

User Guide

iSBEM

An Interface for SBEM (Simplified
Building Energy Model)

*Part of the National Calculation Methodology: SBEM for assessing
the Energy Performance of Buildings*

How to use iSBEM:

(1) Basics - UK

iSBEM version 5.6.b

18 September 2020



Version history

User guide version	For iSBEM version	Building Regulations
22 nd December 2005	1.0	2006
24 th January 2006	1.0.b	2006
9 th March 2006	1.0.b	2006
11 th May 2006	1.1.a	2006
4 th October 2006	1.2.a	2006
6 th April 2007	2.0.a	2006
30 th April 2007	2.0.b	2006
18 th May 2007	2.0.c	2006
2 nd November 2007	2.9.b	2006
6 th February 2008	3.0.a	2006
12 th February 2008	3.0.b	2006
1 st April 2008	3.1.a	2006
9 th July 2008	3.2.b	2006
10 th November 2008	3.3.a	2006
23 rd December 2008	3.3.b	2006
29 th April 2009	3.4.a	2006
15 th May 2009	3.4.a	2006
26 th May 2009	3.4.a	2006
1 st March 2010	3.5.a	2006
28 th May 2010	4.0.a	2010
9 th July 2010	4.0.a	2010
12 th November 2010	4.1.a	2010
31 st March 2011	4.1.c	2010
12 th December 2011	4.1.d	2010
28 th January 2013	4.1.e	2010
6 th April 2014	5.2.b	2013 for England
1 st July 2014	5.2.d_beta	Beta 2014 for Wales
31 st July 2014	5.2.d	2013 for England and 2014 for Wales
20 th November 2015	5.2.g	2013 for England, 2014 for Wales, and 2015 for Scotland
20 th November 2017	5.4.a	2013 for England, 2014 for Wales, and 2015 for Scotland
3 rd October 2018	5.6.a	2013 for England and 2014 for Wales
12 th October 2018	5.6.a	2013 for England, 2014 for Wales, and 2015 for Scotland
18 th September 2020	5.6.b	2013 for England, 2014 for Wales, and 2015 for Scotland

Key changes and additions from previous versions of the User Guide

Changes and additions in version 5.6.b:

NEW

Further
guidance

Changes related to **new functionality** in the new version as well as further explanation or clarification of **existing** parameters and functionality in iSBEM are listed below and denoted in this guide using the “NEW” and “Further guidance” icons in the left margin.

- Key differences in the new version of the software compared to the previous version (see Section 2.1: What is iSBEM, SBEM, and the NCM?).

This manual, together with the software tools described in it, were developed by the BRE for the Ministry for Housing, Communities, and Local Government (MHCLG).

Disclaimer

The iSBEM 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.

Table of Contents

<i>Version history</i>	2
1. WHAT IS IN THIS GUIDE	9
1.1. Scope of the guide	9
2. INTRODUCTION TO iSBEM, SBEM, AND THE NCM	10
2.1. What is iSBEM, SBEM, and the NCM?	10
2.1.1. Key differences in the software.....	11
2.2. Calculation basics for UK Building Regulations compliance purposes.....	12
2.3. Calculation basics for UK Energy Performance Certificate purposes.....	14
2.4. Calculations for the States of Jersey Building Regulations purposes.....	16
2.5. Calculations for Green Deal assessment purposes	17
2.6. Calculations for Scotland Section 63 assessment purposes.....	17
2.7. Deciding whether SBEM is appropriate	17
2.8. Overview of how a building is defined in iSBEM	17
3. ASSEMBLING REAL BUILDING DATA	20
3.1. Introduction	20
3.2. Tips for gathering information for iSBEM	21
3.3. Zoning guide – How to zone your building.....	23
3.4. Measurement and other conventions	24
3.5. iSBEM Nomenclature	27
3.5.1. Naming zones, envelope elements, windows, and doors	27
3.5.2. Naming constructions and building services systems	29
4. iSBEM BASICS – GETTING STARTED	30
4.1. System Requirements	30
4.2. Installing iSBEM on your computer	31
4.3. Opening iSBEM.....	32
4.4. Creating new and opening existing projects	33
4.5. Closing iSBEM	34
4.6. Getting assistance with using iSBEM	36
5. TOUR OF iSBEM	38
5.1. Introduction to the main forms in iSBEM	38
5.2. Hierarchy of forms, tabs, and sub-tabs in iSBEM	39
6. BASIC iSBEM FUNCTIONALITY AND THE HELP MENU	42
6.1. Basic interface functionality and buttons	42
6.2. iSBEM Help.....	45

7. ENTERING A BUILDING INTO iSBEM	48
7.1. Order of data entry	48
7.2. Important note on the default values in iSBEM.....	49
8. iSBEM FILE CONVERSION	50
9. USER-DEFINED CONSTRUCTION DATABASE	54
APPENDIX A: Matrix of activity areas and building types	61

List of Figures

<i>Figure 1: Structure of SBEM objects.....</i>	<i>19</i>
<i>Figure 2: Steps for calculating the energy performance for a building</i>	<i>20</i>
<i>Figure 3: Internal horizontal dimension of a zone</i>	<i>27</i>
<i>Figure 4: Location of the iSBEM Microsoft Access file and Projects folder.....</i>	<i>32</i>
<i>Figure 5: Terms and Conditions dialogue box.....</i>	<i>33</i>
<i>Figure 6: iSBEM Start-up dialogue box.....</i>	<i>33</i>
<i>Figure 7: iSBEM Basic Information form</i>	<i>34</i>
<i>Figure 8: General form showing the correct ways of closing iSBEM</i>	<i>35</i>
<i>Figure 9: The iSBEM END dialogue box.....</i>	<i>36</i>
<i>Figure 10: iSBEM END dialogue box.....</i>	<i>36</i>
<i>Figure 11: The seven forms in iSBEM.....</i>	<i>38</i>
<i>Figure 12: A General sub-tab: basic commands and buttons</i>	<i>42</i>
<i>Figure 13: Help Topics window</i>	<i>46</i>
<i>Figure 14: Help Entries window for area of a zone</i>	<i>47</i>
<i>Figure 15: Order of data entry.....</i>	<i>48</i>
<i>Figure 16: Folder showing the file conversion tool</i>	<i>50</i>
<i>Figure 17: Selecting a file to convert - stage 1.....</i>	<i>51</i>
<i>Figure 18: Selecting a file to convert - stage 2.....</i>	<i>51</i>
<i>Figure 19: Naming the new file</i>	<i>52</i>
<i>Figure 20: The Convert and Quit buttons</i>	<i>52</i>
<i>Figure 21: Message which appears after conversion.....</i>	<i>53</i>
<i>Figure 22: Location of the User-defined construction library</i>	<i>54</i>
<i>Figure 23: Description of Constructions tab in User-defined construction library.....</i>	<i>55</i>
<i>Figure 24: Description of Glazings tab in User-defined construction library</i>	<i>56</i>
<i>Figure 25: Description of Frames tab in User-defined construction library</i>	<i>57</i>
<i>Figure 26: Description of Construction Categories tab in User-defined construction library</i>	<i>58</i>
<i>Figure 27: Description of Sources tab in User-defined construction library.....</i>	<i>59</i>
<i>Figure 28: Description of Import tab in User-defined construction library</i>	<i>60</i>

List of Tables

<i>Table 1: Calculation parameters for SBEM.....</i>	<i>13</i>
<i>Table 2: Asset rating and energy bands in England and Wales</i>	<i>15</i>
<i>Table 3: Tips for gathering information for iSBEM</i>	<i>22</i>
<i>Table 4: Measurement and other conventions.....</i>	<i>26</i>
<i>Table 5: Suggested iSBEM nomenclature</i>	<i>28</i>
<i>Table 6: Examples of building element names</i>	<i>28</i>
<i>Table 7: Structure of the forms, tabs, and sub-tabs in iSBEM.....</i>	<i>41</i>
<i>Table 8: Global parameters</i>	<i>45</i>

Acronyms used in iSBEM and this guide

AHU	Air Handling Unit
BER	Building Emission Rate
BRUKL	Building Regulations United Kingdom Part L (The Building Regulations compliance checking module)
CCHP	Combined Cooling, Heat, and Power
CEN	Comité Européen de Normalisation (The European Committee for Standardisation)
CHP	Combined Heat and Power
CO ₂	Carbon dioxide
ECA	Enhanced Capital Allowance
EER	Energy Efficiency Ratio
EPBD	Energy Performance of Buildings Directive
EPCgen	Energy Performance Certificate Generator (The EPC generator module)
ETL	Energy Technology List
HEPA	High Efficiency Particulate Air
HTHW	High Temperature Hot Water (boiler)
HVAC	Heating Ventilation and Air Conditioning
HWS	Hot Water System
IF	Improvement Factor
iSBEM	Interface for SBEM
LTHW	Low Temperature Hot Water (boiler)
LZC	Low or Zero Carbon
MTHW	Medium Temperature Hot Water (boiler)
NCM	National Calculation Methodology
PVS	Photovoltaic System
SBEM	Simplified Building Energy Model
SSEER	Seasonal System Energy Efficiency Ratio
SSEff	Seasonal System Efficiency
SES	Solar Energy System
SFP	Specific Fan Power
TER	Target Emission Rate
VAV	Variable Air Volume
VRF	Variable Refrigeration Flow
WWHRS	Waste Water Heat Recovery System

1. WHAT IS IN THIS GUIDE

1.1. Scope of the guide

The objective of this document is to give an introduction to the use of iSBEM, an interface for SBEM (Simplified Building Energy Model) - an approach for the National Calculation Methodology (NCM) for assessing the energy performance of buildings.

This guide includes:

- An explanation of the role of iSBEM in the NCM with a brief overview of the methodology.
- How to set up iSBEM to operate on your computer.
- Guidance on how to assemble the required information for your own building.
- How to convert files created with previous versions of iSBEM to be compatible with the current version (5.6.b).

This guide **does not** include:

- A detailed description of the structure of the NCM.
- A full definition of the Notional building which is used to assess compliance with Building Regulations and produce the rating required by the Energy Performance of Buildings Directive (EPBD), or that of the Reference building used for calculating the asset rating.

The above can be found in MHCLG's NCM Modelling Guide which is available from the NCM website at www.uk-ncm.org.uk.

- A description of the contents of the NCM Construction, Glazing, or Activity databases.
- A detailed description of SBEM, the calculation engine to which iSBEM is an interface. This is described in the SBEM Technical Manual, available for download from the NCM website at www.uk-ncm.org.uk.
- Guidance related to energy calculations for the States of Jersey.

This manual is one volume in a set of documentations for the iSBEM User Guide. The other volumes in this set are as follows:

- **How to use iSBEM: (2) Compliance Assessment – UK** - Contains step-by-step guidance on the use of iSBEM for the purpose of assessing compliance with the building regulations in the UK.
- **How to use iSBEM: (3) EPC Generation – UK** - Contains step-by-step guidance on the use of iSBEM for the purpose of generating energy performance certificates for non-domestic buildings in the UK.

2. INTRODUCTION TO iSBEM, SBEM, AND THE NCM

2.1. What is iSBEM, SBEM, and the NCM?

The Energy Performance of Buildings Directive (EPBD) 2002/91/EC of the European Parliament and Council (dated 16th December 2002) requires that the energy performance of new buildings be evaluated with a calculation methodology that complies with the Directive. Separately, the Directive calls for the production of energy performance certificates for existing buildings. This uses the same calculation methodology, although this is not mandatory. In response, the UK's Ministry for Housing, Communities, and Local Government (MHCLG) commissioned the National Calculation Methodology (NCM) for the energy performance of buildings.

The initial use of the NCM was for compliance with the 2006 amendments to Part L of the Building Regulations in England and Wales. The NCM is required for compliance with Advisory Documents ADL1A and ADL2A, but *not* for situations covered by ADL1B or ADL2B. Similar amendments have been made in Scotland and Northern Ireland (Scottish Building Regulations Section 6 and Northern Ireland Building Regulations Part F).

For dwellings, the NCM consists of a new version of the existing Standard Assessment Procedure (SAP). This is not dealt with in this Guide.

SBEM, iSBEM, and the associated databases and files are an implementation of the non-domestic building part of the NCM that is freely available to users (subject to certain licensing conditions). Other accredited software may be used if preferred, but it is intended that SBEM and iSBEM should be applicable to the majority of buildings.

The initial versions of SBEM and iSBEM have principally been aimed at meeting Building Regulations requirements. In later versions, further features have been incorporated in order to allow them to be used to generate Asset Ratings for existing non-domestic buildings.

iSBEM successfully completed the life-cycle of the regulatory period 2006-2013, with the correction of sporadic issues. During 2012, a special version of the software (cSBEM) was developed to implement the changes proposed for the 2013 revision of Part L2A of the Building Regulations in England. This version was used by consultees to investigate the implications of the proposed changes to the Regulations, the Approved Document, and the National Calculation Methodology. A similar approach was followed during the consultation on the proposed changes for 2014 Part L2A of the Building Regulations in Wales using a special version of the software (cSBEMw).

After the results of the consultation processes and impact assessments were fully evaluated, and any adjustments to the proposed changes determined, SBEM was correspondingly adapted in the form of a new version for demonstrating compliance with the 2013 Part L2A of the Building Regulations in England, which came into force on 6th April 2014, and compliance with the 2014 Part L2A of the Building Regulations in Wales, which came into force on 31st July 2014. SBEM was later also updated to accommodate the 2015 Section 6 of the Building Regulations in Scotland, which came into force on 1st October 2015. **This is version 5.6.b described in this manual.**

On the other hand, the 2012 Part F of the Building Regulations is still in force in Northern Ireland, and iSBEM 4.1.e is the version which should be used for demonstrating compliance with those regulations, and for generating EPCs for buildings in Northern Ireland.

This manual and the accompanying volumes in the set describe how to use iSBEM to check for compliance of non-domestic buildings with 2013 Part L2A of the Building Regulations in England, 2014 Part L2A of the Building Regulations in Wales, or 2015

Section 6 of the Building Regulations in Scotland, and to generate an Energy Performance Certificate for non-domestic buildings in England, Wales, or Scotland.

The approach to the NCM embodied in this tool comprises a calculation engine called the Simplified Building Energy Model (SBEMⁱ) operating with a user interface called iSBEMⁱⁱ. The purpose of SBEM and its interface is to produce consistent and reliable evaluations of energy use in non-domestic buildings for Building Regulations compliance assessments and for building performance certification purposes. Although it may assist the design process, it is not primarily a design tool and should **not** be used for making strategic design decisions. It does not calculate internal temperatures, for example.

Vendors of design and other software offer design and asset rating calculations as part of their packages, either by embedding SBEM within them or by offering accredited alternative calculation methods (i.e., DSM – dynamic simulation models).

SBEM consists of a calculation methodology (briefly described below), which runs together with a compliance checking module (BRUKL) and an energy performance certificate generator (EPCgen) which utilise some of the same data during the calculation. The user sees iSBEM, the interface software, which interweaves these components together and interacts with a series of databases to provide consistent data to the calculation while simplifying the user's need to obtain raw building construction data.

SBEM is a compliance and certification procedure and not a design tool. If the performance of a particular feature is critical to the design, even if it can be represented in SBEM, it is prudent to use the most appropriate modelling tool for design purposes. In any case, SBEM should not be used for system sizing.

NEW

2.1.1. Key differences in the software

The main differences in iSBEM_v5.6.b compared to previous versions are as follows:

- An internet connection is no longer required to generate EPC XML files for buildings in England, Wales, and Northern Ireland as EPCgen no longer needs to connect to the National Register's servers to check the assessor's accreditation status and the software version.
- Modified format for UPRN for EPCs in England, Wales, and Northern Ireland.
- New parameter to input RRN of a previous EPC if a UPRN for the building is not available in England, Wales, and Northern Ireland.
- New option to allow generation of EPC in England, Wales, and Northern Ireland even if neither UPRN nor RRN of a previous EPC is available for the building.
- RRNs are now randomly generated for EPCs (and Recommendations Reports) in England, Wales, and Northern Ireland and are no longer based on the UPRN and inspection date.
- Building owner's details are no longer part of the input parameters and are no longer needed for output reports or XML files produced for any purpose of analysis, to avoid GDPR implications for data held by the registers.
- Purposes of analyses restricted to:
 - Compliance assessment with England 2013 Part L2A
 - EPC for England

ⁱ Pronounced s-bem.

ⁱⁱ Pronounced i-s-bem.

- Compliance assessment with Wales 2014 Part L2A
- EPC for Wales
- Compliance assessment with Scotland 2015 Section 6
- EPC for Scotland
- Section 63 assessment for Scotland
- Green Deal assessment for England, Wales, and Scotland

2.2. Calculation basics for UK Building Regulations compliance purposes

The calculation procedure required by the NCM is explained more fully in the National Calculation Methodology Manual. SBEM complies with the NCM. It is suitable for use with the majority of buildings, but some designs will contain features that mean that more accurate energy calculations may be obtained by more sophisticated calculation methods.

In summary, the Building Regulations compliance procedure calculates the total energy consumption of the building and its services (in kWh/m².annum) and compares the corresponding carbon dioxide emissions of the building being evaluated (its “Building Emission Rate” or BER) with a target value (“Target Emission Rate” or TER) derived from similar calculations for a “Notional building” (where both emission values are in kgCO₂/m².annum). Additionally, in Wales, the compliance assessment compares the Building’s Primary Energy Consumption (BPEC) with a Target Primary Energy Consumption that is based on the Notional building (where both values are in kWh/m².annum).

The Notional building has the following characteristics:

- The same geometry, orientation, and usage as the evaluated building.
- The amount of glazing in the Notional building is, however, not the same as that in the evaluated building. The area of glazing is a certain percentage of external walls and roofs and is dependent on the activity and building type.
- It is exposed to the same weather conditions as the evaluated building.
- Standard operating patterns (to allow consistent comparison between buildings in the same sector).
- Standardised assumptions for building fabric, glazing type, and HVAC plant efficiencies.

Detailed specifications of the 2013 England Notional building are in MHCLG’s 2013 NCM Modelling Guide (available from www.uk-ncm.org.uk), and further guidance is in the Building Regulations Approved Document Part L 2013 in England, which can be accessed from

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/540328/BR_PDF_AD_L2A_2013_with_2016_amendments.pdf. Further information on the limiting standards for fixed building services is available in the 2013 Non-Domestic Building Services Compliance Guide, which can be accessed from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/453973/non_domestic_building_services_compliance_guide.pdf.

Detailed specifications of the 2014 Welsh Notional building are in the Wales 2014 NCM Modelling Guide (available from www.uk-ncm.org.uk), and further guidance is in the Building Regulations Approved Document Part L 2014 Wales, which can be accessed from www.wales.gov.uk/docs/desh/publications/140326building-regs-approved-document-l2a-fuel-power-en.pdf. The England 2013 Non-Domestic Building Services Compliance Guide is also applicable in Wales.

Detailed specifications of the 2015 Scottish Notional building are in the Scotland 2015 NCM Modelling Guide, which can be accessed from <http://www.gov.scot/Topics/Built-Environment/Building/Building-standards/techbooks/techhandbooks/ncmg2015>), and further guidance is in the Scotland Building Regulations Section 6 for 2015, which can be accessed from <http://www.gov.scot/Topics/Built-Environment/Building/Building-standards/techbooks/techhandbooks/th2015nondom6>.

NB: Only the communal areas of apartment buildings containing self-contained flats should be assessed for compliance using SBEM, for example, circulation areas (using the “Common circulation areas” activity under the building type “Residential spaces”). The self-contained flats themselves should be assessed using SAP (for domestic buildings).

For Northern Ireland, please refer to www.finance-ni.gov.uk/topics/building-regulations-and-energy-efficiency-buildings for further information on Northern Ireland’s building regulations and published documents.

