



STATE OF WASHINGTON
STATE BUILDING CODE COUNCIL

May 2018
Log No. _____

1. State Building Code to be Amended:

- | | |
|---|---|
| <input checked="" type="checkbox"/> International Building Code | <input type="checkbox"/> International Mechanical Code |
| <input type="checkbox"/> ICC ANSI A117.1 Accessibility Code | <input type="checkbox"/> International Fuel Gas Code |
| <input type="checkbox"/> International Existing Building Code | <input type="checkbox"/> NFPA 54 National Fuel Gas Code |
| <input type="checkbox"/> International Residential Code | <input type="checkbox"/> NFPA 58 Liquefied Petroleum Gas Code |
| <input type="checkbox"/> International Fire Code | <input type="checkbox"/> Wildland Urban Interface Code |
| <input type="checkbox"/> Uniform Plumbing Code | |

For the Washington State Energy Code, please see specialized [energy code forms](#)

Section(s): 107.2, 107.4, 202

Title: Embodied Greenhouse Gas Emissions Reporting and Reduction

2. Proponent Name (Specific local government, organization or individual):

Proponent: New Buildings Institute
Title: Non-profit organization
Date: September 19, 2024

3. Designated Contact Person:

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4. Proposed Code Amendment:

Code(s): Washington State Building Code Section(s): 107.2, 107.4, 202

Chapter 1 Scope and Administration

Section 107.2 Construction Documents

Add new section as follows:

107.2.10 Submittal for reduction of embodied CO₂e. *Construction documents submitted for the construction, addition, alteration, repair, or substantial improvement of any building 100,000 gross square feet or larger shall comply with Section 107.2.10.1, 107.2.10.2, or 107.2.10.3.*

107.2.10.1 Documentation of building reuse. *An addition, alteration, repair, or substantial improvement – where the cost is greater than 50 percent of the assessed value, and the total project area, including existing floor area, is larger than 100,000 gross square feet of occupied or conditioned space – shall submit documentation that demonstrates the preservation of no less than 45 percent combined of the existing building’s primary structural frame and exterior wall envelope, excluding exterior wall covering material. Fenestration, insulation, portions of buildings deemed structurally unsound or hazardous, and hazardous materials that are remediated as part of the project shall not be included in the calculation.*

107.2.10.1.1 Compliance forms for building reuse. *Construction documents shall clearly distinguish the measurements for existing and new elements. At minimum, forms documenting building reuse shall include the information listed in items (a) through (d) below:*

- (a) Area of the existing building(s) in square feet;*
- (b) Area of the aggregate addition(s) in square feet (if applicable);*
- (c) Existing total area and retained total area of the primary structural frame of the existing building(s) in square feet; and*
- (d) Existing total area and retained total area of the exterior wall envelope, excluding exterior wall covering material, of the existing building(s) in square feet.*

107.2.10.2 Documentation of reduced embodied CO₂e of covered products. *Project-specific product quantities shall be submitted along with environmental product declarations that demonstrate that the global warming potential of the total mass or volume of the covered products listed in Section 107.2.10.2.1 is no more than 90 percent the values in Table 107.2.10.2.1 for the same total mass or volume of the covered products.*

107.2.10.2.1 Covered products. *Covered products shall include no less than 90 percent of the total mass or volume of the following:*

- (a) Structural concrete products, including ready mix and concrete masonry units;*
- (b) Reinforcing steel products, specifically rebar;*
- (c) Structural steel products, specifically hot rolled sections, hollow sections, decking, and plate; and*
- (d) Structural wood products, including laminated veneer lumber, laminated strand lumber, glue laminated timber, wood framing, softwood plywood, and Oriented Strand Board (OSB).*

TABLE 107.2.10.2.1 COVERED PRODUCT GWP VALUES

<u>COVERED PRODUCT</u>		<u>GLOBAL WARMING POTENTIAL</u>	<u>UNIT OF MEASUREMENT</u>
<u>Ready mix concrete</u>	<u>Up to 2,499 psi</u>	<u>235</u>	<u>kg CO₂e/m³</u>
	<u>2,500-3,499 psi</u>	<u>261</u>	<u>kg CO₂e/m³</u>
	<u>3,500-4,499 psi</u>	<u>316</u>	<u>kg CO₂e/m³</u>
	<u>4,500-5,499 psi</u>	<u>386</u>	<u>kg CO₂e/m³</u>
	<u>5,500-6,499 psi</u>	<u>408</u>	<u>kg CO₂e/m³</u>

