

Written testimony for 2021 ORSC Low Carbon Concrete Proposal

The Carbon Leadership Forum (CLF) supports code amendment proposal “PP-6”, which requires submission of environmental product declarations (EPDs) and establishes carbon limits for concrete in the 2021 Residential Specialty Code. The language proposed is feasible to implement given the state of EPD data and concrete commonly used in Oregon.

Oregon is already a leader in low carbon concrete with wide availability of environmental product declarations (EPDs), a City of Portland procurement policy that requires EPDs and sets carbon limits, and a recently launched Oregon Department of Transportation (ODOT) program which will also utilize EPDs to lower the impact of purchased concrete for Oregon infrastructure. This proposal helps expand that leadership to residential concrete foundations systems.

Concrete used on residential buildings typically dominates the carbon impacts associated with the home’s building materials, known as embodied carbon, but also represents one of the largest opportunities for carbon reduction given the availability of both materials and knowledge to source lower carbon concrete mixes.¹ In fact, an August 2022 Oregon DEQ pilot project of a residential home in Oregon demonstrated that residential foundation systems are a low risk and feasible application for lower carbon concrete mixes.²

Feasibility of 2021 ORSC Low Carbon Concrete Proposal

The 2021 ORSC Low Carbon Concrete Proposal uses a suite of existing, tested reporting mechanisms and building practices and is feasible for immediate implementation, including EPDs and GWP limits.

Environmental Product Declarations (EPDs)

Embodied carbon is measured using life cycle assessment (LCA). LCA is an analysis methodology that estimates the environmental impacts of a building, product, or process over its life cycle. EPDs are standardized documents that report the environmental impact results of an LCA for a particular material or product. Type III EPDs are third party-verified and governed by product category rules (PCRs). PCRs establish rules and guidelines for a particular product or group of products and dictate how the practitioner should perform the LCA for an EPD of that product category. Both EPDs and PCRs must follow international standards set by the International Organization for Standardization (ISO), including ISO 14025, ISO 14027, ISO 14040, ISO 14044, and ISO 21930.

EPDs are an existing, agreed-upon resource for reporting the embodied carbon of products that are appropriate to include in policies and codes. Concrete EPDs are readily available in Oregon with approximately 2,421 available in December 2022 according to Building Transparency.³ EPDs are available in the follow Oregon cities:

¹ <https://www.buildersforclimateaction.org/report--embarc-report.html>

² <https://www.oregon.gov/deq/mm/Documents/ConcreteCaseStudy-ResBirdsmouth.pdf>

³ <https://buildingtransparency.org/ec3>. Accessed on 12/2/2022

- Portland
- Hillsboro
- Beaverton
- Linnton
- Troutdale
- Wilsonville
- Salem
- Newberg
- McMinnville
- Eugene
- Corvallis
- Bend
- Redmond
- Madras
- Hermiston
- Pendleton
- Boardman
- The Dalles
- Hood River

Oregon was the first state in the nation to provide financial incentives toward the development of concrete EPDs through a public/private partnership launched in 2017. The City of Portland has required concrete EPDs for City projects since 2020, and ODOT is currently developing a program that will include requirements for concrete EPDs. Requirements to disclose and reduce embodied carbon have been incorporated into building code in Marin County, CA for concrete and Vancouver, BC for whole buildings. **EPDs are a practical and standardized way of tracking and disclosing the impacts of manufacturing building materials.**

Global Warming Potential (GWP) Limits

One impact that LCA models calculate is the total contribution to climate change, which is reported as Global warming potential (GWP), which is used to track embodied carbon. GWP limits set a maximum allowable carbon footprint for products. In this code proposal, the limits are set approximately 45% above the National Ready Mix Concrete Association’s Pacific Northwest GWP Benchmarks, which is also where the City of Portland set their limits. These limits are very conservative and would allow roughly 80% of the mixes with EPDs in the Oregon market to meet the proposed limits already. Only the most carbon polluting concrete mixes would be excluded from projects.

The limits proposed are feasible to meet with existing mixes in Oregon. Additional flexibility is given by allowing the project averaging approach, requiring only 75% of the volume to meet the GWP limits, and providing exceptions to the requirements.

Cost Implications

A recent Oregon DEQ pilot project concluded that foundations are a low risk and feasible application to start using lower carbon concrete mixes. The labor-related cost increases experienced in the Oregon DEQ pilot project were primarily related to the flatwork, which was excluded from GWP limits in this code amendment proposal. Existing research does not indicate administrative cost on implementation, but as this only requires submittal before certificate of occupancy it is likely extremely low.

