



Whole Life Carbon Assessments of Buildings: What You Need to Know

Dr Craig Jones & Edwin Lowe

Contents

- What is embodied carbon and what is operational carbon?
- What is whole-life carbon assessment?
- What tools can be used to assist with whole-life carbon assessment?
- What data can product manufacturers and suppliers provide?
- Which standards should you adhere to?
- BREEAM Mat 01 LCA – How to obtain credits, and v7 changes
- How the London Plan requires whole-life carbon assessments
- How whole-life carbon assessment can help to with Net Zero Carbon Buildings

Speakers



Dr Craig Jones

Managing Director

- *20+ years experience embodied carbon*
- *Original author ICE Database*



Edwin Lowe

Delivery Manager

- *10+ years experience in sustainability*
- *Worked for contractors, infrastructure clients and in consulting*



Background & Introduction

Circular Ecology – Introduction



Environmental consultancy, founded in 2013

Offer a range environmental services:

- Carbon Footprint Database (library) Development
- Whole-Life Embodied Carbon Assessments for Construction Projects
- Organisational Carbon Footprints, Scope 1, 2 & 3
- Product Carbon Footprints & Life Cycle Assessments (LCA)
- EPD Development & Publishing
- Carbon Footprint Verification & Assurance
- Net Zero Carbon Strategy
- Online E-Learning Training Courses
- Carbon Offsetting and Tree Planting



Hosts the Inventory of Carbon & Energy (ICE) Database

What's Our Mission?

"Making a difference together - Towards a more sustainable future"



Impactful



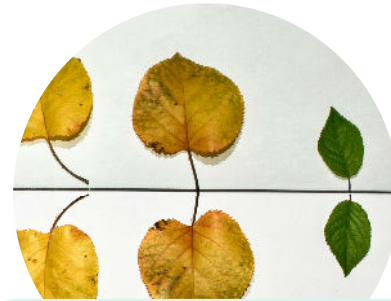
Community



Quality



Ethical



Continuous Improvement



Celebrating 850,000 Trees Planted

- We have facilitated the planting of **over 850,000 trees**
- Through our partnerships with **Eden: People+Planet** (formerly Eden Reforestation) and **Ripple Africa**
- Tree planting available on our online store for **£1 (ex. VAT) per tree**
- **25%** of tree planting sales diverted to our **SCRI fund**





Introduction to Embodied Carbon & Whole Life Carbon Assessment

The Beginning - The Cradle

- Carbon Life Cycle Assessment Starts at the Cradle
- All inputs must be traced back to **The Cradle....**



From the Cradle...



