



# H\B:ERT User Guide

This user guide is a practical guide to installing and running the HBERT version V1 (V2.1.5) for the first time. HBERT V1 (V1) was originally launched in 2018, and this version of HBERT V1 (V2.1.5) has been updated to be compatible with all Revit versions 2018-2022

Hawkins\Brown has worked in partnership with the UCL Institute for Environmental Design and Engineering (IEDE), through their Engineering Doctorate program, to create the Hawkins\Brown: Emission Reduction Tool. The tool was developed as part of research titled 'Refurbish or Replace - the life cycle performance of existing buildings and their replacements' by Dr Yair Schwartz, Research Associate at The Bartlett, UCL. H\B:ERT works by measuring the volume of all materials tagged in the Revit model. It then applies embodied carbon data to that material, broken down into life cycle stages (product, construction, use stage, and end of life. System boundaries: A1-A5, B4, C1-C4) in line with BS EN 15978:2011.

The tool aligns with the RICS and RIBA guidance and currently uses the Circular Ecology ICE database V3 (2019), but can use alternative data where available. This allows an easy yet robust comparison between elemental design options and sets the grounds for a complete life cycle carbon footprint analysis. The tool plugs into Revit and enables the designer to quickly test the embodied carbon emissions of different material options at any time during the design process.

1_Installation	2
2_Running for the first time	2
3_Creating new models	3
4_Potential Issues	7
5_Assessing existing models	7

## 1\_Installation

The HBERT plugin is designed to work with Autodesk Revit 2018- 2022.

Once downloaded, the zipped files should be unzipped, using WinZip or another similar free program. The file contains the following:

- This User Guide
- 5 template files for Revit 2018-2022
- Single installer .msi

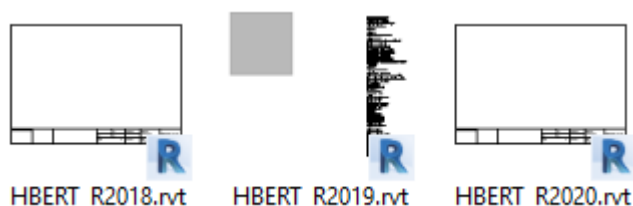
Once unzipped, simply double clicking on the appropriate installer will place the appropriate files in your Revit directory. By default, this is found in: C:\ProgramData\Autodesk\Revit\Addins\2022 for the 2022 version

The installer will automatically add HBERT to all supported Revit versions.

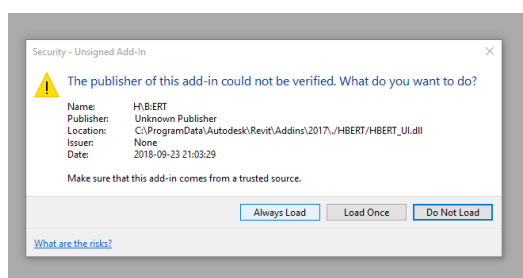
## 2\_Running for the first time

To access the default HBERT materials the Template files provided should to be used, if you try to run HBERT outside of these template files it will not work.

Open Revit, then navigate to the appropriate template from the zipped file and then open and save as a new central file with your desired name etc.



On running for the first time you may see the following message, click “Always Load” , or “Load Once” to continue with HBERT. The software is in the process of being digitally signed, and this message will not appear on future versions.



After opening Revit for the first time after installing a new HBERT menu should be visible on the toolbar, once clicked on you should be able to see the following icon, double click on it to start HBERT.



Further guidance on running the program can be found in this [YouTube video](#) created by Yair Schwartz, for teaching his students at UCL. Yair worked with Hawkins\Brown to develop the tool and the methodology behind it. Please note this video has not been updated to reflect any change to HBERT V1 (V2.1.5) update, namely the install process.

