Supplemental Information to the

SHB 1080 (2021-22) Section 7041 Proviso Report

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Contents

Intent

- Provide Construction Industry information to supplement the SHB 1080, Section 7041 Proviso Report authored by the Department of Enterprise Services (DES) and submitted in January 2022.
- Offer policy makers and State agencies an industry-informed overview of:
    - the current state of material disclosure
    - issues related to Environmental Product Declarations (EPDs) and disclosure
    - future opportunities for embodied carbon reduction in building materials and
    - current sourcing limitations
- Discuss the appropriate use and limitations of using EPDs and Whole Building Life Cycle (WBLCA) in evaluating lower carbon building solutions, creating baselines, and understanding the quality of data currently available.
- Daylight the challenges with the supply of lower carbon source materials and the need for a long-range interagency and construction industry strategy to increase production and remove barriers to bring these materials to market.
- Suggest a roadmap of immediate and longer-term solutions. Provide implementable future actions, strategies, and policy recommendations relating to manufacturing and the project scoping, design, procurement, and construction phases.

Section 1: Executive Summary

1. An adequate supply of construction materials is essential to the economic and environmental sustainability of Washington state and the region. Due to the constrained regional supply of certain materials such as cement, Washington is and will continue to be a net importer of some materials.

2. Sustained incentives are an essential component of a successful embodied carbon reduction strategy. Incentives should invest in new technologies, improved manufacturing processes, lower carbon material transportation, and innovative materials/ingredients which reduce embodied carbon in building products and construction.

3. Washington State will be most successful with a two-pillar approach: 1). increase the number of EPDs to learn from the data and improve the data quality of source information and 2). focus on increasing the availability of the lower embodied carbon source ingredients and improving manufacturing processes.

4. To increase the access to lower carbon source materials, remove unnecessary and burdensome economic, regulatory, and logistical obstacles that impede the advancement of a lower carbon economy without other public benefits. Allow for increased solutions and flexibility for the construction industry.

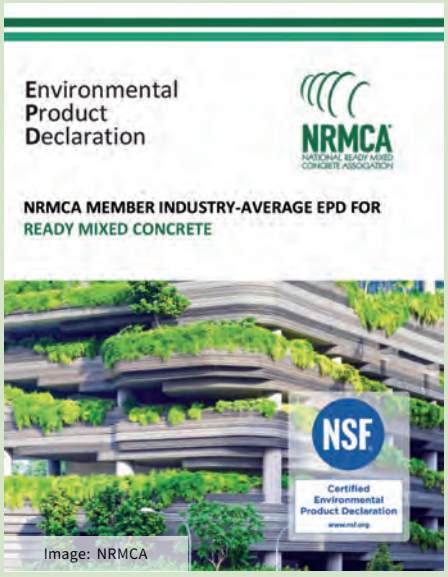


Image: NRMCA

5. Realizing embodied carbon reductions during design, engineering, construction, and the procurement of building materials requires collaboration starting in early design and continuing through construction. Beginning with the collaboration of the entire project team to identify lower carbon building design and materials, the effort continues with the application of practical and innovative solutions from manufacturers and construction teams to meet embodied carbon objectives. This holistic *"Building Clean"* approach enables early input on constructability, scheduling, and cost issues to maximize the innovative use of building materials, technologies, and construction methods.

