Forestry Innovation Investment

Carbon Leadership Forum British Columbia

Powered by zeic

mood provided by: DBTFUL
song: Flexin'

The City of Vancouver's New Embodied Carbon Guidelines

A CLF BC Webinar

November 29, 2023

RESOURCES

Case Study: Passive House and Embodied Carbon

Concrete: A Pragmatic Approach to Lowering Embodied Carbon

Making the Case for Building Reuse

Material Health and Embodied Carbon. At Odds, or Aligned?

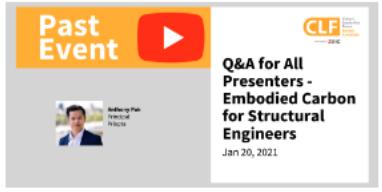
Q&A: CoV Embodied Carbon Modelling Requirements

Embodied Carbon PathFinder Tool & Costing Study

Carbon Storing Buildings: A Gateway to Justice and Belonging

Embodied Emissions Case Study: Nelson Laneway

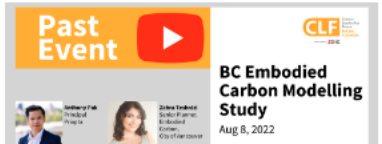
Paving the Way to Carbon Negative Building Materials: A Manufacturer's Perspective

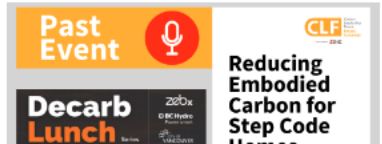


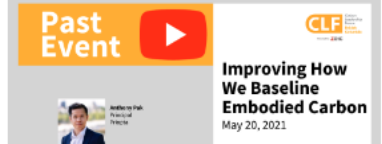
Q&A for All Presenters – Embodied Carbon for Structural Engineers

Embodied Carbon Reductions in Practice and SE 2050 Commitment Program Actions

Importance of Embodied Carbon and the Role of the Structural Engineer

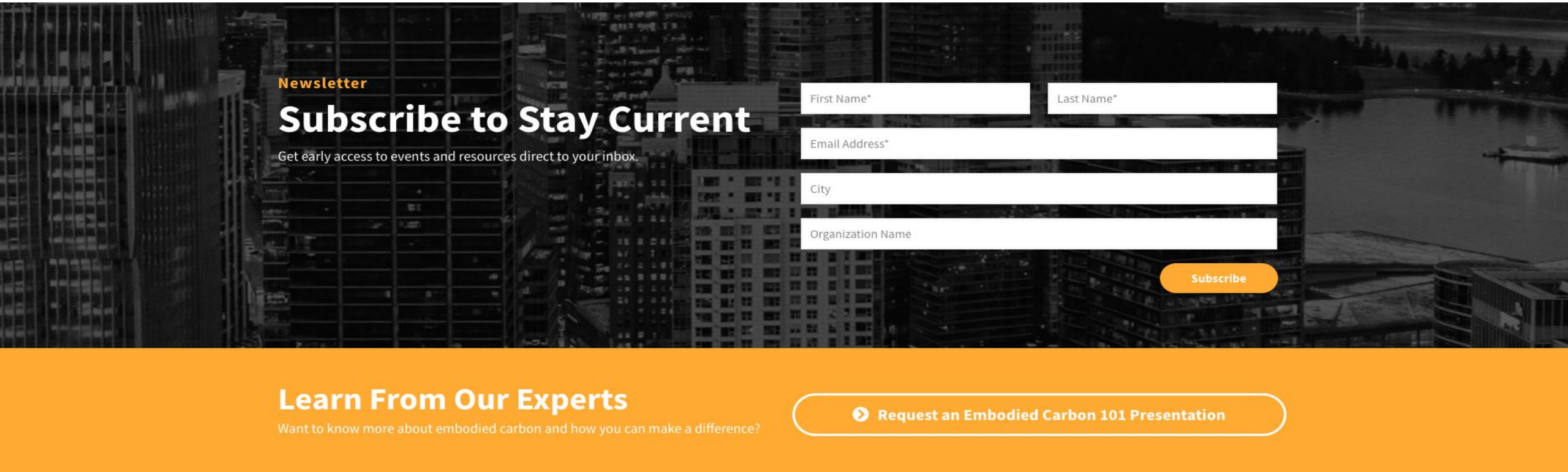






CLF British Columbia

CLF British Columbia (formerly CLF Vancouver) is a local hub of the Carbon Leadership Forum and is now part of the Zero Emissions Innovation Centre (ZEIC). Anthony Pak founded CLF Vancouver in 2019 as the Embodied Carbon Network (ECN Vancouver). In 2022, with funding from the City of Vancouver and Forestry Innovation Investment, CLF Vancouver was adopted as a program area of ZEBx. Since becoming CLF Vancouver, this regional hub of CLF (University of Washington) has been a role model for other CLF regional hubs across the world and has played a key role in the City of Vancouver's efforts to significantly reduce embodied carbon for new buildings by 2030. CLF British Columbia's reach has grown to extend well beyond the Metro Vancouver region.



Case Study

Inlet View

Sep 2023

Case Study

Passive House and Embodied Carbon

Sep 2023

Case Study

Nelson Laneway

Sep 2023

clfbritishcolumbia.com

City of Vancouver Climate Emergency Action Plan

2030 targets

Carbon pollution from buildings will be half what it was in 2007

There will be **40%** less embodied emissions from new buildings and construction projects compared to 2018

In May 2022, City Council approved changes to the Vancouver Building By-law1 (VBBL) to require designers to calculate, limit, and later reduce, embodied carbon in new Part 3 buildings.

By 2030, new buildings will be constructed with lower carbon material

BC's Annual Embodied v. Operational Emissions

From the August 2022 CLF BC Webinar: BC Embodied Carbon Modelling Study

Embodied Carbon
Base Scope (Structure, Envelope)

Category	GHG (MtCO2e)	% of Total Building GHG
Operational Carbon	8.31	68%
Embodied Carbon (Base Scope)	3.94	32%
Total	12.24	100%

Embodied Carbon
Full Scope (Structure, Envelope, Interiors, MEP, Refrigerants)

Category	GHG (MtCO2e)	% of Total Building GHG
Operational Carbon	8.31	54%
Embodied Carbon (Full Scope)	7.19	46%
Total	15.50	100%

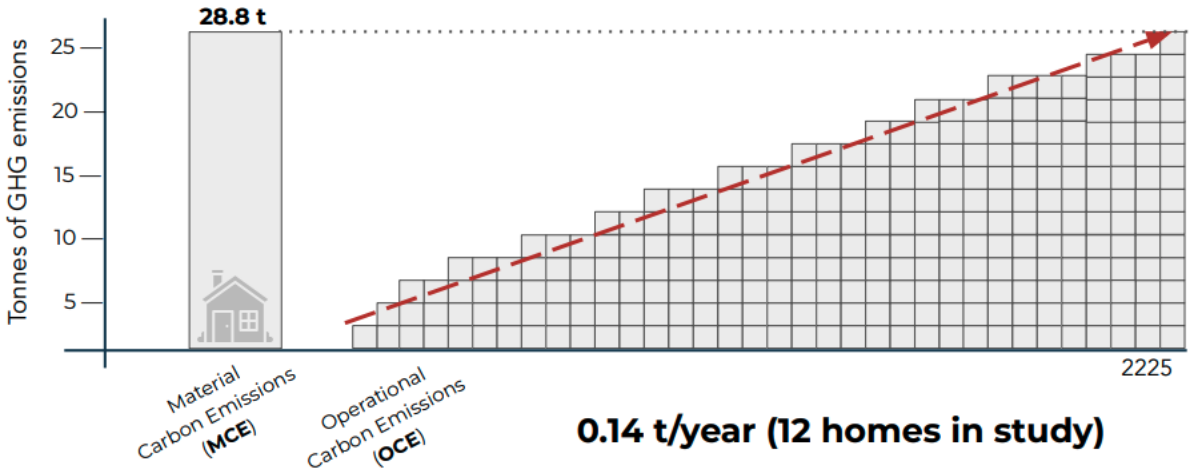
PRIOPTA

Benchmarking Report

Establishing the Average Upfront Material Carbon Emissions in New Low-Rise Residential Home Construction in the City of Nelson & the City of Castlegar

lowest

205 years before today's OCE matches MCE average



- March 2022 study included 34 new, Step 2, 3, 4 and 5 homes in Nelson and Castlegar
- 12 homes in the study had all-electric space and water heating and they averaged 0.14 t/year of operational carbon emissions

Prepared by

Chris Magwood, Director, Builders for Climate Action
Erik Bowden, Embodied Carbon Analyst, Builders for Climate Action
Eve Treadaway, Research Assistant, Builders for Climate Action
Javaria Ahmad, Sustainability Analyst, Builders for Climate Action
Michele Deluca, Registered Energy Advisor, 3West Building Energy Consultants
Natalie Douglas, Embodied Carbon Pilot Coordinator, City of Nelson

POLL 1

Tell us about yourself!

Three-part anonymous poll

City of Vancouver Embodied Carbon Guidelines

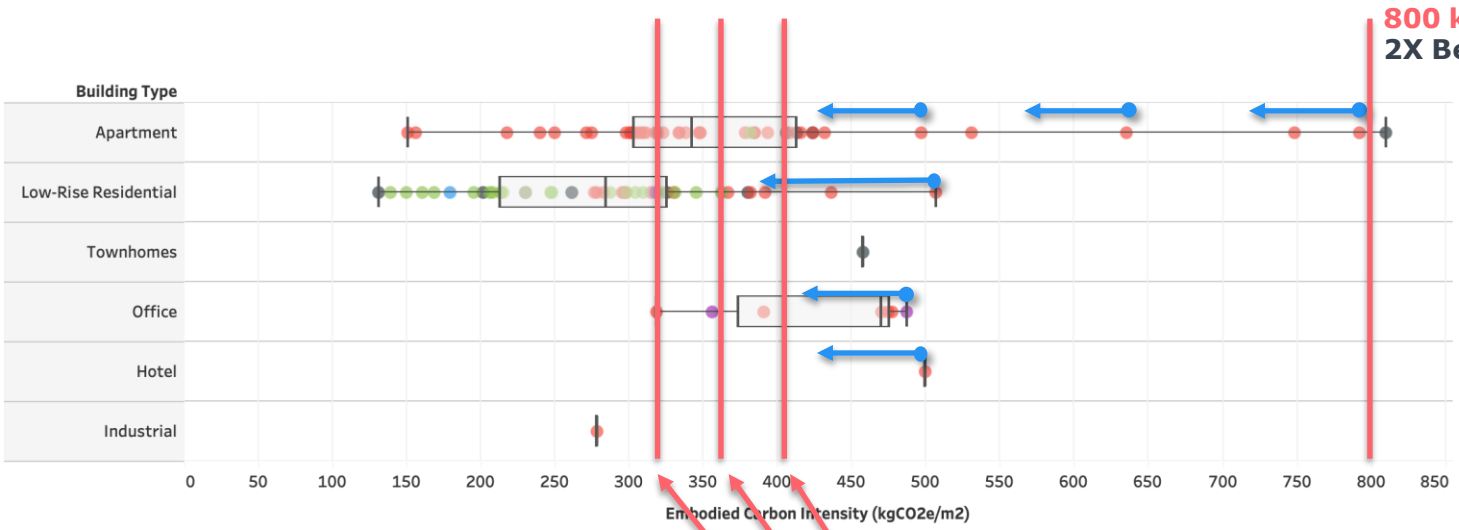
Nov. 29, 2023

Anthony Pak
anthony@priopta.com
PRIOPTA

Part 3

Baseline Definition, Assumptions, and Data Collection

Absolute (kgCO2e/m2) or Baseline (% Reduction)



800 kgCO2e/m2
2X Benchmark (Current)

400 kgCO2e/m2 – Benchmark

360 kgCO2e/m2 OR -10% – All Other Buildings (2025)

320 kgCO2e/m2 OR -20% – Low-Rise Wood (2025)

Data Source: City of Vancouver Rezoning – Embodied Carbon Submissions Anonymized (2017-2021), Visualization by Priopta

Baseline – Functional Equivalence

Thermal Equivalence

- Baseline shall have functionally-equivalent thermal performance
- Can be approximated with clear-wall assembly R-value
- Detailed thermal bridging and thermal equivalence can be conducted but are not required

Structural Equivalence

- Baseline shall have functionally-equivalent structural performance
- Does not need to be the same structural system
- Can reflect intentional material efficiency strategies (e.g. reduce column spans, avoiding transfer slabs, lighter structure / façade systems resulting in smaller foundations etc.)

