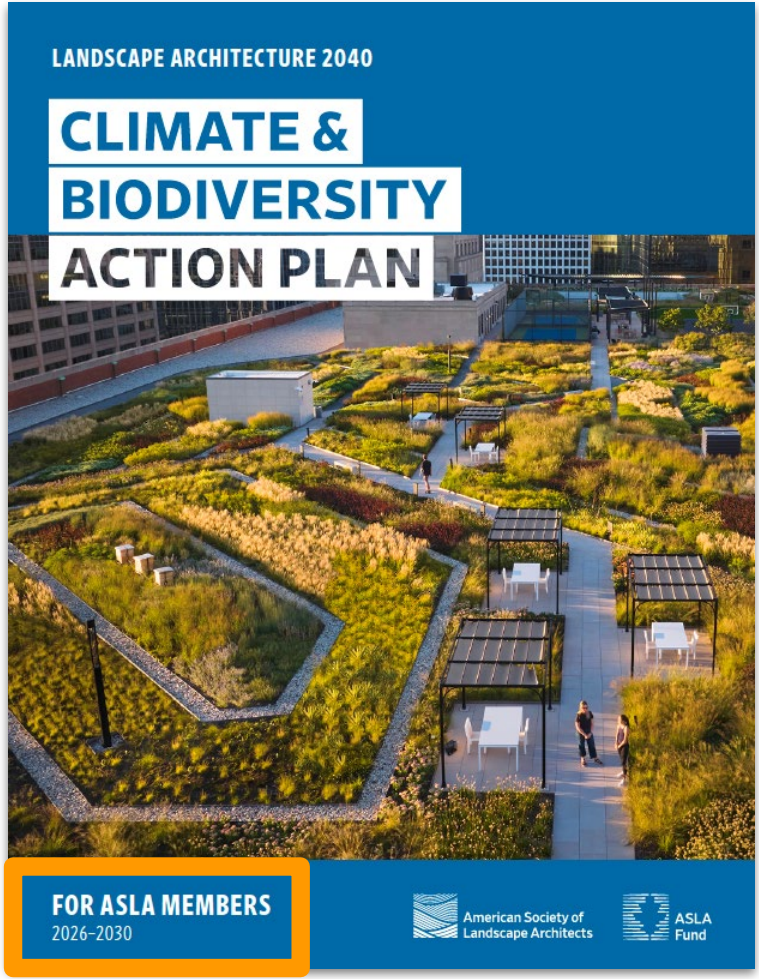
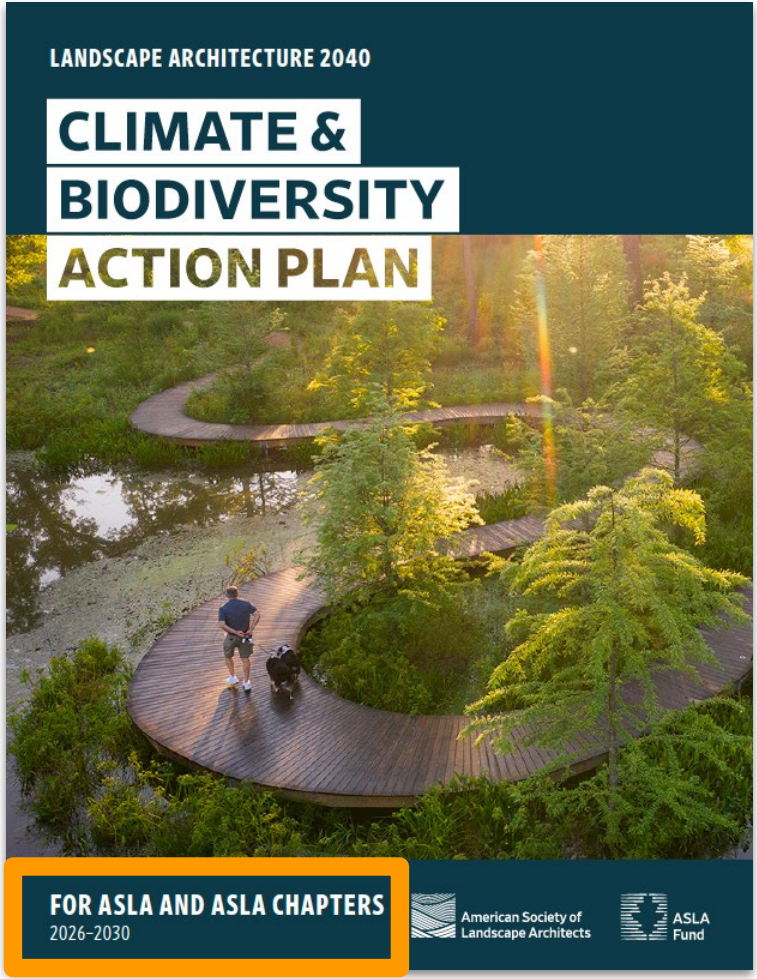
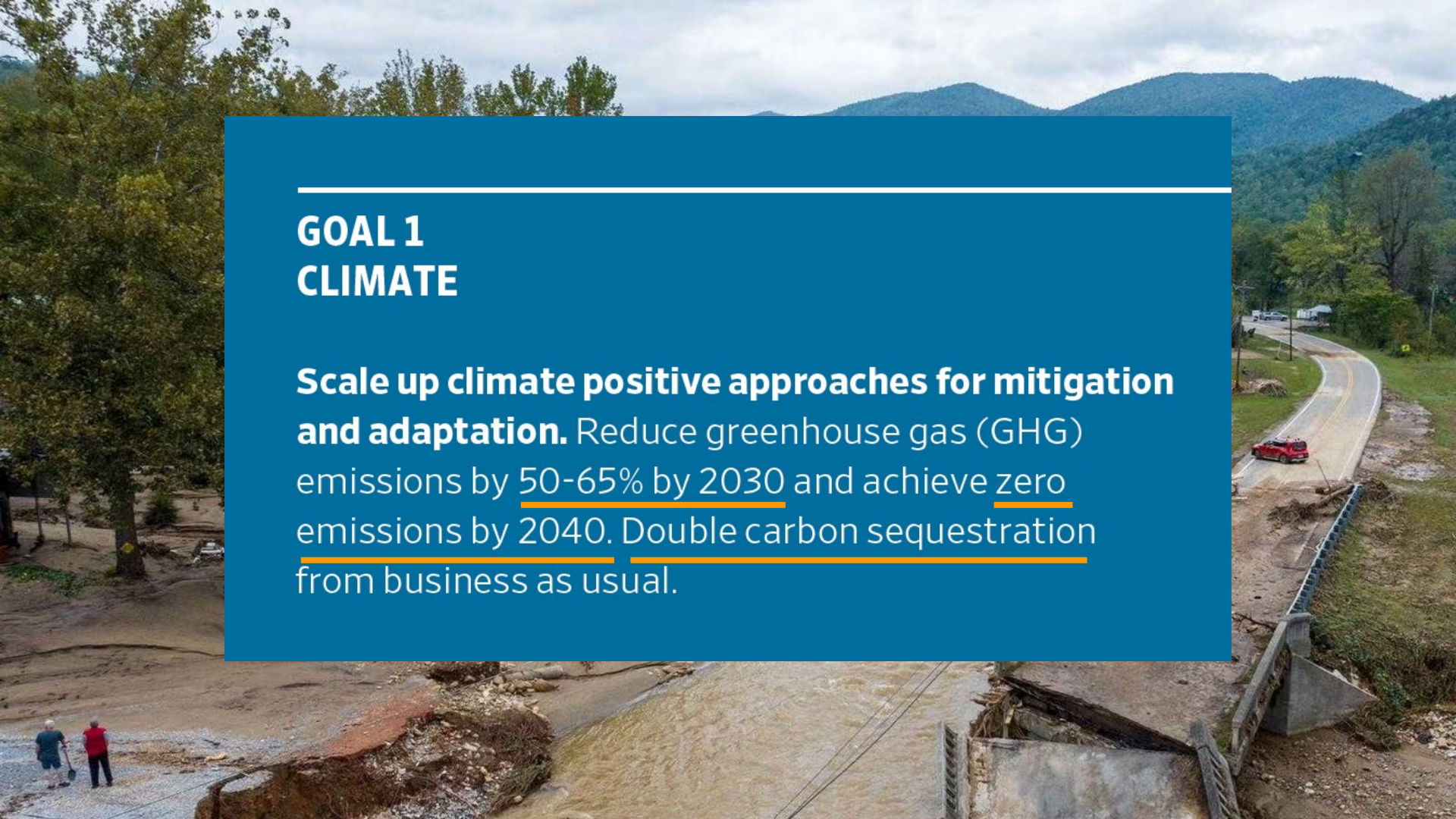
TRACKING WHOLE LIFE CARBON FOR LA 2040


LANDSCAPE ARCHITECTURE 2040
CLIMATE &
BIODIVERSITY
ACTION PLAN
FOR ASLA MEMBERS
2026–2030
American Society of Landscape Architects
ASLA Fund


LANDSCAPE ARCHITECTURE 2040
CLIMATE &
BIODIVERSITY
ACTION PLAN
FOR ASLA AND ASLA CHAPTERS
2026–2030
American Society of Landscape Architects
ASLA Fund

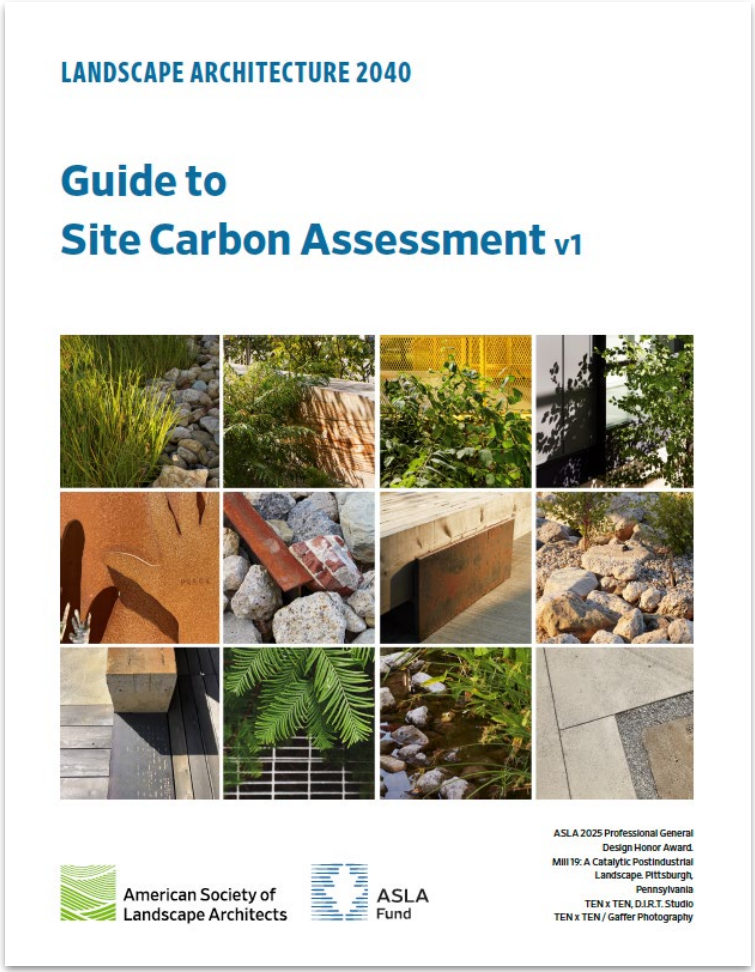
SCAN ME!



GOAL 1
CLIMATE

Scale up climate positive approaches for mitigation and adaptation. Reduce greenhouse gas (GHG) emissions by 50-65% by 2030 and achieve zero emissions by 2040. Double carbon sequestration from business as usual.

You can’t reduce what you don’t track



The LA2040 SCA Guide is here!

SCAN ME!

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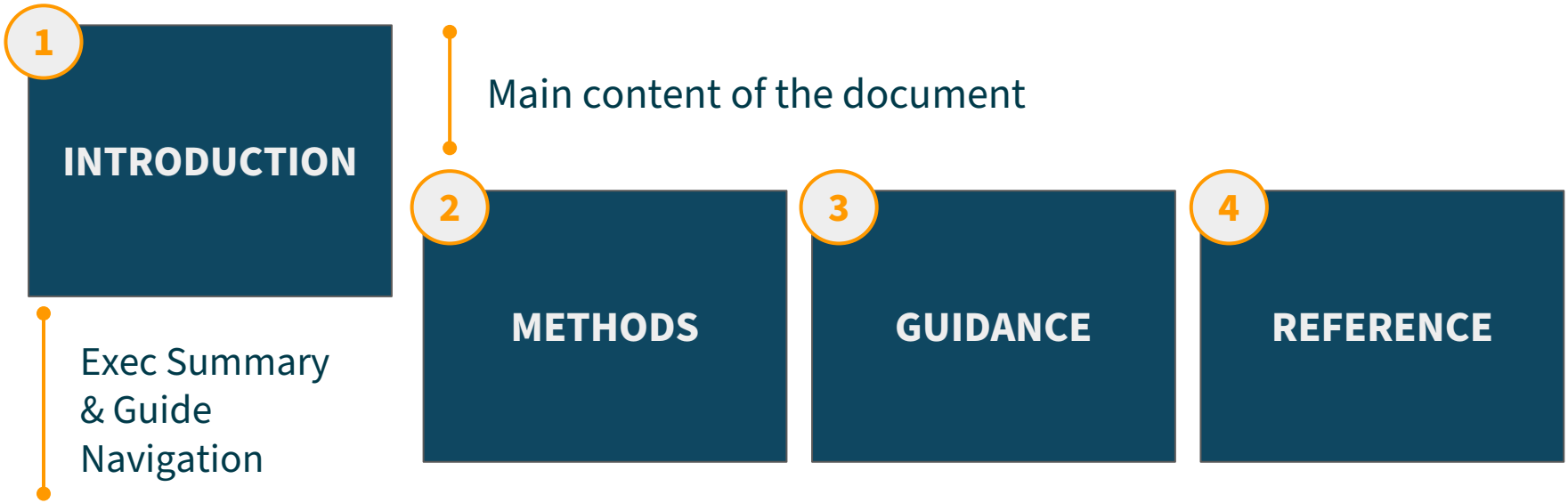
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1. INTRODUCTION