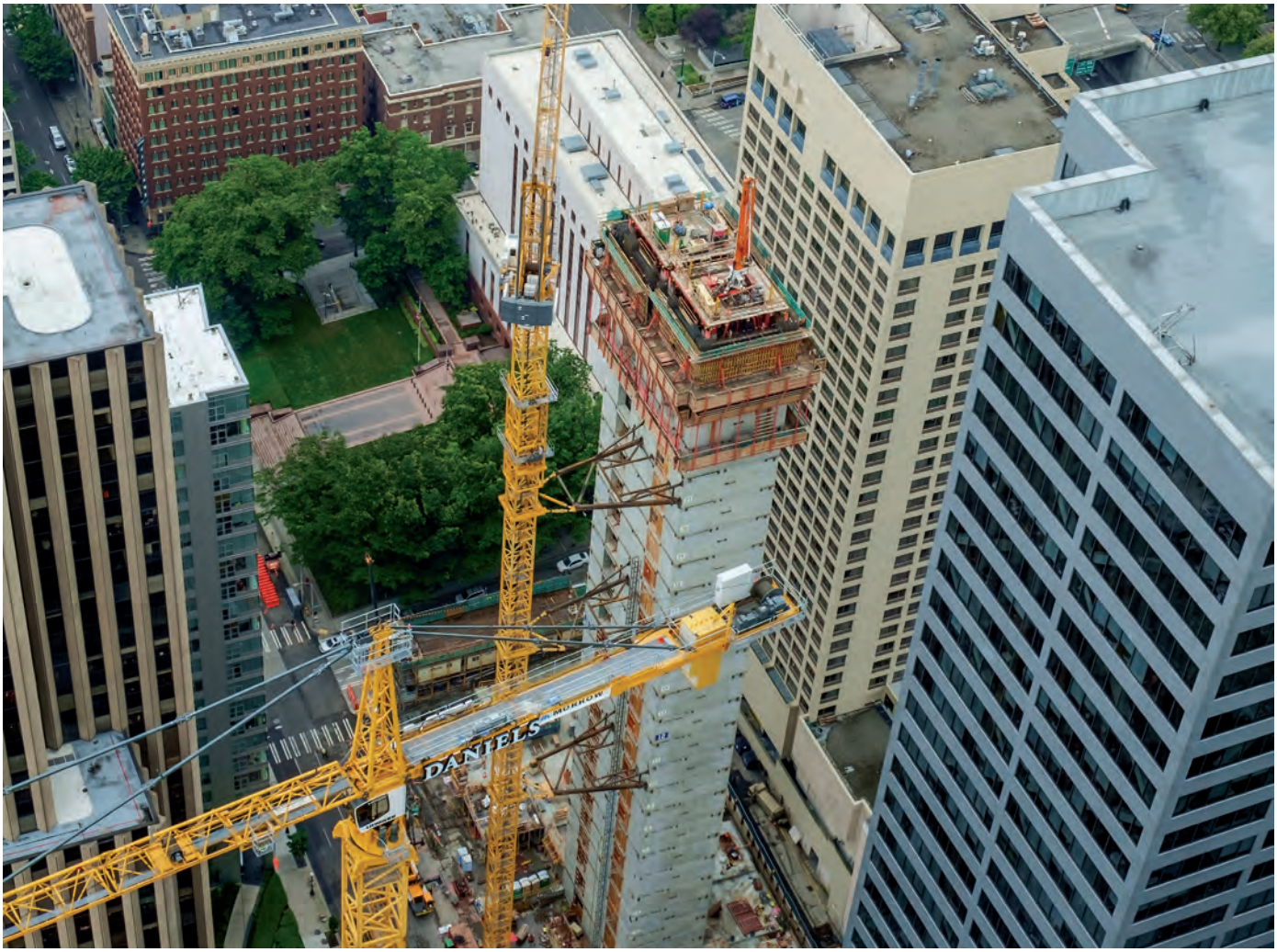
6. Collecting and reporting EPD data is an important starting point, but it is just one part of moving toward lower carbon construction.

7. It is important to clarify the definition of EPDs for consistency and to provide a foundation of understanding among the Legislature, advocacy groups, specifiers and the construction industry based on accepted standards.

8. EPDs typically report a material's cradle-to-gate embodied carbon and are an important tool to understand a product's environmental impacts including embodied carbon. They should only be used to compare like materials that are used in a similar function. EPDs are not to be used, nor is it appropriate, for a comparison between different building materials for the purposes of procurement or building material selection.