Geometry Equivalence

- Baseline shall have functionally-equivalent building geometry and program (i.e., services and function of the spaces, number of residential units and occupancy numbers for multi-unit residential buildings (MURBs), building shape and orientation).

Approaches to Creating a Baseline

Using an Early Design Iteration

- Use early iteration as basis for baseline
- Must meet functional equivalence requirements with proposed design. Use professional judgement.
- Slight variations in geometry from design iterations are acceptable
- If certain materials and/or building elements not specified in early design, must add to maintain equivalence with proposed design
- For materials/elements that are hard to quantify, can reference comparable projects or early-WBLCA software to estimate missing material quantities (e.g. Athena Assembly Builder or One Click LCA's Carbon Designer 3D)

Using the Proposed Design

- Use current Proposed Design as starting point
- Change structure, assemblies, and/or materials to reflect typical practice with industry average values to reflect Baseline Design.
- Ensures Baseline is functionally equivalent to Proposed design and modelled with a similar level of detail

EC Guidelines Aims to Account for Tool-Specific Nuances

Part 9 Buildings

PASSIVEHOUSE CANADA Build better. Feel better.

PHribbon

Part 3 Buildings

Athena Impact Estimator for Buildings

One Click LCA

Modelling Assumptions – Life Cycle Stage

- **Required Life Cycle Stages**
  - Life Cycle Stages A-C
  - Module D Reported Separately
- **Life Cycle Stage A1-A3:**
  - Industry average EPDs / generic data within tools should be used as default assumption.
  - Manufacturer/product-specific EPDs can be used when specified in project documents.
- **Life Cycle Stage A4-C4:**
  - Use default tool values or modify based on higher quality project-specific or regionally-specific data.
  - Modified assumptions must be described and justified in Design Report.
- **Missing Life Cycle Stages:**
  - If software tool is missing data for life cycle stages (e.g. EC3), can use the following placeholder values which are included in the Embodied Carbon Design Report (spreadsheet template).
  - **A4:** 4% of A1-A3 | **A5:** 6% of A1-A3 | **B1-B5:** 10% of A1-A3 | **C1-C4:** 5% of A1-A3
  - These estimates are intended as a temporary measures to address tool gaps that we anticipate will be addressed in the near future.

Modelling Assumptions – Other Topics

- **Building Lifespan and Product Service Life**
  - Building Lifespan = 60 Years
  - Element/Product Service Life = Software Defaults **or** Appendix C Table 6 based on various sources
- **Reported Separately But Not Included in Main Calculation:**
  - Biogenic Carbon, Concrete Carbonation (naturally occurring), & Land Use Change.
- **Bill of Material Sources:**
  - Building Information Model (BIM), cost estimate, and/or takeoffs from drawings.
  - If these sources are missing required elements (e.g. foundations) or materials (e.g. rebar), they must be accounted for. (e.g. manual takeoffs, assumptions, tool assembly level estimates etc.).
- **Required vs Optional Scopes – Building Elements**
  - Refer to Appendix B2 Table 5 – Detailed breakdown of building elements that are required (structure and shell) and optional (interiors, MEP, site) by OmniClass Level 4.
    - Provided only to give clarity on which elements are required vs optional.
    - Building element classification may vary depending on software tool used. Omniclass not required.
  - Materials required for thermal, moisture, acoustic, and fire protection should be included.

Default Assumptions by Building Element

Table 1: Default Common-practice Assemblies and Materials for the Key Building Elements

Building Elements (OmniClass)			Default Material and Product Assumption
Level 1	**Level 2**	**Level 3**	
Substructure	Foundations	-	• Steel-reinforced Concrete* • Subgrade Insulation: Extruded Polystyrene (XPS)
	Subgrade Enclosures	Walls for Subgrade Enclosures	
	Slab-on-Grade	-	
Shell	Superstructure	Floor Construction: Vertical (i.e. columns)	• Steel-reinforced Concrete*
		• Floor Construction: Horizontal (i.e. beams and floor plates) • Roof Construction	• Typical Span: Steel-reinforced Concrete* • Long Span: Steel Trusses

	Exterior Vertical Enclosure	Exterior Walls**	• Type:
			  ○ Office and Commercial Storefront: Aluminum Curtain Wall
			  ○ Residential (7+ storeys): Aluminum Window Wall
			  ○ Other: Steel Framed Wall
			• Framing: 6" deep steel framing @ 16" on-centre
			• Sheathing: Gypsum Board***
			• Thermal Insulation (Cavity): Mineral Wool Batt Insulation
			• Thermal Insulation (Continuous): Heavy Density Mineral Board
			• Cladding: Galvanized Steel

		Exterior Windows	• Window Frame: Aluminum • Insulated Glass Unit (IGU): As required to meet the thermal performance • Window-to-wall ratio: As required to meet the thermal performance

	Exterior Horizontal Enclosures	Roofing	• Insulation:
			  ○ Conventional Roof: Polyiso
			  ○ Inverted Roof: Extruded Polystyrene (XPS)
			• Interior Sheathing: Gypsum Board***
			• Membrane: 2-ply Styrene Butadiene Styrene (SBS)

Interiors (Optional)	Interior Construction (Optional)	Interior Partitions	• Framing: 6" deep steel framing @ 16" on-centre • Sheathing: Gypsum Board*** on Both Sides • Acoustic Insulation (where required): Mineral Wool Batt Insulation
	Interior Finishes (Optional)	Wall Finishes	• Paint

		Floor Finishes	• Office Units: Carpet
			• Residential and Hotel Suites: Vinyl
			• Retail: Ceramic Tiles
			• Industrial: Exposed Concrete
			• Healthcare: Ceramic Tiles
			• All Building Types:
			  ○ Hallways (except for retail): Carpet
			  ○ Below-grade and Service Rooms: Exposed Concrete
			  ○ Bathrooms and Showers: Ceramic Tiles

		Ceiling Finishes	• Drop Ceiling: Acoustic Tile • Other: Gypsum Board*** with Skim Coat and Paint

Default Assumptions – Concrete

Table 2: Default Materials and Product Assumptions and EPD Selection

Material/Product	Default Material Type and EPD Assumptions
Concrete	All concrete shall assume baseline mixes specified in the BC provincial industry-wide EPD[16], with matching air entrainment and at equivalent strength to the proposed design, unless lower strengths are enabled by structural design efficiencies as described in "Design Structure for Material Efficiency" section of Table 3. If no information is available on the proposed design, consider assuming the following compressive strengths can be used: • Foundation, Footings, Slab-on-grade - 25 MPa • Exterior Walls, Interior Walls - 35 MPa • Suspended Floor and Roof Slabs and Beams - 35 MPa • Stairs, Columns, Shear Walls - 40 MPa If no information is available on air entrainment for concrete in the proposed design, air-entrained concrete mixes can be assumed for building elements exposed to exterior conditions (e.g., foundations, parkade slabs, exterior walls, slab-on-grade, etc.) and non-air entrained concrete mixes can be assumed for elements not exposed (e.g., interior concrete elements). **Note:** Athena Impact Estimator and tallyLCA tools currently do not include BC provincial industry-average concrete mixes EPDs in their database. Projects that use Athena tool can select the "Benchmark" mixes defined within older CRMCA 2017 Canadian Industry-Average EPD that is currently available in the tool. Projects using tallyLCA may use the national average values from the US-specific NRMCA 2019 data that is currently available in the tool. If in future BC-average EPDs become available, BC values shall be used. If the project teams wish to claim embodied carbon reduction for using low-carbon intensity concrete, using these tools, they shall follow the guidance provided in this Note box.

Default Assumptions – Insulation, Windows & Glazing

Material/Product	Default Material Type and EPD Assumptions
Insulation	XPS: The newer generation of XPS are compliant with Canadian HFC regulation and shall be referenced (e.g., Owens Corning FOAMULAR NGX, SOPREMA SOPRA- XPS, KingSpan GreenGuard LG XPS, or DuPont's ST-100 XPS). The conventional XPS insulation products that use HFC blowing agents shall not be referenced, as those are banned in Canada due to new regulations that came into effect on Jan. 1, 2021. The CLF Baselines Report averages XPS from both HFC and HFO blowing agent products to derive an average GWP value (See Appendix A.1 (d) (i)). Since XPS insulations that use HFC blowing agents are banned in Canada, the baseline value for XPS in CLF Baselines Report shall not be used.
	Closed Cell Spray Foam: If the Closed Cell Spray Foam (ccSPF) insulation is proposed, it shall reference the newer generation of low-GWP blowing agents compliant with Canadian HFC regulation. Reference the SPFA Industry-wide EPD (2018) for Spray Foam using HFO blowing agents. The conventional ccSPF insulation products that use HFC blowing agents shall not be referenced, as those are banned in Canada due to new regulations that came into effect on Jan. 1, 2021. The CLF Baseline Report averages ccSPF from both HFC and HFO blowing agent products to derive an average GWP value. Do not use this baseline value.
Windows and Glazing	If the software tool does not have data specific to the window frame of the proposed design, a different window frame can be a proxy value. If the software tool does not have data specific to the triple-pane windows: • If the software tool allows it, window frame and glazing layers can be modelled separately. • If the tool only allows using EPDs that combine window frame and glazing, the emissions can be approximated by referencing a double pane window EPD with appropriate window frame and adding an additional pane of flat glass or processed glass with the same area as the proposed window.

Default Assumptions – Rebar & Other Steel

Material/Product	Default Material Type and EPD Assumptions
Steel Reinforcement (Rebar)	The fabricated rebar EPD published by Concrete Reinforcing Steel Institute (CRSI) shall be referenced. The user do not need to model recycled content in the rebar, as the CRSI EPD specifies the recycled-content steel, which is 98%. **Note:** Post-tensioned slabs reduce rebar quantities in structural concrete. However, post Tension (PT) Tendons typically use much lower recycled content steel and have higher GWP impacts compared to conventional rebar. If no EPD is available for PT tendons, embodied carbon calculations shall approximate the impacts by doubling the PT tendon quantity and map to conventional rebar EPD (CRSI industry-wide EPD).
Steel	For non-rebar steel including Plate Steel, Hollow Structural Section (HSS), Hot-Rolled Sections, Steel Framing, and Open Web Steel Joist, baselines shall reference the relevant industry-wide EPD. Where available in the software tool refer to: • Fabricated steel data instead of unfabricated steel • Canadian industry-wide EPDs over US industry-wide EPDs. Examples of organizations that have published industry-wide EPDs are Canadian Institute of Steel Construction (CISC), American Institute of Steel Construction (AISC), American Galvanizers Association (AGA), Steel Framing Industry Association (SFIA), Metal Building Manufacturers Association (MBMA), Steel Joist Institute (SJI), Steel Tube Institute (STI), Steel Deck Institute (SDI), and Metal Construction Association (MCA).

Default Assumptions – Aluminum, Wood & MEP

Material/Product	Default Material Type and EPD Assumptions
Aluminum	Aluminum products shall reference the relevant industry-wide EPD. Where available, reference Canadian industry-wide EPDs (e.g., AluQuebec) over US industry-wide EPDs. Examples of industry-wide EPDs are: • Extruded Aluminum: Aluminum Extruders Council (AEC) • Curtain Wall: AluQuebec • Aluminum Windows: AluQuebec • Aluminum Sheet/Cladding: AluQuebec, Aluminum Association, Ceilings & Interior Systems Construction Association (CISCA), Metal Construction Association (MCA)
Wood	Refer to Section 4.4 (a) on biogenic carbon calculation. Wood products shall reference relevant industry-wide EPDs from the Canadian Wood Council (CWC) or other relevant organizations.
Services	(Optional) Product-specific EPDs, Product Environmental Profiles[17] (PEPs), or industry-wide data shall be used. If none of the above data sources are available, the project team can calculate the embodied carbon of building services using guidance from TM65 Embodied Carbon in Building Services: A Calculation Methodology and TM65LA Embodied carbon in building services: Using TM65 outside the UK (See Appendix A.2 (d)). Refrigerant emissions shall not be included in the embodied carbon assessment or compliance[18].