How to Navigate The Guide: Sections

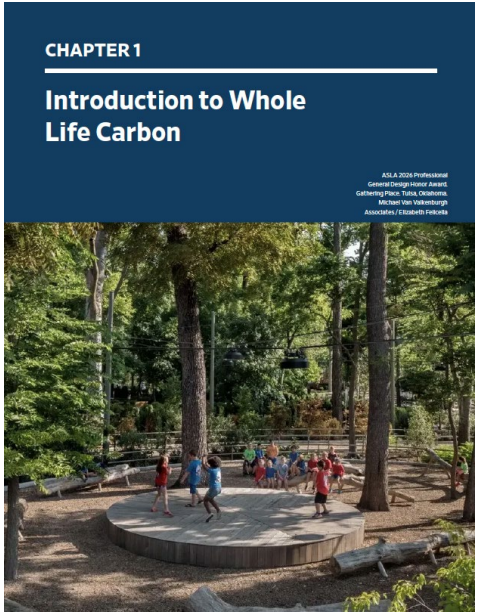


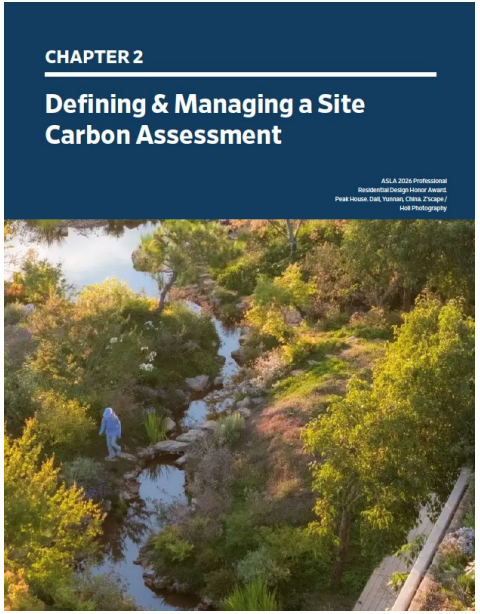
Navigating The Guide: METHODS

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METHODS

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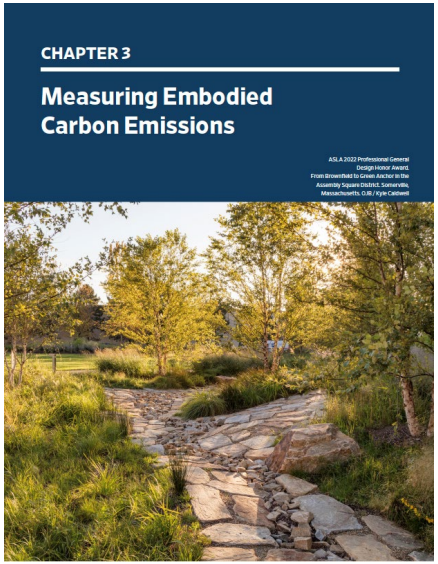


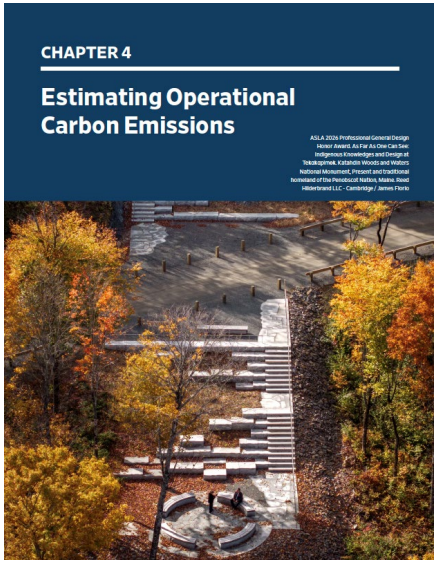


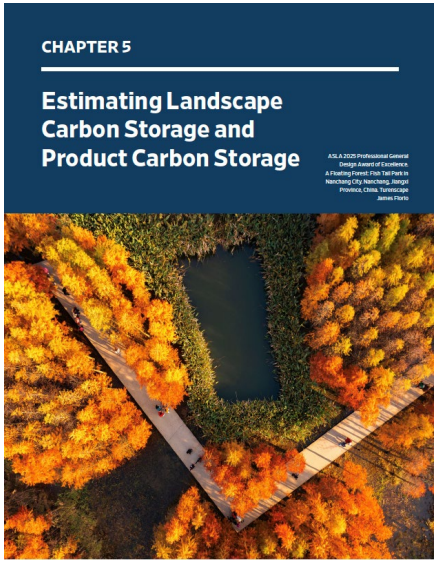
Navigating The Guide: GUIDANCE

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GUIDANCE =





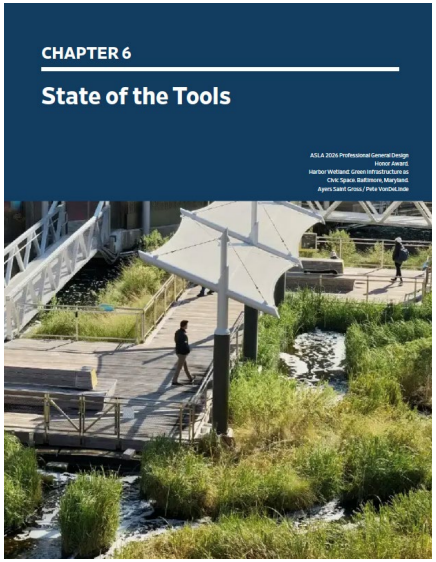


Navigating The Guide: REFERENCE

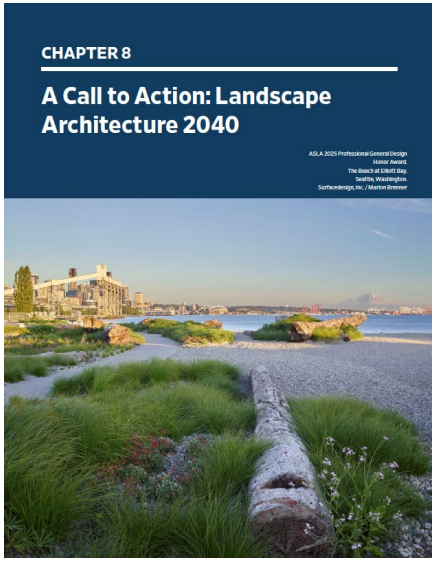
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REFERENCE

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Navigating The Guide: APPENDICES

APPENDIX I: RESOURCES

Resources for Site Decarbonization Strategies

ASLA Climate & Biodiversity Action Committee Research & Guides

- ASLA Decarbonizing Specifications Guide
- ASLA Decarbonizing Design Guide
- ASLA Guide to Navigating Environmental Product Data
- Navigating Environmental Product Data: A Guide for Landscape Architects, Specifiers, and Industry Partners

Climate Positive Design Toolkit

Partner Industry Publications

- CLF Published Research
- ECHO Publications & Schema
- MEP2040 Beginners Guide to Embodied Carbon v2
- ASCE Prestandard for Assessing the Embodied Carbon of Structural Systems for Buildings

Carbon Assessment Tool Resources

- Pathfinder Methodology Report
- Pathfinder User Guide
- C.Scale Methodology
- C.Scale User Guide
- CarbonConscience v2 White Paper

EPD Databases

- Building Transparency's EC3 hosts an open-source database of 152,000 product-specific and industry-wide EPDs for the building industry. Its main function is to enable carbon smart choices during material specification and procurement. Their searchable construction material categories include concrete, masonry, steel, aluminum, wood, sheathing, thermal/moisture protection, cladding, openings, finishes, network infrastructure, asphalt, and manufacturing inputs. EC3 2.0 is in development.

LCA Standards

- ISO 14404, ASHRAE 240P, RICS
- ASCE 73-23 - Standard Practice for Sustainable Infrastructure (Pamela)

Resources for Measuring Operational Carbon Emissions

General References and Standards

- Action 1.2.3, LA 2040 ASLA Climate & Biodiversity Action Plan
- AIA 2030 Design Data Exchange (DDx) Reporting
- Energy Star
- Water Use Classification of Landscape Species (WUCOLS)
- Water Resources of the United States Hydrologic Unit Map
- Operational carbon footprint of the U.S. water and wastewater sector's energy consumption

Energy and Greenhouse Gas Emission Modeling Tools

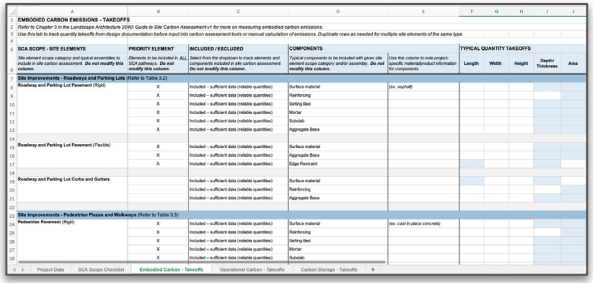
- EnergyPlus
- Sima Pro
- Open LCA
- RETScreen
- Integrated Environmental Solutions Virtual Environment (IES VE)
- Dialux

APPENDIX II: Material Quantities & Takeoff Template

Excel spreadsheet to facilitate tracking project data, site carbon assessment scope, and material quantity takeoffs.

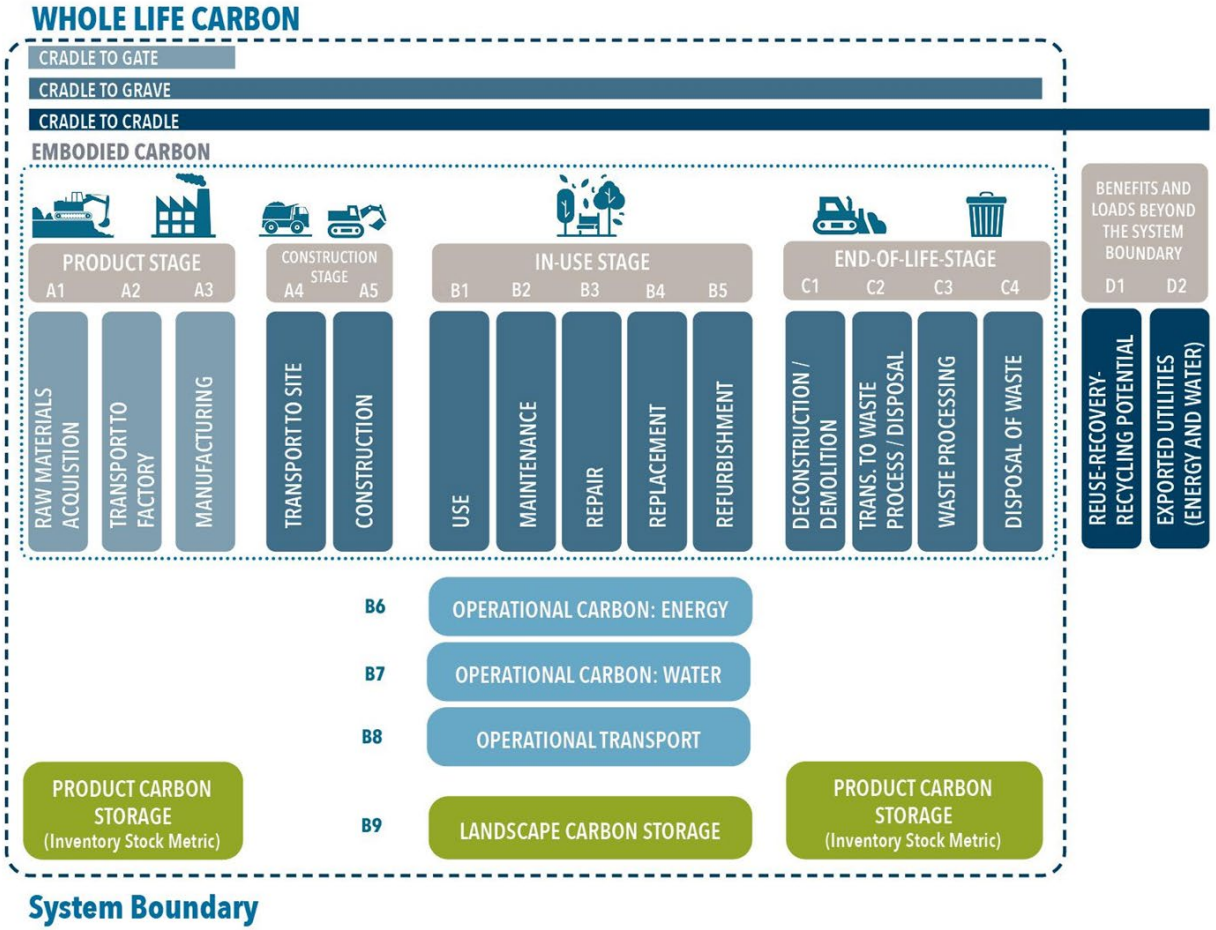
APPENDIX III: B4 Replacement Factors

ELEMENT OR MATERIAL	EXPECTED SERVICE LIFE (years)	REPLACEMENT FACTOR (60 year project life)	NOTES
PAVEMENT			
Concrete	30-50	2	
Porous concrete	20-30	3	
Asphalt Pavement	15-25	3	
Precast concrete unit pavers	30-40	2	
Brick pavers, sand set	50-100	1	Replacement of full system; resurfacing required more often
Stone pavers, sand set	50-100	1	Releveling required
Stone dust, stabilized (binder replacement)	15-25	3	Releveling required
Stone dust, unstabilized	60-100	1	Releveling required
Safety surface	15-25	3	Plant based binders may need to be replaced every 5 years
Artificial turf	10-20	4	Releveling required
WALLS, RETAINING AND FREESTANDING			
Concrete	30-50	2	Replace whole system
Interlocking concrete block	40-70	1	
Timber	20-40	2	
Concrete cantilever, masonry veneer	30-50	2	
Dry Stack Stone	50-70	1	Repair required
Solid stone with mortar	50-70	1	Repoint estimated for every 30yrs
Solid brick with mortar	50-70	1	Repoint estimated for every 30yrs
Rammed Earth	50-70	1	Protection from moisture required
Interlocking compressed earth block	50-70	1	Protection from moisture required



