AECB Lifetime Carbon Assessment	

AECB Lifetime Carbon Standard

This is part of a suite of additional AECB standards that complement the main AECB Building Standard, these are:

- AECB Building Standard
  - AECB Lifetime Carbon Standard
  - AECB Daylighting Standard
  - AECB Water Efficiency Standard

The aim of the AECB Lifetime Carbon Standard is to encourage the use of simple operational and embodied carbon calculations as part of the design process in UK construction projects. To satisfy the criteria you are required to assess and report two alternative options, each option including:

- **operational carbon** (related to heat and power) during the design stage[1], and

- embodied carbon (lifetime carbon, for no less than two alternative whole building construction options)

The AECB standard encourages designers to aim for an optimum balance of operational and embodied carbon.

[1] The operational energy performance of the building may be the same or differ between submitted options 1 & 2.

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Assessment tools

PHribbon has been developed to allow operational and embodied carbon calculations to be carried out easily and should be used for the AECB Lifetime Carbon Standard compliance. The PHribbon Embodied Carbon calculator is designed to work with the PHPP model for your building - which is already required to show compliance with the AECB Building Standard. Material types and quantities from your PHPP are matched to the list of materials in the ICE & EPD databases in the embodied carbon calculator automatically so you only need adjust the choice where necessary.

PHribbon allows you to model embodied carbon options, reporting on both the operational energy performance and the embodied carbon performance. As such it can guide your design decisions so that you can optimise both operational and embodied carbon.

PHribbon is based upon the standard RICS methodology including 60 year nominal life, and a database of over 200 material entries from EPDs, 100 from summaries of EPDS, material densities and expected product lifetimes.

The PHribbon calculates Embodied Carbon from Cradle to Grave, covering stages A-C (and D where information is available) and is suitable for initial estimates for the RIBA 2030 Challenge.

- Stage A, A1-A3 Manufacture including A4 Transport to site and A5 Construction
- Stage B, Use of the building including B4 Replacement
- Stage C, Demolition and Disposal of the building
- Stage D, Reuse, Recycling potential (where information is available)

Major constituents of a building include:

- Substructure
- Superstructure
- Finishes
- Building services

An example of the calculator's graphical output and scope summary report is given below. A copy of these output reports should be submitted via the LEBD with your AECB Building Standard documentation to obtain the AECB Lifetime Carbon Standard.

Operational lifetime carbon

The operational carbon is calculated in the PHribbon using final energy PHPP outputs, and the relevant current carbon fuel factors: emissions over time factor in decarbonisation of the electricity grid, with the default forecast (which must be used for submission purposes) set to follow the latest National Grid decarbonisation forecast. The decarbonisation over time of non-electricity related emissions for other energy carriers can be factored in e.g. for increasing use of Biogas in the gas grid: this facility can be used as and when robust information becomes available.

Because buildings contain materials and components that have very different longevity, such as foundations, protected superstructure versus cladding , windows, services, appliances etc PHribbon allows operational and embodied carbon to be reported over time periods of up to several hundred years to encourage designers to think and design for both short and long term.

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Requirements for AECB Lifetime Carbon Standard

-two operational and embodied calculations for the same building (the two options, using PHribbon), showing different construction techniques. Lifetime carbon is expressed as kg/CO_2e and kg/CO_2e/m^2.

- In addition to this a statement shall be provided (there is space for this in the PHribbon): Taking into consideration the total lifetime carbon emissions (sum of embodied and operational) for your development, please explain which options you have chosen and why.

Submission

Each complimentary AECB standard adopted must be submitted as part of your AECB Building Standard submission and uploaded via the AECB Low Energy Building Database (LEBD). The report summary verifications sheets for each standard must be combined into a single pdf and uploaded as the 'PHPP verification sheet' entry on the LEBD.

You may still submit for the AECB Building Standard only, without any complimentary standards, however we do of course encourage you to adopt as many of these as possible in each project. You may *not* submit complimentary AECB Standards without submitting for the AECB Building Standard or the Passivhaus Standard as a prerequiiste. If you want to retrospectively add complementary standards to an *existing* AECB Standard certified project please contact the AECB team via the LEBD. Evidence for the complimentary standards is to follow the standard reporting format provided by the AECB CarbonLite PHribbon software, available from the AECB.

