18/06/09

User Guide

cSBEM

An Interface for cSBEM
(Consultation Simplified Building Energy Model)

Part of the National Calculation Methodology

A User Guide to cSBEM

(cSBEM version 1.0.0)

To be read in conjunction with iSBEM User Guide v3.4.a

18 June 2009

Communities and Local Government

Disclaimer

The cSBEM User Guide cannot provide legal advice or a definitive interpretation of the law. The guidance provided in this document is limited to the technical operation of the software tool. It is offered in good faith but is not binding on any person(s) or organization. The same applies to the default values in the interface, which should be viewed as conservative suggestions intended to be replaced by actual values.

This manual, together with the software tools described in it, were developed by the BRE for the Department for Communities and Local Government (CLG), under a contract managed for CLG by Faber Maunsell.

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1. SCOPE OF THIS GUIDE

The purpose of this guide is to highlight the differences between cSBEM v1.0.0. (available for download from http://www.2010ncm.bre.co.uk) and iSBEM v3.4.a (available for download from http://www.ncm.bre.co.uk). It should be referred to in conjunction with the document *A User Guide to isbem v3.4.a* released on 26th May 2009, which can also be downloaded from www.ncm.bre.co.uk. Please refer to this more detailed document for further information about cSBEM.

This guide does **not** include any information on the proposed changes to building regulations. Users can download the consultation package and response form from CLG's website at: www.communities.gov.uk/publications/planningandbuilding/partlf2010consultation or www.communities.gov.uk/consultations.

2. ENTERING A BUILDING INTO iSBEM

2.1. General form

2.1.1. General Information tab

Project Details sub-tab:

In this sub-tab, the following information can be entered (Figure 1):

Building Regulations & EPBD Parameters

1. Purpose of the analysis – purpose for carrying out a calculation using cSBEM is restricted to the option of 'England and Wales Building Regulations Part L 2010'.

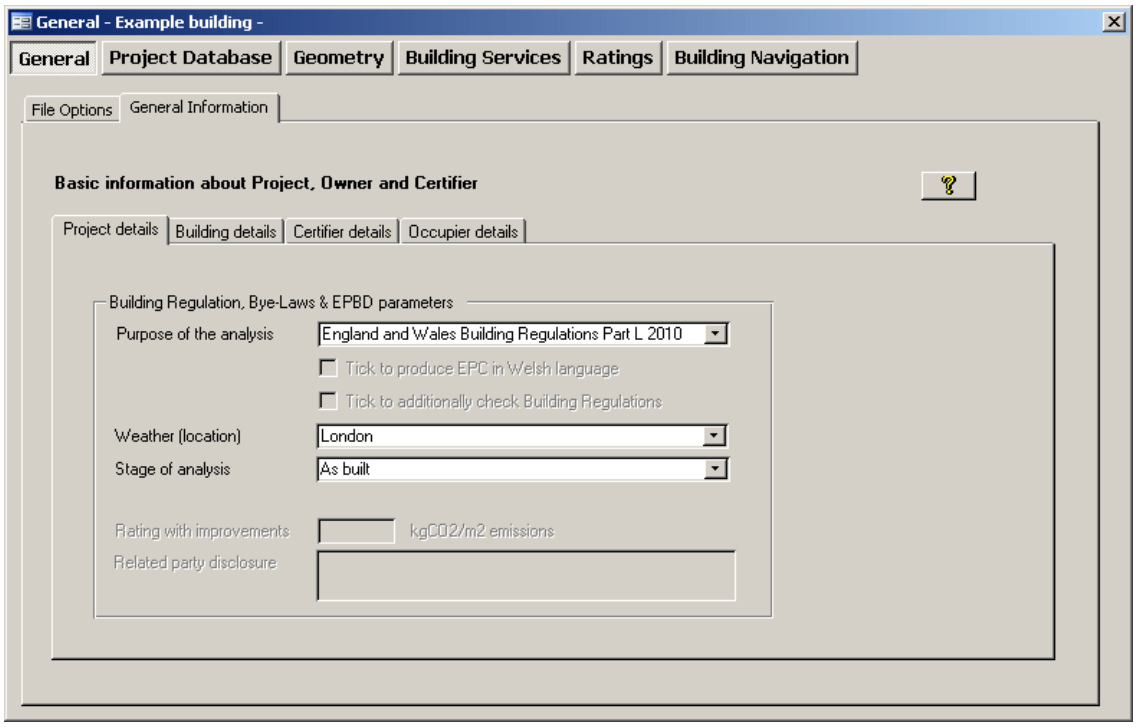

Figure 1: The Project details sub-tab of the General Information tab in the General form