Baseline Definition – Build Less, Reuse More

Table 3: Calculating Embodied Carbon of the Baseline Relative to the Proposed Design

Baseline	Proposed Design
1. Build Less, Reuse More	
Reduce Demolition	
(Out of scope) If the proposed design includes partial or complete removal of any existing building or building element on the site, the baseline shall not include the emissions from the demolition or deconstruction of the existing building.	(Out of scope) See Section 4.3 (c) (vi)
Reuse/Retrofit Existing Buildings	
The baseline shall assume entirely new construction for all building areas, even if some portions of the building will be retained and reused in the proposed design.	See Section 4.3 (c) (vi)
Use Salvaged or Refurbished Materials	
The baseline shall assume entirely new materials for all materials and assemblies, even if salvaged materials are used in the proposed design.	See Section 4.3 (c) (vi)
Design for Disassembly (DfD)	
(Optional) Even if DfD is incorporated in the proposed design, default module C and D assumptions in the software tool shall be used for the baseline. The baseline module C and D data may be modified if the project team can provide more representative project-specific or regional data on these modules.	(Optional) See Section 4.3 (c) (vii)

Where reused materials in proposed design, assume new materials in baseline design

Baseline Definition – Reduced Underground Parking

Baseline	Proposed Design
2. Design Lighter and Smarter	
Reduce Floor Area of Below-Grade Construction	
The baseline shall assume one of the following options to identify the parkade area of the baseline: Option 1. The minimum parking requirements in the City of Vancouver Parking By-law[22]; Option 2. The number of storeys provided in Table 4; or, Option 3. The same as the proposed design.	As per the proposed design

Table 4: Assumptions for Below-Grade Parkade Levels in the Baseline

Above-Grade Storeys	Below-Grade Parkade Storeys	
Proposed Design	Baseline (Developments with Multiple Buildings over Parkade)	Baseline (All Other Developments)
1-3	1	1
4-6	RR zones: 1 All others: 2	RR zones: 1 All others: 2
7-12	2	2
13-18	3	3
19-24	3	4
25-30	3	5
31-36	3	6
37-42	3	7
43+	3	8

Option 1:
CoV Minimum Parking Requirements (embodied carbon intensity per stall)

Option 2:
number of below-grade storeys based on number of above grade storeys in Table 4 (embodied carbon intensity per storey)

Option 3:
Same as proposed design (no reduced underground parking in baseline)

Baseline Definition – Structural Material Efficiency

Baseline	Proposed Design
Design Structure for Material Efficiency	
The baseline may assume a typical structural design, appropriate to the building and functionally equivalent to the proposed design, as determined by the building structural engineer. Where intentional design choices are made that vary from a typical design and result in embodied carbon reduction, those may be reflected in differences between the baseline and the proposed design. Otherwise, both the baseline and proposed design	As per the proposed design
shall have the same structural design assumptions. Examples of these design choices for the structural elements include: • Reducing bay sizing and column and beam spacing; • Reducing member cross sections; • Avoiding cantilevers and transfer slabs; • Reducing rebar and tendons quantities and concrete volume in structural concrete by using post-tensioned concrete slabs; • The knock-on effects of lighter structures, e.g., using void systems, timber structural elements, lighter enclosure and façade systems may result in smaller footings and foundations; • Allowing for the preservation of an existing structure; • Exposing structural materials where possible to avoid finishing. For more guidance, refer to Table 1 and Table 2 in this document. The Whole Building Life Cycle Assessment: Reference Building Structure and Strategies by ASCE/SEI can also be referred to for additional guidance (See Appendix A.2 (f) (i)).	

Where intentional structural material efficiency design choices have been made, baseline design can reflect typical design as determined by structural engineer

Baseline Definition – Finishes, Minimized C&D Waste

Baseline	Proposed Design
Choose Finishes Carefully	
(Optional) If included in the embodied carbon of the proposed design, the baseline may assume typical interior finishes, appropriate to the building and functionally equivalent to the proposed design, as determined by the building architect. See Table 1 for more guidance on interior material and assembly types.	(Optional) As per the proposed design
Minimize Construction and Demolition Waste	
As per the default scenarios in the software tools for modules A5 and C1-C4. The baseline data may be modified, if the tool allows it, and if the project team can provide more representative project-specific, city-wide or regional waste management data.	As per the proposed design

Interior finishes are optional, but if lower carbon design choices have been made in interior finishes, baseline can assume typical finishes to show reductions

If efforts have been made to reduce construction waste on site (A5), proposed design can override default material waste percentages assumed in LCA software

Baseline Definition – Low Carbon Alternatives

Baseline	Proposed Design
3. Use Low-Carbon Alternatives	
Select Lower-Carbon Structural and Enclosure Materials and Assemblies	
The baseline structure and enclosure assemblies and materials shall reflect local typical practice for the building type and application. The project team should use their professional judgement to specify the local common practice for the building archetype and application. Refer to Table 1 for more guidance on common materials and assemblies in Vancouver local practices.	As per proposed design
Select Carbon-Storing Materials	
(Optional for reporting) (Out of scope for compliance) If reported for the proposed design, the baseline shall also report biogenic carbon. The results shall be reported separately and shall not be included in demonstration of compliance.	(Optional for reporting) (Out of scope for compliance) See Section 4.4 (a)
Select Lower-Carbon Mechanical, Electrical, and Plumbing (MEP) Systems	
(Optional) If included in the proposed design, the baseline shall assume typical MEP design that meets the operational carbon requirements in VBBL, as determined by the building mechanical engineer. Refer to Table 2 for more guidance on calculating embodied carbon of services.	(Optional) As per the proposed design

If designing with lower carbon structural system (e.g. mass timber) or envelope assemblies in proposed design, baseline design can follow Table 1 for baseline assemblies/materials.

Carbon storing materials can be reported separately, but not included in embodied carbon reduction calculations

MEP is optional scope for disclosure. If efforts made to reduce embodied carbon in MEP, then baseline can assume typical MEP design to account for reductions (CIBSE TM65)

Baseline Definition – Procure Low Carbon Products

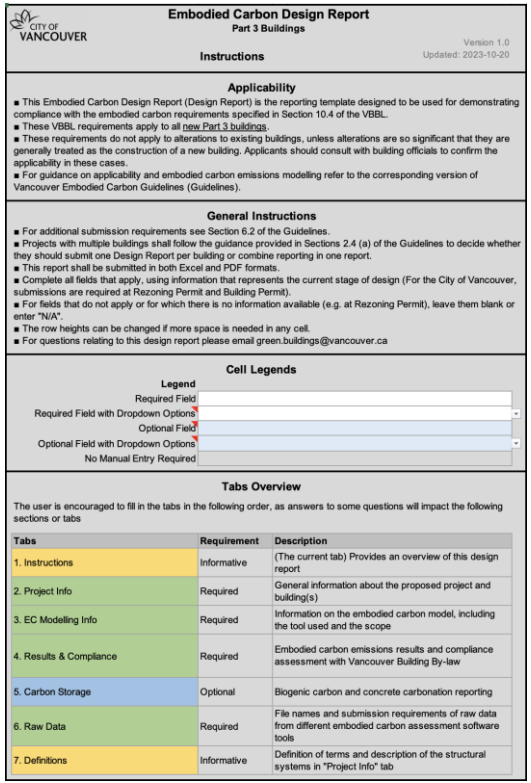
Baseline	Proposed Design
4.Procure Low-Carbon Products	
Use Zero-carbon Construction	
For transportation to site and construction site emissions, the baseline shall be as per the default scenarios in the software tool for modules A4 and A5. The embodied carbon emissions from construction site (A5) tend to be under-reported in the software tools. If the project team intends to claim embodied carbon reduction from construction site, the user may replace the default values in the tool for the baseline with more comprehensive data that the project team may have from comparable recent projects.	See Sections 4.3 (c) (ii) and (iii)
Specify Lower-carbon Options	
The baseline shall use the industry-wide EPD available for a material or product, using the most recent version of the CLF Baselines Report (See Appendix A.1 (d) (i)). The most local EPD shall be selected, by order of priority: BC, Canada, and North America. Refer to Section 4.3 (c) (i) for more guidance on choosing the industry-wide EPDs for common materials and products.	See Section 4.3 (c) (i)

Proposed design can have manual overrides for A4 transportation distances/modes and A5 construction site energy use, while baseline assumes software default values and/or comparable recent projects.

Proposed design uses manufacturer/product-specific EPD while baseline design uses industry average EPDs / datapoints.

Spreadsheet Submission Template – Project Metadata

City of Vancouver – Embodied Carbon Design Report



Embodied Carbon Design Report
Part 3 Buildings

CITY OF VANCOUVER

Version 1.0
Updated: 2023-10-20

Instructions

Applicability

- This Embodied Carbon Design Report (Design Report) is the reporting template designed to be used for demonstrating compliance with the embodied carbon requirements specified in Section 10.4 of the VBBL.
- These VBBL requirements apply to all new Part 3 buildings.
- These requirements do not apply to alterations to existing buildings, unless alterations are so significant that they are generally treated as the construction of a new building. Applicants should consult with building officials to confirm the applicability in these cases.
- For guidance on applicability and embodied carbon emissions modelling refer to the corresponding version of Vancouver Embodied Carbon Guidelines (Guidelines).

General Instructions

- For additional submission requirements see Section 6.2 of the Guidelines.
- Projects with multiple buildings shall follow the guidance provided in Sections 2.4 (a) of the Guidelines to decide whether they should submit one Design Report per building or combine reporting in one report.
- This report shall be submitted in both Excel and PDF formats.
- Complete all fields that apply, using information that represents the current stage of design (For the City of Vancouver, submissions are required at Rezoning Permit and Building Permit).
- For fields that do not apply or for which there is no information available (e.g. at Rezoning Permit), leave them blank or enter "N/A".
- The row heights can be changed if more space is needed in any cell.
- For questions relating to this design report please email green.buildings@vancouver.ca

Cell Legends

Legend	
Required Field	
Required Field with Dropdown Options	
Optional Field	
Optional Field with Dropdown Options	
No Manual Entry Required	

Tabs Overview

The user is encouraged to fill in the tabs in the following order, as answers to some questions will impact the following sections or tabs

Tabs	Requirement	Description
1. Instructions	Informative	(The current tab) Provides an overview of this design report
2. Project Info	Required	General information about the proposed project and building(s)
3. EC Modelling Info	Required	Information on the embodied carbon model, including the tool used and the scope
4. Results & Compliance	Required	Embodied carbon emissions results and compliance assessment with Vancouver Building By-law
5. Carbon Storage	Optional	Biogenic carbon and concrete carbonation reporting
6. Raw Data	Required	File names and submission requirements of raw data from different embodied carbon assessment software tools
7. Definitions	Informative	Definition of terms and description of the structural systems in "Project Info" tab

Project Information

project name, address, submission date etc.