Material Refining

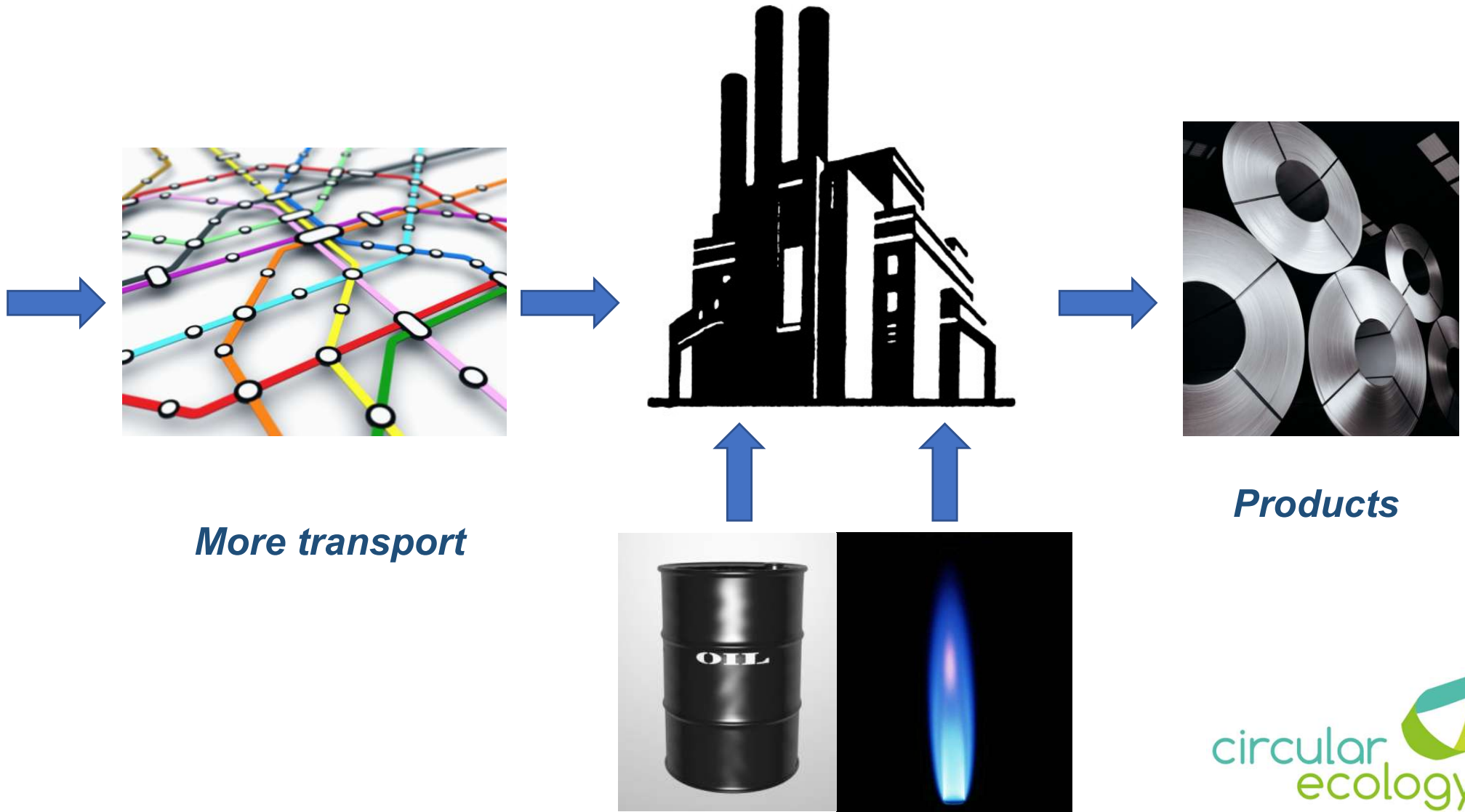


***The Cradle =
The earth, or ground***

Transport

From the Cradle....to (Factory) Gate

Factories: Fabrication, assembly...etc



More transport

Products

...and to (Construction) Site



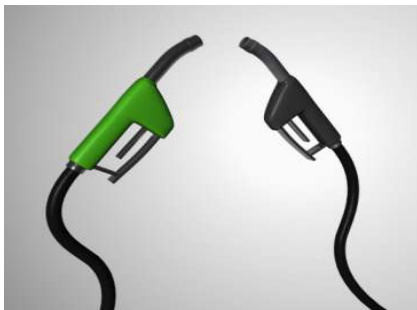
Construction Site



Packaging

Distribution

....On-Site Carbon



Power

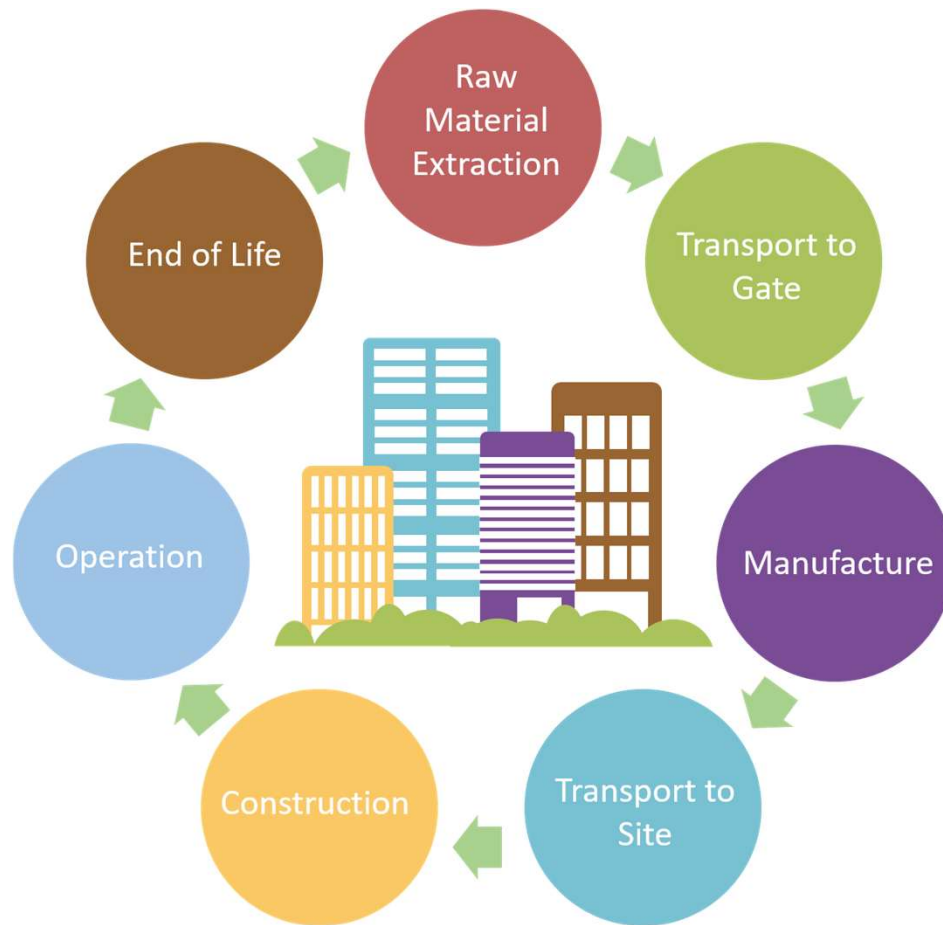


Assembly Activities

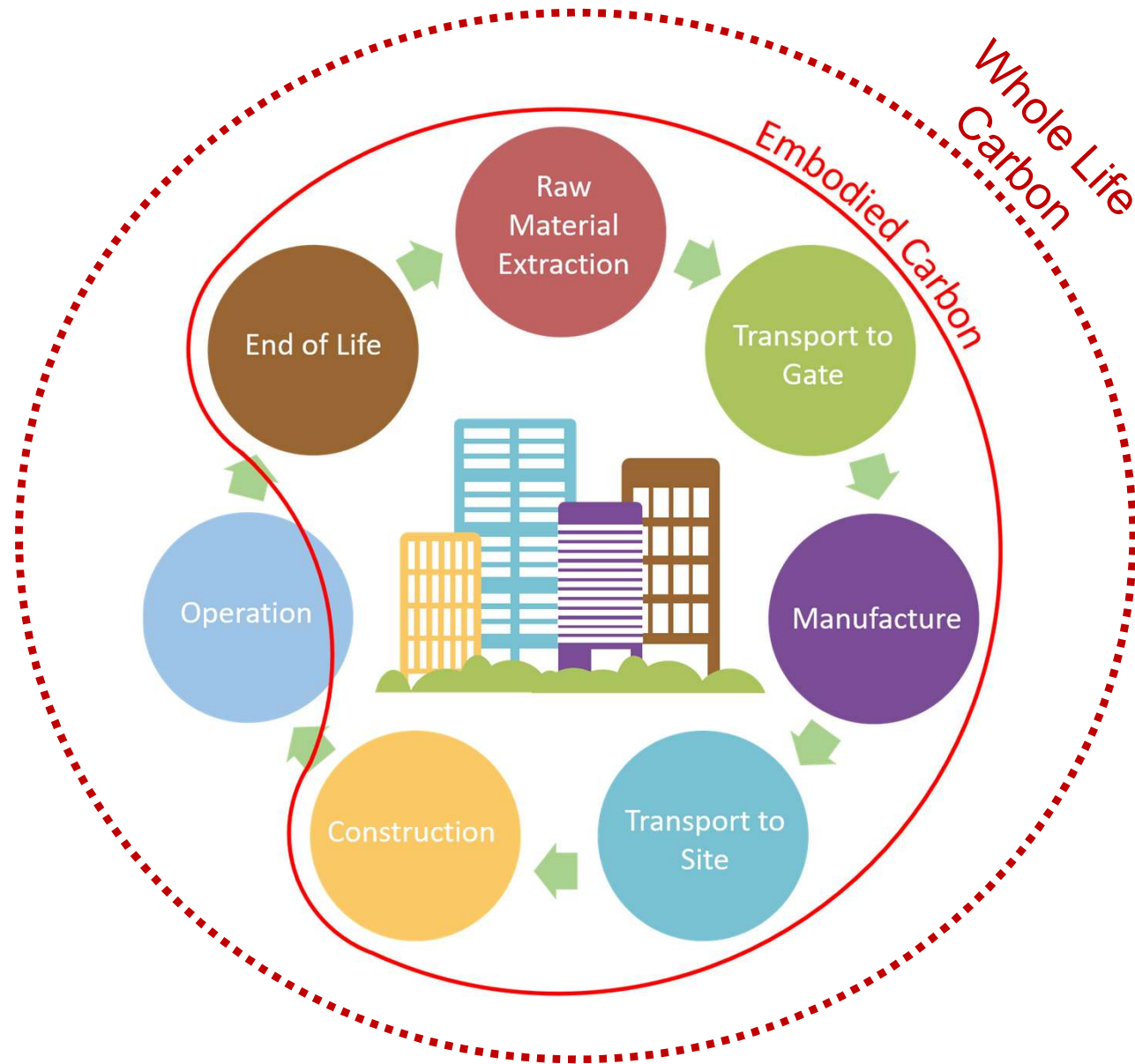


*Waste =
embodied carbon of waste
+ waste management*

The Life Cycle of a Building

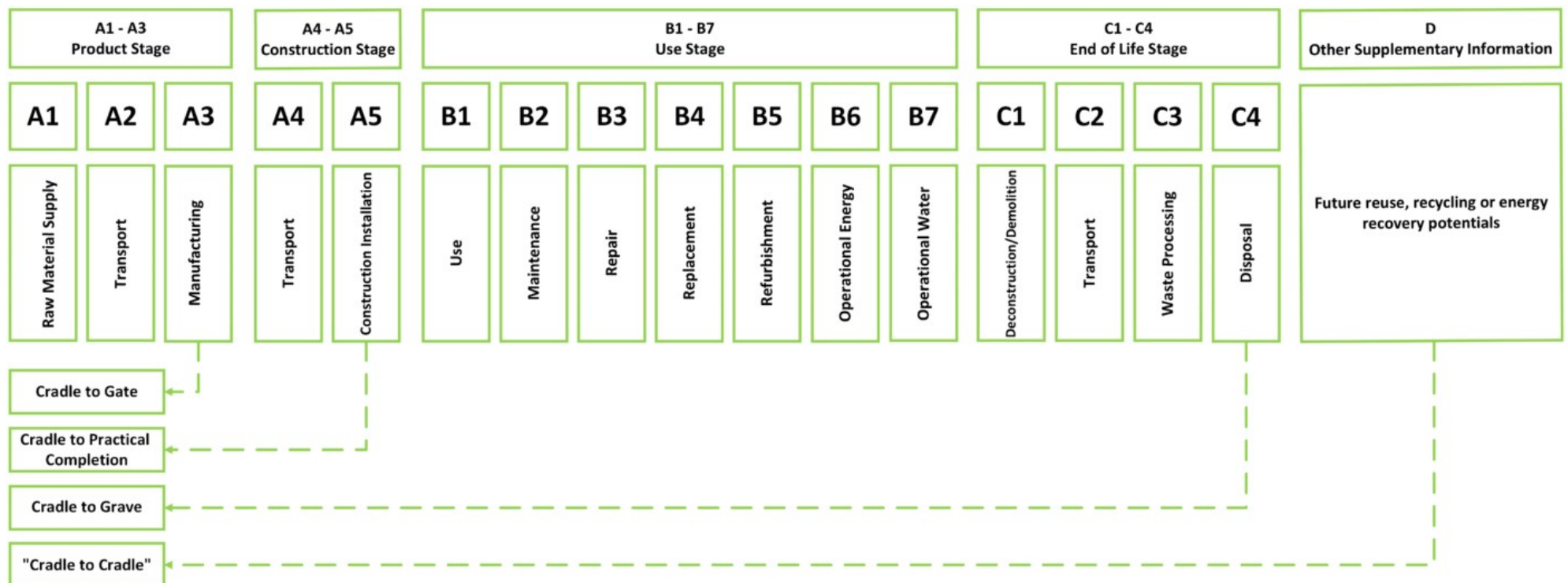


The Life Cycle of a Building



Life Cycle Modules

- Modules A, B, C and D define life cycle stages
- Originally defined in European standards EN15804 / EN 15978 series
- But these Modules are now used extensively around the world