Building Details sub-tab:

In this sub-tab (Figure 2), the following information can be entered:

Building Details

1. Building type - The choice of building type here sets the default building type for the activity areas that you will define later. You will, however, be able to change the building type for each of the activity areas when you come to define them. At this point, you should choose the building type that most closely defines the majority of the building. Please refer to APPENDIX B: Matrix of activity areas and building types, for a full list of all the building types and activities available in cSBEM.

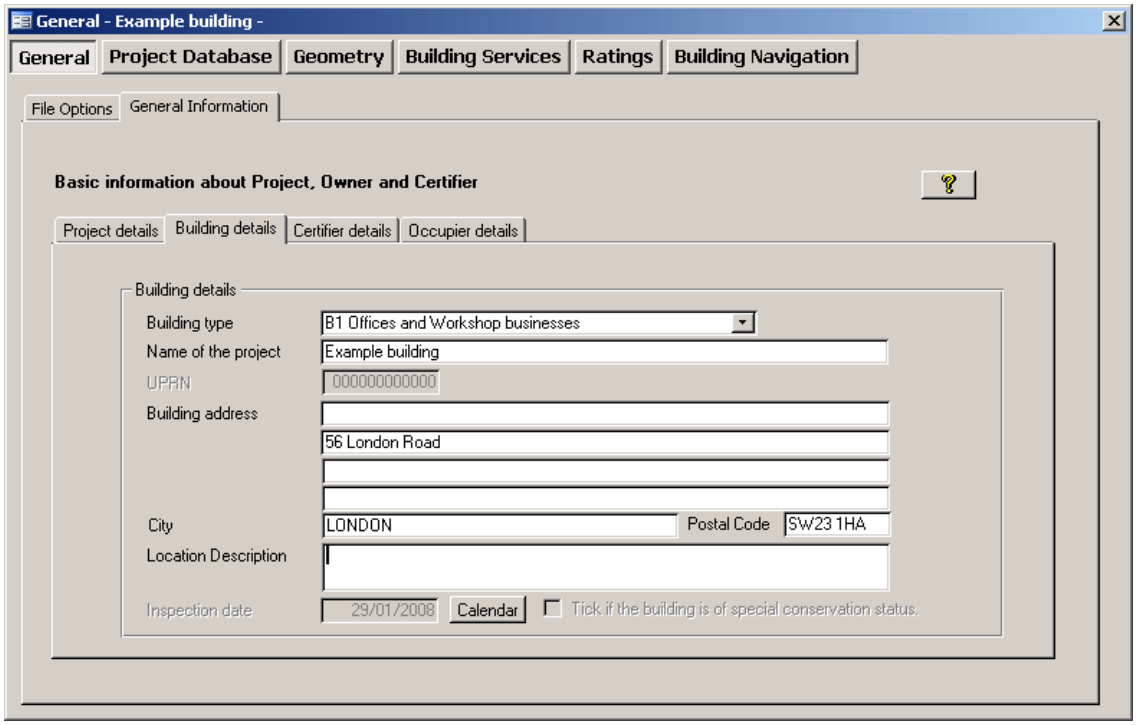

Figure 2: The Building Details sub-tab of the General Information tab in the General form

2.2. Geometry form

2.2.1. Zones tab

General sub-tab:

In this sub-tab (Figure 3), the following information is required:

1. Building type – The default for this field is the building type that was selected when creating the project (this information is recorded in the *General Information* tab in the *General* form). It can, however, be changed for any particular zone, if appropriate.
2. Activity type – A building can be divided into a number of activity areas. For example, in an office building, there may be a reception, open plan office, some cellular offices, a tea room, and some toilets. When you choose your building type and activity area, you are setting a number of default parameters which the tool uses to calculate the energy consumption. These parameters include temperature set points, heat gains from people and equipment, required illuminance, and fresh air requirements amongst others. Each building type has a number of different activity areas to choose from. The description of the activity area, as it appears in the NCM Activity Database, is displayed in a box at the right-hand side of the sub-tab.