SBEM calculates the energy demands of each space in the building according to the activity within it. Different activities may have different temperatures, operating periods, lighting standards, etc. SBEM calculates heating and cooling energy demands by carrying out an energy balance based on monthly average weather conditions. This is combined with information about system efficiencies in order to determine the energy consumption. The energy used for lighting and hot water is also calculated. This requires information from the following sources:

Information	Source
Building geometry such as areas, orientation, etc.	Assessor reads from drawings or direct measurement.
Weather data	Internal database.
Selection of occupancy profiles for activity areas	For consistency, these come from an internal Activity database – assessor selects by choosing building type and activity from the database for each zone.
Activity assigned to each space	Assessor defines within iSBEM by selecting from internal database (the user should identify suitable zones for the analysis by examining the building or drawings).
Building envelope constructions	Assessor selects from internal Construction and Glazing databases or inputs parameters directly (“Inference” procedures may be used for energy certification of existing buildings). Assessor can also define their own constructions in the user-defined construction database.
HVAC systems	Assessor selects from internal databases or inputs parameters directly.
Lighting	Assessor selects from internal databases or inputs parameters directly.

Table 1: Calculation parameters for SBEM

The “inference” facility in iSBEM guides the assessor through the data input procedures and directs him/her towards appropriate internal databases. This option is intended for use when certifying existing buildings if the drawings or construction information are not available.

2.3. Calculation basics for UK Energy Performance Certificate purposes

This section briefly defines the “Reference” building, which is the basis of setting the energy rating scale for Energy Performance Certificates (EPCs) for England and Wales (and Northern Ireland). The “Asset Rating” rates the CO₂ emissions from the Actual building in comparison to a Standard Emission Rate (SER), where both emission values are in kgCO₂/m².annum. The Standard Emission Rate is determined by applying a fixed improvement factor to the emissions from a Reference building, which is defined below.

EPCs are intended to send market signals about the relative performance of comparable buildings, and so it is necessary that the Reference building should be the same for all buildings of a given type. In order to provide this consistency, the Reference building must be the same irrespective of: (a) whether the Actual building is naturally ventilated or air conditioned and (b) the fuel choice in the Actual building.

The insulation levels and HVAC efficiencies in the Reference building are identical to the 2006 Part L Notional building in England & Wales except that certain parameters in the Reference building are fixed (subject to conditions below) irrespective of features in the Actual building (please refer to the England 2013 NCM Modelling Guide, available from www.uk-ncm.org.uk, for the detailed description of the Reference building). These aspects are:

- a. The heating and hot water service is always met by a gas-fired system irrespective of whether a fuel other than gas is used in the Actual building or is even available in the locality of the Actual building.
- b. Each space which is unconditioned, i.e., unheated and uncooled, in the Actual building will also be unconditioned in the Reference building. In all other cases, the spaces in the Reference building have a fixed servicing strategy regardless of the strategy adopted in the Actual building. Therefore:
 - Each space is heated to the heating setpoints defined in the activity database.
 - Each space is cooled, to a fixed cooling setpoint, irrespective of whether the particular space in the Actual building has cooling provision or not.
 - Each space is naturally ventilated, irrespective of whether the corresponding space in the Actual building has natural or mechanical ventilation.

The CO₂ emissions arising from the use of the fixed building services in the Reference building (in kgCO₂/m².annum) are calculated (the Reference Emission Rate or RER), and then adjusted by an improvement factor of 23.5%. This adjusted CO₂ emission rate (in kgCO₂/m².annum) is termed the Standard Emission Rate (SER), i.e., $SER = RER \times 0.765$.

It is not intended that the definition of the Reference building should change as Part L standards change, since this would mean that the energy rating of a given building would also change, even if its energy efficiency had not been varied. Therefore, the Reference building is always as defined above (please refer to the 2013 NCM Modelling Guide, available from www.uk-ncm.org.uk, for the detailed description of the Reference building).

The Asset Rating (AR) in England, Wales, and Northern Ireland is simply the ratio of the CO₂ emissions from the Actual building (i.e., the BER) to the Standard Emission Rate (i.e., the SER) multiplied by 50. The AR should be rounded to the nearest whole number.

$$\frac{BER}{SER} * 50 = AR$$

The Asset Rating is also converted into an energy band/grade on a linear “A-G” scale (with A+ being the most efficient followed by A, and G being the least efficient), Table 2, where the border between grade B and grade C is set at the SER and given an AR of 50. This means that a gas-heated building with mixed-mode cooling that is just compliant with Part L 2006 would have an Asset Rating of 50.

$AR \leq 0.0 \Rightarrow A+$
$0.0 < AR \leq 25.0 \Rightarrow A$
$25.0 < AR \leq 50.0 \Rightarrow B$
$50.0 < AR \leq 75.0 \Rightarrow C$
$75.0 < AR \leq 100.0 \Rightarrow D$
$100.0 < AR \leq 125.0 \Rightarrow E$
$125.0 < AR \leq 150.0 \Rightarrow F$
$150.0 < AR \Rightarrow G$

Table 2: Asset rating and energy bands in England and Wales

In addition to the Asset Rating, the EPC in England and Wales displays two additional calculated items as references/benchmarks:

- The building regulations standard (i.e., the TER). Note this is based on the performance of the Notional building, not the Reference building.
- The performance of a “Typical building”, which was originally based on the 1995 Building Regulations Part L standards but later simplified so that its energy performance is assumed to be equal to twice that of the 2006 target, i.e., approximately equal to the energy performance of the 2013 Notional building multiplied by a factor of ‘2/(0.75 × 0.91)’. Its CO₂ emissions rate is termed the Typical Emission Rate (TYR).

More details on the calculation procedure required by the NCM and the definition of the rating scale are explained in more detail in the NCM Modelling Guide (available from www.uk-ncm.org.uk).

Further information on EPCs (including the treatment of communal areas that accompany units with independent heating systems) can be found in MHCLG’s publication:

“Improving the energy efficiency of our buildings: A guide to energy performance certificates for the construction, sale and let of non-dwellings” which can be accessed from www.communities.gov.uk/publications/planningandbuilding/nondwelling. This

document provides an introduction to energy performance certificates for non-dwellings, describes the scope and requirements of the regulations that apply on construction, sale, or let, and provides guidance on how these are applied in practice.

NB: While no EPCs are required for permanently unconditioned buildings (i.e., buildings which do not use energy to condition the indoor climate and are expected to remain this way), it is possible to voluntarily lodge EPCs for unconditioned buildings and, as such, the definition of the Reference building was revised (see above) in order to allow for the calculated energy rating for these types of buildings to be representative. Permanently unconditioned buildings are different to those which are expected to be conditioned later on, and which should be modelled as per the guidance in MHCLG's publication: *"Improving the energy efficiency of our buildings: A guide to energy performance certificates for the construction, sale, and let of non-dwellings"*, which can be accessed as indicated above. Buildings with no building services currently installed, but which are expected to be installed in the future, should be modelled in iSBEM for the purposes of producing an EPC with assumed building services of the types that are most likely to be installed in those class of buildings and which have the minimum acceptable specification standards that meet the requirements in Part L of the Building Regulations in force when the building was constructed.

NB: The domestic type activities available under the building type "Residential spaces" in iSBEM are to allow the energy calculations for the generation of one EPC for a building which contains residential accommodation above a non-domestic space (e.g., a shop or a pub) provided that the residential space can only be accessed from within the non-domestic space, i.e., the residential part is not designed or altered for use as a separate independent dwelling. In addition to common circulation areas of apartment buildings containing self-contained flats, these are the **only** cases where SBEM can be used to model domestic areas. For more information on the appropriate software tools to use for modelling your building, please refer to MHCLG's publication: *"Improving the energy efficiency of our buildings: A guide to energy performance certificates for the construction, sale, and let of non-dwellings"*, which can be accessed as indicated above.

In Scotland, the EPC displays the approximate CO₂ emissions and energy usage of the building based on a standardised use of the building. The Rating is expressed as the CO₂ emissions in kg per m² of floor area per year (i.e., the same as BER), and it determines where the building sits on a seven-band scale. The EPC also includes a list of recommendations for the cost-effective improvements (lower cost measures) of the energy performance. Further information is available from the Building Standards Division at <http://www.scotland.gov.uk/Topics/Built-Environment/Building/Building-standards>.

For Northern Ireland, the EPC is very similar to that in England and Wales. Please refer to www.finance-ni.gov.uk/topics/building-regulations-and-energy-efficiency-buildings for further information on building regulations.

2.4. Calculations for the States of Jersey Building Regulations purposes

SBEM accommodates the calculations for Part 11 of Building Bye-laws (Jersey) 2007. Please refer to the Jersey Planning and Environment Department <http://www.gov.je/GOVERNMENT/DEPARTMENTS/PLANNINGENVIRONMENT/Pages/index.aspx> for further information and any queries regarding building regulations in the States of Jersey.

2.5. Calculations for Green Deal assessment purposes

SBEM accommodates the calculations for the Green Deal assessments for non-domestic buildings in England, Wales, and Scotland. However, the basics of the calculation and guidance on the related input parameters are dealt with in a separate version of this User Guide specifically for the Green Deal (available from www.ncm-sbem.org.uk).

2.6. Calculations for Scotland Section 63 assessment purposes

SBEM accommodates the calculations for the Section 63 assessments for non-domestic buildings in Scotland. However, the basics of the calculation and guidance on the related input parameters are dealt with in a separate version of this User Guide specifically for Section 63 (available from www.uk-ncm.org.uk).

2.7. Deciding whether SBEM is appropriate

All calculation processes involve some approximations and compromises, and SBEM is no exception. The most obvious limitations relate to the use of the CEN monthly heat balance method. This means that processes which vary non-linearly at shorter time-steps have to be approximated or represented by monthly parameters. The HVAC system efficiencies are an example of this. On the other hand, SBEM does have provision to account for processes that may not be present in software packages that contain more sophisticated fabric heat flow algorithms, such as, duct leakage, thermal bridge calculations, and infiltration allowances.

The user interface, iSBEM, provides the user with routes by which some non-standard systems and other features can be represented. For example, the ability to input specific fan powers provides a route by which demand-controlled ventilation might be handled, using pre-calculated effective SFP. There are also possibilities to go beyond these within the existing SBEM model via more general interfaces.

It is, therefore, difficult to give absolute rules about when SBEM can and cannot be used. As broad guidance, it is more likely to be difficult to use SBEM satisfactorily if the building and its systems have features that are (a) not already included in iSBEM and (b) have properties that vary non-linearly over periods of the order of an hour. However, as the example above shows, this is not a universal rule. There is a balance between the time and effort required to carry out parametric studies to establish input values for SBEM and detailed explicit modelling of a particular building.

Features which cannot currently be represented in iSBEM:

- Ventilation with enhanced thermal coupling to structure
- Light transfer within a building, for e.g., through highly glazed internal surfaces between atria and surrounding spaces

If in doubt about whether iSBEM would be appropriate for modelling your building, please contact your Accreditation Scheme Provider.

2.8. Overview of how a building is defined in iSBEM

There is a number of stages to inputting a building in iSBEM:

- a Enter general information about the building and the certifier/assessor and select the appropriate weather data.
- b Build up a database of the different forms of constructions and glazing types used in the fabric of the building.
- c After “zoning” the building (on the drawings), create the zones in the interface, and enter their basic dimensions, along with the air permeability of the space.
- d Define the envelopes of each zone, i.e., walls, floor, ceiling, etc. The envelopes’ areas, orientations, the conditions of the adjacent spaces, and the constructions used all need to be defined.
- e Within each envelope element, there may be windows/rooflights or doors. The areas and types of glazing or door within each envelope element need to be entered.
- f Similarly, within the envelope elements or within the window/door, there may be additional thermal bridges which need to be defined.
- g Define the HVAC (heating, ventilation, and air conditioning) systems, the HWS (hot water systems), and any SES (solar energy systems), PVS (photovoltaic systems), wind generators, or CHP (combined heat and power) generators used in the building.
- h Define the lighting system and local ventilation characteristics of each zone and assign the zones to the appropriate HVAC system and HWS.
- i Run the calculation and assess compliance or generate an EPC.

The building services systems, zones, envelope elements, windows, and doors are all referred to as “**building objects**” in SBEM. Figure 1 shows each of these building objects and demonstrates how they are linked together so that SBEM can calculate the energy consumption of the building. This diagram gives you an overview of what information is required and where you have to enter it in iSBEM. It may be useful to return to this figure at the end of the tutorial (available in the “Compliance” volume of the User Guide set), by which point you will have been introduced to all the building objects. Each building object should be given a unique name when modelling the building in iSBEM, for e.g., do not give the same name to two different constructions in the *Project Database* form.

Figure 1 serves to provide an overview of the structure of the building objects that you will be introduced to in this User Guide. More details on each item and how they are defined and linked together will be provided in detail in the volume “**How to use iSBEM: Compliance Assessment – UK**” and through the *Help* menu accessible from within iSBEM.

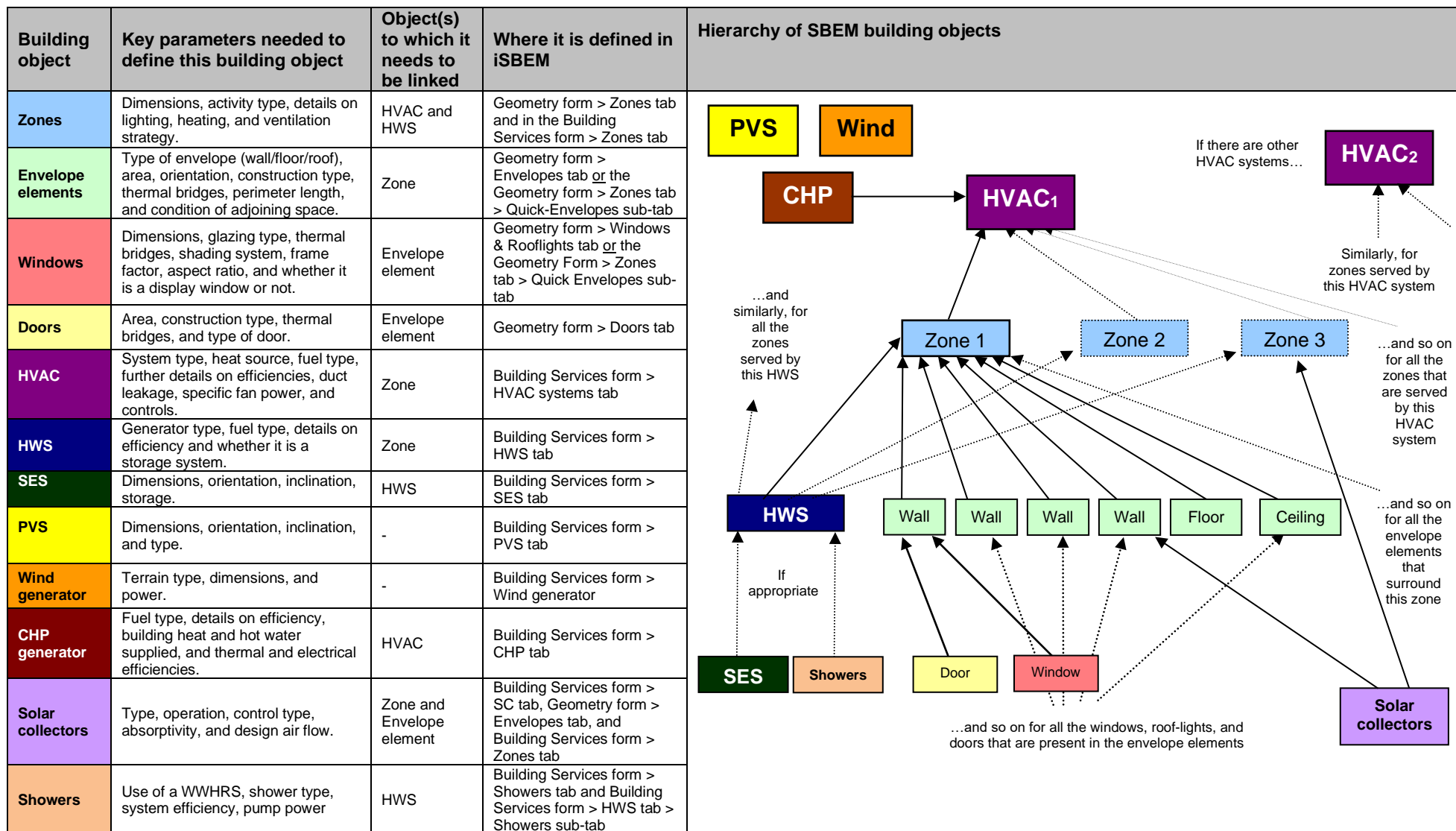


Figure 1: Structure of SBEM objects

3. ASSEMBLING REAL BUILDING DATA

3.1. Introduction

There are four steps to calculating the ratings for a building. First, a decision needs to be made on whether SBEM is the appropriate analysis tool. Then, information on the building needs to be gathered, analysed, and finally, entered into the interface. The tutorial in this User Guide focuses on the functionality of the tool. To ease that process, all the information on the Example building is provided in the appendices, and the zoning is done for you. However, when analysing a real building, you will need to collect and analyse the building data yourself. This chapter will guide you on what information you need to gather, and how you need to process this information before you can enter it into the interface, iSBEM.