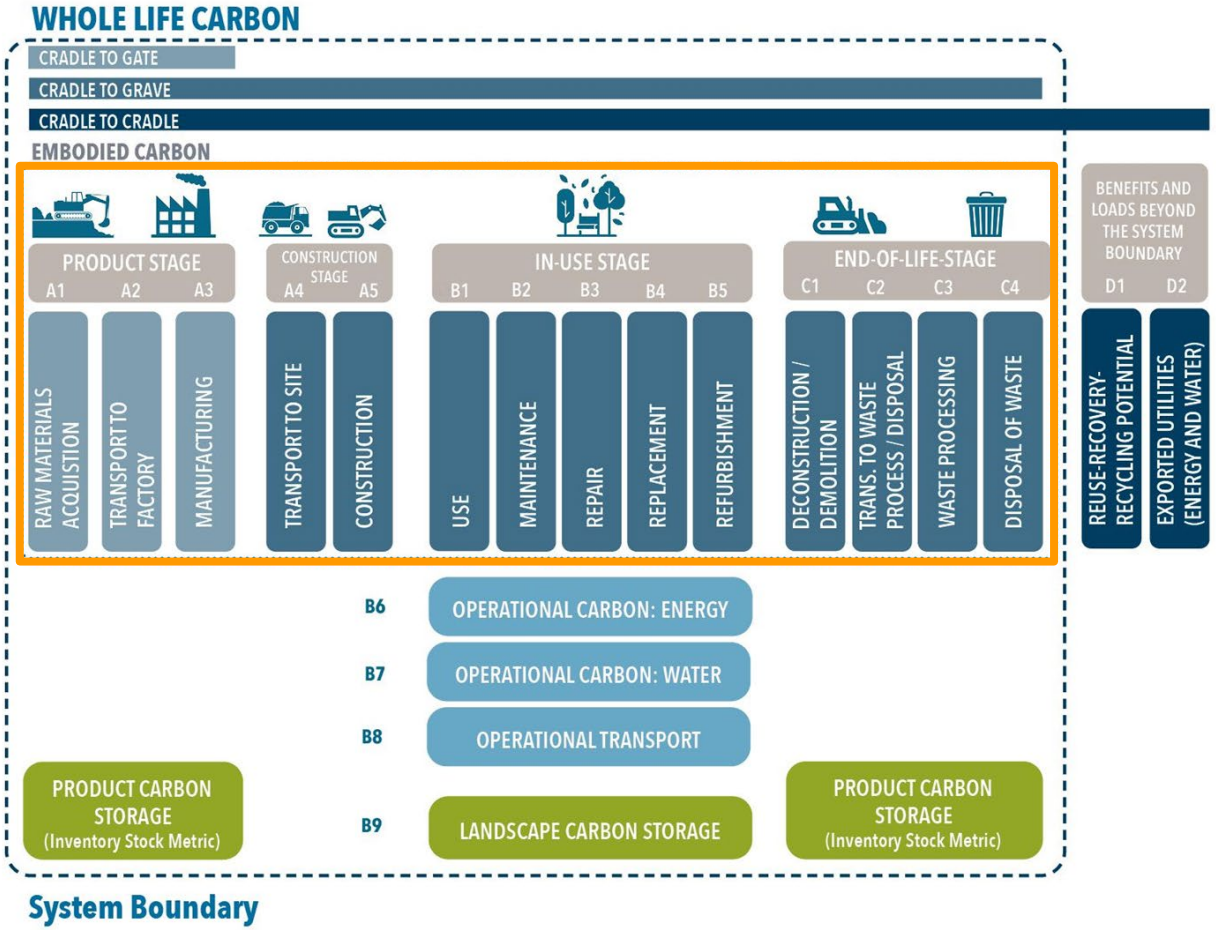
2. METHODS

INTRO TO WHOLE LIFE CARBON



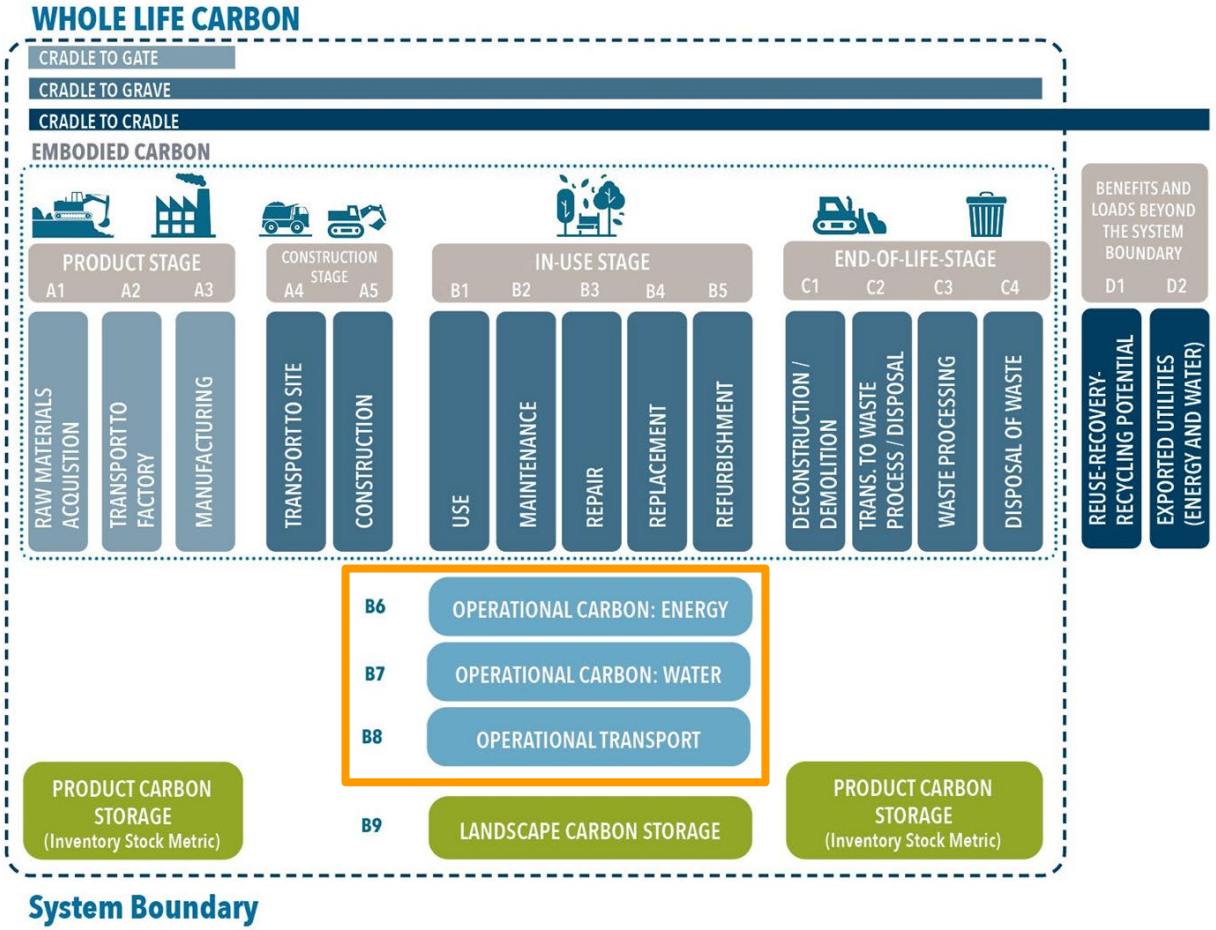
WHOLE LIFE CARBON

Embodied Emissions



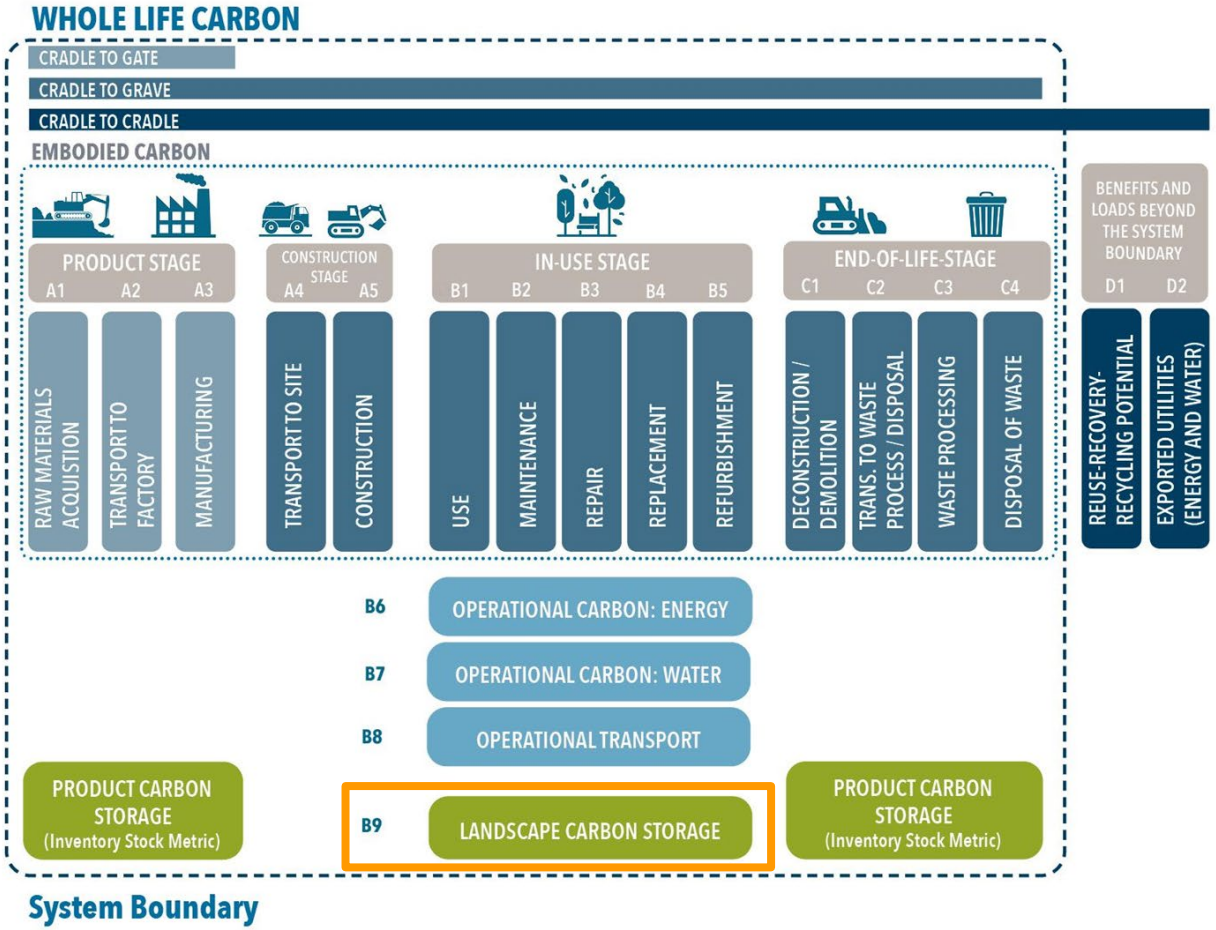
WHOLE LIFE CARBON

Operational Emissions

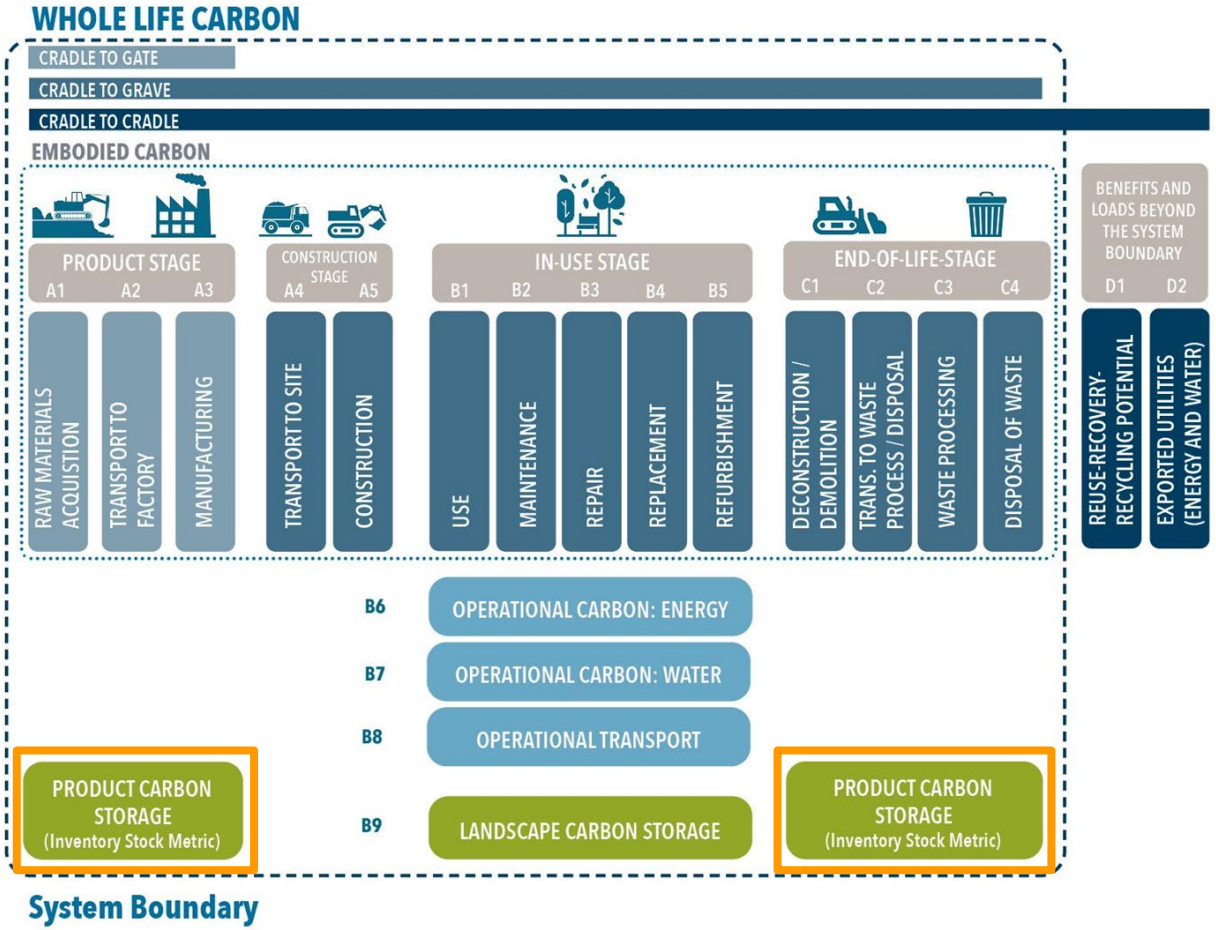


WHOLE LIFE CARBON

NEW! (B9) Landscape Carbon Storage



WHOLE LIFE CARBON



What scope/site elements should I include in my Site Carbon Assessment (SCA)?

