USER GUIDE

VECTORWORKS EMBODIED CARBON CALCULATOR

DIGITAL PRACTICE WORKFLOWS

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INTRODUCTION

The construction industry has been aware for a long time that the operation of buildings produces emissions that harm the planet. Reductions in operational energy of the built environment have brought into sharp focus the way we build and what we build from. This bigger picture is known as project life cycle or 'cradle to grave'.

Measuring embodied carbon for construction projects begins at the source of building materials, or ‘the cradle’. It represents the total sum of emissions required to produce goods (such as a building material) or activities (such as transporting those materials to the construction site), hence the emissions are considered to be ‘embodied’ in the product. Embodied Carbon is usually expressed in kilograms of CO2 equivalent emissions released to create a kilogram of product (kgCO2e/kg). The concept of embodied energy is also used sometimes, and expressed in megajoules per kilogram (MJ/kg).

Emissions released throughout the supply chain, often called cradle to (factory) gate, and gate to site (transport), are being increasingly recognised as embodied carbon is considered to account for 20-50% of whole life carbon emissions (embodied + operational) for new buildings.

In the UK, London Plan 2021 Policy SI 2 sets out a requirement for developments to calculate and reduce WLC emissions in planning applications which are referred to the Mayor. As this comittment framework and other targets of achieving Net Zero carbon in both construction and operation are set by governments and legislative bodies, reducing embodied carbon emissions becomes critical, as does the need for tools to assess it. Being able to easily show the difference between emissions of locally sourced timber and steel imported from a different continent, should provide designers with confidence when assessing their models.

Vectorworks Embodied Carbon Calculator (VECC) has been developed in accordance with and following the recommendations of *RICS Whole life carbon assessment for the built environment, 2017* and *RIBA Embodied and whole life carbon assessment for architects, 2018*, as the industry standard and most comprehensive guidance available in AEC industry.

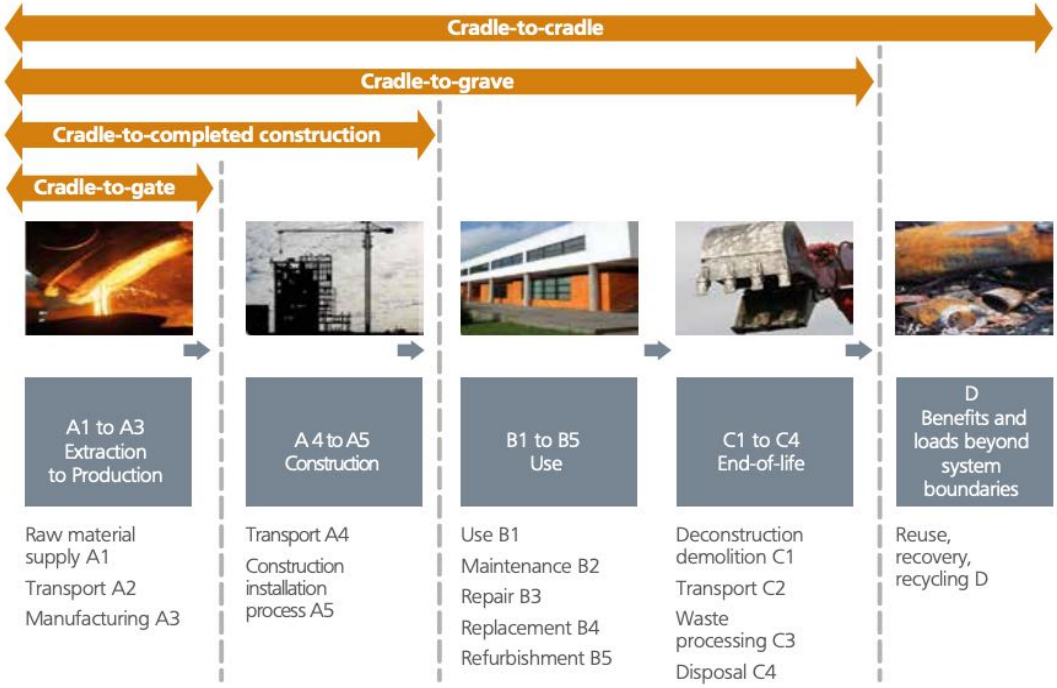
Currently, VECC deals with Stages A, B and C of Project Life Cycle as per *BS EN 15978 - Cradle to practical completion (handover)*.

Sections are split into:
[A1-A3] - Product stage or cradle to gate
[A4] - Transport stage or gate to site
[A5] - Construction stage
[B4] - Replacement stage
[C1] - Deconstruction and Demolition
[C3] - Waste processing for reuse, recovery or recycling stage
[C4] - Disposal stage

In addition to this, **[B6]** Operational energy use can be calculated using the Energos tool within Vectorworks, in order to complete the carbon emissions assessment.

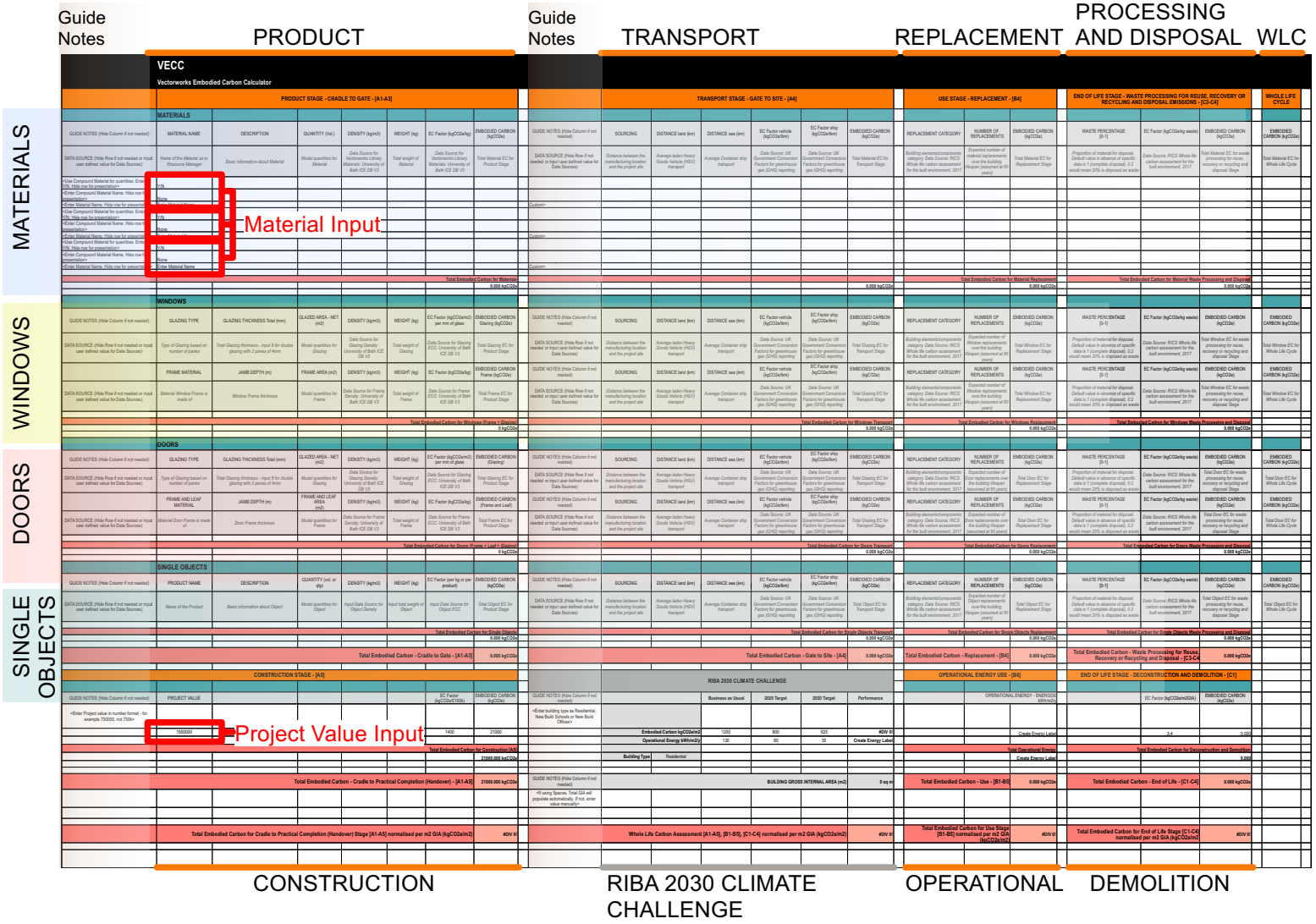
Results can be benchmarked against RIBA 2030 Climate Challenge directly in VECC.

