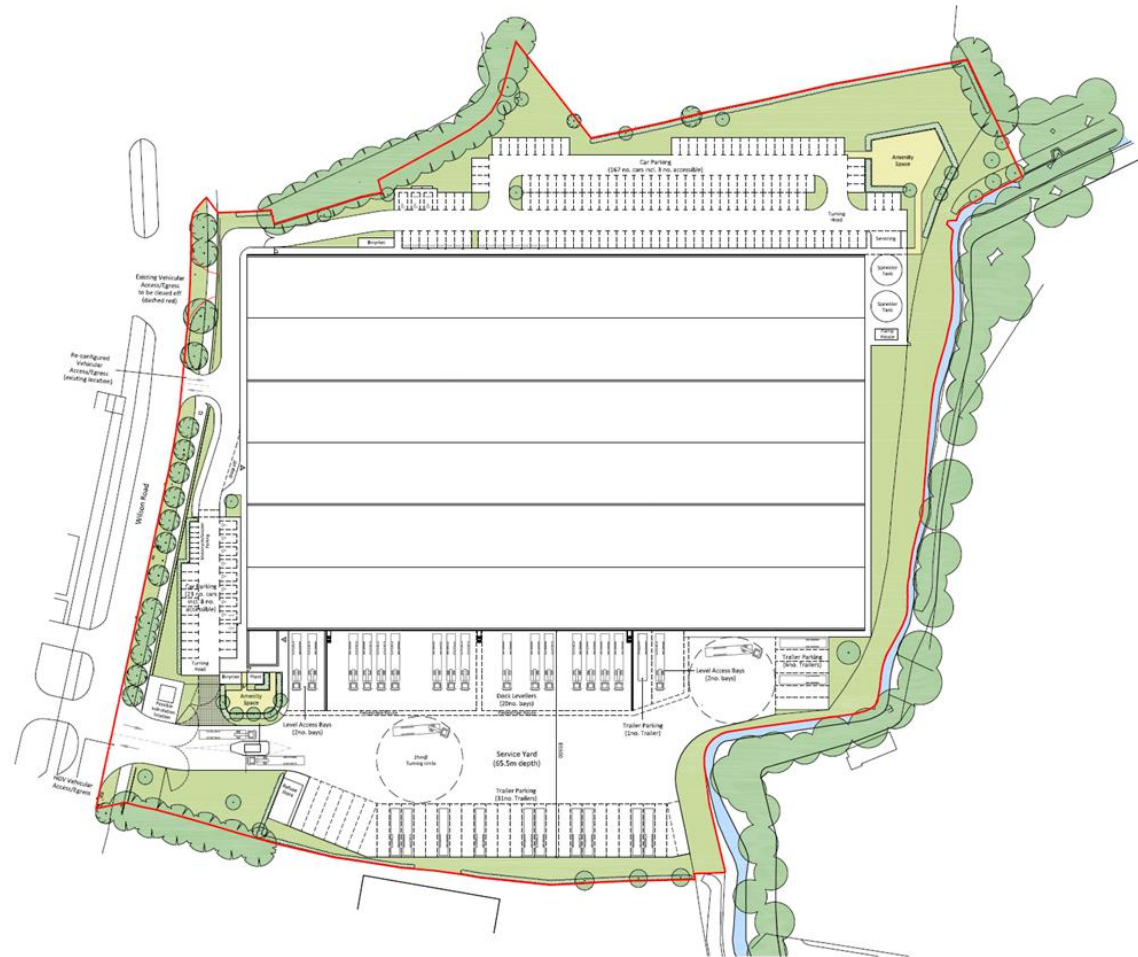


Figure 2: Outlined Site Location

Site Weather

Observation of the CIBSE weather file for Manchester reveals that ambient air temperature varies between 28.2°C and -6.9°C per annum. The maximum quoted temperature occurs during the month of July, whilst the minimum temperatures correspond to the month of December. The average external air temperature throughout the year is 9.82°C.