What to Measure

SITE ELEMENT SCOPE FOR SITE CARBON ASSESSMENT		
EMBODIED CARBON EMISSIONS		
LIFE CYCLE STAGES AND PHASES	**SCA SCOPE CATEGORY**	**SITE ELEMENT CATEGORY**
Product Stage **A1-A3** (required)	Site Improvements	Roadways and Parking Lots Pedestrian Plazas and Walkways Athletic and Playfield Areas Retaining and Site Walls Fences, Gates, and Rails Furnishings and Lighting Site Structures and Features Planting, Soils, Accessories Site Irrigation System Utilities and Distribution Systems
Transport to Site **A4** (required)	Material & Product Transportation	
Construction Stage **A5** (required)	Site Preparation and Construction Activities	Site Clearing and Demolition Construction Activities and Site Earthwork Construction Waste
In-Use Stage **B2-B5**	Site Use	Site Maintenance Equipment Use Replacements
End-of-Life Stage **C1-C4**	Site End of Life	Transportation Disposal Impacts

What to Measure

Table 3.2 Site Improvements - Roadways and Parking Lots

SITE ELEMENT SUB-CATEGORY	PRIORITY ELEMENT	UNITS	COMPONENTS	NOTES + EXCLUSIONS
Roadway and Parking Lot Pavement (Rigid)	x	m^3	Surface material	
	x	m^2	Reinforcing	Area of reinforced pavement and size or spacing of reinforcing
	x	m^3	Setting Bed	
	x	m^3	Mortar	
	x	m^3	Subslab	
	x	m^3	Aggregate Base	
Roadway and Parking Lot Pavement (Flexible)	x	m^3	Surface material	
	x	m^3	Aggregate Base	
	x	m	Edge Restraint	
Roadway and Parking Lot Curbs and Gutters		m^3	Surface material	
		m	Reinforcing	
		m^3	Aggregate Base	

SCA Site Element Scope - *FULL*

SITE ELEMENT SCOPE FOR SITE CARBON ASSESSMENT — 1

EMBODIED CARBON EMISSIONS

LIFE CYCLE STAGES AND PHASES	SCA SCOPE CATEGORY	SITE ELEMENT CATEGORY
Product Stage **A1-A3** (required)	Site Improvements	Roadways and Parking Lots Pedestrian Plazas and Walkways Athletic and Playfield Areas Retaining and Site Walls Fences, Gates, and Rails Furnishings and Lighting Site Structures and Features Planting, Soils, Accessories Site Irrigation System Utilities and Distribution Systems
Transport to Site **A4** (required)	Material & Product Transportation	
Construction Stage **A5** (required)	Site Preparation and Construction Activities	Site Clearing and Demolition Construction Activities and Site Earthwork Construction Waste
In-Use Stage **B2-B5**	Site Use	Site Maintenance Equipment Use Replacements
End-of-Life Stage **C1-C4**	Site End of Life	Transportation Disposal Impacts

SITE ELEMENT SCOPE FOR SITE CARBON ASSESSMENT — 2

OPERATIONAL CARBON EMISSIONS

LIFE CYCLE STAGES AND PHASES	SCA SCOPE CATEGORY	SITE ELEMENT CATEGORY
Operational Energy **B6**	Site Energy Use	Fixtures Equipment
Operational Water **B7**	Site Water Use	Site Irrigation Water Features Site Maintenance Water

LANDSCAPE CARBON STORAGE and PRODUCT CARBON STORAGE — 3

LIFE CYCLE STAGES AND PHASES	SCA SCOPE CATEGORY	SITE ELEMENT CATEGORY
Landscape Carbon Storage **B9.1**	Site Vegetation	Existing Vegetation to Remain Restored Vegetation New Planting
Landscape Carbon Storage **B9.2**	Site Soils	Existing Soils
A1 (Carbon Stored) **C4 (Carbon Released)**	Biobased Construction Materials and Products	Decks and Boardwalks Fences and Gates Site Furnishings Overhead Structures Retaining Walls Play Structures Curbing and Edging

SCA Scope: Priority Site Elements

PRIORITY SITE ELEMENTS			
LIFE CYCLE STAGES AND PHASES	**SCA SCOPE CATEGORY**	**SITE ELEMENT CATEGORY**	**SITE ELEMENT SUB-CATEGORY**
Product Stage A1-A3 (Required)	**Site Improvements**	Roadways and Parking Lots Pedestrian Plazas and Walkways Retaining and Site Walls Site Structures and Features Planting, Soils, Accessories For this sub-category please refer to Table 3.12 for more detail, including the notes connecting elements and assembly components to MEP2040 scope: Utilities and Distribution Systems	Roadway and Parking Lot Pavement (Rigid/Flexible) Pedestrian Pavement (Rigid/Flexible) Pedestrian Pavement (On Structure) Athletic and Play Surfacing Cast In Place Walls Stack and Block Walls Panel and Modular Walls Covers, Shelters and Screens Site Bridges Decks and Boardwalks Turf, Grasses, and Herbaceous Plants Trees and Shrubs
	Site Preparation and Construction Activities	Site Clearing and Demolition Construction Activities and Site Earthwork Construction Waste	Vegetation Removal and Trimming (Existing Trees, Shrubs, and Groundcover) Earthwork

PRIORITY SITE ELEMENTS			
LIFE CYCLE STAGES AND PHASES	**SCA SCOPE CATEGORY**	**SITE ELEMENT CATEGORY**	**SITE ELEMENT SUB-CATEGORY**
Landscape Carbon Stroage B9.1	**Site Vegetation**	Existing Vegetation to Remain Restored Vegetation New Planting	Protected plant communities and vegetation Protected Individual Trees Restored plant communities and vegetation Restored Individual Trees Newly Planted Individual Trees
Landscape Carbon Stroage B9.2	**Site Soils**	Existing Soils	Existing protected SOC

The SCA Pathways*

***Choose your own adventure based on capacity & fluency**

Table 2.3 Site Carbon Assessment Pathways

PATH 1 CARBON ASSESSMENT LITE	PATH 2 SIMPLE CARBON ASSESSMENT	PATH 3 WHOLE LIFE CARBON ASSESSMENT
Only priority site elements in Table 2.3 Life Cycle Stages: A1-A5, B9.	Life Cycle Stages: A1-A5, B2, B4, B9 All site elements in Ch 3-5	All Life Cycle Stages (A-C) All site elements in Ch 3-5

PATH 1

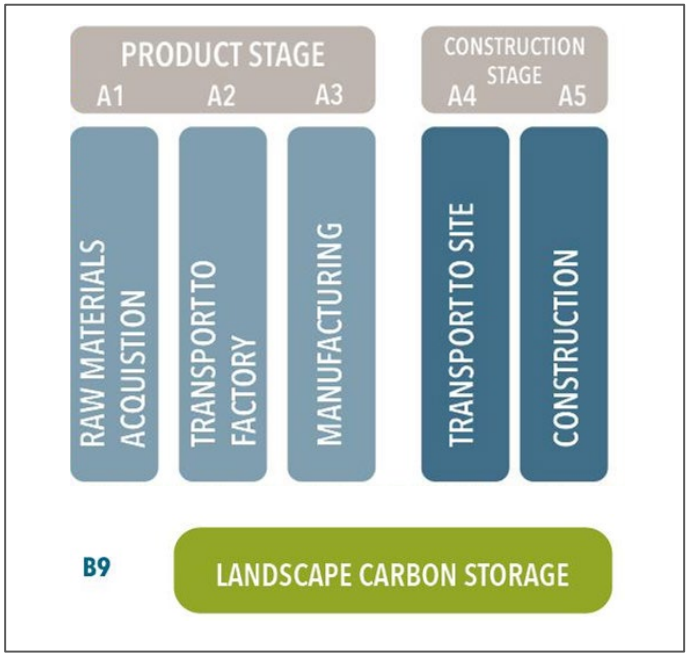
PATH 1
CARBON ASSESSMENT LITE

Only priority site elements in Table 2.3

Life Cycle Stages: A1-A5, B9.

***Path to use if you have limited time or experience. Prioritizes highest impacts**

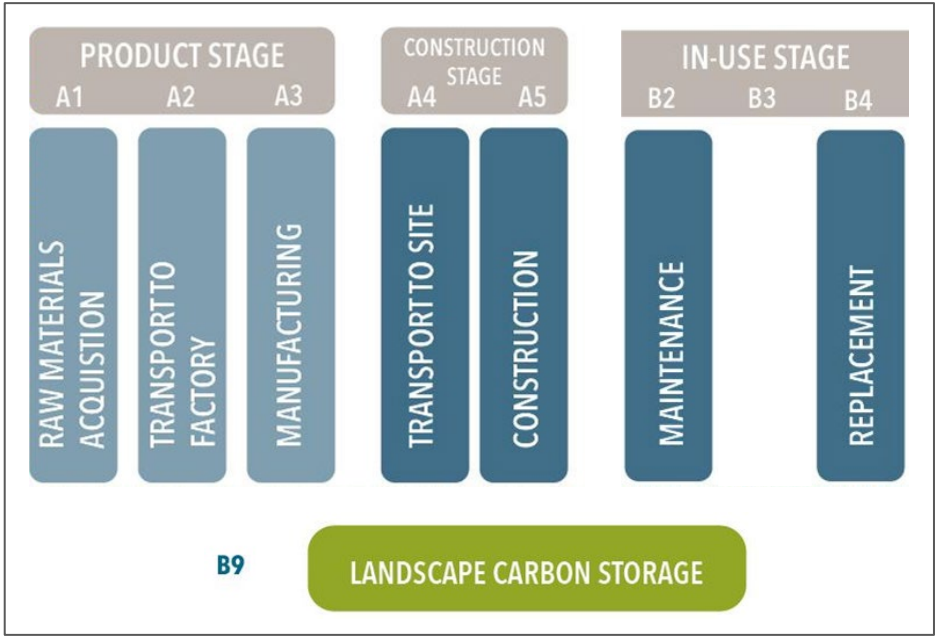
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PATH 2

PATH 2 SIMPLE CARBON ASSESSMENT
Life Cycle Stages: A1-A5, B2, B4, B9 All site elements in Ch 3-5

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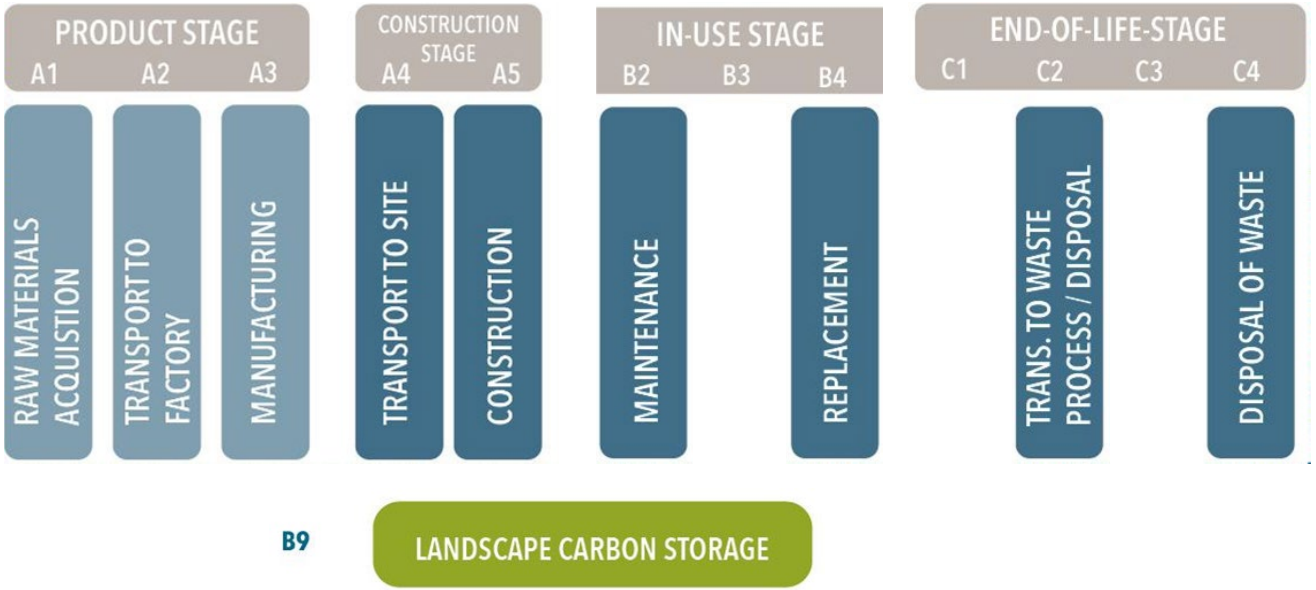
PATH 3

PATH 3
WHOLE LIFE CARBON ASSESSMENT

All Life Cycle Stages (A-C)

All site elements in Ch 3-5

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Standard Parameters of an SCA

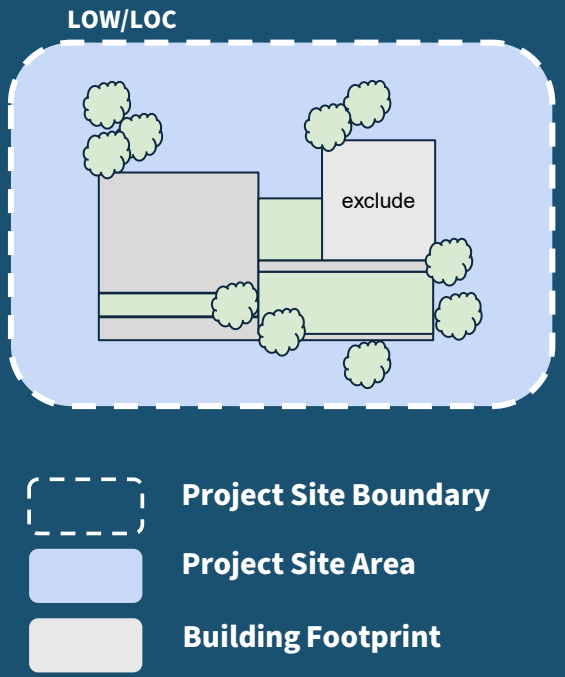
Project Area
The entire area of the site that is impacted by the project, including the building, sitework, and infrastructure.

Project Site Boundary
The Limit of Work (LOW) or Limit of Construction (LOC)

Project Site Area Normalization Unit: m2

SCA Embodied Carbon Intensity (ECI) Normalization Unit:
$kgCO_2e/m^2$

Reference Study Period (RSP): 60 years

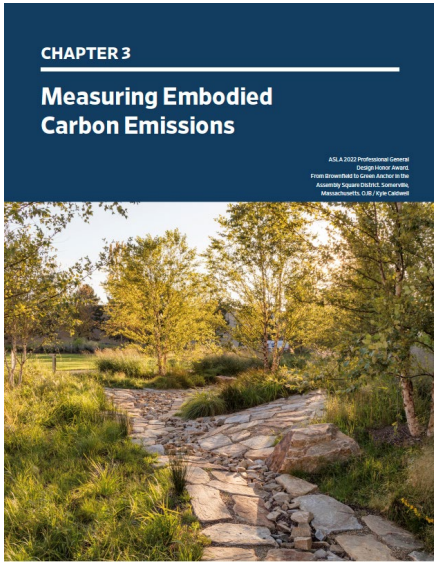


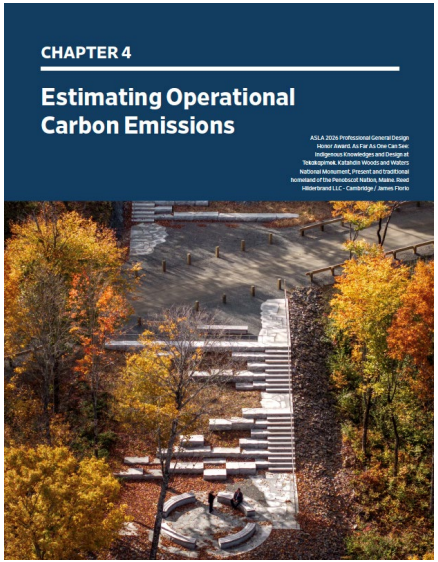
3. GUIDANCE

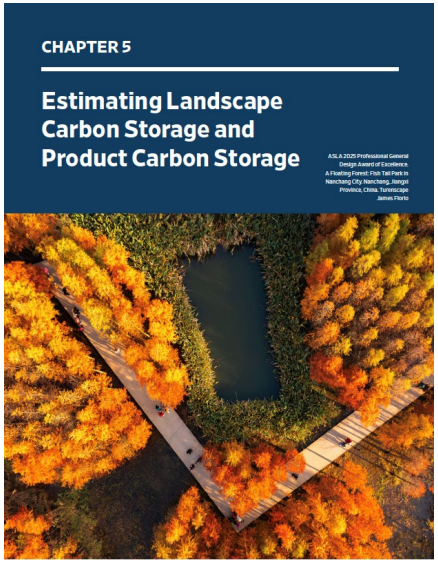
Navigating The Guide: GUIDANCE

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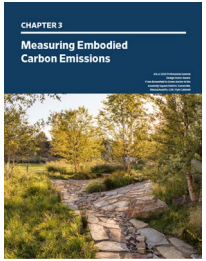