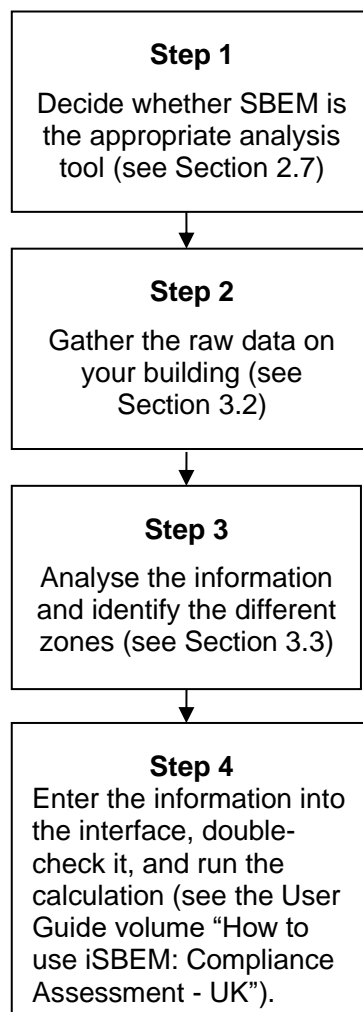


Figure 2: Steps for calculating the energy performance for a building

3.2. Tips for gathering information for iSBEM

Item	Requirements	Potential issues and experiences	
		New build and refurbishment	Existing building
Architectural: building spatial layout of functions, geometry, and orientations	Building plans, sections, site plan	Plans and schedules should be available at this stage. What degree of detail do they show? For instance, have decisions been made on usage of each space in the building?	<p>Are plans available? Have they been kept up-to-date? Can they be used? What degree of detail do the plans show?</p> <p>Have there been changes to the internal layout (with consequent effects on activity type, area, and geometry)?</p> <p>Don't assume that adequate information on an existing building can be obtained easily. Any planning should include time to physically survey at least some parts of the building. Note that there may be practical obstacles to overcome, such as gaining access to secure parts of the building, e.g., plant rooms or areas where confidential work takes place. This may need to be resolved with the building owner or occupier prior to the visit. There could also be safety issues to consider, such as access to the roof or looking into ceiling voids.</p>
Envelope construction materials, air permeability	Detailed drawings, schedules of construction details, pressure test result	Detailed drawings and schedules should be available. What degree of detail do they show? For instance, do details show junctions and hence thermal bridges? Do they rely on the constructors to use initiative to select suitable materials? Has there been confirmation that as-built constructions are equivalent to or better than as-designed?	<p>Are drawings and schedules available? How up-to-date are they? What degree of detail do they show? Have there been changes, for instance replacement of windows, re-roofing, or additional insulation?</p> <p>Any direct investigation of construction details, such as, wall or roof constructions and thermal bridges by opening them up should only be undertaken with the written approval of the building owner and consent of occupants. If this is not given (it would be unusual), then it is possible, using databases built into the software, to infer construction details from non-invasive observations and construction date (assuming compliance with the then current Building Regulations). Any assumptions made must err on the pessimistic side (i.e., constructions that are older and/or do not contain cavities unless their presence can be</p>

			inferred from the external appearance).
Building Services	Description of plant and its controls, schedules of plant sizing including fans, information on construction standards (e.g., leakage tests on ductwork), confirmation whether M&T is being undertaken, lighting description and controls	Detailed drawings and schedules should be available. What degree of detail do they show? For instance, is it possible to work out specific fan power from fan power and air quantity? Has the fine detail of installation been left to equipment suppliers and installers – If so, could they inadvertently compromise the design intent? Are any test certificates available? Is there sub-metering for HVAC systems and/or lighting, and if monitoring and targeting are to be practiced, are out of range alarms built into the software or procedures? Is lighting design information available, rather than relying on simple lamp type information?	<p>Are drawings and schedules available? Are they held on-site or by a maintenance or other remote contractor? Is there a building log book? How up-to-date are they? What degree of detail do they show? Have there been changes, such as, plant replacement or to the control process? Are there any results of tests on the equipment as installed, such as, seasonal system efficiencies, leakage tests on ductwork and/or air handling plant, confirmation of air volumes, etc.? You may be able to confirm with the energy manager whether there is sub-metering for HVAC systems and/or lighting, and if monitoring and targeting are practiced, that out of range alarms are built into the software or procedures.</p> <p>It would also be useful to confirm with the facilities manager which lamp types are used in each zone, and which zones have which types of lighting control applied.</p> <p>If written information is not available, the plant will need to be surveyed. Who has access to plant rooms and when? There are safety issues. Is the surveyor familiar with plant type and specifications? It can be difficult to identify systems from simple visual inspection. Default efficiencies will depend on the installation date and/or ECA listing of equipment – can this be verified from purchase documentation? Any assumptions made must err towards a less efficient plant and/or less precise control.</p> <p>If an external contractor has responsibility for operation or maintenance, it may be necessary to probe carefully how the plant is actually configured. This is to avoid misunderstandings on how it should work.</p>

Table 3: Tips for gathering information for iSBEM

3.3. Zoning guide – How to zone your building

The way a building is subdivided into zones will influence the predictions of energy performance. Therefore, the NCM Modelling Guide (available from www.uk-ncm.org.uk) defines zoning rules that must be applied when assessing a building for Building Regulations purposes (compliance or energy certification). The end result of the zoning process should be a set of zones where each is distinguished from all others in contact with it by differences in one or more of the following:

- The activity attached to it
- The HVAC system which serves it
- The lighting system within it
- The access to daylight (through windows or rooflights).

To this end, the suggested zoning process within a given floor plate is as follows:

1. Divide the floor into separate physical areas, bounded by physical boundaries, such as structural walls or other permanent elements.
2. If any part of an area is served by a different HVAC or lighting system, create a separate area bounded by the extent of those services.
3. If any part of an area has a different activity taking place in it, create a separate area for each activity.
4. Attribute just one “activity” (selected from the drop-down list available for each building type) to each resulting area.
5. Divide each resulting area into “zones”, each receiving significantly different amounts of daylight, defined by boundaries which are:
 - At a distance of 6m from an external wall containing at least 20% glazing.
 - At a distance of 1.5 room heights beyond the edge of an array of rooflights if the area of the rooflights is at least 10% of the floor area.
 - If any resulting zone is less than 3m wide, absorb it within surrounding zones.
 - If any resulting zones overlap, use your discretion to allocate the overlap to one or more of the zones.

NB: Currently iSBEM is not able to realistically model sunspaces or atria as it cannot represent light transfer between highly glazed/reflective internal spaces such as these. For buildings where these elements are a significant part of the design, we suggest that the building be modelled using one of the MHCLG-approved dynamic simulation models but only if they do allow internal light transfer to be modelled.

6. Merge any contiguous areas which are served by the same HVAC and lighting systems, have the same activity within them (e.g., adjacent identical hotel rooms, cellular offices, etc.), and which have similar access to daylight, unless there is a good reason not to.

NB: Small unconditioned spaces like store cupboards, riser ducts, etc., can be absorbed into the adjacent conditioned spaces. In iSBEM, this would involve adding their floor area to that of the adjacent conditioned space. Larger areas should be treated as indirectly conditioned spaces.

NB: Indirectly conditioned/heated spaces - For spaces such as corridors or access areas, which are not serviced by an HVAC system (i.e., have no direct supply of heating or cooling) but are likely to be indirectly conditioned by the surrounding areas due to the high level of interaction with those spaces (allowing the heated air to move freely from the directly conditioned spaces to the indirectly conditioned ones), they should be considered heated or conditioned (indirectly) by the same HVAC system that supplies the most important surrounding area. In this case, you

should assign the HVAC system of the main adjacent space to that indirectly conditioned zone also (although the space is not directly conditioned, the energy to overcome any losses from or gains to it is still required via the conditioned zone and therefore has to be included in the calculation). An example of this would be an open corridor (to heated offices) or a stairwell next and open to offices, i.e., which might have a few envelope elements but is mostly open to the surrounding conditioned areas and which is not directly conditioned but is conditioned through the movement of air (and heat) from the adjacent offices into the corridor. Furthermore, envelope elements between a (directly) conditioned space and an indirectly conditioned space should be labelled as adjacent to a “conditioned adjoining space” and not to an “unheated adjoining space”. On the other hand, if a zone is unheated and totally enclosed thus heated air cannot freely move from a heated zone into it, such as a plant room, a store room, or a toilet, you are advised to define it in iSBEM as “Zones without HVAC”.

7. Each zone should then have its envelopes described by the area and properties of each physical boundary. Where a zone boundary is virtual, e.g., between a daylight perimeter and a core zone, no envelope element should be defined. SBEM will then assume no transfer of heat, coolth, or light across the boundary, in either direction. In the context of iSBEM, the building needs to be divided into separate zones for each activity area, subdivided where more than one HVAC system serves an activity area.

NB: If the internal envelopes between merged zones have been designed of heavy construction to have thermal mass, then their K_m value (renamed from C_m value) will contribute to how the building retains and emits heat, and hence they should be defined in iSBEM. You can sum the areas of two or more internal walls (between merged zones) with the same construction and orientation and enter them as one envelope (assigned to the zone resulting from the merging) with the adjacency of “Same space”. If, on the other hand, the internal walls are partitions of light construction and very small thermal mass, then they should not cause any significant effects on the calculation if they were omitted from the iSBEM model. If in doubt about the thermal mass of the internal partitions, it is better to err on the side of caution and include them in your model as described above.

NB: The term “zone” is used as shorthand for “activity area” throughout this User Guide. It should not be assumed to be the same as a building services control zone, for instance, on the basis of building façade, although in some cases they may align.

NB: It is recommended that users make full use of features such as the “multiplier” function and merging of all contiguous similar areas, in order to generally avoid creating more than 100-150 zones in SBEM on computers running 32-bit Windows operating systems. However, there is an optional 64-bit version of SBEM available which can be used on computers running 64-bit Windows operating systems, and which should allow users to run the calculation for particularly large projects that cannot be processed, due to memory limitations, using the “original” 32-bit SBEM engine (**NB:** The 64-bit of SBEM will not run on computers with 32-bit Windows operating systems).

3.4. Measurement and other conventions

In order to provide consistency of application, standard measurement conventions have been adopted to be used as part of the NCM. These apply to both accredited dynamic simulation tools and third-party software interfaces to SBEM, although some parameters may only relate to the latter. These conventions are specified in Table 4 below:

Parameter	Definition
Zone Height	Floor to floor height (floor to soffit for top floor), i.e., including floor void, ceiling void, and floor slab. Used for calculating length of wall-to-wall junctions, radiant and temperature gradient corrections, and air flow through the external envelopes due to the stack effect.
	Convention: <u>For EPCs - Dimension conventions</u> For further guidance on defining zone height in a range of building configurations, see the User Guide volume “ How to use iSBEM: EPC Generation - UK ”.
Zone Area	Floor area of zone calculated using the internal horizontal dimensions between the internal surfaces of the external zone walls and half-way through the thickness of the internal zone walls (see Figure 3). Used to multiply area-related parameters in databases. Area basis needs to be consistent with that for operational ratings. NB: If the zone has any virtual boundaries, e.g., no walls in certain orientations, the area of the zone is that delimited by the ‘line’ created by that virtual boundary.
	Convention: <u>For EPCs - Dimension conventions</u> For further guidance on defining horizontal dimensions in a range of building configurations, see the User Guide volume “ How to use iSBEM: EPC Generation - UK ”.
(Building) Total Floor Area	Sum of zone areas. Used to check that all zones have been entered in iSBEM.
Envelope perimeter length	Horizontal dimension of the wall. Limits for that horizontal dimension are defined by type of adjacent walls. If the adjacent wall is external or a perimeter wall, the limit will be the internal side of the adjacent wall. If the adjacent wall is internal, the limit will be half-way through its thickness.
Envelope Area	<p><i>Area of vertical envelopes (walls) = $h \times w$</i></p> <p>where:</p> <p>h = floor to floor height (floor to soffit on top floor), i.e., including floor void, ceiling void, and floor slab.</p> <p>w = horizontal dimension of wall. Limits for that horizontal dimension are defined by type of adjacent walls. If the adjacent wall is external or a perimeter wall, the limit will be the internal side of the adjacent wall. If the adjacent wall is internal, the limit will be half-way through its thickness.</p> <p>NB: Areas of floor, ceilings, and flat roofs are calculated in the same manner as the zone area. Area for an exposed pitched roof (i.e., without an internal horizontal ceiling) will be the inner surface area of the roof.</p> <p>Used to calculate fabric heat loss so this is the area to which the U-value is applied.</p>

	<p>Convention: <u>For EPCs - Dimension conventions</u></p> <p>For further guidance on defining envelope areas in a range of building configurations, see the User Guide volume “How to use iSBEM: EPC Generation - UK”.</p>
Window Area	Area of the structural opening in the wall/roof, i.e., it includes the glass and the frame.
Aspect ratio (window)	Ratio of the window's height to its width.
Frame factor (window)	Ratio of the window area which is occupied by the frame to the total window area (see definition above).
Deadleg Length	Length of the draw-off pipe to the outlet in the space (only used for zones where the water is drawn off). Used to determine the additional volume of water to be heated because the cold water in the deadleg has to be drawn off before hot water is obtained. Assumes that HWS circulation maintains hot water up to the boundary of the zone, or that the pipe runs from circulation or storage vessel within the zone.
Flat Roof	Roof with a pitch of 10 degrees or less.
Pitched Roof	Roof with a pitch greater than 10° and less than or equal to 70°. If the pitch is greater than 70°, the envelope should be considered a wall.
Display Window	As defined in ADL2A.
Personnel Door	As defined in ADL2A.
High Usage Entrance Door	As defined in ADL2A.
Vehicle Access Door	As defined in ADL2A.
Glazed door	When doors have more than 50% glazing, then the light/solar gain characteristics must be included in the calculation. This is achieved by defining these doors as windows. (Otherwise, they are defined as opaque doors.)
Curtain walling	<p>Fully glazed curtain walling systems should be modelled as glazing, where the spandrel area (i.e., non-vision areas) can be accounted for in the frame factor.</p> <p><u>For Scotland calculations only:</u> The translucent and transparent areas of curtain walling systems should be modelled as glazing and the opaque parts as wall. N.B: See Scotland NCM Modelling Guide for further details.</p>

Table 4: Measurement and other conventions

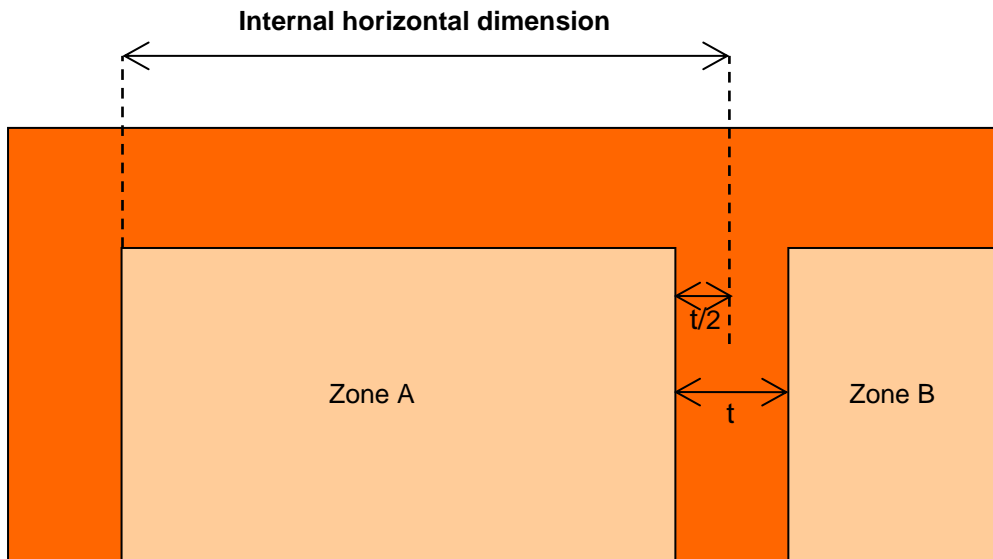


Figure 3: Internal horizontal dimension of a zone

3.5. iSBEM Nomenclature

3.5.1. Naming zones, envelope elements, windows, and doors

There is no set nomenclature for the different items in the *Geometry* form. The only requirement is that they are all unique, for e.g., do not give the same name to two different constructions in the *Project Database* form. You may prefer to assign familiar/representative names. However, with a large building, a methodical nomenclature can make it easier to identify elements and keep track of what has been input.

Below is a suggested nomenclature. If you use *Quick Envelopes* or the “Copy Record” function, the elements you create will be named in this way.

Element	Suggested name	Explanation
Zone	z###	The z stands for zone, and the first number is the storey number (0 for ground floor and 1 for first floor etc.). After the slash, the number(s) stands for the number of the zone on that floor. These can run consecutively throughout the building or start again at 1 for each floor.
Walls	z###ot	The first two groups of figures are to identify, as described above, which zone the wall is part of. Then the o is the orientation (n/nw/e/se etc.) and t is the type (i means internal, u means underground, and no letter means external).
Floors	z###ft	Similar to walls, the first two groups of figures identify the zone. This is followed by an f for floor and then the type t (i for internal floor, e for external space, and no letter for ground floor).
Ceilings/ roofs	z###ct	Similar to walls, the first two groups of figures identify the zone. This is followed by c for ceiling and t is the type (i is for internal ceiling and no letter means the ceiling has no occupied space above it, i.e., it is, in fact, a roof).

Window	z###/ot/g	The first three groups of figures identify which envelope the window is attached to, as described above. The g stands for glazing.
Door	z###/ot/d	The first three groups of figures identify which envelope the door is attached to, as described above. The d stands for door.
And for all the above elements	(name).#	If there is more than one element which would have the same name following the above nomenclature, “.1” is added for the second element and “.2” is added to the third, etc. For example, if there were two north walls in a zone (z0/01), with the same orientation and type, then the first wall would be named “z0/01/n” and the second would have a “.1” added to the end and therefore be named “z0/01/n.1”.

Table 5: Suggested iSBEM nomenclature

See Table 6 for examples.

Name	Description of element
z0/01	Zone 01 on the ground floor (0)
z0/01/n	First North facing external wall of zone 0/01
z0/01/n.1	Second North facing external wall of zone 0/01
z0/01/n.2	Third North facing external wall of zone 0/01
z0/01/ni	A North facing wall of zone 0/01, which is internal
z0/01/nu	A North facing underground wall of zone 0/01
z0/01/n/g	Glazing in the North external wall of zone 0/01
z0/01/n/d	Door in the North external wall of zone 0/01
z0/01/f	Ground floor of zone 0/01
z0/01/fi	Internal floor of zone 0/01, i.e., there is an interior space below
z0/01/fe	External floor of zone 0/01, i.e., there is an exterior space below
z0/01/c	Roof of zone 0/01, i.e., there is an exterior space above
z0/01/ci	Ceiling of zone 0/01, i.e., there is an interior space above

Table 6: Examples of building element names

Recommendations if you set up your own nomenclature:

- Use names which link subordinate parts of the construction (e.g., windows) to the element of which they are part (e.g., walls).
- Incorporate reminders about major distinctions like whether the wall is internal or external, or unusual features like suspended floors over an exterior space.
- Choose characters which avoid using shift keys, e.g., avoid capital letters.

Other points on naming:

- If you use the *Quick Envelopes* to create the walls, roofs, floors, ceilings, and windows, the names are created automatically for you based on the name you gave to the zone to which they are attached. If you follow the suggested nomenclature for the zones, the names for the walls/floors/windows, etc., will be exactly as described above. If you choose another way of naming your zones, the above endings will be added to your zone's name. For example, if you named your first zone, “room1”, then the first north wall created for that zone would be automatically called “room1/n”.
- It is not possible to have two elements with the same name. If you try to use the same name twice, iSBEM automatically renames the second element for you. For example, if you attempt to create a second zone named “z0/01” or a second wall named “z0/01/n”, iSBEM will rename them “z0/01.1” and “z0/01/n.1”, respectively.

- If you use the “Copy Record” function, a name is generated automatically for you. For example, if you copy zone “z0/01”, the new zone will be automatically named “z0/01.1”, which you can later rename. However, any building objects (i.e., envelopes, windows, doors) assigned to the zone, which are also copied as a result, retain the same names as those which they are copied from (e.g., z0/01/n, z0/01/n/g, etc.). It is recommended that you appropriately rename any copied elements.

3.5.2. Naming constructions and building services systems

As there are generally far fewer constructions and building services systems in a building, such a methodical nomenclature system, as that recommended for the geometrical definition of the building, is not generally required, as long as the names you give them are unique, for e.g., do not give the same name to two different constructions in the *Project Database* form. However, names which clearly identify the type and/or use of the construction or building services system are recommended.

4. iSBEM BASICS – GETTING STARTED

This chapter will show you how to install and open iSBEM, start a new project or open an existing project, and finally, close the application correctly.

NB: To open and edit files created with previous versions of iSBEM (i.e., prior to the current version), you will first need to convert each file in order to make it compatible with this version of iSBEM. See Chapter 8 for instructions on how to do this.

4.1. System Requirements

The current version of iSBEM (iSBEM_v5.6.b.mdb) runs on Microsoft Access. If you do not have a 'full' version of Microsoft Access on your computer, installing a run-time version would be sufficient for running iSBEM. A run-time version of Access 2013 is available for download freely from the Microsoft websiteⁱⁱⁱ.

We recommend at least 512 MB RAM on your computer to run the application. To view all of the output documents produced by iSBEM, you will also need Microsoft Internet Explorer, Microsoft Excel, and Adobe Acrobat Reader installed on your computer.

NB: If you have been using MS Access 2000 to run older versions of iSBEM, please note that it cannot cope with the changes introduced from iSBEM_v3.2.b onwards.

The approved version of iSBEM has been developed to work on a Windows platform only. Unfortunately, iSBEM is not compatible with Mac or Linux. SBEM itself will run on most platforms as it is standard C++ and, subject to funding, can be compiled in Mac or Linux, but the iSBEM interface is a Microsoft Access application which will not run on Linux or Mac operating systems.

NB: Ensure that you have full read and write access permissions on the NCM folder (on the C:\ drive), where iSBEM is installed by default on your computer. If you are unable to do this, you need to contact the IT department of your company and ask them to adjust your settings to give you full read and write access rights on the NCM folder on your computer.

