

Manchester Jewish Museum

Post occupancy sustainability

035340

15 February 2022

Revision 02 - Planning Submission

Revision	Description	Issued by	Date	Checked
01	Discharge of post occupancy planning condition	JFB	16.12.2021	BJ
02	Revision to incorporate in-use emissions	JFB	15.02.2022	BJ

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date **15/02/2022**

approved **Ben Jones**

signature



date **15/02/2022**

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Glossary

Term	Definition
MJM	Manchester Jewish Museum
AHU	Air Handling Unit
CHW	Chilled Water
LTHW	Low Temperature Hot Water
BCO	British Council for Offices
VAV	Variable Air Volume
FCU	Fan Coil Unit
MVHR	Mechanical Ventilation Heat Recovery
GIS	Government Indemnity Scheme

1 Introduction

1.1 Purpose of this Report

The Manchester Jewish Museum extension project has achieved practical completion and is now open to the public. The purpose of this note is to discharge a post construction planning condition (Condition 11) regards to sustainability as described below:

Condition 11 - *The development hereby approved shall be constructed in accordance with the Sustainability Statement which addresses sustainability ratings and the provision of renewable energy within the development outlined within Chapter 16 of the Design and Access Statement received by the Local Planning Authority on the 13th September 2017. A post construction review certificate/statement shall be submitted for approval, within a timescale that has been previously agreed in writing, to the City Council as Local Planning Authority.*

Reason - *In order to minimise the environmental impact of the development, pursuant to policies SP1, T1-T3, EN4-EN7 and DM1 of the Core Strategy, policy DP3 of Regional Spatial Strategy for the North West (RSS), and the principles contained within The Guide to Development in Manchester SPD (2007), and the National Planning Policy Framework.*

1.2 Context

Buro Happold Engineering were appointed by Manchester Jewish Museum to undertake design works for the proposed Manchester Jewish Museum redevelopment. This building comprises the restoration of the grade II* listed synagogue and the development of a 2-storey new build extension to house a café, archive and gallery space. Here, visitors see rare and powerful objects, hear personal stories, eat Jewish food and travel back in time to explore Manchester's oldest surviving synagogue. Key aspects include a ground floor entrance and atrium, a screen enclosed roof top plant space and a gas/electrical hybrid building design.

1.3 Description of development

The grade two listed former synagogue building has been fully restored and the existing museum has been extended to house new galleries and spaces for learning, events and commercial operations.

The pre and post development land use quantum are shown below:

- Area pre development – 290 sq m GFA (D1)
- Area post development – 841 sq m GFA (D1)

The planning application boundary is shown in the following figure.

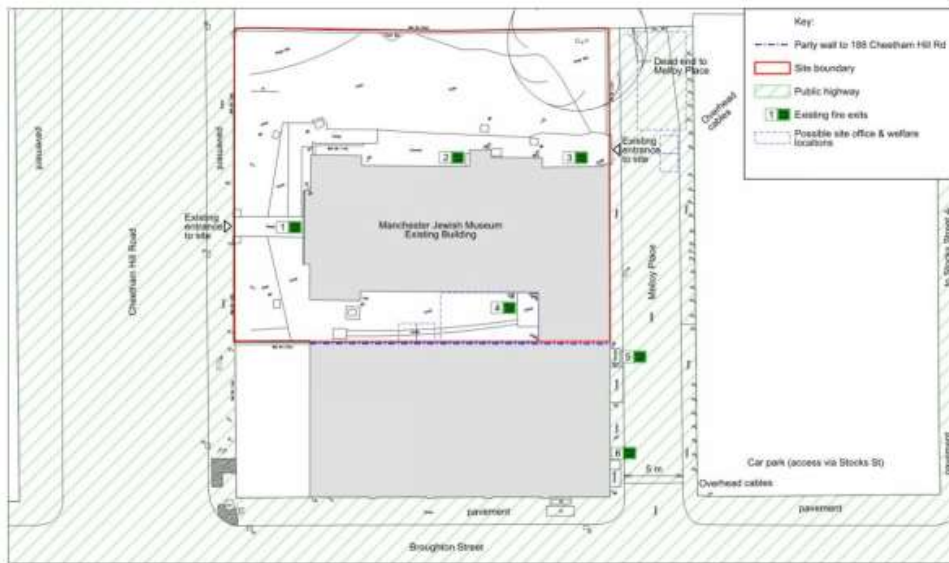


Figure 1 - Site red line boundary

1.4 Site Description

The Manchester Jewish Museum is located on Cheetham Hill Road 1.5km north of Manchester city centre, just north of Broughton Street and approximately 300m south of Manchester Fort Shopping Park. The site location is shown in the following figure.