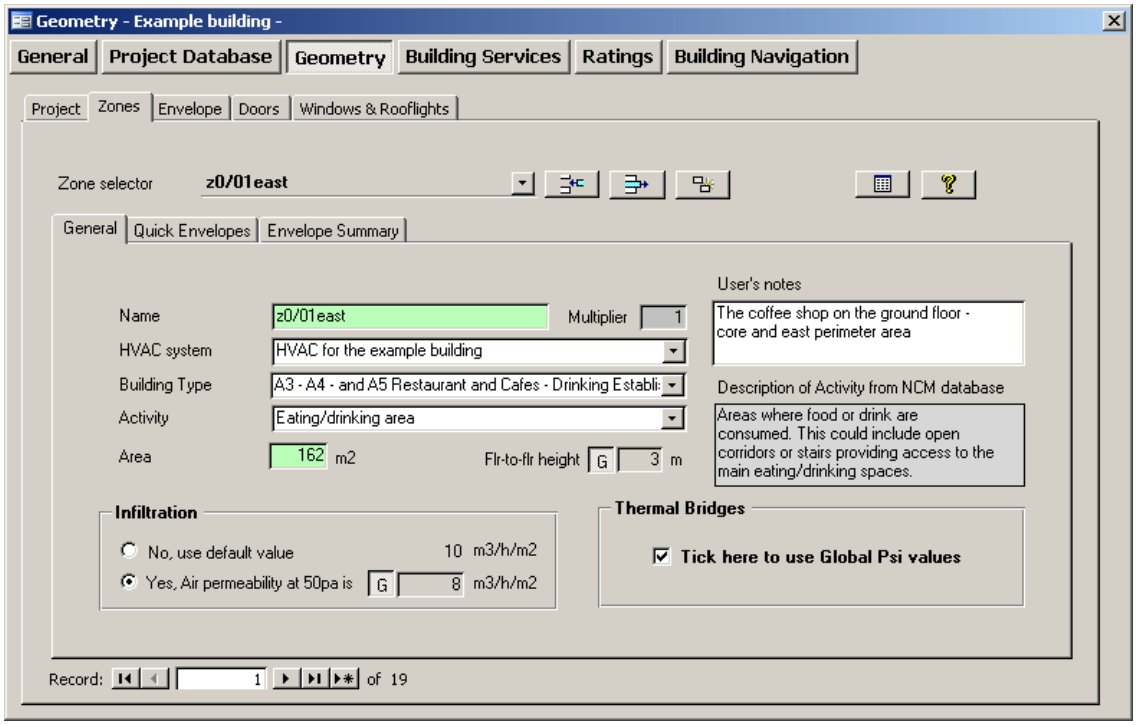

Figure 3: The General sub-tab of the Zones tab in the Geometry form

2.3. Building Services form

2.3.1. Zones tab

System Adjustment sub-tab:

In this sub-tab (Figure 4), the following information is required:

1. Do you know the terminal unit specific fan power for? - Here you can either use the default value, or enter your own SFP for the terminal unit, in W/(l/s).