9. Currently variability exists within the EPD data reporting and the data collection process; it is not consistent for all building materials. When using this information to create a project's carbon footprint, the uncertainty should also be reported, to further a better understanding of the data's appropriate use.

10. Currently, the majority of available product EPDs are for a limited number of material categories and/or in selected manufacturing regions in Washington. Grant funding for capital investments and rebate incentives are needed to create EPDs for smaller producers across Washington.



11. Gathering information to increase reporting transparency, and learning from this data to pursue lower carbon construction solutions are worthy goals, however, the EPD data today for some industries is not mature enough to be ready for creating regulatory caps or limits reductions based upon that data.

12. Labor provisions of materials should be decoupled from the environmental impact provisions of materials. EPD's environmental impacts are based on methodologies that report impact indicators set forth in the Product Category Rules (PCR) . The PCR does not include social aspect indicators.

13. Embodied carbon knowledge needs to be shared state-wide with manufacturers, contractors, and other project stakeholders to dramatically reduce carbon on a wider scale; an outreach and education program is needed.

14. Manufacturers and Contractors are looking for a path to reduce embodied carbon that has both rigor and flexibility. A project-specific "carbon budget" approach considers a portfolio of materials as opposed to individual materials in isolation and offers the flexibility to offset higher emitting materials in some locations with lower-emitting materials to meet the net reduction goals for the project.

15. While EPDs can provide an analysis limited to the Cradle-to-Gate impacts, a Cradle-to-Grave analysis using Whole Building Project Life Cycle Assessment (WBLCA) analyzes all life cycle phases. WBLCA should be used by design teams to evaluate structural and other major assembly alternatives to confirm early design decisions. Early design decisions, including long-term durability, resiliency, and reuse impacts, should use WBLCA decision-making to maximize and holistically achieve carbon optimized construction.

16. The construction industry has a set of recommendations for immediate and longer-term implementation to advance material disclosure and reduce embodied carbon. Refer to the final section of this report for details.

Section 2: Supplemental Information

from Industry Group Members for the Section 7041 Proviso Report

Carbon Reduction Strategies, Sec. 7041 (2):
Proviso Requirement: "The work group shall identify and recommend carbon reduction strategies…"

Construction Industry Supplemental Information:
Refer to Section 4 of this report "Construction Industry Roadmap" for strategies to reduce carbon in the project scoping, design, procurement, and construction project phases.

Intended Application of EPDs, Sec. 7041 (2) (a):
Proviso Requirement: "Clarify the definition of environmental product declarations (EPD) to ensure that the EPDs are applied properly, consistently, and as intended…"

Construction Industry Supplemental Information:
Each type of material – cement, concrete, softwood lumber, hot-rolled structural steel etc. – has its own Product Category Rules (PCR) which govern the data collection and calculation methodology and affect the data of that material's Environmental Product Declarations (EPDs).

Since the system boundaries for each construction material PCR are unique, EPDs from one type of material cannot be compared with another type of material. For example, concrete cannot be compared to steel or wood simply by comparing the global warming potential numbers in their respective EPDs since they are not measuring the same data.

The current North American PCR for concrete has limitations. The PCR does not have the granularity of all strength classes that are used in design, does not require performance application specificities such as flow rheology and cure time, and is limited in the accounting of impacts in other life cycle stages of the product.

A potential and relatively straight-forward approach within one type of material is to compare the proposed Type III product-specific (or "actual production facility") EPD with the corresponding Industry Average EPD for that same material which the same functional characteristics (i.e., in the case of concrete, the same strength class).

Suggested Education Standards, Sec. 7041 (2) (b):
Proviso Requirement: "…create an education and standards brief…"

Construction Industry Supplemental Information:
While some industries, manufacturers, design teams and contractors in Washington have familiarity with EPDs, embodied carbon modeling, lower carbon design, and construction, this is a new topic for many. A meet-people-were-they-are-at outreach and education program is needed for these entire audiences to make meaningful reductions across the state and to ready stakeholders for future project requirements or potential legislation.

