BuildDesk U 3.4

Manual

June 2010

Contents

1 Foreword 4
1.1 BuildDesk U 3.4 4
1.2 Help functions 4
1.2.1 Quickstart in 8 steps 4
1.2.2 BuildDesk Helpdesk 5
2 Introduction 6
2.1 Short description of BuildDesk U 3.4 6
2.2 System requirements 7
2.3 Installing BuildDesk U 3.4 8
3 Understanding and using BuildDesk U 3.$ 9
3.1 Starting BuildDesk U 3.4 9
3.2 The start menu 10
3.3 The main menu 13
3.3.1 The status bar 13
3.3.2 The menu bar 13
3.3.3 The symbol bar 15
3.4 The construction entry window 15
3.5 The catalogue windows 17
3.5.1 Browsing predefined building materials 18
3.5.2 Quality levels of materials 23
3.5.3 Browsing predefined constructions 27
3.5.4 Catalogue highlighting 28
4 Data entry 29
4.1 Table of demanded U-values 29
4.2 Assignment of construction elements 30
4.2.1 Change the default values of Rse/Rsi 33
4.2.2 Boundary conditions adjacent to unheated spaces 33
4.2.3 Change boundary conditions for other elements 37
4.3 Constructions with predefined materials 38
4.3.1 Adding a homogenous layer 38
4.3.2 Buttons and Context Menu 42
4.3.3 Inserting wall ties or fixings and air gaps 45
4.3.4 Inserting inhomogeneous layers 46
4.3.5 Inserting Light steel-frame layer 51
4.3.6 Optimise layer thickness 52
4.3.7 Direct input of U-value 54
4.3.8 Masonry and mortar dialogue 55
4.3.9 Duplicate layer 58
4.3.10 Tapered Layer 58
4.3.11 Rainscreen cladding correction 61
4.4 Constructions with predefined components 64

4.5 Creation of components with own building materials 69
4.6 Entering own building materials 69
4.6.1 Create, delete and rename groups 70
4.6.2 Create, remove and edit building materials 72
4.6.3 Physical properties and sources 74
4.6.4 Patterns 74
4.6.5 Dimensions 75
4.6.6 Information, links, illustrations 76
4.6.7 Material properties 79
4.7 Managing materials and constructions. 82
4.8 Managing catalogues 82
5 Thermal transmittance & condensation risk analysis 88
5.1 Calculation of thermal transmittance (U-value) 88
5.2 Condensation risk analysis 90
5.2.1 Entering climate data 91
5.2.2 Results on the screen 94
5.3 Heat Capacity (Kappa value κ) 97
6 Documentation of results 99
6.1 Saving components 99
6.2 Printing components 100
6.3 Data exchange with BuildDesk Energy Design 3.4 102

1 Foreword

1.1 BuildDesk U 3.4

This Manual for BuildDesk U 3.4 contains explanations of all the available functions of this program.

The structure of this manual follows the process of building up components and its documentation.

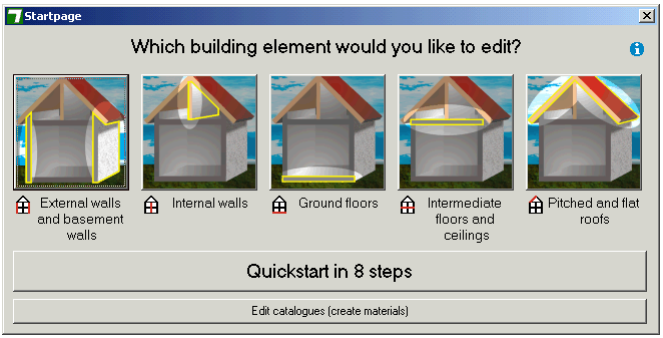
1.2 Help functions

Beside this manual there are two other help features available:

- Quick introduction in 8 steps (see chapter 1.2.1)
- BuildDesk Helpdesk (see chapter 1.2.2)

1.2.1 Quickstart in 8 steps

The "Quickstart in 8 steps" is offered to you whenever you start the program. It contains a quick explanation of the main program functions, starting with "from building up a component" across the themes "finding and selecting building materials" to the "changing of components". The quick introduction was developed to give the user an understanding of the basics of the program in just a few minutes.



You can also access another quick introduction from the start screen:
<Edit catalogues (create materials)> This instruction explains how to enter building materials into the "Own Catalogue".

Many of the detailed BuildDesk U 3.4 functions are only explained in this manual.

1.2.2 BuildDesk Helpdesk

Contact BuildDesk: (01656) 869940

Call this number if you have problems installing or using the software, or if you have any general queries.

Our office hours are:
Mon. – Thu: 9:00-17:00
Fri.: 9:00-16:00

Further information is available from our website at www.builddesk.co.uk or by email at info@builddesk.co.uk.

2 Introduction

2.1 Short description of BuildDesk U 3.4

BuildDesk U 3.4 is Software developed by BuildDesk Ltd in the United Kingdom.

The program consists of catalogues for building materials and building constructions plus a construction entry dialog for the graphical depiction and calculation of U-values.

You can calculate the U – value and the surface temperatures for the following components:

- External walls adjacent to outside air
- External walls adjacent to ground
- Internal walls
- Ground floors in contact with the ground
- Suspended ground floors
- Intermediate floors & ceilings above outside air (exposed)
- Intermediate floors & ceilings between two heated spaces
- Intermediate floors with downward heat flow
- Intermediate floors & ceilings with upward heat flow
- Pitched roofs with incline > 70° e.g. mansard roofs
- Pitched roofs with incline ≤ 70° & flat roofs
- Flat roofs

All components are graphically displayed both in 2-dimensional sections with textures and as a 3-dimensional view with realistic textures.

The material layers of the building construction can be homogeneous (unbridged) or inhomogeneous (bridged) with timber or metal studs, battens or rafters, and mortar joints.

The printouts contain a 3-dimensional representation of the construction, a listing of the material layers and the calculation of the thermal transmittance U value and the condensation risk analysis.

The catalogues are divided into two categories:

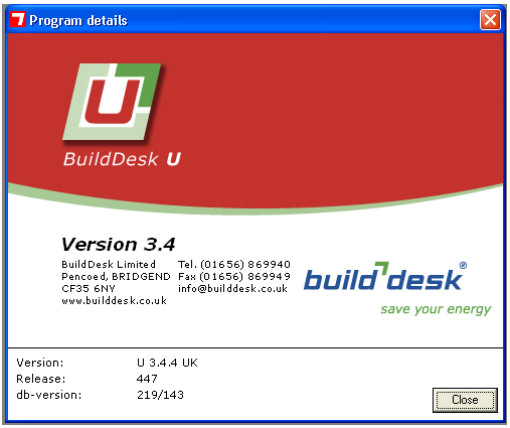
- Catalogues of building materials
- Catalogues of constructions

In the building material catalogues you can find generic building materials with physical properties from standards and building materials from well-known manufacturers.

Of course you can also insert your own building materials and so expand the volume of materials available by building up your own user catalogue.

Every catalogue is structured clearly and supplied with physical properties of the building materials e.g. thermal conductivity, density, its dimensions and other detailed information (data sheets, producer's contact information etc.).

In the component catalogues you can find standardized generic building components, separated into their areas of application as well as your own User Catalogue which can contain your favourite constructions.



2.2 System requirements

BuildDesk U 3.4 is developed for the following operating systems:

- Windows Millennium Edition
- Windows NT 4.0 (Service Pack 5 or higher)
- Windows 2000
- Windows XP
- Windows Vista
- Windows 7

Minimum requirements to the hardware are:

- 128 MB RAM
- 200 MB free hard disc
- CD-ROM drive
- Display 1024x768, 16-bit (65536 colours)
- Graphics printer

Additionally requirements are:

- Microsoft Internet Explorer 5.0 or higher
- Adobe Acrobat Reader 4.0 or higher
- A BuildDesk U 3.3 patch, for users who work with the operating system Windows NT 4.0 and do not have installed Microsoft Office.

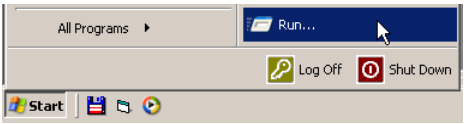
A further recommendation is:

- An Internet connection

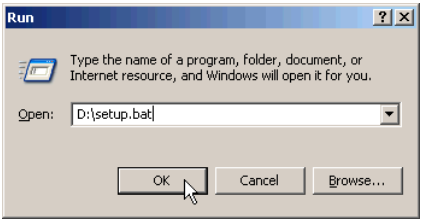
2.3 Installing BuildDesk U 3.4

Place the CD-ROM into the CD drive. The installation routine will start automatically.
If the program does not start automatically, please follow the instructions below:

In the menu <*Start*> click <*Run*>.



Enter for the CD drive (e.g. D) following path: "D\:setup.bat" and click on <*Ok*>.



Follow the instructions of the starting installation program.
As soon as the installation is finished, the computer may need to be restarted.

3 Understanding and using BuildDesk U 3.$

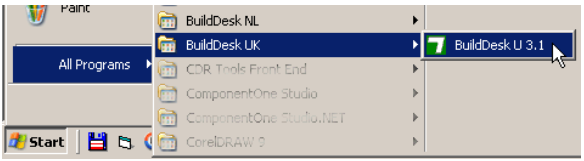
This chapter is a short introduction to the user interface and basic functions of the program.

3.1 Starting BuildDesk U 3.4

There are two ways to start BuildDesk U 3.4:

- Shortcut on the desktop

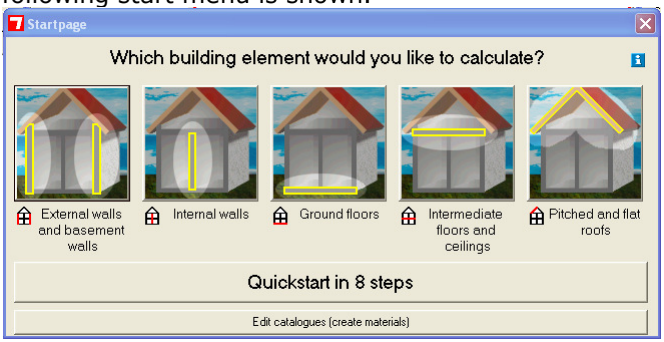
Start-Button/All Programs/BuildDesk UK/BuildDesk U 3.4



During the start process all the necessary catalogues are loaded. This process takes a few moments of computing time, the exact length of time depending on the size of your catalogues and the speed of your computer.

3.2 The start menu

After BuildDesk U 3.4 is started and the catalogues are loaded the following start menu is shown.



choose an option by clicking the button:

Create a new external wall element

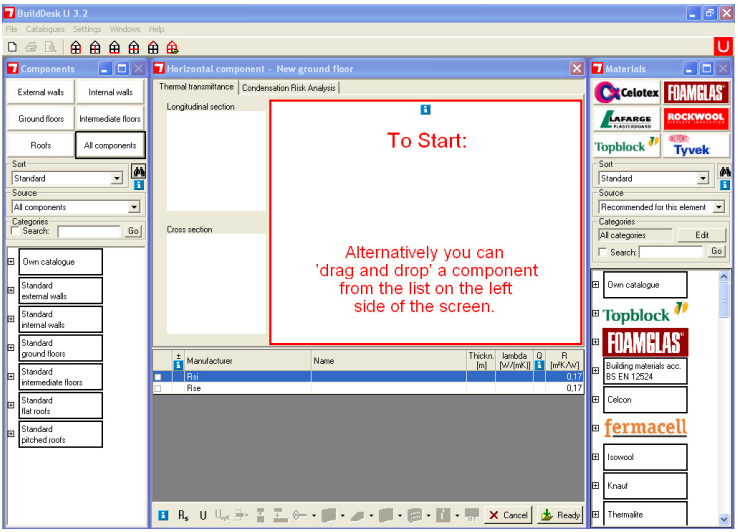
Create a new internal wall element

Create a new ground floor element

Create a new intermediate floor or ceiling element

Create a new pitched of flat roof element

By clicking on one of the above buttons, you will leave the start menu and an empty window for the selected element is opened as well as the catalogues for the constructions and the materials.



Depending on the power of your computer, this process may take some seconds.

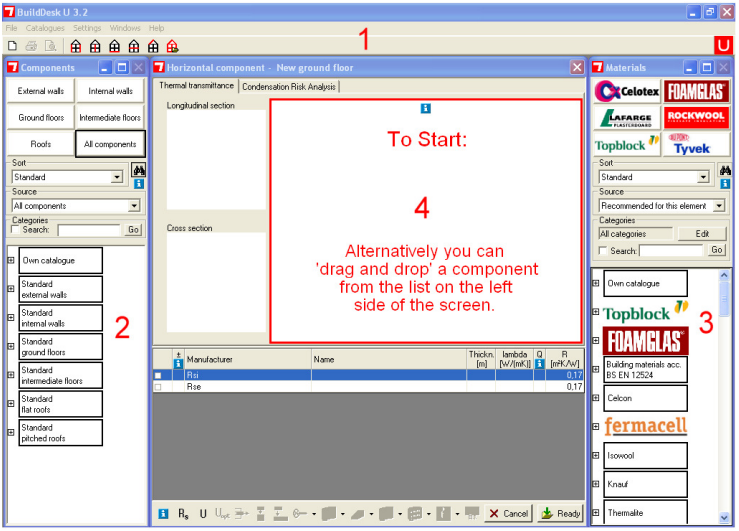
The other options of the start menu are:

By clicking the button <*quick intro in 8 steps*> a short description of the most important functions is shown.

By clicking the button <*entering of components (editing of catalogues)*> a short description for the entering of constructions is shown.

You can also find these description by entering the helpfunctionality in the top of the screen.

The user interface is divided into four sections:



1 ... The main menu
2 ... The component catalogues
3 ... The material catalogues
4 ... The constructions entry window or
the building material creation window.

The sections 1, 2 and 3 are always the same.
The section 4 is variable depending on the component- or material creation process.

Section 1 is the main menu
The commands of the main menu are explained in chapter 3.3.

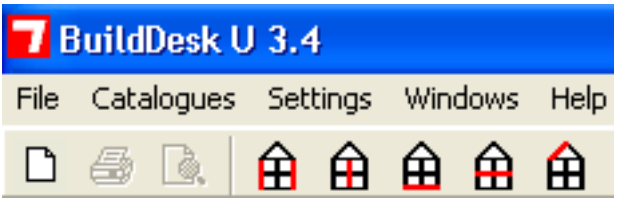
In **section 2** you see the component catalogues, in **section 3** are the building material catalogues. The functions of these catalogues are explained in chapter 3.5.

Section 4 contains the window for construction element creation which is explained in chapter 3.4.
When creating a new material, this window is the "building material creation window" which is explained in chapter 4.6.

3.3 The main menu

The main menu in the section 1 consists of three bars:

- Status bar
- Menu bar
- Symbol bar



3.3.1 The status bar

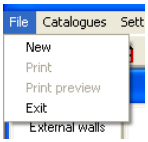
The status bar shows the program symbol and the program title with the version number.

3.3.2 The menu bar

The menu bar consists of the menus:

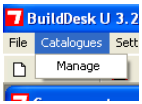
- *<File>*
- *<Catalogues>*
- *<Settings>*
- *<Window>*
- *<Help>*

Menu *<File>*



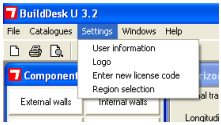
<New> opens a new window for the construction entry
<Print> prints the active construction (See chapter 6.2).
<Exit> quits BuildDesk U 3.3

Menu *<Catalogues>*



<Manage> opens a dialogue window to manage the catalogues (See chapter 4.8).

Menu <*Settings*>



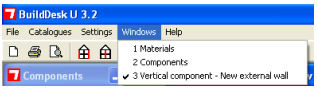
<*User information*> opens a dialogue window to enter user information for the printout (See chapter 6.2).

<*Logo*> opens a dialogue window to enter a logo for the printout (See chapter 6.2).

<*Enter new license code*> opens a dialogue window to enter a new license code

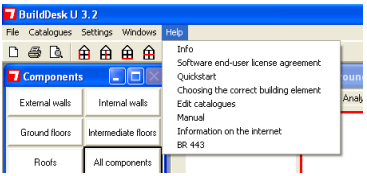
<*Region selection*> opens a dialogue window to select the required region of the British Isles or the Republic of Ireland which sets the source of required U-values used in the program (See chapter 4.1 Table of demanded U-values).

Menu <*Window*>



Every menu item in the menu <*Window*> is for an open window on the screen. The windows <*1 Components*> and <*2 Materials*> are always open and can not be closed. Beside these two menu items you will see the entries for all other open windows listed.

Menu <*Help*>



<*Info*> opens an info window which shows the programs version number as well as the version number of the database.

<*Software end-user license agreement*> opens the license agreement which exists as .pdf file. To read this manual you will need Adobe Acrobat Reader 6.0 or higher.

<*Quickstart*> opens the Quickstart a quick introduction in 8 steps

<*Choosing the correct building element*> opens advice on how to choose the correct building element.

<*Edit catalogues*> opens advice on how to enter your own – user defined - building materials.

<*Manual*> opens the manual which exists as a .pdf file. To read

this manual you will need Adobe Acrobat Reader 6.0 or higher.

<*Information on the internet*> opens the home webpage of BuildDesk UK http://www.builddesk.co.uk

3.3.3 The symbol bar

The symbol bar contains the symbol for printing out the active construction and symbols for entering new constructions. The meaning of these Symbols is:

Enter a new external wall

Enter a new internal wall

Enter a new ground floor

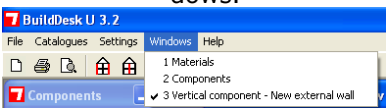
Enter a new intermediate floor or ceiling

Enter a new Pitched or flat roof

3.4 The construction entry window

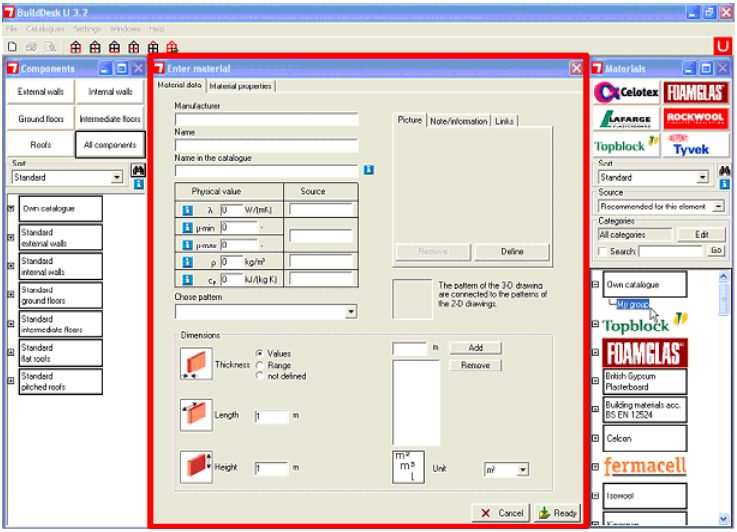
The construction entry window appears when a new construction is accessed.

Attention: If a construction has already been opened and a further construction is opened as well, the new construction entry window lays overlays the old window. The rear window is then invisible. In the menu <*Window*> you can switch between both these windows.



The procedure for entering new materials (or editing existing materials) in the building material catalogue, is explained in section 4 (chapter 4.6).

The material entry window:



3.5 The catalogue windows

On the left side of the construction entry window you see the catalogues of constructions. On the right side are the building material catalogues.

Both catalogues operate in similar fashion. They contain 2 types of catalogue files:

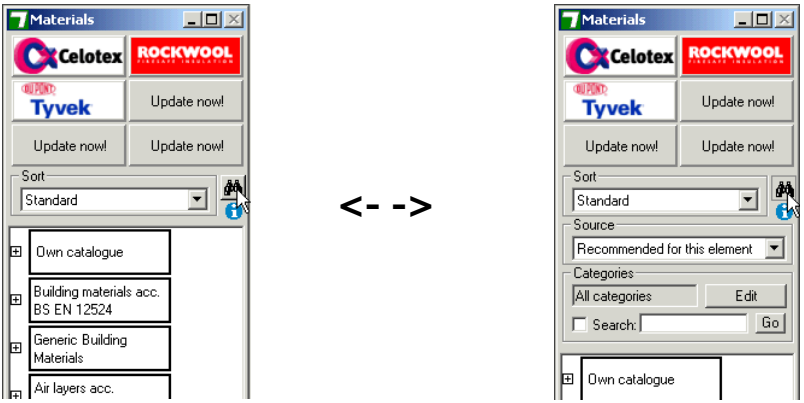
- Non editable catalogues with manufacturers or generic data
- Editable catalogues with user defined data

Note: Catalogues with data of standardized products are treated the same as catalogues with manufacturer data and are not editable.