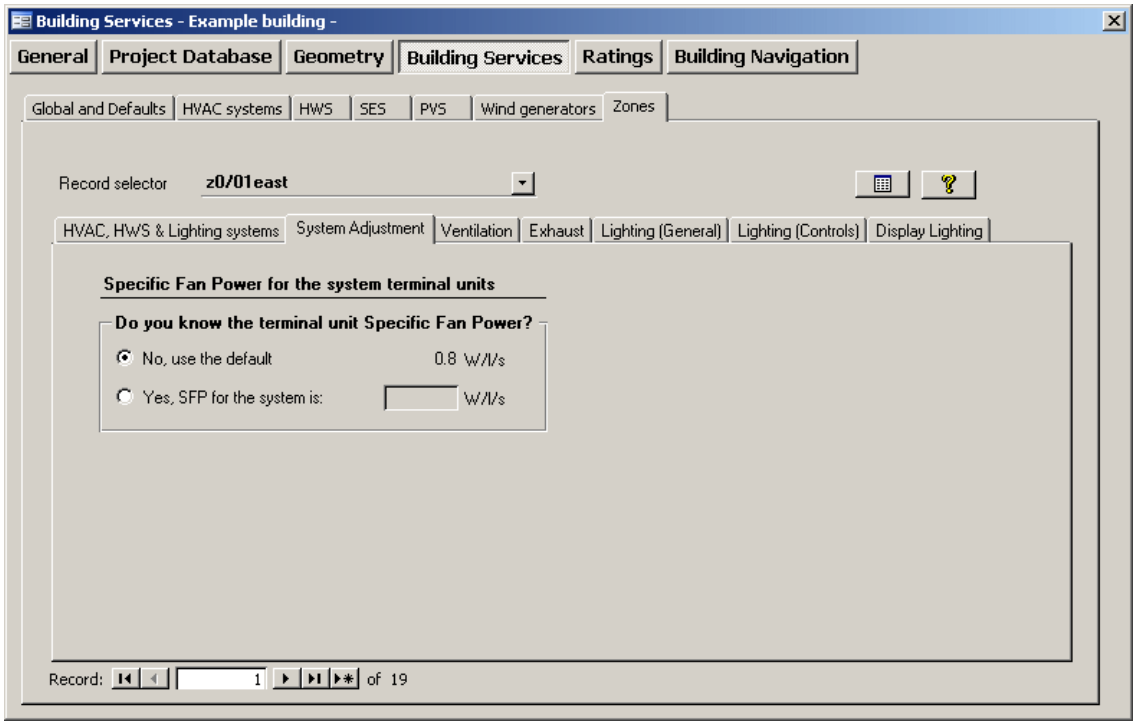

Figure 4: The System Adjustment sub-tab of the Zones tab in the Building Services form

3. CALCULATING AND VIEWING THE ENERGY PERFORMANCE OF THE BUILDING- THE RATINGS FORM AND OUTPUT REPORTS

The compliance with the building regulations is assessed via the *Ratings* form, where the key results are then displayed. Further details on Building Regulations compliance and a more detailed analysis of the energy used and CO_2 emitted from the building are provided in the cSBEM output reports.

3.1. The Ratings form

The *Ratings* form allows the user to run the entered building model through cSBEM and the Compliance Checking Module (BRUKL2) in order to calculate the energy consumption (in kWh per m^2 of building area) and CO_2 emissions of the building (in kg per m^2 of building area), and those of the notional buildings: Notional 2002 and Notional 2010, and then compare the building's CO_2 emission rate with the target emission rates for both the Flat 2010 and the Aggregate 2010.

3.1.1. Building Regulations Check tab

Building Rating sub-tab:

Building Regulations compliance is assessed by clicking on the "Check Regulation" button in the *Building Rating* sub-tab. This initiates the data processing through the SBEM calculation engine and the Compliance Checking Module (BRUKL2). The following calculated information is then displayed in this sub-tab (Figure 5) as follows:

1. The energy used per square metre (kWh/m^2) annually by the actual, the Notional 2002, and the Notional 2010 buildings for space heating, space cooling, auxiliary energy (pumps, fans, and controls), lighting, and water heating.
2. The total energy used per square metre (kWh/m^2) annually by the actual, the Notional 2002, and the Notional 2010 buildings (in terms of both electricity and fuel use).
3. The Actual Building's Emission Rate (BER) – This is the annual CO_2 emissions per square metre for the actual building, in kgCO_2/m^2.
4. The Notional 2002 Building's Emission rate – This is the annual CO_2 emissions per square metre for the Notional 2002 building, in kgCO_2/m^2.
5. The Notional 2010 Building's Emission rate – This is the annual CO_2 emissions per square metre for the Notional 2010 building, in kgCO_2/m^2.
6. The Flat 2010 Target Emission Rate (TER) – This is the target annual CO_2 emissions per square metre calculated using the emissions of the Notional 2002 building, in kgCO_2/m^2.
7. The Aggregate 2010 Target Emission Rate (TER) – This is the target annual CO_2 emissions per square metre calculated using the emissions of the Notional 2010 building, in kgCO_2/m^2.
8. Pass CO_2 with Flat 2010 TER - If the "BER $\leq$ Flat 2010 TER" , the building passes the CO_2 emissions criterion of the building regulations. Otherwise, it does not.
9. Pass CO_2 with Aggregate 2010 TER - If the "BER $\leq$ Aggregate 2010 TER" , the building passes the CO_2 emissions criterion of the building regulations. Otherwise, it does not.