Building Information

# of storeys above and below grade, GFA w/ & w/o parkade area, primary building use, design phase etc.

Design Information

primary structural system, foundation type, seismic

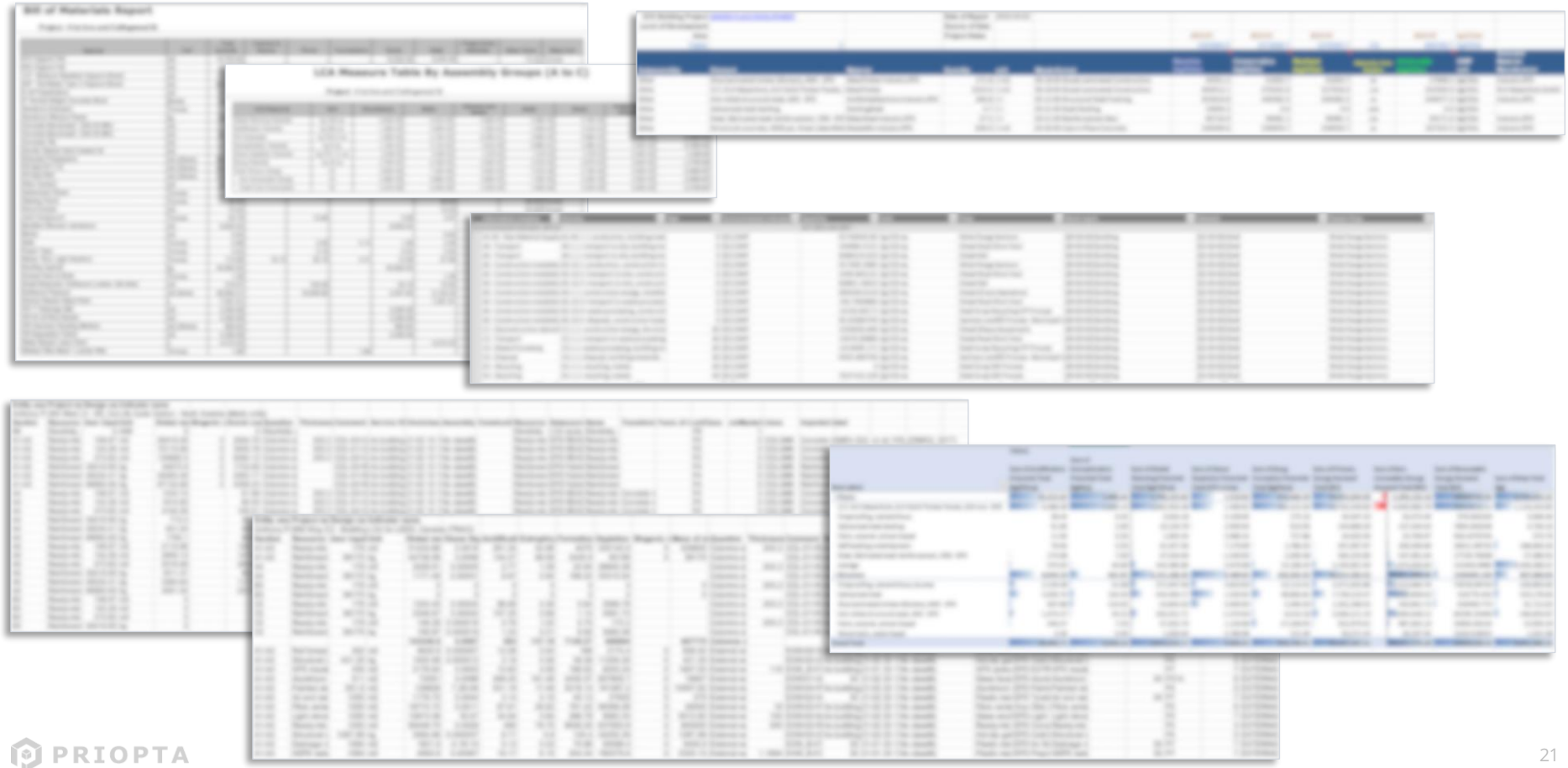
WBLCA Modelling

material takeoff source, software tool, scope of building elements, life cycle stages, non-standard data assumptions etc.

Reduction Strategy

description of reduction strategies, differences between proposed vs baseline

Collect Raw Granular Results From WBLCA Tools



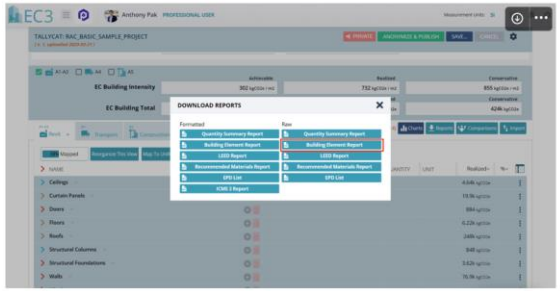
CoV ECDR – Raw Data Submission Instructions

https://tinyurl.com/COV-ECDR

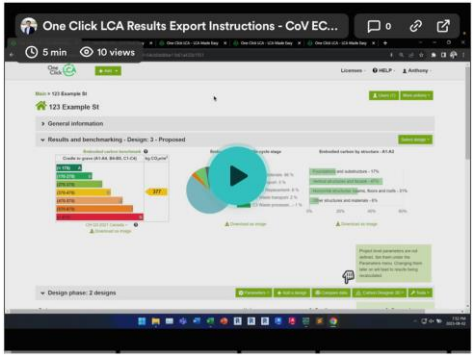
- One Click LCA
- Athena
- Tally (tallyLCA)
- EC3 or tallyCAT

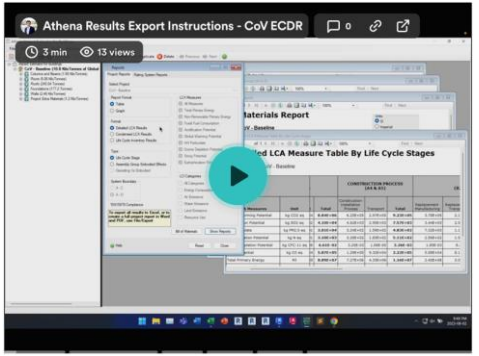
Instructions

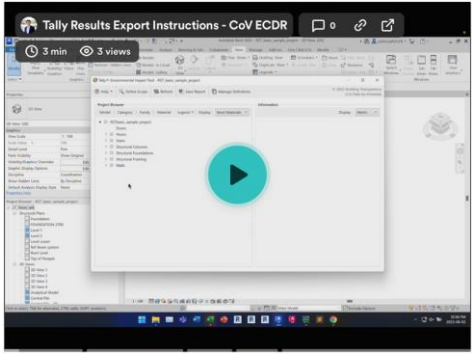
- Results Export Sheets
  - Required: Building Elements Report (Raw)
    - Select `Reports` and under the **Raw** column, click on `Building Element Report` spreadsheet.

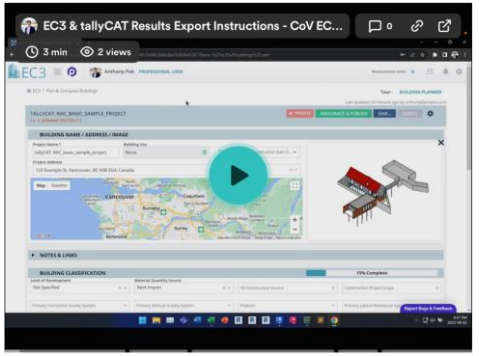


  - Optional: Building Elements Report (Formatted)
    - Select `Reports` and under the **Formatted** column, click on `Building Element Report` spreadsheet.



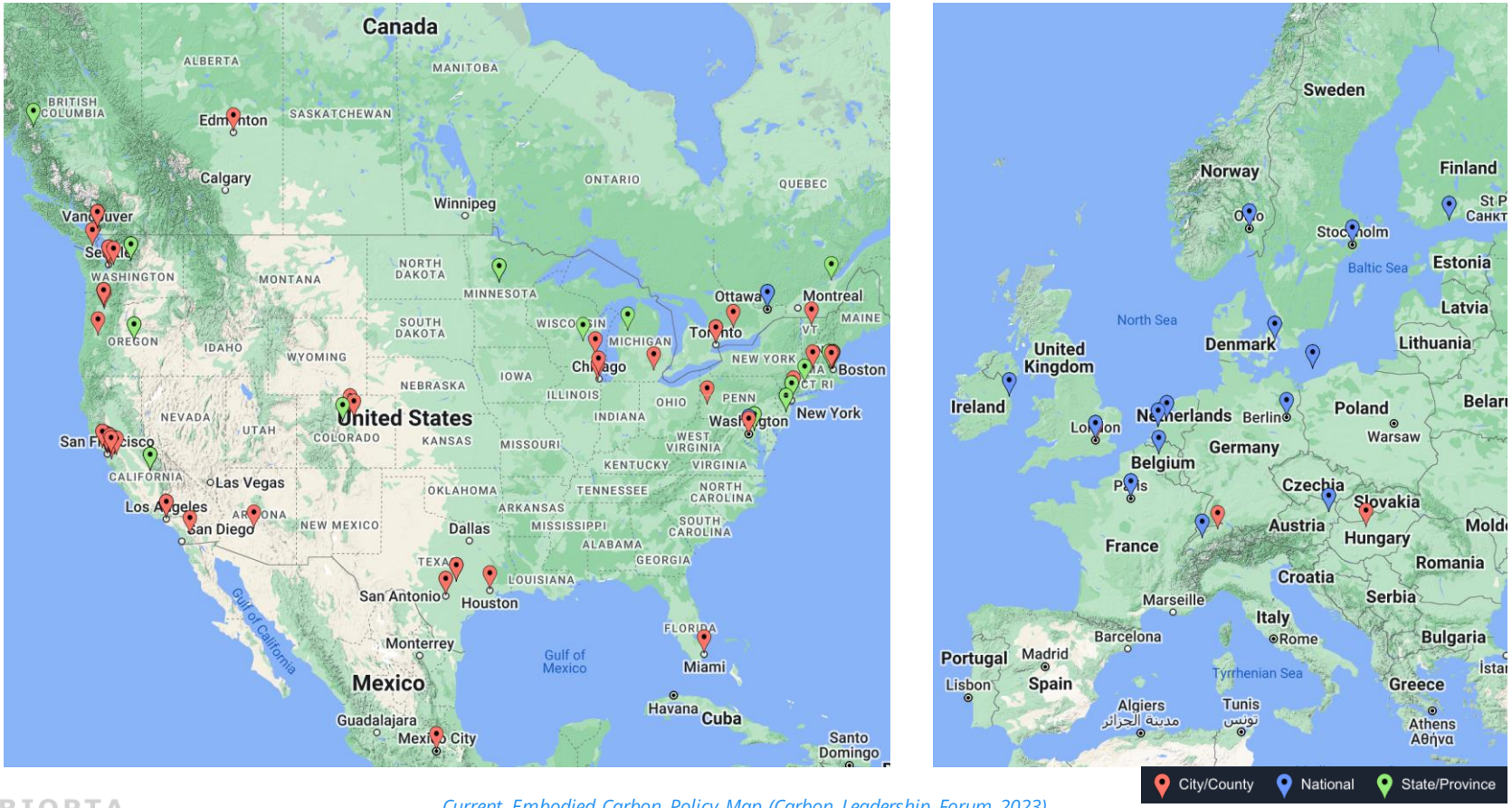






Key Developments Beyond The City of Vancouver

Embodied Carbon Policy in Canada, USA & EU



Current_Embodied Carbon_Policy Map (Carbon_Leadership_Forum_2023)

Embodied Carbon Policies

- **Greening Government Strategy (TBS) – Federal Major New Construction**
  - **2022:** 10% Reduction in Embodied Carbon of Concrete
  - **2025:** 30% Reduction in Embodied Carbon of Structural Materials & WBLCA Disclosure
- **City of Toronto – TGS v4 EC Requirements for Municipal Buildings to be below 350 kgCO2e/m2 (A1-A5)**
- **Embodied Carbon Technical Requirements to be Introduced in National Model Codes 2030 (CBHCC)**
- **CALGreen – California Requirement in June 2024 (10% Reduction WBLCA as 1 of 3 pathways)**
- **Pacific Coast Collaborative (Provinces/States and Municipalities Along West Coast)**
- **CaGBC Zero Carbon Building v4 (EC TAG - June 2024 Launch)**
- **LEED v5 (in development)**

Embodied Carbon Standards/Guidelines/Studies

- **NRC – WBLCA Guidelines, LCI Database Development**
- **Embodied Carbon Harmonization and Optimization (ECHO) Project**
- **ASHRAE/ICC Standard 240p – Quantification of Life Cycle GHG Emissions of Buildings (in development)**
- **RICS v2 (UK) Whole Life Carbon Standard (published)**
- **CLF Benchmarking v2 Study (in development)**