	<u>6,500 psi and greater</u>	<u>487</u>	<u>kg CO₂e/m³</u>
	<u>Lightweight, up to 2,999 psi</u>	<u>518</u>	<u>kg CO₂e/m³</u>
	<u>Lightweight, 2,500-4,499 psi</u>	<u>575</u>	<u>kg CO₂e/m³</u>
	<u>Lightweight, 4,500 psi and greater</u>	<u>632</u>	<u>kg CO₂e/m³</u>
<u>Concrete masonry units</u>	<u>Normal weight, up to 3,249 psi</u>	<u>208</u>	<u>kg CO₂e/m³</u>
	<u>Normal weight, 3,250-4,499 psi</u>	<u>232</u>	<u>kg CO₂e/m³</u>
	<u>Normal weight, 4,500 psi and greater</u>	<u>241</u>	<u>kg CO₂e/m³</u>
	<u>Medium weight, up to 3,249 psi</u>	<u>360</u>	<u>kg CO₂e/m³</u>
	<u>Medium weight, 3,250 psi and greater</u>	<u>244</u>	<u>kg CO₂e/m³</u>
	<u>Lightweight, up to 3,249 psi</u>	<u>395</u>	<u>kg CO₂e/m³</u>
	<u>Lightweight, 3,250 psi and greater</u>	<u>286</u>	<u>kg CO₂e/m³</u>
<u>Reinforcing steel</u>	<u>Rebar – unfabricated</u>	<u>753</u>	<u>kg CO₂e/tonne</u>
	<u>Rebar – fabricated</u>	<u>854</u>	<u>kg CO₂e/tonne</u>
<u>Structural steel</u>	<u>Hot-rolled sections – unfabricated</u>	<u>1,000</u>	<u>kg CO₂e/tonne</u>
	<u>Hot-rolled sections – fabricated</u>	<u>1,220</u>	<u>kg CO₂e/tonne</u>
	<u>Hollow structural sections – unfabricated</u>	<u>1,710</u>	<u>kg CO₂e/tonne</u>
	<u>Hollow structural sections – fabricated</u>	<u>1,990</u>	<u>kg CO₂e/tonne</u>
	<u>Decking</u>	<u>2,320</u>	<u>kg CO₂e/tonne</u>
	<u>Plate – unfabricated</u>	<u>1,480</u>	<u>kg CO₂e/tonne</u>
	<u>Plate – fabricated</u>	<u>1,730</u>	<u>kg CO₂e/tonne</u>
<u>Structural wood</u>	<u>Laminated veneer lumber</u>	<u>361.45</u>	<u>kg CO₂e/m³</u>
	<u>Laminated strand lumber</u>	<u>274.9</u>	<u>kg CO₂e/m³</u>
	<u>Glue laminated timber</u>	<u>137.19</u>	<u>kg CO₂e/m³</u>
	<u>Wood framing</u>	<u>63.12</u>	<u>kg CO₂e/m³</u>
	<u>Softwood plywood</u>	<u>219.32</u>	<u>kg CO₂e/m³</u>
	<u>Oriented Strand Board (OSB)</u>	<u>242.58</u>	<u>kg CO₂e/m³</u>

107.2.10.3 Whole building life cycle assessment documenting embodied CO₂e of building project. A whole building life cycle assessment, complying with Sections 107.2.10.3.1 through 107.2.10.3.6 and performed in accordance with ISO 14040:2006 and ISO 14044:2006, shall be submitted for the proposed building. The *global warming potential* of the proposed building shall be no more than 90 percent of 102 lbCO₂e/square feet (500 kgCO₂e/m²) or no more than 90 percent of the *global warming potential* of the functionally equivalent reference building, where calculated using a whole building life cycle assessment in compliance with Sections 107.2.10.3.1 through 107.2.10.3.6 and performed in accordance with ISO 14040:2006 and ISO 14044:2006.

107.2.10.3.1 Reference building. The reference building shall be of the same size, geographic location, and thermal performance as the proposed building. The products and product quantities in the proposed building and the reference building may vary, provided that the buildings are functionally equivalent per ASTM E2921-22.

107.2.10.3.2 Software and data quality. Software used to conduct a whole building life cycle assessment shall conform to ISO 21931-1:2022 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. Environmental impact data shall not be sourced from expired or retired data sources.