Figure 2 - Site Location

2 Carbon targets

2.1.1 Design and Access Statement

A Design and Access Statement was issued as part of the planning documents issued to Manchester City Council (dated 12/06/2017). This document (shown in Figure 2-1) set out sustainability and energy targets within chapter 16.

The purpose of these targets was to ensure the building demonstrated an improvement against the performance of the pre-project building, acknowledging the constraints of the synagogue being of high heritage value being a listed building.



Figure 2-1 - MJM design and access statement

The energy targets as set out in this report are presented in Figure 2-2. This proposed that an improvement over the typical 'benchmark' museum building of 10.4% could be achieved, resulting in a **target carbon intensity of 37.4kgCO₂/m²annum**.

Benchmark/ 'typical' museum building	CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	41.8	10.4%
Minimum target	Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	41.8	improvement
Design proposals	Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	37.4	

Figure 2-2 - Operational carbon intensity target in D&A statement

3 As-Built EPC

During the construction phase an as-built EPC has been produced by the main contractor and issued to the building control officer in order to demonstrate compliance with Part L of the building regulations, which has been approved. This model contained the as-built information of the building, including as-installed fabric performance and MEP system efficiencies.

The resultant carbon intensity of the building presented in that document is **33.4kgCO₂/m².annum**, 11% lower than the target figure set out in the design and access statement, as shown in Figure 3-1. The as-built BRUKL document can be found in Appendix A.

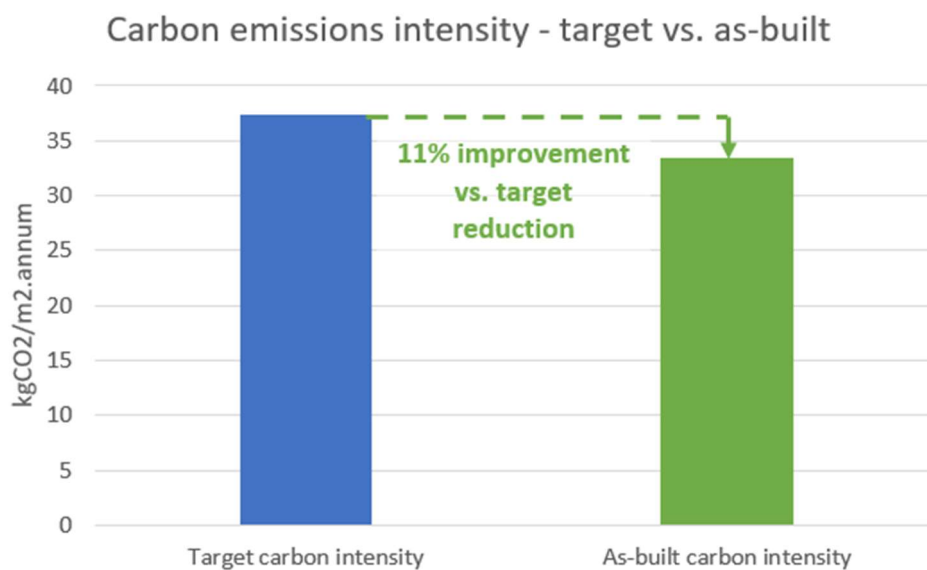


Figure 3-1 - Target vs. as-built carbon intensity

Ideally, actual metered energy consumption from the operational phase of the building would be used to verify the in use performance of the building. However the building is still within the contractor's defects liability phase and the HVAC equipment is still being adjusted in order to maintain suitable conditions within the archive and gallery spaces, thus the data would not constitute accurate in-use data.

4 In-Use Measured Carbon Emissions

The museum re-opened to visitors on 2nd July 2021. The energy consumption of the building since opening has been analysed based on utilities bills for the period. Given that data is only available for the first 6 months (July – December 2021), the remaining months (January – July) have been extrapolated to give the annual demand, as shown in the graphs below.