NB: Please note that iSBEM cannot run on an online cloud-based system, e.g., Access Online with MS Office 365 "subscription-only service". Therefore, you are advised to use a computer with a local MS Office installed or an Access runtime version if you do not have a full local version. Then, you can install iSBEM on the local hard drive (C:\) in order to be able to run it.

NB: Users with 64-bit versions of MS Office will need to follow the guidance in the installation instructions document (available from the UK-NCM website) prior to installing iSBEM, as iSBEM cannot currently run with 64-bit MS Access.

NEW

NB: Please note that an internet connection is no longer required to generate EPC XML files for buildings in England, Wales, and Northern Ireland as EPCgen no longer needs to connect to the National Register's servers to verify the assessor's accreditation status and the software version. The EPC XML file will always be generated if the EPC calculation runs successfully on the user's computer. If 'EPC Scotland' has been selected as the "Purpose of Analysis", the EPC XML file is generated only if the calculation runs successfully for both the actual and potential ratings.

ⁱⁱⁱ <https://www.microsoft.com/en-gb/download/details.aspx?id=39358>.

4.2. Installing iSBEM on your computer

The current version is: **iSBEM_v5.6.b**. The tool can be accessed via the following web address: www.uk-ncm.org.uk.

NB: FILES CREATED WITH PREVIOUS VERSIONS OF iSBEM ARE NOT AUTOMATICALLY COMPATIBLE WITH THIS VERSION AND WOULD REQUIRE CONVERSION BEFORE THEY CAN BE OPENED AND EDITED USING THE CURRENT VERSION (see Chapter 8: iSBEM FILE CONVERSION).

How to install iSBEM:

1. Go to the 'Download' page and complete the form and accept conditions.
2. Click on the hyperlink to download the tool.
3. Save the **iSBEM_v5.6.b.exe** file to a folder of your choice on your hard drive (**do not try to open the file at this point**), such as the Desktop.
4. Once the download is complete, double-click on the **iSBEM_v5.6.b.exe** icon, and then click on "**Unzip**" to initiate the self-extracting process. This will automatically install the application in a new folder on your hard drive (default folder: **C:\NCM**). You may change the installation path if you wish.
5. Once the file has been unzipped to your hard drive, the message "xx file(s) unzipped successfully" will appear (this number may differ for different versions of the tool). Click on '**OK**', and then close the **WinZip** Self-Extractor window (click on '**Close**' or on the cross in the top right-hand corner of the window).

iSBEM is now installed on your computer.

6. To locate iSBEM on your computer, open **Windows Explorer**, and navigate through the following (assuming the default installation path was not changed):

My Computer

C:\ (drive)

NCM\

iSBEM_v5.6.b

iSBEM_v5.6.b.mdb (the tool itself) along with all of its associated databases and files are located within this folder (iSBEM_v5.6.b).

NB: If you changed the installation path (in step 4), the tool will be located in:

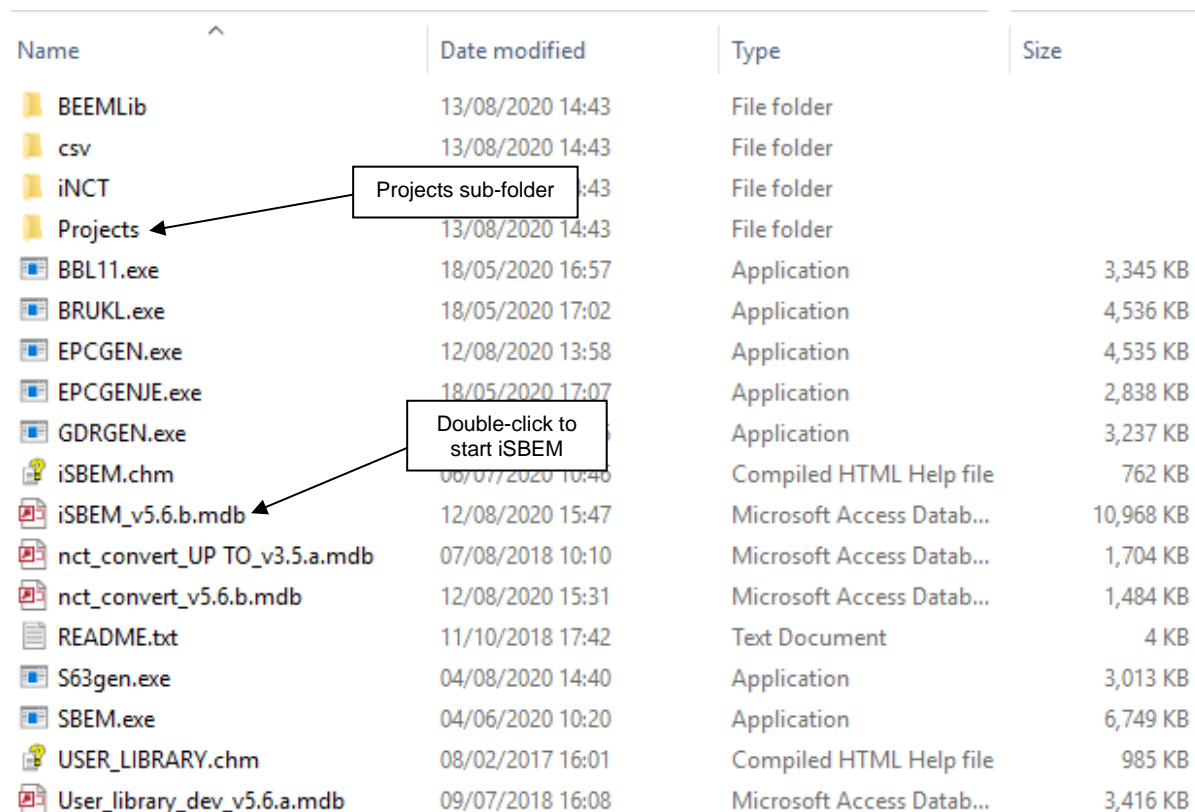
your selected path\iSBEM_v5.6.b.

Users who intend to model and run calculations for particularly large projects (e.g., those containing hundreds of zones) in iSBEM, provided their computers have 64-bit operating systems, may choose to download the file **iSBEM_v5.6.b_x64.exe**, which contains a 64-bit version of the calculation engine, instead of **iSBEM_v5.6.b.exe**. Note that this 64-bit version will not run if installed on computers with 32-bit operating systems.

TIP: You may wish to create a shortcut to the "iSBEM_v5.6.b folder" on your **Desktop** or elsewhere in your system so that you can access it more easily. However, this is optional. To create a shortcut on the Desktop, right-click on the iSBEM_v5.6.b folder, select "Send to" and then "Desktop (create shortcut)".

4.3. Opening iSBEM

After installing iSBEM and double-clicking on the “iSBEM_v5.6.b” folder, you will be presented with the window in Figure 4. In order to start the application, you will need to double-click on the Microsoft Access file called **iSBEM_v5.6.b.mdb**.



Name	Date modified	Type	Size
BEEMLib	13/08/2020 14:43	File folder	
csv	13/08/2020 14:43	File folder	
iNCT	13/08/2020 14:43	File folder	
Projects	13/08/2020 14:43	File folder	
BBL11.exe	18/05/2020 16:57	Application	3,345 KB
BRUKL.exe	18/05/2020 17:02	Application	4,536 KB
EPCGEN.exe	12/08/2020 13:58	Application	4,535 KB
EPCGENJE.exe	18/05/2020 17:07	Application	2,838 KB
GDRGEN.exe	18/05/2020 17:07	Application	3,237 KB
iSBEM.chm	06/07/2020 10:46	Compiled HTML Help file	762 KB
iSBEM_v5.6.b.mdb	12/08/2020 15:47	Microsoft Access Datab...	10,968 KB
nct_convert_UP TO_v3.5.a.mdb	07/08/2018 10:10	Microsoft Access Datab...	1,704 KB
nct_convert_v5.6.b.mdb	12/08/2020 15:31	Microsoft Access Datab...	1,484 KB
README.txt	11/10/2018 17:42	Text Document	4 KB
S63gen.exe	04/08/2020 14:40	Application	3,013 KB
SBEM.exe	04/06/2020 10:20	Application	6,749 KB
USER_LIBRARY.chm	08/02/2017 16:01	Compiled HTML Help file	985 KB
User_library_dev_v5.6.a.mdb	09/07/2018 16:08	Microsoft Access Datab...	3,416 KB

Figure 4: Location of the iSBEM Microsoft Access file and Projects folder

The first time that the application is opened, a dialogue box will appear containing iSBEM's licensing terms and conditions (Figure 5). You will need to accept the terms and conditions before you can proceed. If you tick the “Don't show this message again” box, this window will not appear again on starting the application.

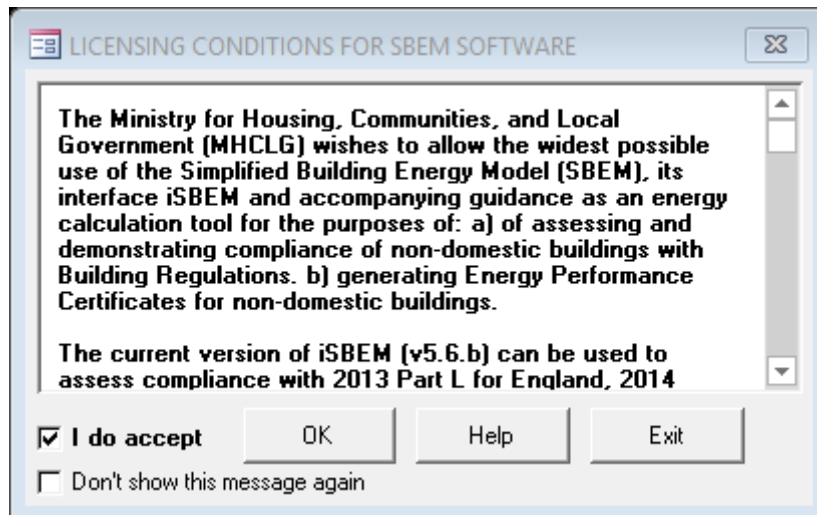


Figure 5: Terms and Conditions dialogue box

4.4. Creating new and opening existing projects

When the terms and conditions have been accepted, a new window will appear which gives **three** “iSBEM Start-up Options” (Figure 6):

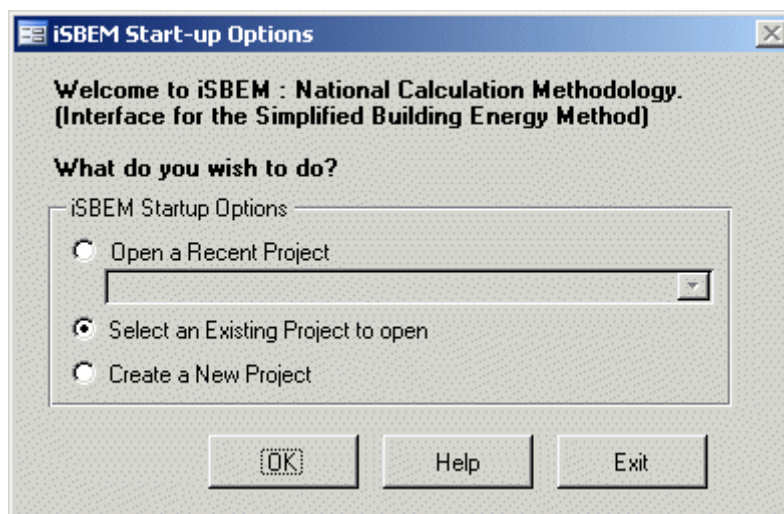


Figure 6: iSBEM Start-up dialogue box

NB: FILES CREATED WITH PREVIOUS VERSIONS OF iSBEM ARE NOT AUTOMATICALLY COMPATIBLE WITH THIS VERSION AND WOULD REQUIRE CONVERSION BEFORE THEY CAN BE OPENED AND EDITED USING THE CURRENT VERSION (see Chapter 8: iSBEM FILE CONVERSION).

1. **Open Recent Projects** – This option has a drop-down menu which contains the 5 most recently-opened projects.
2. **Select an Existing Project** – Selecting this option and clicking on “OK” opens the “Open File” dialogue box, allowing you to browse through your network/computer to locate a project. It is set to open automatically in the “Projects” sub-folder within the iSBEM_v5.6.b folder.

3. **Create a New Project** – If this option is chosen, the “Save New Project” dialogue box appears, and you need to do the following:
 - a. Click on the “Create new folder” button on the top right-hand side of the “Save New Project” dialogue box, enter the project’s name as the name for the folder, and then click on “Open”.
 - b. Click into the “File Name” field and enter the project name again and click on “Save”. (This folder and project file will be saved to the iSBEM “Projects” folder by default – see Figure 4).

NB: It is recommended practice to create a sub-folder for each project (inside the Projects folder) in which all the project-related files are saved.

- c. A form then opens which allows you to enter some basic information about the project - see Figure 7. This includes: purpose of the analysis, weather location, name of the project, building type, etc. You will be able to edit all this information at a later stage in the *General* form if you wish.

The image shows a software window titled "iSBEM Basic Information". It contains two main sections. The first section, "Building Regulation & EPBD parameters", has three dropdown menus: "Purpose of analysis" (selected: England Building Regulations Part L 2013), "Weather (location)" (selected: London), and "Stage of analysis" (selected: As built). The second section, "Building details", has two text fields: "Name of the project" (text: Project name?) and "Building type" (selected: A1/A2 Retail and Financial/Professional service). At the bottom of the window are two buttons: "Help" and "OK".

Figure 7: iSBEM Basic Information form

4.5. Closing iSBEM

There are two ways to close iSBEM (circled in Figure 8):

1. Go to the *General* form and click on “Exit iSBEM”.
2. Go to the *General* form and click on the cross in the corner of the iSBEM screen (the smaller window inside the main Microsoft Access window).*

***It is not advisable** to exit by clicking the cross in the corner of the main Microsoft Access screen.

What to do if you close the application incorrectly, or if there is a power cut

If you click on the cross in the corner of the main Microsoft Access screen, your work will not be saved to your project file but stored within a temporary file until the next time you open the

interface. When you do open the interface next, you will be presented with the “iSBEM Project Recovery” dialogue box. It asks you whether you want to continue working with the last project which was not closed properly. Click on “Yes”, and then, when you are in the *General* form, click on “Save”. If you click “No” here, **all** your changes will be lost. If there is a power cut, your work will be saved into the temporary file as described above, and you should follow the same instructions for recovering your data.

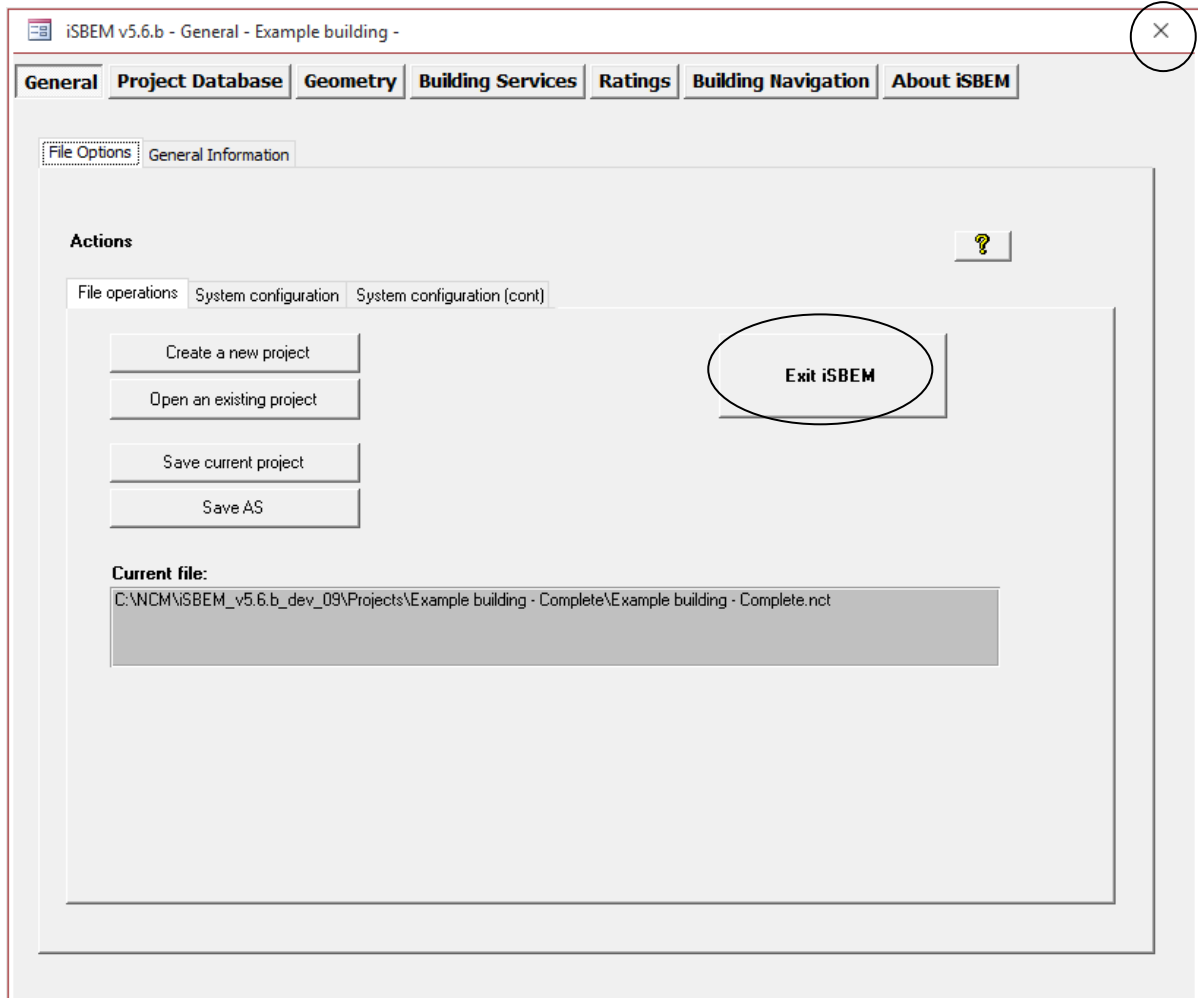


Figure 8: General form showing the correct ways of closing iSBEM

After clicking on either of the 2 options (circled in Figure 8), the iSBEM “END” dialogue box (Figure 9) will open to ask you whether you want to save your changes to the project. The project will be saved to the location determined when you clicked on “Create a New Project” as the project was first entered (the default location was the “Projects” sub-folder within the “iSBEM_v5.6.b” folder).

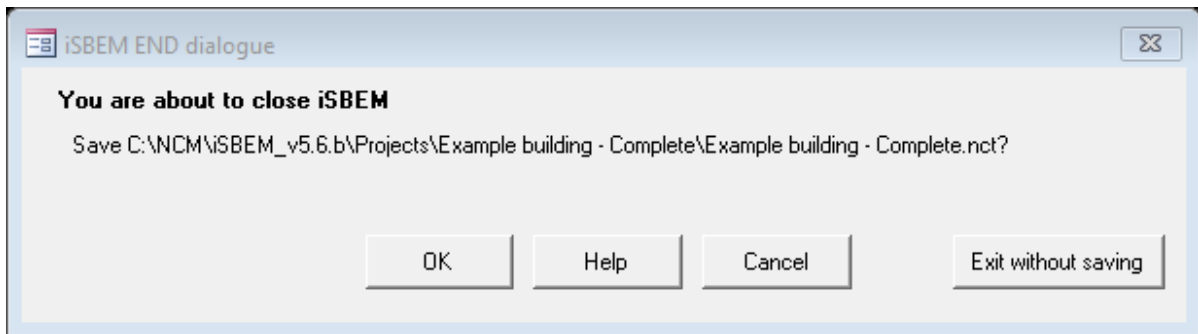


Figure 9: The iSBEM END dialogue box

After you have chosen to save or exit without saving, the iSBEM “END” (Figure 10) dialogue box will open. To exit, click on the button in the centre of the dialogue box.