107.2.10.3.3 Life cycle stages. For new construction and *additions*, the whole building life cycle assessment shall include all modules in life cycle stages A, B, and C, as defined by EN 15978, except for operating energy and water stages (B6 and B7).

107.2.10.3.4 Building elements. The whole building life cycle assessment shall include all of the following *building elements*: *exterior wall envelope; primary structural frame; secondary structural members; roof covering; roof deck; fenestration; load-bearing walls; interior walls and ceiling finishes serving structural purposes; veneer; and internal wall components, including but not limited to mineral board, gypsum board, particleboard, spray-applied foam plastic, and water-resistive barriers.*

Exception: A whole building life cycle assessment that includes no less than 95 percent of the total mass or volume of *building elements*.

Exception: A whole building life cycle assessment submitted for an *addition, alteration, repair, or substantial improvement* may exclude existing and/or remaining building components.

107.2.10.3.5 Reference study period. The reference study period shall be 60 years.

107.2.10.3.6 Registered design professional. The *registered design professional*, as specified in the *construction documents*, shall provide signature verifying compliance with the requirements.

Section 107.4 Amended Construction Documents

Add new section as follows:

107.4.1 Amended submittals for reduction of embodied CO₂e. The contractor for a building project that submits *embodied CO₂e* documentation per Section 107.2.10.2 or Section 107.2.10.3 shall update documentation and calculations based on procured products and attest that they are accurate and align with the construction documents to the best of the contractor's knowledge. All calculations shall be verified by the *registered design professional*.

Chapter 2 Definitions

Section 202 Definitions

Add new definitions as follows:

Embodied CO₂e. The amount of greenhouse gas emissions associated with extraction, production, transport, and manufacturing of a product through the product's life.

Environmental product declaration. A type III environmental product declaration, as defined by the International Organization for Standardization standard 14025 or similarly robust life-cycle assessment methods that have uniform standards in data collection consistent with the International Organization for Standardization standard 14025, industry acceptance, and integrity. When available, the environmental product declaration must include supply chain specific data for production processes that contribute 70 percent or more of a product's cradle-to-gate *global warming potential*, as defined in International Organization for Standardization standard

21930. When supply chain specific data is provided, the environmental product declaration must report the overall percentage of supply chain specific data included.

Global warming potential (GWP). The potential climate change impact of a product or process as measured by a life cycle assessment. Global warming potential is the metric for tracking embodied carbon and is reported in units of carbon dioxide equivalent.

5. Briefly explain your proposed amendment, including the purpose, benefits and problems addressed.

Summary of Requirements and Purpose

This proposal adds a requirement for construction document submittals to include reporting on the embodied carbon emissions associated with proposed projects over 100,000 square feet. Project teams must choose one form of documentation from the following three options:

- (1) submit product environmental product declarations (EPDs) for covered products that indicate a 10% reduction in global warming potential (GWP) compared to the industry average;
- (2) submit a whole building life cycle assessment (WBLCA) for the building's structure and enclosure that indicates a 10% reduction in global warming potential (GWP) compared to industry average;
- (3) submit proof of reuse of at least 45% of an existing building's structure and enclosure.

This code change proposal would support Washington's goal to reduce its greenhouse gas (GHG) emissions by 95% by 2050. In its 2021 State Energy Strategy, the Washington State Department of Commerce identified the reduction of embodied carbon in the built environment as a key strategy for reaching the state's 2050 goal. The state's recent House Bill (HB) 1282 took a major step toward addressing this need by establishing a buy clean and buy fair policy that requires reporting on the embodied carbon of concrete, steel, and wood used in projects over 100,000 square feet beginning in 2025.

This proposal builds on the strong foundation and clear direction that Washington state has set for reducing the embodied carbon associated with building materials. These strategies – intended to increase demand for low embodied carbon products, spur EPD development, and build market awareness of GWP reporting methods – are, however, incomplete without the building code provisions. A code-based approach has the unique capacity to directly influence the design and construction practices demonstrated by building projects across the state.

Problem and Opportunity

Building operations and building construction are responsible for 39% of today's global greenhouse gas (GHG) emissions.¹ About 11% of these emissions are embodied carbon emissions – the emissions associated with the creation of building materials and construction activities. The largest contributors tend to be found in buildings' structures and envelopes, which typically include materials such as concrete, steel, and wood.