While the development of a detailed educational curriculum is outside the scope of this proviso, below is a list of target audiences and applicable topics:

Owners and Agencies:
The carbon impact of project programming, space flexibility, and project right-sizing; budgeting for long-lasting materials and reducing churn; defining carbon reduction requirements and baselines in RFPs (such as targeting a project wide XX% reduction below a measured and documented project GWP, calculated through project design quantities times industry average GWP data) and/or design-build bridging documents.

Architects and Structural Engineers:
The long-term carbon impact of early design decisions; lower carbon materials research and identifying true comparisons; WBLCA modeling options; communicating carbon reduction targets successfully in the contract documents and specifications; the importance of performance oriented specifications versus traditional prescriptive specifications enable and encourage the use of lower carbon materials.

Product Manufacturers/Material Producers:
The basics of embodied carbon; EPDs and the process of producing them; publishing EPDs to ensure visibility to the specifiers, maintain competitiveness, and comply with future requirements.

General Contractors:
The new role of the general contractor in managing the overall carbon goals across multiple materials; the need to forecast carbon in pre-construction so that procurement aligns with the project's specific path to meet the reduction target; how to communicate carbon reduction goals and documentation requirements to bidders; the importance of tracking carbon during construction to confirm the execution of the plan and/or make course corrections for unforeseen conditions.

Data Collection Process, Sec. 7041 (2) (c):
Proviso Requirement: "Outline the environmental project review data collection process in functional detail and use existing data-gathering resources such as EC3."

Construction Industry Supplemental Information:
Key actions (and the responsible party) for requiring, collecting, and analyzing embodied carbon data include:

Project Scoping (Owner):
Clarify in the RFP for design services and in the construction contract RFP the following: which building assemblies (i.e., structure, envelope etc.) are required to meet carbon reduction targets; the material-specific or project-wide carbon reduction target and the baseline from which reductions are measured; any material which are required to submit product-specific EPDs and the timing of that submission.

Design (Architect and Structural Engineer):
Use EC3 or similar embodied carbon EPD databases to research which materials currently have published and valid EPDs at the time of bidding; model the impacts of the specified products and their quantities to verify that products procured per the design and specifications can meet the required reduction target; include project-wide carbon reduction targets, and required EPD documentation within the specifications.

Pre-construction (General Contractor):
If the contractor is involved during design development, model the project's preliminary material assumptions and their quantities using the EC3 software to understand the relative carbon impact of each material and forecast how the procurement of those materials will drive the attainment of the project's carbon goal.

Bidding (General Contractor and Materials Suppliers):
The general contractor's Instructions to Bidders should include an explanation of the material's or project's carbon reduction requirement and the documentation needed from the bidder/material supplier; for materials that will likely have published EPDs available to all bidders, consider requiring EPDs for the anticipated products at the time of bidding.

Construction (General Contractor):
Use EC3 or similar embodied carbon software to model the actual materials and their quantities as procured and installed. Compare the job-to-date embodied carbon with the forecasted carbon model completed in design or in pre-construction, noting significant deviations; adjust concrete mix selections during construction if actual embodied carbon vary significantly from projections.

Following Substantial Completion (General Contractor):
For the assemblies or materials with reduction targets (i.e., "covered materials"), calculate the final quantities used in the project and calculate the embodied carbon of those products and reductions from the baseline. See below for a description of baselines and calculating reductions. Upload project data and the carbon reductions achieved to a publicly accessible database.

Maintenance of a Publicly accessible Project Embodied Carbon Data Base (Building Transparency)

Maintain and promote the use of a publicly accessible database to understand what the market is currently delivering in specific regions. Use this data to make sub-regional adjustments, if necessary, and to recalibrate reduction goals for future project requirements. The access by project teams and the using of this data is key for continual improvements in a given region which both "move the needle" and are implementable.

Establishment of Baselines, Sec. 7041 (2) (d):

Proviso Requirement: "Identify measurable outcome criteria to establish a project baseline..."