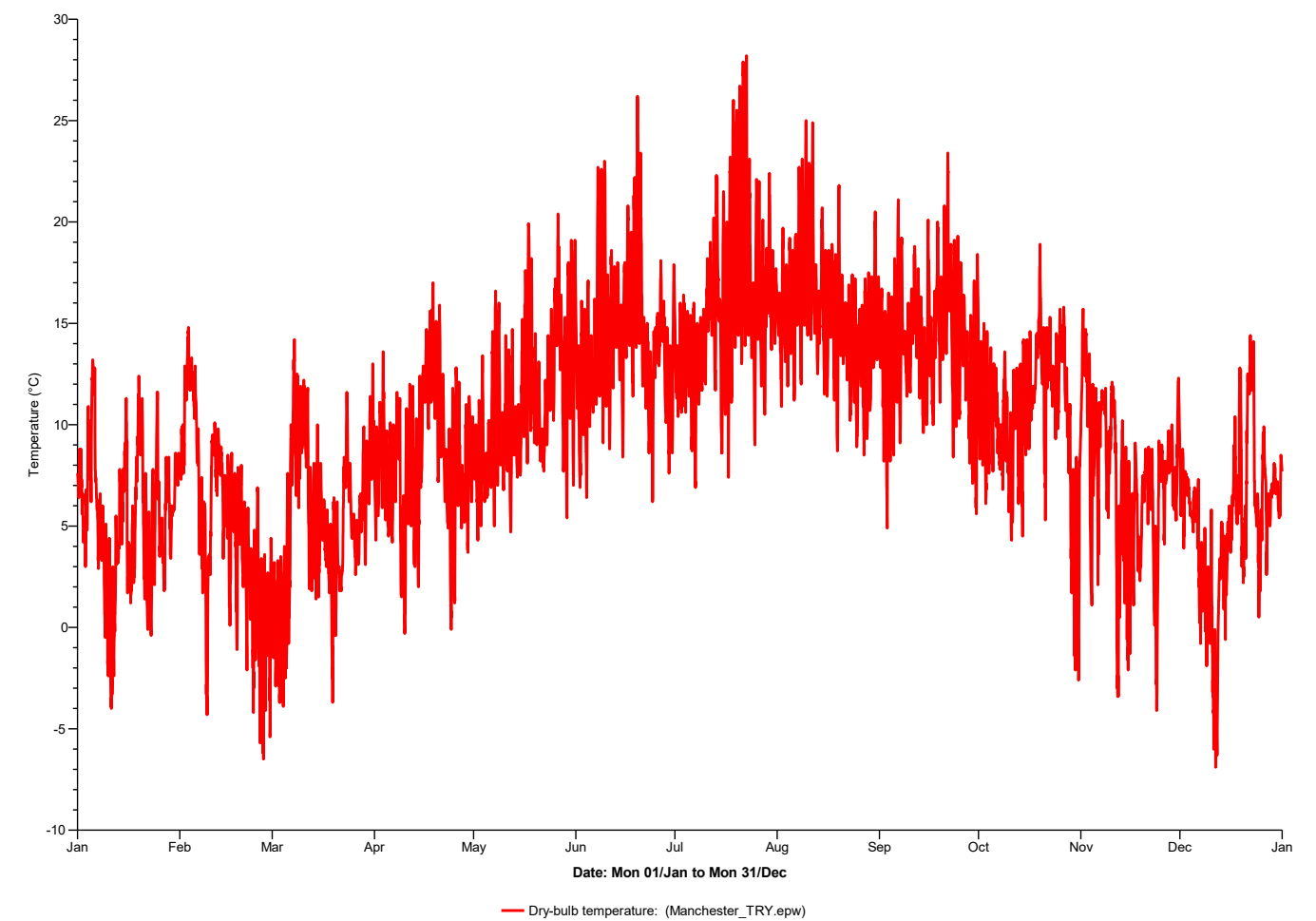


Figure 3: Annual Dry-Bulb Temperature variation (Source: CIBSE TRY weather file for Manchester Weather Centre)

Microclimate

The Huyton warehouse site, located 8km from the Mersey River and 18km from the coast, sits beyond significant maritime influence, with regional weather patterns dominating local conditions. The 21,077m² warehouse's northeast orientation positions its longer facades northwest-southeast, creating some exposure to prevailing southwest winds and potential pressure differentials around building corners. The site's intermediate position between Huyton's urban core and greenbelt edge creates mixed surface roughness conditions. Nearby residential areas provide moderate wind sheltering through varied building heights.

Building Layout

Figure 4 shows the ground floor space adjacent to the warehouse with a three-levels of office above it. The administrative areas include WC and reception facilities. The right side houses a separate transport office entrance adjacent to loading bays. The first floor of office space is also shown, containing open plan office space and support facilities. The office portion extends for two additional levels above this, creating a three-story office building alongside the single-story warehouse space.



Figure 4: Ground floor and level 1 ancillary and office space layout example

Building Form

The proposed development is a long rectangular shaped building, reducing the likelihood of thermal bridging and associated heat loss. The shape creates an optimal surface-to-volume ratio that minimizes exterior wall area, reducing heat transfer and air infiltration points that cause energy loss.

Combined with proper depth-to-height proportions in the office space, this form enables effective natural ventilation while reducing the volume of air requiring conditioning.