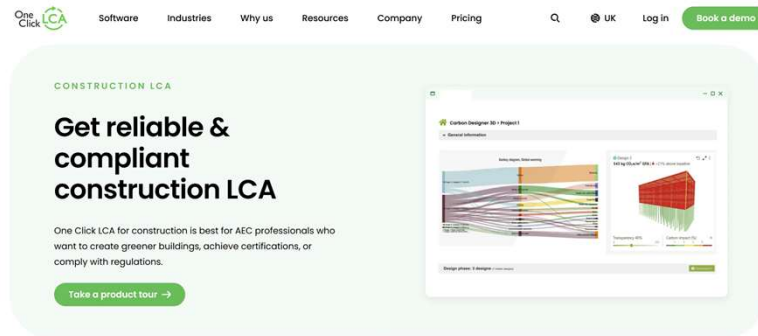
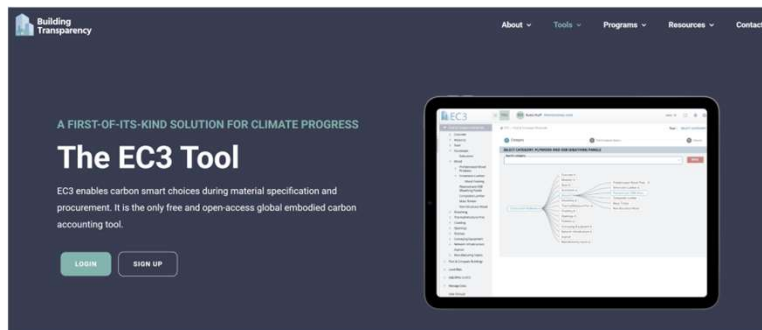




Data and Tools for Whole Life Carbon Assessment

How Do You Measure Whole Life Carbon?

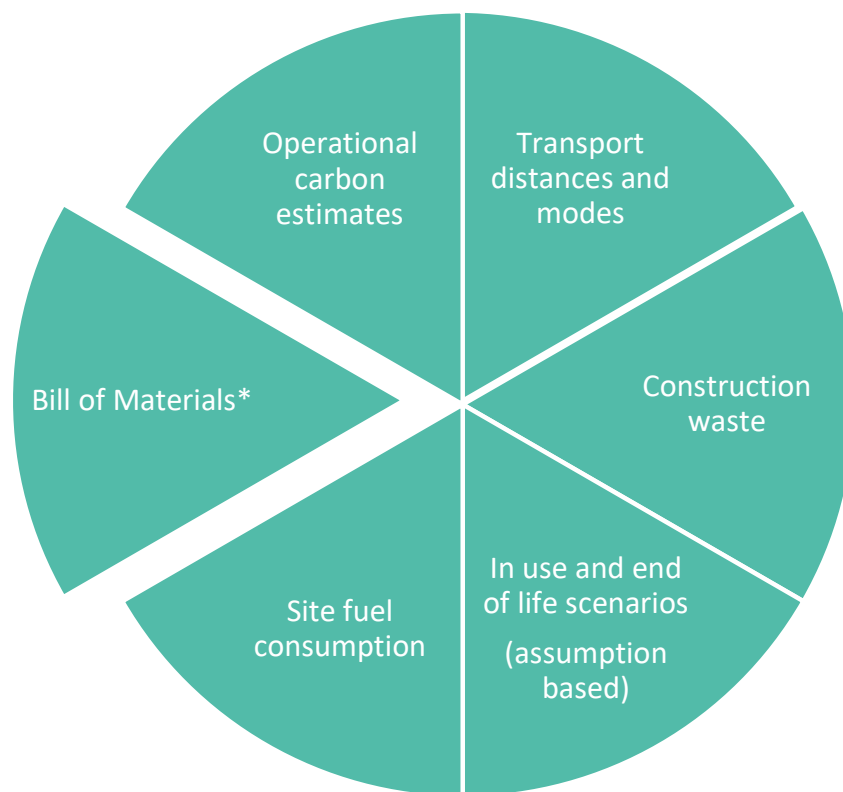
- Assessments can be undertaken through modelling in Excel
 - Using generic data such as the ICE Database and supplier specific carbon factors
 - However, it requires complex excel models and a lot of data
- Therefore, most people now use specialist Whole Life Carbon software and tools, e.g.
 - OneClick LCA (paid) - <https://oneclicklca.com/en-gb/>
 - EC3 (free) - <https://www.buildingtransparency.org/tools/ec3/>



Whole Life Carbon Tools

- There are also many tools for specific types of buildings, or parts of the building:
 - IStructE - The Structural Carbon Tool
 - www.istructe.org/resources/guidance/the-structural-carbon-tool/
 - Cerclos (eTool)
 - <https://cerclos.com/products/etool/>
 - Tally (revit based)
 - <https://choosetally.com/>
 - AECB Embodied Carbon Calculator
 - <https://aecb.net/product/aecb-embodied-carbon-calculator-stand-alone-version-and-first-years-subscription/>
 - RSSB (rail sector cloud-based tool)
 - <https://www.rssb.co.uk/sustainability/net-zero-carbon-rail/rail-carbon-tool>


What Data is Needed for WLC?



* Either Bill of Quantities (BoQ) or access to a good Revit Model plus design drawings and specs

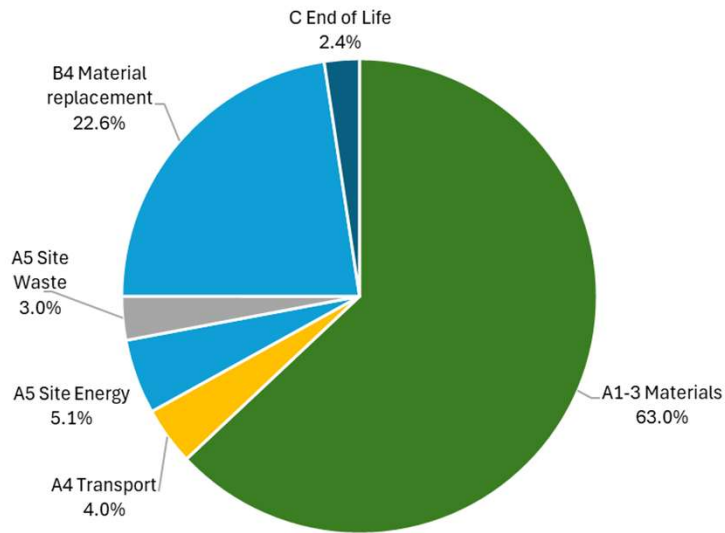
The ICE Database

- An **embodied carbon database (A1-3)** for building materials
 - First version 2005 released by Dr Craig Jones and Professor Geoff Hammond, University of Bath
- Data for over 200 materials
- Thousands of worldwide users
- Excel version free to download from www.circularecology.com/ice-database.html
- ICE Database is becoming an Educational Only resource
 - circularecology.com/news/important-ice-database-announcement
- Launching a new commercial embodied carbon database, called IC+