Q&A

City of Vancouver's Embodied Carbon Guidelines

Nov 29, 2023

Today's Agenda

Part 1: Context

Part 2: Embodied Carbon Guidelines Overview

Q&A

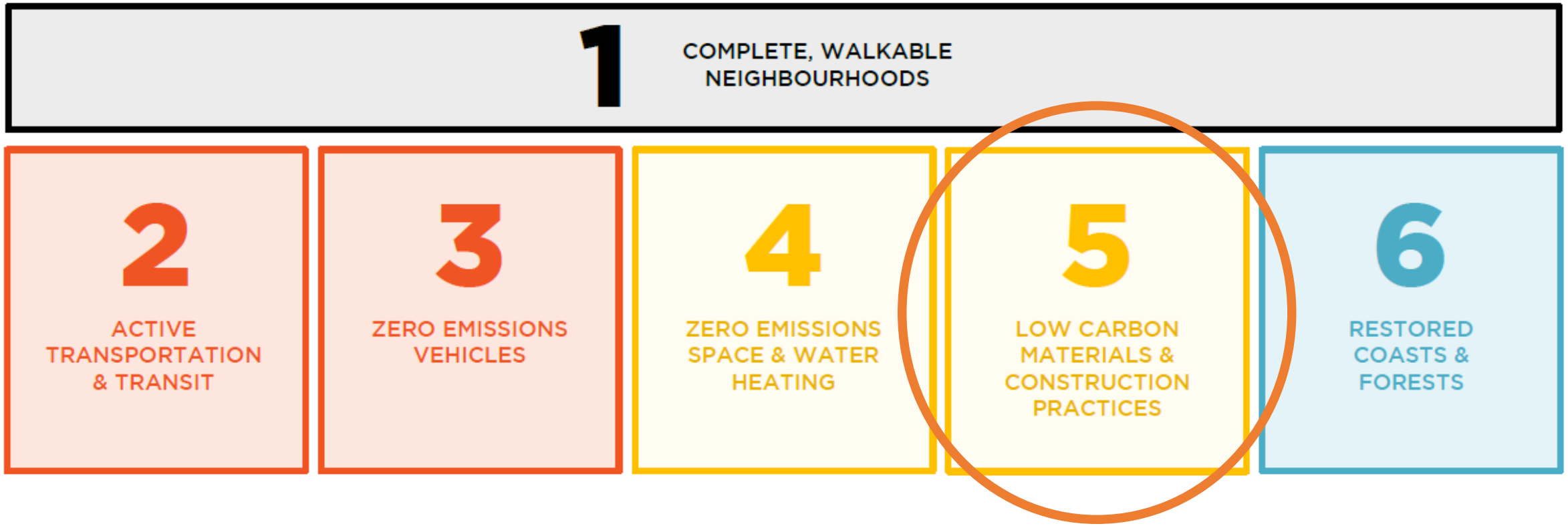
Part 3: Modelling: Assumptions, Baseline, & Data Collection

Part 4: Next Steps

Q&A

Part 1
Context

Climate Emergency
6 Big Moves



40% Reduction in New Buildings by 2030

Code Changes*

October 2023

- Reporting
- Equal or Less than 2x the Baseline
  - Follow the Embodied Carbon Guidelines for Assessment & Setting Baseline

January 2025**

- 20% Reduction: Up to 6-storeys, Can Be Built with Wood
- 10% Reduction: All Other Buildings
- 1 Responsible Materials Criteria

  (Sustainable and Ethical Materials; Healthy and Transparent Materials; Circular Materials)

OR

Double the Percent Reduction

* Part 3 new buildings only (excludes 1-3 storeys residential)

** Approved in principle. The City Council will approve the final 2025 code changes in 2024.

Code Changes: October 2023

Section 10.4. Low Carbon Materials and Construction

10.4.1. Low Carbon Materials and Construction

10.4.1.1. Application

1) This Section applies to *buildings* described in Sentence 1.3.3.2.(1) of Division A.

10.4.1.2. Low Carbon Materials and Construction

1) A *building* shall be designed and constructed to achieve whole-building embodied carbon impacts of not more than double that of a functionally equivalent baseline, as determined in compliance with the City of Vancouver Embodied Carbon Guidelines, or as *acceptable* to the *Chief Building Official*.

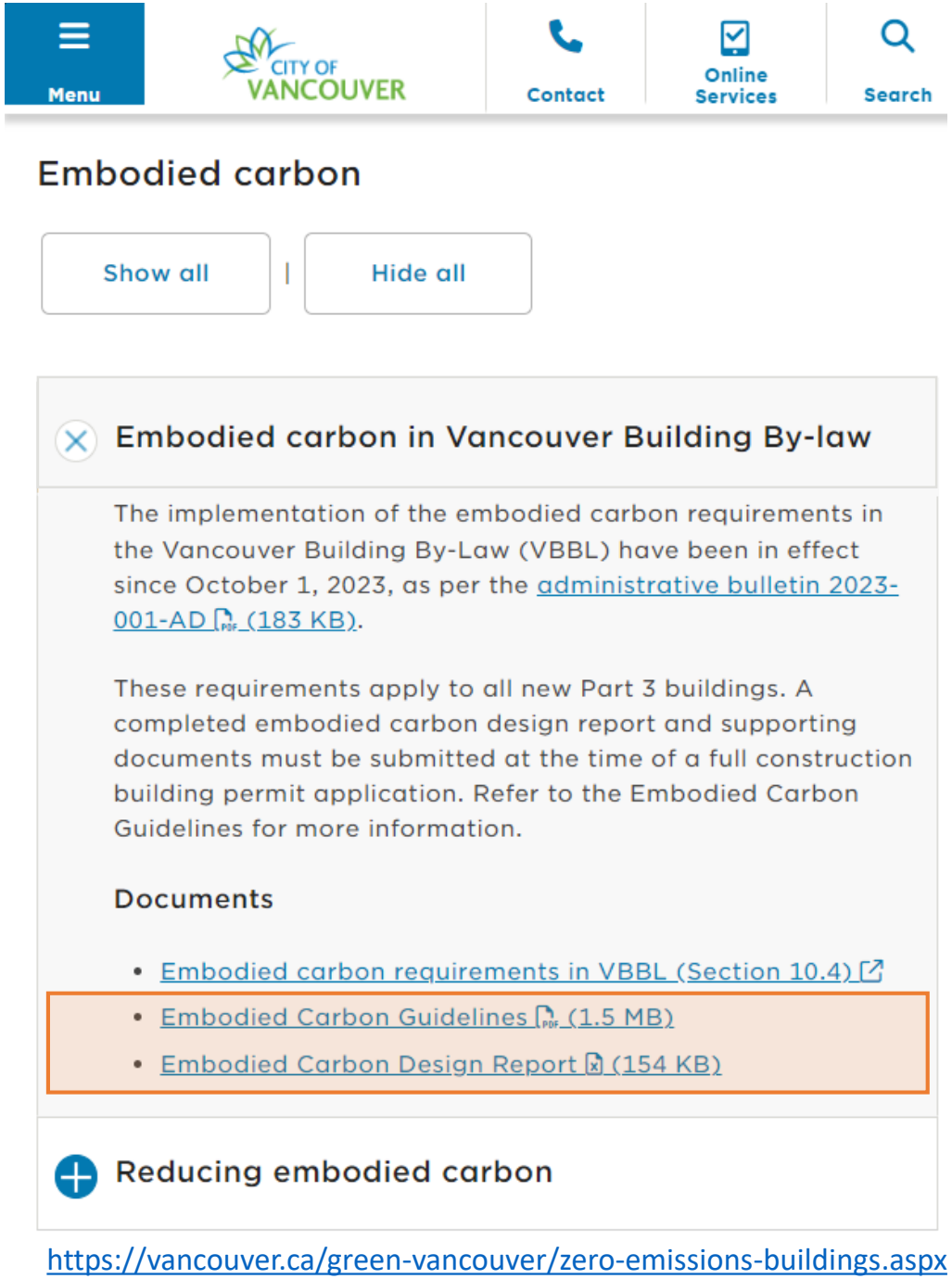
Implementation

Guidelines

- Compliance Pathways
- Standardized wbLCA Scope
- Standardized Quantification Methodology
- Standardized Baseline
- Standardized Documentation & Submittal

Design Report

- Standardized Reporting
- Standardized Data Collection
- Simplified Compliance Review Process



https://vancouver.ca/green-vancouver/zero-emissions-buildings.aspx

Part 2
Embodied Carbon Guidelines & Design Report

Compliance Paths

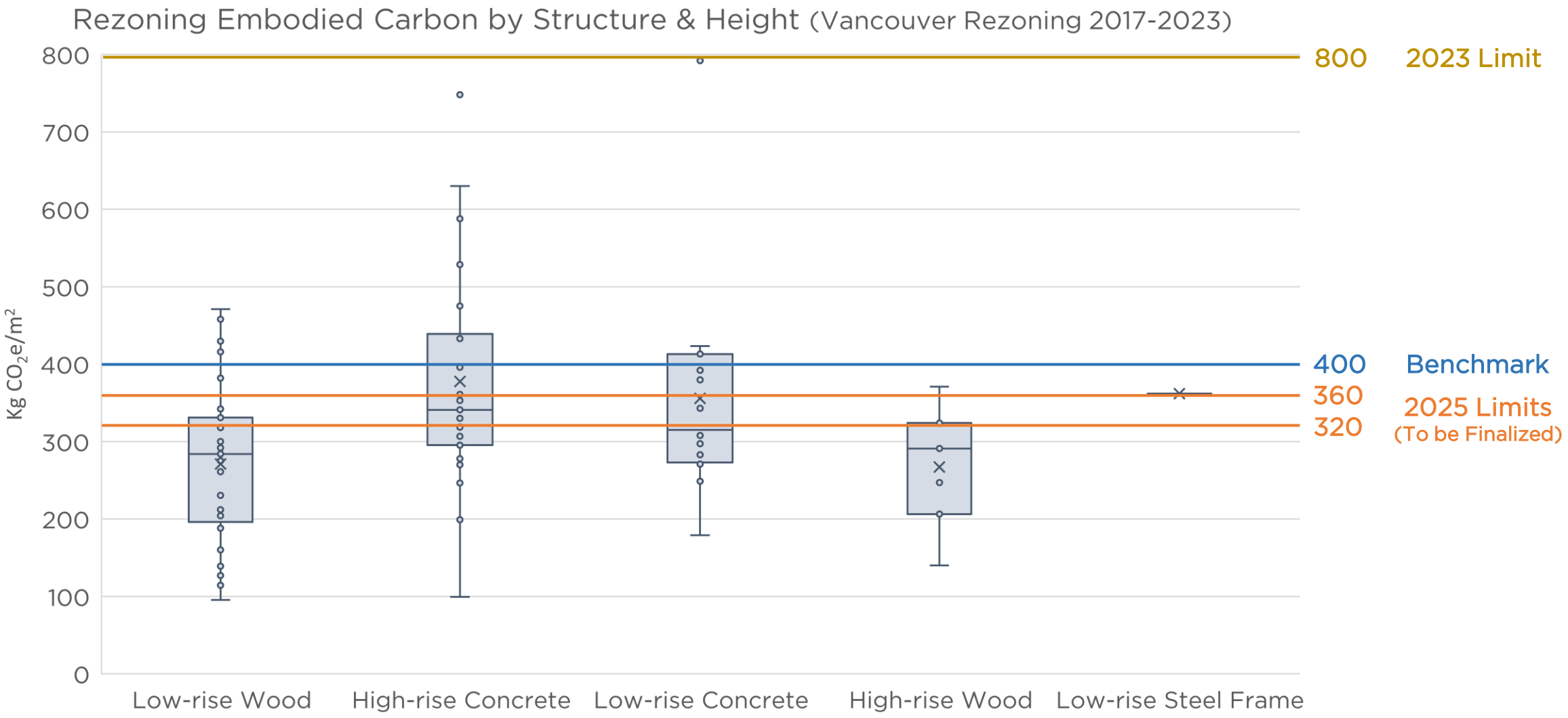
1. Absolute Path

Limits	Embodied Carbon ($kgCO_2e/m^2$) (excluding parkade)
Benchmark	400
Oct 2023 (2x baseline)	800
Jan 2025 (20% reduction*) (Up to 6-storeys, Can Be Built with Wood Structure)	320
Jan 2025 (10% reduction*) (All other buildings)	360

* Approved in principle. The City Council will approve the final 2025 code changes in 2024.