Default material properties for Embodied Carbon and Density applied to Vectorworks Materials within this file come from the *University of Bath Inventory of Carbon and Energy (ICE) Database V3, 2019*.



Life Cycle Assessment (LCA) information modules for the construction sector (BRE)
Source: UK Green Building Council - Embodied Carbon: Developing a Client Brief, March 2017

OVERVIEW



Vectorworks Embodied Carbon Calculator is a live worksheet, associated with the Vectorworks BIM model, which automatically identifies volume of objects and applies values embedded in Vectorworks Materials in order to calculate embodied carbon values.
VECC, Default Materials and Embodied Carbon Sheet Record Format can be found as resources in the downloaded .vwx file and can be copied and pasted into any other Vectorworks file and will be ready to use (alternatively import them into the desired Vectorworks file via the Resource Manager in the standard manner for resources). It can also be found in Tools>Reports>Create Report>Preformatted Report>Embodied Carbon Calculator.

VECC is organised in columns by project life cycle stage - as seen in the figure, Product Stage comes first, followed by Transport, Replacement and Waste processing for reuse, recovery or recycling and Disposal Stage to the right of it, followed by Whole Life Cycle (WLC) totals at the rightmost end of worksheet.
Construction, Deconstruction and Demolition Stages are found below them, with RIBA 2030 Climate Challenge Benchmark also located at the foot of the table. Operational Energy use is also located at the bottom of the table, though this stage only references the results that need to be obtained through Energos.
There is a Guide Notes column to the left of each stage which can be hidden for presentation and printing of results.

Carbon critical elements, defined by RICS document as building components recommended to be included as a minimum in the embodied carbon calculations. Vectorworks Materials should be used as the main method of obtaining material quantity take-offs, and are the first group of rows in VECC, followed by Windows and Doors.
Single Objects can be assessed on an individual basis using Embodied Carbon Sheet Record Format.

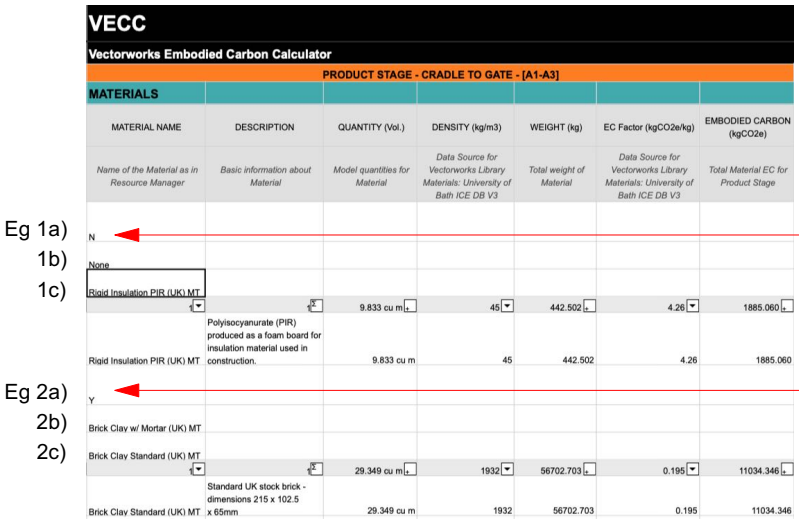
This worksheet structure allows for materials and building components assessment to be followed on an individual basis in rows from left to right through life cycle stages through to totals, and to assess life cycle stages for all relevant components in columns from top to bottom. Construction, Operational Energy Use, Deconstruction and Demolition are located below building components because their emissions are assessed based on those processes and related activities rather than on individual building component basis.

PRODUCT STAGE [A1-A3]

Materials

VECC requires information to be input into 3 fields directly in the worksheet cells:

- Y or N (Use Compound Material for Quantities?)
- Compound Material Name
- Simple Material Name



VECC

Vectorworks Embodied Carbon Calculator

PRODUCT STAGE - CRADLE TO GATE - [A1-A3]