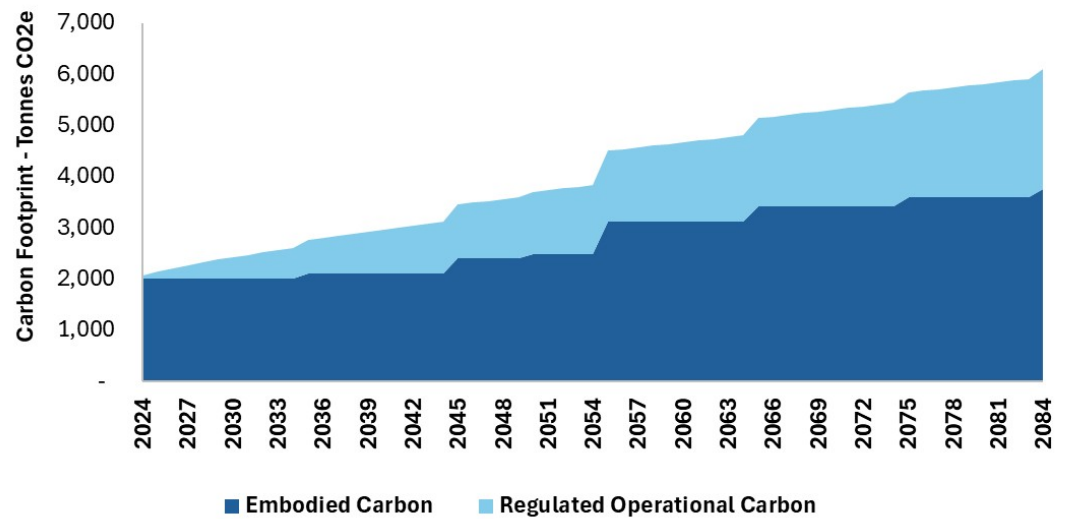
ICE (Inventory of Carbon & Energy)	
<i>All authors are listed alphabetically</i>	
Current Authors:	Circular Ecology*
Affiliation:	
<small>*corresponding author. Contact details: http://www.circularecology.com/contact.html</small>	
Version Control	
Version:	Advanced
Version Number:	V4.0 - Dec 2024
<small>This version is valid for a period of 3 years from the above date. After which it will expire and the data shall not be used.</small>	
<small>Users are required to Register for Permission to use the data for Non-educational Use. Registration is Free. Use the link below and fill in the form on the webpage.</small>	
Is this version still valid?	Check link below, to see if a newer version is available.
Register for permission to use the data for non educational use and to check if this copy is up to date at:	http://www.circularecology.com/embodied-energy-and-carbon-footprint-database.html

Whole Life Carbon Assessment Results

Whole Life Embodied Carbon Breakdown



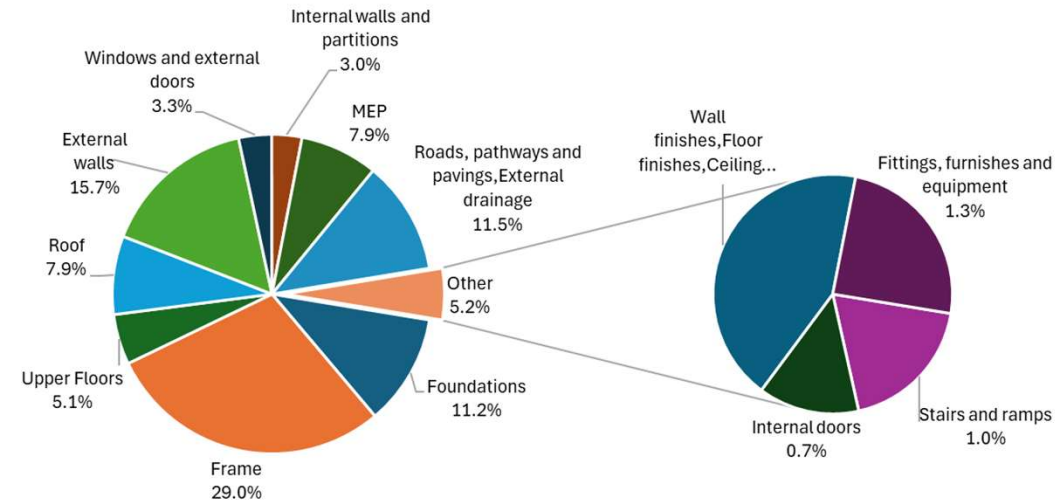
Whole Life Carbon Results



Whole Life Carbon Assessment Results

Building Component	Sub-Component	Embodied Carbon - Excluding Biogenic Carbon (kgCO2e)
0.1 Toxic Mat	Toxic material treatment	-
0.2 Demolition	Major demolition work	-
0.3 Supports	Temporary supports	-
0.4 Groundworks	Specialist groundworks	-
0.5 Diversion	Temporary diversion works	-
1 Substructure	Foundations	251,478
2 Superstructure	Frame	648,753
2 Superstructure	Upper Floors	113,979
2 Superstructure	Roof	177,615
2 Superstructure	Stairs and ramps	21,987
2 Superstructure	External walls	352,178
2 Superstructure	Windows and external doors	74,859
2 Superstructure	Internal walls and partitions	68,159
2 Superstructure	Internal doors	15,879
3 Internal finishes	Wall finishes, Floor finishes, Ceiling finishes	49,865
4 Fittings, furnishes and equipment	Fittings, furnishes and equipment	28,497
5 Services (MEP)	MEP	176,548
6 Prefabricated buildings and building units	prefab	-
7 Work to existing buildings	Works to existing buildings	-
8 External Works	Roads, pathways and pavings, External drainage	256,789

Embodied Carbon Breakdown of Materials



Whole Life Carbon Assessment

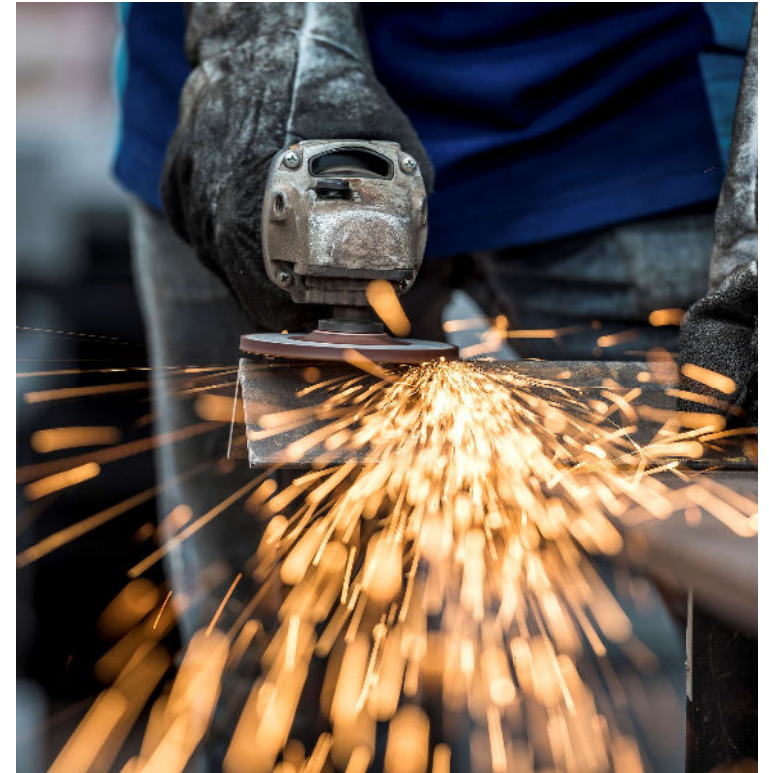
- What about operational carbon?
 - Operational carbon assessment has often been a separate assessment
 - Often using the regulated energy emissions (e.g. Part L building energy calcs)
 - With the results integrated into the Whole Life Carbon Assessment
 - However, there is increased movement to more predictive operational energy modelling
 - Such as CIBSE TM54 encouraged in the RICS 23 WLC Method
- How long does an assessment take?
 - As assessment can be completed in a few weeks
 - However, most detailed assessments span months
 - For example, over the construction timeline of the project
 - Which should ideally include interaction with the design teams to find carbon reduction measures



What Data Can Suppliers and Manufacturers Provide?