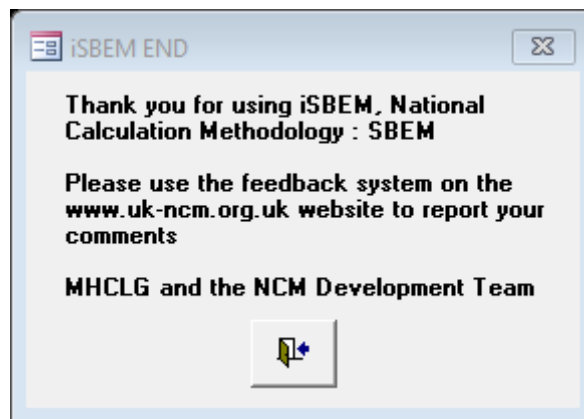


Figure 10: iSBEM END dialogue box

4.6. Getting assistance with using iSBEM

The following sources are available if you need assistance on the use of iSBEM and have been unable to locate the information you need in this Guide:

- You can click “F1” while in any field within the iSBEM interface to get Help information on any specific input item (see Section 6.2: iSBEM Help).
- Frequently Asked Questions (FAQs) can be accessed from the NCM website at www.uk-ncm.org.uk.
- If you are an energy assessor, for all (software and policy) queries related to Non-Domestic EPCs, you should contact your Accreditation Scheme Provider.
- For policy queries related to Part L, you can contact the Building Control department of your local council or MHCLG through enquiries.br@communities.gsi.gov.uk.
- You can also refer to MHCLG’s website at www.communities.gov.uk, including MHCLG’s publication: “Improving the energy efficiency of our buildings: A guide to energy performance certificates for the construction, sale and let of non-dwellings” which can be accessed from: www.communities.gov.uk/publications/planningandbuilding/nondwelling.
- For all other queries, you can contact the SBEM Helpline either through the Feedback page on the NCM website www.uk-ncm.org.uk. Unfortunately, the SBEM Helpline cannot be contacted by telephone.

- **Jersey users:** Enquiries on using iSBEM to undertake BBL11 compliance checks should be directed to the States of Jersey, Planning and Environment Department, Phone: +44 (0)1534 448421, Fax: +44(0)1534 448461, e-mail: BuildingControl@gov.je.

5. TOUR OF iSBEM

The interface consists of a number of screens into which the data for a building needs to be entered in order to model your building. This chapter gives an overview of these screens.

5.1. Introduction to the main forms in iSBEM

The iSBEM opening screen (Figure 11) gives access to **seven** main forms:

- **General**
- **Project Database**
- **Geometry**
- **Building Services**
- **Ratings**
- **Building Navigation**
- **About iSBEM**

Within each of these forms, there are various tabs and sub-tabs as shown in Figure 11.

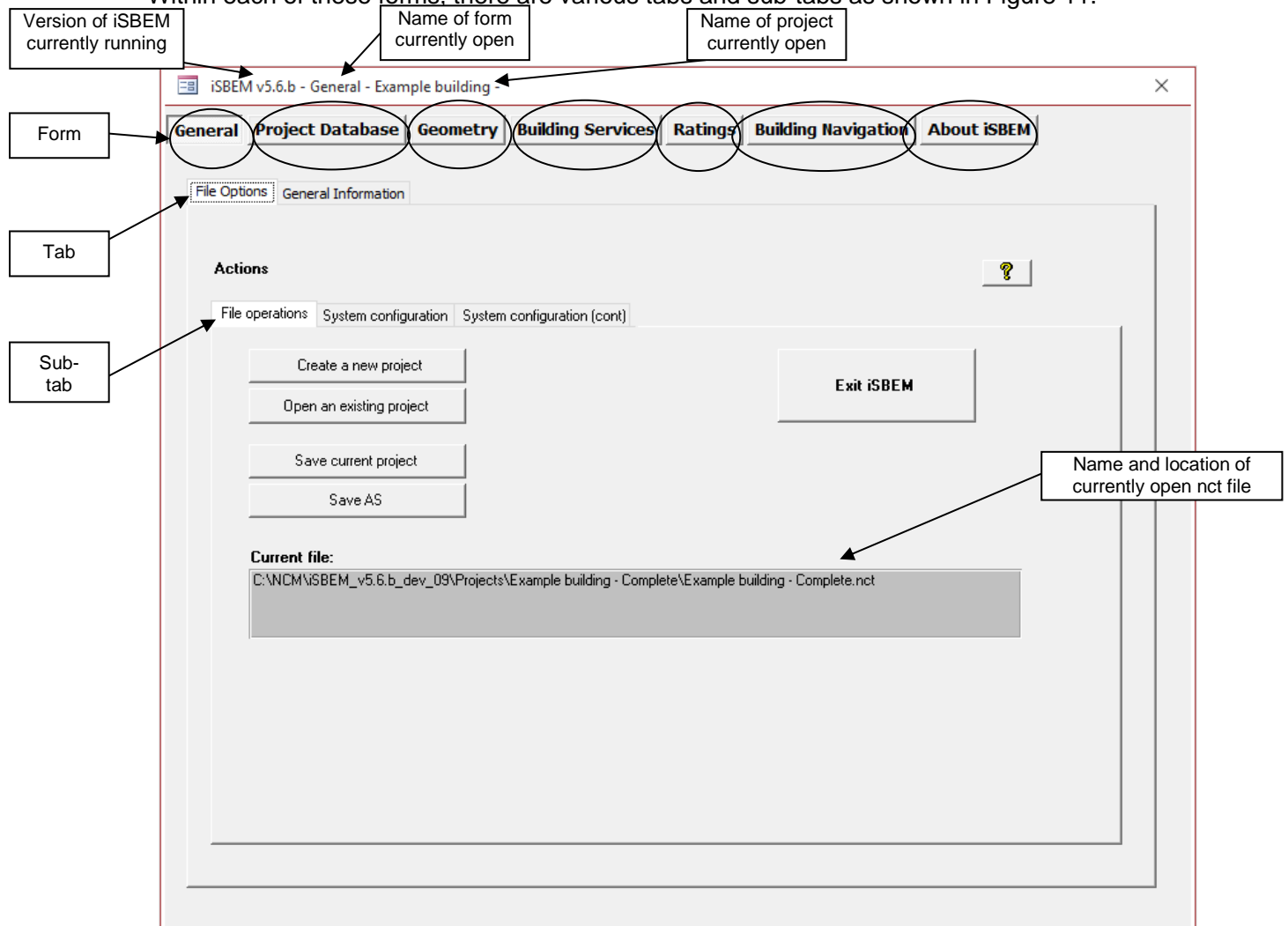


Figure 11: The seven forms in iSBEM

As can be seen in Figure 11, the top bar of the window displays the version number of iSBEM you are using, the name of the form currently open, and the name of the project. This bar is always visible in all the form, tabs, and sub-tabs of the interface.

Below is a summary of the data which needs to be entered into each form:

General: The *General* form is where projects can be saved and opened. General information relating to the project can also be recorded here, such as the name and address of the project, type of the project (e.g., shell and core or modular and portable building), weather data, and details about the certifier/energy assessor. This information may have already been entered when the project was first created (see Section 4.4: Creating new and opening existing projects, under 'Create a new project'), but they can be edited here.

Project Database: The *Project Database* form is where the glazing and construction details of your building fabric are entered.

Geometry: The *Geometry* form is where the activity, size, and envelope orientations of the "zones" are entered. Each zone requires a description of the walls, floor, roof/ceiling, doors, and windows which comprise its envelopes.

Building Services: The *Building Services* form is where all the building's systems are described, including: HVAC, HWS, PVS, SES, Wind, and CHP systems. Further information on the lighting and ventilation characteristics specific for each zone is also input through this form.

Ratings: The *Ratings* form is used to carry out the energy performance calculation and compliance checking, access the results, and obtain the Building Regulations compliance document along with the Asset rating for the Energy Performance Certificate. The only data entry in this form is related to modifying the energy efficiency recommendations for the report that accompanies the EPC.

Building Navigation: The *Building Navigation* form provides a hierarchical summary of all the building objects that have been defined, assigned and unassigned, along with key details on some of the objects. There is no data entry in this form.

About iSBEM: The *About iSBEM* form displays the licensing conditions for the software. There is no data entry in this form.

5.2. Hierarchy of forms, tabs, and sub-tabs in iSBEM

Detailed information on each of the listed forms, tabs, sub-tabs, and sub-forms within them is provided in the relevant sections in the User Guide volume "How to use iSBEM: Compliance Assessment - UK".

Form	Tab	Sub-tab	Sub-form
General			
	File Options		
		<i>File Operations</i>	
		<i>System Configuration</i>	
		<i>System Configuration (cont.)</i>	
	General Information		
		<i>Project Details</i>	
		<i>Additional Project Details</i>	
		<i>Special Considerations</i>	
		<i>EPBD Recast</i>	
		<i>Building Details</i>	
		<i>Certifier/Energy Assessor/Agent Details</i>	
			<i>Certifier/Energy Assessor details</i>

Project Database

Constructions for Walls

General

Assigned

Constructions for Roofs

General

Assigned

Constructions for Floors

General

Assigned

Constructions for Doors

General

Assigned

Glazing

General

Assigned

Geometry

Project

General and geometry

Thermal bridges

Zones

General

Envelope Summary

Quick Envelopes

Envelopes

General

Windows Summary

Doors

General

Windows and rooflights

General

Building Services

Global & Defaults

HVAC System Defaults (if the “Purpose of the analysis” selection in the General form > General Information tab > Project details sub-tab is one of the options to generate EPCs)

Project Building Services

Air Conditioning Inspection (if the “Purpose of the analysis” selection in the General form > General Information tab > Project details sub-tab is one of the options to generate EPCs, except EPC Scotland)

HVAC Systems

General

Heating

Cooling

Systems Adjustments

Metering Provision

System Controls (if the “Purpose of the analysis” selection in the General form > General Information tab > Project details sub-tab is one of the options to generate EPCs)

Bi-valent Systems

Zone Summary

HWS

General

Storage & Secondary Circulation

Assigned

Bi-valent Systems

Showers

SES

Collector Parameters

Solar Storage & Collector Loop

Auxiliary Energy & Distribution Losses	
PVS	<i>General</i>
Wind Generators	<i>General</i>
Solar Collectors	<i>General</i>
	<i>Air Flows</i>
CHP Generator	<i>General</i>
Showers	<i>General</i>
Zones	<i>HVAC and HWS Systems</i>
	<i>Ventilation</i>
	<i>Ventilation (cont.)</i>
	<i>Exhaust</i>
	<i>Lighting</i>
	<i>Lighting Controls</i>
	<i>Display Lighting</i>
	<i>Solar Collectors</i>
Ratings	
Building Regulations Check	<i>Building Rating</i>
	<i>Calculation Logs</i>
	<i>SBEM.log</i>
	<i>BRUKL.log</i>
	<i>Calculation Errors</i>
	<i>SBEM.err</i>
	<i>BRUKL.err</i>
	<i>Supporting Documents</i>
<i>OR (if the “Purpose of the analysis” selection in the General form > General Information tab > Project details sub-tab is one of the options to generate EPCs)</i>	
Asset Rating	<i>Building Rating</i>
	<i>Graphic Rating</i>
	<i>Recommendations</i>
	<i>EPC Audit</i>
	<i>Construction</i>
	<i>Geometry</i>
	<i>HVAC & HWS</i>
	<i>Lighting</i>
	<i>Calculation Logs</i>
	<i>SBEM.log</i>
	<i>EPCgen.log</i>
	<i>BRUKL.log</i>
	<i>Calculation Errors</i>
	<i>SBEM.err</i>
	<i>EPCgen.err</i>
	<i>BRUKL.err</i>
	<i>Supporting Documents</i>
Building Navigation	
	Selections
	Object Properties
About iSBEM	

Table 7: Structure of the forms, tabs, and sub-tabs in iSBEM

6. BASIC iSBEM FUNCTIONALITY AND THE HELP MENU

6.1. Basic interface functionality and buttons

Within the *Project Database*, *Geometry*, and *Building Services* forms, you are required to enter information about various aspects of the building. The *Project Database* form requires you to enter the information about the properties of each of the construction and glazing types. The *Geometry* and *Building Services* forms require you to enter details about the zones, their envelope elements, windows, and doors and all of the building services systems found in the building (all these items are shown in Figure 1: Structure of SBEM objects).

All of these items are 'records' within the interface, and there is a *General* sub-tab, like the one shown below (Figure 12), for each, where you can view, add, delete, and edit them.

Within iSBEM, there is an alternative way of entering some types of records, in particular, the envelope elements and windows. These can be entered using the *Quick Envelope* sub-tab. The functionality of this and any other screens in iSBEM will be explained in the relevant sections of the User Guide volume **"How to use iSBEM: Compliance Assessment - UK"**.

The majority of the buttons and functionality of iSBEM can, however, be demonstrated by the *General* sub-tab (Figure 12).

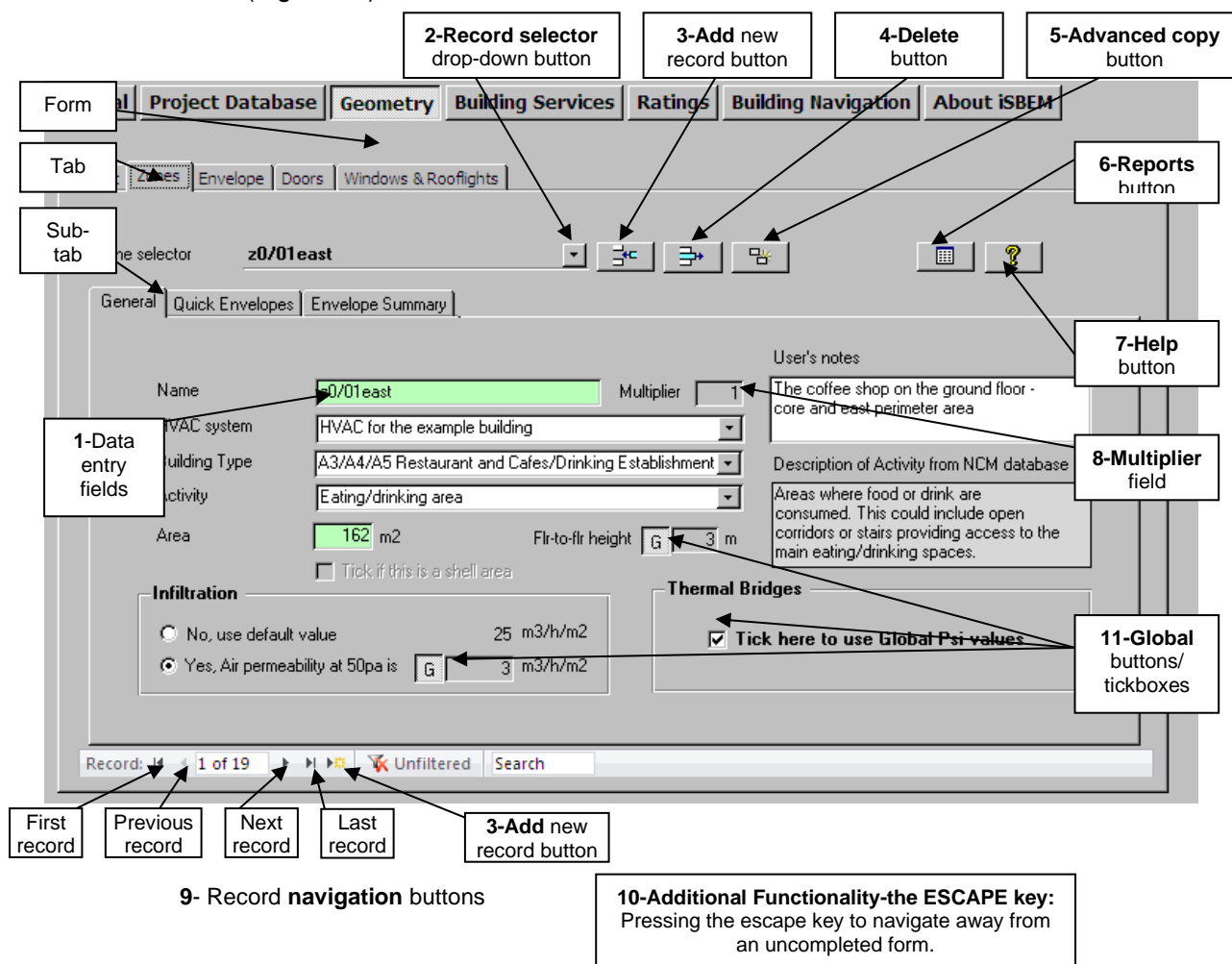


Figure 12: A General sub-tab: basic commands and buttons

1. Data entry fields

The data entry fields in iSBEM require the user to either enter text/numbers or select an option from a drop-down menu. Some of the fields have a green background. These fields are mandatory and must be filled in before proceeding to the next record or navigating away from that screen.

2. Record selector button


Clicking on the record selector drop-down button produces a drop-down list of all of the records in that sub-tab. For example, in the *Project Database* form > *Constructions for Walls* tab, clicking on the record selector drop-down button displays all of the constructions for walls that have already been defined in that project.

To the right of the name of the record, there is further information about the parent building objects for that record. For example, in the *Zones* tab, clicking the record selector button displays all of the zones in the building along with the HVAC system with which each zone is associated (the HVAC system that serves the zone).

Extra features:

“Copy single object” function (this function will be available in future versions of the tool): The first entry in the drop-down list begins with “Choose action or X from the list” where X can be a construction, zone, wall, HVAC system, etc. The only action currently planned to become available is to “Copy a single object”. This will allow (when it becomes functional in future versions) the user to copy only the selected object with none of its associated/child objects (To copy the object and all of the associated objects, you will need to use the “Advanced Copy” button, which is discussed below).

3. Add new record button

If you hover over this button with the mouse cursor, the text “Click here to insert a new X” will appear, where X could be a construction object, zone, HVAC system, etc. You can also click on the “Add new record” button  at the bottom of the screen. You will then be prompted to enter a name for the record. Once you have done this, press on the **Tab** or **Enter** button on your keyboard. You will then be able to start entering the rest of the information necessary for that record.

NB: The name should be entered in the “Name” field. Do not try to add a name in the “Record selector” field.

4. Delete record button

If you hover over this button with the mouse cursor, the text “Click here to delete current X” will appear. To delete a record, select the record you want to delete from the drop-down “Record selector” menu, and click on the “Delete” record button. Not only will the record be deleted but any associated sub-objects as well. For example, if you delete an envelope element, any associated windows and doors will also be deleted (If a Microsoft Access message box appears showing “Reserved error” or “No current record”, click on “OK” to proceed). A dialogue box will then appear to confirm that you intend to delete the record. Any deletion cannot be undone. It is very important that you determine which associated sub-objects are going to be deleted at the same time. If you are sure you want to delete the record and all its associated records, click on “Yes”.

5. Advanced copy button

The “Advanced Copy” button is available in the *Geometry* and *Building Services* forms. By clicking on this button, the selected building object, along with all of its associated sub-objects, are copied. The new record is given a name automatically. For example, if you copied an envelope named X, a new envelope would be created and named “X.1”. At the same time, all of its associated objects would also be copied. For example, if an envelope element were copied, any associated windows and doors would also be copied. The copied windows and doors, however, keep the same name as those they were copied from. For a zone, this would mean all of its associated envelope elements, windows, and doors would be copied, and if any HVAC systems were copied, so would every associated zone, along with all of its envelope elements, windows, and doors.

If you need to only copy the selected record and not any of its sub-objects, use the copy single object function found in the record selector menu (this function will be available in future versions of the tool).

6. Reports button

Clicking on the “Reports” button produces two reports: the *Data Summary* report and the *Unassigned Objects* report. These reports are for double-checking the data entered. For more details on these two reports, see the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.