Checks regarding other Building Regulations compliance criteria, such as U-Value checks and building services efficiencies checks can be found in the *Building Regulations Compliance* document (see Section 3.2.1: SBEM BRUKL2 Output Document: Compliance with Building Regulations) which can be accessed from the *Building Rating* sub-tab.

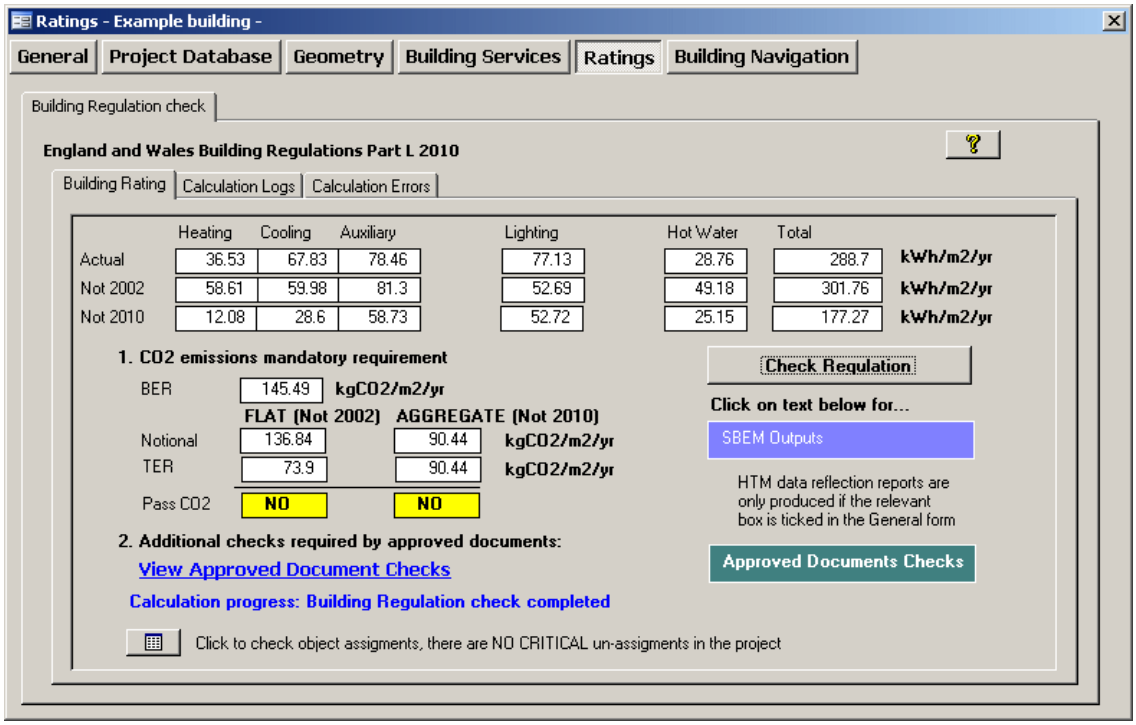

Figure 5: Assessing compliance with Building Regulations in the Building Regulation Check tab of the Ratings form

3.2. SBEM Output reports

Output reports when running SBEM for building regulations compliance checking:

Once the calculation has run to check compliance with building regulations, cSBEM produces the following output reports:

1. SBEM Main Calculation Output Document – "project name"_**sbem.pdf**
2. SBEM BRUKL2 Output Document: Compliance with Building Regulations – "project name"_**brukl2.pdf**
3. Technical Output Report for the Actual Building – "project name"_**sim.csv**
4. Technical Output Report for the Notional 2002 Building – "project name"_**not_sim.csv**
5. Technical Output Report for the Notional 2010 Building – "project name"_**not2010_sim.csv**

The first two reports are accessible from within the interface, using the appropriate buttons in the *Ratings* form > *Building Regulations Check* tab > *Building Rating* sub-tab. These reports are all stored in the same location as the project files, along with the *Technical Output* Reports, which can only be accessed from the Projects folder. The default location for the project files is within the specific project folder (created when the project was first created within the cSBEM_v1.0.0 folder, e.g., C:\NCM\cSBEM_v1.0.0\ Projects\Example building-complete.