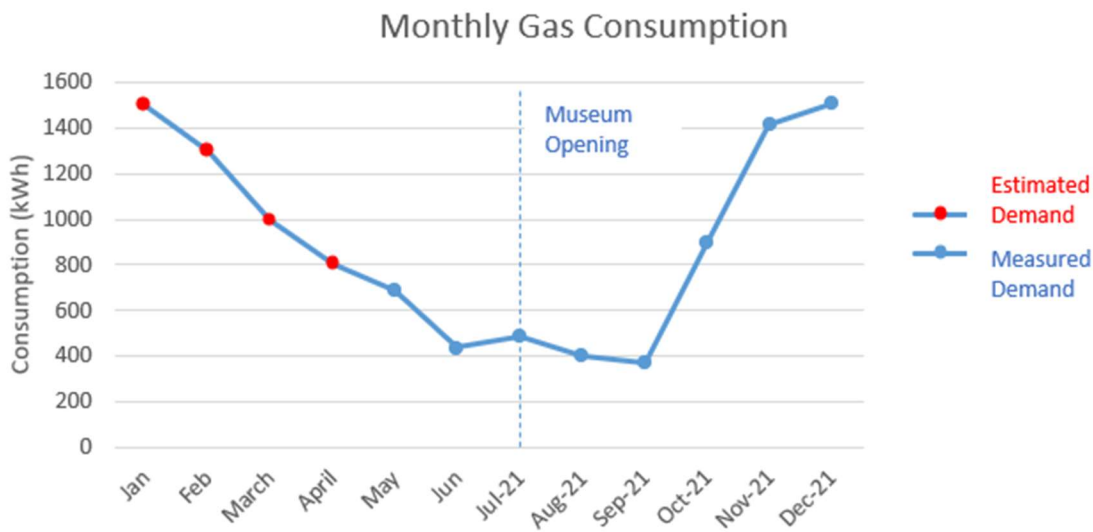


Figure 4-1 - Monthly gas consumption

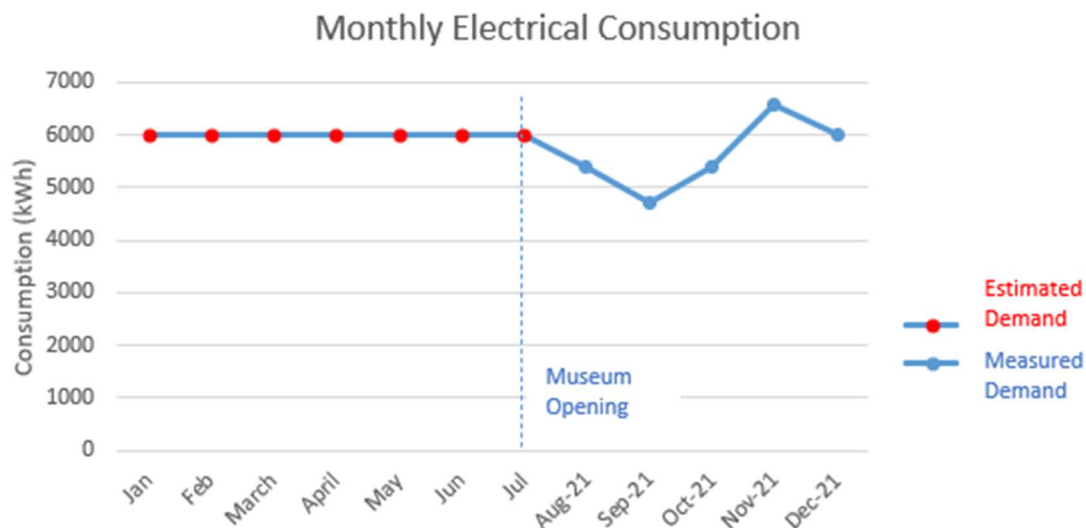


Figure 4-2 - Monthly electrical consumption

Utilising this annual gas and electricity consumption, the resulting carbon emissions can be calculated. The latest BEIS conversion factors have been used (*BEIS - Conversion factors 2021: revised January 2022*) for the year 2021, which are as follows:

$$\text{Electricity} = 0.212 \text{ kgCO}_2/\text{kWh}$$

$$\text{Gas} = 0.203 \text{ kgCO}_2/\text{kWh}$$

This relates to the following actual in-use measured carbon performance, given a total floor area of 862m²:

	Annual Energy Consumption		Annual Carbon Emissions	
	kWh/yr	kWh/yr/m ²	kgCO ₂	kgCO ₂ /yr/m ²
Gas	10,808	12.5	2,194	2.55
Electricity	70,099	81.3	14,861	17.24
Total	80,907	93.9	17,055	19.8

The carbon emissions intensity of 19.8 kgCO₂/yr/m² represents a 47% improvement over the target 37.4 kgCO₂/yr/m² as shown in Figure 4-3.

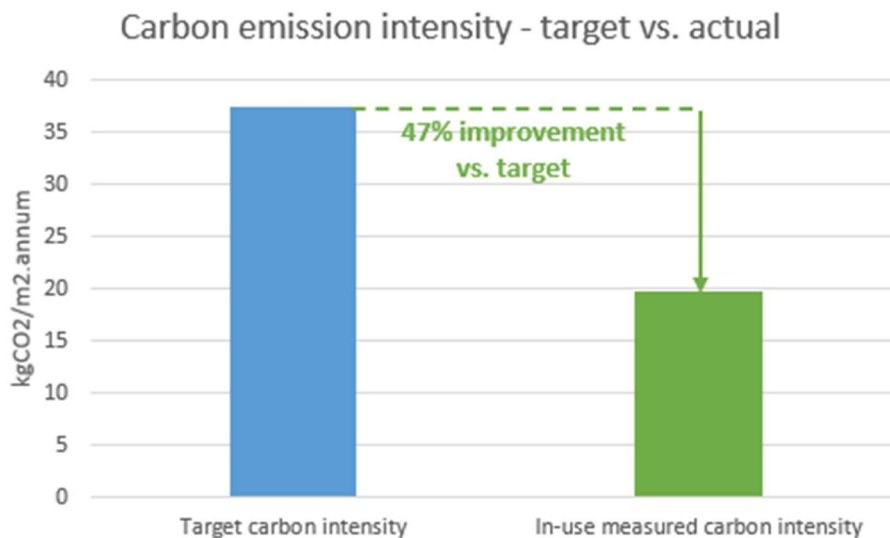


Figure 4-3 - Carbon emissions - target vs. actual

5 Other sustainability measures

It has become clear over recent years that part of the solution to zero carbon will be a societal shift towards circular economy thinking and thus re-use and repurposing more existing assets. The Jewish Museum was on a path to decline and, whilst demolition was not an option due to the listed status of the building, the revitalisation of buildings such as these will be critical to ensure they are used more, loved more, looked after and thus last longer.

Despite addition of a formal gallery space, archive and café to the building which would typically increase the energy density of the development, the carbon intensity of the building will actually reduce by around 20%, through passive design measures such as improved fabric and natural ventilation. Sustainable features such as cycle stores, LED lighting and efficient water fittings were adopted, and materials sourced locally wherever possible. Unique historic buildings need careful care, both in conserving their form, as well as adapting and expanding them for future use. The project includes the full restoration of the existing structure, including intrusive repairs to the existing oak synagogue roof trusses, all the while designing details which were sympathetic to the original building fabric.

Appendix A As-built BRUKL document

Project name

Manchester Jewish Museum

As built

Date: Thu Apr 01 20:59:10 2021

Administrative information

Building Details

Address: 190 CHEETHAM HILL ROAD, MANCHESTER,
MANCHESTER, M8 8LW

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.1"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.1

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Andrew Hart

Telephone number: 07969730551

Address: 31 Edale Grove Sale, Manchester, M33 4RG

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	34.1
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	34.1
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	33.4
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _{a-Limit}	U _{a-Calc}	U _{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.18	1.32	Existing - Syna Exist Wall-exposed
Floor	0.25	0.13	0.13	New - Ground Floor
Roof	0.25	0.12	0.12	New - First Floor
Windows***, roof windows, and rooflights	2.2	1.42	1.59	G-W24 Proposed
Personnel doors	2.2	1.76	2.39	G-D13 Proposed Plant Door
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project

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)]

* There might be more than one surface where the maximum U-value occurs.