7. Help button

The “Help” button can be found in the top right-hand corner of every sub-tab of iSBEM. Clicking on this button opens the Help menu (see Section 6.2: iSBEM Help, for further information).

8. Multiplier field

If there is more than one identical zone, for example, this field allows the user to only define it once and then enter the number of these identical zones that exist in the building. Remember that this would also “multiply” all of its associated envelope elements, windows, doors, and additional thermal bridges during the calculation.

9. Record navigation buttons

These buttons allow you to scroll through the records in that sub-tab quickly.

10. The Escape key – navigating away from incomplete records

Once a new record has been created, iSBEM will not allow you to navigate away from that screen until you have completed all the mandatory fields (all the green fields). iSBEM does not have default values for these fields, and they are needed for SBEM to carry out its calculations. If you need to navigate away from the screen before it is completed, press the **Escape** key on your keyboard.

11. The Global buttons or tick boxes

Global buttons and tick boxes allow you to use previously defined ‘global’ values for a variety of parameters. For example, in Figure 12, the global ‘air permeability at 50pa’ button is pressed in. This means that the current record (in this case, zone z0/01east) takes the previously defined

‘global’ air permeability value (this global value is defined in the *Geometry* form > *Project* tab > *General and Geometry* sub-tab – see Table 8: Global parameters).


When the Global button or tick box is not pressed in or ticked, you are able to enter a value specifically for that record. Table 8: Global parameters - shows the global parameters available in iSBEM, where they are defined, and where they are later used.

Parameter	Global value defined:	Location of Global button or tick box
Air permeability	<i>Geometry</i> form > <i>Project</i> tab > <i>General and Geometry</i> sub-tab	<i>Geometry</i> form > <i>Zones</i> tab > <i>General</i> sub-tab
Zone height	<i>Geometry</i> form > <i>Project</i> tab > <i>General and Geometry</i> sub-tab	<i>Geometry</i> form > <i>Zones</i> tab > <i>General</i> sub-tab
Thermal bridges	<i>Geometry</i> form > <i>Project</i> tab > <i>Thermal bridges</i> sub-tab	<i>Geometry</i> form > <i>Zones</i> tab > <i>General</i> sub-tab
Condition of adjoining space for envelope elements	<i>Project Database</i> form > <i>Construction for Walls</i> tab > <i>General</i> sub-tab <i>Project Database</i> form > <i>Construction for Floors</i> tab > <i>General</i> sub-tab <i>Project Database</i> form > <i>Construction for Roofs</i> tab > <i>General</i> sub-tab	<i>Geometry</i> form > <i>Envelope</i> tab > <i>General</i> sub-tab <i>Geometry</i> form > <i>Zones</i> tab > <i>Quick Envelopes</i> sub-tab

Table 8: Global parameters

6.2. iSBEM Help

iSBEM Help can be accessed in two ways:

1. By pressing the “Help”  button which appears on every sub-tab in the interface as described in Section 6.1. This opens the “Help Topics” window from which you can navigate to the item of interest (see Figure 13).
2. By clicking into the field of interest and pressing the **F1** key on your keyboard. This opens the specific Help entry relating to that particular field in the “Help Entries” window (see Figure 14). From there, you can click either “Contents”, “Index”, or “Find” to open the “Help Topics” dialogue box.

There are Help entries on each of the fields in the interface, and there is a selection of “How to” entries, such as, how to close iSBEM, how to name the building objects, or how to go about describing a roof. Most of this information can also be found in this User Guide.

Help Topics window (Figure 13)

All of the Help topics are listed in the “Help Topics” window. It contains two screens from which you can navigate to your chosen topic: the “Contents” screen and the “Index” screen.

- The “Contents” screen lists all the entries under the iSBEM form, tab, or sub-tab to which they relate or under the “How to..” menu.

- The “Index” screen lists all the entries in alphabetical order, and it contains a “Find” facility which brings back all the Help entries which contain, in their contents, a given word or phrase.

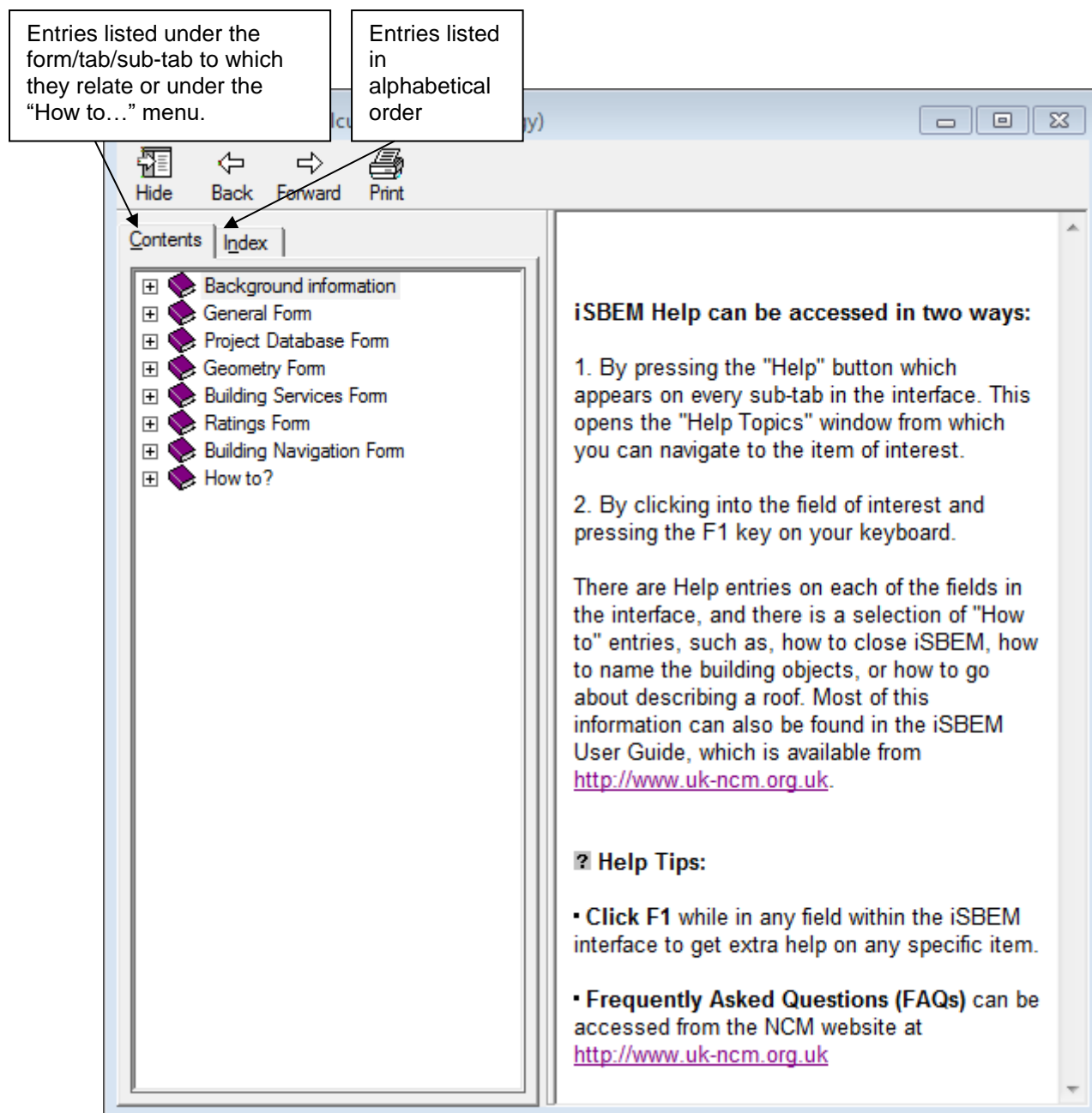


Figure 13: Help Topics window

Help Entries window (Figure 14)

Double-clicking on the item of interest in the “Help Topics” window, or clicking on **F1** on your keyboard, while the cursor is in the relevant field in the interface, opens the “Help Entries” window on the page of interest.

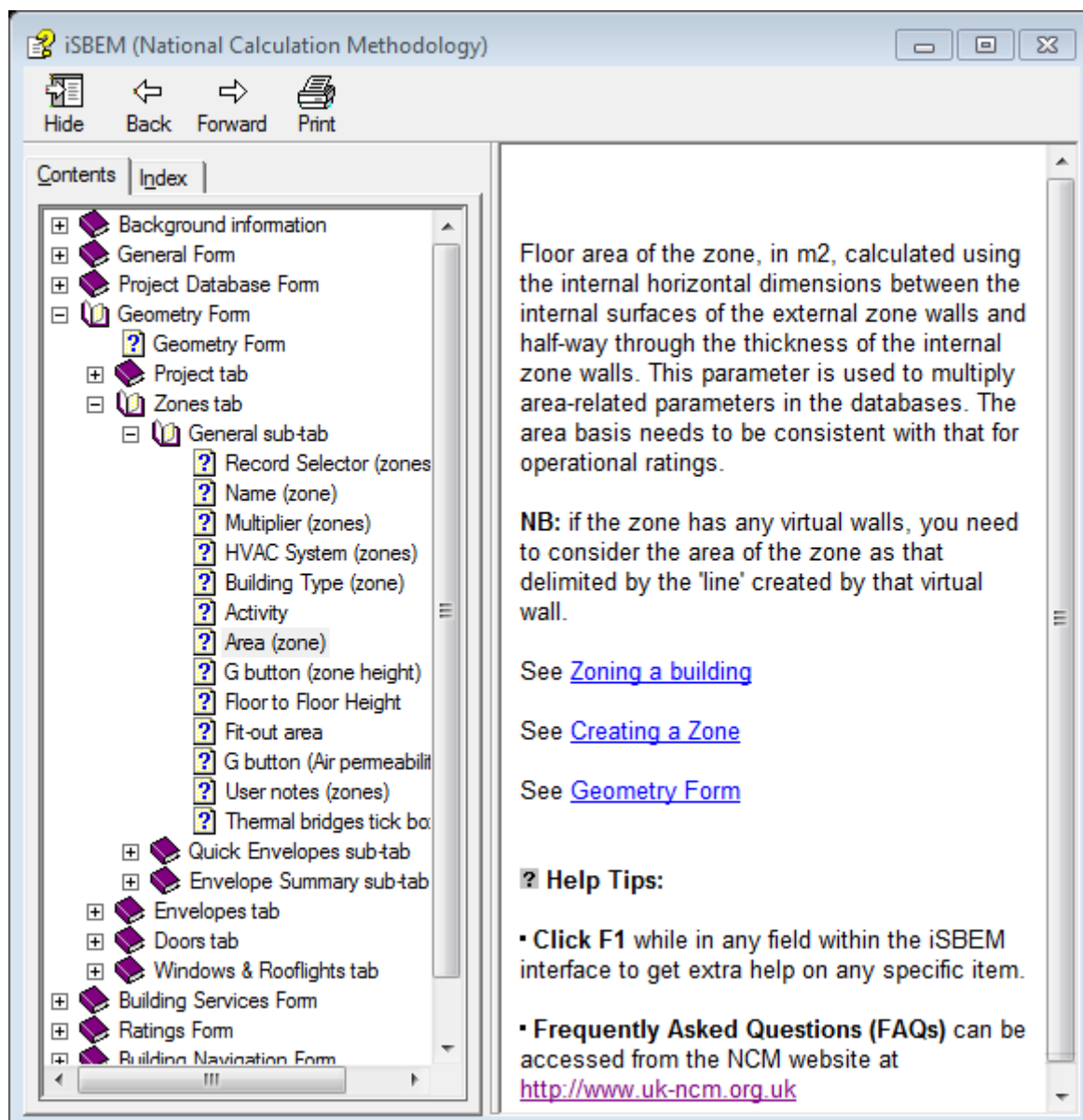


Figure 14: Help Entries window for area of a zone

7. ENTERING A BUILDING INTO iSBEM

7.1. Order of data entry

Some items need to be defined before others in iSBEM. For example, the building fabric needs to be defined before the walls, doors, and windows can be fully described. This hierarchy between the different elements defined in iSBEM can be seen in Figure 1: Structure of SBEM objects. However, there is a degree of flexibility too.

Figure 15 shows which elements need to be entered before others and also gives a suggested order of data entry. It is this order that is followed in the tutorial.

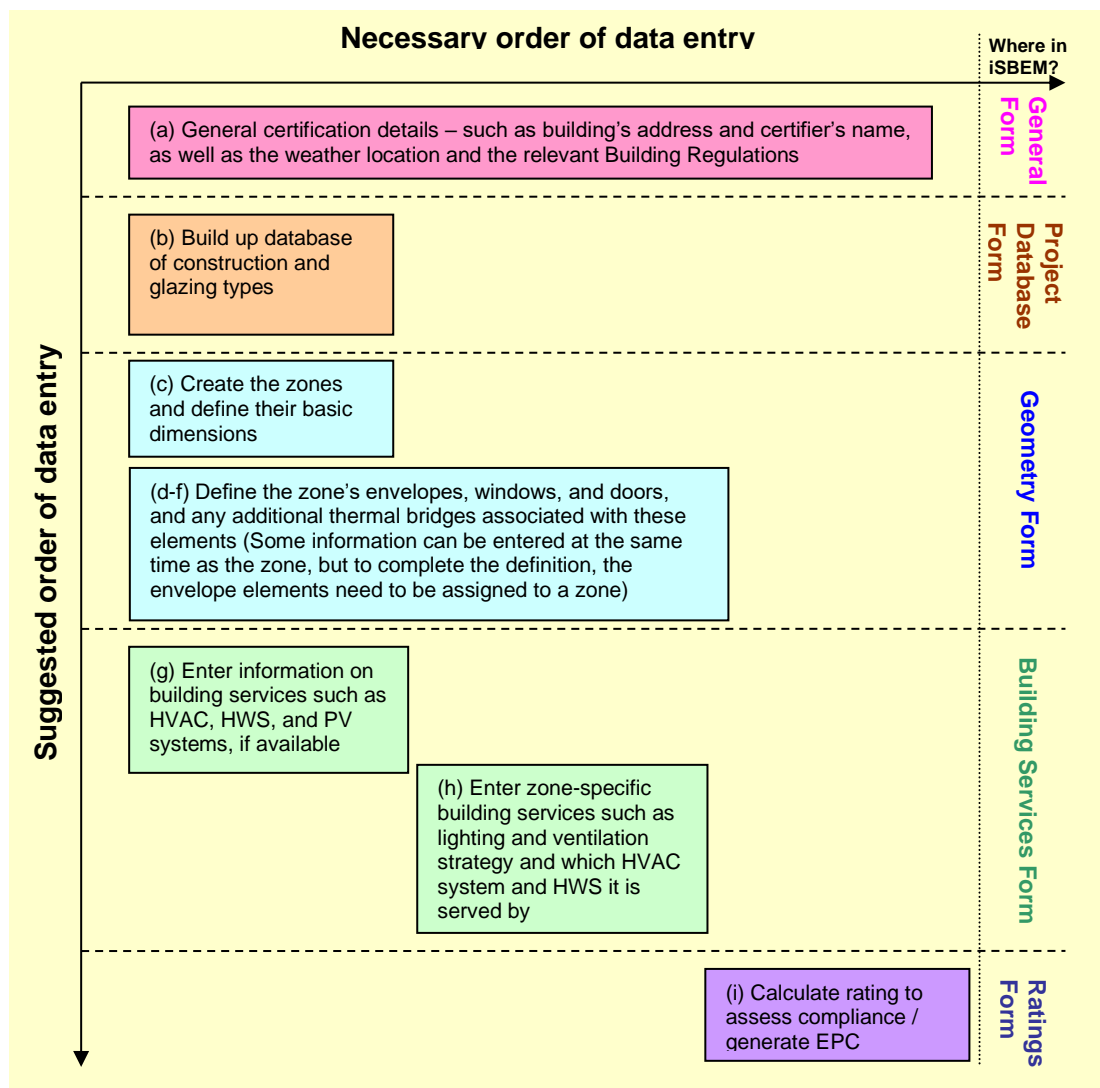


Figure 15: Order of data entry

(The stages, indicated by the letters in Figure 15 (a – i) correspond to the stages described in Section 2.8: Overview of how a building is defined in iSBEM).

7.2. Important note on the default values in iSBEM

In iSBEM, there are default values included for various parameters. For example, there are default seasonal efficiencies for HVAC systems and default constructions for envelope elements so that you can select them when defining the envelopes of a zone when learning how to use the tool. These default values are not generous (i.e., usually pessimistic), should be checked by the user, and, if appropriate, changed or added to.

NB: If none of the default values in iSBEM are changed when modelling a new building, it is very likely that the building will not comply with Building Regulations and will not achieve a good Asset Rating.

8. iSBEM FILE CONVERSION

If you want to open and edit files which were created with the previous versions from iSBEM v3.5.a onwards using this current version (v5.6.b), you will need to convert them to v5.6.b using the conversion tool “nct_convert_v5.6.b.mdb”, as described below. If you wish to open and edit versions which were created with iSBEM versions prior to v3.5.a, you will need to convert them first to v3.5.a using the conversion tool “nct_convert_UP TO_v3.5.a.mdb”, and then convert the v3.5.a. nct file to v5.6.b using the conversion tool “nct_convert_v5.6.b.mdb”. Both file conversion tools are downloaded and installed to your computer at the same time as you download and install the new version of iSBEM. There are 6 stages to converting the files from v3.5.a onwards to v5.6.b:

1. **Open the file conversion tool** - Double-click on the ‘nct_convert_5.6.b.mdb’ file in the iSBEM_v5.6.b folder, as shown in Figure 16.

Name	Date modified	Type	Size
BEEMLib	13/08/2020 14:43	File folder	
csv	13/08/2020 14:43	File folder	
iNCT	13/08/2020 14:43	File folder	
Projects	13/08/2020 14:43	File folder	
BBL11.exe	18/05/2020 16:57	Application	3,345 KB
BRUKL.exe	18/05/2020 17:02	Application	4,536 KB
EPCGEN.exe	12/08/2020 13:58	Application	4,535 KB
EPCGENJE.exe	18/05/2020 17:07	Application	2,838 KB
GDRGEN.exe	29/06/2020 12:55	Application	3,237 KB
iSBEM.chm	06/07/2020 10:46	Compiled HTML Help file	762 KB
iSBEM_v5.6.b.mdb	12/08/2020 15:47	Microsoft Access Datab...	10,968 KB
nct_convert_UP TO_v3.5.a.mdb	07/08/2018 10:10	Microsoft Access Datab...	1,704 KB
nct_convert_v5.6.b.mdb	12/08/2020 15:47	Microsoft Access Datab...	1,484 KB
README.txt	11/08/2020 14:43	Text Document	4 KB
S63gen.exe	04/08/2020 14:40	Application	3,013 KB
SBEM.exe	04/06/2020 10:20	Application	6,749 KB
USER_LIBRARY.chm	08/02/2017 16:01	Compiled HTML Help file	985 KB
User_library_dev_v5.6.a.mdb	09/07/2018 16:08	Microsoft Access Datab...	3,416 KB

Double click to open the file conversion tool

Figure 16: Folder showing the file conversion tool

2. **Select the file you want to convert** - To do this, click on the button shown in Figure 17. This opens a dialogue box, shown in Figure 18, from which you need to browse to find the file you want to convert. Once you have found the file, click on ‘Open’. This file must have been created using iSBEM_v3.5.a or later, or it was converted to iSBEM_v3.5.a from an earlier version.