A typical submission might look like this:

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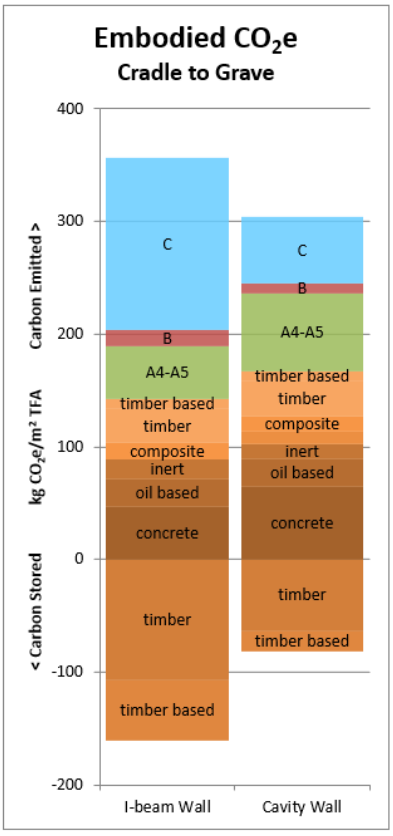
AECB Lifetime Carbon Assessment

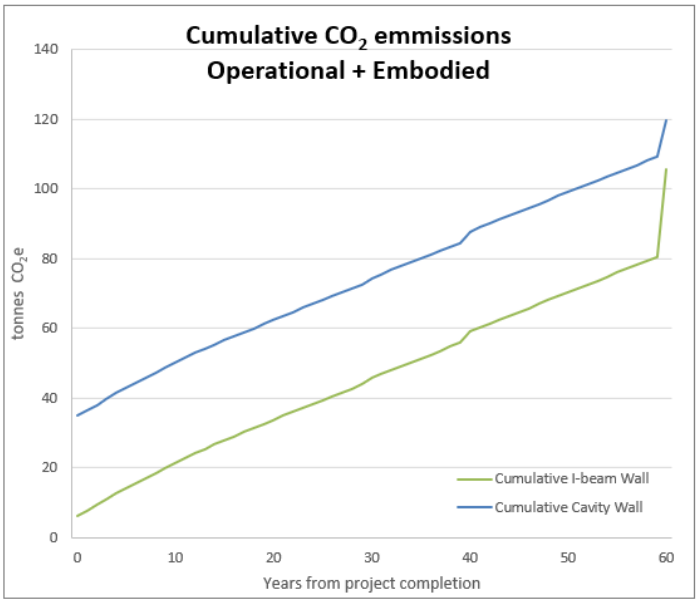
Consultant:	Tim Martel		
Street:	Withdene, Frome Park Road		
Postcode/City:	GL5 3LF	Stroud	
Province/Country:	Gloucestershire	GB-United Kingdom/ Brit	
Client:	Example		
Street:			
Postcode/City:			
Province/Country:			
Building:	Example		
Street:			
Postcode/City:			
Province/Country:			
Building type:			

AECB Embodied Carbon Assessment

Year of construction:	
No. of dwelling units:	1
TFA, m^2	156.6

For this Certificate Building life must be 60 yrs





		I-beam Wall	Cavity Wall
Operational	SSHD	15.1	
	Total kWh/m2.a	62.2	
	tonnes CO_2e	74.2	
	kgCO2e/m² TFA	0.5	
Embodied	tonnes CO_2e	30.7	43.8
	kgCO2e/m² TFA	196.0	280.0

Taking into consideration the total lifetime carbon emissions (sum of embodied and operational) for your development, please explain which option you have chosen and why.

The I-beam was chosen, partly for emissions, partly also for the thickness of the construction. I-beams clearly have a much lower embodied CO2 by practical completion, the green line is almost 40 tonnes lower because of the effect of timber and timber based insulation. Operational emissions are mainly from the burning of natural gas, it is possible that may change at some point in the next 60 years considered. There is a large uptick in emissions from the timber at the end of life if it is incinerated as in the standard assumption which makes the final emissions by the end of life not so different. Nevertheless the majority of the structure should be reusable and there is some possibility it could be reused/recycled by that time.