### 3\_Creating new models

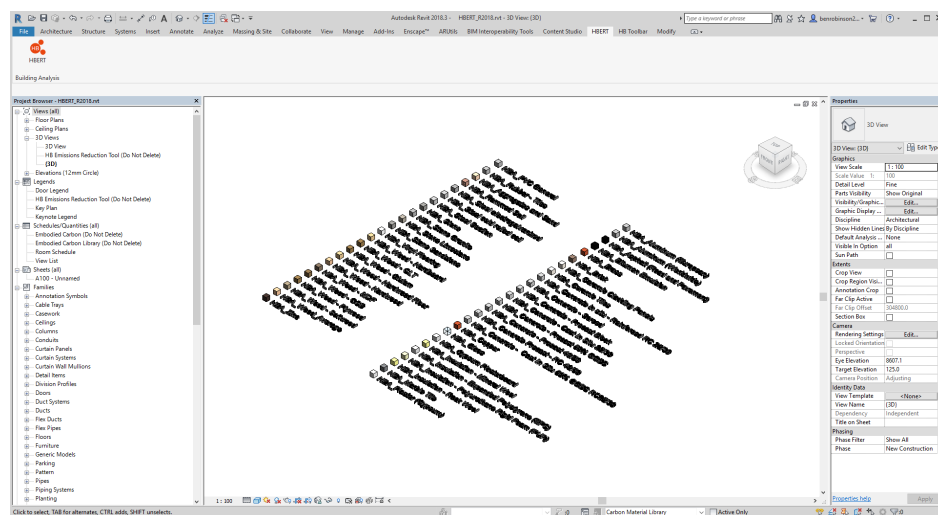
New models should be created within the supplied Revit project files HBERT\_'Revit Version'.

#### Assigning materials

Once the supplied template is loaded a design option (named **Carbon Materials Library**) will be available which shows each of the standard materials (named **HBA\_Material**).

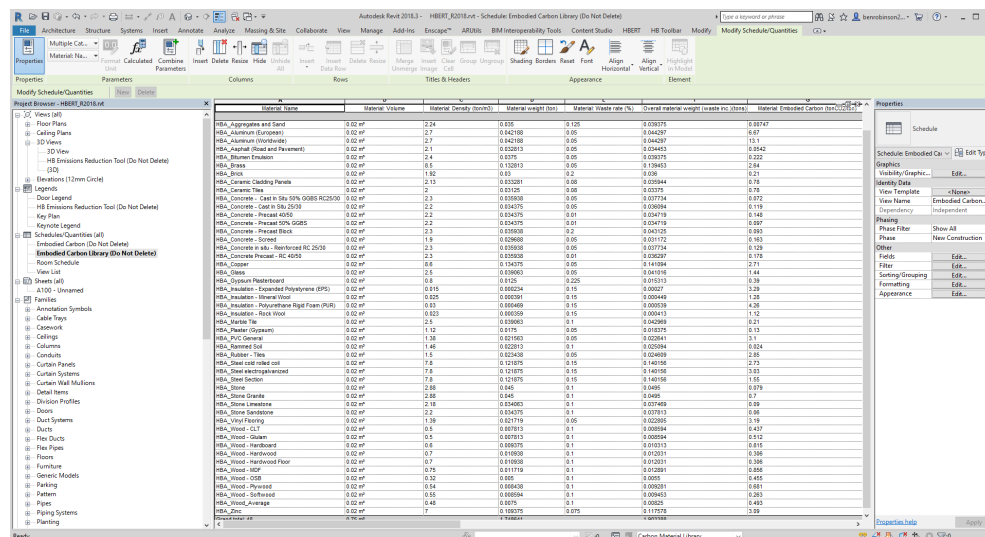
If working with design options within one project, all models should be created in a separate design option, this allows the tool to read the material volumes separately when comparing of a range of options.

These materials all have assigned values for embodied carbon and a range of other values, as can be seen in the **Embodied Carbon Schedule**.



#### Managing the Schedule

The template contains two schedules. The first **Embodied Carbon Library (Do Not Delete)** shows the material library from the embodied carbon design option in its entirety.