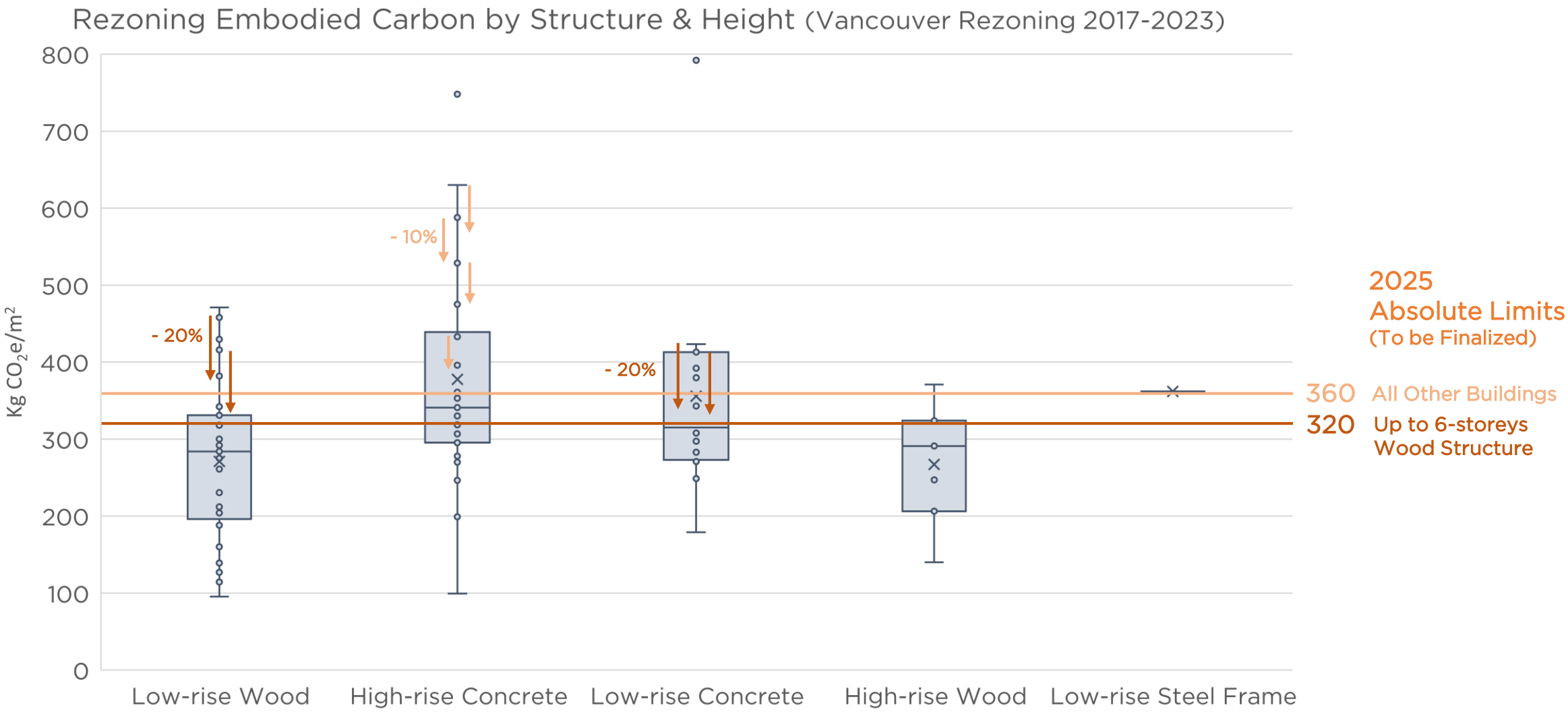
Compliance Paths

1. Absolute Path



Compliance Paths

2. Baseline Path



Object of Assessment (Scope)

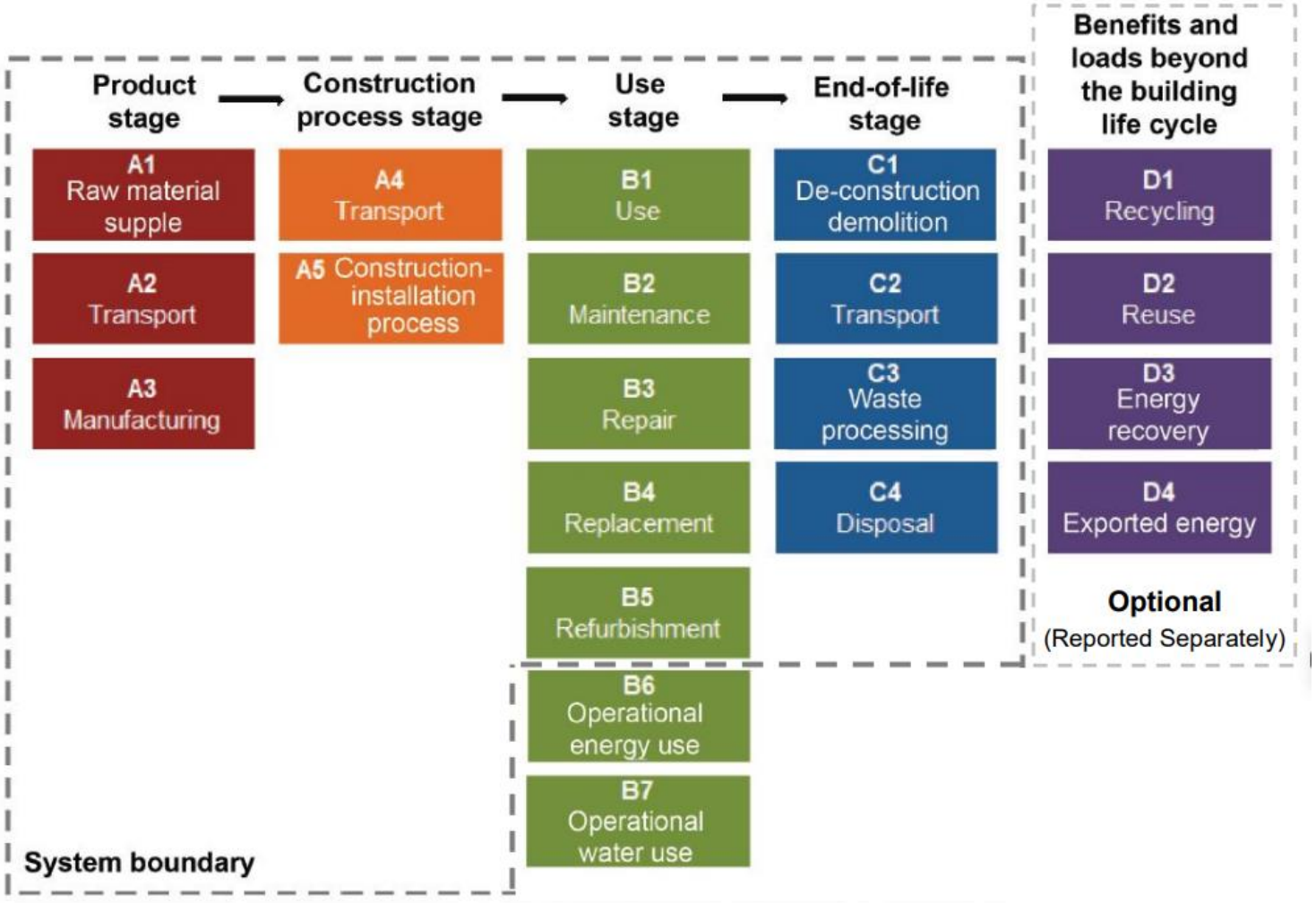
Life Cycle Stages

Include any of the following modules available in wbLCA tool

- A1-A5
- B1-B5
- C1-C4

Optional, report separately, exclude from compliance

- D1-D4
- Biogenic carbon
- Concrete Carbonation



Object of Assessment (Scope)

Building elements

Mandatory

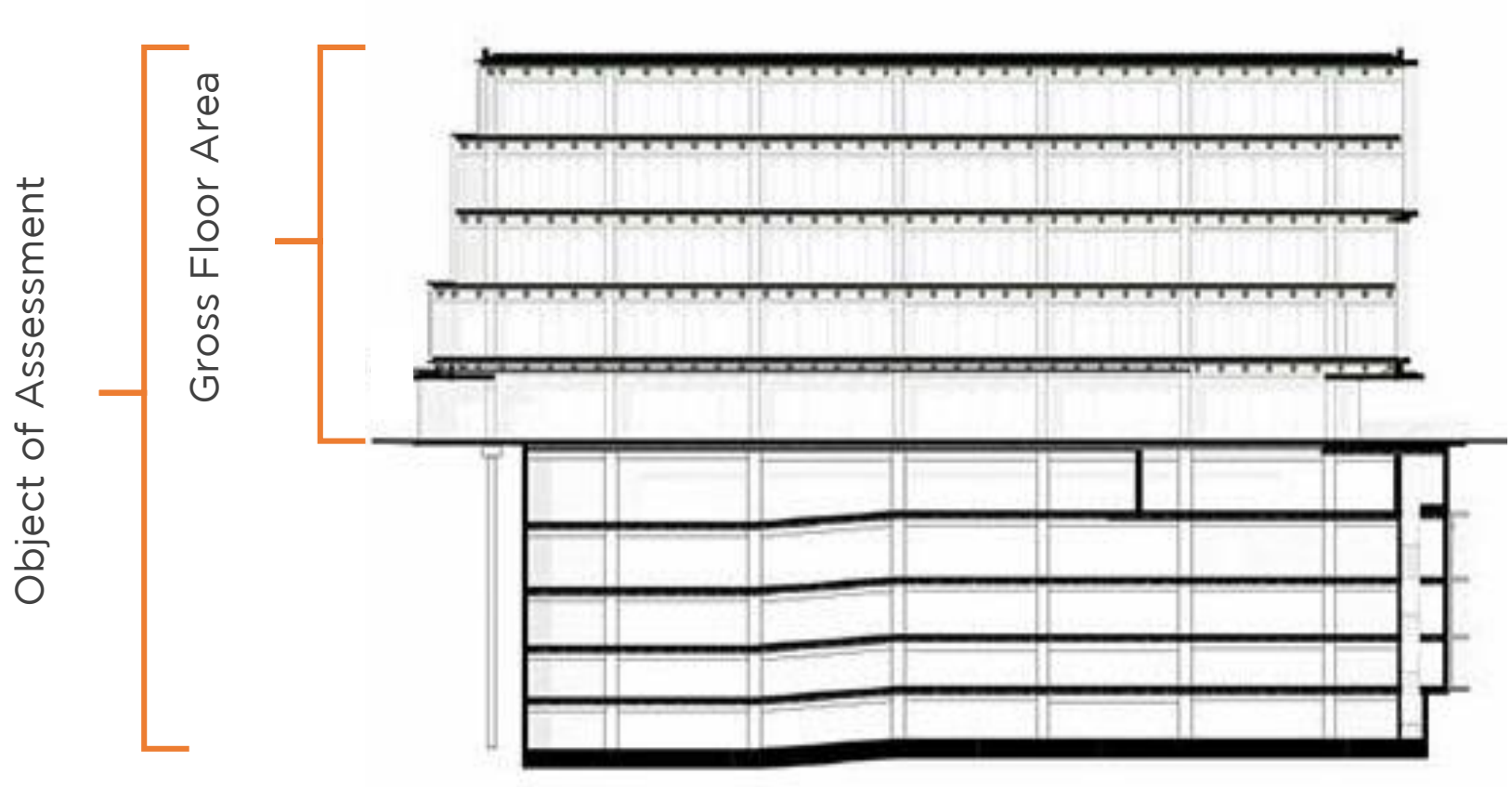
- Structure
  - Below & Above Grade
- Shell

Optional

- Interior
- Services
- Equipment and Furnishings
- Special Construction
- Sitework

Object of Assessment (Scope)

Gross Floor Area



Quantification: Bill of Materials

Source

- Building Information Modelling (BIM)
- Cost Estimate
- Takeoffs from Drawings

- BoM generated by early design tools are not acceptable for Building Permit (BP) but can be used for minor elements.