The need to confront and reduce embodied carbon is urgent. The IPCC reports that limiting warming to the target set by the Paris Agreement – and avoiding the worst-case impacts of the climate crisis – is contingent on GHG emissions peaking by 2025 at the latest and reducing them by 43% by 2030.

Historically, policies that have targeted the reduction of the built environment's climate impact have focused on the operations associated with buildings' uses: the amount of pollution generated by fuel consumption from mechanical systems used to heat, cool, or light a building. While this focus has been critical, it has not accounted for the full scope of buildings' climate impacts. Additionally, as clean energy policy and efficiency standards and practices ratchet down operational carbon emissions, embodied carbon will continue to become a larger share of buildings' carbon footprint.

Doing justice to the urgency presented by climate change requires a focus on the embodied emissions associated with the early phases of buildings' construction and materials. Unlike operational emissions, which can be improved over the lifespan of a building through deep-energy retrofits and decarbonizing the electric grid, embodied carbon emissions occur before a building is occupied and cannot be reduced over time. A joint University of Washington and University of California, Berkeley study found that, on average, 80% of a building's embodied carbon impacts over its lifetime takes place in the phases leading up to a building's completion before occupancy. Therefore, addressing embodied carbon in the construction of buildings presents an urgent and valuable opportunity to reduce carbon emissions in Washington. Code-based policies thus hold critical potential to address this bulk of emissions, as they impact decisions made early during the design process, which directly and most substantially influence early production and construction activities. Prioritizing these immediate emissions will help to stop the accumulation of GHGs in the atmosphere, improving the likelihood that the world – and Washington – will reach their GHG peaks sooner.

Finally, this code proposal holds the potential to safeguard the public from the hazards associated with the creation of building materials. The International Building Code (IBC) has been in place and used by the design and construction industry to ensure that materials in the built environment preserve public health and safety. This proposal looks to expand the impact of the IBC to further safeguard the public from the hazards associated with the creation of building materials. This entails reducing emissions in the extraction, manufacturing, and transportation of these products, which can improve air quality and public health in communities located near industrial centers and manufacturing facilities.

Methodology and Reasoning

The materials and building elements that fall within the scope of this proposal were chosen because they are accountable for significant GHG emissions throughout their production phases – at the building level, this means the structure and enclosure; at the material level, this means concrete, steel, and wood.

Three compliance pathways were included to provide project teams the flexibility to choose an option that is most suitable and accessible for its unique circumstances. These pathways are also based in precedent, drawing from California's statewide building code, CALGreen, the latest version of which is now in effect.

Pathway Option 1: Building reuse is incentivized by exempting reuse projects from the reduction and reporting requirements of the other pathways. The aim of including this pathway is to amplify the significant role that building reuse can play in lowering the state's embodied carbon associated with its construction activities. A 2011 study by Preservation Green Lab, Skanska, Green Building Services, and others found that reuse of a variety of building types could realize between 4 and 46 percent embodied carbon savings compared to new construction operating at an equivalent energy performance level.¹ Moreover, it can take between 10 and 80 years for new buildings designed with energy efficiency features to overcome the environmental impacts associated with the construction process. Scaling the practice of reuse across a state's building stock can realize significant reductions.

The reduction requirements proposed for the next two pathways – both set at 10% below industry average – is also based in precedent and widely regarded as an achievable value for most projects. This requirement would encourage the highest-emitting projects and manufacturers to reduce the carbon content of their systems and materials to be more competitive in the market.

Pathway Option 2: The second pathway in the proposal is a materials-based approach, requiring EPD submission and reduction of GWP across 90% of covered materials by 10% compared to industry average

¹ Patrice Frey, Liz Dunn, and Ric Cochran, "The Greenest Building: Quantifying the Environmental Value of Building Reuse" (National Trust for Historic Preservation Green Lab, 2022), https://living-future.org/wp-content/uploads/2022/05/The_Greenest_Building.pdf.

values. This sort of limit has been passed in other jurisdictions including California; New York State; Toronto; Marin, CA; Santa Monica, CA; and the Denver Green Code. The U.S. General Services Administration (GSA) has also made strides in setting materials-based GWP limits for concrete and cement; asphalt; steel; and glass. The state of Washington has also begun to chart its own course by requiring reporting for certain materials through the Buy Clean and Buy Fair Act. The industry average values provided in the table are drawn from the Carbon Leadership Forum’s 2023 material baselines.