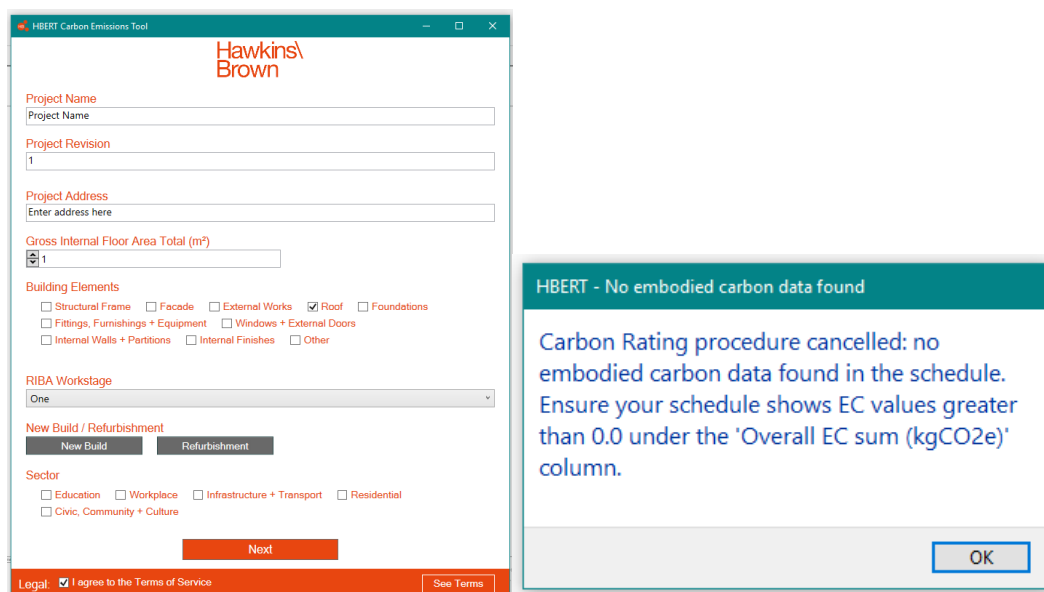
Material Name	Material Volume	Material Density (ton/m3)	Material Weight (ton)	Material Waste rate (%)	Overall material weight (ton)	Material Embodied Carbon (kgCO2e/m3)
HBA_Aggregate and Sand	0.02 m³	2.4	0.05	0.125	0.05075	0.00747
HBA_Aluminum (European)	0.02 m³	2.7	0.054	0.05	0.04927	0.01
HBA_Aluminum (Northwest)	0.02 m³	2.7	0.054	0.05	0.04927	13.1
HBA_Arsenal (Steel and Reinforcement)	0.02 m³	2.1	0.042	0.05	0.04043	0.04247
HBA_Brass	0.02 m³	8.5	0.17	0.05	0.16175	0.00275
HBA_Brick	0.02 m³	1.8	0.036	0.2	0.0368	0.01
HBA_Cement Cladding Panels	0.02 m³	2.15	0.043	0.05	0.04084	0.01
HBA_Ceramic Tiles	0.02 m³	2	0.04	0.05	0.0375	0.01
HBA_Concrete - Cast in Site (C20/25)	0.02 m³	2.2	0.044	0.05	0.04175	0.01
HBA_Concrete - Cast in Site (C25/30)	0.02 m³	2.2	0.044	0.05	0.04175	0.01
HBA_Concrete - Precast (C20/25)	0.02 m³	2.2	0.044	0.05	0.04175	0.01
HBA_Concrete - Precast (C25/30)	0.02 m³	2.2	0.044	0.05	0.04175	0.01
HBA_Concrete - Precast (C30/37)	0.02 m³	2.2	0.044	0.05	0.04175	0.01
HBA_Concrete - Precast (C40/50)	0.02 m³	2.2	0.044	0.05	0.04175	0.01
HBA_Concrete - Precast (C50/60)	0.02 m³	2.2	0.044	0.05	0.04175	0.01
HBA_Concrete - Precast (C60/80)	0.02 m³	2.2	0.044	0.05	0.04175	0.01
HBA_Concrete - Precast (C70/90)	0.02 m³	2.2	0.044	0.05	0.04175	0.01
HBA_Concrete - Precast (C80/100)	0.02 m³	2.2	0.044	0.05	0.04175	0.01
HBA_Copper	0.02 m³	8.9	0.178	0.05	0.1685	0.01
HBA_Glass	0.02 m³	2.5	0.05	0.05	0.0475	0.01
HBA_Gypsum Plasterboard	0.02 m³	0.9	0.018	0.05	0.0171	0.01
HBA_Insulation - External (EPS)	0.02 m³	0.035	0.0007	0.05	0.000675	0.01
HBA_Insulation - External (XPS)	0.02 m³	0.035	0.0007	0.05	0.000675	0.01
HBA_Insulation - External (PIR)	0.02 m³	0.035	0.0007	0.05	0.000675	0.01
HBA_Insulation - Internal (EPS)	0.02 m³	0.035	0.0007	0.05	0.000675	0.01
HBA_Insulation - Internal (XPS)	0.02 m³	0.035	0.0007	0.05	0.000675	0.01
HBA_Insulation - Internal (PIR)	0.02 m³	0.035	0.0007	0.05	0.000675	0.01
HBA_Masonry - Brick	0.02 m³	1.8	0.036	0.05	0.0368	0.01
HBA_Masonry - Concrete	0.02 m³	2.2	0.044	0.05	0.04175	0.01
HBA_Masonry - Stone	0.02 m³	2.2	0.044	0.05	0.04175	0.01
HBA_Masonry - Timber	0.02 m³	0.5	0.01	0.05	0.005	0.01
HBA_Masonry - Glass	0.02 m³	2.5	0.05	0.05	0.0475	0.01
HBA_Masonry - Steel	0.02 m³	7.8	0.156	0.05	0.1482	0.01
HBA_Masonry - Timber	0.02 m³	0.5	0.01	0.05	0.005	0.01
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HBA_Masonry - Steel	0.02 m³	7.8	0.156	0.05	0.1482	0.01