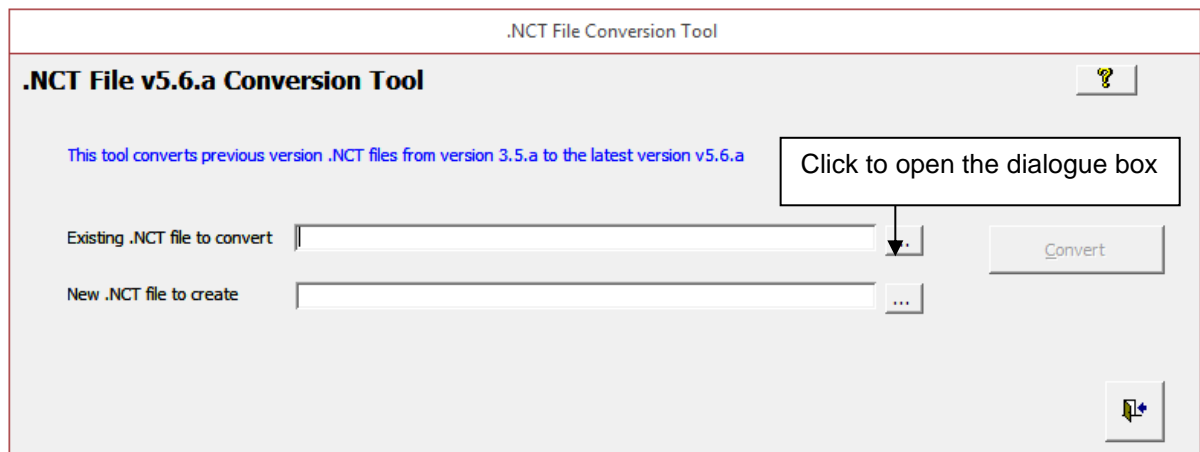


Figure 17: Selecting a file to convert - stage 1

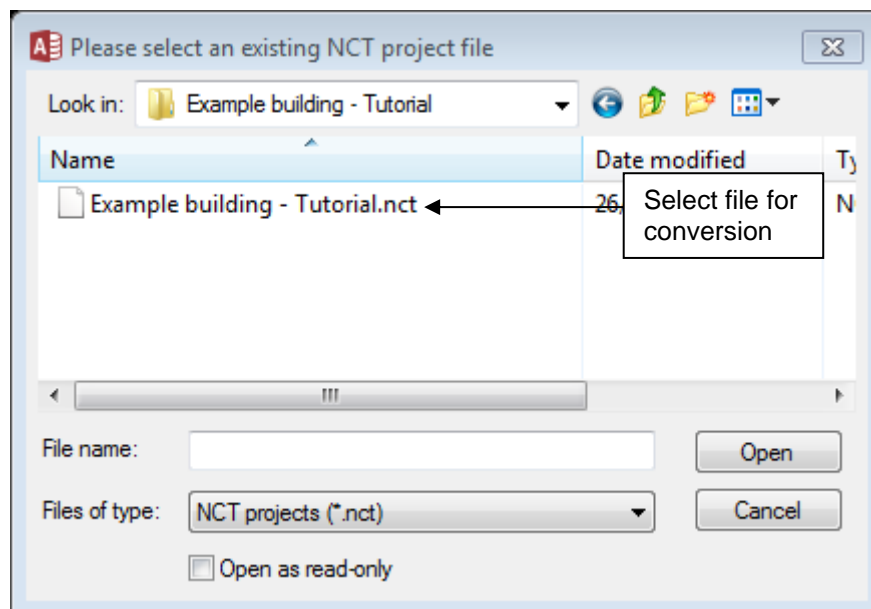


Figure 18: Selecting a file to convert - stage 2

3. Choose a name for the converted file - There are two options:

- i. Click on the button shown in Figure 19. This opens a dialogue box (the same as in stage 2). Re-select the file you are converting and click on 'Save'. The new file will automatically be given the name: "original file name_v5.6.b.nct". The original file will not be over-written by the conversion tool, and you should keep it for future reference.
- ii. If you want to give the converted file a new name of your own, type a new name and its full path into the field (shown in Figure 19).

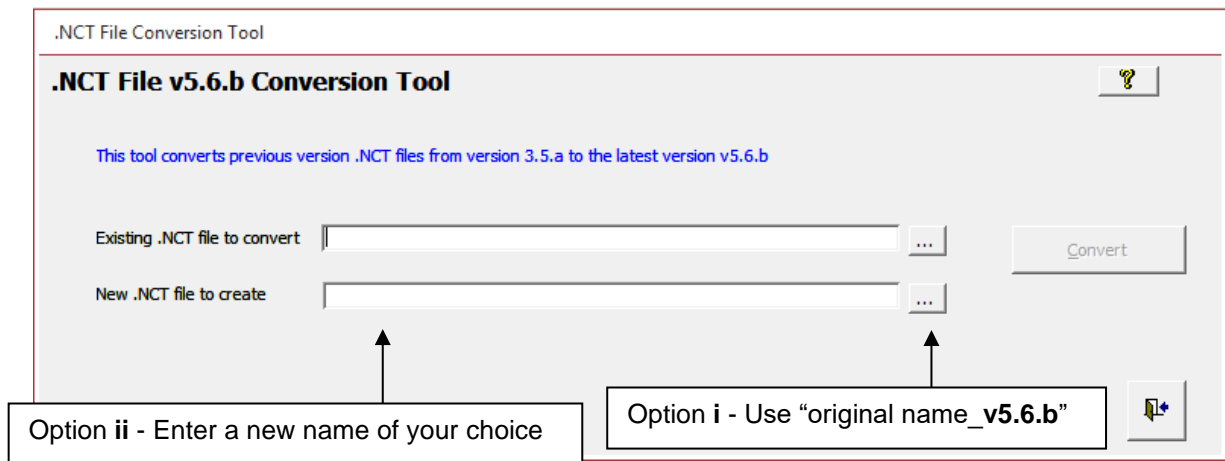


Figure 19: Naming the new file

4. Convert the file – When both of the fields are filled, the 'Convert' button becomes active (see Figure 20). Clicking on this button converts the files and produces the message shown in Figure 21. Click on 'OK'. The new file will be saved to the same folder as the original file by default, unless you specify otherwise.

5. Close the tool – Click on the 'Exit' button (see Figure 20).

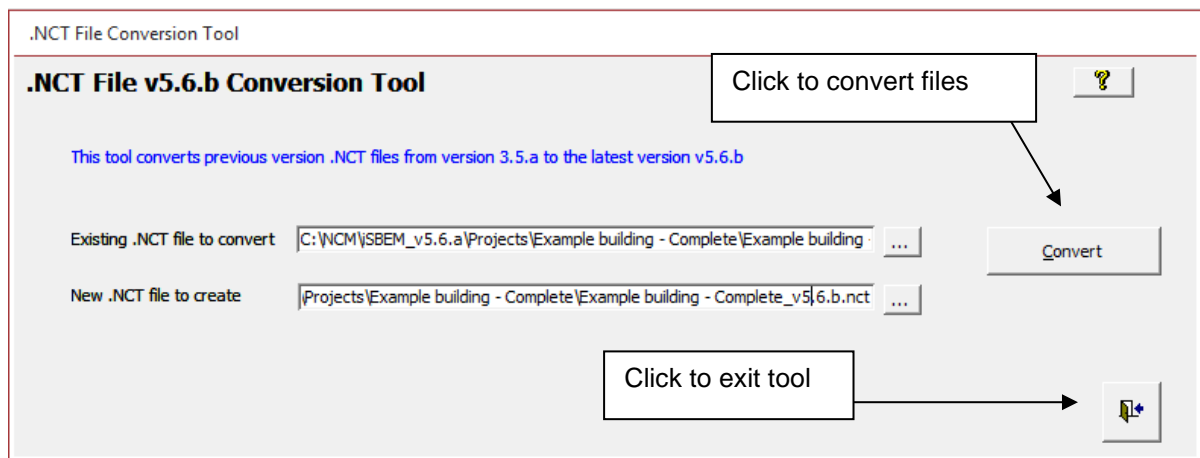


Figure 20: The Convert and Quit buttons

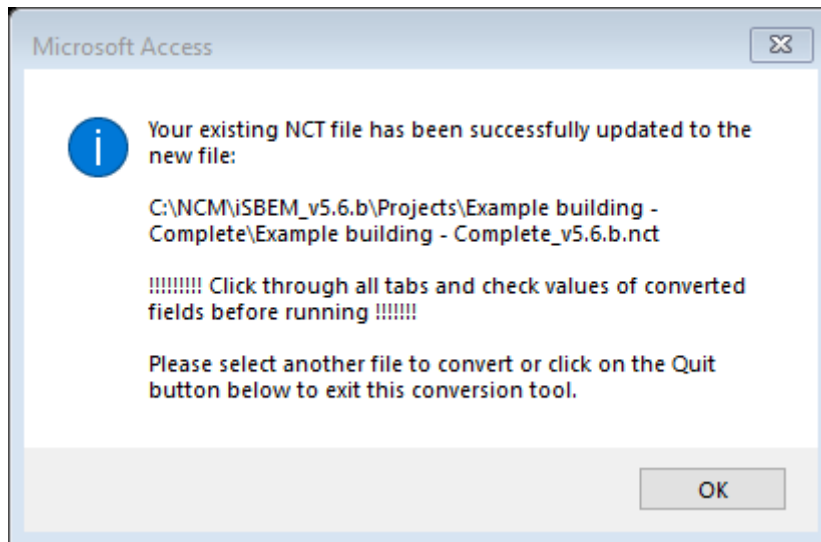


Figure 21: Message which appears after conversion

6. **Open iSBEM and open the newly created nct file** - Due to the nature of the changes introduced in the new version, some fields in some projects may not get refreshed automatically. In order to ensure all the fields in your project are refreshed and updated, after converting files generated by a previous version, you need to do the following (using the record navigation arrows at the bottom):
 - Click through all the zones in the *Geometry* form > *Zones* tab.
 - Click through all the envelope elements in the *Geometry* form > *Envelope* tab.
 - Click through all the HVAC systems in the *Building Services* form > *HVAC systems* tab > *General* sub-tab.
 - Click through all the sub-tabs in the *Building Services* form > *Zones* tab.
 - Due to the construction database having been updated in certain parts, you may wish to review your construction definitions in the *Project Database* form if the constructions were selected either from the library or using the inference method.
7. **Double check and note the points which have changed since the previous version:** Please see section 2.1.1: Key differences in the software for a list of the changes introduced in this version of the tool and manual. It is essential that you click through and review **all** the different forms, tabs, and sub-tabs of iSBEM and ensure that you provide input for parameters that did not exist in previous versions. This would also allow any changes that have been made to iSBEM's default values to be adopted into the input correctly. You might also wish to modify your input for any of the existing parameters based on any further guidance added in this manual or the Help pages.

NB: The development of each new version of iSBEM has incorporated improvements to the calculation algorithms, added features, modifications to some of the underlying databases, and correction of identified minor bugs. Hence, the generated results may differ either way from those generated by previous versions, depending on the individual projects. This is especially true if you are comparing results from the current version to those produced by a much older version of the tool.

9. USER-DEFINED CONSTRUCTION DATABASE

The User Library (User_library_5.6.b.mdb) is a feature first introduced with iSBEM_v2.0.c. You can now build up a database of your commonly used constructions so that you do not need to re-enter them each time you start a new project. You can also import constructions into your Library from a project you have been working on in iSBEM or from another User Library.

This chapter will take you through the basics of:

1. How to add a construction type to your library – and add this to iSBEM
2. How to add a glazing type to your library – and add this to iSBEM
3. How to add a frame type to your library – and add this to iSBEM
4. How to edit the list of opaque constructions categories and the list of sources
5. How to import constructions previously entered into an iSBEM project or in another User Library into your own User Library

For definitions of a particular parameter, place the cursor in that field and press F1. This will open a window with the Help item for that field, in the same way that the Help can be accessed within iSBEM. These definitions are not included in this chapter.

The User library can be found as shown in Figure 22:

Name	Date modified	Type	Size
BEEMLib	13/08/2020 14:43	File folder	
csv	13/08/2020 14:43	File folder	
iNCT	13/08/2020 14:43	File folder	
Projects	13/08/2020 14:43	File folder	
BBL11.exe	18/05/2020 16:57	Application	3,345 KB
BRUKL.exe	18/05/2020 17:02	Application	4,536 KB
EPCGEN.exe	12/08/2020 13:58	Application	4,535 KB
EPCGENJE.exe	18/05/2020 17:07	Application	2,838 KB
GDRGEN.exe	29/06/2020 12:55	Application	3,237 KB
iSBEM.chm	06/07/2020 10:46	Compiled HTML Help file	762 KB
iSBEM_v5.6.b.mdb	12/08/2020 15:47	Microsoft Access Datab...	10,968 KB
nct_convert_UP TO_v3.5.a.mdb	07/08/2018 10:10	Microsoft Access Datab...	1,704 KB
nct_convert_v5.6.b.mdb	12/08/2020 15:31	Microsoft Access Datab...	1,484 KB
README.txt	11/10/2018 17:42	Text Document	4 KB
S63gen.exe	04/08/2020 14:40	Application	3,013 KB
SBEM.exe	04/06/2020 10:20	Application	6,749 KB
USER_LIBRARY.chm	08/02/2020 10:46	Compiled HTML Help file	985 KB
User_library_dev_v5.6.a.mdb	09/07/2020 10:46	Microsoft Access Datab...	3,416 KB

Double click to open the User-defined construction library

Figure 22: Location of the User-defined construction library

1. How to add a construction type to your library – and add this to iSBEM

To add a construction to the User Library, click into the *Constructions* form and follow the instructions starting by clicking on the “create new construction” button and finishing by updating the library in iSBEM.

The screenshot shows the 'User Library' interface with the 'Constructions' tab selected. The interface includes a top navigation bar with tabs: 'Constructions', 'Glazings', 'Frames', 'Construction Categories', 'Sources', and 'Import'. Below this is a 'New Construction' form with a 'General' sub-tab. The form contains the following fields and controls:

- Object selector:** A dropdown menu currently showing 'New Construction'.
- Name:** A text field containing 'New Construction'.
- Env. type:** A dropdown menu showing 'Wall'.
- Category:** A dropdown menu showing 'Cavity wall (full fill)'.
- Source:** A dropdown menu showing 'BRE Digest 465'.
- CM:** A text field containing '50' with units 'kJ/m2K'.
- U-value:** A text field containing '0.25' with units 'W/m2K'.
- Does the construction contain metal cladding?:** A checkbox that is currently unchecked.
- Description:** A large text area for entering a description.
- Buttons:** 'Update the SBEM Construction Library' (blue), and 'To view all the constructions in your library, click here' and 'To delete a construction, click here' (both in blue text).
- Record navigation:** A bar at the bottom showing 'Record: 1 of 1' with navigation icons.

Numbered callouts provide the following instructions:

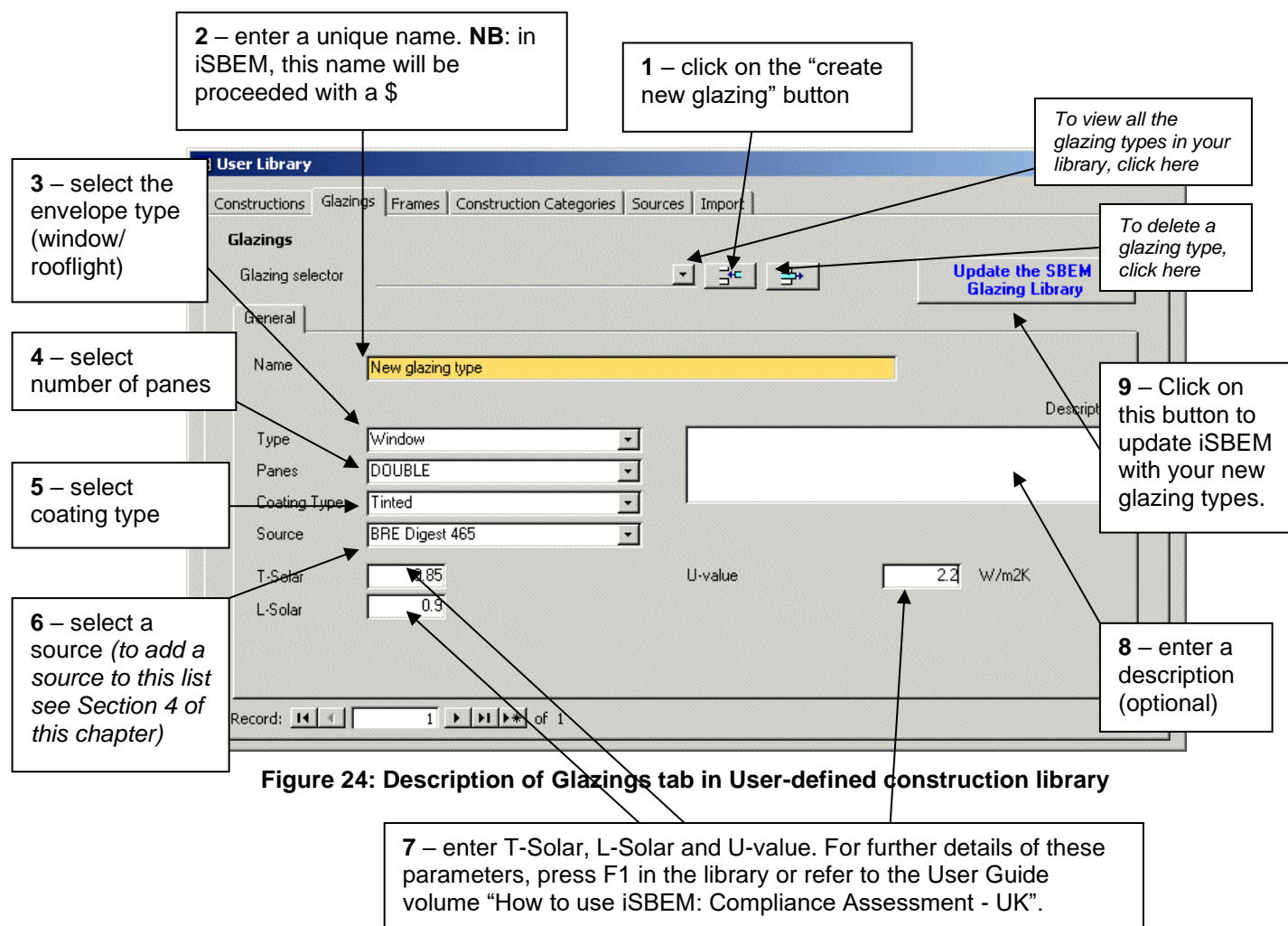
- 1 – click on the “create new construction” button
- 2 – enter a unique name. **NB:** in iSBEM, this name will be proceeded with a \$
- 3 – select the envelope type (wall/roof/floor/door)
- 4 – select the category under which you want this to appear in iSBEM (to add a category, see Section 5 of this chapter)
- 5 – select a source (to add a source to this list see Section 4 of this chapter)
- 6 – enter K_m value, U-value, and tick if construction contains metal cladding. For further details on these parameters, press F1 in the library or refer to the User Guide volume “How to use iSBEM: Compliance Assessment - UK”.
- 7 – enter a description (optional)
- 8- Click on this button to update iSBEM with your new construction.

Figure 23: Description of Constructions tab in User-defined construction library

A construction created in this way will be accessible in iSBEM from the *Project Database* form. It will be located in the “Constructions for X” tab, where X is the type of envelope as selected in the envelope type field (stage 3) and under the category as selected in the category field (stage 4). The construction will be called $\$Construction\ Name$, where *Construction Name* is the name entered in the name field.

2. How to add a glazing type to your library – and add this to iSBEM

Adding a new glazing type to the glazing Library and updating iSBEM with this information is done in the same way as for constructions but in the *Glazing* form. For glazing, in addition to requiring a unique name, U-value, and source of the information, you are required to enter parameters which describe the solar and light transmission properties of the glazing. For details of any of the parameters, press F1, or see the User Guide volume “**How to use iSBEM: Compliance Assessment - UK**”.