Quantification: Bill of Materials

Completeness: Sub-elements

Legend:

Required	Optional	Exclude

UniFormat Level 3	OmniClass Level 3		Level 4		Inclusion in Scope
A	01 00 00	Substructure			
A10	01 10	Foundations			
A 1010	01 10 10	Standard Foundations	01 10 10 10	Wall Foundations	Required
			01 10 10 30	Column Foundations	
			01 10 10 90	Standard Foundation Supplementary Components	Optional
A1020	01 10 20	Special Foundations	01 10 20 10	Driven Piles	Required
			01 10 20 15	Bored Piles	
			01 10 20 20	Caissons	
			01 10 20 30	Special Foundation Walls	Optional
			01 10 20 40	Foundation Anchors	
			01 10 20 50	Underpinning	
			01 10 20 60	Raft Foundations	Required
			01 10 20 70	Pile Caps	
			01 10 20 80	Grade Beams	
A20	01 20	Subgrade Enclosures			
A2010	01 20 10	Walls for Subgrade Enclosures	01 20 10 10	Subgrade Enclosure Wall Construction	Required
			01 20 10 20	Subgrade Enclosure Wall Interior Skin *(Include thermal, moisture, acoustic, and fire protection layers, if any)*	
			01 20 10 90	Subgrade Enclosure Wall Supplementary Components	Optional

UniFormat Level 3	OmniClass Level 3		Level 4		Inclusion in Scope
A	01 00 00	Substructure			
A40	01 40	Slabs-on-Grade			
A4010	01 40 10	Standard Slabs-on-Grade	-	-	Required
A4030	01 40 20	Structural Slabs-on-Grade	-	-	Required
A4040	01 40 30	Slab Trenches	-	-	Optional
A4040	01 4040	Pits and Bases	-	-	Optional
A4090	01 40 90	Slab-On-Grade Supplementary Components	01 40 90 10	Perimeter Insulation	Required
			01 40 90 20	Vapor Retarder	
			01 40 90 30	Waterproofing	
			01 40 90 60	Subbase Layer	
			01 40 90 50	Mud Slab	Optional
A60	01 60	Water and Gas Mitigation			
A6010	01 60 10	Building Sub-drainage	01 60 10 10	Foundation Drainage	Optional
			01 60 10 20	Under-slab Drainage	
A6020	01 60 20	Off-Gassing Mitigation	01 60 20 10	Radon Mitigation	Exclude
			01 60 20 50	Methane Mitigation	
A90	01 90	Substructure Related Activities			
A9010	01 90 10	Substructure Excavation	01 90 10 10	Backfill and Compaction	Optional
A9020	01 90 20	Construction Dewatering	-	-	Exclude
A9030	01 90 30	Excavation Support	01 90 30 10	Anchor Tiebacks	Exclude
			01 90 30 20	Cofferdams	
			01 90 30 40	Cribbing and Walers	
			01 90 30 60	Ground Freezing	
			01 90 30 70	Slurry Walls	
A9040	01 9040	Soil Treatment	-	-	Exclude

Quantification: Bill of Materials

Completeness: wbLCA Classification

Source: KPMB Lab WBLCA Classification System, 2022 (Modified)

WBLCA Methodology Classifications

CLASS	Ⓓ	Ⓒ	Ⓑ	Ⓐ
NAME	**Indicative Estimate**	**Assembly Estimate**	**Design Estimate**	**As - Built Model**
METHODOLOGY	Building area **x** typology-based estimates	Assembly definitions with GWPs **x** area of each assembly	Individual material and product quantities **x** material specific GWPs	Bills of lading for materials/products on construction site **x** EPDs for each product/material.
QUANTITIES	Building areas from RFP or concept model if available.	Assembly areas, from design model.	Quantity take-off from design model.	Bills of lading from construction site plus: -Construction Waste Haul Tickets -Utility/Fuel Bills for Site equipment (Crane/Bobcats/ Excavators/Site Office).
GWP DATASOURCE	Typology-based estimates	Assembly GWP estimates, National LCI Data, and generic global EPDs.	Blend of national Generic EPD's, National LCI Data, and Product Specific EPD's.	Factory specific EPDs.
TYPICAL TOOLS	• Excel • Athena Impact Estimator • Carbon Designer 3D tool by OneClick • EC3	• Excel • One Click LCA • Athena Impact Estimator • Cardinal LCA • Tally LCA	• BIM modelling software, e.g. Revit, ArchiCad, etc. • OneClick LCA • Tally LCA	• Excel • One Click LCA
SUITABLE PROJECT PHASES	All	Concept Design or SD through completion.	DD or CD through completion.	Construction phase through completion.

Rezoning **Building Permit**

Quantification: Software

Building Permit

- Athena
- One Click LCA
- tallyLCA
- tallyCAT
- EC3

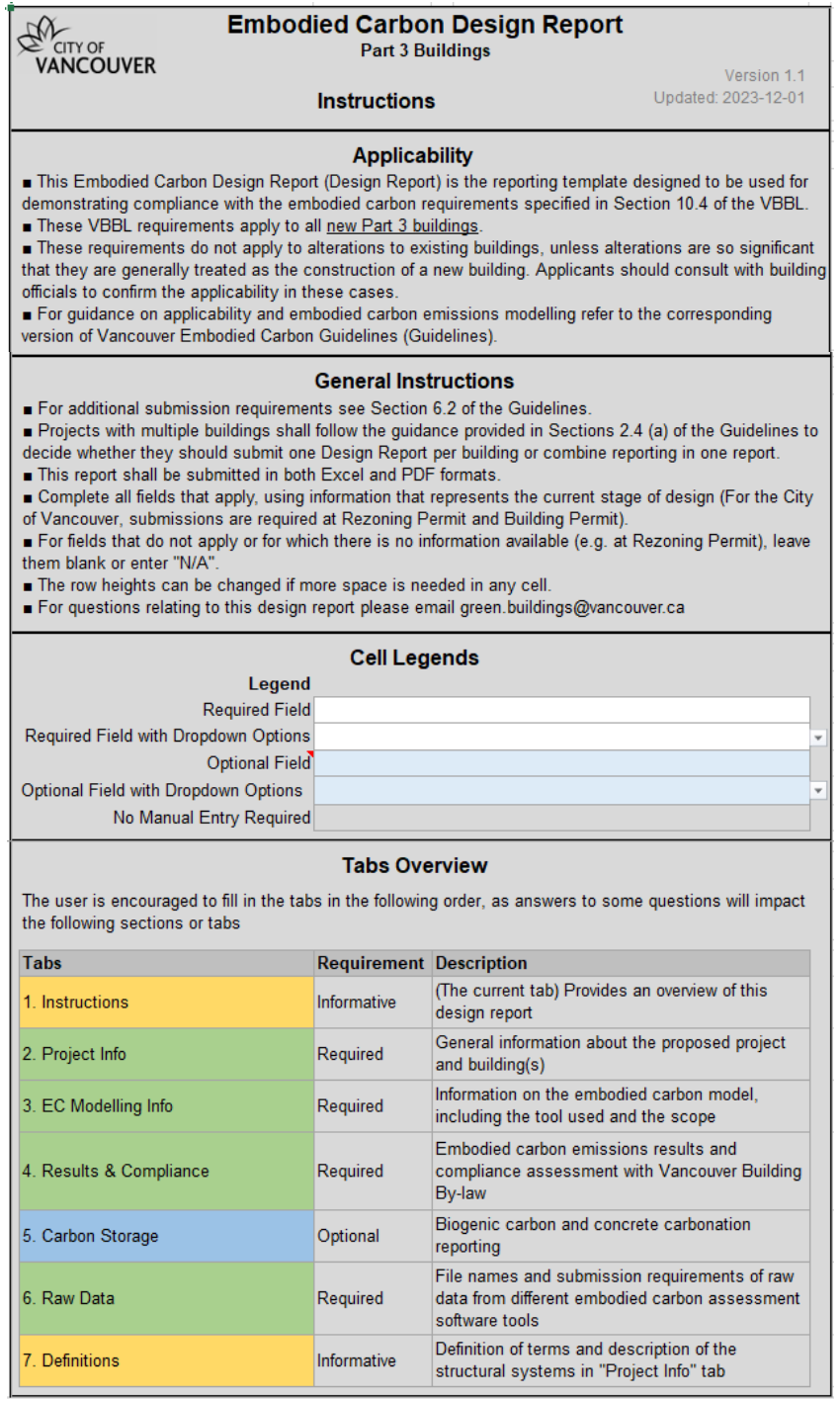
Rezoning Permit

- Athena (Assembly Approach)
- One Click LCA (Carbon Designer)
- Embodied Carbon Pathfinder

+ All other tools accepted in BP

Documentation and Reporting

- Design Report
- Raw Data from the Software Tool
- Manual Calculations (if applicable)
- Supporting Report (Optional)



CITY OF VANCOUVER

Embodied Carbon Design Report
Part 3 Buildings

Version 1.1
Updated: 2023-12-01

Instructions

Applicability

- This Embodied Carbon Design Report (Design Report) is the reporting template designed to be used for demonstrating compliance with the embodied carbon requirements specified in Section 10.4 of the VBBL.
- These VBBL requirements apply to all new Part 3 buildings.
- These requirements do not apply to alterations to existing buildings, unless alterations are so significant that they are generally treated as the construction of a new building. Applicants should consult with building officials to confirm the applicability in these cases.
- For guidance on applicability and embodied carbon emissions modelling refer to the corresponding version of Vancouver Embodied Carbon Guidelines (Guidelines).

General Instructions

- For additional submission requirements see Section 6.2 of the Guidelines.
- Projects with multiple buildings shall follow the guidance provided in Sections 2.4 (a) of the Guidelines to decide whether they should submit one Design Report per building or combine reporting in one report.
- This report shall be submitted in both Excel and PDF formats.
- Complete all fields that apply, using information that represents the current stage of design (For the City of Vancouver, submissions are required at Rezoning Permit and Building Permit).
- For fields that do not apply or for which there is no information available (e.g. at Rezoning Permit), leave them blank or enter "N/A".
- The row heights can be changed if more space is needed in any cell.
- For questions relating to this design report please email green.buildings@vancouver.ca

Cell Legends

Legend	
Required Field	
Required Field with Dropdown Options	
Optional Field	
Optional Field with Dropdown Options	
No Manual Entry Required	

Tabs Overview

The user is encouraged to fill in the tabs in the following order, as answers to some questions will impact the following sections or tabs

Tabs	Requirement	Description
1. Instructions	Informative	(The current tab) Provides an overview of this design report
2. Project Info	Required	General information about the proposed project and building(s)
3. EC Modelling Info	Required	Information on the embodied carbon model, including the tool used and the scope
4. Results & Compliance	Required	Embodied carbon emissions results and compliance assessment with Vancouver Building By-law
5. Carbon Storage	Optional	Biogenic carbon and concrete carbonation reporting
6. Raw Data	Required	File names and submission requirements of raw data from different embodied carbon assessment software tools
7. Definitions	Informative	Definition of terms and description of the structural systems in "Project Info" tab

Design Report

Project Info

CITY OF VANCOUVER

Embodied Carbon Design Report
Part 3 Buildings

Version 1.0
Updated: 2023-10-20

Project and Building Information

Instructions

- Use the form below to provide the general information regarding the proposed project and building(s) included in this Design Report.
- See the definition of terms and description of the structural systems in "Definitions" tab.