MATERIALS

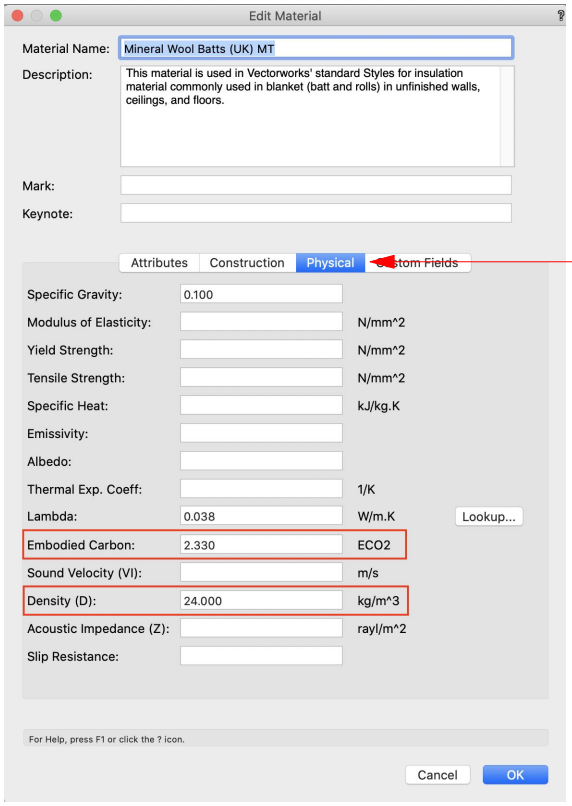
	MATERIAL NAME	DESCRIPTION	QUANTITY (Vol.)	DENSITY (kg/m3)	WEIGHT (kg)	EC Factor (kgCO2e/kg)	EMBODIED CARBON (kgCO2e)
	Name of the Material as in Resource Manager	*Basic information about Material*	*Model quantities for Material*	*Data Source for Vectorworks Library Materials: University of Bath ICE DB V3*	*Total weight of Material*	*Data Source for Vectorworks Library Materials: University of Bath ICE DB V3*	*Total Material EC for Product Stage*
Eg 1a)	N						
1b)	None						
1c)	Rigid Insulation PIR (UK) MT		9.833 cu m	45	442.502	4.26	1885.060
	Rigid Insulation PIR (UK) MT	Polyisocyanurate (PIR) produced as a foam board for insulation material used in construction.	9.833 cu m	45	442.502	4.26	1885.060
Eg 2a)	Y						
2b)	Brick Clay w/ Mortar (UK) MT						
2c)	Brick Clay Standard (UK) MT		29.349 cu m	1932	56702.703	0.195	11034.346
	Brick Clay Standard (UK) MT	Standard UK stock brick - dimensions 215 x 102.5 x 65mm	29.349 cu m	1932	56702.703	0.195	11034.346

Example of Material input in VECC

Example 1: (a Simple Material)
- 1a. N
- 1b. None
- 1c. Rigid Insulation PIR (UK) MT

Example 2: (a Compound Material)
- 2a. Y
- 2b. Brick Clay w/ Mortar (UK) MT
- 2c. Brick Clay Standard (UK) MT

The information to be input relates to information found in Vectorworks Materials within the Resource Manager for this file. These materials are tagged with the term 'Embodied Carbon' and can be searched for in the Resource Manager search feature.



Material Physical Properties - Embodied Carbon and Density

Within the Edit Material dialog for each material, values for the following fields should be populated:

For the Product Stage Calculations
Physical tab:
- •Embodied Carbon
- •Density

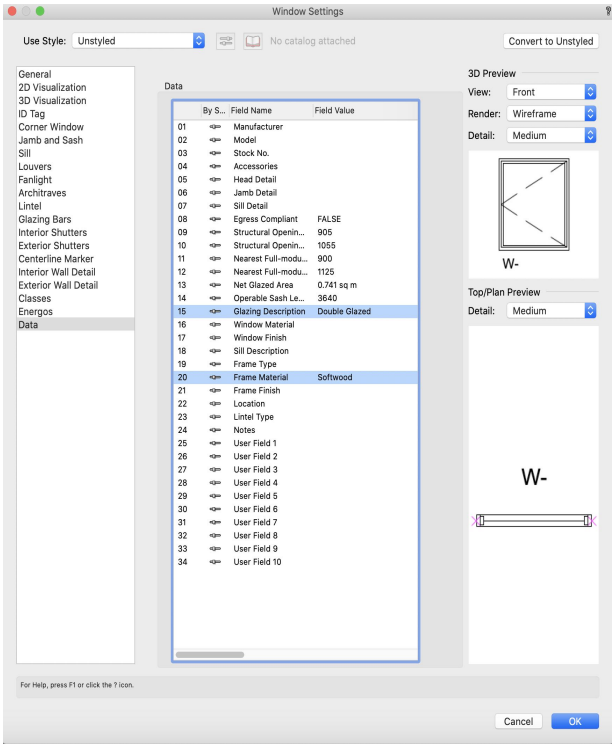
For Transport Stage Calculations
Construction tab:
- •Product Source

Also within the Edit Material dialog, Report as Volume needs to be checked so correct quantities can be obtained.

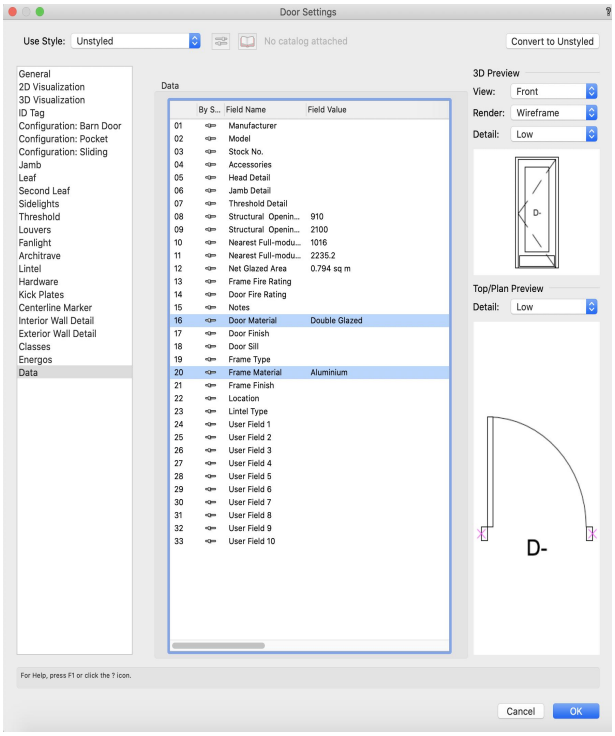
Values for Embodied Carbon (EC) and Densities are often found for compound materials such as *Brick Clay w/ Mortar (UK) MT* instead of separated into constituent 'simple' materials - *Brick Clay Standard (UK) MT* + *Mortar (UK) MT*. It is therefore recommended to use such materials. As seen in example 2 using *Brick Clay w/ Mortar (UK) MT* above, for these and similar materials (like reinforced concrete), input 2a) should be Y and input 2b) should be the Compound Material Name eg. *Brick Clay w/ Mortar (UK) MT*.

However the simple material name, eg *Brick Clay Standard (UK) MT,* still needs to be input for 2c) because Embodied Carbon and Density properties will be populated from the main constituent Simple Material in this version.

For compound materials such as Insulated Studwork, it would be recommended to use N for first input and obtain separate quantities for Simple Materials - Timber/Metal studs + Insulation as properties of those materials are found separate from each other.



Door Settings / Data Pane - Door Material and Frame Material input for calculations



Window Settings / Data Pane - Glazing Description and Frame Material input for calculations

Windows and Doors

VECC will report all Window and Door objects in the file. The calculation separates Glazing and Frame for Windows, and Glazing and Frame + Leaf for Doors, making the assumption that the door leaf and frame will be made of the same material.

- **Glazing**

- Glazing Type - In preparation, Single Glazing, Double Glazing or Triple Glazing should be entered into the Window/Door PIO dialogs via Data > Glazing Description for Windows and Data > Door Material for Doors. The words (Single Glazing, Double Glazing, Triple Glazing) should then be input into the Glazing Type cells in VECC, spelled identically, for the formulas to work. The entry can be left blank for Non-glazed Doors.