Orientation

The buildings axis of orientation is Northeast. As the building is located within an industrial estate, their orientation is driven by the available space within the site and other parameters that relate to function, circulation and logistics within the overall site and therefore it cannot be modified.

Building Fabric

At the current design stage, building fabric performance has been defined as per Table 5, below. Predominantly the initial U-values match those set by Part L of the Building Regulations 2021 Notional building. The area of improvement is in the ground floor U-Value, carrying the capacity to reduce heat losses through the floor.

Table 5: Thermal Properties of the notional and proposed building's fabric

	Notional Building (NCM 2021)	Proposed Building
Floor U-value	0.15-0.22 W/m ² .K Side-lit – Top-lit activities	0.12 W/m ² .K
Roof U-value	0.15-0.18 W/m ² .K Side-lit – Top-lit activities	0.15 W/m ² .K
Wall U-value	0.18-0.26 W/m ² .K Side-lit – Top-lit activities	0.18 W/m ² .K
Doors U-value	1.3-1.9 W/m ² .K Side-lit – Top-lit activities	1.3-1.6 W/m ² .K
Window U-value	1.4 W/m ² .K	1.4 W/m ² .K
Air Permeability	3-5 m ³ /m ² h @ 50 Pa Side-lit – Top-lit activities	3 m ³ /m ² h @ 50 Pa
Glazing G-Value	29-40%	40%
Visual Light Transmittance	60-71%	71%

Thermal Mass

Design specifications at the proposed development outline intentions for the incorporation of high thermal mass, exposed concrete slab floor constructions. Such a material is characterised by its high density and specific heat capacity, which allows for thermal energy to be absorbed, stored and released – passively providing means of temperature regulation. Glazing g-values are a significant determinant in the solar gain realised by these concrete floor plates and has been specified as 0.4 for the proposed buildings. Low emissivity properties have also been defined for proposed glazed areas of the building envelopes, further improving the construction's thermal efficiency.

Building Occupancy Type

The proposed development is a large logistics warehouse with adjoining office space and supporting WC, reception and plant space. The buildings within the scope of this assessment comprise of manufacturing, canteen and WC spaces. Under the National Calculation Methodology (NCM) the primary activity assigned to this building occupancy type is a Warehouse Storage profile. At this early stage of design, operational days and hours of these spaces have not yet been defined.

Daylighting Strategy

The natural daylighting provision for the proposed development is enhanced through certain design elements. Rooflights serve as the primary source of daylight to the storage warehouse, while the office spaces feature significant glazing. The storage areas rely entirely on overhead natural lighting through the rooflight system, maximizing natural light penetration into the warehouse spaces while maintaining appropriate lighting levels for storage operations. The extent of office and warehouse glazing can be seen in figures 5 and 6. The daylighting strategy has been further capitalised on by the addition of daylight dimming sensors in the office and warehouse spaces. The functionality of these sensors has been further extended from the notional building to reduce lighting loads.



Figure 5: South- west facing elevation

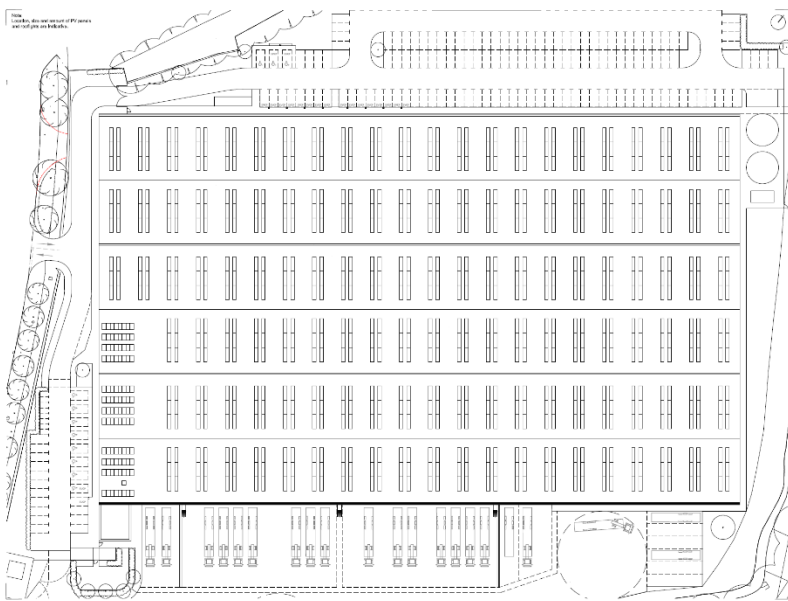


Figure 6: Roof plan

Ventilation Strategy

The warehouse will be naturally ventilated through the loading bays. The volume of the space make it impractical to mechanically ventilate the warehouse. There are also no known operational requirements in the warehouse that would make this necessary. Mechanical supply and extract ventilation has been specified in the office spaces by the development's MEP engineers as mechanical ventilation heat recovery (MVHR) units.