The second **Embodied Carbon (Do Not Delete)** will only show the materials applied to elements in the active design option.

By selecting the carbon materials library you can see all the embodied carbon information contained in the model. These default values are taken from a range of sources. The 'Embodied Carbon (tonCO<sub>2</sub>/ton)' figure is derived from the Circular Ecology Inventory of Carbon and Energy Database V3 2019, found [here](#). The values used for the timber materials exclude the carbon stored within the timber. If specifying sustainably sourced timber please refer to the respective section within the ICE V3 database (or EPDs to suit) and either edit the HBA material to include stored carbon or manually incorporate in your calculation if relevant. Please refer to the 'data sources' section for further information on the data used in the carbon materials library.

## Running HBERT

When you click the HBERT icon and HBA materials are detected in your model the below left form will appear. If HBA materials are not detected you will get the right hand dialog.

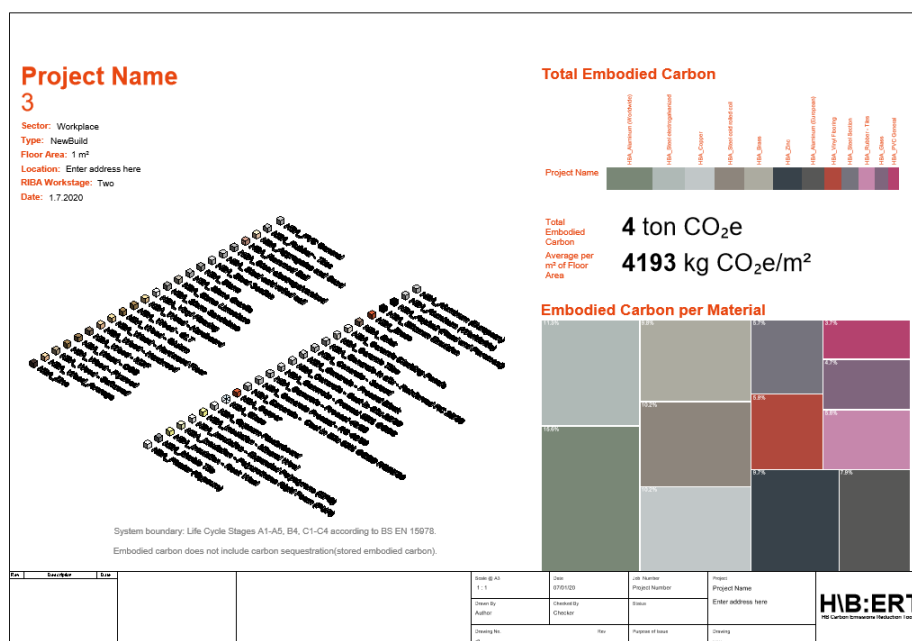


The image shows two screenshots. On the left is the 'HBERT Carbon Emissions Tool' window, which is a form for inputting project details. It includes fields for Project Name, Project Revision (set to 1), and Project Address. Below these is a section for 'Gross Internal Floor Area Total (m²)' with a value of 1. The 'Building Elements' section has checkboxes for Structural Frame, Facade, External Works, Roof (checked), Foundations, Fittings, Furnishings + Equipment, Windows + External Doors, Internal Walls + Partitions, Internal Finishes, and Other. There is a 'RIBA Workstage' dropdown