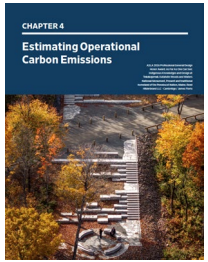


HOW To Measure - Whole Life Carbon Emissions

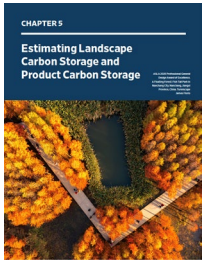
- ★ These chapters are organized by tables that detail the Site Element Categories, their Sub-Categories, and Components.
- ★ Guidance is provided for measuring emissions under each category
- ★ Two options are provided for measurement:
  - Process via Carbon Assessment Tool
  - Process via Manual Calculation
  - Situations might call for a combination of both



LIFE CYCLE STAGE AND PHASE	EMISSIONS CATEGORY	SCA SCOPE CATEGORY	SITE ELEMENT CATEGORY
Product Stage A1-A3 (required)	Embodied Carbon	Site Improvements	Roadways and Parking Lots Pedestrian Plazas and Walkways Athletic and Playfield Areas Retaining and Site Walls Fences, Gates, and Rails Furnishings and Lighting Site Structures and Features Planting, Soils, Accessories Site Irrigation System Utilities and Distribution Systems
Transport to Site A4 (required)	Embodied Carbon	Material & Product Transportation	No Sub-Categories
Construction A5 (required)	Embodied Carbon	Site Preparation and Construction Activities	Site Clearing and Demolition Construction Activities and Site Earthwork Construction Waste
In-Use Stage B2-B5	Embodied Carbon	Site Use	Site Maintenance Equipment Use Replacements
End-of-Life Stage C1-C4	Embodied Carbon	Site End of Life	Transportation Disposal Impacts



LIFE CYCLE STAGE AND PHASE	EMISSIONS CATEGORY	SITE ELEMENT CATEGORY	SITE ELEMENT SUB-CATEGORY
Operational Energy B6	Operational Carbon	Site Energy Use	Fixtures Equipment
Operational Water B7	Operational Carbon	Site Water Use	Site Irrigation Water Features Site Maintenance Water



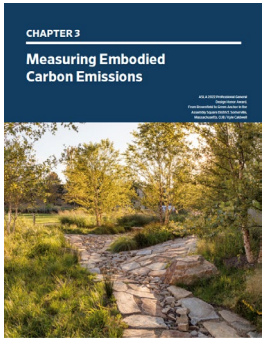
LIFE CYCLE STAGE AND PHASE	EMISSIONS CAT-EGORY	SITE ELEMENT CATEGORY	SITE ELEMENT SUB-CATEGORY
Landscape Carbon Storage B9	Stored Carbon	Site Vegetation (B9.1)	Existing Vegetation to Remain Restored Vegetation New Planting
	Stored Carbon	Soils (B9.2)	Existing Soils
A1 (Carbon Stored) C4 (Carbon Re-leased)	Stored Carbon	Biobased Construction Materials and Products	Curbing and Edging Play Structures Retaining Walls Fences, Gates, and Rails Site Furnishings Covers, Shelters, and Screens Decks and Boardwalks

APPENDIX II - Materials Tracker

	A	B	C	D	E	F	G	H	I	J
1	**EMBODIED CARBON EMISSIONS - TAKEOFFS**									
2	*Refer to Chapter 3 in the Landscape Architecture 2040: Guide to Site Carbon Assessment v1 for more on measuring embodied carbon emissions.*									
3	*Use this tab to track quantity takeoffs from design documentation before input into carbon assessment tools or manual calculation of emissions. Duplicate rows as needed for multiple site elements of the same type.*									
4										
5	**SCA SCOPE - SITE ELEMENTS**	**PRIORITY ELEMENT**	**INCLUDED / EXCLUDED**	**COMPONENTS**		**TYPICAL QUANTITY TAKEOFFS**				
6	*Site element scope category and typical assemblies to include in site carbon assessment. **Do not modify this column.***	*Elements to be included in ALL SCA pathways. **Do not modify this column.***	*Select from the dropdown to track elements and components included in site carbon assessment. **Do not modify this column .***	*Typical components to be included with given site element scope category and/or assembly. **Do not modify this column.***	*Use this column to note project-specific material/product information for components.*	**Length**	**Width**	**Height**	**Depth/ Thickness**	**Area**
7	**Site Improvements - Roadways and Parking Lots** (Refer to Table 3.2)									
8	**Roadway and Parking Lot Pavement** (Rigid)	X	Included – sufficient data (reliable quantities)	Surface material	*(ex. asphalt)*					
9		X	Included – sufficient data (reliable quantities)	Reinforcing						
10		X	Included – sufficient data (reliable quantities)	Setting Bed						
11		X	Included – sufficient data (reliable quantities)	Mortar						
12		X	Included – sufficient data (reliable quantities)	Subslab						
13		X	Included – sufficient data (reliable quantities)	Aggregate Base						
14										
15	**Roadway and Parking Lot Pavement** (Flexible)	X	Included – sufficient data (reliable quantities)	Surface material						
16		X	Included – sufficient data (reliable quantities)	Aggregate Base						
17		X	Included – sufficient data (reliable quantities)	Edge Restraint						
18										
19	**Roadway and Parking Lot Curbs and Gutters**		Included – sufficient data (reliable quantities)	Surface material						
20			Included – sufficient data (reliable quantities)	Reinforcing						
21			Included – sufficient data (reliable quantities)	Aggregate Base						
22										
23	**Site Improvements - Pedestrian Plazas and Walkways** (Refer to Table 3.3)									
24	**Pedestrian Pavement** (Rigid)	X	Included – sufficient data (reliable quantities)	Surface material	*(ex. cast in place concrete)*					
25		X	Included – sufficient data (reliable quantities)	Reinforcing						
26		X	Included – sufficient data (reliable quantities)	Setting Bed						
27		X	Included – sufficient data (reliable quantities)	Mortar						
28		X	Included – sufficient data (reliable quantities)	Subslab						

Project Data | SCA Scope Checklist | **Embodied Carbon - Takeoffs** | Operational Carbon - Takeoffs | Carbon Storage - Takeoffs | +

HOW To Measure - Embodied Emissions



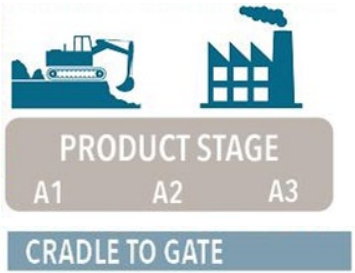
LIFE CYCLE STAGE AND PHASE	EMISSIONS CATEGORY	SCA SCOPE CATEGORY	SITE ELEMENT CATEGORY
Product Stage A1-A3 (required)	Embodied Carbon	Site Improvements	Roadways and Parking Lots Pedestrian Plazas and Walkways Athletic and Playfield Areas Retaining and Site Walls Fences, Gates, and Rails Furnishings and Lighting Site Structures and Features Planting, Soils, Accessories Site Irrigation System Utilities and Distribution Systems
Transport to Site A4 (required)	Embodied Carbon	Material & Product Transportation	No Sub-Categories
Construction A5 (required)	Embodied Carbon	Site Preparation and Construction Activities	Site Clearing and Demolition Construction Activities and Site Earthwork Construction Waste
In-Use Stage B2-B5	Embodied Carbon	Site Use	Site Maintenance Equipment Use Replacements
End-of-Life Stage C1-C4	Embodied Carbon	Site End of Life	Transportation Disposal Impacts

Organized by 18 tables including equations for manual calculations* of A-C Stage emissions

Some are exempt due to lack of data

HOW To Measure: Product-Stage Emissions

A1 - A3 Emissions



=

RAW MATERIALS ACQUISTION

TRANSPORT TO FACTORY

MANUFACTURING

LIFE CYCLE STAGE AND PHASE	EMISSIONS CATEGORY	SCA SCOPE CATEGORY	SITE ELEMENT CATEGORY
Product Stage A1-A3 (required)	Embodied Carbon	Site Improvements	Roadways and Parking Lots Pedestrian Plazas and Walkways Athletic and Playfield Areas Retaining and Site Walls Fences, Gates, and Rails Furnishings and Lighting Site Structures and Features Planting, Soils, Accessories Site Irrigation System Utilities and Distribution Systems

Measuring Product Stage (A1-A3) Embodied Carbon Emissions A1-3

The process for quantifying Product Stage A1-A3 emissions for a site carbon assessn

1. Develop a material inventory for all site elements included in the site project scope.
   a. Refer to the Site Element Category tables in this chapter for typical material assemblies and components that must be accounted for in each site element.
   b. Conduct takeoffs for the component material quantities. Depending on the component, these takeoffs could be for volume, area, length, mass, etc.

2. Quantifying the emissions of the component materials can then rely on an a carbon assessment tool, manual calculations, or a combination of both:

   Carbon Assessment Tool:

   a. Input the component material quantities into a carbon assessment tool to calculate A1-A3 emissions. *Placeholder A1-A3 carbon factors vary across different tools, as does the ability to manually enter product-specific carbon data. Carbon assessment tools are addressed in Chapter 6.*

   Manual Calculations:

   a. The individual component material quantities can then be multiplied by their respective carbon factors. *The primary carbon data sources for A1-A3 are discussed in Sourcing & Collecting Carbon Data in Chapter 2 to identify the appropriate data source within the recommended sourcing hierarchy.*

   Combined approach:

   a. *Site assessment tools often lack the ability to comprehensively quantify everything addressed in this guide, and a combined approach may be required for certain materials, processes, or life cycle stages.*

Understanding & Locating A1-A3 Carbon Data

These are some of the most reliable sources of carbon data for construction materials and building products.
Here is their recommended hierarchy of use:

1. **Product Specific (PS) Type III Environmental Product Declaration (EPD)** – This type of EPD collects LCA data for a specific product from an individual manufacturer and reports GWP along with other environmental impact categories. Product Specific EPDs are accessible through manufacturer websites, product reps, or public EPD databases such as Building Transparency's EC3 and the ASLA Product Manufacturer EPD List.

   When there is no available Product Specific Type III EPD for the product or material you're using, use one of the next available data sources in the order listed:

2. **Material Category GWP Baseline** – The Carbon Leadership Forum (CLF) publishes a North American Material Baselines Report, which "provides a snapshot of the state of environmental product declarations (EPDs) for North American-produced building materials." The report collects both Industry Average and Product Specific EPDs on the market for respective material categories and averages the reported values to provide GWP baselines. Materials such as cement and concrete, asphalt, masonry, wood, and steel. This report is available online and published every two years.

3. **Individual Industry Average Type III EPD** – This type of EPD aggregates LCA data from multiple manufacturers representing a majority of production for a material or material type. These manufacturers combine their data to provide average values and report on embodied carbon amongst other environmental impact categories. Industry Average EPDs are accessible through manufacturer websites, product reps, or public EPD databases, such as Building Transparency's EC3

4. **Generic GWP Values** – These could be from a carbon assessment tool's dataset or other background datasets. Different tools offer different options for sourcing and managing material and project carbon data (See Chapter 6: State of the Tools). Some allow you to pull in your own EPDs, some use industry average or product specific EPD averages as defaults, some pull from existing or shared industry databases, and some allow you to do all three. It is important to be aware of the sources of background data and the assumptions being applied at various life cycle stages that are not coming directly from product-specific EPDs.

5. **Proxy GWP Data/Proxy EPD** – A proxy substitute is the selection of another, similar product, ideally made by the same manufacturer, to use in lieu of the EPD for the material being used on the project without any data.

Understanding & Locating A1-A3 Carbon Data

2025 CLF Material Baselines for North America Report

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Executive Summary

The building industry has an essential role to play in tackling the greenhouse gas (GHG) emissions associated with materials manufacturing, transport, use, and disposal — also known as ***embodied carbon***. Our present understanding of the importance of embodied carbon has been enabled by rigorous quantitative modeling that tracks carbon emissions across the full life cycle of materials and products, using life cycle assessment (***LCA***). LCA calculates and reports embodied carbon impacts using a metric called global warming potential (***GWP***). GWP is quantified in kilograms of CO_2 equivalent (kg CO_2e) and is used in this report to communicate the embodied carbon of materials and products.

Environmental product declarations (***EPDs***) can be used as a tool to inform product-level decision-making. EPDs are independently verified documents based on LCA models, developed in conformance with international standards, that report the embodied carbon and other environmental impacts of a product. EPDs can be used to estimate a product's impacts and to compare products if (i) the products are functionally equivalent and (ii) the EPDs have aligned LCA scopes, methods, and data.

This report analyzes available EPDs to establish baseline GWP values and to describe the available EPD data in North America for use by a wide range of stakeholders in understanding and reducing the embodied carbon from construction products.

The need for product-level embodied carbon data

North American policies and programs increasingly use product-level GWP values as thresholds, limits, or targets to encourage reductions in embodied carbon. This includes Buy Clean and similar government procurement policies, green building certification programs like LEED, and independent voluntary programs by owners and project teams. Policymakers, agency staff working on implementing policies, owners, designers, specifiers, contractors, and procurement officers need resources to help answer the following questions:

- *How do we categorize products for appropriate embodied carbon comparisons?*
- *What is the industry-average GWP for these product types?*
- *What is the current state of environmental product declarations (EPDs) for these product types? How many EPDs are there? Where are the facilities? What is the range of embodied carbon?*
- *What are the nuances for each category that could affect comparability?*

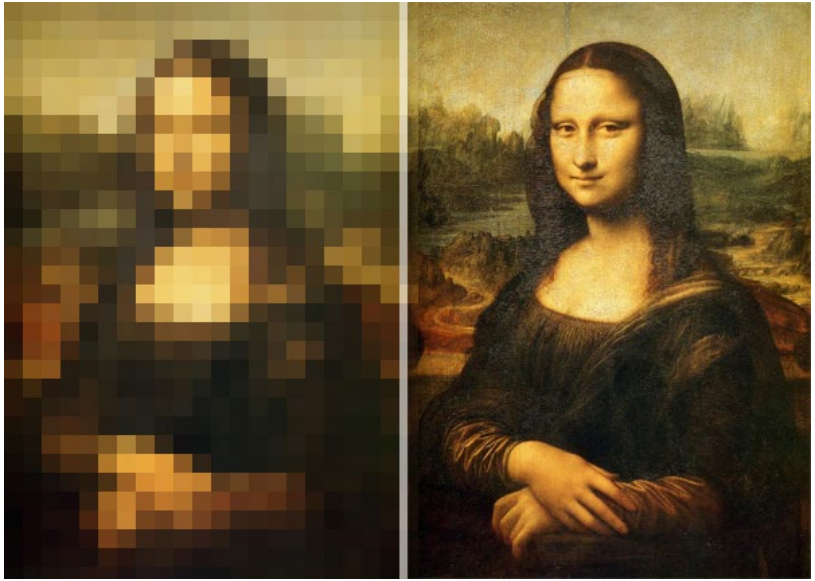
Tool developers and teams working on whole-project and assembly-scale carbon assessments also need product-type embodied carbon data. Industry-average GWP intensity values are appropriate data sources in models during early planning (when the specific product is unknown) or when there is no product-specific GWP data available for the selected product. Further, when published at regular intervals, industry-average embodied carbon data supports the measurement and tracking of industry progress over time to reduce emissions.