Climate Change Adaptation

The building should be designed with resilience to future climatic conditions and be competent in providing thermal comfort in line with BREEAM Hea04 – Thermal Comfort. Early design considerations, notably fabric U-values that exceed performance requirements stipulated by Part L Building Regulations, indicate that this should be achieved.

Passive Design Measure Savings

The proposed buildings will incorporate the following passive design measures:

- Thermal performance of the floor construction

The energy modelling results indicate that the proposed design would yield a reduction in CO₂ emissions in the order of 2%, compared to the standard building.

Table 6: Energy Modelling Results – CO2 Emissions

Energy Modelling Results	
Standard Building (kg of CO ₂ /m ² per year)	1.33
Proposed Design (kg of CO ₂ /m ² per year)	1.3
Percentage Reduction over the Standard Building	2%

The energy modelling results also indicate that the proposed design, incorporating the aforementioned passive design measures, would reduce the energy demand of the development by 2%, compared to that of the standard building as seen in Table 7, below.

Table 7: Energy Modelling Results – Energy Demand

Energy Modelling Results	
Standard Building (kWh/m ² per year)	12.61
Proposed Design (kWh/m ² per year)	12.37
Percentage Reduction over the Standard Building	2%

Conclusion

A passive design analysis has been carried out for the proposed warehouse development at the 35 Wilson Road, United Kingdom.

The new development is assessed under BREEAM UKNC Version 6.1 This analysis has been carried out in compliance with ENE04 Low Carbon Design (1 credit – Passive Design Analysis).

The proposed design will incorporate passive design measures including U-values that exceed Part L performance such as the thermal performance of the floor constructions.

This passive design measure will reduce CO2 emissions by 2% compared to the standard building – as defined by the BREEAM ENE04 methodology and energy modelling results.

The energy modelling results also highlighted that the proposed passive design measures will also effectively reduce the energy demand, compared to that of the Standard Building, achieving 2% reduction.

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

	Actual	Notional
Heating + cooling demand [MJ/m ²]	13.62	15.94
Primary energy [kWh _{PE} /m ²]	13.89	14.84
Total emissions [kg/m ²]	1.33	1.39

BRUKL Output Document

 HM Government

Compliance with England Building Regulations Part L 2021

Project name

Linden Hill BRUKL 1As built

Date: Thu Nov 27 11:53:23 2025

Administrative information

Building Details

Address: 35 Wilson Rd, Liverpool, L36 6AE

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

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m²]: 533.64

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

Target CO ₂ emission rate (TER), kgCO ₂ /m²·annum	1.39
Building CO ₂ emission rate (BER), kgCO ₂ /m²·annum	1.3
Target primary energy rate (TPER), kWh _{eq} /m²·annum	14.85
Building primary energy rate (BPER), kWh _{eq} /m²·annum	13.59
Do the building's emission and primary energy rates exceed the targets?	BER =< TERBPER =< 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	0.26	0_000003:Surf[0]
Floors	0.18	0.15	0.15	0_000004:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.15	0.15	0F000000:Surf[0]
Windows** and roof windows	1.6	1.34	1.34	0_000001:Surf[2]
Rooflights***	2.2	2.09	2.09	0_000003:Surf[2]
Personnel doors^	1.6	1.6	1.6	0_000001:Surf[1]
Vehicle access & similar large doors	1.3	1.3	1.3	0_000003:Surf[103]
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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use	
	Actual	Notional	% Area	Building Type
Floor area [m²]	21786.4	21786.4		Retail/Financial and Professional Services
External area [m²]	50493.7	50493.7		Restaurants and Cafes/Drinking Establishments/Takeaways
Weather	MAN	MAN		Offices and Workshop Businesses
Infiltration [m³/hm² @ 50Pa]	3	5		General Industrial and Special Industrial Groups
Average conductance [W/K]	14673	13435.5	100	Storage or Distribution
Average U-value [W/m²K]	0.29	0.27		Hotels
Alpha value* [%]	25	10		Residential Institutions: Hospitals and Care Homes

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

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
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	1.46	1.55
Cooling	0.63	0.31
Auxiliary	0.36	0.99
Lighting	4.55	3.77
Hot water	5.4	3.95
Equipment*	30.87	30.87
TOTAL**	12.4	10.57

* 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	3.64	0.61
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	3.64	0.61

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	13.35	15.94
Primary energy [kWh _{FE} /m²]	13.59	14.85
Total emissions [kg/m²]	1.3	1.39



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