Two important modes of operation result from this non editable protection mechanism:

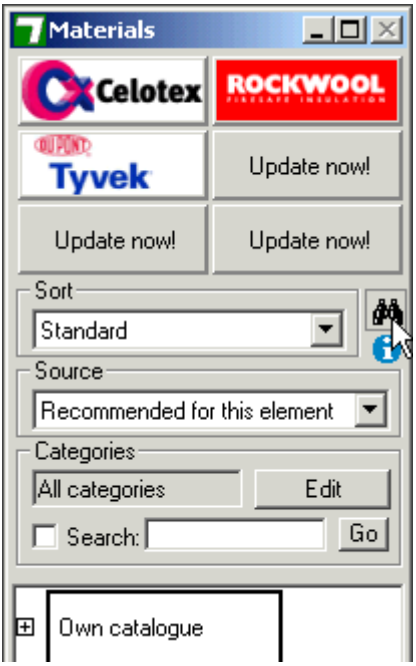
1. If constructions in a protected catalogue are opened by double click, they are not protected and editable. If they are changed and closed, BuildDesk U 3.3 will save this amended construction in a user catalogue.
2. If building materials of a protected catalogue (e.g. BS EN 12524) are opened with a double click, they are free to edit. When the entry window is closed, BuildDesk U 3.3 saves the amended building material in a user catalogue.

To see the material catalogue window like it is shown on the next page, click on the icon. The window changes its features and includes search and filter functions like those shown here:



3.5.1 Browsing predefined building materials

The section of the building materials is structured as follows:



Links to six selected A-Brand catalogues.

Sort function

Source sort function

Filter function
Search function

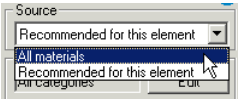
Material Catalogues

When one of the 6 A-Brand links is clicked, BuildDesk U 3.3 jumps automatically to the same catalogue in the lower area and opens it to the next level (group of building materials).

The Source Function is pre selected to „recommended for this construction". This means that only those building materials are shown which are recommended for this type of construction.

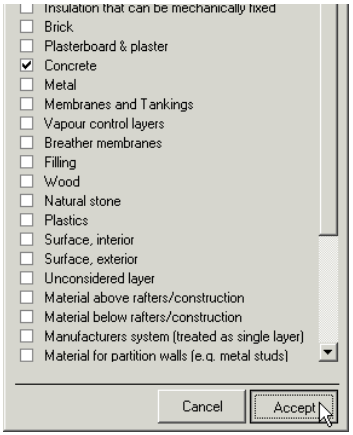
If you choose instead of

<recommended for this construction>
the setting
<All materials>

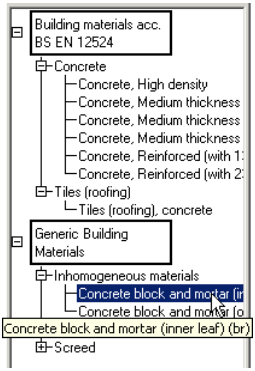


the number of building materials available increases. This is because all materials, whether recommended for this construction or not, are now shown.

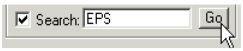
The filter function offers the ability to restrict the number of the building materials to only those which fulfil your chosen criteria.



-->

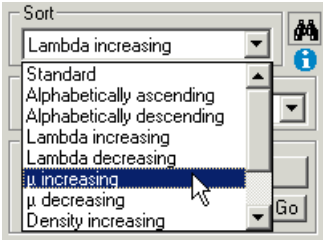


The search function offers the ability to search by keywords found in the building material descriptions.



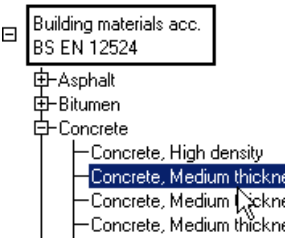
The sort function enables the sorting of the building materials according to the following criteria:

- Standard (by Categories)
- Alphabetically ascending
- Alphabetically descending
- Lambda value increasing
- Lambda value decreasing
- µ-Value increasing
- µ-Value decreasing
- Density increasing
- Density decreasing
- Specific heat capacity increasing
- Specific heat capacity decreasing



It is also possible to select a combination between source-, filter-, and search function.

The catalogues are arranged in 3 levels.



Level 1:
Catalogue title

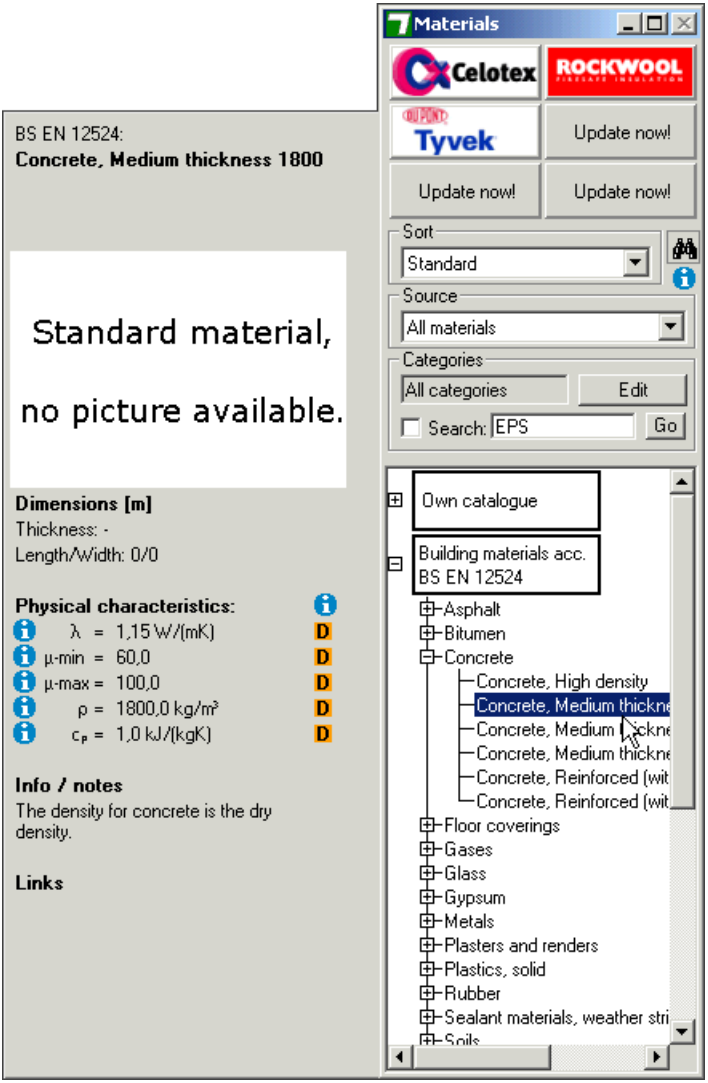
Level 2:
Group of building material

Level 3:
Building material

Click on the icon ⊞ to open a further level of the catalogue.
To close a level in a catalogue, click in the icon ⊟.

When a building material is selected with the mouse pointer, the information window for this building material is shown after a one second delay.

Example of an opened information window:



On the information window, which pops up automatically, you can find the following information:

Manufacturer

Product description

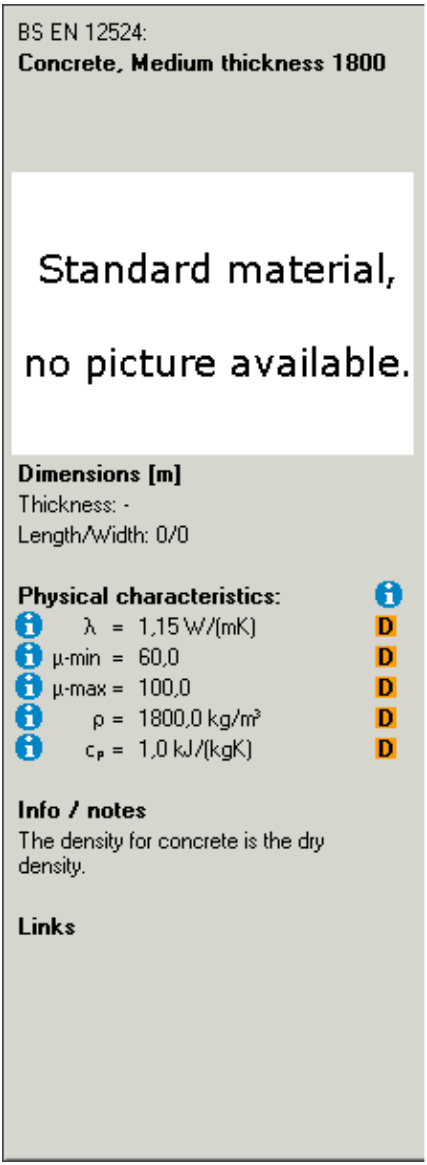
Product illustration

Dimensions in metres:
Thickness (es)
With / Length

Physical characteristics
Thermal conductivity
Vapour diffusion resistance
Density by volume
Thermal capacity

Information text or information files

Address, email or links to web pages



By clicking on the icon, further information for the physical value is shown.

3.5.2 Quality levels of materials

Quality levels are shown in the information window under the physical characteristics with coloured icons on the right side.

Quality levels are used for following physical values of a material:

- Lambda
- μ
- Density
- Thermal capacity

For each of these values a quality level is defined:

Quality level A **Continuous control**
Data is entered and validated by the manufacturer or supplier. Data is under continuous 3rd party testing e.g. Keymark products require additional 3rd party voluntary testing above that required by CE marking.

Quality level B **3 party control**
Data is entered and validated by the manufacturer or supplier. Data is also certified by 3rd party e.g. CE marking.

Quality level C **Approved by manufacturer**
Data is entered and validated by the manufacturer or supplier.

Quality level D **Entered by BuildDesk**
Information is entered by BuildDesk without special agreement with the manufacturer, supplier or others.

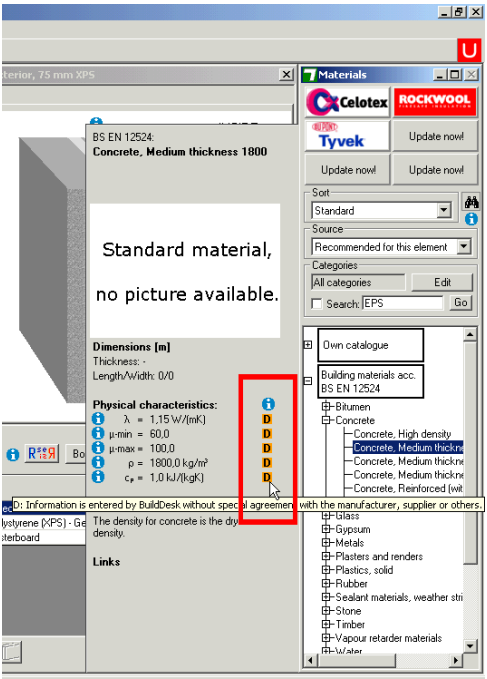
Quality level E **Own material entry**
Information is entered by the user of the BuildDesk software without special agreement with the manufacturer, supplier or others.

Quality level unknown **Quality level of material is undefined**
Own material entry
No information about the quality is available. Materials of quality level unknown indicate that someone has omitted to define the quality level for these materials.

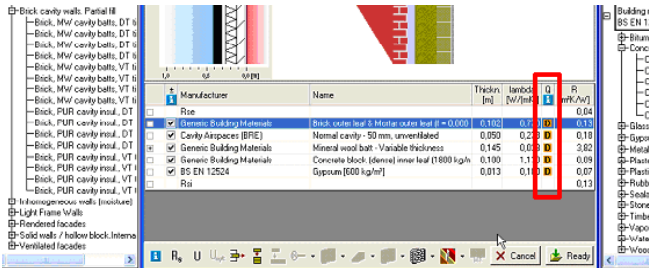
The user is able to copy materials of all quality levels. Whenever a material is copied the quality levels of all four physical values will automatically be changed to quality level E, the user will then be able to fully edit the material and properties..

The coloured icons showing the quality level (A, B, C, D & E) are present at the following places:

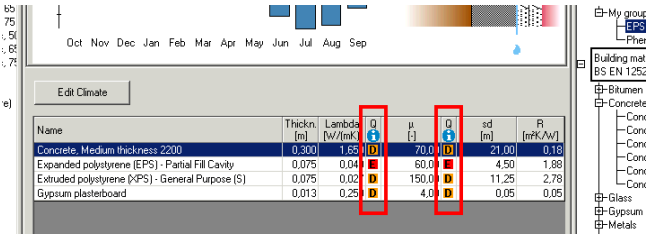
- **Info-page of materials:** For the four physical values (lambda, µ, density, thermal capacity) the quality level will be displayed to the right of the physical value.



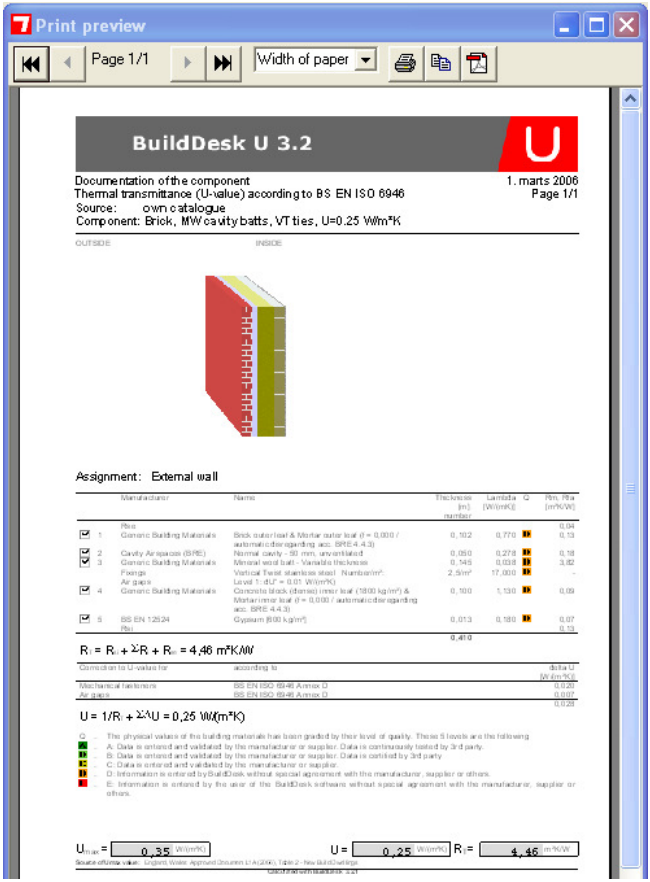
- **U-table:** The quality level of the lambda-value is displayed to the right of the lambda-value.



- **Moisture-table:** The quality level of the µ-value is displayed to the right of the µ-value.



- **Printout documentation** (layers of construction)**:** The quality level of the lambda-value will be displayed to the right of the lambda-value. On the printout documentation a footnote for the column "Q" and a legend explaining the 5 quality levels will be placed at the end of relevant tables.



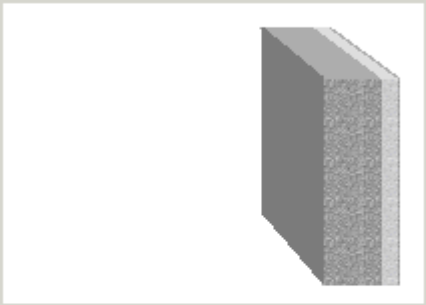
Info-buttons for the explanation of the quality levels are placed on the info-page and on the U-table.

3.5.3 Browsing predefined constructions

Construction catalogues in section 2 of the screen are structured in the same way as the building material catalogues in section 3. The differences are only in the content of the catalogues.

Instead of single building materials, the component catalogues always contain a set of building material layers (a construction).

When clicking a construction an information window pops up which contains the following information.

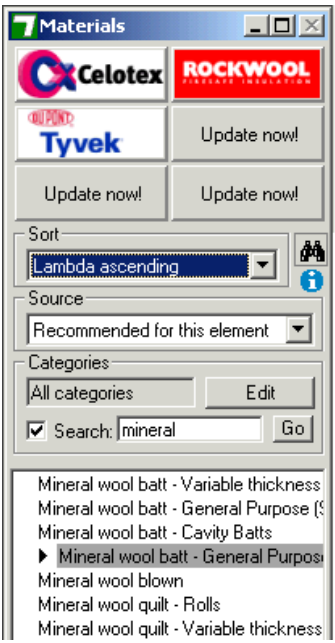
Catalogue title	STANDARD EXTERNAL WALLS:
Construction description	**300 mm cast concrete exterior, 75 mm XPS**
Drawing of the construction	
Component thickness in metres	Thickness: 0,388 m
U-Value	U-value: 0,18 W/(m²K)
R-Value	R-value: 3,01 m²K/W
Construction type	Type of component: Basement wall
Information text or information files	**Info / notes**
Links to web pages	**Links**

3.5.4 Catalogue highlighting.

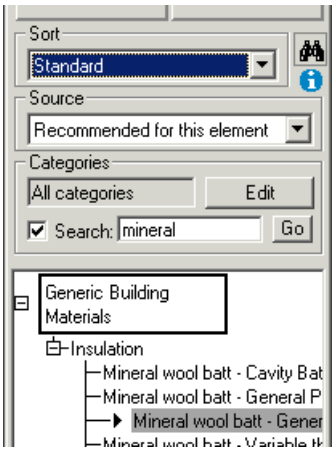
To provide faster viewing of the catalogues for favourite constructions and building materials, there is a simple highlighting function present.

Example:
Search the building material catalogues for a mineral wool with a certain Lambda-value:

Type the word "mineral" in the search field, click on the <*Go*> button and sort the search output by increasing Lambda value.
As you identify your required building material, set a highlight by clicking building material using the right mouse button.
The building material will be indented, coloured grey blue and tagged with an arrow.



<-->



When you then sort e.g. by catalogues (standard), it is easy to find the building material with the highlighting:

In the same way you can use the highlighting function for the construction catalogue.

4 Data entry

Construction elements consist of layers, which are divided into

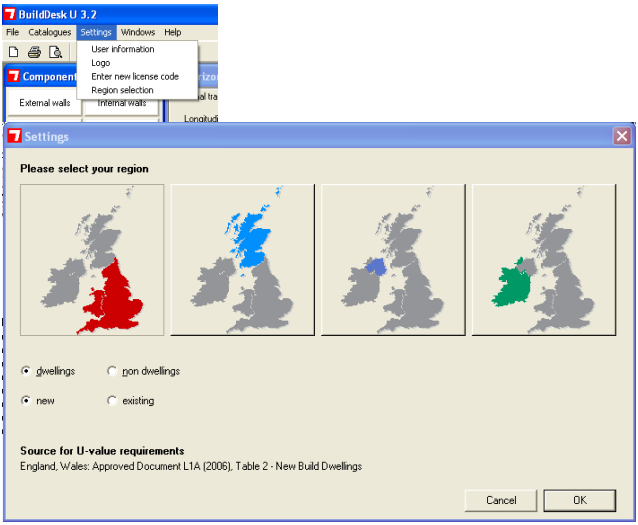
- homogeneous (non bridged) layers,
- inhomogeneous (bridged) layers and
- light steel-frame layers.

A homogeneous layer consists of only one material, a inhomogeneous layer consists of two materials with their relative percentages by area. Light steel-frame layers allows the user to consider typical steel-framed construction elements.

The second way of distinguishing construction elements is by their assignment (e.g. External walls can be either exposed or semi exposed walls etc.).

4.1 Table of demanded U-values

In order to compare calculated U-values with the maximum permissible values, you must choose the correct region of the British Isles for the project and select the correct type of building from the options available.
Please go to the menu bar (see chapter 3.3.2), select the menu *<Settings>* and click on *<Region selection>.*



Now the following screen appears.

Please select the correct region and the building type from the additional options.
The program will now pick the appropriate set of elemental U-values and uses them for the calculation.

