



Code Amendment Proposal Application

Department of Consumer & Business Services

Building Codes Division

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Read the entire code amendment proposal application before completing this form. Please complete all parts before submitting your proposal and refer to the provided checklist.

APPLICANT INFORMATION

Name:	Date:	
Representing (if applicable):	Work phone:	
Mailing address:	Cell phone:	
City:	State:	Zip:
Email address:		

PROPOSAL INFORMATION

Specialty code:
Code section(s):
Briefly explain the subject of your proposal:

INSTRUCTIONS AND CHECKLIST

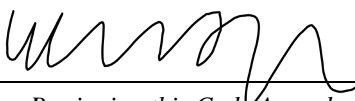
Fill in all the information above and submit this page, signed and dated, with the required supplementary information for Parts I, II, III, and IV described on page 2 of this application. This application may be submitted by mail to the mailing address above, or by email to BCD.PTSPtech@oregon.gov.

Summary checklist for the applicant:

- Part I** Code amendment language is attached in the proper format.
- Part II** Amendment proposal requirements for amending the code have been reviewed.
- Part III** Amendment proposal criteria questions have been answered and are attached.
- Part IV** If applicable, additional ORSC energy efficiency amendment proposal information is attached.

Note: One application is required for each code section you are proposing to amend. If this proposal requires changes in other sections of the code for alignment, include those changes as part of this application.

APPLICANT SIGNATURE

Signature:  Date:

Copyright notice: By signing this Code Amendment Proposal Application, I understand and acknowledge that the work contained in this application is original, or if not original, I have the right to copy the work. By signing this work, I understand that any rights I may have in this work, including any form of derivative works and compilations, are assigned to the Department of Consumer and Business Services Building Codes Division. I also understand that I do not retain or acquire any rights once this work is used in a Department of Consumer and Business Services Building Codes Division publication.

Add new sections as follows:

Chapter 2

R202 Definitions

CRADLE-TO-GATE. Refers to construction product development activities associated with the product production stage and modules A1 through A3, in accordance with ISO Standards 14025 and 21930.

GLOBAL WARMING POTENTIAL (GWP). A measurement that combined the impact of the various greenhouse gases relative to an equivalent unit of carbon dioxide over a given period of time.

PRODUCT-SPECIFIC TYPE III ENVIRONMENTAL PRODUCT DECLARATION (EPD). Type III environmental product declaration (EPD) complying with the goal and scope for the production stage and modules A1 through A3 (also referred to as cradle-to-gate) requirements in accordance with ISO Standards 14025 and 21930 and be available in a publicly accessible database. The data must represent the impacts for a specific mix design and manufacturers across multiple facilities.

Chapter 5 Floors

R506 Concrete Floors on Ground.

R506.2.5 Materials for Concrete. Materials for concrete shall comply with the requirements of Section R608.5.7.

Chapter 6 Wall Construction

Section R608 Exterior Concrete Wall Construction.

R608.5.1 Concrete and materials for concrete. Materials used in concrete, and the concrete itself, shall meet the requirements of R608.5.7, conform to the requirements of this section and PCA 100 or ACI 318.

R608.5.1.7 GWP of concrete products. 75 % of all concrete mixes must not exceed the maximum GWP of the individual concrete mixes used in the construction shall not exceed the values specified in Table R608.5.1.7 based on the compressive strength of each individual mix, and meet the documentation requirements of R608.5.1.7.1.

Exceptions:

1. Precast, shotcrete, or auger cast concrete.
2. Driveways, patios, walks, or other flatwork.
3. Concrete with product strengths for which the nearest supplier with a cradle to gate Type III product-specific EPD is located more than 100 road miles from the project site.

**TABLE R608.5.1.7
GWP LIMITS IN CONCRETE MIXTURES**

<u>Procured compressive strength f'_c, psi</u>	<u>Maximum kg/m³(SI)</u>	<u>High-early strength Maximum kg/m³ (SI)^a</u>	<u>Lightweight concrete Maximum kg/m³ (SI)^b</u>
2501 - 3000 psi	381	496	716
3001 - 4000 psi	467	607	819
4001 - 5000 psi	568	738	904
5001 - 6000 psi	597	777	N/A
6001-8000 psi	692	900	N/A

- a. High-early strength concrete achieves a compressive strength could achieve structural concrete quality within 24 hours to seven days.
- b. Lightweight concrete contains lightweight aggregate and has an equilibrium density determined by ASTM C567.

R608.5.1.7.1 GWP Limit Method - Project. Total GWP (GWPproj) of all concrete placed at the project shall not exceed the project limit (GWPmax) using the GWP limits in Table R608.5.1.7 in Equation R608.5.1.7.1.