Construction Industry Supplemental Information:

At the Product-level:

Use an Industry Average EPD as the Baseline:
Compare the embodied carbon of each installed material to its corresponding industry average EPD embodied carbon. Sum the material quantities used in the final construction and then multiply the product quantities by the global warming potential shown in product specific EPD. Then compare that as-built embodied carbon to the industry-average embodied carbon for the same quantity of material. This method requires only EPDs and simple math calculations. Calculations can also be done with an online tool or within a spreadsheet.

The third-party reviewed industry average EPD values should be provided by the following material organizations:

Wood – American Wood Council (AWC)

Steel – American Institute of Steel Construction (AISC)

Steel Reinforcing – Concrete Reinforcing Steel Institute (CRSI)

Ready Mixed Concrete – National Ready Mixed Concrete Association (NRMCA)

At the project-level:

Since each project is a unique collection of materials and the proportions of installed materials vary with each project, it is difficult to establish a fixed project-level baseline that can be generally applied to a wide range of buildings.

A possible approach is to use a **Project-specific Carbon Budget** for covered materials. In this method, industry averages for each material category define the material-specific baselines and then the baselines for all the covered materials are combined as a weighted average project-specific baseline to reflect the proportion in which they are occur in the project.

This is similar to a financial portfolio, where each holding is measured against its corresponding index, but the portfolio performance is measured as a whole and is the weighted average of the performance of all the individual holdings.

Express Embodied Carbon Reductions as the Percentage Difference between the:

Industry Average Case (Design):

Calculate total project embodied carbon by summing each covered material's contribution to project embodied carbon (quantity of each of type of material used multiplied by the corresponding industry average specific EPD)

As-built Case (Final Project):

Calculate total project embodied carbon by summing each covered material's contribution to project embodied carbon (quantity of each type of material used multiplied by the corresponding product specific EPD)

This approach compares materials with like materials. Because the reductions are measured as a weighted average of the "portfolio", this provides flexibility when one material exceeds the industry average, it can be compensated by selecting another material that is below the industry average in equal measure.

Identification of low(er) carbon building materials, Sec. 7041 (2) (e):
Proviso Requirement: "Identify sustainable and low-carbon emitting materials…"

Lower carbon materials may include these materials with the following characteristics:

Concrete products:
When appropriate for the application and in accordance with the project requirements, use performance oriented specifications and concrete with Portland Limestone Cements (Type 1-L) or blended cements which reduces the amount of limestone clinker, supplementary cementitious materials, and recycled aggregates.

Steel products:
When available for the application and in accordance with the project requirements, maximize the use of steel with high recycled content and produced in electric arc furnace mills using electricity with a low carbon fuel mix and/or electricity from renewable energy sources. Not all required products will be able to meet this goal.

Wood products:
Sourced from forests that exceed requirements in the State's Forestry Practices Act and minimize the carbon release associated with ground disturbance.

Section 3: The State of Material Disclosure in Washington

1. **The Evergreen Advantage:**
   Washington has advantages that many regions do not enjoy: net-zero carbon electricity powers the electric arc furnace technology in Seattle's steel mini-mill, carbon-reducing Portland Limestone Cement (Type 1-L or PLC) is widely used in metropolitan areas, and wood with chain-of-custody certification demonstrating climate and habitat friendly forestry is available in Washington. There is also a unique confluence of climate-savvy owners and agencies, manufacturers producing lower carbon products, architects, structural engineers, and general contractors experienced in embodied carbon modeling and delivering projects which reduce carbon from industry baselines. Finally, academia and non-profit organizations in our state have elevated awareness of embodied carbon in North America and beyond.

2. **The Changing and Uneven Landscape of Material Disclosure:**
   The last ten years have seen rapid and exponential interest in disclosing the environmental impacts of products, and in particular, building materials. Environmental Product Declarations (EPDs) are the driving force of much of this disclosure, particularly the impacts of greenhouse gasses also referred to as "GHG", "CO2-equivalents" or "embodied carbon." While the uptake of published EPD from Washington's manufacturers is impressive – 2,614 unique Washington products currently in the EC3 Database – it's important to realize that this is concentrated in a few industries at a few manufacturing locations, mills, or batch plants. So, while the total of EPDs is impressive, that does not indicate that all manufacturers in all regions are disclosure-ready today.