- Glazing thickness - This is input directly into the VECC. EC Factor values for Single Glazed, Double Glazed and Triple Glazed glass unit are obtained per mm of glass thickness. The number entered should be total glass thickness across multiple panes - ie. for Double Glazed unit 8mm Glazing Thickness means 4mm + 4mm (spacer thickness is not taken into account). If there are Fanlights (Window and Door), Sidelights, Vision Panels or Leaf Top Panel Glazing, the thicknesses should be entered for those as well. Please note that while total net glazed areas will be correctly calculated regardless of different glazing elements present, only same thickness glazing is supported at the moment - ie. both Sidelight glazing and Fanlight glazing need to be the same.

- **Frame**

- Frame Material - The Frame Material should be entered into the Window/Door dialog via Data > Frame Material. As stated above, in the case of Doors, this applies to Leaf as well as Frame. Currently, Hardwood, Softwood, Aluminium, PVC and Composite are supported. Composite assumes a default mix of 80% softwood and 20% aluminium.
The words (Hardwood, Softwood, Aluminium, PVC, Composite) should be input, spelled identically, for the formulas to work.

- Jamb Depth - Jamb Depth will determine quantities of frame material and as such will have an impact on final results.

- **Note:** The approach above performs a carbon assessment of Windows and Doors based on the generic Materials they are made of. In the event that the EC factor for these products is available via manufacturer EPDs, they can be treated as Single Objects instead - see page 5. If this is the case, the Single Objects Report Criteria should be edited so *Type is not Window* and *Type is not Door* is removed as Criteria.

In order to avoid double reporting, also hide the Windows/Doors row AND remove these cells references from the totals calculation formula.

PRODUCT STAGE [A1-A3]

Single Objects

Environmental Product Declarations (EPD) are sometimes given on a product basis rather than per Material quantity. For example, sanitaryware items or kitchen elements. VECC accomodates such objects via the 'Single Objects' rows which count by quantity instead of volume.

Items for inclusion as Single Objects need to be assigned the *Embodied Carbon Sheet* Record Format (available in the Resource Manager). As demonstrated in the image to the left, the record fields mirror the properties used for the Materials based approach.

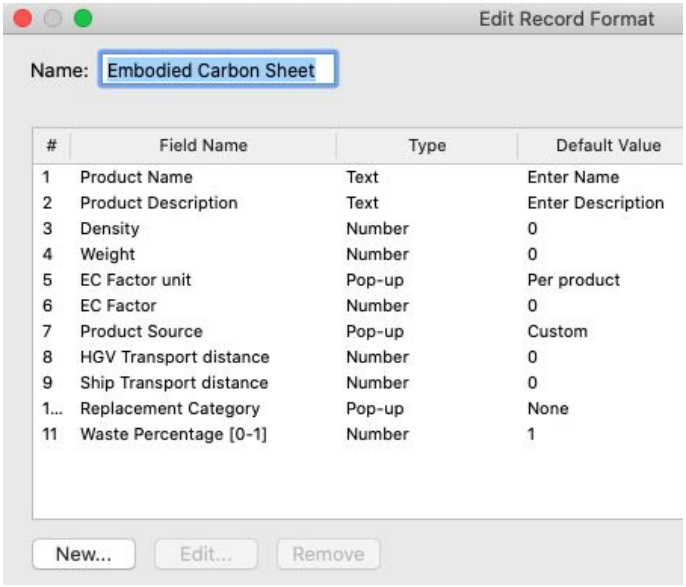
The VECC worksheet will automatically find those objects that have the record attached, but also filter out any that have Materials or are either Doors or Windows from the Single Objects section, in order to safeguard against double reporting. Objects are grouped (summarized) by Product Name in the first column.

The input required is based on the two approaches:

1. EC Factor unit choice - *Per Product*
    - Enter Product Name and Description
    - Enter EC factor
    - Enter Weight
    - Enter Product Sourcing (see page 6)

2. EC Factor unit choice - *Per kg*
    - Enter Product Name and Description
    - Enter EC factor
    - Enter Density
    - Enter Product Sourcing (see page 6)

The quantity reported will depend on the EC value unit. Per Product will give quantity in instances of that object, while Per kg will report Volume. Per kg requires Density to be entered and Weight will be calculated automatically, while Per Product requires the Product weight to be entered (density is irrelevant in this case).

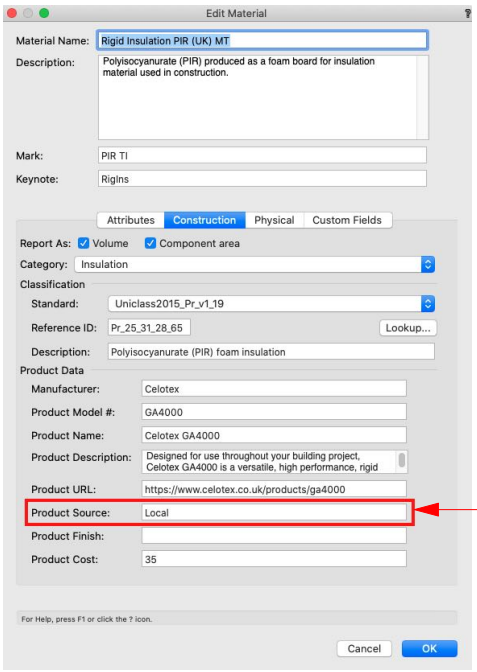


Embodied Carbon Sheet Record Format - Carbon assessment on a Single Object basis

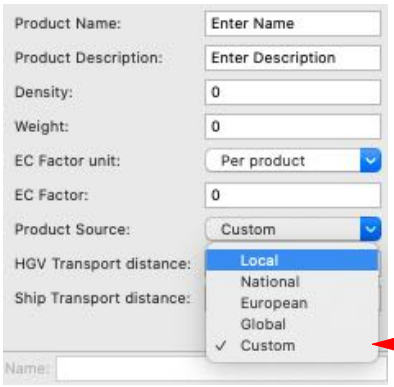
SINGLE OBJECTS						
PRODUCT NAME	DESCRIPTION	QUANTITY (vol. or qty)	DENSITY (kg/m3)	WEIGHT (kg)	EC Factor (per kg or per product)	EMBODIED CARBON (kgCO2e)
Name of the Product	*Basic information about Object*	*Model quantities for Object*	*Input Data Source for Object Density*	*Input total weight of Object*	*Input Data Source for Object ECC*	*Total Object EC for Product Stage*
3	3	6.137	1547	4900.366	286.27	11511.416
External Wall	Brick cavity external wall	3.137	1547	4852.166	2.27	11014.416
Washbasin	Wall mounted vitreous china left handed washbasin	2	0	19.2	213	426
Toilet	One piece wall hung ceramic toilet	1	0	29	71	71

Example of Single Object carbon assessment showing Per Product and Per kg approach

TRANSPORT STAGE [A4]



Material Construction Properties - Product Source



Embodied Carbon Sheet RF - Product Source

Materials
VECC uses results from Product Stage [A1-A3] to obtain quantities for transport.
The Material >Material Construction>Product Source field should also be populated as per the options detailed below.