set to 'One'. The 'New Build / Refurbishment' section has buttons for 'New Build' and 'Refurbishment'. The 'Sector' section has checkboxes for Education, Workplace, Infrastructure + Transport, Residential, and Civic, Community + Culture. A 'Next' button is at the bottom. At the very bottom, there is a 'Legal' section with a checked box for 'I agree to the Terms of Service' and a 'See Terms' link. On the right is a dialog box titled 'HBERT - No embodied carbon data found'. The text inside says: 'Carbon Rating procedure cancelled: no embodied carbon data found in the schedule. Ensure your schedule shows EC values greater than 0.0 under the 'Overall EC sum (kgCO<sub>2</sub>e)' column.' There is an 'OK' button at the bottom right of the dialog.

All fields must be populated before you are able to move to the next step.

The output is designed to fit on a A3 titleblock. The template comes with the titleblock **HB\_Titleblock\_A3\_Landscape\_Vertical** preloaded. A default view window is also contained in the template named **HB Emissions Reduction Tool (Do Not Delete)**.

Clicking **Publish** will send the anonymous data contained in the schedule, and the fields filled in the first dialogue to the HBERT cloud storage, for more information please read the Terms of Service (link within Revit 'See Terms'). It will also produce a sheet with the name given that will look like the below.

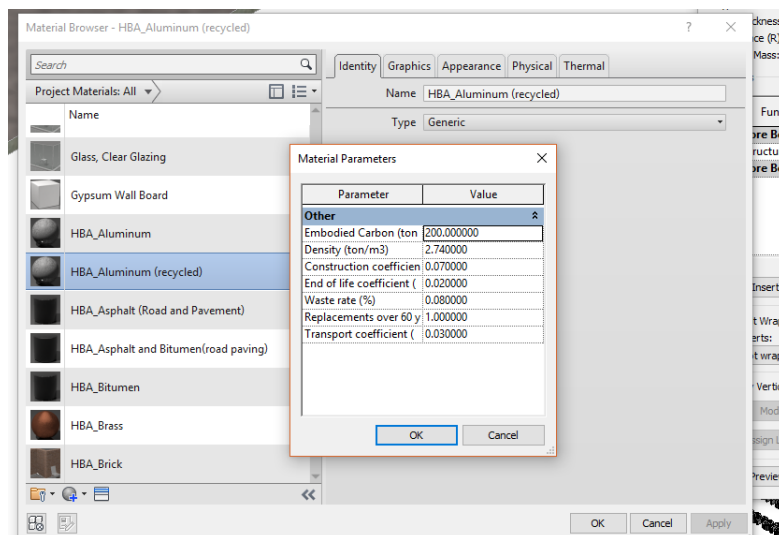


Each time you run HBERT a new sheet will be created. You can also export the **Embodied Carbon (Do Not Delete)** schedule to excel as a spreadsheet. This spreadsheet has the embodied carbon broken down into different lifecycle stages according to RICS and RIBA guidance.