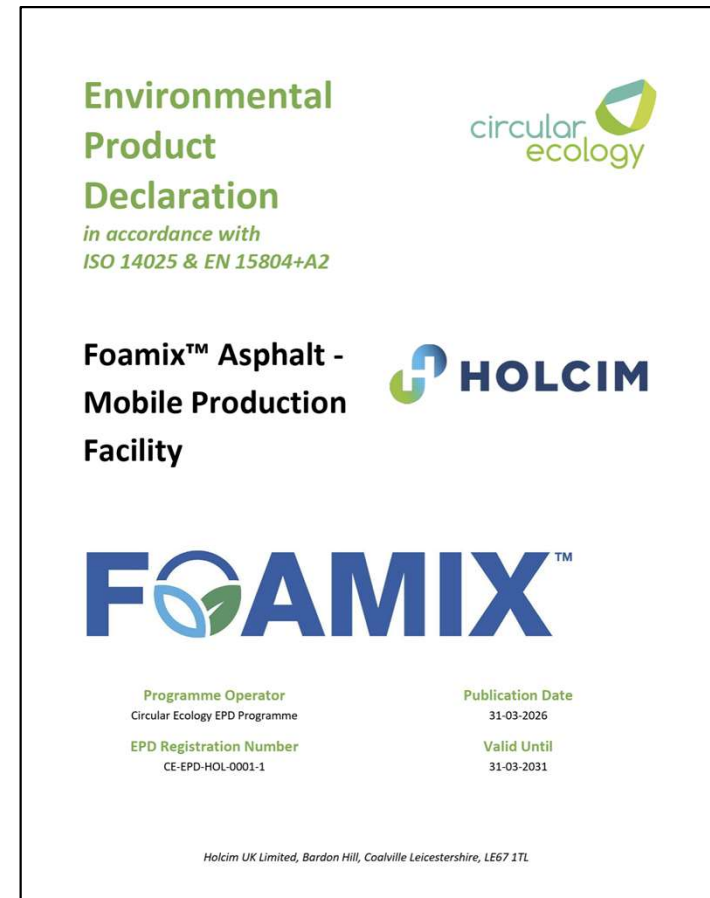
What Data Can Suppliers and Manufacturers Provide About Their Products?

- Embodied carbon data: Cradle to (factory) Gate, A1-3:
 - A1 - Raw material extraction & use of recycled materials
 - A2 - Transport to site of manufacture
 - A3 - Energy consumed in manufacturing process
- Other data includes material quantities, composition and product service life
- Usually in the form of an EPD, LCA or Product Carbon Footprint compliant with EN15804 + A2



Environmental Product Declarations (EPD)

- **Environmental Product Declarations (EPDs)** are short documents usually provided by a product manufacturer
- EPDs show the results of a Life Cycle Assessment, and contain information on the impact of a material or product over a certain lifespan
- A wide range of impact categories are included (not only carbon)
- **Circular Ecology recently became an EPD publisher...**



Why Is Supplier Specific Data Useful?



Helps improve accuracy of WLC assessments



Can inform low carbon decision making (e.g., comparison of multiple products with similar function)



Assists with identification of carbon hotspots to inform where best to focus efforts

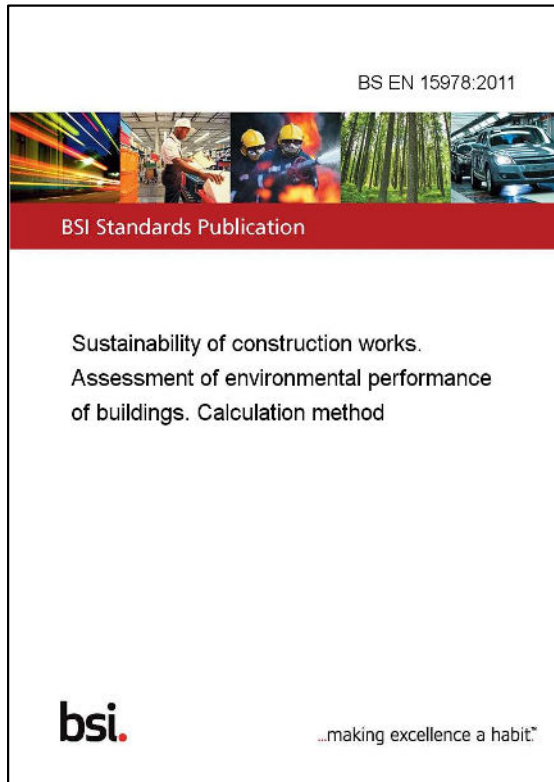


RICS Edition 2 requires use of EPDs where appropriate, some certification schemes give credits for their use

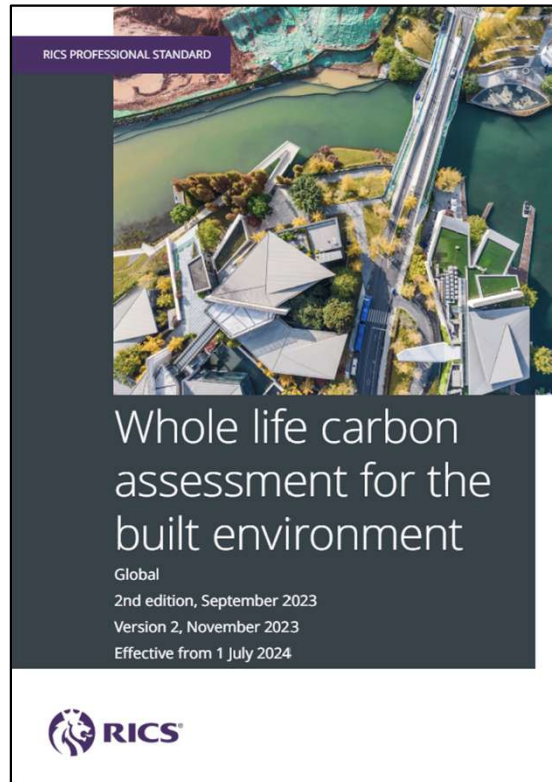


Whole Life Carbon Standards

What Standards Should Be Adhered To?



BS EN 15978:2011



RICS Professional Standard – Whole
life carbon assessment for the built
environment -
2nd Edition



