STATE OF WASHINGTON

STATE BUILDING CODE COUNCIL

WA SBCC 24-GP1-118-BRFW

EMBODIED CARBON CODE DRAFT

Beyreuther V 2025-05-23

Appendix Q
Embodied Carbon ~~Greenhouse Gas Emissions Reporting and Reduction~~

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

User note:

About this appendix: *The purpose of Appendix Q is to establish methods to measure and reduce the embodied carbon impact of building materials over the course of a building's life. Appendix Q provides criteria for the production and submission of environmental product declarations, whole building life cycle assessment, and proof of building reuse for a building project.*

Section Q101
General

Q101.1 Scope. The provisions of this appendix promote methods to measure and to reduce the environmental impact of building materials over the course of a building's life.

Section Q102
Definitions

Section Q102.1 General. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of ~~this code~~ the *International Building Code* for general definitions.

Covered project. A new building or structure, or an addition to an existing building or structure~~, [INSERT 50,000 OR 100,000] gross square feet or larger~~; or an *alteration* that impacts a *work area* that retains no less than a combined 45 percent, of the existing building's primary and secondary structural frame and exterior wall envelope as part of the work area ~~of [INSERT 50,000 OR 100,000] gross square feet or larger~~.

Embodied carbon. The sum of greenhouse gas emissions associated with extraction, production, transport, and manufacturing of a product through the product's life.

Environmental product declaration (EPD). A third-party verified report providing information about the environmental performance or impact of a covered product or material.

Global warming potential (GWP). The metric for tracking *embodied carbon*, which is reported in kg CO_2e/unit. GWP normalizes different gases associated with a product to an equivalent mass of carbon dioxide over a period of 100 years.

Industry-average EPD. An *EPD* that reports the impacts of a product, which is an average of data provided by multiple manufacturers in a clearly defined sector and/or geographical area.

Product and facility-specific EPD. An *EPD* that represents the impacts of a single product from a single manufacturing facility.

Work area. That portion or portions of a building consisting of all reconfigured spaces as indicated on the construction documents. *Work area* excludes other portions of the building where incidental work entailed by the intended work must be performed and portions of the building where work not initially intended by the owner is specifically required by this code.

Section Q103
Embodied Carbon ~~environmental product declaration (EPD)~~.

Q103.1 Embodied Carbon. *Covered projects* shall document *embodied carbon* on *construction documents,* which shall be submitted to the *building official*.

Q103.2 Documentation of Embodied Carbon. Documentation of *embodied carbon* for *covered projects* shall meet one of the following pathway~~s~~:

1. ~~Product compliance or w~~Whole building compliance pathway; for a new building or structure, or an *addition* to an existing building or structure~~, **[INSERT 50,000 OR 100,000]** gross square feet or larger~~.

~~2. Building reuse compliance pathway; for an *alteration* that impacts a *work area* of **[INSERT 50,000 OR 100,000]** gross square feet or larger.~~

~~3. Product compliance, whole building compliance, or building reuse compliance pathway; for an *addition* to a building or structure that also includes an *alteration*, where the *addition* and *work area* of the *alteration* have a combined area of **[INSERT 50,000 OR 100,000]** gross square feet or larger.~~

~~**Q103.3 Product compliance pathway.** *Covered projects* shall submit Type III *environmental product declarations*, which cover the cradle-to-gate phase or life cycle modules A1 through A3, for all covered products per section Q103.3.1. The product compliance pathway shall calculate the *global warming potential (GWP)* of the total mass or volume of the covered products and total no more than **[INSERT 85, 90, 100, or 120, OR 175]** percent of the sum of the applicable *GWP* values from Table Q103.3.1, for the same total mass or volume of the covered products. The calculation shall include the following:~~

~~1. Project-specific product quantities and *product-specific EPDs,*~~
~~2. Be summed averaged across the entire project based on mass or volume, and~~
~~3. Be submitted on a product pathway compliance form (see example in this appendix).~~