3.2.1. SBEM BRUKL2 Output Document: Compliance with Building Regulations

This report can be accessed from the *Ratings* form > *Building Regulations Check* tab > *Building Rating* sub-tab by clicking on the "Approved Documents checks" button or hyperlink. The file is in "pdf" format.

The cSBEM Building Regulations Compliance Document currently follows, in format, the Compliance Checklist criteria found in England and Wales' Approved Document L2A Appendix A. Where cSBEM can be used to demonstrate compliance, SBEM will fill in the appropriate sections of the document. On the other hand, where compliance should be demonstrated in separate supporting documents (i.e., it cannot be performed through cSBEM), the cSBEM Compliance Document will state that clearly.

This compliance document contains the following sections:

- Administrative Information: This section gives information about the project's address, the building's occupier including name, telephone number, and address, and the building's certifier including name, telephone number, and address. It also gives information about the certification tool used to generate the results
- Criterion 1: This section of the report contains information about the building's predicted CO_2 emission rate (BER) and the target CO_2 emission rate (TER) in kg/m^2.year for both the Flat 2010 and the Aggregate 2010. It then states whether the building's emission rate is less than or equal to each of the target values.
- Criterion 2: This section of the report contains information about the building fabric, including the construction U-values, air permeability, and the building services systems. Then, the report states whether the building's U-values are better than the design limits for each construction type and whether the air permeability of the building is better than the worse acceptable standard. It also states whether the building service standards are acceptable compared to their limiting standards.
- Criterion 3: This section of the report contains information about whether the solar gains limit is exceeded in each of the zones where the solar gains check is applicable.
- Criterion 4: This section of the report states whether the performance of the building as built is consistent with the BER. Compliance is not checked by the tool for this criterion, and separate supporting documents would be required.
- Criterion 5: This section covers the provision of information about the building. Compliance is not checked by the tool for this criterion, and separate supporting documents would be required.
- Technical Data Sheet (Actual Vs. Notional 2010 Building): This section displays some information about the overall energy performance of the building (actual and Notional 2010) and some specific information on the HVAC systems in the building. It also lists some general information, such as the weather location of the building and the percentages of total building floor area occupied by the different activity types.

See APPENDIX A: for a sample England and Wales *Building Regulations Compliance* document.

APPENDIX A: Sample SBEM BRUKL Output Document

BRUKL2 Output Document

HM Government

Compliance with England and Wales Building Regulations Part L 2010

Project name

Example building

As built

Date: Mon Jun 22 12:06:26 2009

Administrative information

Building Details

Address: 56 London Road, LONDON, SW23 1HA

Certification tool

Calculation engine: SBEM

Calculation engine version: 1.0.0

Interface to calculation engine: iSBEM

Interface to calculation engine version: 1.0.0

BRUKL2 compliance check version: 1.0.0

Occupier Details

Name: John Jones

Telephone number: 987654321

Address: 53 London Road, LONDON, SW23 1HA

Certifier details

Name: <insert name>

Telephone number: 9999999999

Address: <insert address>, <insert city>, XX XXX

Criterion 1: Predicted CO2 emission from proposed building does not exceed the target

		Flat 2010	Aggregate 2010
1.1	CO2 emission rate from notional building, kgCO2/m2.annum	136.8	90.4
1.2	Improvement	Refer to methodology	None
1.3	LZC benchmark	0.1	None
1.4	Target CO2 Emission Rate (TER), kgCO2/m2.annum	73.9	90.4
1.5	Building CO2 Emission Rate (BER), kgCO2/m2.annum	145.5	
1.6	Are emissions from building less than or equal to the target?	BER > TER	BER > TER
1.7	Are as built details the same as used in BER calculations?	Separate submission	

Criterion 2: The performance of the building fabric and the building services systems should be no worse than the design limits

2.1 Are the U-values better than the design limits? Not better than design limits

The building does not follow guidance in England and Wales Building Regulations Part L