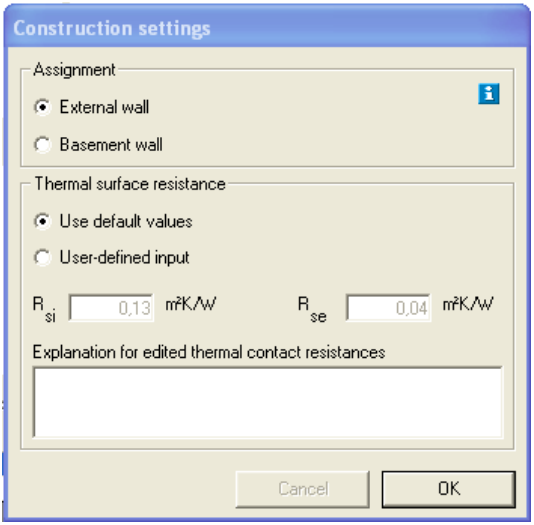
4.2 Assignment of construction elements

This section explains the different kinds of construction elements and their assignment. In general, we distinguish between

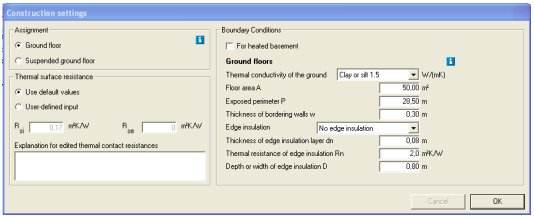
- External Walls (Shortcut EW) or exposed walls
- Internal Walls (Shortcut IW) or semi-exposed walls
- Floors (Shortcut FL), ground floors
- Intermediate floors & Ceilings (Shortcut IF), ceilings or floors between storeys
- Roofs (Shortcut RO)

The following table contains all construction elements and their possible assignments.

BuildDesk automatically asks the user what the construction is to be used for, and then defines the necessary default values for the surface resistances, the user can also input his own user defined values if required.
For example, let us define an external wall. By clicking on the external wall icon in the symbol bar the following popup window will automatically appear.



A further example, defining a ground floor.
First the user has to choose the correct assignment in the popup menu, define the thermal surface resistance and consider the boundary conditions.
Press OK and the programme takes all this into account.



Choose the option “Suspended ground floor”.

Sc.	Assignment	Option	Description
EW	External wall	(No)	Wall adjacent to outside air, heat flow horizontal
EW	Basement wall	(No)	Wall adjacent to ground, heat flow horizontal
IW	Internal wall	Adjacent to unheated space (semi exposed) = true	Internal wall adjacent to unheated space (semi exposed), heat flow horizontal
IW	Internal wall	Adjacent to unheated space (semi exposed) = false	Internal wall adjacent to heated space
FL	Ground floor	For heated basement = false	Ground bearing floor, heat flow downwards
FL	Ground floor	For heated basement = true	Basement floor heated space, heat flow down-wards
FL	Suspended ground floor	(No)	Suspended floor, heat flow downwards
IF	Intermediate floor – semi exposed, heat flow downwards	Above unheated basement = true	Intermediate floor above unheated basement, heat flow downwards
IF	Intermediate floor – semi exposed, heat flow downwards	Above unheated basement = false	Intermediate Floor above unheated space (semi exposed), heat flow downwards
IF	Intermediate floor/ceiling – semi exposed, heat flow upwards	Adjacent to loft space = false	Intermediate floor/ceiling to unheated space, heat flow upwards
IF	Intermediate floor/ceiling – semi exposed, heat flow upwards	Adjacent to loft space = true	Intermediate floor/ceiling below unheated loft space, heat flow upwards
IF	Floor – exposed	(No)	Floor above outside air (exposed), heat flow downwards
IF	Intermediate floor - internal	(No)	Intermediate floor, heated spaces above & below
RO	Roof with a pitch >= 70°	(No)	Roof with a pitch >= 70°
RO	Pitched roof < 70°	with insulation between rafters = selected	Pitched roof with insulation between rafters
RO	Pitched roof < 70°	with integral insula-tion =selected	Pitched roof with integral insulation
RO	Pitched roof < 70°	with insulation between joists = selected	Pitched roof with insulation between joists
RO	Flat roof (pitch <= 10°)	(No)	Flat roof (pitch <= 10°)

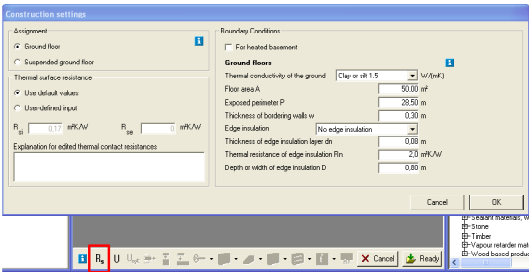
The different construction elements regard

- Calculation method (see chapter 5.1)
- Default thermal resistances (see chapter 5.1)
- U-value demands in the different regions (see chapter 4.1)

4.2.1 Change the default values of Rse/Rsi

The default values are based on the assignment of the construction and normative values provided in BS EN ISO 6946.
See chapter 5.1 to get detailed information about for the default values of the different construction elements.

Should you wish to override these default values; click the Rs icon in the lower part of the construction entry window and you can then enter your own values.



4.2.2 Boundary conditions adjacent to unheated spaces

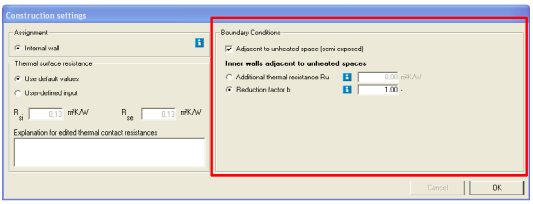
For certain types of construction elements additional information is required to determine the U-value.
These constructions are:

a) Internal walls and intermediate floors adjacent to unheated spaces. These boundary conditions are described in this chapter.
b) Basement walls, ground floors, floors of heated basements, Suspended floors, intermediate floors above unheated basements. This group is described in chapter 4.2.3 Change boundary conditions for other elements.

This first group (a) of boundary conditions concern the additional effect of an unheated space which is considered by adding a thermal resistance Ru or temperature reduction factor b.

BuildDesk automatically ask the user what boundary conditions shall be used when activating the icons mentioned under (a) and (b) For example, let us define an internal wall. By clicking the internal wall icon in the symbol bar this popup window will automatically appear.

The user now has the opportunity to uncheck the box "adjacent to unheated spaces (semi exposed)"



Tip: If the temperatures are known (or may be assumed), you can enter for b (reduction factor):

b = (Ti - Tu)/(Ti - Te),

where:

Ti...internal temperature [°C]
Tu...temperature of the bordering unheated space [°C]
Te...external temperature [°C]

The info button in the input dialogue leads to the following additional information.

A correction value has to be applied for U -values of elements that separate heated and unheated spaces (these were previously known as semi-exposed layers) this is described in BS EN ISO 6946 AND BS EN ISO 13789.

- BS EN ISO 6946 gives a simplified procedure, where an unheated space is allowed for in the calculation as if it were a homogeneous layer with a thermal resistance Ru. (See tables in SAP 2005)
- BS EN ISO 13789 gives a more precise procedure for the calculation of heat transfer from a building to the external environment via unheated spaces and may be used when a more accurate result is required.

The following formula may be used to derive elemental U-values (taking the unheated space into account) for typical housing situations irrespective of the precise dimensions of the unheated space.

$U_0 = 1/(1/U-R_u)$ or $U = 1/(1/U_0+R_u)$

Where:

U - U-value of the element adjacent to unheated space (W/m^2K), taking the effect of the unheated spaces into account.

U_0 - U-value of the element between heated and unheated spaces (W/m^2K), calculated as if there was no unheated space adjacent to the element.

R_u - Effective thermal resistance of unheated space inclusive of all external elements (m^2K/W).

R_u for typical unheated structures from SAP 2005 (including garages, access corridors to flats & rooms in the roof) are provided in the tables 3.1- 3.4 below. These values can be used when the precise details of the structure providing the unheated space are not available or not crucial. Please check the latest release of the SAP document for the current values.

Table 3.1

R_u for integral single garages				
Single garage Type		**Element between garage and dwelling**	**Inside [1]**	**Outside[2]**
Fully integral		Side wall, end wall and floor	0.68	0.33
Fully integral		One wall and floor	0.54	0.25
Partially integral displaced forward		Side wall, end wall and floor	0.56	0.26

The table 1 gives R for single garages; use (0.5 x R) for double garages when extra garage is not fully integral and (0.85 x R) for fully integrated garages.

[1]) Inside: when the insulated envelope of the dwelling goes round the outside of the garage

[2]) Outside: when the walls separating the garage from the dwelling are the external walls

Table 3.2R_u for integral double garages				
Double garage Type		**Element between garage and dwelling**	**Inside [1]**	**Outside[2]**
Fully integral		Side wall, end wall and floor	0.59	0.28
Fully integral		Side wall, halves of the garage end wall and floor	0.34	N/a
Partially integral displaced forward		Part of the garage side wall, end wall and some floor	0.28	N/a

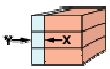
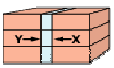
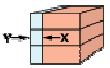
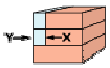
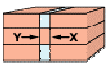
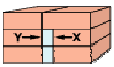
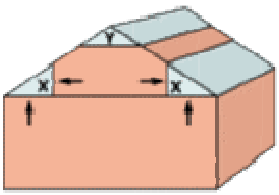
Table 3.3Ru for common configurations of stairwells and access corridors			
X - Wall adjacent to unheated space Y - Facing wall			**Ru**
Stairwells:		Facing wall exposed	0.82
		Facing wall not exposed	0.90
Access corridors:		Facing wall exposed, corridor above **and** below (illustration shows corridor above)	0.28
		Facing wall exposed, corridor above **or** below (illustration shows corridor above)	0.31
		Facing wall not exposed, corridor above and below	0.40
		Facing wall not exposed, corridor above or below (illustration shows corridor below)	0.43

Table 3.4 Ru for room in roof adjhacent to unheated loft space		
In the case of a room in roof construction, the U-value of the walls of the room in roof construction and of the ceiling of the room below the space adjacent to these walls can be calculated using the procedure below.		
	**X**	Treat as unheated space **Ru = 0.5 m^2K/w**
	Y	U-value calculated as normal roof

- Elements adjacent to unheated space

If you are uncertain, you can leave the default values to get reliable results.

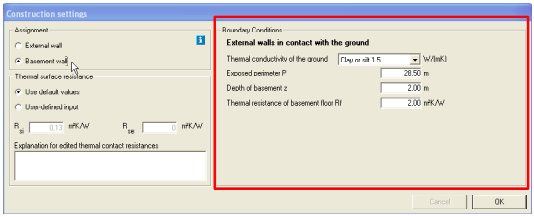
4.2.3 Change boundary conditions for other elements

This second group of boundary conditions concerns basement walls, ground floors, floors of heated basements, suspended floors, intermediate floors above unheated basements.

Here you can enter additional information required for the determination of the U-value according BS EN ISO 13370.

BuildDesk "boundary conditions" automatically appear when activating the icons mentioned under (a) and (b) For example, let us define an basement wall. By clicking the the external wall icon in the symbol bar this popup window will automatically appear. Click the basement wall as assignment. Then clicking basement wall and the boundary conditions will automatically appear.

The screenshot below shows the boundary conditions for a basement wall.



Boundary conditions for a basement wall.

If the information is not known or not available, you can leave the default values to get reliable results.
See also section 5.1. These are the constructions where calculation rules "B" and "C" apply.

4.3 Constructions with predefined materials

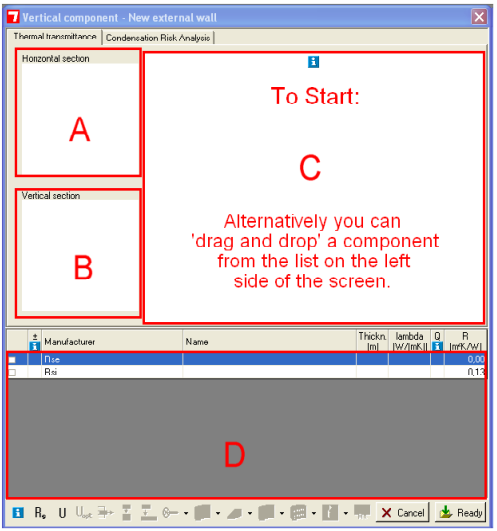
4.3.1 Adding a homogenous layer

This process is explained with the example of an external wall.

Create a new external wall component.

Click the icon in the symbol bar.

In section 4 (see chapter **Error! Reference source not found.**) you will get the following construction entry window, divided into 4 areas:



A ... 2-dimensional drawing in horizontal section (plan view)
B ... 2-dimensional drawing in vertical section
C ... 3-dimensional representation. (Drag and drop zone)
D ... Tabled list of building material layers (Drag and drop zone)

After you click the symbol referring to the construction in the top bar, a popup defining the assignment of the construction automatically appear.

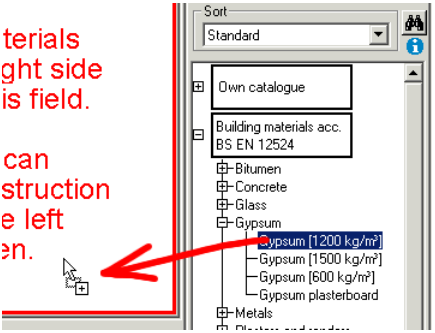
Choose the right assignment and press OK.

Select the appropriate assignment e.g. external wall.

The assignment of a construction element is an important setting. The thermal contact resistance R_{si} and R_{se} are defined by this selection as are the default values for the maximum permissible U values. These settings are also important in the following programme BuildDesk Energy design 3.4.

The thermal contact resistances are required to calculate the U-values.

Now add one layer at a time to the construction using the building material catalogues.
Use select and drag the building material, as described in chapter 3.5.1, and drop it in the area C or area D.
This process is called "drag & drop".

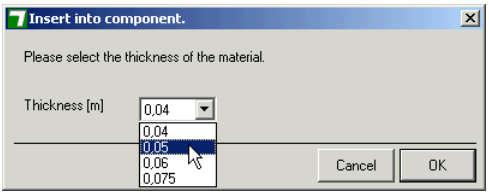


If you drag and drop directly into area D, you will have the opportunity to define immediately where in the construction the material shall be placed.

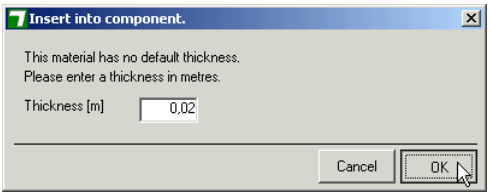
You will need to enter the thickness of the selected building material. In selecting the thickness you could have 3 options to choose from.

1. The building material has only one defined thickness – BuildDesk U 3.3 enters the layer without any dialogue.

2. The building material has several different predefined thicknesses – BuildDesk U 3.4 asks you to select one from the defined thicknesses.

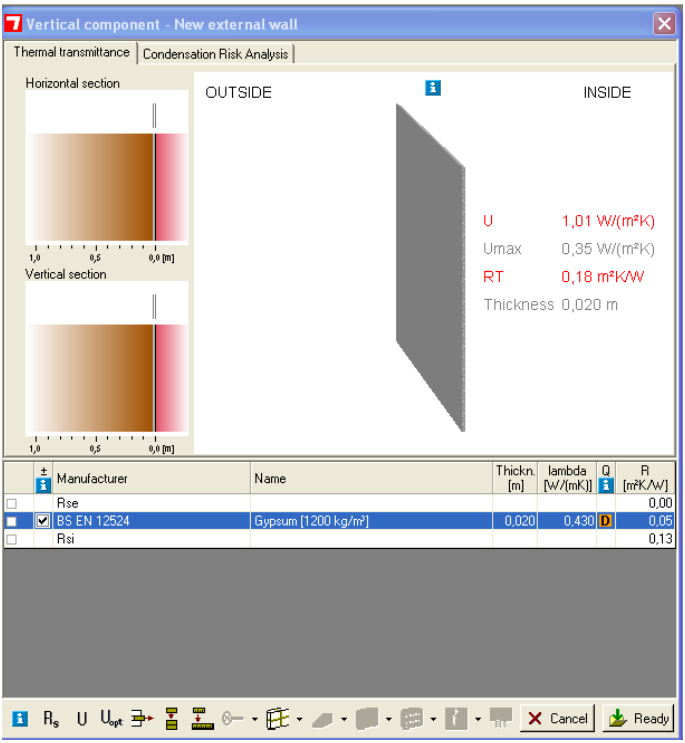


3. The building material has no predefined thickness. BuildDesk U 3.4 asks you to enter the required thickness value.



NB Please be aware that thickness values always have to be entered in metres.

Example:
For a required thickness of 20 mm enter a value of 0.02.
After you entered the first layer, the window looks like the following screenshot:



In the screen areas A and B the building material layer is bordered by cold air or ground(shaded blue or brown depending on wether it is ground or air) to the outside and by warm air (shaded red) to the inside.

In area C you see the building material layer on the right hand side (inner side of the wall to the right of the screen).
R and U are calculated automatically. Red coloured results are indicating a non-compliant U value of the construction. Green coloured results would indicate that a compliant U-value has been reached.

In area D the building material layers are listed.

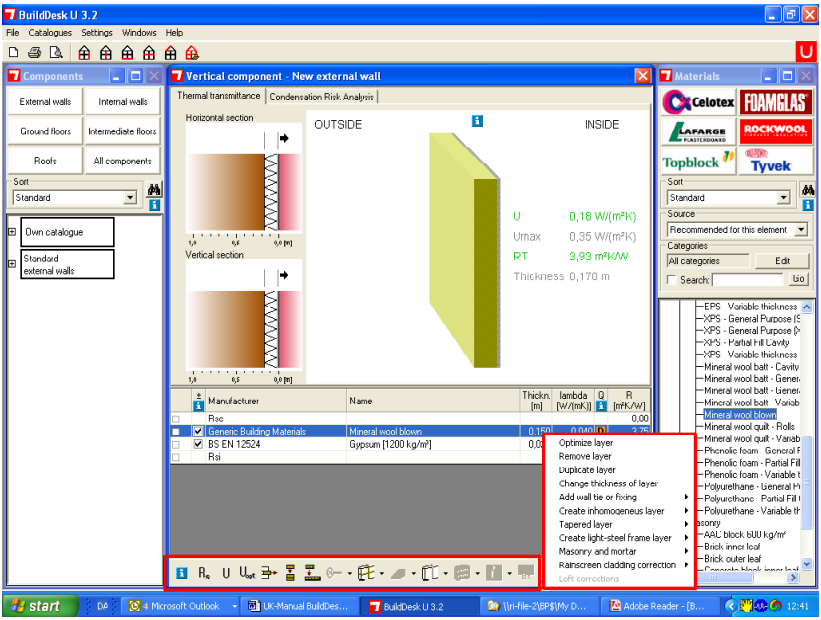
Repeat the process of inserting building material layers until the desired construction is build.

Extra attention should be paid to insulating materials which may be bridged. BuildDesk has added special functions for these material layers.

1. Fixings (See chapter 4.3.3)
2. Inhomogeneous layers (See chapter 4.3.4)
3. Air gaps (See chapter 4.3.3)
4. Light-steel frame layer (See chapter 4.3.5)
5. Rainscreen cladding corrections (See chapter 4.3.11)

4.3.2 Buttons and Context Menu

To edit a layer, first you have to highlight the layer in the tabled list of layers in the construction entry window.
You will then have two options to open the menu and edit the material layer: Using the buttons or the context menu.
(See the picture on the next page)



Using the buttons:

In the lower part of the construction entry window you will find the following buttons.
They are used to edit a selected construction or layer.

<Rsi / Rse>
Edit the assignment or boundary conditions.

<Direct input of U-value> (see chapter 4.3.7)
Edit a constructions U-value.
This function is only available to edit a complete construction.
So you can NOT access this function by the context menu.