The first time you run HBERT it will automatically place the view in the template named **HB Emissions Reduction Tool (Do Not Delete)** onto the newly created sheet. If you rerun HBERT with the originally created sheet still in the model you will need to manually add a 3D view to the new sheet.

### Custom materials:

Any custom materials can also have their data manually added when the material is created or modified from another material in the **Material Browser** window. The best way to create a new HBA material is to duplicate the closest material and then rename it and add in the new materials data in **Custom Parameters...** as you can see in the following image.



## 4\_Potential Issues

Currently we support data on 48 materials. We will continue to add materials as and when their data becomes available.

For elements such as timber or metal studs, SFS, support systems, or timber rafters which are typically not modelled as individual elements in Revit require custom materials to be created. A timber stud zone for example in Revit will be modelled as one solid zone when in reality ~80% of this zone could be empty space. Therefore, the custom parameter values of the HBA material used would have to be factored down in order to account for this. There is no set guidance on how to create bespoke materials for these 'zones' and therefore users are encouraged to create their own agreed methodology.

Additionally, Revit does not return the volumes of the following elements in schedules:

- Mullions
- Entourage
- Fascia's
- Gutters
- Railings
- Ramps
- Roof Soffits
- Slab Edges
- Stairs: Landings & Supports
- Wall Sweeps

These elements must be modelled separately and added to the final analysis. Mullions particularly can have a significant impact on the final analysis. Users should also check any hollow components which may have been modelled as solid and apply a factor to account for the hollow portion.

## 5\_Assessing existing models

If you want to run analysis on an existing project you will need to firstly copy all the materials from the **Carbon Materials Library** design option into a new design option in the existing model.

Then you need to copy the **Embodied Carbon (Do Not Delete)** schedules into the model and finally the **HB\_Titleblock\_A3\_Landscape\_Vertical** title block if you would like to use our HBERT title block. After this you will be able to run the analysis directly in your own model. Editing the name or layout of the schedules or changing the names of the HBERT parameters will prevent HBERT from being able to run.

### Reassigning materials in an existing project

This must be done manually, by reassigning to the closest material in the default set of materials, or by creating a custom material based on bespoke information (e.g. EPDs). All element types and families must be modified to use materials with an embodied carbon value. To speed up the process you can use or build a 'find and replace materials tool'.

### Setting the view

When running HBERT the tool will attempt to automatically place a 3D view with the name **HB Emissions Reduction Tool (Do Not Delete)** onto the new sheet. You will need to change the name of a 3D view to this name for it to be added automatically otherwise you will need to manually add a view to the sheet.

### Data sources:

The default data embedded within each HBA material is derived from a variety of sources. Each coefficient is editable and adaptable to suit flexibility, and enable bespoke or more detailed analyses. For example, EPD data can be formatted and used to replace the generic material data given. The various sources used for the coefficients are listed below:

**Embodied Carbon (tonCO<sub>2</sub>/ton)** - these figures are derived from the Circular Ecology Inventory of Carbon and Energy Database V3 2019, found [here](#). The values used for the timber materials exclude the carbon stored within the timber. If specifying sustainably sourced timber please refer to the respective section within the ICE V3 database (or EPDs to suit) and either edit the HBA material to include stored carbon or manually incorporate in your calculation if relevant.

**Construction, end of life, transport coefficients:** These coefficients are derived from the work by Dr. Schwartz, taken from a variety of academic references: Cole & Kernan (1996), Blengini & Di Carlo (2010), Dixit et al. (2010), Gustavsson et al. (2010) and Monahan & Powell (2011).

**Material waste rate:** Based on data from the WRAP Net Waste Tool V.1 (2008) and BRE The Green Guide to Specification: an environmental profiling system for building materials and components (2009).

**Replacements over 60 years:** The life expectancy data is based on EToolGlobal Typical Life Expectancy of Building Components (2017), InterNACHI: 'Typical " Life Expectancy " Table for common building materials & systems' (2017) and Building Materials Life Expectancy Chart (2018) .

To find out more about the methodology behind H\B:ERT, read Dr Schwartz's paper found [here](#).