I confirm that the values given herein have been determined following the RICS methodology and based on the characteristic values of the building. The PH Ribbon calculations are attached to this verification.

Task:	Name		
Designer	Tim Martel		
	Issued on:	City:	Signature:
Example	29/09/20	Stroud	

AECB Lifetime Carbon Assessment

Calculation Scope Summary

Date of assessment	05/09/2020	Year of project completion	2020				
Carried out by	Tim Martel						
Project type	New build						
Assessment objective	Design Stage calculation						
Project location	Herefordshire						
Property type	Residential						
Building description	2 storey timber clad building with flat roof						
Size		TFA	156.559	m^2	GIA	83	m^2
Project design life:	Required to be 60 years for this assessment						
Assessment scope	Cradle to Grave						
Assessment stage	Design stage (PHPP)						
Data sources	PHPP for quantities of thermal elements, drawings and correspondence for others.						
	EPD certificates, ICE Database 2019 (using PHribbon v2.28)						

Building elements coverage

# Building parts	Building elements	Est of Coverage	Clarification if needed
0 Facilitating works	0.1 Temporary/Enabling works/Preliminaries		
	0.2 Specialist groundworks		
1 Substructure	1.1 Substructure	100%	
2 Superstructure	2.1 Frame	100%	
	2.2 Upper floors incl. balconies	100%	
	2.3 Roof	100%	
	2.4 Stairs and ramps		
	2.5 External Walls	100%	
	2.6 Windows and External Doors	100%	using estimates
	2.7 Internal Walls and Partitions	100%	
	2.8 Internal Doors		
3 Finishes	3.1 Wall finishes	80%	external finishes only
	3.2 Floor finishes	100%	
	3.3 Ceiling finishes	80%	paint not included
4 Fittings, furnishings and	Building-related		
	Non Building-related		
5 Building services / MEP	5.1–5.14 Building-related services		
	Non Building-related		
6 Prefab Buildings an	6.1 Prefabricated Buildings and Building Units		
7 Existing Building	7.1 Minor Demolition and Alteration Works		
8 External works	8.1 Site preparation works		
	8.2 Roads, Paths, Pavings and Surfacings		
	8.3 Soft landscaping, Planting and Irrigation Systems		
	8.4 Fencing, Railings and Walls		
	8.5 External fixtures		
	8.6 External fittings drainage		
	8.7 External Services		
	8.8 Minor Building Works and Ancillary Buildings		

Assumptions and scenarios

This calculation only covers Cradle to Grave (stages A-C), though it can include stage D where this information is available.
An official RICS calculation would require much more information, this calculation is a reasonable starting point at design stage.
A1-A3 manufacturing emissions from EPDs or ICE2019.
Window manufacture emissions are approximate when chosen by m2, separation into materials would be more accurate.
Carbon storage of timber based products is included, timber is assumed to be from FSC/PEFC approved sources
For timber based products the manufacturing emissions should be added above the x-axis (carbon emitted) on top of that shown and an equal amount added below the x-axis (carbon stored) if these are available. Applies to both graphs.
A4 transport to site uses RICS methodology rather than any EPD information, usually not declared or may have different assumptions.
A5 construction is based on standard RICS assumptions, records of energy use on site would be better when available.
B1 use stage emissions or CO2 absorbtion e.g. from concrete is from EPDs where this is available.
B2,B3,B5 maintenance, repair and refurbishment scenarios should be added for the building, info not available to add automatically.
B4 replacement uses the material design life from PHribbon EmbodC tab (from RICS or mfr) for the RICS design life of 60 years, but where missing (yellow cells in col Q) it is not clear from the material, e.g. timber cladding life much shorter than timber.
C1 demolition is based on standard RICS assumptions.
disposal transport uses standard RICS assumptions, and requires cell J6 to be entered.
waste processing uses information from EPDs where available, though often missing in the EPD.
C4 disposal uses standard RICS assumptions for recycling/inceration/landfill rates. Other scenarios to that favour reuse/recycling could be developed, however very few EPDs contain the information required.
D Reuse and Recycling potential have to be reported separately, few EPDs contain this information.