Element	$U_{e\text{-}Limit}$	$U_{e\text{-}Calc}$	$U_{i\text{-}Limit}$	$U_{i\text{-}Calc}$	Surface where this maximum value occurs*
Wall**	0.35	0.32	0.7	1.7	z1/02/wi.1
Floor	0.25	0.12	0.7	0.25	z1/01centre/fe
Roof	0.25	0.25	0.35	0.25	z1/01centre/c
Windows***, roof windows, and rooflights	2.2	2.1	3.3	2.1	z0/01north/n/g
Personnel doors	2.2	2	3	2	z0/02/w/d
Vehicle access & similar large doors	1.5	-	4	-	"No Vehicle access doors in project"
High usage entrance doors	6	-	6	-	"No High usage entrance doors in project"

$U_{e\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m2K)] $U_{i\text{-}Limit}$ = Limiting individual element U-values [W/(m2K)]

$U_{e\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m2K)] $U_{i\text{-}Calc}$ = Calculated individual element U-values [W/(m2K)]

* There might be more than one surface exceeding the limiting standards

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standards are similar to those for windows.

*** Display windows and similar glazing are not required to meet the standard given in this table.

2.2 Is air permeability no greater than the worst acceptable standard? No greater than worst acceptable standard

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	8

2.3 Are all building services standards acceptable?

2.3a-1 HVAC for the example building HVAC system standard is not acceptable

The building does not follow guidance in England and Wales Building Regulations Part L

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.81
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.83.		
Efficiency check	**Limiting Cooling Nominal efficiency**	**This building**
Cooling efficiency	2.25	3.12
Efficiency check	**Limiting Specific Fan Power**	**This building**
SFP	2	2.9

2.3b- "No HWS in project, or hot water is provided by HVAC system"

2.4	Does fixed internal lighting comply with England and Wales Building Regulations Part L paragraphs 49 to 81?	Separate submission
2.5	Are energy meters installed in accordance with GIL65?	Separate submission

Criterion 3: The spaces in the building without air-conditioning have appropriate passive control measures to limit the effects of solar gains

3.1 Refer to methodology for process of assessing compliance.

The building does not follow guidance in England and Wales Building Regulations Part L

Zone	Solar gain limit exceeded?
z0/01east	NO
z0/02	NO
z0/03	NO
z1/01centre	NO
z1/02	NO
z1/03	NO
z0/01north	NO
z0/01west	YES
z0/01south	NO
z1/01north	NO
z1/01west	YES
z1/01south	YES
z1/01east	YES
z0/01southwest	YES
z0/01northwest	NO
z1/01northeast	NO
z1/01southeast	YES
z1/01southwest	YES
z1/01northwest	NO

Criterion 4: The performance of the building, as built, is consistent with the BER

4.1	Have the key features of the design been included (or bettered) in practice?	Separate submission
4.2	Is the level of thermal bridging acceptable?	Separate submission
4.3	Has satisfactory documentary evidence of site inspection checks been produced?	Separate submission

4.4 Design air permeability

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	8

4.5	Has evidence been provided that demonstrates that the design air permeability has been achieved satisfactorily?	Separate submission
4.6	Has commissioning been completed satisfactorily?	Separate submission
4.7	Has evidence been provided that demonstrates that the ductwork is sufficiently airtight?	Separate submission

Criterion 5: Providing information

5.1	Has a suitable building log-book been prepared?	Separate submission

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area (m2)	2900	2900
External area (m2)	4308	4308
Weather	LON	LON
Infiltration (m3/hm2 @ 50Pa)	9	5
Average conductance (W/K)	1373.62	1113.53
Average U-value (W/m2K)	0.32	0.26
Alpha value (%)	5.98	5.0

Building Use

% area	Building Type
31	A1/A2 Retail/Financial and Professional services
16	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
53	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Telephone exchanges
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs

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] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity									
Actual	[illegible]	[illegible]	30.5	67.8	78.5	0.81	[illegible]	0.81	2.5
Notional	[illegible]	[illegible]	[illegible]	28.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Key to terms