<Optimise layer thickness> (see chapter 4.3.6)

<Duplicate layer> (see chapter 4.3.9)

<Delete layer>

<Change thickness of layer>

<Add wall tie or fixing> (see chapter 4.3.3)

<Create inhomogeneous layers> (see chapter 4.3.4)

<Tapered layer> (see chapter 4.3.10)

<Create light-steel frame layer> (see chapter 4.3.5)

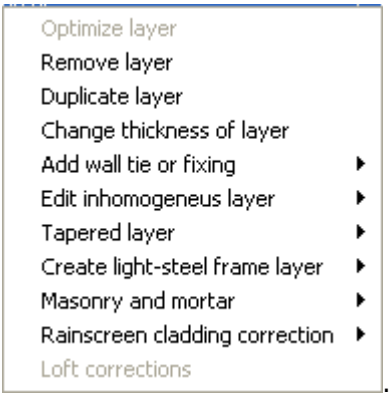
<Open Masonry and mortar dialogue> (see chapter 4.3.8)

<Rainscreen cladding correction> (see chapter 4.3.11)

<Loft hatch corrections> (see chapter 4.3.8)

Using the context menu:

It is also possible to change the construction by clicking on a material layer in the building material list view using the right mouse button:



- With <*Optimise layer*> it opens a dialogue to optimise the layer thickness to reach a specified target U-value. This function is described in more detail in chapter 4.3.6.
- With <*Remove layer*> the selected layer will be deleted.
- With <*Duplicate layer*> the selected layer will be duplicated.
- With <*Change thickness of layer* > it opens a dialogue to change the thickness.
- With <*Add wall tie or fixing*> You can add, remove or change the number of fixings, wall ties etc. (see chapter 4.3.3)
- With <*Edit inhomogeneous layer*> you will go to the creation window for inhomogeneous layers. (see chapter 4.3.4).
- With <*Tapered layer*> you will go to the creation window for tapered layers. (see chapter 4.3.10).
- With <*Create light steel frame layer*> you will go to the creation window for light-steel frame layers. (see chapter 4.3.5).
- With <*Open Masonry and mortar dialogue*> you will open the dialogue window for Masonry and mortar (see chapter 4.3.8)
- With <*Rainscreen correction*> *you can define* you the effect of fixing brackets etc. bridging an insulation layer (see chapter 4.3.11)

After all layers of a construction have been created or changed, the construction is filed in a construction catalogue.

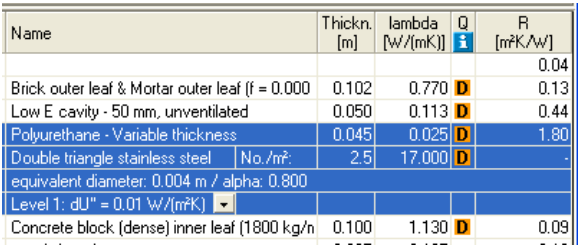
To file the construction click on the button

on the lower right side of the construction creation window.

For further information about the filing of constructions please refer to chapter 6.1 Saving components.

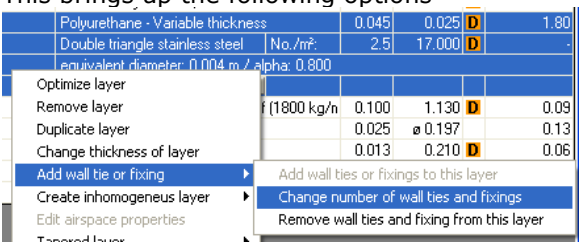
4.3.3 Inserting wall ties or fixings and air gaps

Insert a layer of insulating material to the area C using the "drag & drop" function. If the insulation material properties have been set in the catalogue 'filter' as an 'insulation that can be mechanically fixed' then fixings will be added.
BuildDesk U automatically defaults to add a vertical twist wall tie and fixings at the rate of 2.5 per m2.

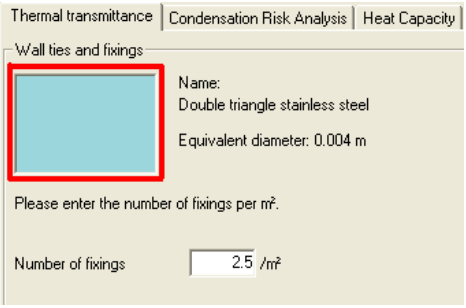


Name		Thickn. [m]	lambda [W/(mK)]	Q	R [m²K/W]
					0.04
Brick outer leaf & Mortar outer leaf (f = 0.000		0.102	0.770	D	0.13
Low E cavity - 50 mm, unventilated		0.050	0.113	D	0.44
Polyurethane - Variable thickness		0.045	0.025	D	1.80
Double triangle stainless steel	No./m²:	2.5	17.000	D	-
equivalent diameter: 0.004 m / alpha: 0.800					
Level 1: dU" = 0.01 W/(m²K)					
Concrete block (dense) inner leaf (1800 kg/n		0.100	1.130	D	0.09

Later on you can change, remove or add fixing as you like by either right click or clicking on the icon
This brings up the following options



By selecting 'Change number of wall ties and fixing' you can then select a new tie or fixing by 'drap & drop' from the 'Wall ties and fixings' catalogue. You can also type in the number of fixings per m2.



If you don't want to add fixings to the layer, choose "remove wall ties and fixings from this layer "

The latest drag & drop method of inserting wall ties from the 'Wall ties and fixings' catalogue also allows you to create and add your own wall ties in your own catalogue.

Air Gaps

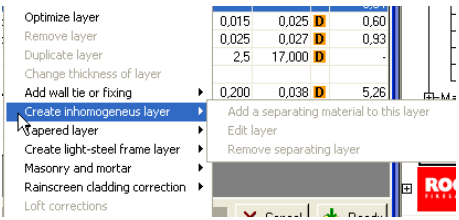
Air gaps are automatically inserted into the layers when insulation is inserted. This applies for walls and roofs not floors.
You can change the level of the air gaps simply by pressing the down arrow and choose the air gap level.

4.3.4 Inserting inhomogeneous layers

Inhomogeneous building material layers can be identified by vertical or horizontal bands in the building material layer. A typical example is a timber stud wall. Timber 500 kg/m3 is also the default bridging layer.

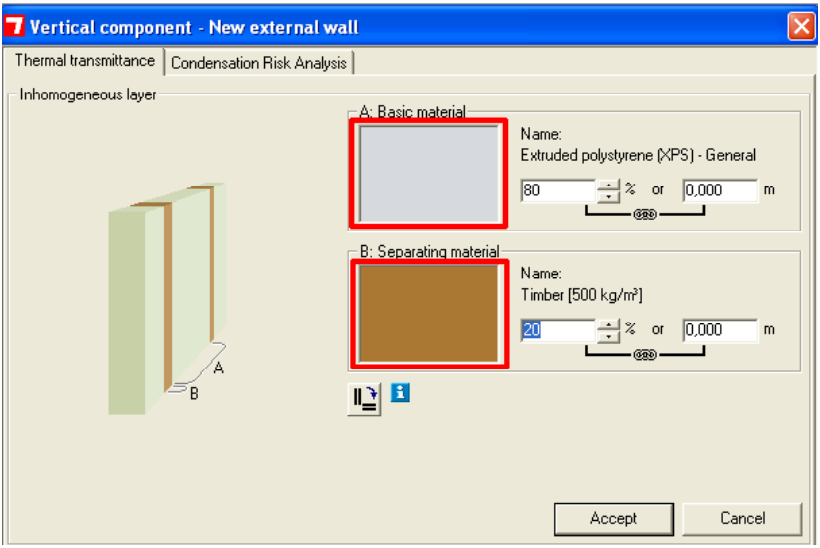
With the same command, also which you use to change the type or the number of fasteners, you can select the function

<Insert inhomogeneous layer> by using the button or the context menu.



In area C of the creation window the dialogue for creating inhomogeneous layers will appear.

By clicking the button the button the orientation of the inhomogeneous layer rotates e.g. from horizontal to vertical.



Without any further data entry the proportion of the separating material is set to a default value of 20%.

You can change the proportion in two ways:

1. By changing the percentage value – in whole numbers
2. By entering the width measurements for materials A and B according to the drawing. This function can also be used when the required bridging factors uses less than whole percentage figures e.g. for 6.6% bridging use .934m for material A & .066m for material B.

You can edit the separating layer by dragging a new separating material different from the default material from the building material catalogue to the field with the red coloured text A and B using the "drag & drop„ function.

Finish the entry by clicking on the button

.

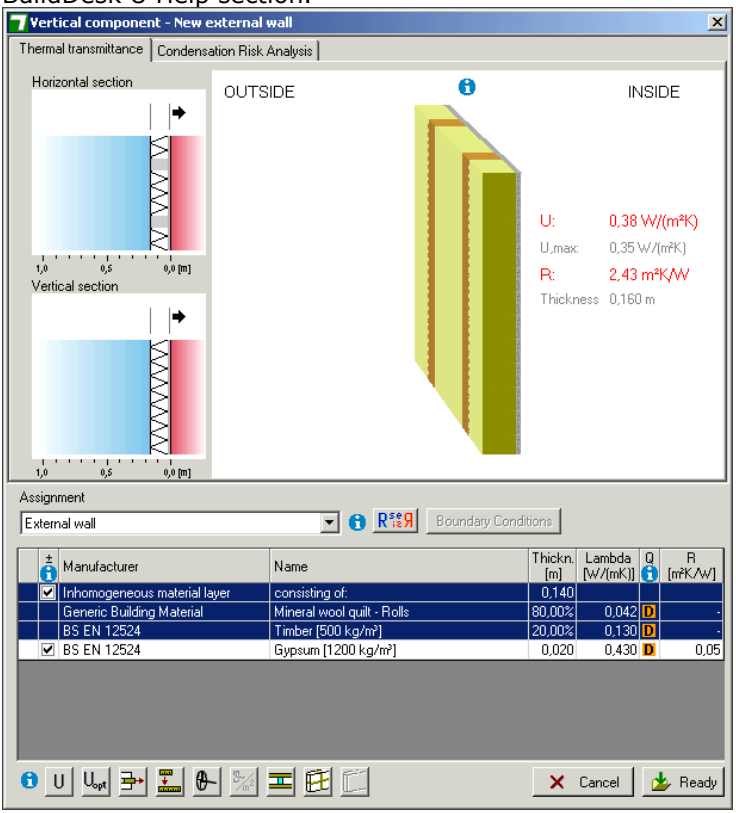
You will get the following result:

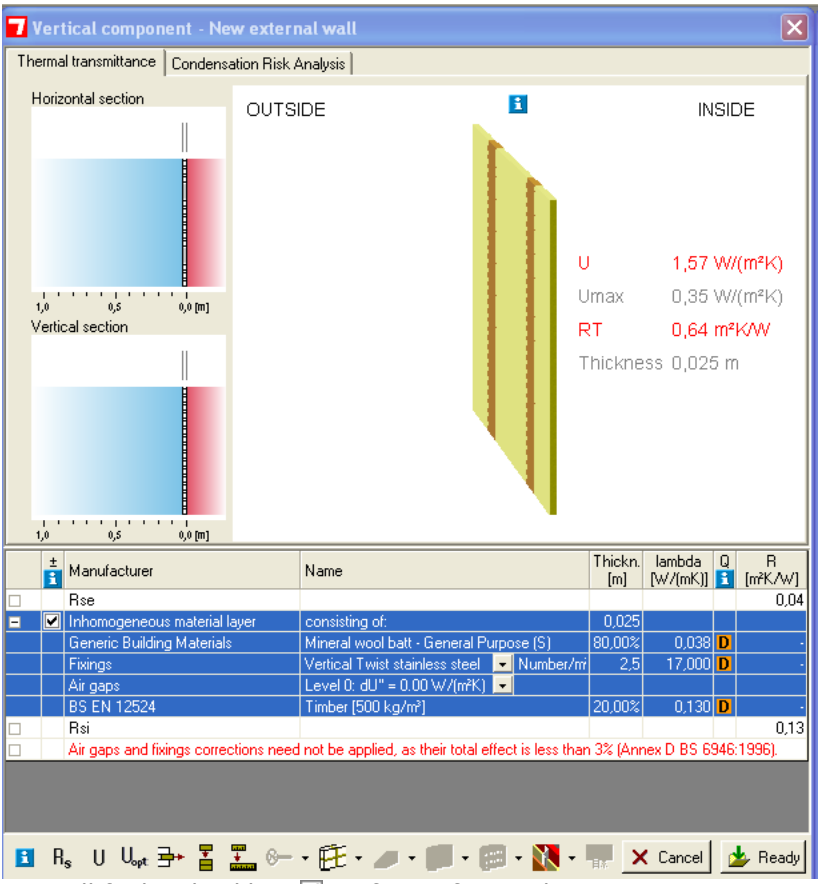
Guidance on bridging factors:

For the UK the % bridging factor for timber in structural timber frames is taken by convention as being 15%

For The Republic of Ireland the % bridging factor for timber in structural timber frames is taken by convention as being 12%.

Further information can be found in BRE 443:2005 Conventions for U-value calculations published by the BRE and found in the BuildDesk U Help section.

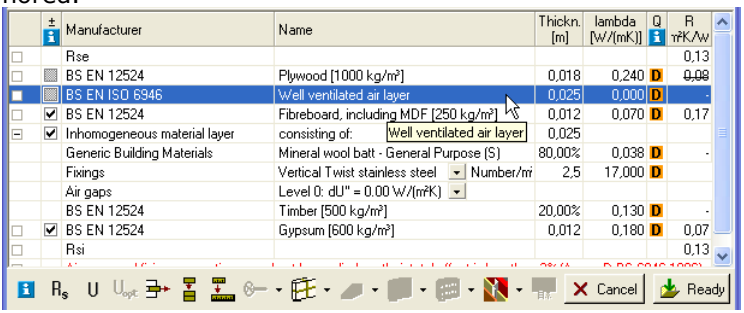




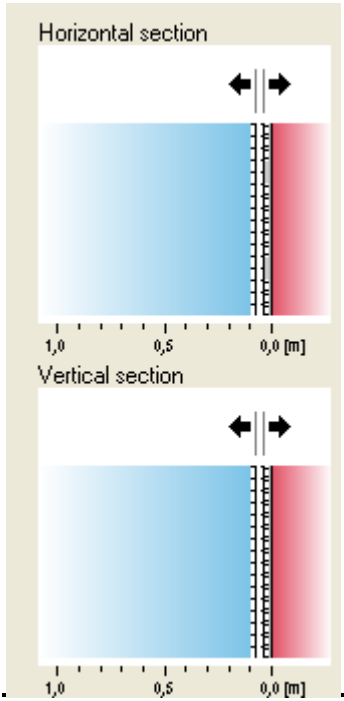
You will find a checkbox ☑. in front of every layer.

If you click on the checkbox this will remove the tick which will have the following result:
The layer remains a part of the construction and will still be listed in the table and graphically displayed but will be ignored for calculating the constructions R- and U- value. This function will enable you to look more closely at the effect of each layer.

In some situations BuildDesk U 3.4 will automatically deactivate this function on it own.
An example is when:
A construction containing a well ventilated air layer on the outside. According to BS EN ISO 6946 all the following layers have to be ignored for the calculation of R and U and the outer thermal contact resistance has to be adopted. BuildDesk U 3.4 recognises this situation and makes the necessary corrections by its own. This prevents making errors by including layers which should be ignored.



You can also change the order of material layers in the construction.

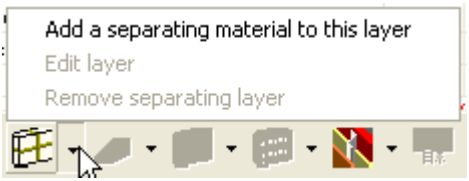


With any construction consisting of more than two layers, the order of the layers can be changed. If you would like to change the order of layers mark the layer in the low window and drag it to the right position or go to the 2 dimensional windows (A or B). The highlighted layer in the tabled list of the building material layers is in the both section windows A and B where it is tagged by an arrow.

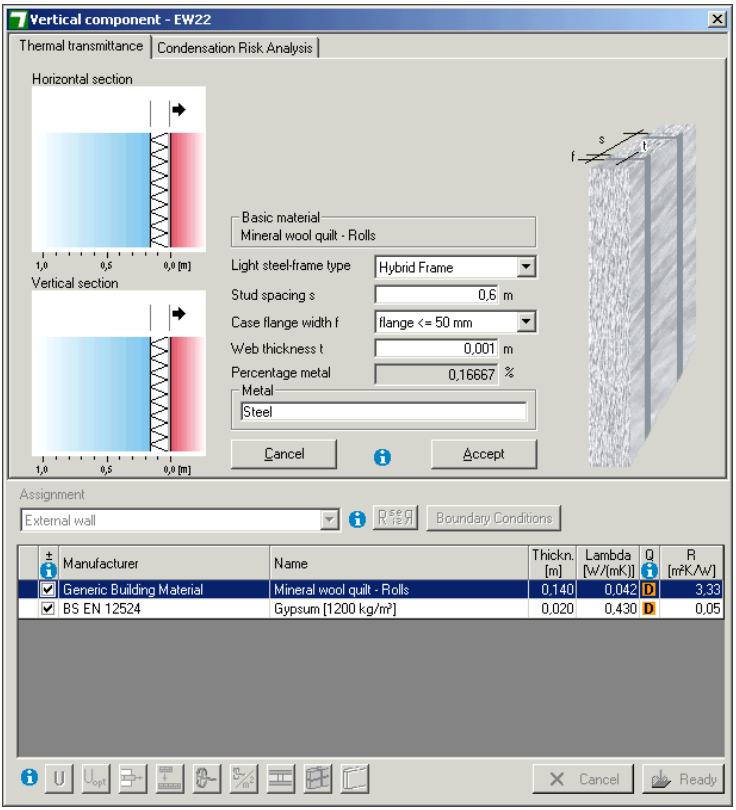
Click on this arrow and the layer changes its position in the direction of the arrow.

4.3.5 Inserting Light steel-frame layer

Entering a light steel-frame layer is very similar to the process for entering an inhomogeneous layer.
Select the layer where you want to insert a light-steel frame and use the button or the context menu with the right mouse button.



This layer allows the consideration of layers bridged by metal structures, which is excluded from the scope of BS EN ISO 6946. Such situations are typical for steel frame constructions. The calculation rule used is described in BRE, Digest 465. The calculation is similar to that used when calculating other inhomogeneous layers.



Add the required material and enter the necessary parameters.

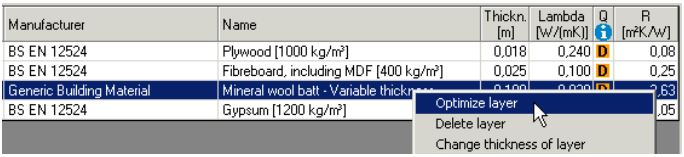
4.3.6 Optimise layer thickness

Usually you start with a component with a given construction and calculate the U-value.

Often you will wish to establish what thickness of the insulation has to be used to achieve the required U-value.

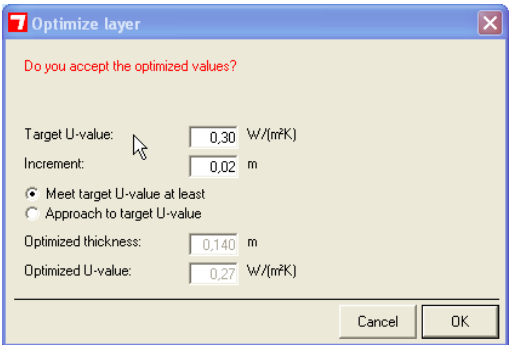
To help we have equipped this BuildDesk program with a special function that solves this problem in a quick and reliable way.

To activate this function, mark the layer that has to be optimised (in most cases the insulation layer) and press button U_{opt} or press the right mouse button.



Select the command <*Optimise layer*> and insert the desired U-value.

Now BuildDesk U 3.4 calculates the necessary insulation thickness to reach the given U-value ("reach at least target U-value") or to approach ("approach to target U-value").



BuildDesk U 3.4 takes account of the available thicknesses of the building material. If the building material is not available in the required thickness, BuildDesk U 3.4 points that out and chooses the highest thickness of the building material available. It may be necessary to duplicate the insulation layer and use the optimise feature again to reach the required thickness.

With "Increment" you can define the increments of thicknesses in which the calculation is carried out (currently defaulted at 20mm). So you are assured that the calculated thickness will be a useful value.

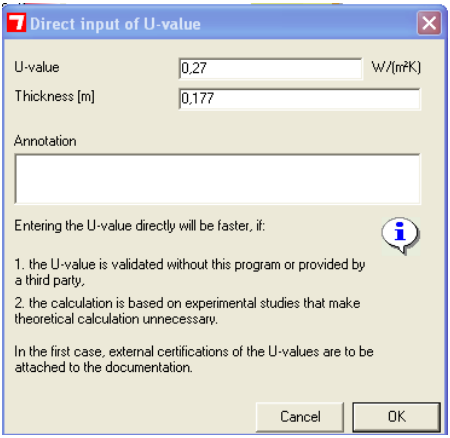
Accept the calculated proposal with <*OK*>.

The thickness of the building material will be changed and the construction is redrawn and recalculated.

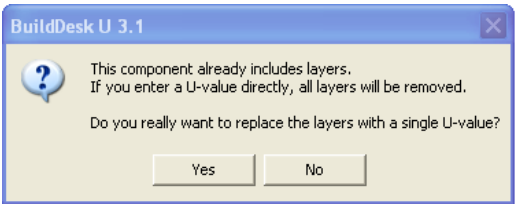
4.3.7 Direct input of U-value

BuildDesk U 3.4 also allows you to manually enter a U-value for a construction.
This function is only available to edit a complete construction. So you can NOT access this function by the context menu.