~~A *product-specific EPD* is permitted to combine varying levels of manufacturing specificity and may be covered across multiple facility locations. Where a *product-specific EPD* is not available for a building product, an *industry-average EPD* shall be permitted.~~

~~**Q103.3.1 Covered products.** Covered products shall include no less than 90 percent of the total combined mass or volume of all product(s) used in the building project that are included in Table Q103.3.1.~~
~~(a) Structural concrete products, including ready mix, shotcrete, precast, and concrete masonry units.~~
~~(b) Reinforcing steel products, specifically rebar and posttensioning tendons.~~

(c) Structural steel products, specifically hot rolled sections, hollow sections, metal deck, and plate; and (d)Engineered wood products, such as cross-laminated timber, glulam beams, laminated veneer lumber, parallel strand lumber, dowel laminated timber, nail laminated timber, glulam laminated timber, prefabricated wood joists, wood structural panel, solid sawn lumber, structural composite lumber, and structural sawn lumber.

TABLE Q103.3.1
COVERED PRODUCT GWP VALUES[a]

COVERED PRODUCT		GLOBAL WARMING POTENTIAL	UNIT OF MEASUREMENT
Ready mix concrete products	Up to 2,500 2,499 psi	235	kg CO_2e/m^3
	32,0500-3,999 psi	261	kg CO_2e/m^3
	3,500 psi	289	kg CO_2e/m^3
	4,000-4,999 psi	316	kg CO_2e/m^3
	4,500 psi	351	kg CO_2e/m^3
	5,000-5,999 psi	386	kg CO_2e/m^3
	5,500 psi	397	kg CO_2e/m^3
	6,000-7,999 psi	408	kg CO_2e/m^3
	8,000 psi and greater	487	kg CO_2e/m^3
	Lightweight, up to 3,000999 psi	518	kg CO_2e/m^3
	Lightweight 3,500 psi	547	kg CO_2e/m^3
	Lightweight, 4,000-4,999 psi	575	kg CO_2e/m^3
	Lightweight 4,500 psi	604	kg CO_2e/m^3
	Lightweight, 5,000 psi and greater	632	kg CO_2e/m^3
Concrete masonry unit products[1,2]	Normal-weight, f'm ≤ 2000 psi Normal weight, up to 3,249 psi	208	kg CO_2e/m^3
	Normal-weight, f'm = 2500 psiNormal weight, 3,250-4,499 psi	232	kg CO_2e/m^3
	Normal-weight, f'm ≥ 3000 psiNormal weight, 4,500 psi and greater	241	kg CO_2e/m^3
	Medium-weight, containing manufactured lightweight aggregate,[23] f'm ≤ 2000 psi	360	kg CO_2e/m^3

[1] For products that fall in-between a strength designation (PSI), round to the nearest applicable product.
[2] Grey structural units only – these values do not represent architectural colored or textured units.
[23] Examples of manufactured lightweight aggregate are expanded shale, clay, and slate.

	Medium weight – manufactured, 2,000 to 3,249 psi Medium weight, up to 3,249 psi		
	Medium weight, containing natural aggregate and industrial byproducts,[34] f'm ≤ 2500 psi Medium weight – natural, 2,000 to 4,499 psi Medium weight, 3,250 psi and greater	244	kg CO_2e/m^3
	Lightweight, containing manufactured lightweight aggregate, f'm ≤ 2500 psi Light weight – manufactured, 2,000 to 4,499 psi Lightweight, up to 3,249 psi	395	kg CO_2e/m^3
	Lightweight, containing natural aggregate and industrial byproducts, f'm ≤ 2000 psi Light weight – natural, 2,000 to 3,249 psi Lightweight, 3,250 psi and greater	286	kg CO_2e/m^3
Reinforcing steel products	Rebar – unfabricated	753	kg CO_2e/metric ton
	Rebar – fabricated	854	kg CO_2e/metric ton
Structural steel products	Hot rolled sections – unfabricated	1,000	kg CO_2e/metric ton
	Hot rolled sections – fabricated	1,220	kg CO_2e/metric ton
	Hollow structural sections – unfabricated	1,710	kg CO_2e/metric ton
	Hollow structural sections – fabricated	1,990	kg CO_2e/metric ton
	Decking	2,320	kg CO_2e/metric ton
	Plate – unfabricated	1,480	kg CO_2e/metric ton

[34] Examples of natural aggregates are pumice, scoria, and limestone. Examples of industrial byproducts are expanded slag and bottom ash.