Default Distances
These options trigger default transport scenarios and distances by land and sea to be automatically populated in the VECC:

- Local - default transport distance is 50km by road
- National - default transport distance is 300km by road
- European - default transport distance is 1500km by road
- Global - default transport distance is 200km by road and 10000km by sea

The words (Local, National, European, Global) should be input spelled identically for the formulas to work.

Custom Distances
Enter the word 'Custom' in the Product Source field or leave the field blank. Embodied Carbon Sheet Record Format needs to be attached to the Material, and selecting *Custom* under Product Source allows the user to enter a number in *HGV transport distance* field for road transport and *Ship transport distance* field for sea transport (ie. 384 for 384km distance).

Single Objects, Windows and Doors
VECC uses results for Product Stage [A1-A3] to obtain quantities for transport.
In addition to this it needs input for sourcing of each object in Product Source field of the Embodied Carbon Sheet Record Format.
Default transport scenarios and distances by land and sea are same as above and are automatically populated when selected, while custom distances are also obtained as detailed above.

TRANSPORT STAGE - GATE TO SITE - [A4]						
INSTRUCTION (Hide Column if not needed)	SOURCING	DISTANCE land (km)	DISTANCE sea (km)	EC Factor vehicle (kgCO2e/tkm)	EC Factor ship (kgCO2e/tkm)	EMBODIED CARBON (kgCO2e)
	Distance between the manufacturing location and the project site	*Average laden Heavy Goods Vehicle (HGV) transport*	*Average Container ship transport*	*Data Source: UK Government Conversion Factors for greenhouse gas (GHG) reporting*	*Data Source: UK Government Conversion Factors for greenhouse gas (GHG) reporting*	*Total Material EC for Transport Stage*
<Enter Product Sourcing as Local, National, European, Global or Custom>	1	1	0	0.21275	0.016142	5917.079
	600	600	0	0.21275	0.016142	5917.079
<Enter Product Sourcing as Local, National, European, Global or Custom>	1	50	0	0.21275	0.016142	4.742
	Local	50	0	0.21275	0.016142	4.742

Example of Transport Stage calculation in VECC

CONSTRUCTION STAGE [A5]

VECC only requires a single Project value as input to perform the calculations for the construction stage. The number should be input as an integer to the nearest pound sterling ie. 750000, not as 750k or 0.75M in order for the formulas to work.

As recommended by *RICS Whole life carbon assessment for the built environment, 2017* the calculation is based on 1400 kgCO2e per £100k of Project Value as the benchmark value for construction site building emissions.

48	**CONSTRUCTION STAGE - [A5]**						
49							
50	PROJECT VALUE					ECC (kgCO2e/£100k)	EMBODIED CARBON (kgC02e)
51							
52	750000					1400	10500
53							

Example of Project Value input into VECC

USE STAGE - REPLACEMENT [B4]

USE STAGE - REPLACEMENT - [B4]		
REPLACEMENT CATEGORY	NUMBER OF REPLACEMENTS	EMBODIED CARBON (kgCO2e)
Building elements/components category. Data Source: RICS Whole life carbon assessment for the built environment, 2017	*Expected number of material replacements over the building lifespan (assumed at 60 years)*	*Total Material EC for Replacement Stage*
Roof coverings	1	10796.727
Floor finish - finish layer	5	718.020
Floor finish - finish layer	5	3532.632
None	0	0.000

Example of Replacement stage emissions in VECC

Building part	Building elements/components	Expected lifespan
Roof	Roof coverings	30 years
Superstructure	Internal partitioning and dry lining	30 years
Finishes	Wall finishes: Render/Paint	30/10 years respectively
	Floor finishes Raised Access Floor [RAF]/Finish layers	30/10 years respectively
	Ceiling finishes Substrate/Paint	20/10 years respectively
Facade	Opaque modular cladding e.g. rain screens, timber panels	30 years
	Glazed cladding/Curtain walling	35 years
	Windows and external doors	30 years

Indicative component lifespans from RICS Whole life carbon assessment for the built environment, 2017

VECC uses results from Product Stage [A1-A3] to obtain the Embodied Carbon value for replacement.

It is assumed that items are being replaced on a like-for-like basis and in full (100%) once the lifespan is reached. Building lifespan is assumed at 60 years as per *RICS Whole life carbon assessment for the built environment, 2017*.

In the absence of specific data coming from replacement scenarios based on facilities management and maintenance stratagies and O&M manuals, *RICS* document gives indicative generic assumptions for component lifespans of items based on information from various sources.

VECC uses these expected lifespans for building components to determine the number of replacements over the building lifespan - for example expected lifespan of 30 years would mean that the component is replaced once before the built asset reaches the end of its expected lifespan of 60 years and the component is either disposed of or recovered and reused.

In order for Replacement Stage carbon emissions to be calculated, *Embodied Carbon Sheet* Record Format needs to be attached to objects and resources for which the assessment is to be made, and relevant category chosen under *Replacement Category*. The default value is *None*, for which the number of replacements is 0. Under the assumption of like-for-like replacement, VECC multiplies the number of replacements with the Embodied Carbon totals from Product Stage [A1-A3]

USE STAGE - OPERATIONAL ENERGY [B6]

OPERATIONAL ENERGY USE - [B6]		
	OPERATIONAL ENERGY - ENERGOS kWh/m2/y	
		85.45 kWh/sq m/a
		Total Operational Energy
		85.45 kWh/sq m/a

Example of Operational energy stage use in VECC

Operational Energy Use is at the same time separate from Embodied Carbon and part of the same analysis, two sides of the same coin. While Embodied Carbon is expressed in kgCO2e/kg, Operational Energy Use is typically expressed in kWh/m2/year.

Operational Energy Use can be assessed using Energos, and when that assessment is complete, Energy Label should be created with Primary Energy Demand checked under Performance Overview section of Energy Label Settings. This value will be read in VECC for displaying results and benchmarking against RIBA 2030 Climate Challenge.