Product Type	Baseline GWP (kg CO_2e / declared unit)	Declared unit	Method	Data source and notes
CMU, USA, medium weight, manufactured aggregate	360	1 m³	Industry	USA CMU industry-average EPD (CMHA, 2024)
CMU, USA, medium weight, natural aggregate and industrial byproducts	244	1 m³	Industry	USA CMU industry-average EPD (CMHA, 2024)
CMU, USA, medium weight	300	1 m³	Industry	USA CMU industry-average EPD (CMHA, 2024). Unweighted average of medium-weight subtype values. Parent category baseline.
CMU, USA, lightweight, manufactured aggregate	395	1 m³	Industry	USA CMU industry-average EPD (CMHA, 2024)
CMU, USA, lightweight, natural aggregate and industrial byproducts	286	1 m³	Industry	USA CMU industry-average EPD (CMHA, 2024)
CMU, USA, lightweight	340	1 m³	Industry	USA CMU industry-average EPD (CMHA, 2024). Unweighted average of lightweight subtype values. Parent category baseline.
CMU, Eastern Canada, normal weight (all cement types)	200	1 m³	Industry	Canada CMU industry-average EPD (CCMPA, 2022). Unweighted average of "GU SCM" and "GUL SCM" subtypes. Parent category baseline.
CMU, Eastern Canada, normal weight, GU SCM	205	1 m³	Industry	Canada CMU industry-average EPD (CCMPA, 2022)
CMU, Eastern Canada, normal weight, GUL SCM	191	1 m³	Industry	Canada CMU industry-average EPD (CCMPA, 2022)
CMU, Eastern Canada, lightweight (all cement types)	170	1 m³	Industry	Canada CMU industry-average EPD (CCMPA, 2022). Unweighted average of "GU SCM" and "GUL SCM" subtypes. Parent category baseline.
CMU, Eastern Canada, lightweight, GU SCM	177	1 m³	Industry	Canada CMU industry-average EPD (CCMPA, 2022)
CMU, Eastern Canada, lightweight, GUL SCM	164	1 m³	Industry	Canada CMU industry-average EPD (CCMPA, 2022)
CMU, Western Canada, normal weight (all cement types)	240	1 m³	Industry	Canada CMU industry-average EPD (CCMPA, 2022). Unweighted average of "GU SCM" and "GUL SCM" subtypes. Parent category baseline.
CMU, Western Canada, normal weight, GU SCM	252	1 m³	Industry	Canada CMU industry-average EPD (CCMPA, 2022)
CMU, Western Canada, normal weight, GUL SCM	232	1 m³	Industry	Canada CMU industry-average EPD (CCMPA, 2022)
CMU, Western Canada, lightweight (all cement types)	210	1 m³	Industry	Canada CMU industry-average EPD (CCMPA, 2022). Unweighted average of "GU SCM" and "GUL SCM" subtypes. Parent category baseline.
CMU, Western Canada, lightweight, GU SCM	214	1 m³	Industry	Canada CMU industry-average EPD (CCMPA, 2022)
CMU, Western Canada, lightweight, GUL SCM	198	1 m³	Industry	Canada CMU industry-average EPD (CCMPA, 2022)

Quantity Takeoffs and Project Data Resolution

With the progression of each design phase, things becomes clearer and more accurate. The SCA being conducted should allow for the carbon data resolution to develop over time, typically in line with the project's Level of Development (LOD).

- Planning & Concept: Measure based on land uses.
- Schematic Design: Area takeoff quantities from preliminary designs.
- Design Development: Material schedules and associated quantities, preliminary area takeoffs, and quantity analysis reported in cost estimates.
- Construction Documents: Cross-reference project drawings, details, and specifications during or after the final CD set.



HOW To Measure: Construction Stage Emissions

A4 & A5 Emissions



=

TRANSPORT TO SITE

CONSTRUCTION

Transport to Site A4 (required)	Embodied Carbon	Material & Product Transportation	No Sub-Categories
Construction A5 (required)	Embodied Carbon	Site Preparation and Construction Activities	Site Clearing and Demolition Construction Activities and Site Earthwork Construction Waste

A4

Table 3.13 Recommended default emissions for typical transit modes

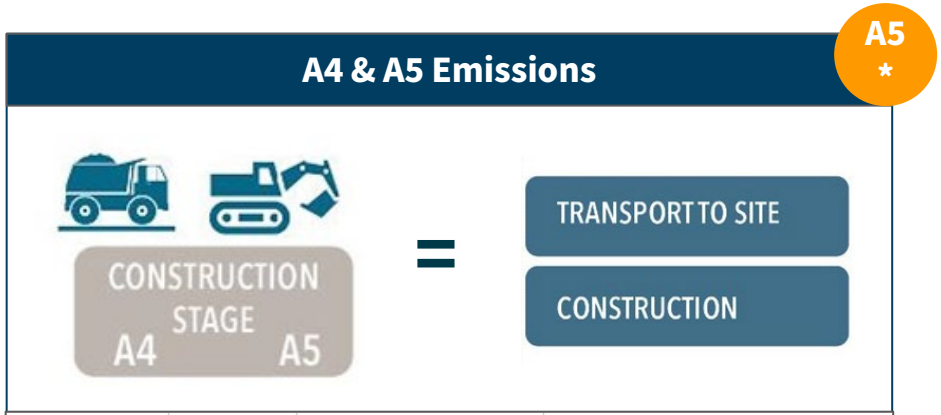
TRANSIT TYPE	GWP (kg CO_2 eq/ton-ne*km)	GWP (kg CO_2 eq/ton*mile)
Truck (less than 500 miles)[1]	0.132	0.193
Truck (more than 500 miles)	0.088	0.128
Electric Truck (less than 500 miles)[c]	0.041	0.059
Electric Truck[c] (more than 500 miles)	0.027	0.039
Aircraft	0.830	1.212
Ship or barge (ocean)	0.008	0.012
Ship or barge (inland)	0.018	0.026
Rail	0.019	0.028
Concrete Mixer Truck[1]	0.304	0.444

[1] Emissions factor figures should be used with the mileage of the outbound trip distance. Using these factors will automatically account for return trips for trucking scenarios.

Source: Torabi, M., Huang, M., Manesh, M. T., Nanayakkara, I., & Simonen, K. (Forthcoming 2026). A Data-Driven Method for Quantifying the Environmental Impacts of Freight Transportation in Construction for Prospective LCA in the United States

These are <u>new</u> A4 emissions factors. It is up to the user to decide how they want to track their A4 emissions for a project and the associated materials…

HOW To Measure: Construction Stage Emissions



Transport to Site A4 (required)	Embodied Carbon	Material & Product Transportation	No Sub-Categories
Construction A5 (required)	Embodied Carbon	Site Preparation and Construction Activities	Site Clearing and Demolition Construction Activities and Site Earthwork Construction Waste

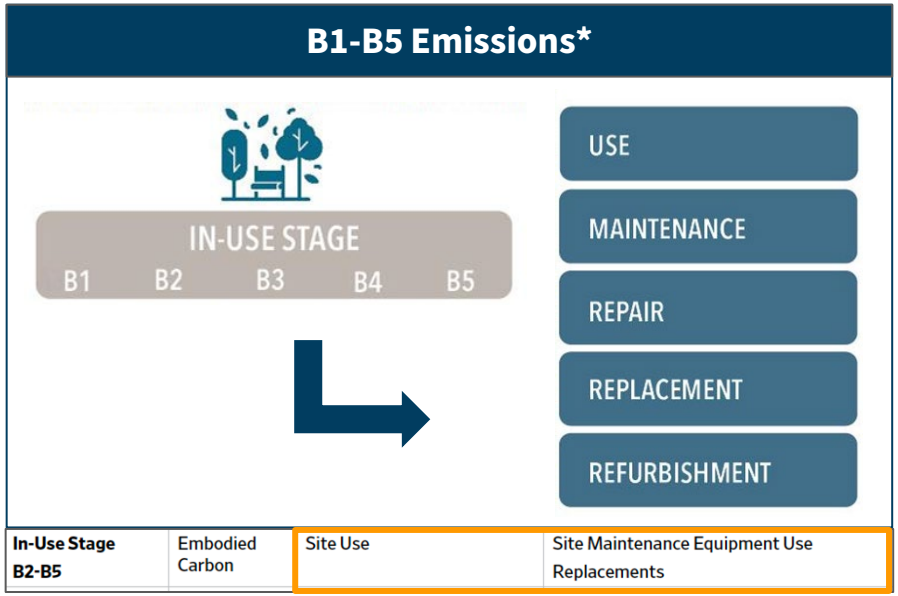
ASHRAE values were provided for A5.1 & 5.2

A5.1 Pre-Construction Demolition
Includes both demolition and site prep activities, as well as the carbon released from the demo and subsequent decay of cleared plants.

A5.2 Construction Activities (and Site Earthwork)
Includes construction activities for hardscape and softscape, earthwork impacts from cut and fill, importing new material, and using additional fill on-structure. Emissions from machinery used to construct the site are measured along with the release of SOC from earthwork.

A5.3 Construction Waste
Includes the transportation impacts of hauling soil, plants or demod hardscape off-site; and from the manufacture, transportation, and end-of-life impacts of construction wastage (Table 3.15).

HOW To Measure: In-Use Stage Emissions



This guide does not address phases address phases B1, B3, and B5 due to limited data and lack of inclusion in most site carbon assessment tools.

B2

Table 3.17 Site Maintenance Equipment Use

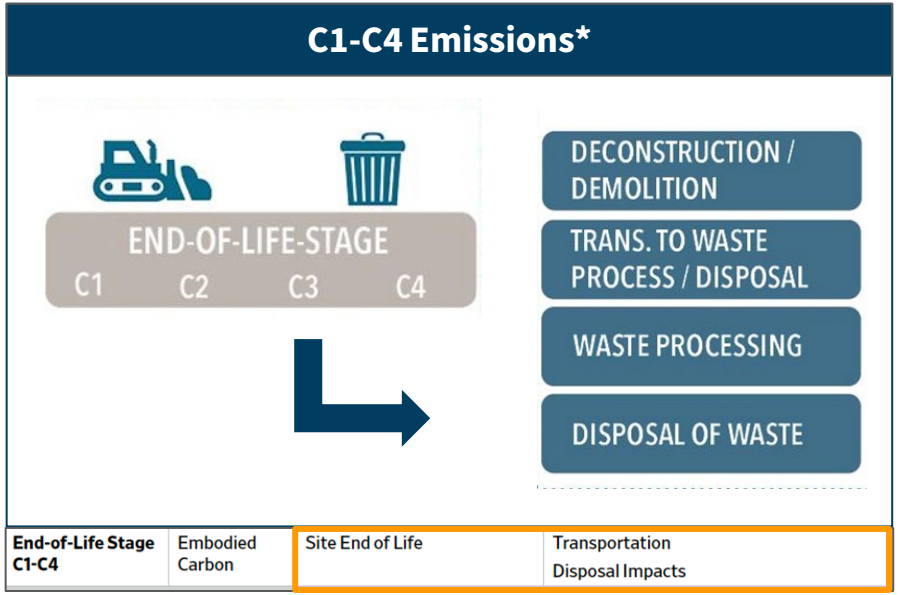
EQUIPMENT	NOTES
Lawn Mowers	
Leaf Blowers/Vacuums	
Trimmers/Edgers/Cutters	
Other	

B4

APPENDIX III: B4 Replacement Factors

ELEMENT OR MATERIAL	EXPECTED SERVICE LIFE (years)	REPLACEMENT FACTOR (60 year project life)	NOTES
PAVEMENT			
Concrete	30-50	2	
Porous concrete	20-30	3	
Asphalt Pavement	15-25	3	
Precast concrete unit pavers	30-40	2	
Brick pavers, sand set	50-100	1	Replacement of full system; resurfacing required more often
Stone pavers, sand set	50-100	1	Releveling required
Stone dust, stabilized (binder replacement)	15-25	3	Releveling required
Stone dust, unstabilized	60-100	1	Releveling required
Safety surface	15-25	3	Plant based binders may need to be replaced every 5 years
Artificial turf	10-20	4	Releveling required

HOW To Measure: End-of-Life Stage Emissions



C2 C4

5. Use the following formula to identify the C2 emissions:

[C2] = (M x EF x TD)

Where M = material mass from A stage (metric tons);
EF = transportation emission factor ($kgCO_2e$/ton*mile) from Table 3.13;
TD = transportation distance (miles) based on Table 3.19

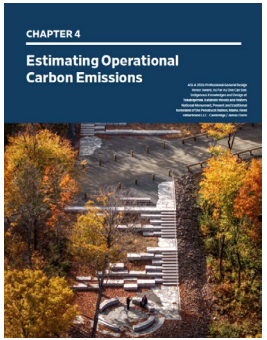
Table 3.18 End of Life Scenarios for Selected Site Construction Materials for C2 and C4

MATERIAL COMPONENT	RECYCLED/REUSED	DISPOSED
Concrete	80%	20%
Asphalt	95%	5%
Metals	80%	20%
Aggregate	85%	15%

Source: US Environmental Protection Agency (US EPA) (2020). Advancing Sustainable Materials Management: 2018 Fact Sheet. Washington, DC: US EPA.

This guide does not address phases C1 and C3 due to limited data and lack of inclusion in most site carbon assessment tools.

