VERDANT
Structural Engineers

EMBODIED CARBON ACTION PLAN - 2024 (Year 4):

At Verdant Structural Engineers, we aim to perform carbon conscious designs. We specialize in projects utilizing optimal and efficient use of conventional building materials, as well as projects utilizing environmentally sensitive methods and building materials such as straw bale, hemp-lime (hempcrete), rammed earth, cob, adobe, super adobe, earthbag, and bamboo. VSE works closely with the natural and green building community to develop standards and procedures for green building practices.

We support the vision that all structural engineers shall understand, reduce, and ultimately reach net-zero embodied carbon in their projects by 2050. During our fourth year of participation in the SE2050 movement, we commit to implementing and completing the action plan outlined below.

Embodied Carbon Reduction Champion (ECRC):

Nora Murray will continue as the ECRC and the firm administrator for the SE2050 database.

EMBODIED CARBON EDUCATION PLAN:

Our firm's strategy to educate employees about embodied carbon and reduction methods will focus on webinars and short reading assignments, followed by office wide discussions, and application of knowledge learned. The assignments will be selected specifically to aid in the reduction of embodied carbon in our day-to-day design decisions.

Education Electives: (2 required, 4 recommended)

1. **(Required) Embodied Carbon Reduction Champion - Office Engagement:**

   Nora Murray in the role of ECRC will continue to implement the office-wide education plan by communicating with the staff using the in-office SE2050 Slack channel. She will continue to share resources, reports, and reading/webinar assignments. Office wide discussions for reading/webinar assignments will take place during all-hands meetings.

This year's reading assignments will continue to focus on the core concepts & skills training tools available in the Resources section on the SE2050 website. We will be focusing on reinforced concrete, optimizing foundation design to reduce concrete volumes, and exploring carbon-conscious detailing practices.

The ECRC will also introduce our SE2050 commitment and embodied carbon action plan to new engineering staff and assign the on-boarding embodied carbon education webinars.

2. **(Required)** All engineering staff will watch one webinar on the topic of Embodied Carbon and share main takeaways during our all-hands meeting.

   Webinar options:

   TEDxSeattle: Change our buildings, save our planet by Andrew Himes, CLF's Director of Collective Impact

   Environmental Protection Agency (EPA) webinar: Reducing Embodied GHG Emissions: Construction Materials Prioritization & Env. Data Improvements

3. **(Recommended)** All new engineering staff will be asked to watch the following three webinars as part of the on-boarding process within the first three months of joining the Verdant team.

   Boston Society of Architects "Embodied Carbon 101" sessions listed below:

   - Embodied Carbon 101: Basic Literacy

   - Embodied Carbon 101: Procurement

   - Embodied Carbon 101: One additional session of choice

4. **(Recommended)** All engineering staff will continue to engage in embodied carbon reduction design skills (SE2050 Resources) with an emphasis on reinforced concrete. Additional resources below will be used.

   National Ready Mixed Concrete Association EPD

   Carbon Smart Materials Palette

5. **(Recommended)** One staff member will engage with a Carbon Leadership Forum (CLF) Regional Hub by attending presentations or working sessions and reporting back to the firm.

KNOWLEDGE SHARING PLAN:

We will share our firm's efforts and lessons learned with our clients, the design community, and the public by adding a SE2050 Commitment Update post on our company website and sharing the post on social media. The update will include our BEAM LCA data summary, embodied carbon intensity comparison of our projects, and a conclusion of our findings. We will highlight the highest embodied carbon contributors and the benefits of using carbon storing materials, such as straw bale insulation. The findings will also be presented in our all-hands meeting by the LCA team.

EMBODIED CARBON REDUCTION STRATEGY:

Reduction Goal:

Our embodied carbon reduction strategy includes efforts to reduce embodied carbon in our designs by encouraging our engineers to select wood products and steel sections with lower embodied carbon based on EPD data. We will continue to collaborate with contractors to use reduced embodied carbon concrete mixes, and continue our firm's commitment to use and promote the use of biogenic materials and products.

Our general notes have been updated to include specifications with reduced cement ratios and SCM recommendations. Our goal is to continue to engage with contractors for 80% of our projects, request concrete mix submittals, and log received submittals for our use and reference. As the industry and suppliers continue to move in the direction of reduced carbon mixes, we hope to increase the use of mixes with EPDs to better quantify concrete carbon reduction for our projects. We will also explore the use of Limestone Calcined Clay Cement (LC3) as it becomes available in our area.

We encourage the use of lumber that is reclaimed/salvaged and certified by The Forest Stewardship Council (FSC) or The Sustainable Forestry Initiative (SFI) or from locally sustainable harvested sources.

Reduction Electives: (1 required, 4 recommended)

1. **(Required)** Firm-wide reduction targets:
   Short term (1 yr) reduction target: Our short term reduction target is to work with contractors and concrete suppliers to reach an average of 225 lb/yd3 of portland cement in mix designs collected in 2024.
   Long term (5 yr) reduction target: Our long term reduction target is to work with contractors and concrete suppliers to reach an average of 175 lb/yd3 of portland cement in mix designs collected between 2024 - 2029.