BUILDING GROSS INTERNAL AREA (m2)		**168.469 sq m**	

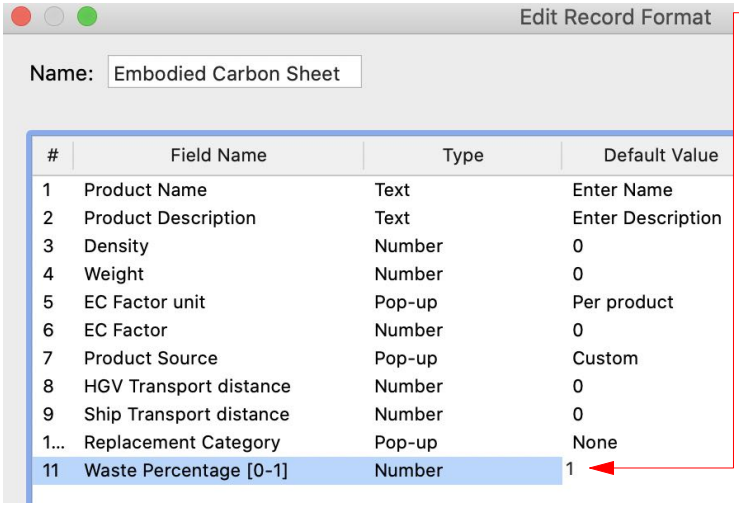
Gross Internal Area input in VECC, pulled from Spaces

END OF LIFE STAGE - DECONSTRUCTION AND DEMOLITION - [C1]		
	EC Factor (kgCO2e/m2GIA)	EMBODIED CARBON (kgC02e)
	3.4	572.795

Deconstruction and Demolition emissions calculation in VECC

END OF LIFE STAGE - WASTE PROCESSING FOR REUSE, RECOVERY OR RECYCLING AND DISPOSAL EMISSIONS - [C3-C4]		
WASTE PERCENTAGE [0-1]	EC Factor (kgCO2e/kg waste)	EMBODIED CARBON (kgCO2e)
Proportion of material for disposal. Default value in absence of specific data is 1 (complete disposal), 0.2 would mean only 20% is waste	*Data Source: RICS Whole life carbon assessment for the built environment, 2017*	*Total Material EC for waste processing for reuse, recovery or recycling and disposal Stage*
0.200	0.013	8.234
1.000	0.013	2.361
1.000	0.013	10.422
1.000	0.013	744.506

Waste processing for reuse, recovery or recycling and disposal emissions calculation in VECC



Embodied Carbon Sheet Record Format input for Waste Percentage

END OF LIFE STAGE - DECONSTRUCTION AND DEMOLITION [C1]

VECC requires project Gross Internal Area (GIA) as input to perform the calculations for the deconstruction and demolition stage. If using Spaces, the value will be input into the correct cell automatically. In case Spaces are not used, the number should be input manually in m2 in the appropriate cell.

As recommended by *RICS Whole life carbon assessment for the built environment, 2017* the calculation is based on 3.4 kgCO2e per m2 of GIA as the benchmark value for emissions related to deconstruction and demolition activities.

END OF LIFE STAGE - WASTE PROCESSING FOR REUSE, RECOVERY OR RECYCLING [C3] AND DISPOSAL [C4]

The assessment for these two stages is joined together as reuse, recovery or recycling is defined as a proportion of material/component that is not being disposed of. *RICS Whole life carbon assessment for the built environment, 2017* document suggests that in the absence of specific information regarding the waste processing for items to be repurposed, the default emissions for disposal to landfill should be applied.

The default figure suggested is 0.013 kgCO2e/kg waste.

In order for carbon emissions of this stage to be calculated, *Embodied Carbon Sheet* Record Format needs to be attached to objects and resources for which the assessment is to be made, and a number between 0 and 1 input under Waste Percentage. Default value is 1, meaning complete disposal of material/component, which is in line with RICS document recommendations in absence of specific information. For intended End of Life (EoL) scenario where 20% of material/component is disposed of, 0.2 should be input into the Record Format field. This would effectively leave the other 80% to be repurposed.

VECC uses results from Product Stage to obtain quantities for weight and applies the above factors to those values.

CALCULATION METHODOLOGY

RICS Whole life carbon assessment for the built environment, 2017 prescribes the assessment method for life cycle stages.

• **[A1-A3] - Product Stage**

- Material weight (volume x density) x EC factor
- Windows and Doors (glazing) - Net glazed area x Glazing thickness x EC factor
- Windows (frame) and Doors (frame and leaf) - Frame (and leaf) area x Jamb depth x Density x EC factor
- Single Objects - Per product - Qty (No.) x EC factor
- Single Objects - Per kg - Weight (volume x density) x EC factor

• **[A4] - Transport Stage**

- Material weight x Distance x Carbon conversion factor

• **[A5] - Construction Stage**

- 1400 kgCO2e/£100k of project value can be assumed for building construction site emissions, in the absence of more specific information.

• **[B4] - Replacement Stage**

- (Product Stage Embodied Carbon + Transport Stage Embodied Carbon) x No of replacements

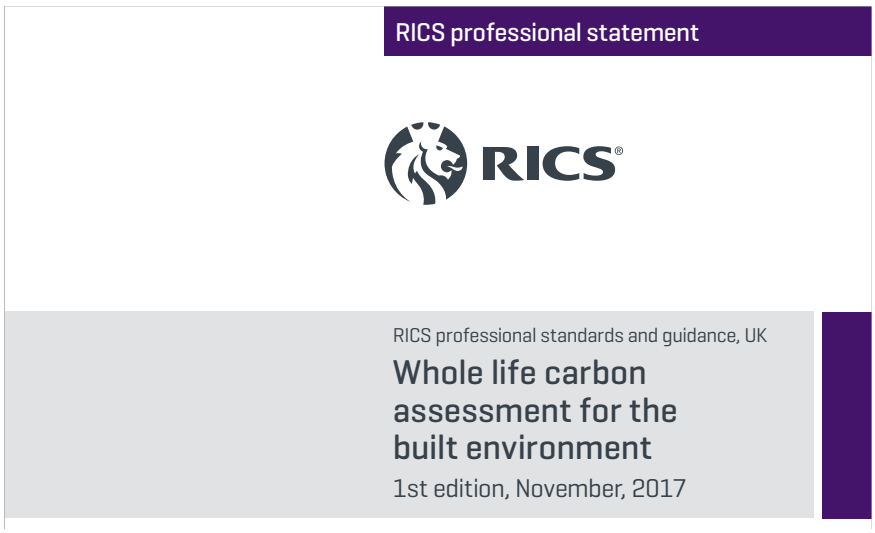
• **[C1] - Deconstruction and Demolition Stage**

- 3.4 kgCO2e/m2 of project Gross Internal Area (GIA) can be assumed for emissions relating to deconstruction and demolition activities site emissions, in the absence of more specific information.

• **[C3]&[C4] - Waste Processing for Reuse, Recovery or Recycling**

Calculation method is the same for [C3] and [C4], and it's done in the same column.

- Material weight x Waste percentage x EC factor for disposal emissions



RICS Whole life carbon assessment for the built environment, 2017

DATA SOURCES

Data assigned to the resources in this file (including both the VECC worksheet and the Vectorworks Materials) comes from various recognised and verified industry standard sources. Materials with these values are tagged with 'Embodied Carbon' and can be searched for in the Resource Manager:

• Default values for Embodied Carbon Factors / Global Warming Potential (GWP) and Density, as assigned to the supplied Vectorworks Materials and also used in the Windows and Door Glazing and Frame calculations, come from *University of Bath Inventory of Carbon and Energy (ICE) Database V3, 2019*.