PAS 2080:2023 – Carbon
management in buildings and
infrastructure

Tips for Ensuring Compliance



Ensure use of reputable WLC calculation tools



Seek third party validation of assessments



Ensure a clear scope and boundary



Maintain an audit trail and detail any assumptions



Undertake specific whole life carbon training courses

Certification Schemes Considering WLC



BREEAM®

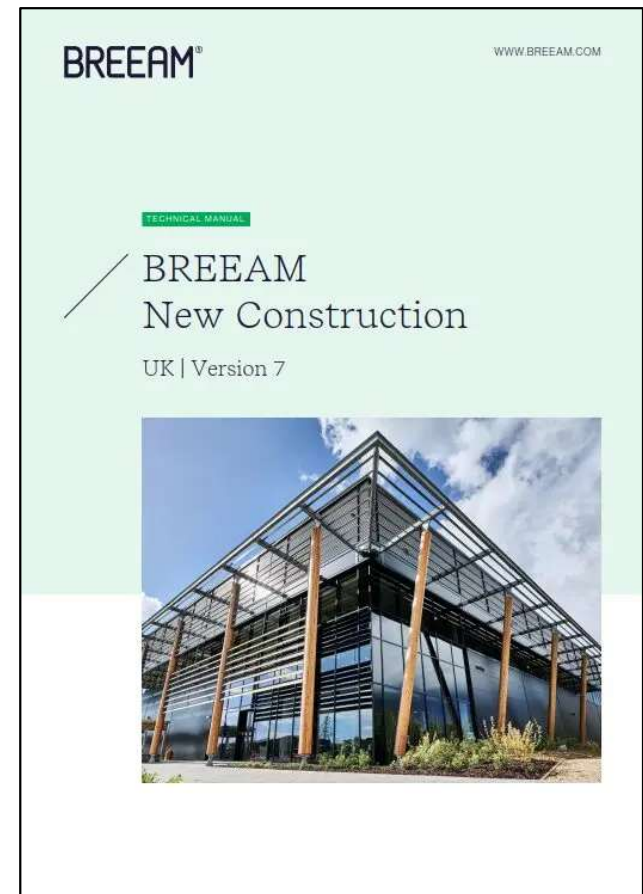




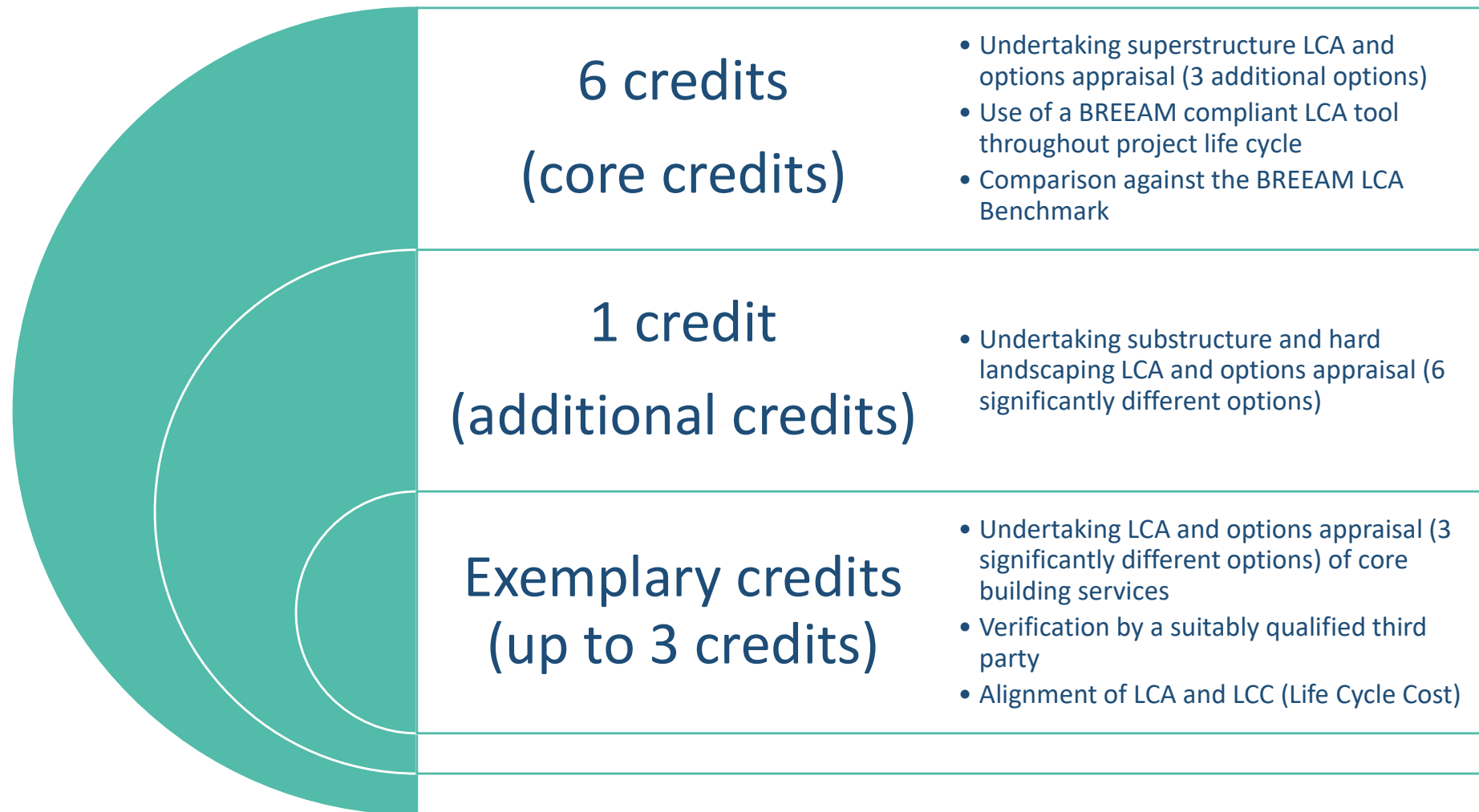
BREEAM Mat 01 LCA Credits

BREEAM Mat 01

- Credits are available for undertaking LCA – contributing to overall BREEAM rating
- Mat 01 Life Cycle Assessment (LCA) is designed to **assess** and **drive design decisions** which can reduce the environmental impacts of a construction project
- Mat 01 covers range of lifecycle impacts (not just Global Warming Potential)
- Only recognised tools should be used to conduct the LCA
- “*Significantly different design options*” are required to be assessed against each other
- Currently in transition from V6 to V7
- UK and International versions now fully aligned (for Mat 01)



Mat 01 Available Credits (Version 6)



Mat 01 Available Credits (Version 7)

Significant updates to Mat 01 in Version 7, to improve effectiveness and drive low carbon decision making

7 core credits + **3** exemplar credits available

3 stages instead of 2 (introduction of post-completion assessment, which must use as-built data for A1-5)

Verification credit must be completed by a 3rd party, not related to the project or the initial assessment (exemplar credit)

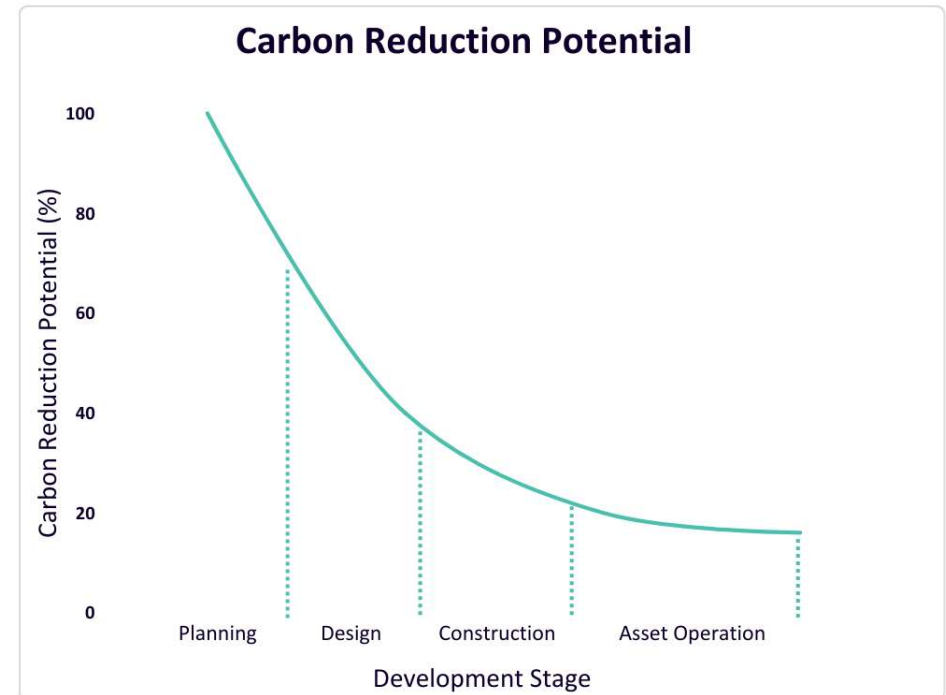
Mat 01 Building Element Coverage

Table 4: Scope and breakdown of building elements classification for BREEAM assessment types