3. **Growing and Centralized Databases:**
   EPDs when published often appear on the website of the various EPD program operators. Traditionally, this resulted in decentralized information and has hindered meaningful analysis. Currently, there are several organizations seeking to consolidate embodied carbon data to support informed decision-making. Launched by the University of Washington's Carbon Leadership Forum (CLF) and now administered by the non-profit Building Transparency, the EC3 sustainability software is the de facto, albeit incomplete, product-level database for North American building product EPDs. At the project-level, the American Institute of Architects' AIA 2030 DDx program and the Structural Engineering Institute's SE 2050 program are both developing embodied carbon databases at both the project- and firm level. Project-level data is generally less developed currently than product-level data.

4. **Material Comparison Caveats:**
While databases can provide a centralized collection of downloadable EPDs and help users understand how a specific product compares in the context of similar products, there are some important caveats for database users to understand EPD limitations:

   - **EPDs often only include some of the lifetime carbon impacts:**
   Over a product's lifetime, embodied carbon can occur during several lifecycle stages, beginning from the extraction stage (A1), the "cradle", through the demolition stage (C) to the potential reuse stage (D). It's important to note that almost all EPDs appearing in a database just look at a portion of lifetime embodied carbon, the so-called "cradle-to-gate" stages (A1-A3). With some materials, the end-of-life stages are particularly important and whether a material can be economically and effectively recycled or whether it goes to a landfill can have embodied carbon implications, both positive or negative.

   - **Not all products in the database may be available to a supplier:**
   Depending on contractual relationships or the vertical organization of some building material suppliers, not all products viewable in a database may be obtained by all suppliers. In short, selecting the lowest carbon options appearing in the database may be out of reach for the contractor due to cost or contractual limitations.

   - **Some products which appear comparable, are not:**
   Ideally, a database could filter like materials to ensure that comparisons are between truly "peer" projects.

   Concrete presents a special challenge since mixes are classified and typically compared to mixes of similar strength, such as 4,000 psi or 6,000 psi. But not all mixes of the same strength serve the same function or application. For example, two mixes of the same strength class (i.e., 5,000 psi concrete) used in dissimilar applications (i.e., slab on grade vs. post-tensioned elevated slabs) will have differing abilities to reduce embodied greenhouse gases due to differing requirements to achieve early strength.

   For this reason, the database user needs to drill down on how the mix is used, its application, and not just its strength at 28 days to identify true "peer" materials for meaningful analysis.

   Very careful attention is needed when comparing concrete products, particularly by project members who may not have a detailed understanding of the different types of concrete applications and the nuances of producing the most appropriate concrete mixes for a specific application.

   In the case of steel, it's important to distinguish between various types of steel such as hot-rolled sections and hollow sections due to differering metallurgy and production processes.

   For this reason, overall project GWP reduction goals can be meaningful, but material specific GWP caps may often lead to un-intended consequences, and may not always incentivize or achieve lowest carbon construction.

5. **Low Carbon Sourcing Plan:**
   Energy-intensive manufacturing is both carbon and cost-intensive, so there is often an inherent business case for reducing energy use and the associated carbon. Despite this alignment of reducing cost and carbon, there are significant challenges with adequate sourcing of low carbon ingredients and the timeline to bring on additional production capacity. A comprehensive and inter-agency analysis with industry input is needed to address capacity issues in the coming decades while safeguarding ecology and water quality.