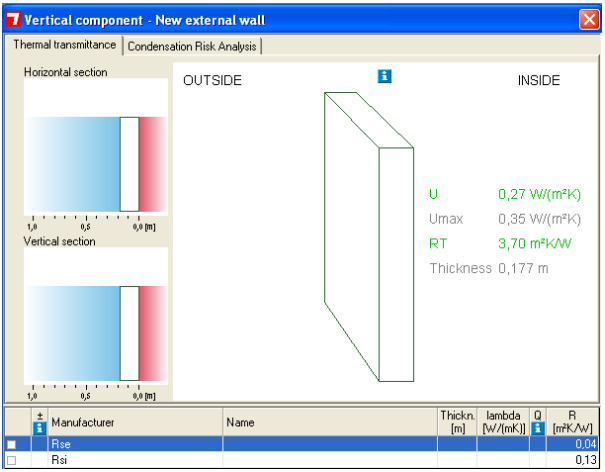
To activate this function, mark the layer which has to be optimised (in most cases the insulation layer) and press button U. or press the right mouse button.
The following window appears to enter the U-value and the thickness of the construction



Finish the entry by clicking <*OK*> but please be aware that all the existing layers will then be replaced by one layer with the entered thickness and U-value.



Confirm with Yes.
The result will look similar to the following screenshot:



No layers will be shown in either the list view or in the drawing of the construction.

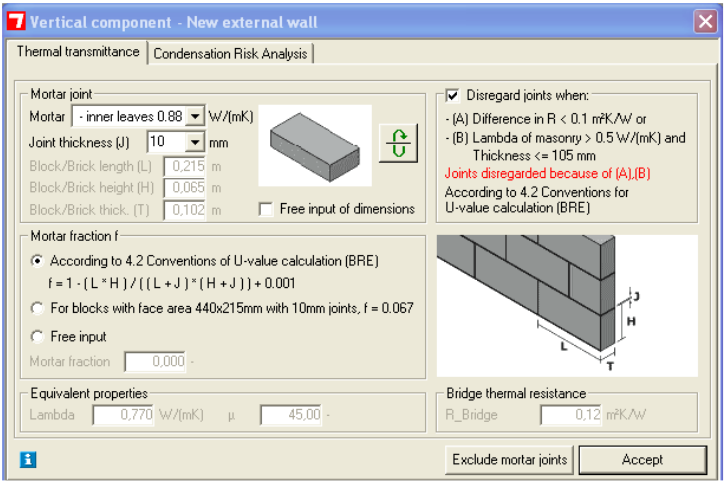
Confirm with *<Ready>* to save the construction in your own catalogue.

4.3.8 Masonry and mortar dialogue

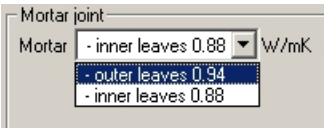
According to BRE Conventions for U-value calculations BR 443:2006 section 4.2 "Mortar joints in masonry construction" we need to consider the effect of mortar joints by treating them as thermal bridges in the masonry construction. The average resis-

tance of the masonry is calculated by considering the thermal conductivity of the joints and masonry units and their relative fractions.
Having selected your Brick or Block material from the relevant materials catalogue the corresponding dimensions will automatically be placed in the Masonry & mortar dialogue box below, or this dialogue box can be activated by clicking the masonry icon.

It is suggested that the 'Include mortar joint' window is activated so that these corrections can be included in the calculation. The window 'Disregard joints when:' should also be activated so that the calculation also follows the 2 caveats laid down in BR 443:2006. The dialogue box will indicate which caveat is used to disregard the joints if one, or both are applicable.

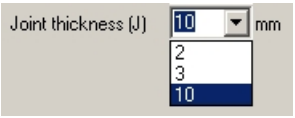


For the calculation to take place you need to specify whether the masonry is on the interior or exterior of the construction. If the material is external leaf the mortar joint thermal conductivity should be selected from the drop down list as "outer leaves 0.94" but if the internal leaf is being considered the "inner leaves 0.88" should be used.



Joint thickness (J)

In order to assess the thermal bridge caused by the mortar we need to specify the joint thickness. Usually in masonry this is 10mm but in thin joint systems this can often be reduced to 3mm. The input for (J) can be selected from the drop down list or manually entered.



Should you require a masonry unit size that does not appear in the catalogue you should activate the 'Free input of dimensions' and manually input the dimensions.

Changing rotation of Block

By clicking on the icon below you can rotate the Block and the dimensions will be rotated automatically. This function is useful if you wish to lay the blockwork on it's side e.g. when building solid external walls. This will automatically correctly adjust the mortar fraction (f).

You also have the opportunity to exclude mortar joints by pressing the button with the same name just beside the accept button.

Mortar fraction f

The mortar fraction f is calculated according to a formula laid down in BR 443:2006. You have 3 options for setting the mortar fraction.

1. By automatic calculation

2. Use the standard default value for standard size blocks 440 x 215 with 10mm mortar joints f = 0.067. The mortar joints occupy 6.7% of the vertical surface area.
3. Manually input the mortar fraction if known by selecting ”Free input”.

Equivalent properties
The calculated Lambda value & μ value are displayed for the combined masonry & mortar joints.

Bridge thermal resistance
The thermal resistance of the mortar layer.

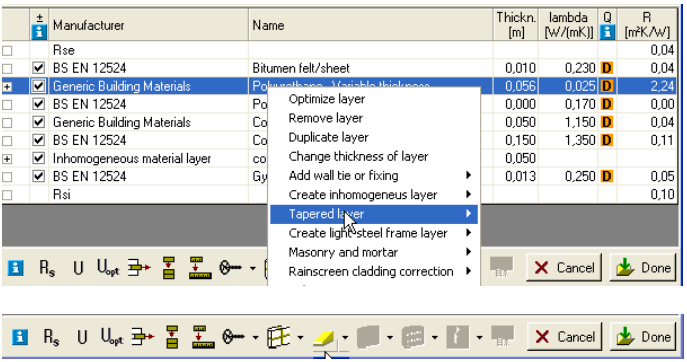
4.3.9 Duplicate layer

BuildDesk U 3.4 allows you to duplicate one existing layer or a locked construction entry by clicking the material or construction in question. Afterwards you right click and choose duplicate layer or simply just clicking on the icon allows you to manually enter a U-value for a construction.
This function is only available to edit a complete construction. So you cannot access this function via the context menu.

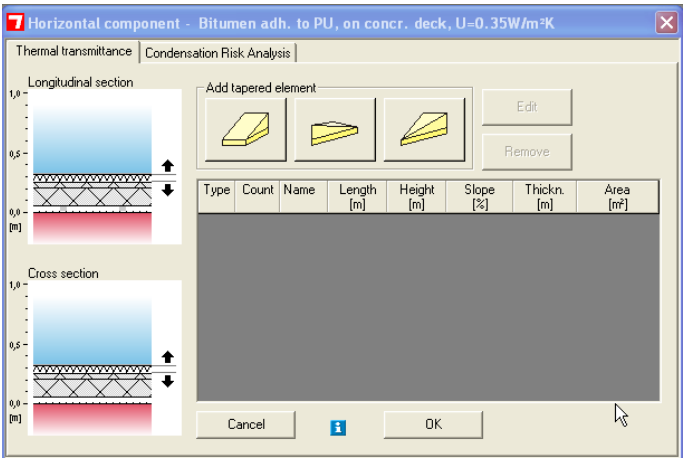
4.3.10 Tapered Layer

Tapered layers are only used on flat roofs.

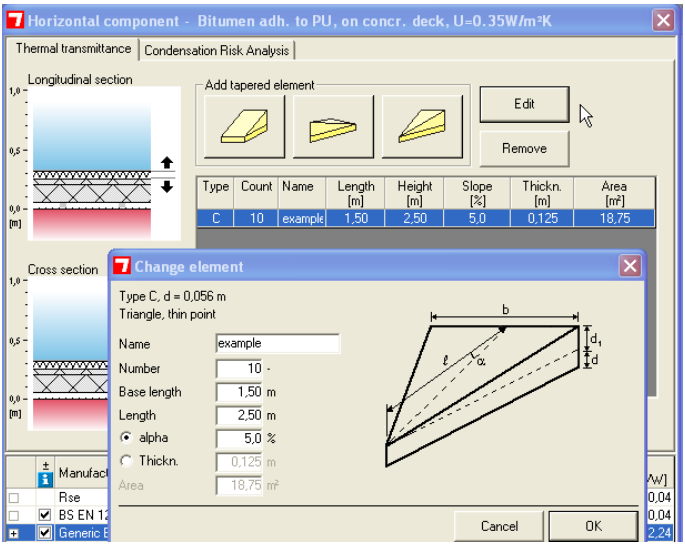
You can add, edit and remove “cut to fall” insulation by clicking the icon above.
You can also activate the module by mouse right click and choose Tapered layer.



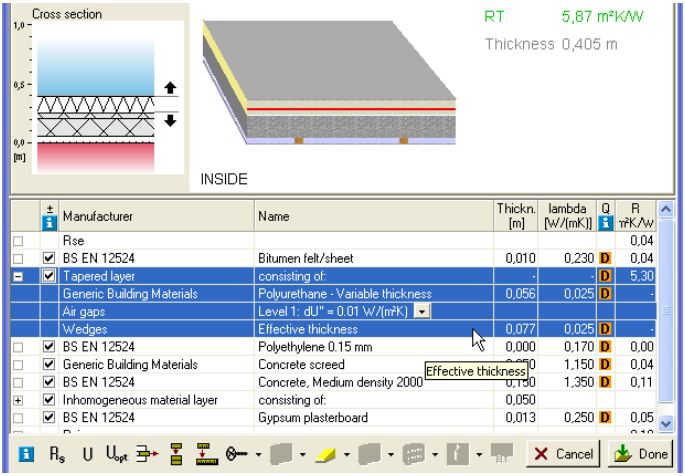
By activating the module this dialogue appears:



The first thing you have to do, is to pick the type off cut to fall insulation, by pressing one of the buttons in “add tapered layer”. Next it is possible to create different types of tapered layer and afterwards mark, edit and remove them once again.
All the different tapered layers will appear as a list in the window.



When pressing OK, all the tapered layers are show in the grid below as an average weighed thickness etc. The tapered layer is indicated with a red line in the top window.

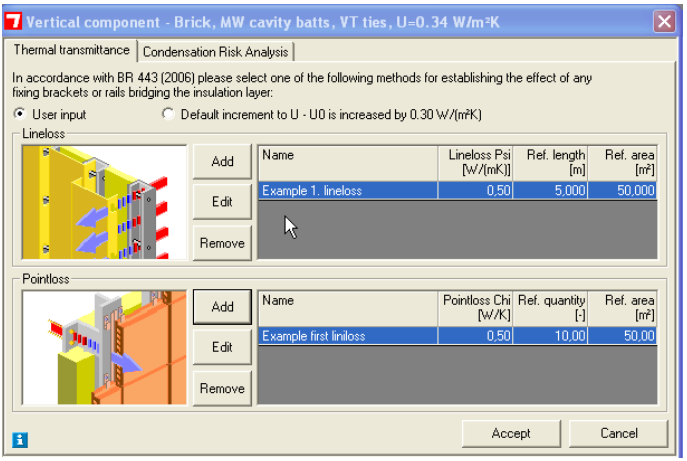


4.3.11 Rainscreen cladding correction

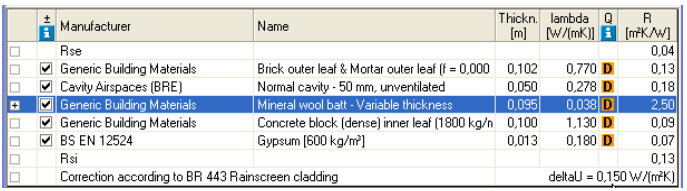
This correction can be activated by pressing the icon or by right clicking and choosing Rainscreen cladding.

This allows the user to add the additional thermal bridge line losses and point losses in a specific Rainscreen application.

In accordance with BR 443:2006 you are able to evaluate the U-value of the total wall and take into account the effect of the line losses, such as rails and point-losses such as brackets that penetrate the insulation layer.



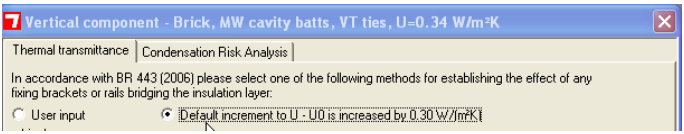
After pressing accept in the button of the dialogue the total effect of the line losses and point-losses can be seen in the button of the grid.



		Manufacturer	Name	Thickn. [m]	lambda [W/(mK)]	Q	R [m²K/W]
		Rse					0,04
	☑	Generic Building Materials	Brick outer leaf & Mortar outer leaf (f = 0,000	0,102	0,770	D	0,13
	☑	Cavity Airspaces (BRE)	Normal cavity - 50 mm, unventilated	0,050	0,278	D	0,18
+	☑	Generic Building Materials	Mineral wool batt - Variable thickness	0,095	0,038	D	2,50
	☑	Generic Building Materials	Concrete block (dense) inner leaf (1800 kg/n	0,100	1,130	D	0,09
	☑	BS EN 12524	Gypsum [600 kg/m³]	0,013	0,180	D	0,07
		Rsi					0,13
		Correction according to BR 443 Rainscreen cladding			deltaU = 0,150 W/(m²K)		

It's also possible to make the simple approach and activate the radio button "Default increment to the U-value".

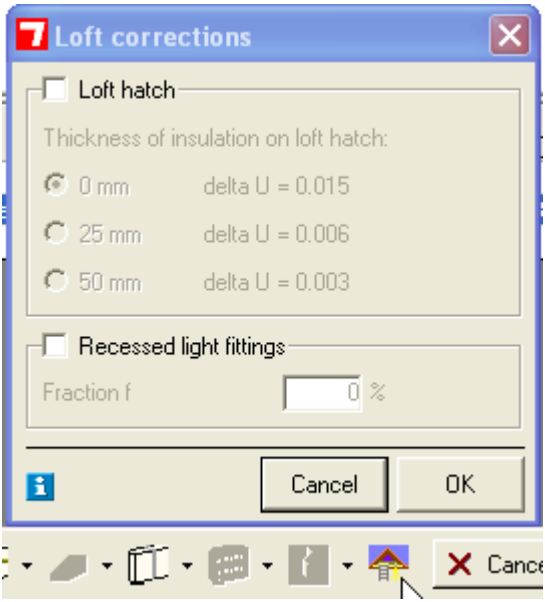
According to BR 443:2006 the Uo value is increased by 0,30 W/m2K, so that the U values equals Uo + 0,3.



Therefore a U-value of 0.25 would be automatically defaulted to a corrected value of 0.55

4.3.12 Loft Hatch corrections.
According to BR443 it is possible to correct the U value of the roof if a loft hatch is present. The value of the correction applied depends on the thickness of the insulation present on the loft hatch. Also according to BR443 a correction for the presence of recessed light fitting is required.

These functionalities are activated by pressing the icon



By checking the empty boxes "loft hatch" or "Recessed light fittings" you have the opportunity to add these corrections.

The result of these corrections is shown in the button of the grid.

	±	Manufacturer	Name	Thickn. [m]	lambda [W/(mK)]	Q	R [m²K/W]
☐		Rse					0,10
☐	☑	Generic Building Materials	Mineral wool batt - General Purpose (S)	0,100	0,038	D	2,63
☐		Rsi					0,10
☐		Correction according to BR 443 Loft hatch, insulation thickness = 25 mm			deltaU = 0,006 W/(m²K)		
☐		Correction according to BR 443 Recessed light fittings, fraction f = 10 %			deltaU = 0,165 W/(m²K)		

Be aware that this functionality is only available when choosing one of the following assignments.

2.2.1 Assignments

Gr.	Assignment	Option	Description
RO	Pitched roof < 70°	with insulation between joists = selected	Pitched roof with insulation between joists
IF	Intermediate floor/ceiling – semi exposed, heat flow upwards	Adjacent to loft space = false	Intermediate floor/ceiling to unheated space, heat flow upwards
IF	Intermediate floor/ceiling – semi exposed, heat flow upwards	Adjacent to loft space = true	Intermediate floor/ceiling below unheated loft space, heat flow upwards

4.4 Constructions with predefined components

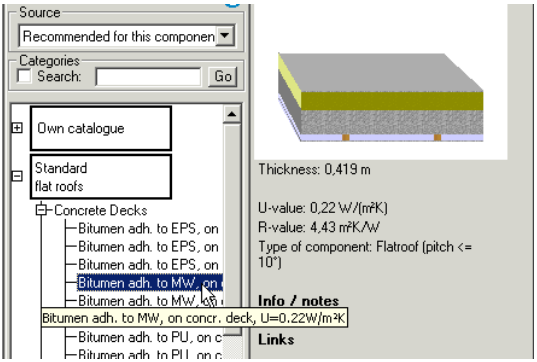
The difference between the creation of constructions using building materials and the usage of constructions from the construction catalogues is, that in the first case every single layer is inserted separately and in the second case blocks of layers (components) are inserted.

It is also possible to use a combination of both methods when creating a construction. The creation of a construction using predefined components of the construction catalogues is explained with the following example of a flat roof.

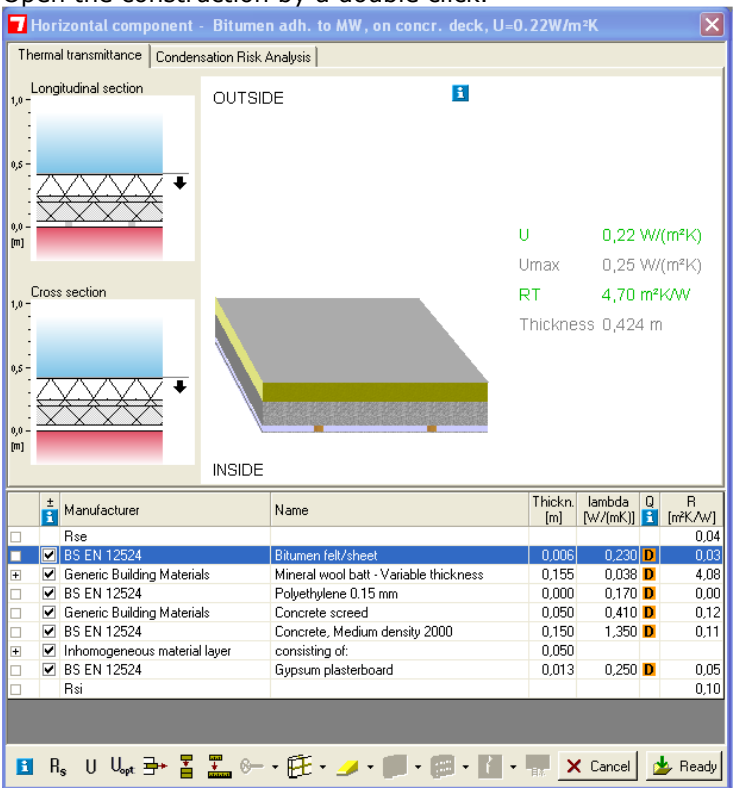
To show the flexibility of the BuildDesk software, the task is shown in two different both ways using the both methods.

Task:
Adding to a flat roof construction out of the catalogue "Standard constructions" an additional insulation with a wood battens should be added. The insulation/battens is covered with plasterboard on the interior side.

Solution 1:
In the Construction catalogue search in the group "Standard flat roofs" for the component „Bitumen adh. to MW on concr. deck, U-value = 0,22 W/m²K".



Open the construction by a double click.

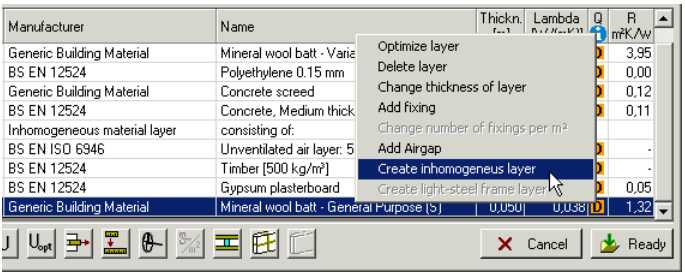


The next step is to search in the building material catalogue for an insulation e.g. a mineral wool.

Drag it with the 'Drag & Drop' function into the area C or D.