** 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.

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

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	15

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- UFH+NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.96	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

2- RAD+EF_03_01 (FF EXT WC)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.96	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

3- UFH+EF_03_01 (3 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.96	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

4- KEF_01_00 (GF EXT KITCHEN)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

5- AHU_01_01 CO2 and HUMIDITY

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.96	4.52	-	1.52	0.79
Standard value	0.91*	2.55	N/A	1.6^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					
^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.					

6- AHU_02_01 HUMIDITY

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.96	4.52	-	1.73	0.82
Standard value	0.91*	2.55	N/A	1.6^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					
^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.					

1- POU Water Heaters

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	0
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I			
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		Zone	Standard
FF EXT WC	-	-	1.1	-	-	-	-	-	-	-	-	N/A
GF EXT FEMALE WC	-	-	1.1	-	-	-	-	-	-	-	-	N/A
GF EXT MALE WC	-	-	1.1	-	-	-	-	-	-	-	-	N/A
GF EXT ACC WC	-	-	1.1	-	-	-	-	-	-	-	-	N/A
GF EXT KITCHEN	-	-	-	-	-	-	-	-	0.8	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
FF EXT GALLERY 1	-	-	60	135
FF EXT GALLERY 2	-	-	60	350
FF EXT LOBBY	-	97	-	34
FF EXT WC	-	110	-	34
GF EXT PLANT	150	-	-	28
GF EXT FEMALE WC	-	110	-	40
GF EXT MALE WC	-	110	-	30
GF EXT ACC WC	-	110	-	23
GF EXT ARCHIVE STORE	138	-	-	24
GF EXT KITCHEN	-	103	-	215
GF EXT CAFE	-	100	-	54
GF EXT DRAFT LOBBY	-	103	-	16
GF EXT ATRIUM	-	88	-	168
GF EXT LIFT LOBBY	-	110	-	19
GF EXT CIRCULATION	-	110	-	15
GF EXT SECONDARY LOBBY	-	103	-	14

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
FF EXT GALLERY 1	N/A	N/A
FF EXT GALLERY 2	N/A	N/A
GF EXT ARCHIVE STORE	N/A	N/A
GF EXT CAFE	NO (-24%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

Building Use

	Actual	Notional
Area [m ²]	398	398
External area [m ²]	926	926
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	15	3
Average conductance [W/K]	260	354
Average U-value [W/m ² K]	0.28	0.38
Alpha value* [%]	24.86	24.86

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

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
100	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 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	42.77	27.52
Cooling	0.56	3.44
Auxiliary	17.96	13.6
Lighting	15.52	29.52
Hot water	12.54	14.51
Equipment*	23.73	23.73
TOTAL**	89.36	88.59

* 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	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	156.64	132.34
Primary energy* [kWh/m ²]	195.19	188.91
Total emissions [kg/m ²]	33.4	34.1

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	263	0	80.5	0	2.5	0.91	0	0.96	0
Notional	182.8	0	62	0	1.5	0.82	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	161.1	0	49.3	0	32.1	0.91	0	0.96	0
Notional	112.9	0	38.3	0	17.6	0.82	0	----	----
[ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	156.9	0	48	0	29.7	0.91	0	0.96	0
Notional	112.9	0	38.3	0	16.4	0.82	0	----	----
[ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	0	0	0	0	46.7	0	0	0	0
Notional	0	0	0	0	34.7	0	0	----	----
[ST] Single-duct VAV, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	93.3	19.1	28.6	1.2	27	0.91	4.52	0.96	4.52
Notional	28.3	110.9	9.6	8.6	22.5	0.82	3.6	----	----
[ST] Single-duct VAV, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	66.5	17.2	20.4	1.1	15.2	0.91	4.52	0.96	4.52
Notional	14	14.9	4.7	1.2	9.2	0.82	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEEF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.15	New - Corten Cladding
Floor	0.2	0.13	New - Ground Floor
Roof	0.15	0.12	New - Plant Roof
Windows, roof windows, and rooflights	1.5	1.4	New - Glass Roof to Atrium
Personnel doors	1.5	1.52	G-D16 Proposed
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	15

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