- A successful carbon strategy must recognize and adapt to the fact that the construction material supply chain is complex and dynamic.
- Global supply chain and material source limitations, manufacturing plant maintenance outages, and labor disruptions have demonstrated that material sourcing can change during construction, necessitating an unavoidable change from the anticipated material from the database and the actual material available at the time of installation.
- To address these challenges, we recommend that Washington State study current supply-chain challenges and develop a 2030 Low Carbon Source Material Plan (2030 LCSP).
- One element of this 2030 LCSP should be a comprehensive plan to maximize the in state production of Cementitious materials (lowest carbon materials) when feasible. The plan should also include the scope of producing natural pozzolanic materials for use in the cement supply chain and funding for capital investments in production facilities.

Photo: Dave Walsh

Definitions

Definitions Excerpted from the
American Institute of Architects-
Carbon Leadership Forum
EMBODIED CARBON TOOLKIT FOR ARCHITECTS

Authors: Meghan Lewis, Monica Huang, Stephanie Carlisle, Kate Simonen

Embodied carbon emissions
Embodied carbon emissions are generated by the manufacturing, transportation, installation, maintenance, and disposal of construction materials used in buildings, roads, and other infrastructure.

Life Cycle Assessment
Life cycle assessment (LCA) is a methodology that is used to measure the environmental impacts of a building, product, or process over its full life cycle, from raw material extraction through end-of-life and disposal. LCA measures impacts through a variety of metrics, such as global warming potential, acidification potential, eutrophication potential, smog formation potential, and ozone depletion potential. Global warming potential (GWP) is the metric used to measure and track embodied carbon. GWP is quantified in kilograms of CO_2 equivalent (kg CO_2e). The "equivalent" or "e" in "kg CO_2e" means that other greenhouse gases like methane are included alongside carbon dioxide and normalized to the impact of CO_2 based on their radiative forcing potentials relative to CO_2.

Life Cycle Stages
The life cycle of buildings and building materials are broken into four main life cycle stages:

A: Manufacturing and construction
B: Use
C: End-of-life
D: Benefits & loads beyond the system boundary

Building vs. Product LCA
Building vs. product LCA In the building industry, architects will typically encounter LCAs being performed at two different levels:

"Building-level LCAs", which are typically referred to as whole building LCAs (WBLCA)

"Product- or material-level LCAs", which are typically communicated via an environmental product declaration (EPD). EPDs are created by LCA practitioners and product manufacturers.

Section 4: A Construction Industry Roadmap for Carbon Policies

Immediate Recommendations (2022-2023)

1. **EPD Funding:**
   Provide matching grant funds for smaller building material manufacturers in Washington to produce product-specific Environmental Product Declarations. Since producing EPDs require the collection of 12 months of data, funding should not be delayed so smaller manufacturers can begin this data collection now to be ready for future disclosure requirements and maintain their long-term competitiveness. The external costs for a single facility to produce EPDs consists of data collection costs and analysis costs (site and facility specific). The costs for EPD generation by a EPD provider is approximately $5,000, plus subscription fees. Additional third party verification costs are approximately $2,000 or more with ongoing annual maintenance fees of $2,000 per facility.

2. **Fund and Implement an Outreach and Education Program:**
   Develop an embodied carbon and EPD education and outreach program for the project stakeholders as outlined above for Proviso section 7041 (2) (b).

3. **Publicly Accessible Embodied Carbon Database:**
   Fund a publicly accessible database of completed projects with embodied carbon, material type and quantity data; the project name, the project team members, and suppliers/manufacture names shall be redacted. To ensure fair comparisons between projects, the database should also include more granular information such as the type(s) of structural system, the types of building material applications, and the project location.

   Owners, agencies, and design teams are encouraged to use data from past "peer" projects which have similar materials, concrete applications, project size, and project location to understand the "business-as-usual" (BAU) case and to inform goal setting for future projects as the new BAU.

4. **Project Scoping Carbon Impact Analysis:**
   Prior to state agencies issuing a project design RFP, require agencies to conduct studies to confirm the necessity and the "right-sizing" of projects, and the adequacy of project budgets to support the purchase of primary structural and enclosure materials with a 60-year or longer life span.