•Whilst the ICE database uses generic material values, product specific values can be sought via Environmental Product Declarations (EPDs), and/or from a growing list of databases - including, but not limited to ICE Database or *EC3 Tool by C-Change Labs at Building Transparency*.

• Default Transport scenarios and distances by land and sea are obtained from *RICS Whole life carbon assessment for the built environment, 2017.* The default transport scenarios are 50km by road for local sourcing, 300km by road for national sourcing, 1500km by road for european sourcing, 200km by road and 10000km by sea for global sourcing.

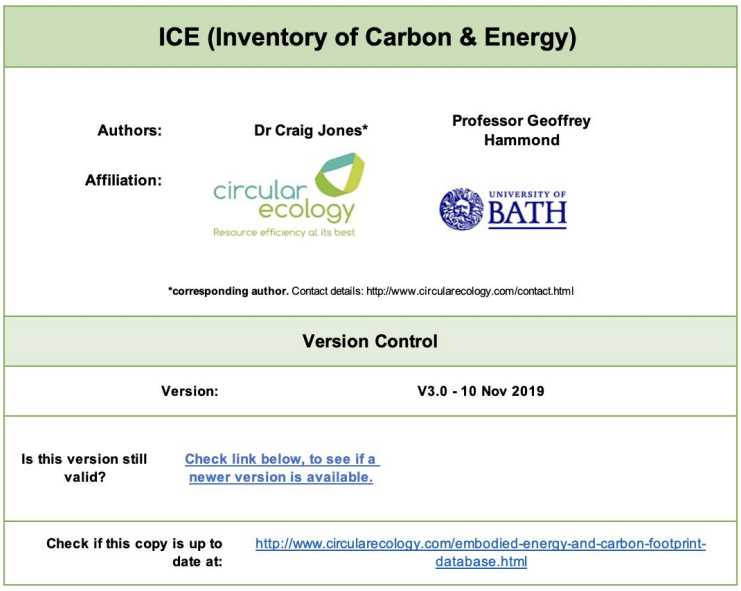
• Carbon conversion factors for transport stage are obtained from *UK Government Conversion Factors for greenhouse gas (GHG) reporting for 2020*, for average-laden rigid Heavy Goods Vehicles (HGV) for transport by land and average cargo container ship for transport by sea.

• *RICS Whole life carbon assessment for the built environment, 2017* recommends using the figure of 1400kgCO2e per £100k of Project value as the benchmark value for construction site building emissions.

• *RICS Whole life carbon assessment for the built environment, 2017* gives indicative lifespans for following components as: Roof coverings - 30y; Internal partitions and dry lining - 30y; Wall finish - render - 30y; Wall finish - paint - 10y; Floor finish - raised access floor - 30y; Floor finish - finish layer - 10y; Ceiling finish - substrate - 20y; Ceiling finish - paint - 10y; FF&E furniture and fittings -10y; Sanitaryware - 20y; Lift and conveyor installations - 20y; Lighting fittings - 15y; Space heating and air treatment - 20y; Opaque modular cladding - rain screens, timber panels… - 30y; Glazed cladding / curtain walling - 35y; Windows and external doors - 30y

• *RICS Whole life carbon assessment for the built environment, 2017* recommends using an average rate of 3.4 kgCO2e/m2 GIA as a benchmark value for carbon emissions related to on- or off-site deconstruction and demolition activities, including any energy consumption for site accommodation and plant use. The rate is derived from monitored demolition case studies in central London.

• *RICS Whole life carbon assessment for the built environment, 2017* suggests a default figure of 0.013 kgCO2e/kg waste. This figure has been developed as an average with reference to *BEIS 2016 Government GHG conversion factors for company reporting* and *Ökobaudat*.



ICE (Inventory of Carbon & Energy)

Authors:	**Dr Craig Jones***	**Professor Geoffrey Hammond**
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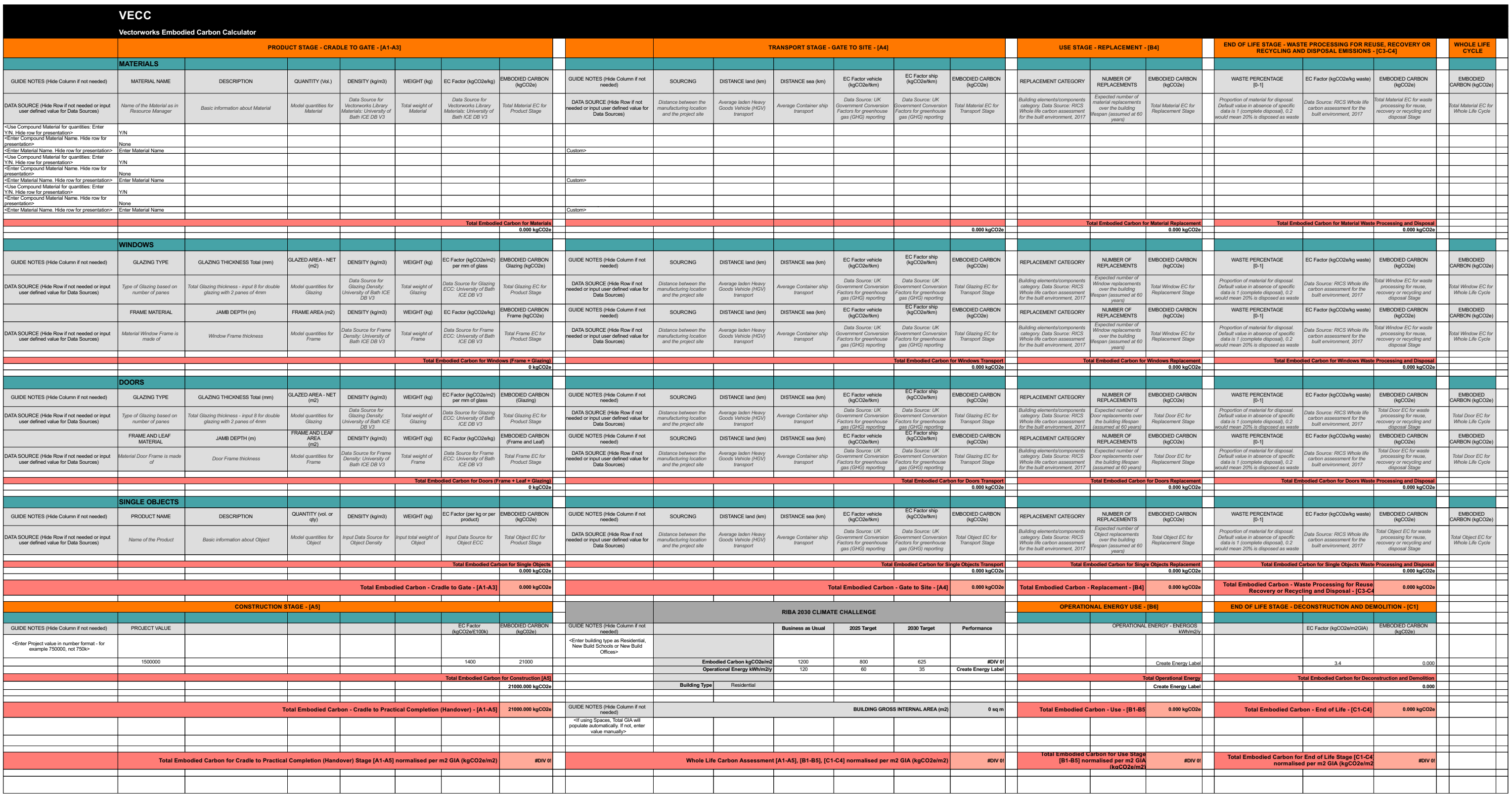
Version Control