Building elements		BREEAM							General	
Granularity Level 1 Early design stage	Granularity Level 2 Technical design and construction phase	New construction			RFO				Cat A*	Cat B
		Fully fitted	Shell and core	Shell only	Part 1	Part 2	Part 3	Part 4		
Demolition	Toxic material treatment	Y	Y	Y	Y	N	N	N	Y	Y
	Major demolition works	Y	Y	Y	Y	N	N	N	Y	Y
Facilitating works	Temporary / enabling works	Y	Y	Y	Y	N	N	N	Y	Y
	Specialist ground works	Y	Y	Y	Y	N	N	N	Y	Y
Substructure	Substructure	Y	Y	Y	Y	N	N	N	Y	Y
Superstructure	Frame	Y	Y	Y	Y	N	N	N	Y	Y
	Upper floors	Y	Y	Y	Y	N	N	N	Y	Y
	Roof	Y	Y	Y	Y	N	N	N	Y	Y
	Stairs and ramp	Y	Y	Y	Y	N	N	N	Y	Y
	External walls	Y	Y	Y	Y	N	N	N	Y	Y
	Windows and external doors	Y	Y	Y	Y	N	N	N	Y	Y
	Internal walls and partitions	Y	S	S	S	N	N	Y	S	Y
	Internal doors	Y	S	S	S	N	N	Y	S	Y
Finishes	Wall finishes	Y	S	N	N	N	N	Y	S	Y
	Floor finishes	Y	S	N	N	N	N	Y	S	Y
	Ceiling finishes	Y	S	N	N	N	N	Y	S	Y
FF&E	FF&E (fixed)	Y	S	N	N	N	N	Y	S	Y
	FF&E (non-fixed)	Y	N	N	N	N	N	Y	N	Y
Building services	Building services	Y	S	N	N	S	S	S	S	Y
	Refrigerant leakage	Y	S	N	N	Y	S	N	S	Y
	Renewable electricity generation	Y	S	N	N	Y	N	N	S	Y
Prefabricated buildings	Pre-fab building units	Y	Y	S	Y	N	N	N	Y	Y
Work to existing buildings	Minor demolition and alternation	Y	Y	S	Y	N	N	N	S	Y
External works	External works	Y	Y	S	Y	S	N	S	S	Y

Mat 01 Considerations

- Mat 01 LCA is undertaken at RIBA Stage 2 Concept Design, Stage 4 Technical Design and Stage 6 Handover (Post-Construction)
- Mat 01 assessments can be undertaken by specialists including consultants and architects
- Assessments can be produced in as little as 1-2 weeks, but 4-6 weeks is more appropriate



Recreation of graphic from UK Government Infrastructure Carbon Review



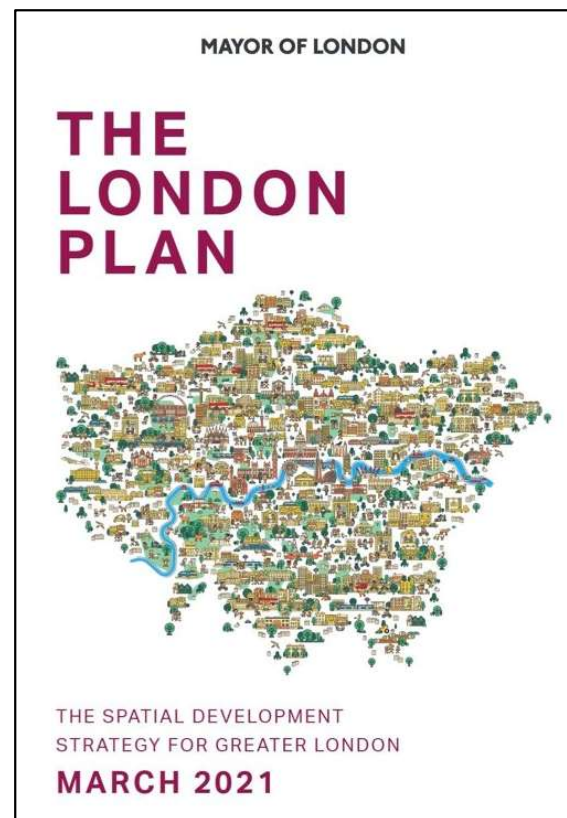
Whole Life Carbon in the London Plan

London Plan Whole Life Carbon

“Whole life-cycle carbon emission assessments are therefore required for development proposals referable to the Mayor.”

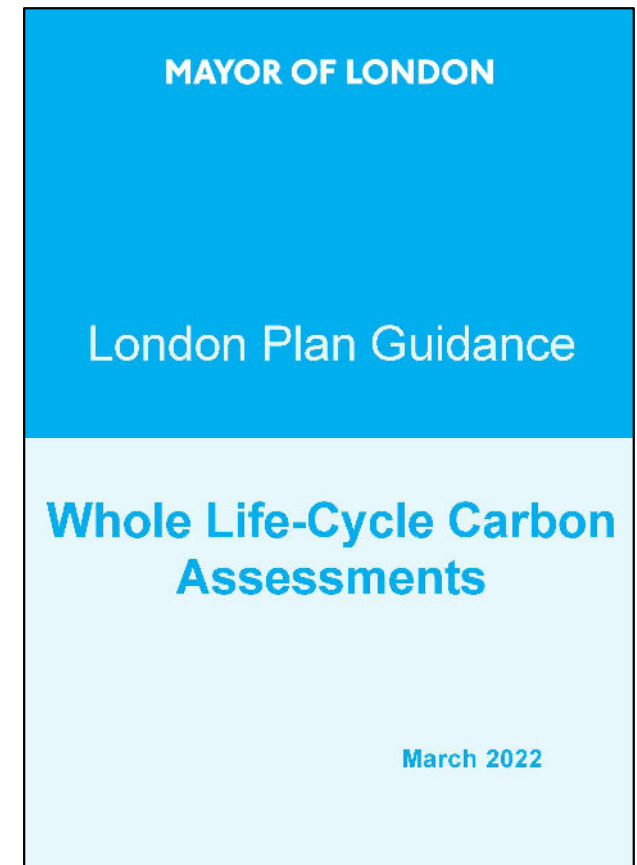
“Major non-referable development should calculate unregulated emissions and are encouraged to undertake whole life-cycle carbon assessments.”

The London Plan, 2021, Chapter 9 Sustainable Infrastructure



London Plan Guidance

- Based on BS 15978:2011 and RICS WLC Edition 2 – with some specific deviations:
 - Specific reporting requirement for operational carbon
 - All life-cycle modules (A-D) to be reported – including pre-construction demolition (A5.1)
 - Quantification of “key” carbon reduction actions
 - Infrastructure projects can be required to complete WLC, but are recommended to align with PAS 2080



Stages of London Plan WLC

Pre-application Stage

- Provide brief outline details of the proposal
- Confirm details of, or otherwise outline justification of exclusion of, range of carbon reduction measures
- Estimation of emissions associated with any pre-construction demolition

Outline or Detailed Planning Stage

- Estimation of total Whole Lifecycle Carbon Emissions for each lifecycle module
- Completion of Material Quantities and End of Life Scenarios (in line with details provided in the project's Circular Economy Statement)

Post-Construction Stage

- Assessment based on actual materials, products and systems used
- Comparison of post-construction stage assessment with planning stage assessment and details of any deviations
- Comparison with GLA's benchmark values for the building type and summary of good practices and lessons learned

Benchmark Values

WLC benchmark	A1-A5	B-C (excl B6 & B7)	A-C (excl B6 & B7)
Offices	<950	<450	<1400
Residential	<850	<350	<1200
Schools, Universities etc.	<750	<250	<1000
Retail	<850	<200	<1050
Aspirational WLC benchmark	A1-A5	B-C (excl B6 & B7)	A-C (excl B6 & B7)
Offices	<600	<370	<970
Residential	<500	<300	<800
Schools, Universities etc.	<500	<175	<675
Retail	<550	<140	<690