Pathway Option 3: The last pathway takes a building-level approach, requiring the submission of a whole building LCA that indicates a 10% reduction compared to an industry average baseline. Other jurisdictions that have adopted this building-level approach include California, Minnesota, Toronto, and Vancouver. The 10% reduction required in the whole building life cycle assessment pathway falls within range of these precedents and others, including ASHRAE 189.1, San Francisco’s Municipal Green Building Requirements, and LEED v4.1.

Determination of Compliance

Chapter 1 of the building code, focusing on Scope and Application as well as Administration and Enforcement, addresses the process with which a project must comply when applying for a permit. Section 107 on Construction Documents includes a description of the submittal documents, where an addition of embodied documentation reporting can seamlessly fit.

This code proposal was integrated into Chapter 1 with the intent to provide a clear path for code officials to determine compliance at two points along the project timeline: at the initial submission of construction documents and at the subsequent submission of amended construction documents. The role of the code official is to check for the submission of required documentation; confirm that requirements were met; and verify that the registered design professional has signed off on meeting these provisions.

6. Specify what criteria this proposal meets.

- The amendment is needed to address a critical life/safety need.
- The amendment clarifies the intent or application of the code.
- The amendment is needed to address a specific state policy or statute.
- The amendment is needed for consistency with state or federal regulations.
- The amendment is needed to address a unique character of the state.
- The amendment corrects errors and omissions.

7. Is there an economic impact: Yes No

If no, state reason:

Costs to Design Teams

A project’s embodied carbon can be significantly reduced at little to no additional up-front cost.

Case studies in the Pacific Northwest have shown an embodied carbon savings potential of 19%–46% at cost premiums of less than 1%.² These reductions are achievable simply by specifying and substituting material alternatives with lower embodied carbon during the design and specification process. Reductions that go well beyond 50% are possible when an early, whole-building design view is considered.

² Rebecca Esau, Matt Jungclaus, Victor Olgyay, and Audrey Rempher, “Reducing Embodied Carbon in Buildings: Low-Cost, High-Value Opportunities” (RMI, 2021), https://rmi.org/wp-content/uploads/dlm_uploads/2021/08/Embodied_Carbon_full_report.pdf

These cases demonstrate that there are products and solutions available today that can realize embodied carbon reductions with low to no financial burden. Additionally, embodied carbon code provisions can result in additional cost savings in the future as the production of low embodied carbon materials, the practice of conducting a whole building life cycle assessment, and pursuing building reduce scale up and the cost of low embodied carbon materials goes down as a result of increased practice and demand.

Costs of Code Enforcement

A study published for CALGreen's 2022 embodied carbon requirements, which includes similar prescriptive, performance, and building reuse requirements as this proposal, determined that there was a minor increase of costs to local governments to review and check plans for compliance.³ However there is no major fiscal impact on local governments to enforce the regulation. Local governments would only need to verify results provided by developers, in a standardized manner, to ensure compliance with the proposed pathways.

Costs to Manufacturers and Suppliers

Material manufacturers can face costs associated with the production of EPDs. However, most of the products that fall within scope of this proposal are already covered by the Buy Clean and Buy Fair Act. The few outstanding softwood products that were added to this proposal were chosen due to the fact that there already exist sufficient EPDs on the market to determine an industry-wide GWP threshold.

For the most part, manufacturers and suppliers will not experience any additional burden due to the provisions of this proposal because they are either already required to produce EPDs by other state law or have already incurred the upfront costs of producing them. Smaller product manufacturers and suppliers that do not yet have EPDs may see a small financial impact from the development of EPDs for their products, but a study by Energy Transitions Commission showed that the company pass-through cost to the individual projects to create the initial \$5-30K EPD is negligible.⁴

Please send your completed proposal to: sbcc@des.wa.gov

³ "Economic and Fiscal Impact Statement (Form 399) Attachment C – CCRC regulations 45day" (California Department of General Services, 2022), <https://www.dgs.ca.gov/-/media/Divisions/BSC/03-Rulemaking/2022-Intervening-Cycle/Public-Comments/GREEN-45-Day/BSC/BSC-04-22-399-PT11-Attachment-C-R1-45day.pdf?la=en&hash=E1121CBF2FEA6D07492DCD1E962D8AA1AFC43618>

⁴ Mission Possible: Reaching Net-Zero Carbon Emissions From Harder-to-Abate Sectors by Mid-Century, Energy Transitions Commission, 2018.