A glazing type created in this way will be accessible in iSBEM in the *Project Database* form > *Glazing* tab. It will be accessible when the “import one from the library” radio button is selected, from the glazing library. The glazing type will be called \$Glazing Name, where *Glazing Name* is the name entered in the name field.

3. How to add a frame type to your library – and add this to iSBEM

As with the glazing, you can add a frame to your frames library in the same way that you add a construction to the constructions library but in the *Frames* form. The only parameters required to define a frame is the type (PVC, hardwood, softwood, steel, etc.) and the U-value. You are able to enter a description as with the constructions and glazing libraries.

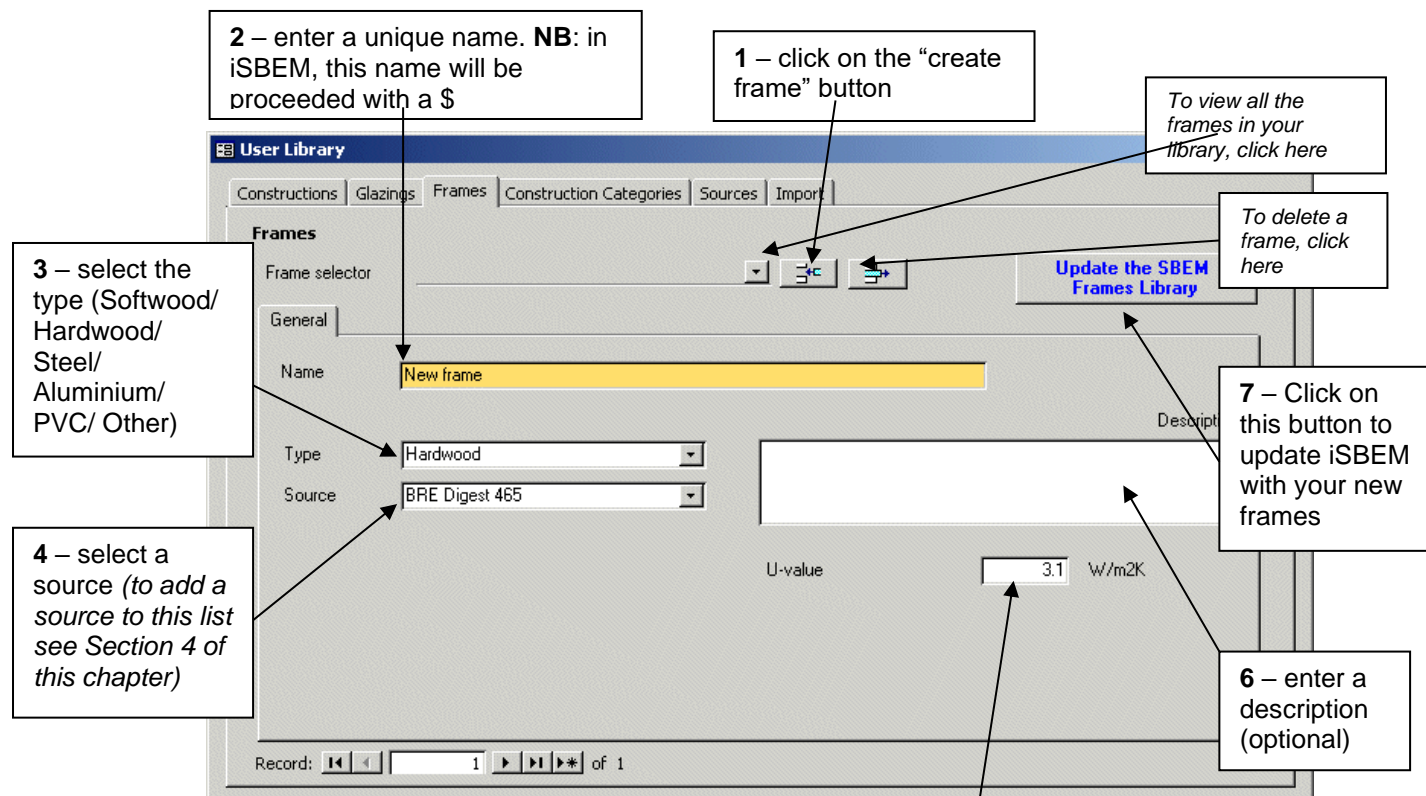


Figure 25: Description of Frames tab in User-defined construction library

A frame type created in this way will be accessible in iSBEM in the *Project Database* form > *Glazing* tab. It will be accessible when the “import one from the library” radio button is selected, from the frame library. The frame type will be called \$Frame Name, where *Frame Name* is the name entered in the name field.

4. How to edit the list of opaque constructions categories and the list of Sources

- **Editing the list of categories for opaque constructions**

As described in Section 1, when creating a new construction type for your library, you need to select a category under which your construction will appear in iSBEM. If none of the pre-defined categories are appropriate, you can add a new one to the library in the *Category* form. To do this, enter the *Category* form, click on the “create new category” button, add a unique name in the name field, select an envelope type, and if you want, add a description. This category will now appear in the “Category” field in the *Constructions* form.

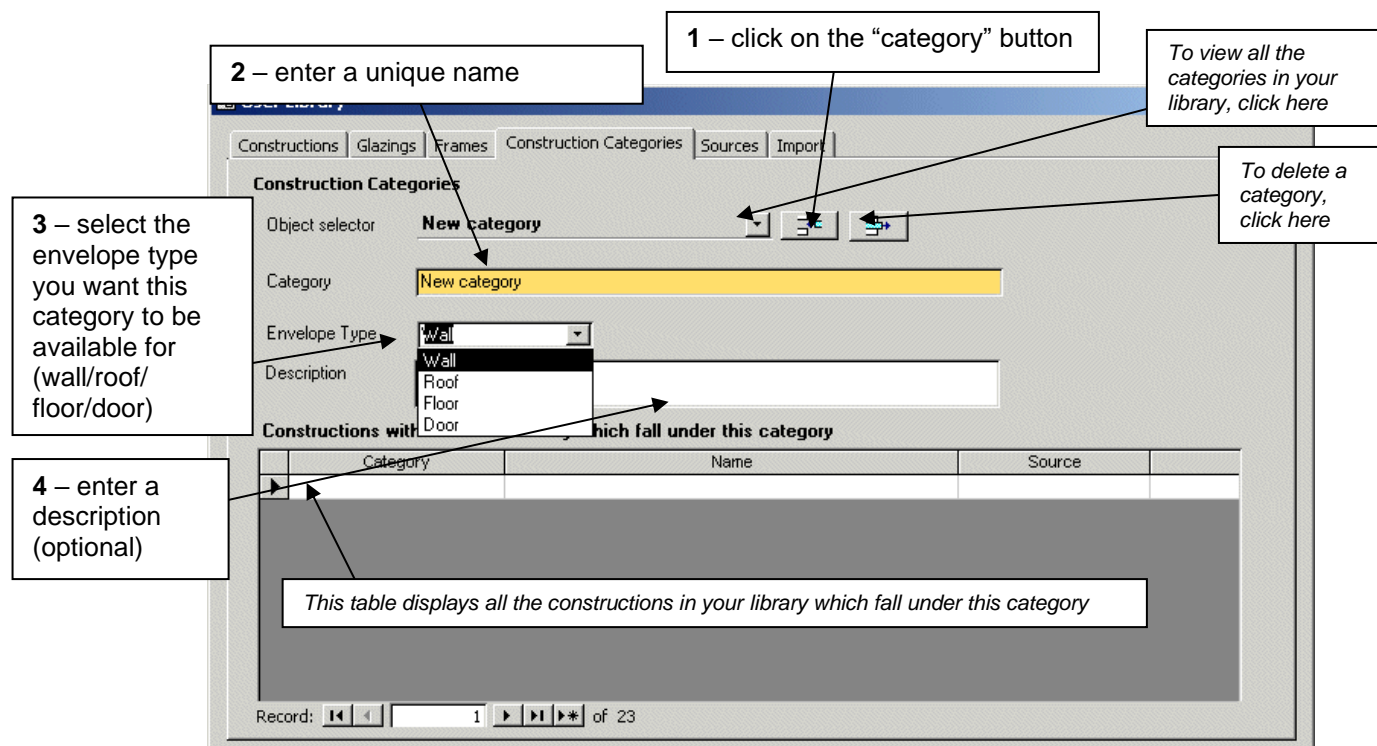


Figure 26: Description of Construction Categories tab in User-defined construction library

- **Editing the list of sources which you can select when defining opaque constructions, glazing types, or frame types**

The list is viewable and editable in the *Sources* form. To add a new source, click on the “enter new source” button and write the name of the source in the source field. This source will now be available for selection in the *Construction*, *Glazing*, and *Frames* form.

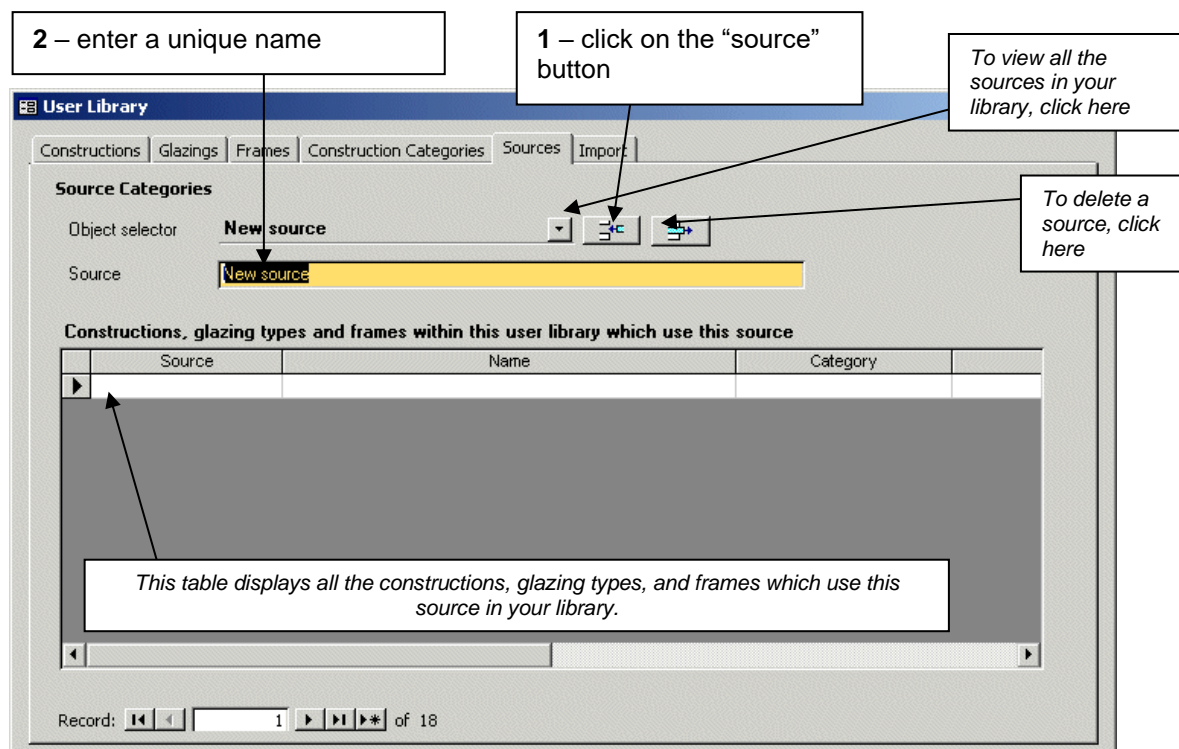


Figure 27: Description of Sources tab in User-defined construction library

5. How to import constructions previously entered into an iSBEM project or in another User Library into your own User Library

You may wish to import constructions from an existing User Database into your own, for example, from a colleague's User Database. This can be done in the *Import* form. Similarly, In iSBEM, there is already a library of constructions which you can choose from in the *Project Database* form. If you wanted to edit any of these, you could import these into your User Library. This is done by selecting the mdb (User Database) file or nct (iSBEM file) and clicking on the appropriate import button as shown in Figure 28.

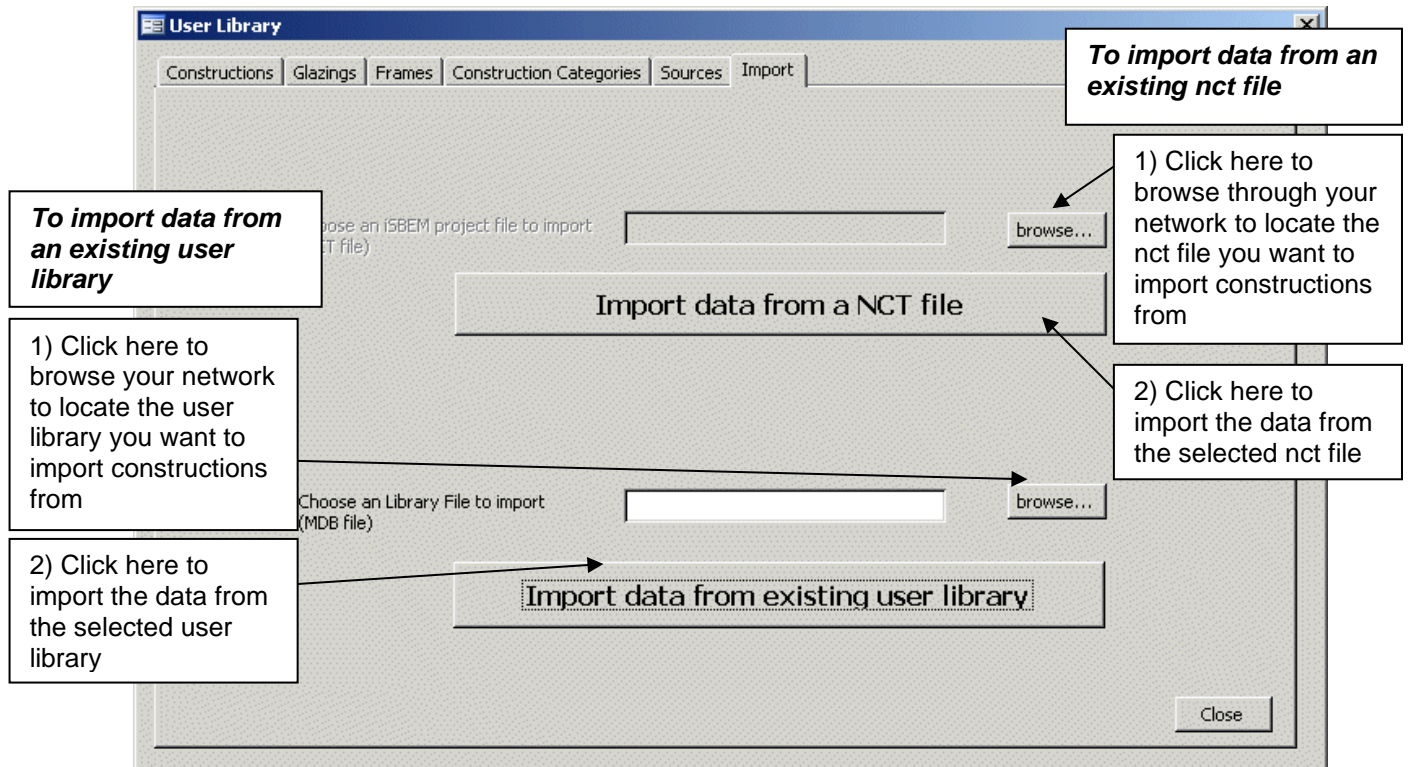


Figure 28: Description of Import tab in User-defined construction library

Once this procedure is successfully completed, these records will be available for editing within the User Library tool and should also be automatically available for use within iSBEM without any further updates needing to be carried out.

NB: All user-updated constructions, glazings, and frames from the User Library (including those that have been imported) will have the prefix "\$ " added to them (unless it already exists, in which case an additional \$ will NOT be added).

NB: Should a construction/glazing/frame of the same name as an existing construction/glazing/frame be imported into the User Library, a number will be appended to the end of it, according to the number of records in the User Library with a similar name, i.e., a record with name *Name* will have its name changed to *Name.1*, *Name.2*, *Name.3*, etc. depending on whether there are already 1, 2, 3, etc. records in the database already with a similar name (excluding the suffix).

NB: Frames cannot be imported from NCT files due to the nature of their table layouts. Only constructions and glazings can be imported by this procedure.

APPENDIX A: Matrix of activity areas and building types

Activity Type / Building Type	A1/A2 Retail and Financial/Professional services	A3/A4/A5 Restaurant and Cafes/Drinking Establishments and Hot Food 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	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 plus Night Clubs and Theatres	Others - Passenger terminals	Others - Emergency services	Others - Miscellaneous 24hr activities	Others - Car Parks 24 hrs	Others - Stand alone utility block
24 hrs Consulting/treatment areas							X															
24x7 Bedroom Unit							X															
24x7 Circulation area (corridors and stairways)																				X		
24x7 Generic Office Area					X															X		
24x7 Reception																				X		
24x7 Toilet																				X		
24x7 Warehouse storage					X																	
Assembly areas / halls						X	X															
Auditoria																	X					
Bathroom						X	X	X	X	X									X			
Bedroom								X	X										X			
Bedroom Only						X																
Bedroom Unit							X															
Car Park	X		X																		X	
Cell (police/prison)										X					X				X			
Changing facilities with showers			X		X	X	X	X	X	X		X		X			X		X			X
Circulation area (corridors and stairways)			X	X	X	X		X	X	X		X		X	X	X			X		X	
Circulation area (corridors and stairways) - non public	X	X											X				X	X				
Circulation area (corridors and stairways) - non-public/restrict							X															
Classroom							X		X	X												
Common circulation areas											X											
Computer lab								X	X					X								
Data Centre																					X	
Dept Store Sales area - chilled	X																					
Dept Store Sales area - electrical	X																					
Dept Store Sales	X																					

area - general																						
Diagnostic Imaging							X															
Display and Public areas													X									
Display window	X																					
Domestic Bathroom																						
Domestic Bedroom																						
Domestic Circulation																						
Domestic Dining room																						
Domestic Kitchen																						
Domestic Lounge																						
Domestic Toilet																						
Dry sports hall							X		X	X	X		X		X		X		X			
Eating/drinking area	X	X	X	X	X	X	X	X	X	X		X	X	X		X	X	X	X			
En suite bedroom							X															
Fitness Studio																	X					
Fitness suite/gym			X			X			X	X							X		X			
Food preparation area	X	X	X	X	X	X	X	X	X	X		X	X	X		X	X	X	X			
Generic Checkin areas																		X				
Generic Office Area	X	X	X	X	X	X							X			X	X	X	X		X	
Generic Ward							X															
Hall/lecture theatre/assembly area								X	X	X		X	X	X		X	X					
Heavy Plant Room																				X		
Hydrotherapy pool hall							X															
Ice rink																	X					
Industrial process area				X			X															
Laboratory				X			X	X	X				X	X								
Laundry	X					X	X	X	X	X							X					
Light plant room	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X		X	
Lounges																		X				
Office and consulting areas							X	X	X	X		X		X	X							
Operating theatre							X															
Performance area (stage)		X															X					
Physiotherapy Studio							X															
Post Mortem Facility							X															
Public circulation areas							X										X					
Reception			X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X			
Residents common rooms								X	X													
Residents kitchen									X													
Retail Warehouse Sales area - chilled	X																					
Retail Warehouse Sales area - electrical	X																					
Retail Warehouse Sales area - general	X																					
Sales area - general																	X					
Server Room																				X		
Small Shop Unit Sales area - chilled	X																					
Small Shop Unit Sales area - electrical	X																					
Small Shop Unit Sales area - general	X																					

Store Room	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X			
Swimming pool					X		X	X					X			X					
Teaching Areas							X						X								
Toilet	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X		X
Waiting Rooms																	X				
Warehouse storage				X	X																
Workshop - small scale			X				X	X	X		X	X	X			X					