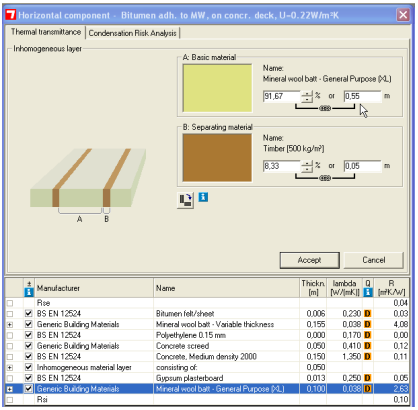
BuildDesk U 3.4 inserts the insulation as top layer above the 'Bitumen felt/sheet'. With the moving function in the areas A or B click the arrow to the lower side as often as the insulation is moved to the lowest layer (=inner side of the component).
As an alternative you can simply drag and drop the material around in area D and insert it directly where you want in the list.

Now click the highlighted insulation with the right mouse button and open the creation dialogue <*Create inhomogeneous layer*>.



Change the orientation of the layers by clicking on the icon .

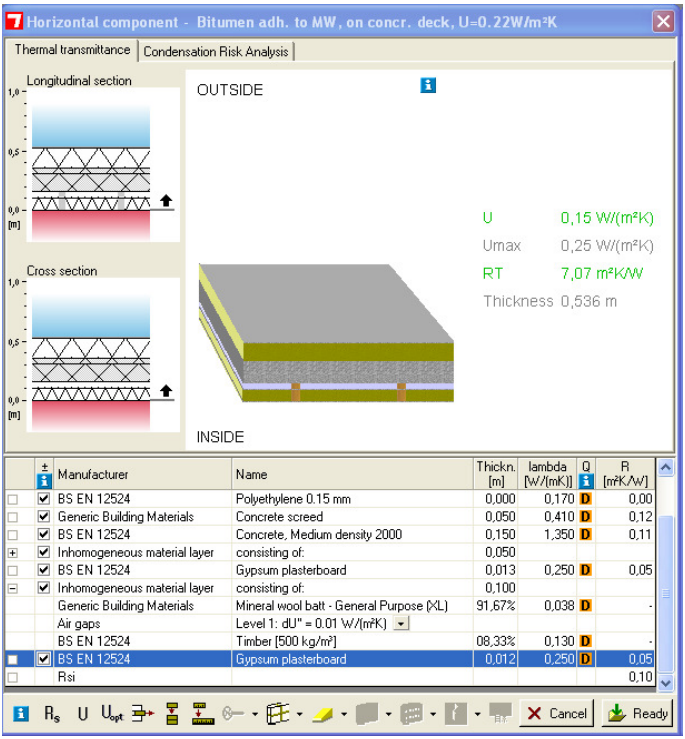
Enter the values 0.55 for A and 0.05 for B. As you see the separating material is defaulted 'Timber 500 kg/m3'. If you want to change this simply drag and drop another materiel into window B, separating material. Exit the Creation window with <*Accept*>.



Then search in the building material catalogue for a plasterboard and drag it into the area C or area D using the "drag & drop" function.

Drag and drop the material in the area field D or C.

Now the construction has the following assembly:



Exit the Entry by clicking the button <*Ready*>.

File the construction in the "Own catalogue" file.

Solution 2:

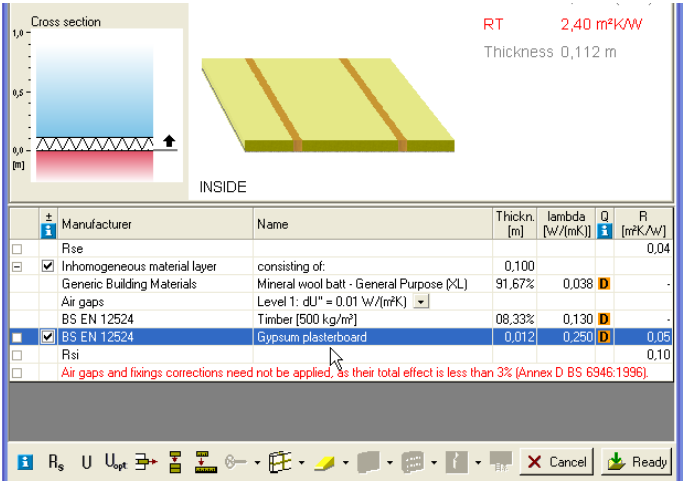
Create a new roof construction. Click the icon in the symbol bar.

Choose ‘flat roof’ in the pop up menu ‘construction settings’.

Now search the building material catalogue for a plasterboard and drag it into the area D or C. Next search for an insulation material and insert it above the plasterboard.

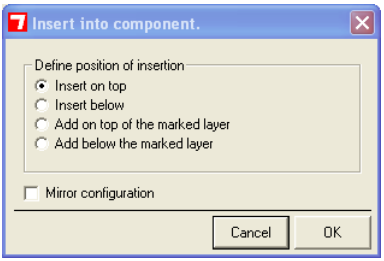
Change the insulation to an inhomogeneous layer using the same method as in solution 1. Use the same parameters as in that solution.

You will get the following assembly:



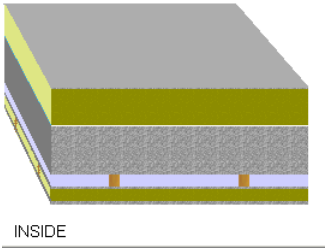
As before, search in the group- flat roof for the flat roof component “Bitumen adh. to MW on concr. deck, U-value = 0,22 W/m²K” and drag it into the area C using the “drag & drop” function.

Now the complete flat roof component will be inserted with all its layers.



BuildDesk U 3.4 then asks for the insertion position. Enter the position "Insert on top".

BuildDesk U 3.4 delivers the following result:



Now the construction is ready. Click the button <*Ready*> and file the construction in the 'Own catalogue' file.

4.5 Creation of components with own building materials

There is no difference to the method of „creation of constructions with predefined components" of chapter 4.4.

Naturally you can use both building material types in one component. Also the integration of complete constructions is possible and is described in chapter 4.4.

4.6 Entering own building materials

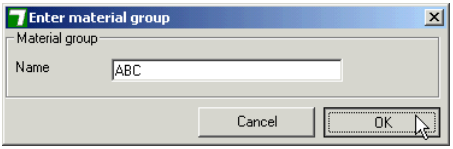
Own building materials can only be created in the "Own catalogue".

4.6.1 Create, delete and rename groups

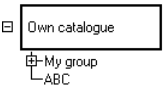
Building materials in a catalogue (e.g. "Own catalogue") are structured into groups.

Create a group:
To create a group in the "Own catalogue" mark the heading "Own catalogue" and click the right mouse button.

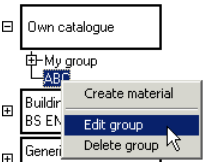
Select the command <*Create group*>.
Enter the group name (e.g. "ABC").



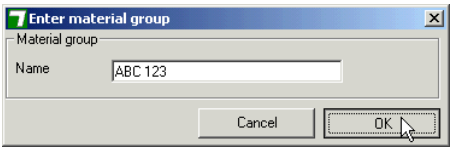
Confirm with <*OK*> and you will get the following result:



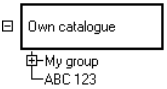
Rename a group:
To rename a group, click the group name using the right mouse button.



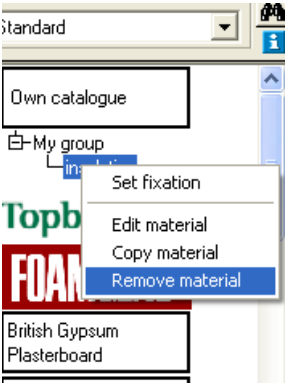
Select <*Edit group*>.



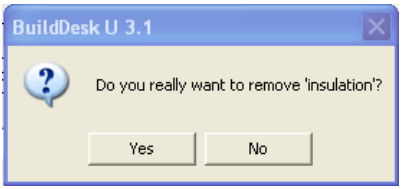
Change the group name (e.g. to "ABC 123") and confirm with *<OK>*.
You will get the following result:



Delete a group or material:
To delete a group or material within a group mark it using the right mouse button.



Click on *<Remove material>.*



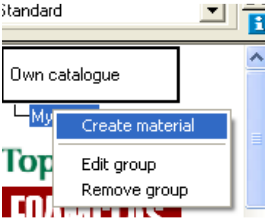
Confirm the dialogue and the material will be removed:

ATTENTION: If you want to delete a building material group that still contains building materials, you have to firstly delete all the building materials before you can delete the building material group.

4.6.2 Create, remove and edit building materials

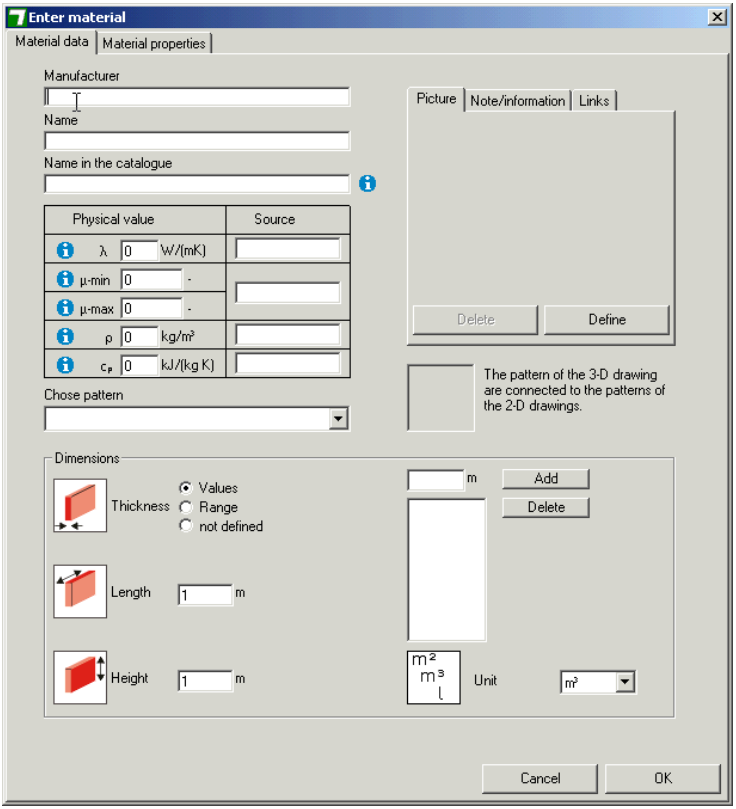
In the 'Own catalogue' select a building material group (e.g. "My group") using the right mouse button.

Create a material entry:



Click on:
<Create material>.

The following window will occur. Please enter all parameters described under this picture.



In the field "Manufacturer" enter the name of the manufacturer and under "Name" enter the name of the material. Please note that you are limited to a maximum of 50 characters.

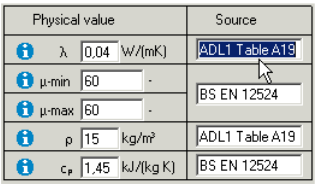
A detailed description of how to fill out the material properties is explained in the chapters 4.6.3 to 4.6.7

The entry of a new building material is completed by pressing <*OK*>. BuildDesk U 3.4 will check your input and will inform you if you failed to complete all the necessary data.

Rename or delete a material:
The renaming and deleting of building materials works in the same way as renaming and deleting of building material groups.

4.6.3 Physical properties and sources

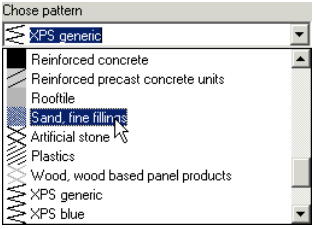
Every building material has to have physical properties assigned to it. For calculations with BuildDesk U 3.4, the **µ-min-value is the design value**.



It is recommended to note the source where the physical values were obtained from.

4.6.4 Patterns

Every building material has to have a pattern assigned to it.
To do that, select a pattern from the drop down list <*Choose pattern*>:



The list of available patterns has been predefined for you.

BuildDesk U 3.4 uses technical design patterns for the 2-dimensional illustrations of the constructions in "horizontal cross sections" (plan view) and "vertical cross sections".

Realistic patterns are used for the 3-dimensional illustrations (in the middle of the construction creation window).

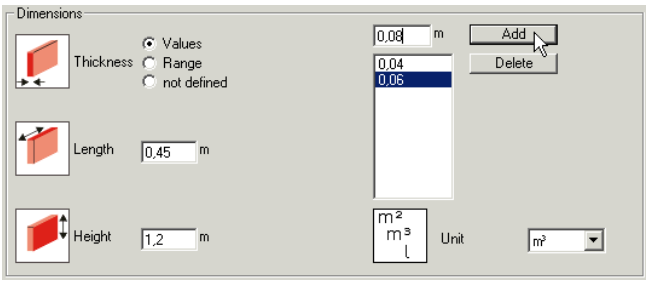
Every 2-dimensional pattern also has is a 3-dimensional pattern assigned to it.

4.6.5 Dimensions

The most essential dimension of any material is the value for the thickness. We can enter this value in three ways:

1. Fixed values ("Values")
2. Range of values ("Range")
3. "Not defined"

In the case of "Values" you can enter one or more values for the thickness.



Using 'Range' the minimum and the maximum thickness is determined.

Using 'Not defined' there is no value to enter.

Depending on this entry the material software reacts different when a material is inserted into a construction.

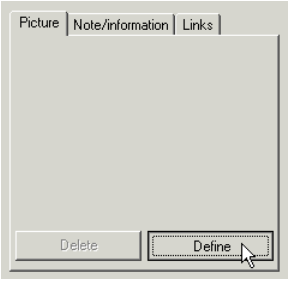
The specification of the unit is only for program internal information and is not used for calculation of the U-value.

4.6.6 Information, links, illustrations

Additional to technical properties there is the opportunity to add visual information about the building material. Possible additional information could include:

1. Picture of the building material
2. Note
3. File with information
4. Link to a URL address
5. Link to Email address
6. Name of manufacturer, address, telephone number

To define a picture click on <*Define*>.



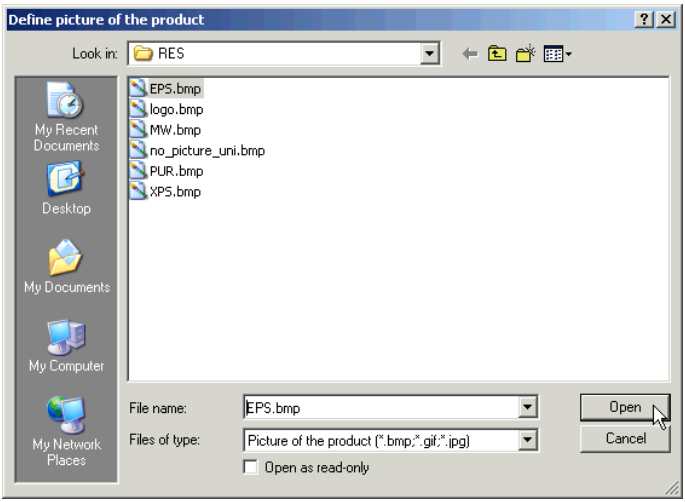
A dialogue opens which allows the selection of the file.

Before you assign a picture to a material you have to assure that the picture is

- filed in the correct folder and
- is a Windows bitmap image file and

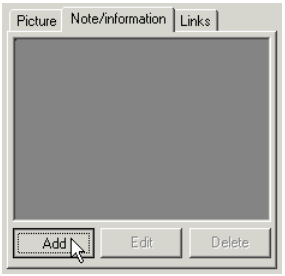
- has a maximum size of 210 pixels horizontal by 148 pixel vertical. This is a Landscape format.

The folder where the picture has to be filed is on the hard disk:
C:\Program Files\BuildDesk UK 3.4\Catalogues\OWN_CATALOGUE\RES

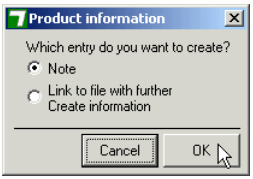


Select the desired picture and confirm with <*Open*>.

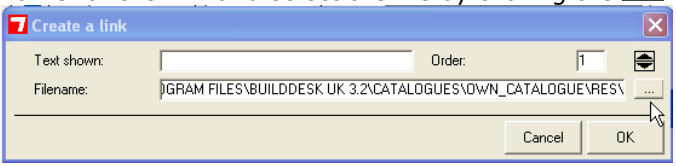
To select a note or an information file select the tab "Note/information" and click on <*Add*>.



Then you are asked to choose an option.



To link a file to the material a dialogue box appears. Enter a short name for the link and select the file by clicking the ... button.

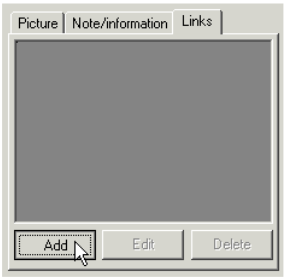


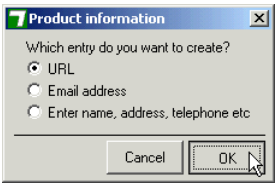
BuildDesk U 3.4 accepts the following file formats for information files:

- AdobeAcrobat Reader files (*.pdf)
- HTML files (*.htm, *.html)

The files have to be stored in the same way as pictures in a folder: C:\Program files\BuildDesk UK 3.4\Catalogues\OWN_CATALOGUE\RES

To define a link select the tab "Links" and click on <*Add*>.





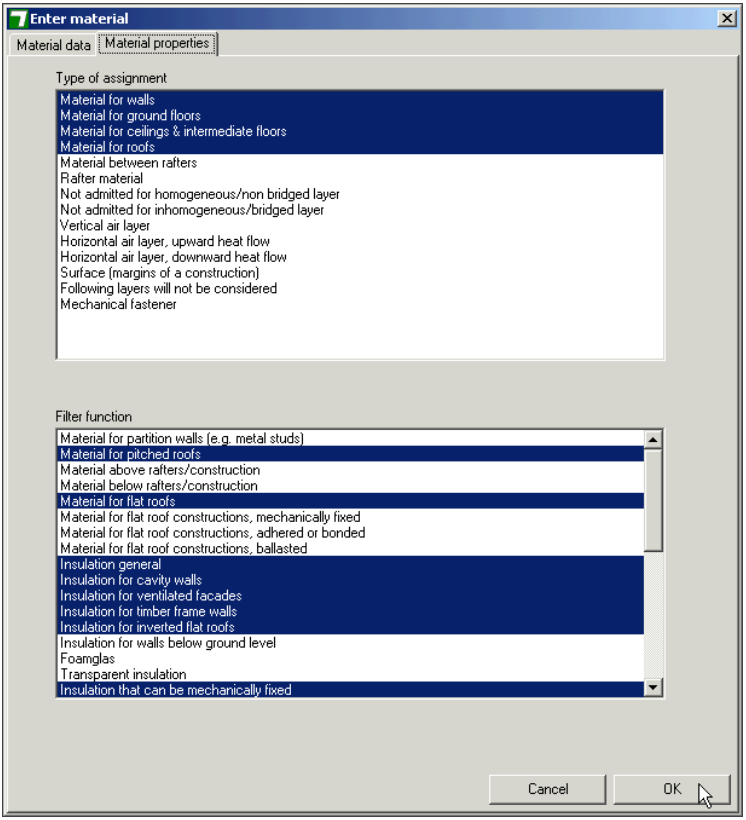
Select an option and enter the desired information.

4.6.7 Material properties

To enable an optimised workflow when searching for a certain building material, additional building material properties have to be defined.

Two different groups of properties are distinguished:

- properties which are necessary for the logical treatment by BuildDesk U 3.4 (usage types)
- properties which enable filter functions to help the user finding a building material (filter types)



Determine the correct types and close the window with <*OK*>.

The meaning of the properties of the first group (usage types) is:

Material for walls	This property defines if a building material is recommended for the construction application which is being created.
Material for ground floors	
Material for intermediate floors	
Material for roofs	
Material between rafters	This property defines the usage for components in inhomogeneous constructions.
Rafter material	
Not admitted for homogeneous/ non bridges layer	
Not admitted for inhomogeneous/ bridged layer	
Vertical air layer	This property defines the usage for constructions with vertical air layer.
Horizontal air layer, upward heat flow	This property defines the usage for constructions with upward heat flows.
Horizontal air layer, downward heat flow	This property defines the usage for constructions with downward heat flows.
Surface (margins of a construction)	This material may only be used on surfaces.
Following layers will not be considered	Using a building material with this property means that all layers following this layer will not be considered in the U-value calculation.
Mechanical fixings	This material may only be used as mechanical fixings.