Alpha value (%) = percentage of the building's average heat transfer coefficient which is due to thermal bridging
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 SSEFF = Heating system seasonal efficiency
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SEFF = Heating generator seasonal efficiency
Cool gen SEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

APPENDIX B: Matrix of activity areas and building types

BUILDING TYPE	24 hrs Consulting/treatment areas	Assembly areas / halls	Auditoria	Bathroom	Bedroom	Bedroom unit	Car Park	Cell (police/prison)	Changing facilities with showers	Circulation area (corridors and stairways)	Circulation area (corridors and stairways) - non public	Classroom	Common circulation areas	Computer lab	Data Centre	Diagnostic Imaging	Display and Public areas	Display area	Domestic Bathroom	Domestic Bedroom	Domestic Circulation	Domestic Dining room	Domestic Kitchen	Domestic Lounge	Domestic Toilet	Dry sports hall	Eating/drinking area	Fitness Studio	Fitness suite/gym	Food preparation area	Generic Checkin areas	Generic Office Area	Generic Ward	Hall/lecture theatre/assembly area	Hydrotherapy pool hall	Ice rink	Industrial process area	Laboratory	Laundry	Lounges	Office and consulting areas	Operating theatre	Performance area (stage)	Physiotherapy Studio	Plant room	Post Mortem Facility	Public circulation areas	Reception	Residents common rooms	Residents kitchen	Sales area - chilled	Sales area - electrical	Sales area - general	Server Room	Storage area	Storage area - chilled	Storage area - cold room (<0degC)	Swimming pool	Teaching Areas	Toilet	Waiting Rooms	Warehouse sales area - chilled	Warehouse sales area - electrical	Warehouse sales area - general	Warehouse storage	Warehouse storage - chilled	Workshop - small scale
A1/A2 Retail and Financial/Professional services							x				x							x									x			x		x							x						x						x	x	x		x	x	x			x		x	x	x			
A3/A4/A5 Restaurant and Cafes/Drinking Establishments and Hot Food takeaways											x																x			x		x											x		x										x	x	x			x							
B1 Offices and Workshop businesses							x		x	x																	x		x	x		x													x			x							x	x				x							x
B2 to B7 General Industrial and Special Industrial Groups										x																	x			x		x					x	x							x			x							x	x	x			x					x	x	
B8 Storage or Distribution									x	x																	x			x		x													x			x							x	x	x			x					x	x	
C1 Hotels		x		x		x			x	x																x	x		x	x		x							x						x			x							x		x	x		x							
C2 Residential Institutions - Hospitals and Care Homes	x	x		x		x			x		x	x				x											x			x			x		x		x	x	x		x	x		x	x	x	x	x							x	x	x			x							
C2 Residential Institutions - Residential schools				x	x				x	x				x												x	x			x				x				x	x		x				x			x	x						x			x	x	x							x
C2 Residential Institutions - Universities and colleges				x	x				x	x		x		x												x	x		x	x				x				x	x		x				x			x	x	x					x			x		x							x
C2A Secure Residential Institutions				x				x	x	x		x														x	x		x	x				x					x		x				x			x							x					x							x
D1 Non-residential Institutions - Community/Day Centre									x	x																x	x			x				x							x				x			x							x					x							x
D1 Non-residential Institutions - Crown and County Courts								x		x																	x			x		x		x											x			x							x					x							
D1 Non-residential Institutions - Education									x	x				x												x	x			x				x				x			x				x			x							x			x	x	x							x
D1 Non-residential Institutions - Libraries Museums and Galleries											x						x										x			x		x		x				x							x			x							x					x							x
D1 Non-residential Institutions - Primary Health Care Building										x																															x				x			x							x					x							
D2 General Assembly and Leisure plus Night Clubs and Theatres			x						x		x							x								x	x	x	x	x		x		x		x			x				x		x		x	x					x		x			x		x							x
Others - Car Parks 24 hrs							x			x																						x													x															x							
Others - Emergency services				x	x			x	x	x																x	x		x	x		x													x			x							x					x							
Others - Miscellaneous 24hr activities															x																																							x													
Others - Passenger terminals											x																x			x	x	x								x					x			x							x	x	x			x	x						
Others -Telephone exchanges										x																						x													x			x							x					x							
Residential spaces													x						x	x	x	x	x	x	x																																										