Project Information

Project Working Title / Name	
Address *(Street No., Street Direction, Street Name)*	
City	Vancouver
Province/State	British Columbia (BC)
Postal Code *(A9A 9A9)*	
Secondary Address *(Street No., Street Direction, Street Name)*	
Secondary Postal Code *(A9A 9A9)*	
Number of Buildings in the Project	3
Number of Buildings included in this Design Report	2
Projected Date of First Building Permit Application *(YYYY-MM-DD)*	2025-01-01
Date wbLCA Model Completed *(YYYY-MM-DD)*	
Estimated Project Completion Year *(YYYY)*	

Building(s) Information

- *Unless other guidance is provided below, specify the following information for the largest building included in this Design Report (by gross floor area).*

Building Name *(If different from the Project)*	
Building Address *(If different from the Project)*	
Postal Code *(If different from the Project)*	
Project Phase	Construction Documents
Permit Application Stage	Building Permit
Percent of Project Phase Completed *(%)*	
Drawing Set Used for Embodied Carbon Modelling	Building Permit
Primary Building Use	C (Residential Occupancies)
Secondary Building Use	
Construction Type	New Construction

- *Provide the total floor area and parkade areas of all the buildings included in this Design Report.*

Gross Floor Area without Parkade (m^2)	50,000
Parkade Gross Floor Area (m^2)	5,000
Gross Floor Area with Parkade (m^2)	55,000

- *Provide the number of storeys and height for the tallest building included in this Design Report.*

Storeys Above Grade	5
Storeys Below Grade	1
Parking Type	Below grade
Building Height (m)	10

- *Provide the total number of units and bedrooms in all the buildings included in this Design Report.*

No. of Units	
No. of Bedrooms	

Structure

- *Provide this information for the largest building (by gross floor area) included in this Design Report.*

Primary Structural System	
Primary Horizontal Gravity System	
Primary Vertical Gravity System	
Primary Lateral System	
Podium	
Foundation Type	
Seismic Design Category	
Risk Category	
Seismic Site Class	
Allowable Soil Bearing Pressure (kg/m^2)	
Typical Column Grid, Long Direction (m)	
Typical Column Grid, Short Direction (m)	
Typical Floor Live Load (kg/m^2)	
Ground Snow Load (kg/m^2)	
Ultimate Wind Speed (kph)	

Multiple Buildings Information

Are the building(s) in this Design Report connected to other buildings in the project that are reported separately, i.e. are not included in this Design Report?	Yes
How is the common space allocated to the building(s) that their embodied carbon is reported in separate Design Reports?	Proportional to GFA

- Provide the following information for each of the buildings included in this Design Report.
  Building Use Type; Storeys Above Grade; Storeys Below Grade; Gross Floor Area without Parkade; Parkade Gross Floor Area; and Primary Structural System.

Design Report

Embodied Carbon Modelling Info

CITY OF VANCOUVER

Embodied Carbon Design Report

Part 3 Buildings

Version 1.1
Updated: 2023-11-29

Embodied Carbon Modelling Information

Instructions

- Use the form below to indicate the optional scope included in embodied carbon reporting and compliance with the City of Vancouver's requirements.
- Unless specified in "Reporting" and/or "Compliance" columns below as "Yes", all the optional scopes will be assumed to be excluded from the embodied carbon reporting and compliance.
- Emissions and benefits from module D, biogenic carbon, and concrete carbonation can be reported. However, these should be reported separately and are excluded from the results used for demonstrating compliance with the City of Vancouver's requirements.
- All optional scopes are excluded from the compliance, if the "Absolute Path" is selected in tab "Results & Compliance".
- Optional scopes are included in the results used for compliance, if the "Baseline Path" is selected in tab "Results & Compliance" and if they are indicated to be included in the "Compliance" column below.

wbLCA Model

LCA Modeller *(Company Name)*	
LCA Modeller *(Contact Person Name)*	
Primary Material Quantity Source	BIM / Revit Takeoffs
Secondary Material Quantity Source	Project Drawing Takeoffs
Software Tool	EC3
Green Building Rating System or Certification Pursued	Other
Name of the Rating System or Certification Pursued	

Building Life

Building Life Time	60

Life Cycle Stages

Specify the life cycle stages that you are including in your reporting, using data from your software tool or using project-specific or regional data.

- *The "Reporting" column is automatically populated based on the software specified in cell #D16, except for when "Other" is selected.*
- *Do not modify the auto-populated responses, unless the project is reporting embodied carbon of the missing life cycle stages using project-specific or regional data.*

	Reporting	Compliance
Product (A1-A3)	Yes	Yes
Construction Process - Transport (A4)	Yes	Yes
Construction Process - Construction (A5)	No	Yes
Use (B1-B5)	No	Yes
End-of-Life (C1-C4)	No	Yes
Benefits and Loads Beyond the Building Life Cycle (D1-D4)	Yes	No

Building Elements

- See Section 3.3 and Table 5 in Appendix B.2 of Vancouver Embodied Carbon Guidelines for a detailed list of required and optional elements and sub-element for compliance with VBBL.

Required Elements

	Reporting	Compliance
(Foundations, Subgrade enclosure, Slab-on-grade) Substructure	Yes	Yes
(Superstructure, Below-grade interior structure, Envelope, Roof) Shell	Yes	Yes

Are any required sub-elements excluded from the reporting or are any optional sub-elements within mandatory elements included in the reporting? Yes

- *List the required sub-elements excluded from the reporting and a brief description of the reason.*
- *List the optional sub-elements included in the reporting of required elements.*

SAMPLE

Optional Elements

Are you including building elements other than substructure and shell (i.e. structure and enclosure) in your embodied carbon reporting? Yes

In the "Reporting" column below, specify the additional elements included in the embodied carbon reporting.

Are the reported optional elements included in the compliance assessment? A Selection

Override the formula in the "Compliance" column below, to change the default answer from "Yes" to "No" for the optional elements that are not included in the compliance assessment.

	Reporting	Compliance
(Interior Construction) Interior	Yes	Yes
(Interior Finishes) Interior		
(Plumbing) Services	Yes	Yes
(HVAC) Services		
(Electrical) Services	Yes	No
(Other) Services		
(Fixed Furnishings) Furnishings		
(Movable Furnishings) Furnishings		
(Landscaping) Sitework		
(Other) Sitework		
Other		

Provide any additional details regarding the optional elements and sub-elements that are included in the reporting and compliance.

Design Report

Embodied Carbon Modelling Info

Carbon Storage (Optional)

	Reporting	Compliance
Biogenic Carbon Reported	Yes	No
Concrete Carbonation Reported	No	No

Reporting carbon storage is optional and may be reported separately in the "Carbon Storage" tab.

Embodied Carbon Reduction Strategies

Describe any strategies used in the proposed design to reduce embodied carbon emissions.

(Optional) Were design for disassembly and adaptability (DfD) strategies incorporated in the proposed design, based on the CSA Z782 or ISO 20887 standards? Yes

Describe these strategies incorporated and the elements for which they are implemented for.

SAMPLE

Assumptions, Data Modifications, and Manual Calculations

- *If the baseline compliance path is used, answer the following questions for the proposed design and baseline.*

Did you substitute any major material or component in the building design with a proxy, due to the lack of data availability in the software tool? No

Did you modify any of default assumptions or data sources used in the software tool inside the tool or manually outside it? No

Provide any additional information on the project, embodied carbon inputs, or outputs here.

Additional details may be provided in a supporting report, as described in Section 6.2 (d) of the Guidelines.

Design Report

Results & Compliance

CITY OF VANCOUVER

Embodied Carbon Design Report
Part 3 Buildings

Version 1.0
Updated: 2023-10-20

Results & Compliance

Instructions

- Use the form below to report the embodied carbon emissions and assess compliance with the embodied carbon requirements of Vancouver Building By-law.
- "Required Elements" should only include substructure and shell (i.e. structure and enclosure).
- "Optional Elements" shall include the other elements, indicated to be included in the "Building Elements" section of "EC Modelling Info" tab.
- Biogenic carbon and concrete carbonation shall not be included in this tab. They may be reported separately in "Carbon Storage" tab.

Compliance Path and Requirements

The embodied carbon of the proposed design should be 20% below the benchmark for Part 3 buildings that are up to 6 storeys and can be built with wood structure and 10% for all other Part 3 buildings. The benchmark is set based on the compliance path.

Compliance Path	Baseline Path
Gross Floor Area without Parkade (m2)	50,000
Projected Date of First Building Permit Application	2025/01/01
Storeys Above Grade	5
According to VBBL, is the building 1-6 storeys in height and can the primary building structure be wood or mass timber construction?	Yes
Is the project planning to achieve any of the "Responsible Material Sourcing" criteria?	Yes

Specify and describe the Responsible Material Sourcing criterion or criteria the project is meeting.
Additional details may be provided in a supporting report, as described in Section 6.2 (d) of the Guidelines.

Compliance Assessment

Embodied Carbon Limit

	Proposed	Benchmark	Limit
Total Embodied Carbon Emissions ($kg\ CO_2e$)	**42,300,000**	55,400,000	**44,320,000**
Embodied Carbon Intensity (without Parkade) ($kg\ CO_2e/m^2$)	846.00	1,108.00	886.40

Embodied Carbon Reduction from the Benchmark (%)

The proposed design meets the embodied carbon limit	Yes
Minimum Reduction Required	**20%**
Reduction Achieved	24%
Required Scope Reduction (Substructure & Shell)	31%

Results

Proposed Design

	(Reporting) Required Elements	(Compliance) Required+Optional Elements (Partial)	(Reporting) Required+Optional Elements (All)
Total Embodied Carbon Emissions ($kg\ CO_2e$)			
Product (A1-A3)	20,000,000	30,000,000	40,000,000
Transport - Construction Process (A4)	5,000,000	6,000,000	7,000,000
Construction - Construction Process (A5)	1,200,000	1,800,000	2,400,000
Use (B1-B5)	2,000,000	3,000,000	4,000,000
End-of-Life (C1-C4)	1,000,000	1,500,000	2,000,000
Total (A-C)	29,200,000	42,300,000	55,400,000
Beyond the Building Life (D1-D4)			
Embodied Carbon Intensity (without Parkade) ($kg\ CO_2e/m^2$)			
Modules A-C	584	846	1,108
Modules D			
Embodied Carbon Intensity (with Parkade) ($kg\ CO_2e/m^2$)			
Modules A-C	531	769	1,007
Modules D			

Design for Disassembly and Adaptability (DfD) Credit ($kg\ CO_2e$)

Report default values from the software tool for modules C1-C4 of elements designed with DfD strategies.

End-of-Life (C1-C4) *Elements Designed with DfD Strategies*			
Contribution of DfD Credit to the Total Reduction Achieved	0%		

Baseline

	(Reporting) Required Elements	(Compliance) Required+Optional Elements (Partial)	(Reporting) Required+Optional Elements (All)
Total Embodied Carbon Emissions ($kg\ CO_2e$)			
Product Stage (A1-A3)	30,000,000	40,000,000	50,000,000
Transport - Construction Process (A4)	6,000,000	7,000,000	8,000,000
Construction - Construction Process (A5)	1,800,000	2,400,000	3,000,000
Use Stage (B1-B5)	3,000,000	4,000,000	5,000,000
End-of-Life Stage (C1-C4)	1,500,000	2,000,000	2,500,000
Total (A-C)	42,300,000	55,400,000	68,500,000
Beyond the Building Life (D1-D4)			
Embodied Carbon Intensity (without Parkade) ($kg\ CO_2e/m^2$)			
Modules A-C	846	1,108	1,370
Modules D			
Embodied Carbon Intensity (with Parkade) ($kg\ CO_2e/m^2$)			
Modules A-C	769	1,007	1,245
Modules D			

Part 4
Next Steps

Next Steps for Vancouver

Compliance Assessment

- Support Applicants Through Permitting Process (Embodied Carbon & Mass Timber)
- Develop an Online Submission and Review Platform
    - Automate Quality Control and Compliance Assessment

Code Expansion

- Add a Prescriptive-like Compliance Path for Part 3
- Biogenic Carbon
- Part 9
    - Learn from NearZero Program

Next Steps for Vancouver

Mass Timber Construction

- Zoning Incentives for Mass Timber
- Changes to VBBL to Enable Mass Timber in More Application

Capacity Building

- Support CLF BC and Other Knowledge Sharing Initiatives
- Develop Case Studies of Best Practices
- Learn from City Owned Projects
- Support Educational Programs
- Coordinate with Other Organizations and Jurisdictions