The meaning of the properties of the second group (filter types) is:

Material for partition walls (e.g. metal studs)	Component application type
Material for pitched roofs	
Material above rafters/construction	
Material below rafters/construction	
Material for flat roofs	
Material for flat roof constructions, mechanically fixed	
Material for flat roof constructions, adhered or bonded	
Material for flat roof constructions, ballasted	
Insulation general	Type of the insulation
Insulation for cavity walls	
Insulation for ventilated facades	
Insulation for timber frame walls	
Insulation for inverted flat roofs	
Insulation for walls below ground level	
Foamglas	
XPS	
Transparent insulation	
Insulation that can be mechanically fixed	
Membranes and tankings	Type of the membrane
Vapour control layer	
Breather membranes	
Bituminous sealing sheet	
Plastic sealing sheet	
Wood	Material type
Concrete	
Metal	
Natural stone	
Plastics	
Filling	
Brick	
Plasterboard & plaster	
Air in general (incl. gases)	Type of the air layer
Air layer, unventilated	
Air layer, slightly ventilated	
Air layer, well ventilated	
Surface, interior	Usage type
Surface, exterior	
Unconsidered layer	

Manufacturers system (treated as single layer)	

4.7 Managing materials and constructions.

Building materials and constructions are organized in catalogues. The place where a building material is filed is either determined by BuildDesk and/or with the manufacturer or it can be determined by the user when saving the material.

Components are filed in the same way as building materials.

The changing of the position of the material can be done by copying the entries. In that case, entries out of protected catalogues like "Rockwool Ltd" can only be copied into the "Own catalogue".

As soon as an element is copied from a protected catalogue into the "Own catalogue", all its physical values can than be changed.

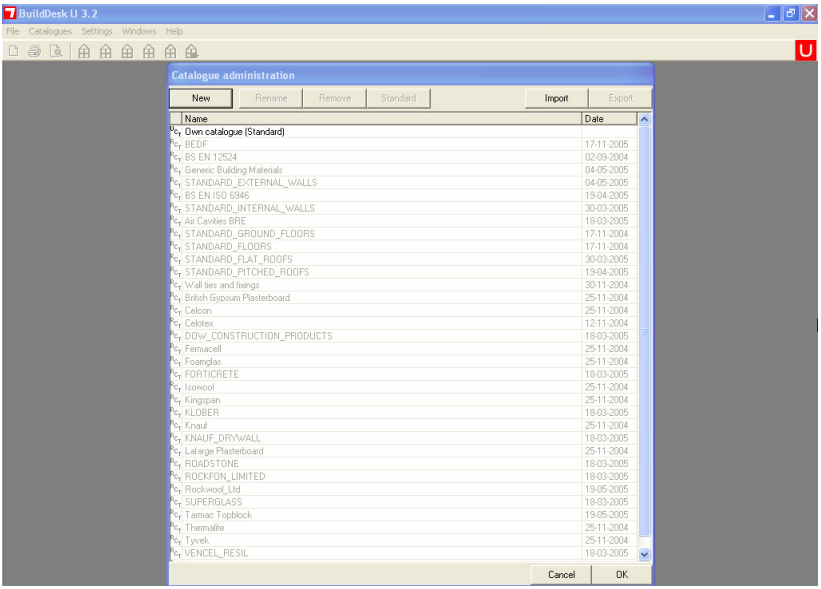
4.8 Managing catalogues

With this function you can:

- Display the date of the catalogues
- Create a new "User defined catalogue"
- Rename a "User defined catalogue"
- Delete a "User defined catalogue"
- Set a "User defined catalogue" as the standard "User defined catalogue".
  (There is only one standard "User defined catalogue" possible at any one time.)
- Import catalogues in the form of *.bdc files
- Export "User defined catalogue" to a *.bdc file

In the menu bar click on <*Catalogues*> and select <*Manage*>

The following figure shows the window, which appears and shows you the used catalogues.

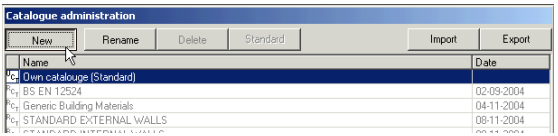


In the list you see the names of the catalogues loaded on BuildDesk U 3.4, its abbreviation and its creation date.

The grey coloured catalogues are “Manufacturer Catalogues” or “Generic Catalogues”. This type of catalogues is closed and cannot be edited.

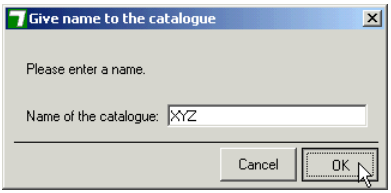
You should also find one or more black coloured catalogues which indicate “User defined Catalogues” which are open and can be edited.

Create a new user defined catalogue by pressing the button *<New>* on the menu bar in the catalogue management window.



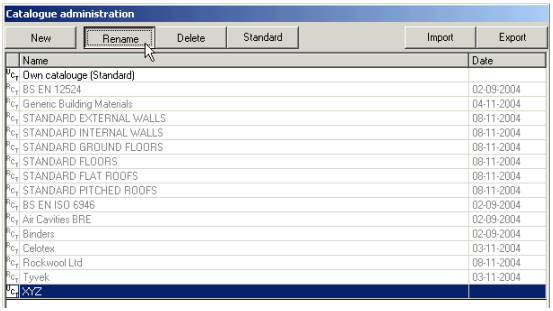
A window appears which asks you to enter the name of the new user catalogue.

Enter the name e.g. “XYZ”.

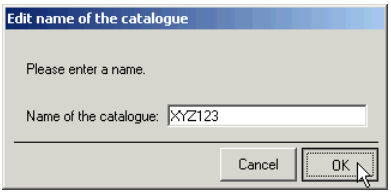


Click <*OK*> to finalise the process.

Rename a user defined catalogue by clicking in the button <*Rename*> on the menu bar in the catalogue management window.

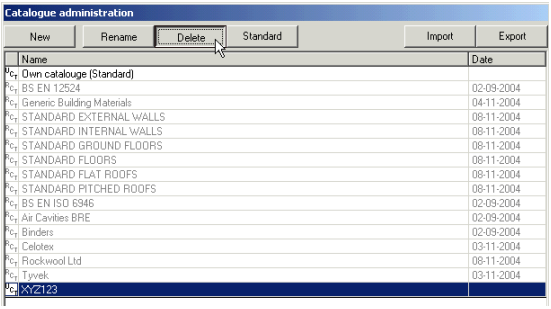


Enter the new name e.g. "XYZ123"

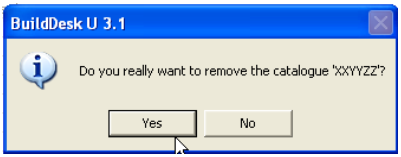


Click <*OK*> to finalise the process.

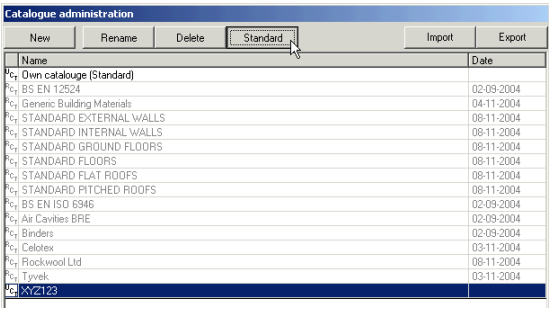
To **Delete a user defined catalogue** select the catalogue you want to remove and click the button <*Delete*> on the menu bar in the catalogue management window.



Confirm the process by clicking *<Yes>*



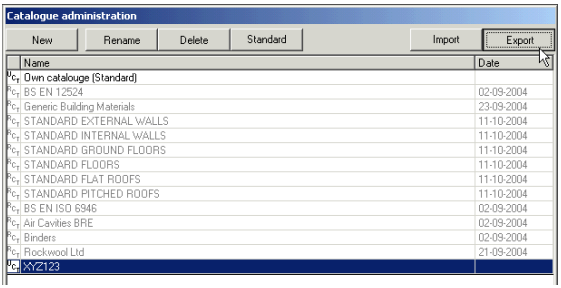
Set a user defined catalogue as standard catalogue means that this will be the default catalogue to store new entered components when saving them.
To do so select the desired catalogue and click the button *<Standard>*



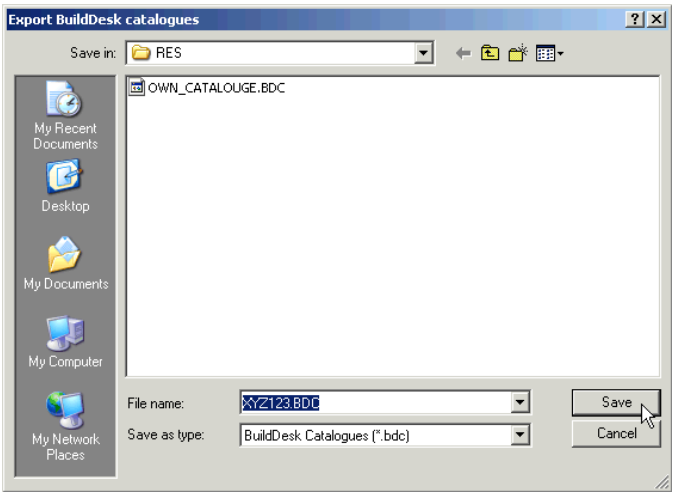
The word "(Standard)" will appear after the name of the new standard catalogue.

The functions **Import and export of catalogues** allows updates of catalogues. The user receives the catalogues by e-mail or via download from our website.

To **export a catalogue** select the desired catalogue in the list and click the button <*Export*>.

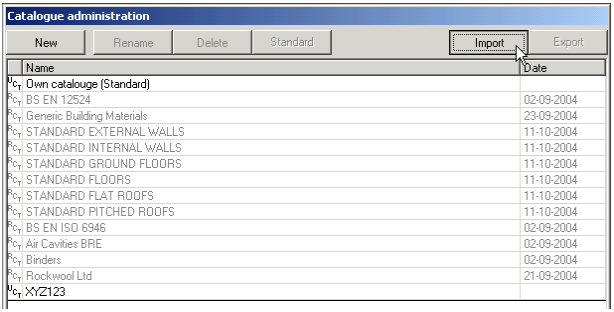


A dialogue opens to select the folder and file name.

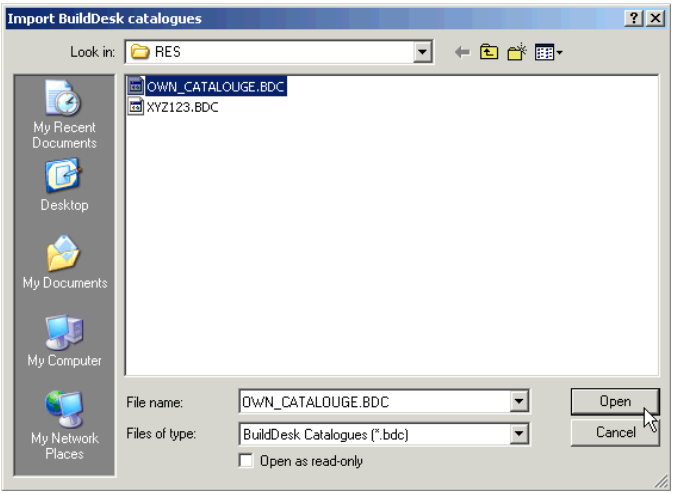


Enter the file name and confirm with <*Save*>.

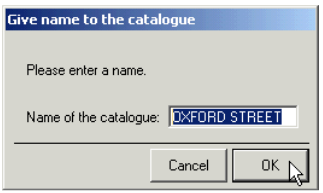
To **import a catalogue** click the button <*Import*>.



In the dialogue window select the desired folder and the .BDC file and <*Open*>.



Enter the name which the new imported catalogue should have in your BuildDesk U 3.4 application and confirm with <*OK*>.



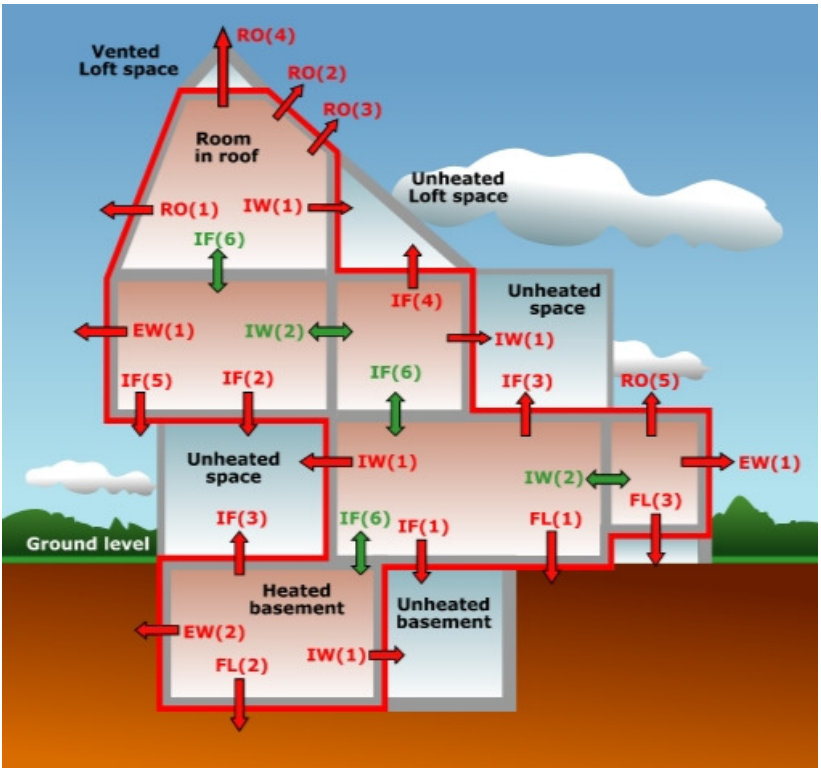
Now the catalogue is imported and shown in your list of catalogues.

5 Thermal transmittance & condensation risk analysis

This section refers to the bases of the calculation of thermal transmittances (U-values) and the performance of a condensation risk analysis.

5.1 Calculation of thermal transmittance (U-value)

This picture shows the different kinds of construction elements and their assignment.
See chapter 4.2 how to set the assignment of a component and chapter 4.2.3 to change the values of default surface resistances.



The following table gives shortcut and description, default surface resistances and calculation rule for each construction element.

Construction element		**R_{si}** m^2K/W	**R_{se}** m^2K/W	**Calc**
EW(1)	Wall adjacent to outside air, heat flow horizontal	0.13	0.04	A
EW(2)	Wall adjacent to ground, heat flow horizontal	0.13	0.00	B
IW(1)	Internal wall adjacent to unheated space (semi exposed), heat flow horizontal	0.13	0.13	C
IW(2)	Internal wall adjacent to heated space	0.13	0.13	A
FL(1)	Ground bearing floor, heat flow downwards	0.17	0.00	B
FL(2)	Basement floor heated space, heat flow downwards	0.17	0.00	B
FL(3)	Suspended floor, heat flow downwards	0.17	0.17	B
IF(1)	Intermediate floor above unheated basement, heat flow downwards	0.17	0.17	B
IF(2)	Intermediate floor above unheated space (semi exposed), heat flow downwards	0.17	0.17	C
IF(3)	Intermediate floor / ceiling to unheated space, heat flow upwards	0.10	0.10	C
IF(4)	Intermediate floor / ceiling below unheated loft space, heat flow upwards	0.10	0.10	C
IF(5)	Floor above outside air (exposed), heat flow downwards	0.17	0.04	A
IF(6)	Intermediate floor, heated spaces above & below	0.11	0.11	A
RO(1)	Roof with a pitch >= 70°	0.13	0.04	A
RO(2)	Pitched roof with insulation between rafters	0.10	0.04	A
RO(3)	Pitched roof with integral insulation	0.10	0.04	A
RO(4)	Pitched roof with insulation between joists	0.10	0.04	A
RO(5)	Flat roof (pitch <= 10°)	0.10	0.04	A

Calculation rule:

A	constructions adjacent to outside air: BS EN ISO 6946 (for light steel-frames: BRE digest 465)
B	constructions adjacent to ground, including floors to unheated basement and suspended floors: BS EN ISO 13370
C	constructions adjacent to unheated spaces: BS EN ISO 6946 (for light steel-frames: BRE digest 465), BS EN ISO 13789, SAP 2005

5.2 Condensation risk analysis

Constructions can also be investigated for condensation risk. Surface condensation may lead to mould growth and interstitial condensation can lead to long term damage of the construction fabric.

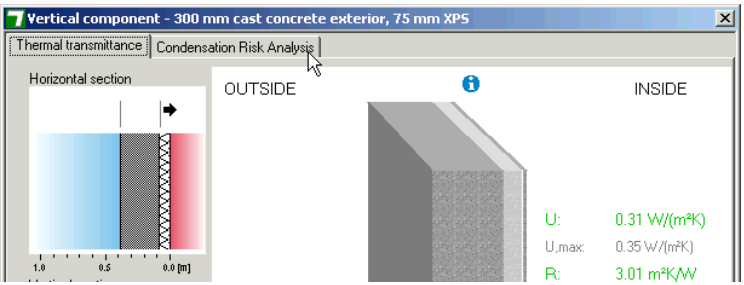
The risk assessment is performed according BS EN ISO 13788.

For a condensation risk analysis to be calculated the following conditions must apply

- A construction must consist solely of homogeneous layers of materials with a valid vapour resistance factor (µ-value)
- Climatic conditions: temperature and relative humidity of the internal and external for each month.

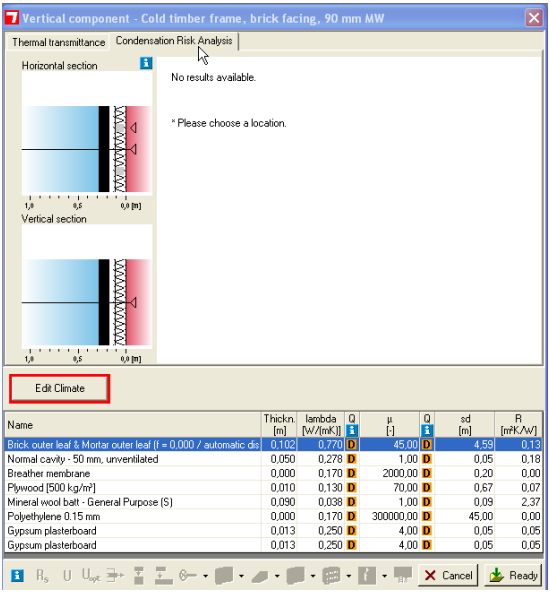
Enter the climatic conditions by choosing a location and a humidity class appropriate for the use of the building. Alternatively, all values can be entered as a free input.

Click on the flag <*Condensation Risk Analysis*>.



Another window opens. (see next page)
Follow the instructions on the next pages.

5.2.1 Entering climate data



Click on <*Edit Climate*> to enter the environmental conditions.

You have two possibilities to enter the necessary data:

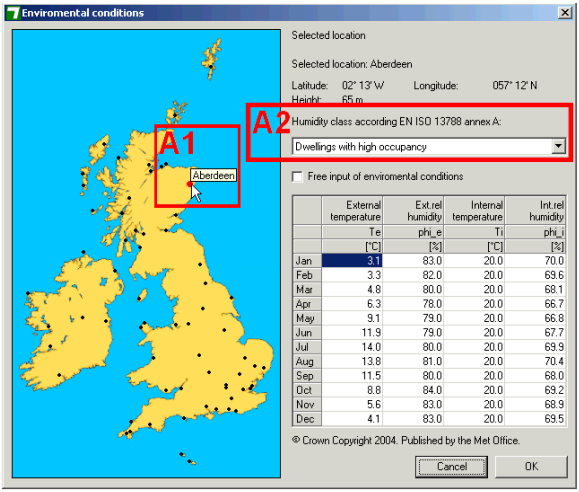
- Select the environmental conditions from a reference location and the humidity class or
- By free input of the temperature and humidity values.

Selection of the location and humidity class

BuildDesk has entered the external temperature and humidity values for over 60 reference locations covering the United Kingdom and the Republic of Ireland. The internal temperature and humidity values for humidity classes according to BS EN ISO 13788 annex A are also provided.

To work with these values, first select a reference location on the map at the right hand side (see A1 the picture below). So the external values are selected.

