VERDANT
Structural Engineers

EMBODIED CARBON ACTION PLAN: 2023 (Year 3)

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 building materials and methods 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 third 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 will focus on 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 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 be focused on the core concepts & skills training tools available in the Resources section on the SE2050 website. The

content will focus on educating the staff about the embodied carbon found in wood and steel, focusing specifically on the building products on the American Wood Council EPDs list and the AISC Steel EPDs list.

Nora will also introduce our SE2050 commitment and embodied carbon action plan to new staff and assign the on-boarding 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 engage in embodied carbon reduction design skills (SE2050 Resources) specifically focused on wood and steel materials using the resources below. This is in addition to our current efforts to reduce embodied carbon of concrete.

   American Wood Council EPDs

   AISC Steel EPDs

   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.

6. **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 will include 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 our collaboration 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 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)** Collaborate with concrete suppliers to reduce carbon in mix designs.
2. **(Recommended)** Incorporate sustainably harvested biogenic materials on at least one project.
3. **(Recommended)** Complete an embodied carbon comparison study during the project concept phase for one project.
4. **(Recommended)** Update specifications to incorporate embodied carbon performance criteria.

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 focus on training two additional staff on how to use 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 we will submit to the SE2050 database in January of 2024.

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 add two staff members each year to the LCA team until all engineering staff members are trained.

Reporting Commitment:

Our goal is to submit embodied carbon data for six projects to the SE2050 database. 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. Ideally, the projects selected for LCA will be completed or in a later 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)** Publicly declare your firm as a member of the SE 2050 Commitment.
3. **(Recommended)** Encourage industry and policy change by promoting and using low-carbon and carbon sequestering materials.
4. **(Recommended)** Engage with local, state, and federal governments to communicate the importance of low-embodied carbon procurement and construction policies.

LESSONS LEARNED:

For our second year commitment, we performed and submitted LCA (A1-A3) data to the database for four residential projects of various sizes and complexities. The LCA team encountered several challenges that highlighted the limitations of the LCA tool we are using, the difficulties of calculating material quantities for complex residential structures, and the pros/cons of performing a LCA for a completed project versus a project in the design phase.

LCA Tool:

With the addition of two more staff members joining the LCA team, we encountered the limitations of having multiple users signed into the LCA tool. The tool is google sheets based and gets shared by the administrator with a user. The issue we encountered was that the tool is not designed to be accessed by multiple google accounts. We discovered this when trying to open previously created LCA files and received an error message. The proposed solution is to have a single google account dedicated to the LCA tool that each team member will sign into inorder to access the tool. If this continues to be an issue, this will be a strong factor in seeking an alternative LCA tool for future use.

Calculating Material Quantities:

The first year LCA projects, we selected small structures with straight forward foundations, simple architecture and framing systems, and few material types. We created a simple spreadsheet to help with the calculation of material volumes to enter into the LCA tool. It was a good starting point and introduction to the process. However, the second year we selected projects that are more in line with our typical project size and complexity. It quickly became clear that our initial spreadsheet was inadequate to handle complex foundations, framing for complex architecture, and an increased variety of material types. Tips learned included requesting the complete permit architectural plans from the architect and using the information shown on the Title 24 sheet. The Title 24 information typically includes areas for doors, windows, roof, floor, and walls which are broken up by building direction (N, S, E, W elevations). The use of door and window schedules is helpful if that information is not shown on the Title 24 sheet. The use of SketchUp to create models of foundations for concrete volume calculations was also implemented by one of our team members.

LCA for Projects in Design Phase vs Completed:

Three out of the four projects we selected to perform an LCA were completed or far along in the construction phase, one of the projects is still in the design/permitting phase. What we learned is that the LCA for completed projects is quantitative with a final result, the concrete mix is known, the field changes are known, and finishes are known. While the LCA for projects in design are qualitative and fluid, with the potential to influence design decisions along the way. A downside is that this may require more effort over an extended period of time.