2. **(Recommended)** Incorporate sustainably harvested biogenic materials on at least one project.
3. **(Recommended)** Develop and implement a workflow that makes it easier to make early design decisions based on embodied carbon. This will be focused on strategies to help us reach our reduction targets.
4. **(Recommended)** Update specifications to incorporate embodied carbon performance criteria. This will be focused on strategies to help us reach our reduction targets.

EMBODIED CARBON REPORTING PLAN:

Getting The Data:

We will continue to use the BEAM LCA tool to quantify embodied carbon for A1-A3 (cradle-to-gate) stage. BEAM has been formally released and is now available for industry wide use. We have selected this tool because it includes embodied carbon data for carbon storing materials such as straw.

The material quantities to be used/input into the BEAM LCA tool will be calculated with an in-house created spreadsheet using our construction documents, with the understanding that actual material quantities used in construction may vary. In the future, we would like to transition to BIM modeling to extract material quantities more accurately and efficiently.

As LCA tools continue to improve and develop, we are open to trying a different LCA tool in the future.

LCA Internal Training:

We will train one additional staff member on the BEAM LCA tool, increasing our team size to six staff members with BEAM LCA tool proficiency. Each team member will perform one LCA to obtain project data that will be submitted to the SE2050 database by March 31, 2025.

The long term goal is to train all of our engineering staff to be LCA proficient and perform one LCA (minimum) annually to be submitted to the SE2050 database. We will incrementally train one staff member each year, until all engineering staff members are trained.

Reporting Commitment:

Our goal is to meet the minimum requirement of submitting embodied carbon data for 2 projects by the deadline, with efforts made to submit additional projects

when completed by each trained staff member throughout the year. The projects will be strategically selected to be of similar size and complexity. Ideally, one project will be a conventionally wood framed structure and the others will include biogenic, carbon storing materials, and a concrete mix with 50% SCM or greater. The projects selected for LCA will be completed or in a late stage of construction.

Reporting Electives: (1 required, 2 recommended)

1. **(Required)** Submit a minimum of 2 projects to the SE 2050 Database.
2. **(Recommended)** Compare the embodied carbon emissions from multiple projects across your firm. Analyze and document what data or pieces of information are most important and communicate the findings to your firm.

ADVOCACY PLAN:

Marketing:

We have been and will continue to share our knowledge via social media posts and conference presentations to bring awareness to industry partners of ways to reduce embodied carbon in the built environment. All staff email signatures have been updated to include the SE2050 logo to bring awareness to our collaborators that we have joined the commitment.

Proposals:

Language declaring our commitment to SE2050 will be added to our proposal template.

Advocacy Electives: (2 required, 4 recommended)

1. **(Required)** Describe the value of SE2050 to clients. Collaborate with the design team to reduce embodied carbon.
2. **(Required)** A declaration of our firm's commitment to SE2050 is posted on the company website.
3. **(Recommended)** We will engage with structural materials suppliers in our region to communicate the importance of Environmental Product Declarations (EPDs) and low-carbon material options.
4. **(Recommended)** Engage with local, state, and federal governments to communicate the importance of low-embodied carbon procurement and construction policies.

LESSONS LEARNED:

Concrete Mix Submittals:

Since joining SE2050, we have focused our efforts on the reduction of cement in concrete. We regularly request concrete mix submittals from contractors, however we don't always receive the submittals. I have brought up this topic during the breakout sessions in the quarterly SE2050 meetings. From the responses from peers in the breakout group, it seems this is not an issue for commercial projects or large scale projects. I am often the only person in the group representing a firm that primarily works on custom residential projects. There is a local jurisdiction that has adopted the CAL Green requirement for 25% SCM in concrete mixes. This may help increase the responsiveness to our request for submittals. We will continue to request concrete mix submittals and talk to contractors about the reasons behind our request. We hope to increase the number of mixes we receive in 2024 so we can better track our reduction efforts.

Life Cycle Assessments:

We established a new workflow for using the BEAM LCA tool. As suggested by the tool creator/administrator, we created a single google account dedicated to the LCA tool that each team member signs into inorder to access the tool and store our LCAs in one location. This has helped solve the multi-user problems we encountered the previous year. As our LCA team continues to grow, we will learn the capacity of this solution.

We continue to use our in-house material quantities spreadsheet to calculate material quantities entered into the LCA tool. One of the difficulties previously encountered included the calculation of linear feet of reinforcement in each bar size. This reinforcement calculation becomes increasingly complicated when a footing type contains multiple reinforcement bar sizes. Improvements have been made to help simplify this calculation, but the process remains time consuming.

In efforts to improve the accuracy of the LCAs, we try to use our best judgment when making assumptions that will affect the carbon intensity of a project. We have encountered limitations with the materials library available in the LCA tool we are currently using. These limitations highlight the importance and need for manufacturers to have EPDs available for their products. Our current way of addressing this lack of available data is to include embodied carbon data of a similar material or alternatively not include the material in the LCA at all. Neither option is ideal, but we expect the accuracy of the LCAs to improve as more EPDs become available.

Projects Submitted to Database:

Our ECAP for 2023 included a commitment to train two additional engineering staff members to use the LCA tool and submit six projects to the database. We optimistically aimed for that goal, but were unable to meet that commitment. Only one additional staff member was trained on using the LCA tool and only four projects were submitted to the database.