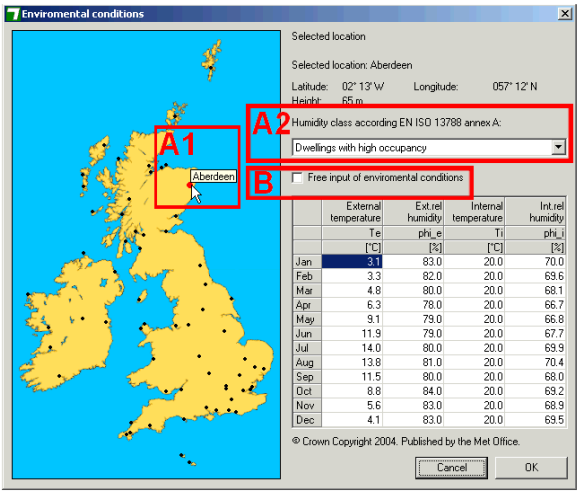
Then select a humidity class by choosing the option from the drop down menu (see A2 the picture below).



Click <*OK*> to save the values and resume.

Selection of the location and humidity class

The second method of entering the external and internal conditions is by the free input of values.



It is necessary to select a location which has conditions that are similar to those of the desired destination. (see A1 in the above picture)
By selecting this location, the table is filled with reference values of the locations external values and the internal reference values of "dwellings with low occupancy" according to
BS EN ISO 13788 annex A.

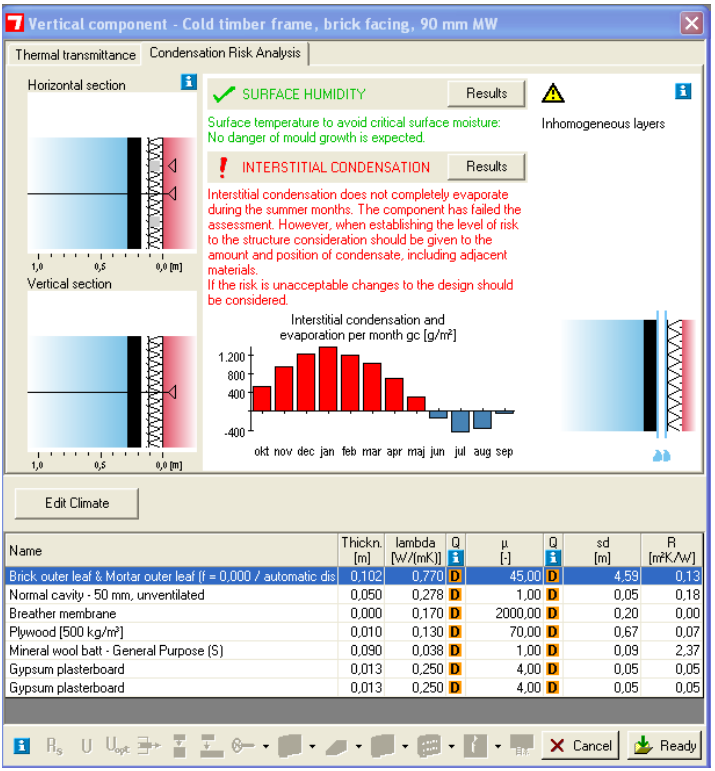
You can also change the humidity class to get internal values that are nearer to your values. Do this by choosing the option from the drop down menu (see A2 at the picture above).

Now select the box at <*Free input of environmental conditions*> (see B at the picture above) to make the values in the table editable.
Then edit the values by double-clicking at the field and entering your values.

Click <*OK*> to save the values and resume.

5.2.2 Results on the screen

As soon as the internal and external climate conditions are entered, the results of the condensations risk analysis are shown as a summary similar to the following.



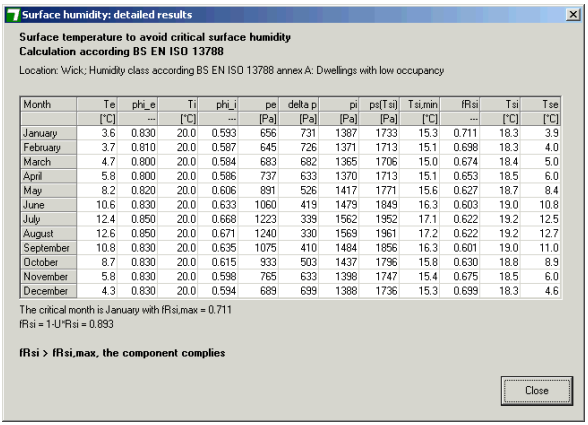
At the top you can see results for the surface humidity and the interstitial condensation of the component.
Green text and a check mark indicates a positive result.
Red text and an exclamation mark indicates a negative result.

The graph below shows the condensation and/or the evaporation for each month.
The position of the interface layer, where condensation is predicted is indicated as a blue line in the drawing next to the graph.

Surface humidity: detailed results

To get detailed results of the surface humidity click on the button:

A window opens where you can see the detailed results.

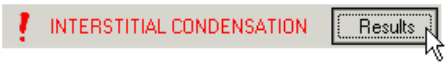


Month	Te	phi_e	Ti	phi_i	pe	delta p	pi	ps(Tsi)	Tsi,min	fRsi	Tsi	Tse
	[°C]	---	[°C]	---	[Pa]	[Pa]	[Pa]	[Pa]	[°C]	---	[°C]	[°C]
January	3.6	0.830	20.0	0.593	656	731	1387	1733	15.3	0.711	18.3	3.9
February	3.7	0.810	20.0	0.587	645	726	1371	1713	15.1	0.698	18.3	4.0
March	4.7	0.800	20.0	0.584	683	682	1365	1706	15.0	0.674	18.4	5.0
April	5.8	0.800	20.0	0.586	737	633	1370	1713	15.1	0.653	18.5	6.0
May	8.2	0.820	20.0	0.606	891	526	1417	1771	15.6	0.627	18.7	8.4
June	10.6	0.830	20.0	0.633	1060	419	1479	1849	16.3	0.603	19.0	10.8
July	12.4	0.850	20.0	0.668	1223	339	1562	1952	17.1	0.622	19.2	12.5
August	12.6	0.850	20.0	0.671	1240	330	1569	1961	17.2	0.622	19.2	12.7
September	10.8	0.830	20.0	0.635	1075	410	1484	1856	16.3	0.601	19.0	11.0
October	8.7	0.830	20.0	0.615	933	503	1437	1796	15.8	0.630	18.8	8.9
November	5.8	0.830	20.0	0.598	765	633	1398	1747	15.4	0.675	18.5	6.0
December	4.3	0.830	20.0	0.594	689	699	1388	1736	15.3	0.699	18.3	4.6

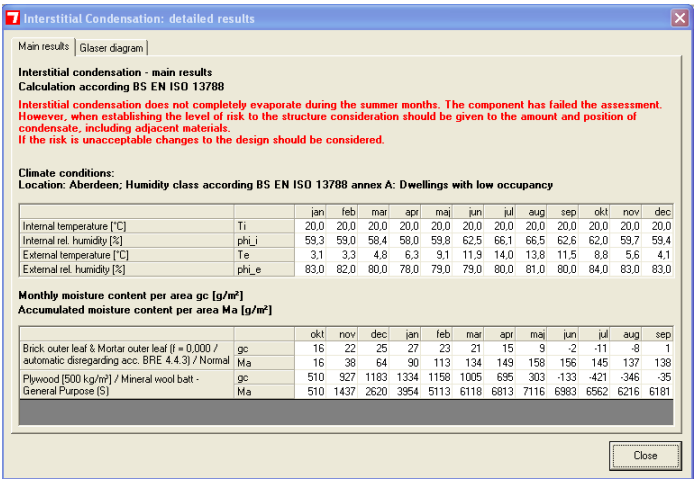
Click <*Close*> to go back to the summary view.

Interstitial condensation: Main Results

To get detailed results of the interstitial condensation click on the button:



A window opens where you can see the detailed results.



		jan	feb	mar	apr	maj	jun	jul	aug	sep	okt	nov	dec
Internal temperature [°C]	Ti	20,0	20,0	20,0	20,0	20,0	20,0	20,0	20,0	20,0	20,0	20,0	20,0
Internal rel. humidity [%]	phi_i	59,3	59,0	58,4	58,0	59,8	62,5	66,1	66,5	62,6	62,0	59,7	59,4
External temperature [°C]	Te	3,1	3,3	4,8	6,3	9,1	11,9	14,0	13,8	11,5	8,8	5,6	4,1
External rel. humidity [%]	phi_e	83,0	82,0	80,0	78,0	79,0	79,0	80,0	81,0	80,0	84,0	83,0	83,0

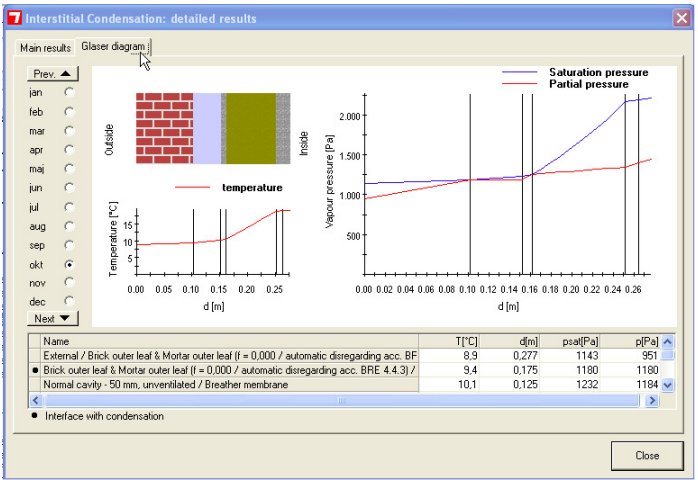
		okt	nov	dec	jan	feb	mar	apr	maj	jun	jul	aug	sep
Brick outer leaf & Mortar outer leaf (f = 0,000 / automatic disregarding acc. BRE 4.4.3) / Normal	gc	16	22	25	27	23	21	15	9	-2	-11	-8	1
	Ma	16	38	64	90	113	134	149	158	156	145	137	138
Plywood [500 kg/m³] / Mineral wool batt - General Purpose (S)	gc	510	927	1183	1334	1158	1005	695	303	-133	-421	-346	-35
	Ma	510	1437	2620	3954	5113	6118	6813	7116	6983	6562	6216	6181

The main results view displays the detailed results of internal and external humidity and temperature.

You see the amount of condensate per month "gc" in [g/m^2] and the sum of condensate in each month "MA" in [g/m^2].

Interstitial condensation: Glaser diagram

To see the corresponding Glaser diagrams click on the flag *<Glaser diagram>*.



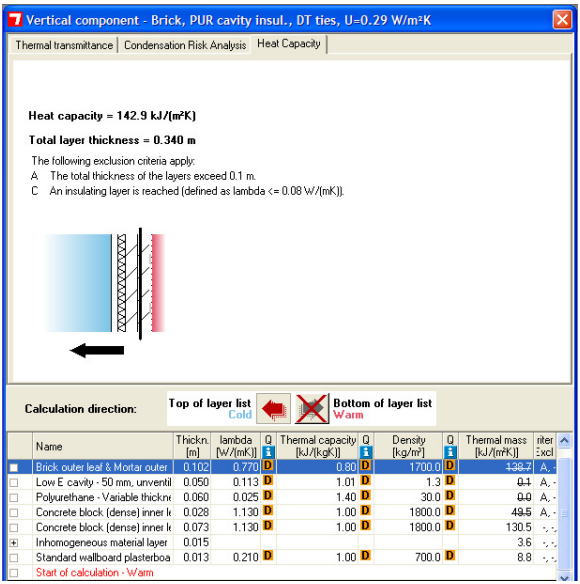
Name	T[°C]	d[m]	psat[Pa]	p[Pa]
External / Brick outer leaf & Mortar outer leaf (f = 0,000 / automatic disregarding acc. BF	8,9	0,277	1143	951
Brick outer leaf & Mortar outer leaf (f = 0,000 / automatic disregarding acc. BRE 4.4.3) /	9,4	0,175	1180	1180
Normal cavity - 50 mm, unventilated / Breather membrane	10,1	0,125	1232	1184

At the top of the window you see the Glaser diagrams for each month and in the table below that, the physical values are shown.

5.3 Heat Capacity (Kappa value κ)

The new SAP 2009 and existing SBEM calculations will be heavily influenced by the thermal capacity of the internal and external construction elements. Once you have modelled the build up of layers for the U-value calculation you can obtain the heat capacity value via the new Thermal capacity **κ** calculation tab.

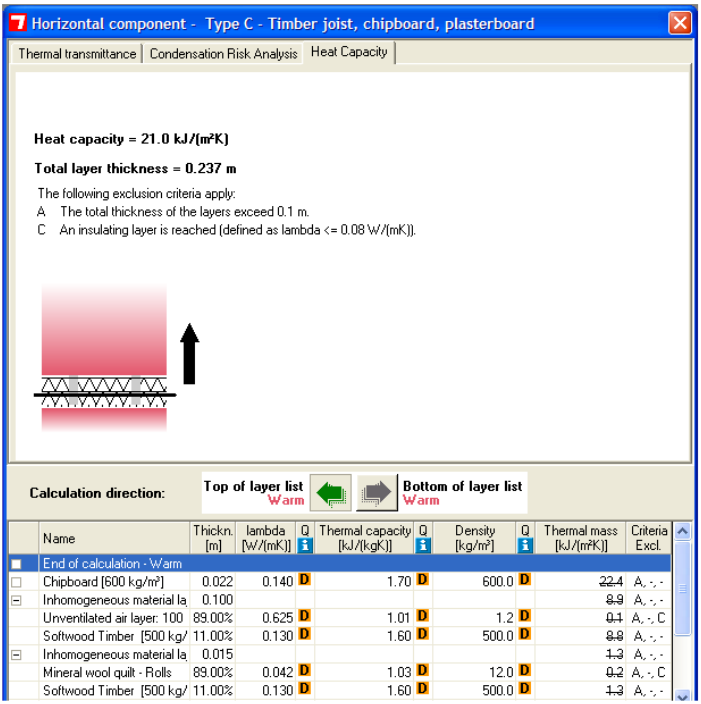
The κ-value is the effective heat capacity per unit area and is a measure of the thermal response characteristics of the construction. The higher the number, the more heat will be stored for later release.



In the case of internal walls and floors, the heat capacity may be needed for each side of the element. Many internal constructions are not symmetrical and in these cases you may need to take an average of the calculation from both sides.

From the calculation rules, the position of the insulating layer is important, internal insulation or lightweight framed constructions can reduce the effective heat capacity substantially.

BuildDesk U allows you to calculate internal U-values and so the heat capacity can also be calculated. You are able to switch the 'Calculation direction' in BuildDesk U to check the heat capacity from both sides.



The heat capacity results will then be used in the whole building SAP 2009 or SBEM calculations to calculate the Thermal Mass or Thermal Mass Parameter (TMP) of the building.

The printout of the heat capacity calculation result is available via the print preview in the symbol bar.

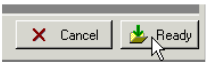
6 Documentation of results

6.1 Saving components

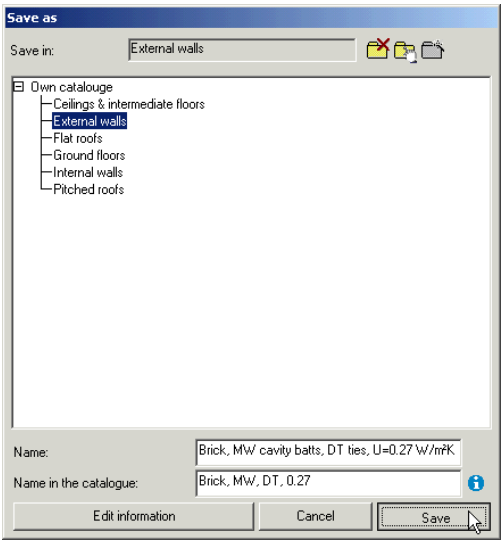
After you have entered all the layers of your component, the construction is saved in the component catalogue.

Because of the restricted status of the manufacturer catalogues the new or edited component can only be saved in the "Own catalogue" which is set as the standard catalogue.

To save the component, click on the button <*Ready*> on the lower side of the window.



A new dialogue opens where you are asked to select the folder of your catalogue and enter the long- and the short name for the component.



With the three buttons on the upper right side of the window, you can:

- Delete the selected folder of the catalogue
- Edit the selected folders name
- Add a new folder when the catalogue is selected

Short and long names

BuildDesk U 3.4 databases use short and long names for materials and constructions.

The short names - the entry in the field *"Name in the catalogue"* - should be easy to recognize – and give the user a quick overview of the database contents.

The long names - the entry in the field *"Name"* - are used at several places in the program where a full description is required e.g.

- Print outs
- In the list below the main central screen
- Information pages.

If new materials or constructions are being entered, both names have to be given. The short and long names you use must not exceed a maximum length of 50 characters.

6.2 Printing components

You can only print the component that is visible in the selected component creation window (see 3.4 The construction entry window).

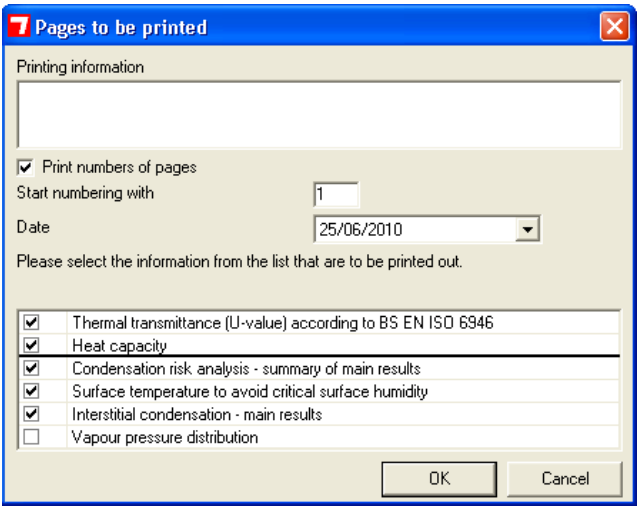
Then click on button in the symbol row.

If there is more than one page to be printed, a dialogue window opens where you are asked to select the information that you wish to be printed.

Click on <*Print*>.

A further option is to use the print preview button.

In this dialogue you choose what you want to preview



By clicking on the printer symbol the Windows dialogue to select a printer is opened. Select the desired printer and the job is sent to the printer.

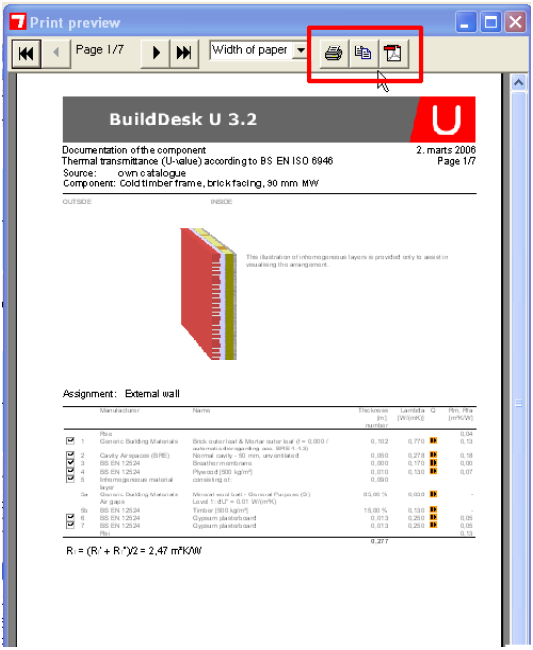
In addition to the print out on paper there are two other ways to document your results:

- Copy the print preview into the clipboard.
- Create an Acrobat Reader pdf file out of the print preview.

By copying the print preview into the clipboard the results can be pasted into other applications (e.g. Microsoft Word).

With the function

an Adobe Acrobat Reader file (.pdf) is created.



Data exchange
BuildDesk U 3.4 does not work with projects but exclusively with catalogues.

All building materials out of the catalogues can be used with other BuildDesk programs with the same software version number. This means that the catalogues are exchangeable.

6.3 Data exchange with BuildDesk Energy Design 3.4

If the programs BuildDesk Energy Design 3.4 are installed in the same (recommended) folder
'C:\Programs\BuildDesk UK 3.4'
all three programs use by default the same catalogues for components and for building materials.

When you work with BuildDesk U 3.4 and BuildDesk Energy Design 3.4 at a later date you should install these programs into the same recommended folder. This way you can avoid building up similar constructions or materials for each program.