	Plate – fabricated	1,730	kg CO_2e/metric ton
Cold-Formed Steel Framing Products	Hot-dipped galvanized cold-formed steel members	2440	kg CO_2e/metric ton
Open-Web Steel Joist and Joist Girders	Open-web steel joists and joist girders	1430	kg CO_2e/metric ton
Structural wood products	Laminated veneer lumber	361	kg CO_2e/m^3
	Laminated strand lumber	275	kg CO_2e/m^3
	Glue laminated timber	137	kg CO_2e/m^3
	Wood framing – US Southern	6390.39	kg CO_2e/m^3
	Wood framing – US Pacific Coast	73.81	kg CO_2e/m^3
	Wood framing – US Inland Northwest	71.35	kg CO_2e/m^3
	Softwood plywood	219	kg CO_2e/m^3
	Oriented Strand Board (OSB)	242	kg CO_2e/m^3
Insulation products	Expanded polystyrene (EPS) – Type I[45]Expanded polystyrene (EPS)	2.532.67	kg CO_2e/ m^2 @ RSI 1 m^2 @ RSI 1
	Polyiso - wall[56] Polyiso - wall	4.104.19	kg CO_2e/ m^2 @ RSI 1 m^2 @ RSI 1
	Polyiso – roof – GRF facer Polyiso – roof – GRF facer	2.112.20	kg CO_2e/ m^2 @ RSI 1 m^2 @ RSI 1
	Polyiso – roof – CFG facer Polyiso – roof – CFG facer	2.953.04	kg CO_2e/ m^2 @ RSI 1 m^2 @ RSI 1
	Extruded polystyrene (XPS)[67] ≤ 25 psiExtruded polystyrene (XPS)	8.841	kg CO_2e/ m^2 @ RSI 1 m^2 @ RSI 1

[45] There are multiple types of EPS insulation. The industry-average EPD provides methods to calculate the impacts for types other than Type I.

[56] CLF updated the three polyiso values to be only A1-A3. (The previous values also included C4.)

[67] Notes on XPS: A) The US EPA's HFC ban in effect as of January 1, 2025 (https://www.epa.gov/climate-hfcs-reduction/technology-transitions-hfc-restrictions-sector) affects the pool of XPS products, and represents a major change from past XPS data. The XPS values here represent only products using the new generation of reduced-GWP blowing agent blends. B) Like concrete products, XPS products come in a range of compressive strengths, and this attribute affects both function/application and GWP. Therefore, the provided XPS values are distinguished by compressive strength. C) There is no XPS industry-average EPD. Each of the four major North American XPS manufacturers have published EPDs. However, only one of them provides separate results for each of the listed strengths. (One provides separate results for three strengths, but excludes B1 result values. [See * note at end of table.] The other two provide only a single value for all XPS.) Therefore the listed values are based on a single manufacturer's reported results.