* All benchmark values in kg CO₂e/m²

Submission Deadlines

BREEAM Mat 01

- The Concept Stage LCA must be completed **within 20 working days** of submitting for planning application (N.B., those working to V6 must submit **ahead** of planning)

London Plan WLCA

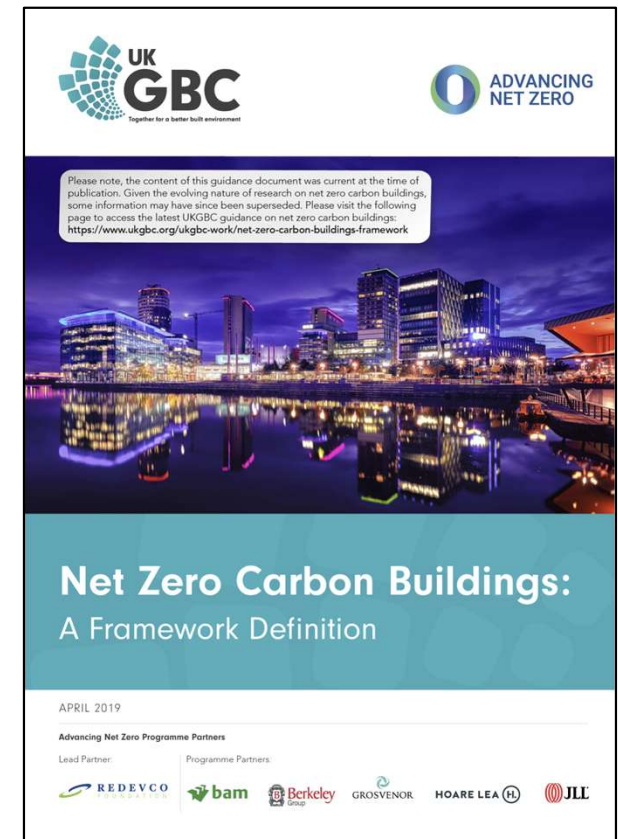
- For planning applications referable to the Mayor, a WLC assessment should be submitted at the following stages:
 - Pre-application (where relevant)
 - Planning application submission (i.e. RIBA stage 2/3)
 - Post-construction (i.e. prior to occupation of the development. Expected within three months post-construction)



How Can Whole Life Carbon Help with Net Zero Carbon Buildings

The Rise of Net Zero Carbon Buildings

- UK GBC Net Zero Carbon Framework set the foundation for NZC buildings back in 2019
- They also released guidance on:
 - Levels of performance
 - Renewable energy procurement
 - Carbon offsetting good practice guidance
- This framework has now been superseded by the development of UK NZC Standard
- It was an important standard for development of NZC buildings



UK Net Zero Carbon Buildings Standard

- **UK Net Zero Carbon Standard was launched in pilot phase Sept 24**
- Builds upon the same principles as UKGBC standard – single agreed definition of NZC building
- **UK GBC framework is being retired**
- UK NZC Standard doesn't currently allow Net Zero Construction (embodied carbon), covers **both** upfront and operational carbon
 - Although have indicated that these requirements may be developed in the future
- **UK NZC Standard Version 1 launched in March 2026**



Achieving NZ Building Certification

Certification is made up of 4 components:

- Limits
- Targets
- Reporting Requirements
- Optional Requirements

There is also an “on track” review at **Practical Completion (PC) stage.**

A verification partner has been appointed, however the pool of approved verifiers is expected to expand over time.



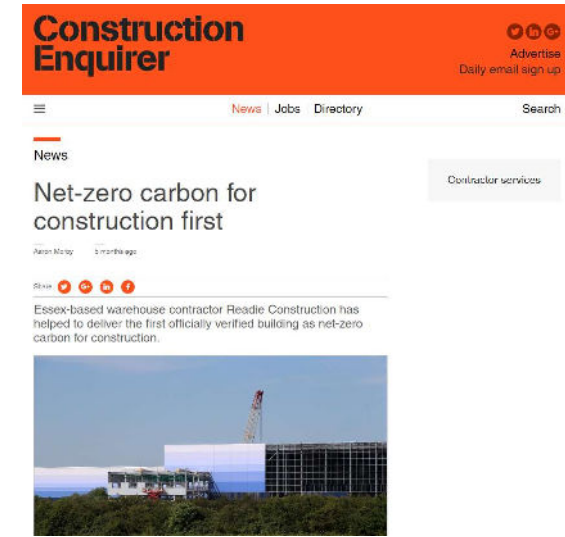
Net Zero Carbon Buildings

Whole Life Carbon assessments help with the requirements of any of these NZC building standards

- Target lower embodied and whole life carbon emissions
- Reduce embodied carbon
- Measure residual embodied carbon
 - Evidenced by as-built embodied carbon
- Project operational carbon emissions over the lifetime

World's First UKGBC Net Zero Carbon Building

- GLP Magnitude – Net Zero Carbon Construction
 - Logistics centre - 29,183 m² GIA
 - First building verified to UKGBC as Net Zero Construction (Embodied carbon)
- Circular Ecology:
 - Measured embodied carbon
 - Advised on carbon reduction
 - Took through the Net Zero Carbon verification process
 - Provided the carbon offsets - 11,735 tCO₂e
- Example news:
 - <https://www.constructionenquirer.com/2020/08/25/net-zero-carbon-for-construction-first/>



Net Zero Carbon Buildings:
A Framework Definition

APRIL 2019







Advancing Net Zero Programme Partners

Lead Partners:



Carbon Offset Credits

- We have **offset many construction projects for carbon neutrality**, or for **Net Zero Embodied Carbon achievements**
- Selection of offsets on our **online store**:
 - circularecology.com/product-category/carbon-offset
- We are working on automating **carbon offset certificates**. For now, we ask interested parties to request a certificate for their order via email
- For larger volumes, we encourage people to contact us for **bulk pricing (500+ tCO₂e)**
- Currently **6 projects on sale – up to 20% off per tCO₂e**

 <p>Sale!</p>	 <p>Sale!</p>	 <p>Sale!</p>
CARBON OFFSETS General Offset Portfolio £10.00 £8.00	CARBON OFFSETS Gold Standard Portfolio - Renewable Energy £8.00 £6.50	CARBON OFFSETS CommuniTree Forestry Project Nicaragua £18.00 £14.75
 <p>Sale!</p>	 <p>Sale!</p>	 <p>Sale!</p>
CARBON OFFSETS Gold Standard Safe Water - Gender Equality Certified Project £19.00 £15.00	CARBON OFFSETS Gold Standard Biogas and Clean Cookstoves Project Kenya £19.75 £18.00	CARBON OFFSETS Gold Standard Biogas Digesters Project Indonesia £19.00 £17.00



Summary

Today's Webinar - Recap

- What is Embodied Carbon, Operational Carbon and Whole Life Carbon Assessment
- Tools used to assist WLCA
- Data that suppliers can provide to assist WLCA
- Standards that WLCA can be aligned to
- Certification schemes for buildings
- BREEAM Mat 01 – Version 6 and 7
- London Plan WLCA
- Net Zero Buildings

Next Webinars

Next Webinars -

- An Overview of Carbon Neutrality: Measure, Manage, Offset, Improve – 30th April 2026
- Carbon Reduction Plans: PPN 006 & NHS Net Zero Supplier Roadmap – 7th May 2026

Webinars on Demand - Watch these webinars on our website,

circularecology.com/webinars-on-demand.html

- An Introduction to Bespoke Carbon Datasets
- How to Produce an EPD: An Overview
- An Introduction to the Circular Ecology EPD Programme
- Organisational Carbon Footprints - From Measurement to Meaningful Action
- Product Carbon Footprints & LCAs: What You Need to Know

Keep an eye on our networks for more information

- Website - circularecology.com
- LinkedIn - linkedin.com/company/circular-ecology