Version:	**V3.0 - 10 Nov 2019**
Is this version still valid?	**Check link below, to see if a newer version is available.**
Check if this copy is up to date at:	**http://www.circularecology.com/embodied-energy-and-carbon-footprint-database.html**

University of Bath Inventory of Carbon and Energy (ICE) Database V3, 2019

This is the Vectorworks Embodied Carbon Calculator. It can be copied and pasted into any other Vectorworks file and will be ready to use (alternatively import it into the desired Vectorworks file via the Resource Manager in the standard manner for resources). It can also be found in Tools>Reports>Create Report>Preformatted Report>Embodied Carbon Calculator.



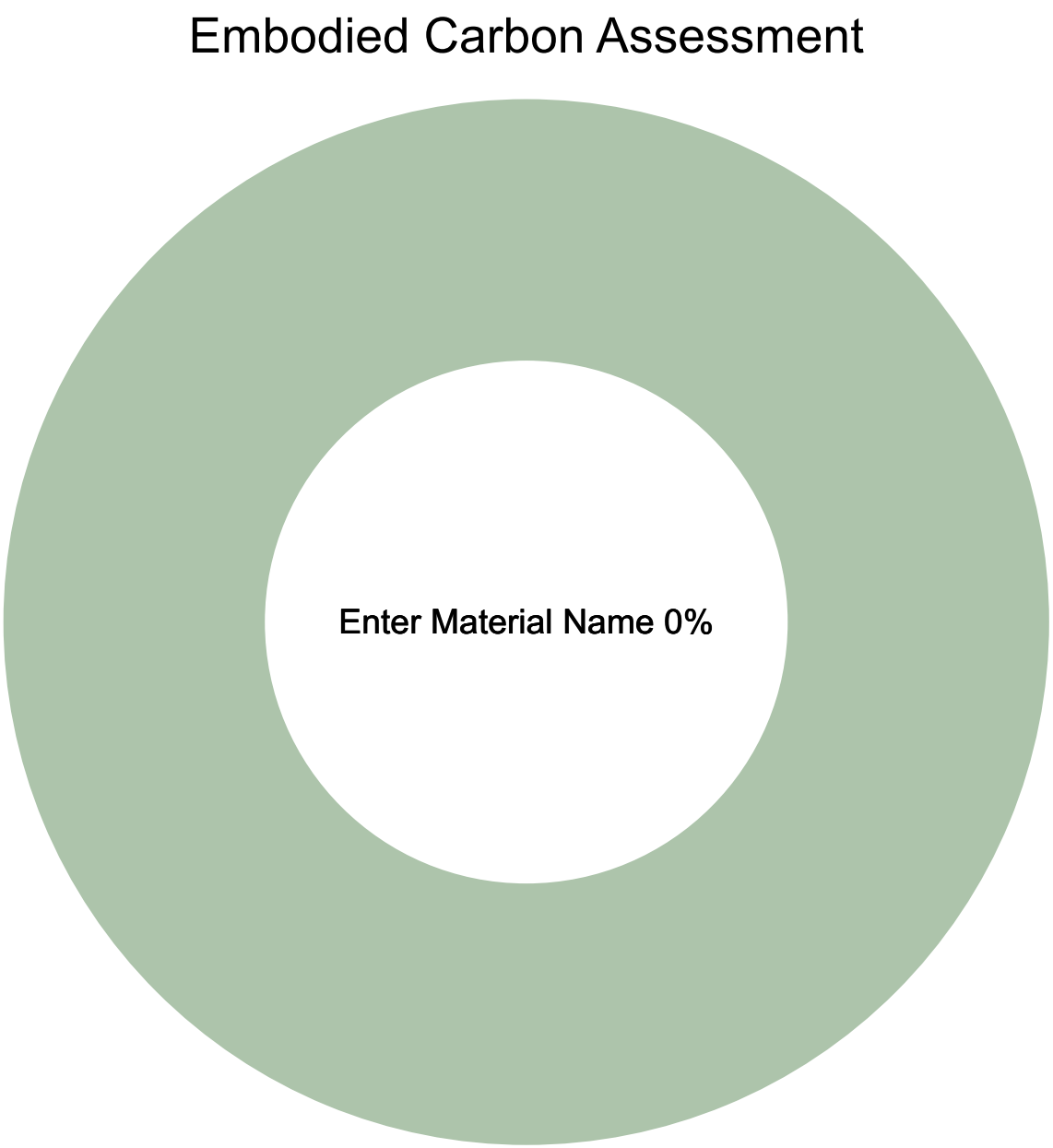
The embodied Carbon Assessment pie chart is a Marionette object which reads the results from VECC worksheet. The VECC needs to be populated with Material names. Results should be obtained in the VECC in the first instance, before selecting the pie chart and clicking update in the Object Info Palette.

When the pie chart is selected, parameters in the Object Info Palette (OIP) allow the user to name the pie chart, choose a font, move the title and change the size of the chart. Note that if the worksheet name is changed from VECC to something else, this needs to be updated under *Worksheet Name.*

At the moment the pie chart can only show results for the Material section for whole life cycle, excluding Doors, Windows and Single objects.

In order for the pie chart to show the complete Material assessment, the number of Materials input into the VECC needs to be entered into the pie chart OIP parameter *No of Materials in VECC*. By default this number is 3 as there are only 3 Material rows in the default VECC worksheet. Therefore, this number needs to be increased when more rows are copied and pasted to allow for a more extensive Material assessment. For example, if there are 23 Materials in the model and in VECC worksheet, then 23 needs to be entered into this field.

Finally, the number of Materials appearing on the chart can be determined by entering a number into *No of Materials on Chart* in the pie chart OIP parameter field. If 10 is entered, it will show top 10 Material contributors to the total Embodied Carbon over the whole life cycle and the percentages of those contributions.



GET IN TOUCH

If you have any questions or feedback related to the content in this paper, please feel free to contact us at architect@vectorworks.net

Download...

The Vectorworks files and resources contained within, are available for download from university.vectorworks.net

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