	Extruded polystyrene (XPS) – 40 psi	10.9	kg CO_2e/ m^2 @ RSI 1
	Extruded polystyrene (XPS) – 60 psi	14.1	kg CO_2e/ m^2 @ RSI 1
	Extruded polystyrene (XPS) – 100 psi	20.1	kg CO_2e/ m^2 @ RSI 1
	Fiberglass board	5.02	kg CO_2e/ m^2 @ RSI 1
	Heavy density mineral wool board	68.82.35	1 m^2 @ RSI 1
	Mineral wool blanket (Light density mineral wool board)Mineral wool blanket	2.683.33	kg CO_2e/ m^2 @ RSI 11 m^2 @ RSI 1
	Fiberglass blanket (Fiberglass batt) – unfaced	1.01	kg CO_2e/ m^2 @ RSI 1
	Fiberglass blanket (Fiberglass batt) – faced	1.06	kg CO_2e/ m^2 @ RSI 1
	Closed-cell spray polyurethane foam – medium density[78]Closed-cell spray polyurethane foam – medium density	2.3612.1	1 m^2 @ RSI 11 m^2 @ RSI 1
	Closed-cell spray polyurethane foam - roofingClosed-cell spray polyurethane foam - roofing	3.4515.5	1 m^2 @ RSI 11 m^2 @ RSI 1
	Open-cell spray polyurethane foamClosed-cell spray polyurethane foam - 2K-LP	1.0519.7	1 m^2 @ RSI 11 m^2 @ RSI 1
	Loose-fill celluloseOpen-cell spray polyurethane foam	0.4871.6	1 m^2 @ RSI 11 m^2 @ RSI 1
	Loose-fill fiberglassLoose-fill cellulose	0.9880.49	1 m^2 @ RSI 11 m^2 @ RSI 1
	Loose-fill mineral wool	1.89	1 m^2 @ RSI 1
	Flat glass (clear, tinted, and low-iron products)Loose-fill mineral wool	1,4301.56	1 1 metric tonn m^2 @ RSI 1
Flat Glass	Flat glass (clear, tinted, and low-iron products)	1,430	1 metric ton

[78] Values provided for closed-cell spray foam are for HFO-based products only given the US EPA's national HFC ban for spray foams coming into effect January 1, 2025. (See https://www.epa.gov/climate-hfcs-reduction/technology-transitions-hfc-restrictions-sector.) (Previous spray foam values were an average of results from HFC- and HFO- based products.)

~~a. The GWP values in the table represent industry-average values based on the 2023 Carbon Leadership Forum (CLF) North American Material Baselines Report.~~

Q103.~~4~~3 Whole building compliance pathway. *Covered projects* shall submit a whole building life cycle assessment, developed in accordance with section Q103.~~4~~**3**.1, and comply with one of the following:

1. **Absolute reduction requirement.** The *global warming potential* of the proposed building shall be no more than ~~90 percent of 102~~92 lbCO_2e/square feet (~~500~~450 kgCO_2e/m^2).

2. **Relative reduction requirement.** The *global warming potential (GWP)* of the proposed building shall be no more than 90 percent of the *GWP* of a functionally equivalent reference building. The reference building shall be of the same size, geographic location, and thermal performance as the proposed building, and shall be functionally equivalent per ASTM E2921-22. The products and product quantities in the proposed building and the reference building are permitted to vary. The same LCA tool(s) or software shall be used to complete the whole building life cycle assessment for both the reference and proposed building designs.

   Q103.~~4~~3.1 Whole building life cycle assessment. Whole building life cycle assessments shall comply with the following:

   1. ISO 14040 and ISO 14044.

   2. Software used to conduct a whole building life cycle assessment shall conform to ISO 21931—1 and/or EN 15978 and shall have a data set compliant with ISO 14044 and ISO 21930 and/or EN 15804. The software shall utilize calculation methodology that is compliant with EN 15978, ISO 21931—1 and ISO 21929—1. Environmental impact data shall not be sourced from expired or retired data sources.

   3. The scope shall cover cradle-to-grave, including all modules in life cycle stages A, B, and C. The scope is permitted to exclude modules B6 and B7, covering operating energy and water stages.

   4. The assessment shall include all of the following building elements: foundations; *exterior wall envelope; primary structural frame; secondary structural members; roof covering; roof deck; fenestration; load-bearing walls;* and insulation. The assessment is permitted to include *non-load-bearing walls;* fireproofing; interior constructions and *interior finishes.* An assessment submitted for an *addition* or *alteration* is permitted to exclude existing and/or remaining building components.