HOW To Measure - Operational Emissions



LIFE CYCLE STAGE AND PHASE	EMISSIONS CATEGORY	SITE ELEMENT CATEGORY	SITE ELEMENT SUB-CATEGORY
Operational Energy **B6**	Operational Carbon	Site Energy Use	Fixtures Equipment
Operational Water **B7**	Operational Carbon	Site Water Use	Site Irrigation Water Features SIte Maintenance Water

Organized by assessing projections of site energy use and site water use for the life of the project (60 years)

HOW To Measure: Site Operational Energy

- ★ Create a lighting and maintenance equipment schedule
  - Develop a template and re-use project to project
- ★ These will be projections but can be used to advocate for an alternative
- ★ Validate and coordinate scope with MEP engineers
- ★ Manual calculations are provided if so desired

Table 4.2 Site Energy Use - Fixtures

FIXTURES	NOTES + EXCLUSIONS
Light Fixtures	*Emissions from light fixture operations are noted as an optional input in MEP 2040 guidance. They should not be counted in both the SCA and in MEP 2040.*
Other Fixtures	

Table 4.3 Site Energy Use - Equipment

EQUIPMENT	NOTES + EXCLUSIONS
Transformers	*Emissions from light fixture operations are noted as an optional input in MEP 2040 guidance. They should not be counted in both the SCA and in MEP 2040.*
Timers	
Sensors	
Drywell Pumps	
Irrigation Booster Pumps	
Irrigation Controllers	
Pump Lift Stations	
Submersible Groundwater Pumps	
Other	

HOW To Measure: Site Operational Water

- ★ Create a schedule based on the table categories
- ★ These will be projections but can be used to advocate for an alternative
- ★ Manual calculations are provided if so desired:

$$[B7] = \sum [(DW_{YEAR}\,1 \times WE \times EF_{YEAR}\,1) + \ldots (DW_{YEAR}\,60 \times WE \times EF_{YEAR}\,60)]$$

Where DW = Domestic Water in meters cubed, annual (m^3/yr)(kWh/yr);
WE = Water Energy Intensity (kWh/m^3);
EF = Emissions factor for specified year

Table 4.4 Site Water Use - Site Irrigation

SITE IRRIGATION EQUIPMENT	NOTES + EXCLUSIONS
Drip Irrigation Standard	
Drip Irrigation Pressure Compensated	
Fixed Spray Pattern Irrigation	
Micro Spray Irrigation	
Rotors	

Table 4.5 Site Water Use - Water Features

WATER FEATURES EQUIPMENT	NOTES + EXCLUSIONS
Water Feature	
Spa	
Other	

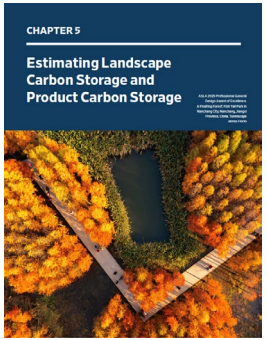
Table 4.6 Site Water Use - Maintenance Water

MAINTENANCE WATER	NOTES + EXCLUSIONS
Wash waster for pavements and surfaces	
Wash water for vertical surfaces	
Wash water for cleaning equipment and vehicles	
Other water use for maintenance	

Table 4.7 Generic Energy and Water Intensity of Water Types

WATER TYPE	GENERIC ENERGY INTENSITY (kWh/m^3 water)[1]
Treated Water	0.35
Ground Water	0.528
Brackish Ground Water	0.845
Desalinated Seawater	3.645
Recycled water	0.291

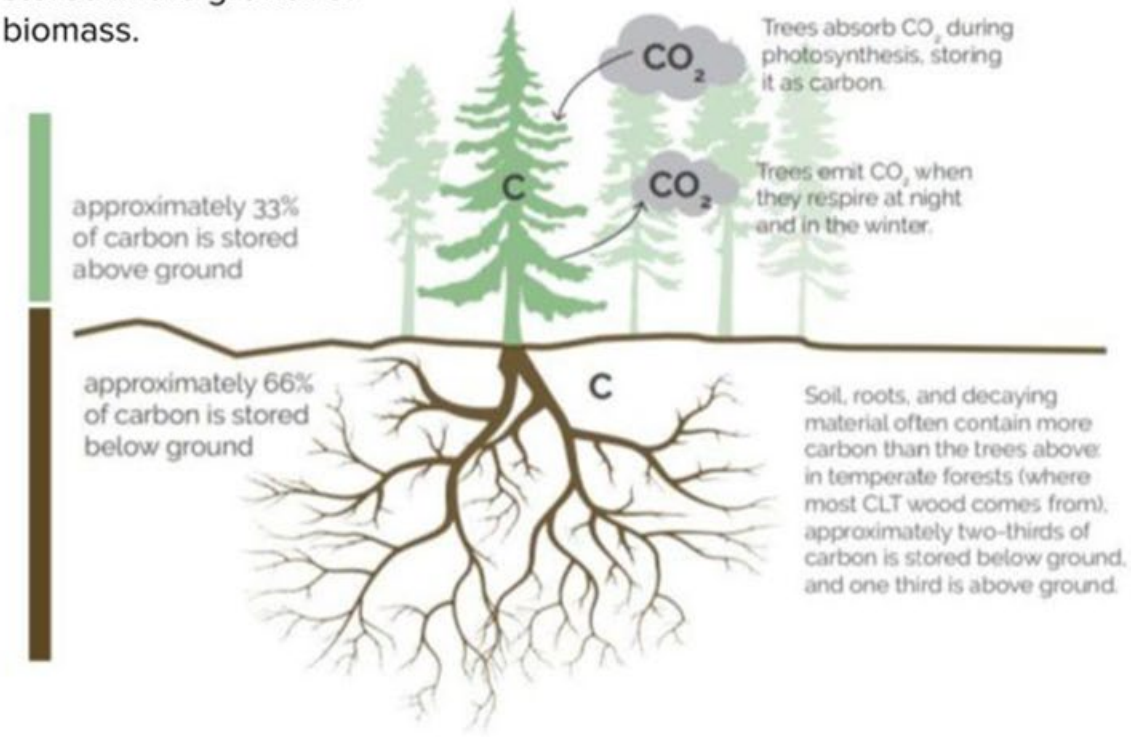
HOW To Measure - Stored Emissions



LIFE CYCLE STAGE AND PHASE	EMISSIONS CATEGORY	SITE ELEMENT CATEGORY	SITE ELEMENT SUB-CATEGORY
Landscape Carbon Storage **B9**	Stored Carbon	Site Vegetation (B9.1)	Existing Vegetation to Remain Restored Vegetation New Planting
	Stored Carbon	Soils (B9.2)	Existing Soils
A1 (Carbon Stored) **C4 (Carbon Released)**	Stored Carbon	Biobased Construction Materials and Products	Curbing and Edging Play Structures Retaining Walls Fences, Gates, and Rails Site Furnishings Covers, Shelters, and Screens Decks and Boardwalks

Organized by site vegetation and soils, and product carbon storage

Biogenic Carbon is carbon stored in the growth of biomass.

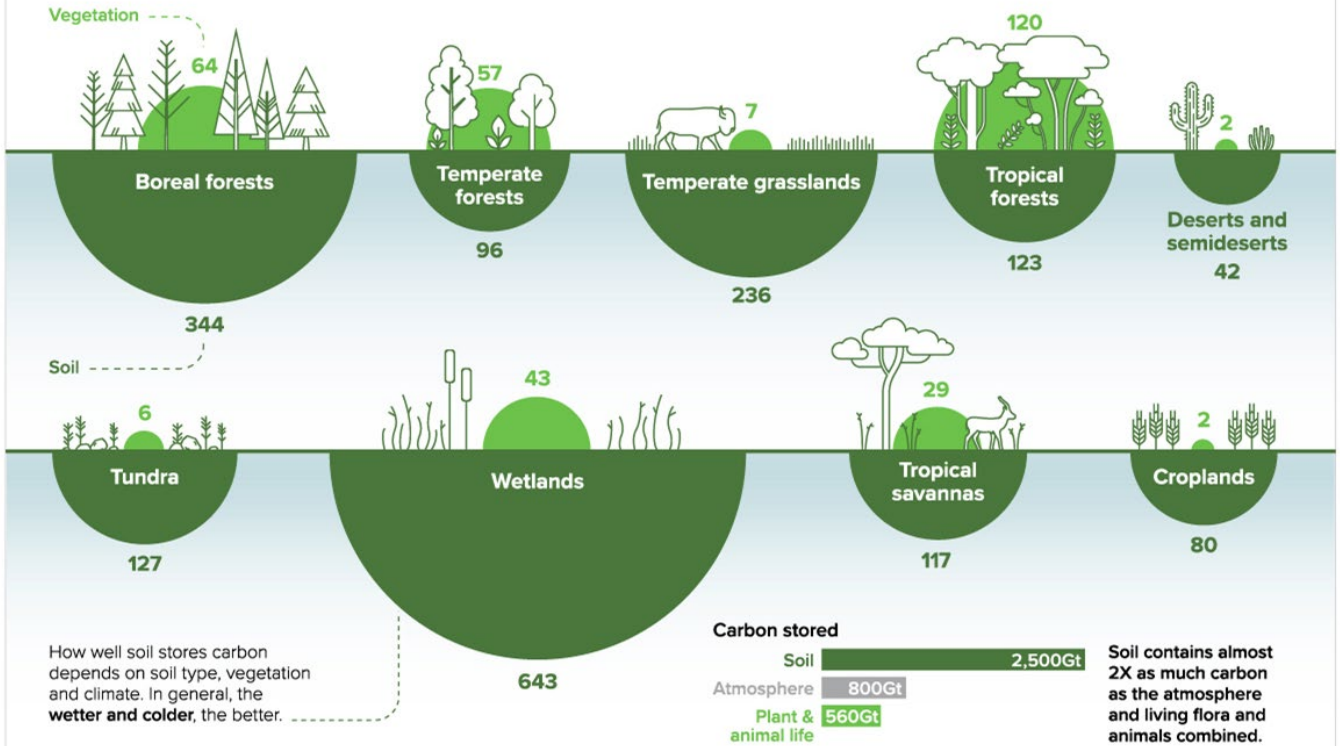


Carbon Storage

Tonnes of Carbon

The world's forests absorb around **15.6 gigatonnes** of CO_2 each year. That's around 3X the annual CO_2 emissions of the United States.

However, around **8.1 gigatonnes of CO_2 leaks back into the atmosphere** due to deforestation, fires and other disturbances.



How well soil stores carbon depends on soil type, vegetation and climate. In general, the **wetter and colder**, the better.

Carbon stored

Soil	2,500Gt
Atmosphere	800Gt
Plant & animal life	560Gt

Soil contains almost 2X as much carbon as the atmosphere and living flora and animals combined.

Average stored carbon in tonnes per hectare at a ground depth of one meter

Sources: IPCC; NASA

Visual Capitalist

Landscape Carbon Storage in Mature Ecosystems



Table 5.2 Average Landscape Carbon Storage in Mature Ecosystems (60yrs)

ECOSYSTEM TYPES	AVERAGE LANDSCAPE CARBON STORAGE IN MATURE ECOSYSTEMS (inclusive of SOC) (kg CO_2e/m^2)
Tropical Rainforest	90.936
Tropical Moist Deciduous	46.592
Tropical Dry Deciduous	39.986
Tropical Shrublands	46.574
Mangrove Forest	240.513
Forested/Shrubby Peat Swamp	463.356
Subtropical Humid Forest	44.030
Dry Forest (Mediterranean)	69.357
Temperate Oceanic Rainforest	145.119
Temperate Continental Forest	79.770
Boreal Forest	89.487
Prairie Grassland	70.272
Dry Meadows	45.700
Temperate Mixed Tree, Shrub and Forb Landscape	81.863
Temperate Wetland and Salt Marsh	97.719
Temperate Turf Lawn	39.017

Sources: Carbon Conscience dataset, from aggregated literature review, mostly based on FAO global ecological zones (FAO 2001), and urban coverage studies by (Nowak et al., 2013).

Table 5.5 Site Vegetation - New Planting

NEW PLANTING	PRIORITY ELEMENT	UNITS	NOTES + EXCLUSIONS
Trees	x	qty	Some carbon assessment tools categorize individual trees by mature size, conditions, and climate to account for this variability and focus on biomass growth potential.
Shrubs		qty or m^2	Some carbon assessment tools categorize shrubs by area, container size, and/or low or high intensity.
Herbaceous plantings		m^2	Quantify herbaceous plants by area because of the relatively low biomass of living tissue in most typical individual herbaceous plants.
Lawn		m^2	

Risk of Reversal for Landscape Carbon Storage

RISK OF REVERSAL QUALIFIER	MULTIPLIER	PROJECT DESIGN & OPERATIONS SCENARIO
Protected	1.00	The study area will have a perpetual easement, such as a park, trail, or conservation easement that prevents future development without the consent of both the landowner and the easement holder, such as a land trust or parks department, and generally must not cause a material adverse effect on the easement's purpose. In addition, the project has an operations and maintenance plan or refers to existing operational standards, such as those within an agency, that provide best practices for the maintenance and protection of trees, plantings, and soils.
Semi-Protected	0.75	The study area will have a term or appurtenant easement, such as a voluntary deferment easement for a specific piece of land that can be terminated at will, or a temporary conservation easement that prevents future development for a set period (at least 20 years). Or the owner or client is willing to sign an affidavit that the intention of the planting plans will be maintained for at least 20 years. In both scenarios, the project has an operations and maintenance plan or refers to existing operational standards.
Possible	0.50	There are no easements or legal commitments to protect the planting but the landscape is long term not temporary.
Temporary	0	If the landscape is known to be temporary for less than 10 years, it is not recommended to report storage potential.





Product Carbon Storage

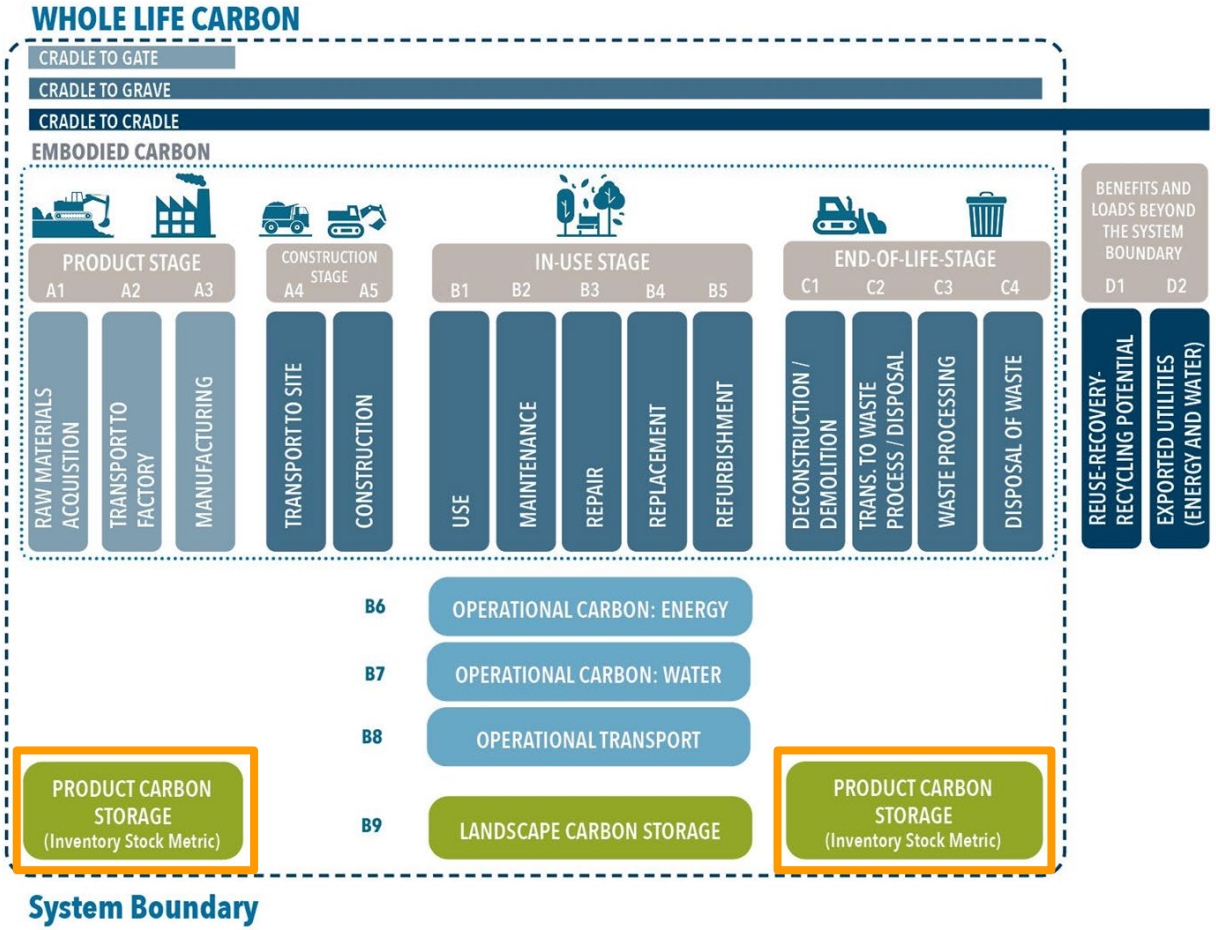
Biogenic carbon stored in construction materials produced from biological materials until they decay or burn.