Since a significant number of concrete EPDs already exist in Oregon, the cost of creating them for manufacturing locations that don’t currently have EPDs is likely to be minimal for two main reasons: 1) ODOT is developing an EPD grant program, and 2) the recently passed Inflation Reduction Act has allocated \$250 million to develop and carry out a program to support the development, and enhanced standardization and transparency, of EPDs for construction materials and products.⁴

⁴ Inflation Reduction Act of 2022. Section 60112 - <https://www.congress.gov/117/plaws/publ169/PLAW-117publ169.pdf>

Who is the Carbon Leadership Forum (CLF)?

The Carbon Leadership Forum (CLF) is a University of Washington-based organization with a mission to eliminate embodied carbon in buildings and infrastructure by inspiring innovation through collective action to create a just and thriving future. As part of our work, we conduct research on materials, buildings and infrastructure and act as a technical advisor to inform policy development and implementation related to our research. Policies and standards are critical to widespread reductions in embodied carbon, and building codes are a key pathway to broadening knowledge and action once tested strategies are available.

What is embodied carbon, and why does it matter?

Embodied carbon refers to the greenhouse gasses (GHGs)⁵ generated by the manufacturing, transportation, installation, maintenance, and disposal of construction materials used in buildings, roads, and other infrastructure. In contrast, operational carbon refers to the emissions associated with the energy used to operate a building. Together, operational and embodied carbon represent a building's total GHG emissions.

Key points about embodied carbon:

1. **Embodied carbon is significant.** In Oregon, the operational carbon emissions of buildings account for 22% of all statewide GHG emissions. Embodied carbon emissions account for 8% of statewide emissions making embodied carbon over ¼ of all building-related emissions in Oregon⁶. A similar trend exists at the global level where the embodied carbon emissions of building materials also account for approximately ¼ of all global greenhouse gas emissions associated with buildings⁷.
2. **Embodied carbon is an opportunity:** Carbon reduction goals are typically focused on reduction targets for 2030 and 2050. When looking at building-related carbon emissions over that same timescale, we find that the embodied carbon of building materials comprises 38-67% of total emissions by 2030 or 28-56% by 2050.⁸ While operational emissions accumulate slowly over time, embodied emissions spike in short increments during new construction and renovations. Reducing embodied carbon has large benefits over a short time scale for carbon reductions.
3. **Embodied carbon is linked to public health and equity.** Extraction, manufacturing, transportation, installation, and removal of building materials affects human well-being in two ways: (1) directly, through the local health impacts of pollution from nearby industrial manufacturing sites, construction sites, highways (where materials are transported), or landfills; and (2) indirectly, through the myriad impacts of climate change (e.g., extreme weather events, spread of disease, and scarcity of food, water, and other resources).

⁵ Greenhouse gasses are substances in the atmosphere that contribute to global warming. Carbon dioxide (CO₂) is the predominant greenhouse gas, making up roughly 76% of global emissions ([US EPA](#)). "Carbon" is a shorthand for greenhouse gasses, and we typically report these emissions and the resulting global warming impacts in terms of carbon dioxide equivalents (CO₂e).

⁶ Oregon DEQ presentation to Resilient Efficient Buildings Task Force, April 13, 2022. <https://olis.oregonlegislature.gov/liz/mediaplayer/?clientID=4879615486&eventID=2022041009>

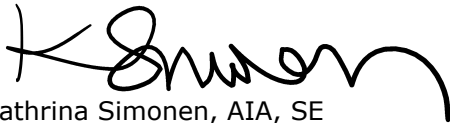
⁷ UNEP GBAC. 2022 *Global Status Report for Buildings and Construction*. <https://globalabc.org/our-work/tracking-progress-global-status-report>

⁸ Lewis, M., Huang, M., Carlisle, S., and Simonen, K. (2021). *AIA-CLF EMBODIED CARBON TOOLKIT FOR ARCHITECTS Part 1: Introduction to embodied carbon*. <https://carbonleadershipforum.org/clf-architect-toolkit/>

4. **Embodied carbon can be reduced now with available tools and strategies.** Designers, builders, and material manufacturers and suppliers are already taking action to reduce embodied carbon in their building projects and products. While leaders continue to reach increasingly lower embodied carbon footprints for their projects and products, codes play a critical role in standardizing the actions that have already been tested and deployed, such as requiring reporting through EPDs and procuring products under conservative GWP limits.

Summary

Code amendment proposal “PP-6” proposes feasible, ready to implement language for limiting the carbon of concrete in residential foundations, the largest single source of building material emissions for residential projects. This proposal would build on several Oregon-led initiatives and expand its leadership to residential concrete foundations systems.



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