   5. The reference study period shall be 60 years.

   6. Reuse and salvage. Existing and salvaged building components shall be included or excluded at the discretion of the project team. For reused materials, it is permissible to assume the A1-A4 stages carry no impact in the Proposed Design WBLCA to show the benefit of reusing materials, while retaining the A1-A4 estimated impacts for these products for these materials in the Baseline Design WBLCA. For salvaged materials, it is permissible to assume the A1-A3 stages carry no impact in the Proposed Design WBLCA to show the benefit of reusing materials, while retaining the A1-A3 estimated impacts for these products for these materials in the Baseline Design WBLCA.

   ~~5.~~7. Biogenic carbon. Biogenic carbon and carbon sequestration shall be reported separately from fossil GWP

~~**Q103.5 Building reuse compliance pathway.** An *alteration* shall retain no less than a combined 45 percent, as calculated per section Q103.5.1, of the *existing building's primary* and *secondary structural frame* and *exterior wall*~~

~~*envelope* as part of the *work area*. An *addition* to a building or structure that also includes an *alteration*, where the *addition* and *work area* of the *alteration* have a combined area of **[INSERT 50,000 OR 100,000]** gross square feet or larger, is permitted to use this compliance pathway.~~

~~**Q103.5.1 Building reuse compliance calculation.** The calculation shall include roof and floor areas, and façade area as measured in elevation, for the entire building. Façade areas are permitted to be considered retained even if the existing *exterior wall covering* is repaired, replaced, or modified to increase insulation or airtightness.~~

~~**Exception:** Buildings, or portions of building, that are deemed unsafe or *dangerous*, or that have *hazardous materials,* that are remediated as part of the project.~~

~~**Q103.5.2 Construction documents for building reuse compliance pathway.** *Construction documents* for the building reuse compliance pathway shall clearly distinguish the square footage for existing and new elements, and include the following information:~~

~~(a) Gross floor area of *existing building*(s) in square feet;~~
~~(b) Gross floor area of the aggregate addition(s) in square feet (if applicable);~~
~~(c) Gross floor area of the *alteration* in square feet;~~
~~(d) Existing total floor area and retained total floor area of the *primary* and *secondary structural frame* of the *existing building*(s) in square feet; and~~
~~(e) Existing total *exterior wall* and *fenestration* surface area and total retained *exterior wall* and *fenestration* surface area of the *existing building*(s) in square feet, as well as areas allowed to be excluded from the calculations.~~

Section Q104
Verification and amended documentation of reduction of embodied carbon

Q104.1 Registered design professional. A *Registered Design Professional* shall prepare the *construction documents* and provide signature verifying compliance with the requirements of this appendix.

Q104.2 Amended construction documents for embodied carbon. Covered products shall be installed in accordance with the approved *construction documents*. Where any change in products occur that are not in compliance with the approved *construction documents,* amended *construction documents,* based on data from procured products, shall be resubmitted for approval prior to the issuance of a certificate of occupancy.

Q105
Referenced Standards

Q105.1 General. See Table Q105.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

TABLE Q105.1 REFERENCED STANDARDS

Standard Acronym	Standard Name	Sections Herein Referenced
ASTM E2921—2022	*Standard Practice for Minimum Criteria for Comparing Whole Building Life Cycle Assessments for Use with Building Codes, Standards, and Rating Systems*	Q103.4.1.2.1
EN 15804—2022	*Sustainability of construction works – Environmental product*	Q103.4.3

	declarations – Core rules for the product category of construction products	
EN 15978—2011	*Sustainability of construction works – Assessment of environmental performance of buildings – Calculation method*	Q103.4.3
ISO 14040—2006	*Environmental management – Life cycle assessment – Principles and framework*	Q103.4, Q103.4.1
ISO 14044—2006	*Environmental management – Life cycle assessment – Requirements and guidelines*	Q103.4, Q103.4.1, Q103.4.2
ISO 21929-1—2011	*Sustainability in building construction – Sustainability indicators – Part 1: Framework for the development of indicators and a core set of indicators for buildings*	Q103.4.3
ISO 21930—2017	*Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services*	Q103.4.3
ISO 21931-1—2022	*Sustainability in buildings and civil engineering works – Framework for methods of assessment of environmental, social and economic performance of construction works as a basis for sustainability assessment – Part 1: Buildings*	Q103.4.3