Equation R608.5.1.7.1

$GWP_{proj} < GWP_{max}$

where: $GWP_{proj} = \sum GWP_n v_n$ and $GWP_{max} = \sum GWPlim_n v_n$

and

n = the total number of concrete mixtures for the project

GWP_n = the global warming potential for mixture n per mixture EPD, kg/m^3

$GWPlim_n$ = the global warming potential limit for mixture n per Table R608.5.1.7, kg/m^3

v_n = the volume of mixture n concrete to be placed

R608.5.1.7.2 Documentation of Product GWP. 75% of the concrete mixes must have a product-specific cradle-to-gate Type III EPD complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO Standards 14025 and 21930 and be available in a publicly accessible database. Confirmation of the product's EPDs shall be provided to the code official prior to the certificate of occupancy.

Proposal Criteria Questions for R202, R506, and R608

1. Describe the concept and purpose of this proposal.

This code change proposal will support Oregon's climate goals to reduce greenhouse gas (GHG) emissions by 45% by 2035. Oregon has been a leader in sustainable building practices, including the recent Buy Clean legislation, which will require products used in infrastructure projects to be lower carbon. This proposal uses existing policy mechanisms to safeguard the public from the environmental hazards associated with the creation of concrete, and supports state GHG emission reduction goals.

This proposal requires 75% of concrete mixes to meet specific global warming potential (GWP) limits and document compliance through environmental product declarations (EPD).

2. What problem in the existing Oregon code or national model code is this proposal solving? How does this amendment address the issue? If you have evidence demonstrating the problem, submit that information.

Building operations and construction are responsible for 39% of today's global carbon emissions. 11%, or more, of these emissions, are embodied carbon emissions, the emissions associated with the creation of building materials and construction activities. Unlike operational emissions, which can be improved over the lifespan of a building through deep-energy retrofits and the decarbonization of the electric grid, embodied carbon emissions occur before a building is occupied and cannot be reduced over time. Therefore, addressing embodied carbon in the construction of buildings presents an urgent and valuable opportunity to reduce carbon emissions in Oregon.

As the Oregon energy code continues to improve building energy efficiency and the grid energy becomes cleaner, operational carbon emissions will be reduced and embodied carbon will become a larger part of a building's total carbon emissions. The materials chapters in the residential code have been in place and used by the design and construction industry to ensure that building materials in the built environment preserve public health and safety.

Recent policies have started to address high GWP emissions in concrete. Oregon Buy Clean applies to transportation, and Portland's Low-Carbon Concrete Initiative requirement applies to jurisdictional projects. While these two policies cover many projects in the state, it misses one of the most common, and growing source of concrete – residential construction. Residential projects use the second most amount of concrete, second only to jurisdictional projects. Oregon contractors add about 20,000 residential units each year, with half of them being single family homes.

As these proposals become a reality, the requirements for concrete contractors working on single-family construction will have an opportunity to grow their businesses. With the understanding and knowledge of how low embodied carbon and the development of EPDs, they can expand their business and be qualified to work on Oregon Department of Transportation projects. As an unintended positive consequence, *the expansion of services can grow local businesses and support the economy.*

While low-carbon concrete ingredients have been available and used in Oregon for over 20 years, some contractors may see the product as new-to-them. An August 2022 study of low carbon concrete in Oregon residential projects found that the wet consistency of the product in horizontal applications is a little different from conventional concrete. While additional tools are not needed to work the product, there's a one-project learning curve for contractors that will quickly be overcome. For this reason, flatwork is excluded from this proposal to focus solely on the building itself.

This proposal aligns with the impact of the residential code to establish minimum requirements to safeguard the public from the hazards associated with buildings. The approach presented within this code change proposal includes EPD reporting and GWP targets for concrete since this is the most commonly used and highest embodied carbon product used on a project. Lower embodied carbon concrete supports a path toward a decarbonized built environment and lowers Oregon's GHG emissions. The proposed language will encourage the highest 25% of concrete products to reduce the carbon content of their materials to be more competitive in the market.

3. Has this been proposed at the national model code level. If so, explain when it was proposed, what happened, and why it was not adopted. Provide all associated national model code hearing information and background.

Low GWP concrete has not been proposed in the national residential code. A similar proposal was presented to the IBC in January. It was voted down when combined with steel requirements that address the means and methods of construction. The proposal can be seen by seeking out IBC 178-S.

This proposal differs from the IBC proposal because it only addresses concrete, includes more exceptions, aligning with other regional policies. The GWP limits are aligned with these policies, addressing the unique nature of Oregon residential projects.