5. **Carbon Reduction Targets for State Design-Build Projects:**
   When a state-funded project is eligible for design-build project delivery, require quantifiable embodied carbon budgets and identify the baseline for measuring the budgets. Unlike the design-bid-build project delivery method, the design-build method enables the crucial early and iterative collaboration between the design team, general contractor and material producer which is needed to optimize solutions that satisfy carbon budget, schedule, and cost requirements. This model was successfully tested in the design-build Helen Sommers State Office Building in Olympia.

6. **Define Reduction Requirement as Project-Specific Carbon Budget:**
   As described above, setting a project-specific carbon budget can provide both rigor (measurement against published industry averages) with the flexibility (the ability for contractors to offset higher emitting materials with lower emitting materials in equal measure).

7. **Encourage Continued Conversion to Portland Limestone Cements; Type 1-L Cement:**
   Allow Type 1-L cement in specifications for public projects across the state. Type 1-L is not currently allowed by code on many projects at the City, County, and State levels. Coordinated efforts should be made to allow by code Type 1-L cement in all mix designs. Often this simple restriction prohibits a concrete supplier from making this easy change.
   Adoption and conversion to PLC will require overcoming regulatory and financial hurdles in permitting and installation of new equipment such as silos for the manufacturer.

Within Five Years (2022-2027):

1. **Expand the Focus beyond Procurement to Whole Building LCA**
   Recommend requiring Cradle-to-Grave Whole Building Life Cycle Assessment (WBLCA) during design development for state-funded projects over 50,000 square feet to test alternatives and confirm early design decisions such as:
   - the choice of the structural and enclosure materials
   - the type of structural systems
   - the impact of column spacing and spans
   - the ability for structural and envelope systems to be demolished and or disassembled to maximize recycling of materials in future projects and minimize landfill volumes and the associated potential methane release.

- The WBLCA scope would be a cradle-to-grave analysis and would measure trade-offs such as when a higher GWP material is intentionally used to reduce overall quantities for a net GHG reduction or use of material results in a reduction of operational carbon resulting in an overall lifetime net carbon reduction.

2. **Reward Manufacturing and Transportation Reductions:**
   Provide a point bonus during bid award analysis for manufacturing facilities that have reduced manufacturing energy usage and process emission through participation in programs such as Energy Star Plant Certification, the Concrete Sustainability Council, or conversion of diesel equipment and delivery trucks to either renewable diesel, CNG (RNG) or electric.

3. **Analyze the Embodied Carbon Database to Re-evaluate Project Targets**
   As more project data become available in publicly accessible databases, such as EC3, reevaluate what level of carbon reduction is no longer a stretch goal and has become the business-as-usual case. Recalibrate stretch goals for project in collaboration with input from the structural engineering, material manufacturing and contracting stakeholders.

2030 and Beyond:

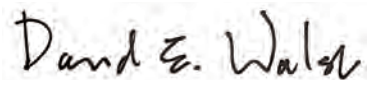
1. **Low Carbon Sourcing Plan:**
   Convene an industry and cross agency working group to identify and provide solutions to supply-chain challenges of lower carbon source materials. Issue an actionable Low Carbon Sourcing Plan (LCSP) to increase the availability of these materials.

As a participant in the Construction Industry Work Group convened by the Department of Enterprise Services, I want to thank the Department for the opportunity to provide supplemental information to the SHB 1080 Section 7041 Proviso Report.

This information reflects not only my perspective as an architect and as the former Director of Sustainability of Sellen Construction, but also my ongoing conversations with the architectural, structural engineering, manufacturing and construction communities regarding embodied carbon.

In an effort to include multiple viewpoints on this Proviso and embodied carbon, this document also benefitted from subject matter expert comments from members of the Construction Industry Work Group including: Magnusson Klemencic Associates, the National Ready Mixed Concrete Association, the Washington Aggregates and Concrete Association, CalPortland, Lehigh Hanson, Inc., and CRH Americas Materials.

Respectfully submitted,



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