Table 5.8 Biobased Construction Materials and Products

Assembly components likely to be made from wood are listed while components such as footings and fasteners are not listed because they are not biobased. Other biobased materials such as coatings or erosion control materials are not included, as the amount of product carbon storage is minimal. This chart is tracking product carbon storage. Embodied carbon of these elements is tracked and totaled separately.

SITE ELEMENT SUB-CATEGORY	PRIORITY ELEMENT	COMPONENTS	NOTES + EXCLUSIONS
Decks and Boardwalks	*Reference Ch. 3*	Decking	
		Joists	
		Beams	
		Posts	
		Bracing	
		Rails	
		Steps	
Fences and Gates	*Reference Ch. 3*	Top/Bottom Rails	
		Fence Panel	
		Posts	
Site Furnishings	Reference Ch. 3	Benches	
		Waste Receptacles	
		Signage	
		Other	
Overhead Structures	*Reference Ch. 3*	Posts	
		Beams	
		Joists	
		Purlins/lattice/other	
Retaining Walls	*Reference Ch. 3*	Timbers	
		Deadmen	
		Boards	
		Other	
Play Structures	*Reference Ch. 3*	Posts	
		Beams	
		Joists	
		Decking	
		Rails	
		Steps	
		Other	
Curbing and Edging	*Reference Ch. 3*	Board	
		Stakes	
		Other	

Product carbon storage is released as emissions in the End-of-Life Stage



Step-by-Step: How to Use This Guide

This guide is a framework for assessing and estimating whole life carbon for sites. It includes guidance for tracking both hardscape and softscape, as well as site prep and earthwork. It is very important to keep track of assumptions made about materials, processes, exclusions, and operations.

1. Review this guide in full
2. Use Table 2.3 to establish a Site Carbon Assessment Pathway to pursue
3. Identify and measure applicable site elements to assess their embodied carbon (See Chapter 3: Measuring Embodied Carbon Emissions.)
4. Identify and measure applicable site elements to assess their operational carbon (See Chapter 4: Measuring Operational Carbon Emissions.)
5. Identify and measure applicable vegetation, soils, and biobased products to assess their landscape and product carbon storage (See Chapter 5: Estimating Landscape Carbon Storage and Product Carbon Storage.)
6. Input measurements of Site Elements, Vegetation, and Soils into a carbon assessment tool (See Chapter 6: State of the Tools). Or reference the carbon data hierarchy discussed in Chapter 2 to identify carbon factors for project materials and products in order to conduct manual calculations.
7. Determine the carbon impact of a site project. Track total embodied and operational carbon emissions together, and landscape carbon storage and product carbon storage separately.

4. REFERENCE

State of the Tools: Reporting Overview

TOOL	REPORTING FEATURES				
	Emissions Broken Out by Life Cycle Stage	Product Carbon Storage Reported Separately	Landscape Carbon Storage Reported Separately	Includes Operational Energy Carbon Emissions	Includes Operational Water Carbon Emissions
CarbonConscience v2	no	yes	yes	no	no
Pathfinder v3.3	yes	no	yes	yes	yes
C.Scale	yes	yes	yes	yes	no
One Click Infrastructure LCA*	yes	yes*	no*	no*	no*

**One Click Infrastructure LCA measures emissions from site hardscape materials and infrastructure assemblies but does not measure landscape carbon storage.*

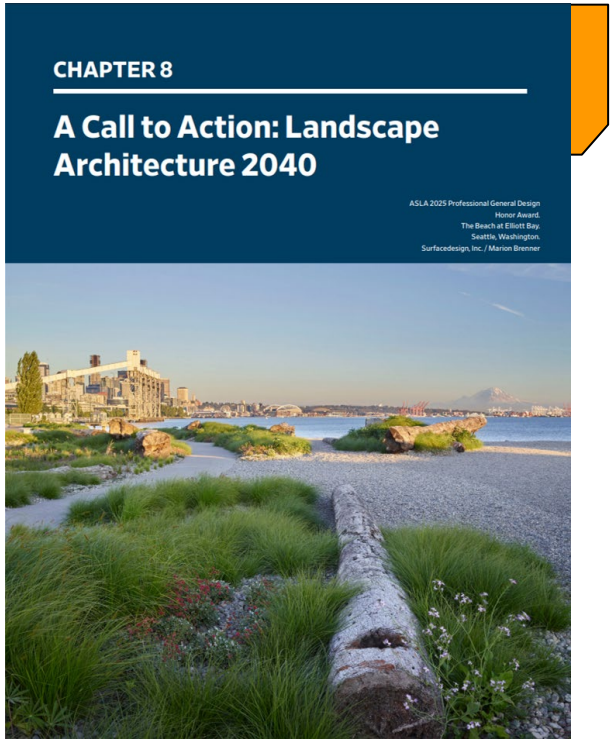
CARBON CONSCIENCE

c.scale™

One Click LCA

pathfinder©

A Call To Action: LA2040



1 Commit to Greenhouse Gas Emissions Reduction

In 2025, ASLA joined our discipline partners (MEP2040, SE2050, AIA2030, Infrastructure 2050) in committing to greenhouse gas emission reduction targets in Landscape Architecture 2040: ASLA Climate & Biodiversity Action Plan. LA2040 encourages landscape architects to design and build for equitable climate and biodiversity solutions.

The climate goal of our plan asks the landscape architecture community to reduce greenhouse gas emissions from projects by 50–65 percent by 2030 and double carbon sequestration and achieve zero emissions by 2040.

2 Protect & Restore Ecosystems

When we protect soils and ecosystems, we preserve the landscape carbon stored there that took years to accumulate. When we increase biodiversity, natural systems bolster existing landscape carbon storage, deepen landscape storage capacity, and buffer our communities from the extremes of climate change. By designing this way, we align our work with the limits of the planet, instead of pushing beyond them.

The biodiversity goal of our plan asks the landscape architecture community to protect, conserve, restore, enhance, and manage for biodiversity. Every project can support the global goals of protecting 30 percent of existing ecosystems and restoring 30 percent of degraded ecosystems by 2030.

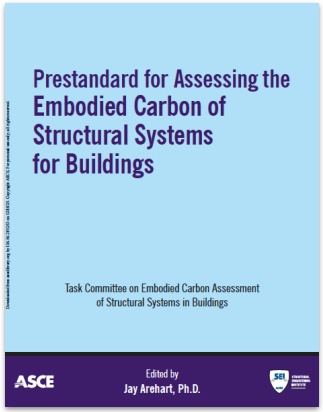
3 Measure Our Impact

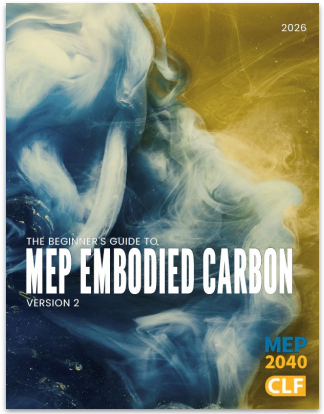
In order to hold ourselves accountable and track momentum across the industry, we need to measure our impacts. This guide provides a standardized method of site carbon assessment and we advocate that you leverage it, share it, and report with it.

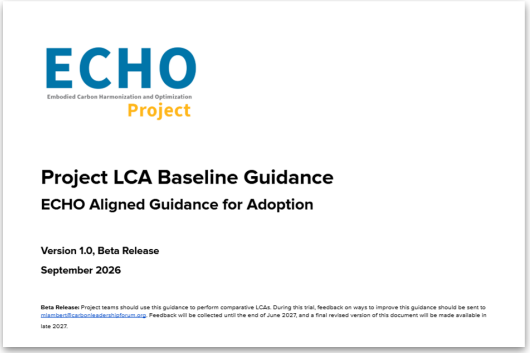
You can’t cap what you can’t compare

SCA Pilot Benchmark Study

- ★ **Leveraging the foundation and methods set by the newly published LA2040 SCA Guide v1**
- ★ **Will develop additional criteria and parameters to make data as comparable as possible**
- ★ **Targeting collaboration with partner organizations and commitment programs**
- ★ **Intention would be to get preliminary data in hopes of revealing patterns and setting targets from which to decarbonize from**







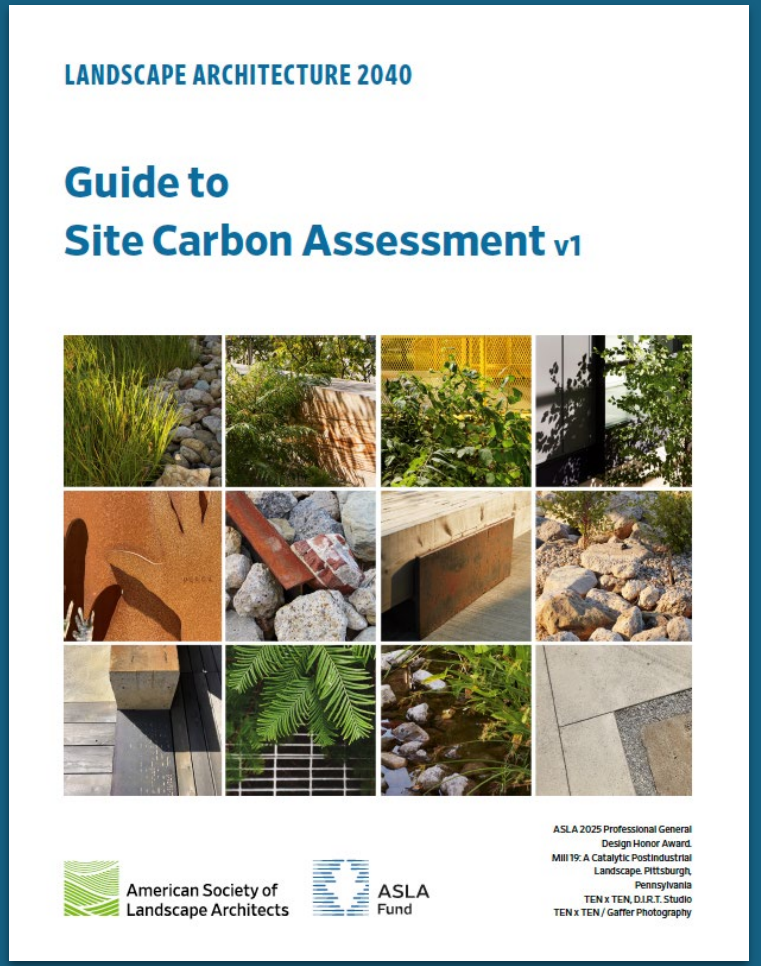
Continue the Conversation!

Join us at ASLA Practice Basecamp in Expo

2:45-3:30 pm

Questions?

SCAN ME!



State of the Tools: Pathfinder

CARBON ASSESSMENT TOOL	LIFE CYCLE STAGES INCLUDED						LANDSCAPE CARBON STORAGE & PRODUCT CARBON STORAGE
	A1-A3	A4	A5.1 - 5.3	B2 - B5	C1-C4	D STAGE	
Pathfinder v3	yes	Default & editable placeholder assumption factors for both distance &	**A5.1**: Default emissions factor applied to user demo inputs **A5.2:** 2.5% Emissions contingency applied to materials **A5.3**: n/a	B2, B4 Landscape Carbon Storage + (vegetation only)	no	D2 Exported Utilities	Landscape and product carbon storage is shown for wood and other biobased materials, protected trees, and protected ecosystems. Landscape carbon storage is equal to 50% of the dry biomass. Gross sequestration and decomposition figures for each tree group and age period are summed and then subtracted to calculate net sequestration for the project over 60 years.

State of the Tools: CC

CARBON CONSCIENCE

CARBON ASSESSMENT TOOL	LIFE CYCLE STAGES INCLUDED						LANDSCAPE CARBON STORAGE & PRODUCT CARBON STORAGE
	A1-A3	A4	A5.1 - 5.3	B2 - B5	C1-C4	D STAGE	
Carbon Conscience v2	yes	Default & editable placeholder assumption factors for both distance &	**A5.1**: Default emissions factor applied to user demo inputs **A5.2**: 1% - 4% Emissions contingency applied to materials **A5.3**: n/a	B4 only Landscape Carbon Storage	no	no	Biogenic Carbon in construction materials is reported as a separate value from emissions & is included as an independent variable, assuming that 50% of the dry biomass of the wood used in the project is pure carbon and is sustainably sourced in accordance with EN Code 16485, 2014.Carbon Sequestration is projected by land use for a 60yr growth cycle, accounting for comparable carbon-carrying capacities by biome.

State of the Tools: c.scale

CARBON ASSESSMENT TOOL	LIFE CYCLE STAGES INCLUDED						LANDSCAPE CARBON STORAGE & PRODUCT CARBON STORAGE
	A1-A3	A4	A5.1 - 5.3	B2 - B5	C1-C4	D STAGE	
C.Scale	yes	Default Distance and Mode aligned with 240P per material category Assumption Factors C.Scale defaults to emission factors from the ASHRAE 240P draft guidance in table 6.5.2.1.	**A5.1:** Calculated per floor area of the demolished building, using a default emissions factor from ASHRAE 240P (2nd draft) **A5.2:** When no additional data is provided, C.Scale uses a default emissions factor from ASHRAE 240P (2nd draft) of project floor area. **A5.3** For each material and building assembly, C.Scale assumes a % of the installed total is wasted during construction. For all waste incurred during A5.3, we calculate A1-A4 and C2-C4 emissions for the wasted material and assign it to A5.3 emission for that material's category	yes Landscape Carbon Storage reported as a separate inventory metric	yes	D1 per material, D2 Exported Utilities	C.Scale reports fossil carbon emissions (GWP-fossil) associated with manufacturing, use, and end-of-life of biobased materials, but does not include the "negative emissions" from biogenic carbon entering the "product system" in modules A1-3, nor the release of CO_2 back to the atmosphere in C3/C4. The model adopts a carbon balance approach over the lifetime of the building. Currently, C.Scale does not report biogenic carbon emissions (GWP-bio) per life cycle stage. Product carbon storage is shown as an inventory metric per ISO21931, EN15978 and ACLCA Guidance. C.Scale measures the annual landscape carbon storage of living and growing landscapes. They assume that all plantings will achieve maturity across the building project's reference period. Landscape carbon storage is accrued year over year by amortizing the total landscape carbon storage in mature landscapes over the model's reference period.

c.scale™