4. Explain how the proposed provisions would be enforced? Are additional inspections or permits required? Describe any necessary equipment, training, tests, or special certifications.

Reporting can be reviewed at two main points in the project. First, the project documents should include requirements for concrete to meet specific GWP requirements. Second, before occupancy, the documentation, or summary of documentation can be provided to confirm compliance.

Reporting requirements could include a summary table of concrete mix GWP. AHJ may request that the allowable GWP of each concrete mix is included on the construction documents. Beyond confirming the requirement is incorporated in the construction documents, this proposal will not impact the permit process.

The concrete mix global warming potential (GWP) requirements should be included in construction documents. Contractors will confirm that the bids include the proper GWP limits. With over 2,366 EPDs available from Oregon concrete providers, 75% of which meet the GWP limits proposed within. As more concrete providers are developing EPDs, this number will grow. Additionally, by expanding the available EPDs past Oregon's borders, even more, EPDs are available to Oregon projects.

5. What is the fiscal impact of this proposal? Provide a cost-benefit analysis and include the resources or methods you used to determine the fiscal impact.

At the project-level, collecting and tracking concrete EPDs adds minimal time to include the requirements in the construction documents and when requesting concrete bids.

An August 2022 study of low carbon concrete in Oregon residential projects found no cost premium for concrete used in the foundation. There was a 5% cost premium for flatwork concrete due to the need for additional contractors or those with more experience working with lower carbon concrete. The report noted that contractors would overcome the initial learning curve of laying flat concrete, and the cost premium would not be needed. Flatwork has been excluded from this proposal for this reason.

With 50,000 residential units built each year in Oregon, and assuming that each was to use 10 yards of concrete, a Spring 2022 survey by the federal government found that over 80% of U.S. concrete manufacturers already produce low embodied carbon materials and over 55% sell those materials for about the same as conventional equivalents. The code change proposal catches projects outside of state and federal requirements to move the entire market to support Oregon's GHG emission reduction goals.

A 2021 analysis by RMI showed that concrete could lower the carbon by as much as 33% than conventional concrete can be purchased for less than a 1% cost premium.

Cement manufacturers sell low embodied carbon concrete at \$2-20 more per cubic yard than conventional products, with higher strength products sold at the higher cost premium range. The marginal increase since the amount of concrete used in each cubic yard of concrete is minimal. Overall, the concrete mix price does not impact the project by more than \$20 for a 1200-square-foot house that may be a total of 10 yards of concrete.

Anecdotal evidence in Portland has shown that the product itself is not more expensive. *Whether the cost is a 0-5% increase for concrete itself, this is a very minimal and cost-effective option to address Oregon's GHG emissions.*

6. It is important that proposals be shared with stakeholders that they will impact. Was this proposal developed with people or organizations likely to be affected by it? Has it been reviewed or shared with people or organizations likely to be affected by it? If so, who, and if not, why not?

The cement and concrete industries have started adapting to this regulation. The Global Cement and Concrete Association set the goal of reducing emissions by 50% by 2030 and reaching net zero by 2050. A GSA survey on low embodied carbon concrete showed that over 80% of replying concrete producers are already providing complying materials.

New Buildings Institute has been working with national concrete associations, including the National Ready Mixed Concrete Association (NRMCA) and the American Concrete Institute (ACI.)

This proposal has been shared with local designers, contractors, policymakers, and others who would be responsible for implementing the policy. They have provided potential implementation concerns cost information. Their comments have shaped the content, including the exceptions.

GWP limits for concrete mixes were set by evaluating the national industry-wide environmental product declaration (IW-EPD) issued by NRMCA. The GWP limits are set at 150% of the IW-EPD, which is about at the 75th percentile for all existing concrete EPDs, meaning the lowest 25% of concrete providers' mixes would need to be adjusted to comply. The high early strength concrete was given an additional 130% GWP allowance.

The 150% of IW-EPD was reviewed against the Portland low carbon concrete policy. The proposed GWP limits are 2-5% higher than the Portland values, meaning that the proposed values are less stringent than the Portland GWP limits.

Contractors have shared that the optimizations needed to produce compliant concrete mixes can be achieved primarily by reducing cement in concrete mixes through strategies like high performance aggregate selection or cement substitution. These interventions can be made without a cost impact on the individual project if the criteria are effectively communicated to ready-mixed suppliers.

7. Does this proposal impact other specialty codes or statewide programs?

This will support additional policies. As concrete manufacturers prepare to comply with the Portland policy and Buy Clean, they will have the EPDs necessary to comply with the requirements within.