

EMBODIED CARBON ACTION PLAN

2022



LINCHPIN
STRUCTURAL
ENGINEERING

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Introduction

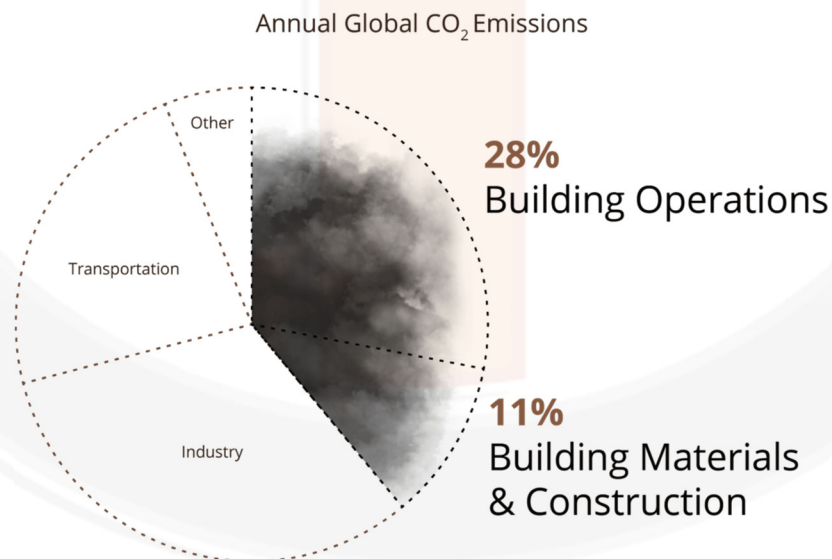
Linchpin Structural Engineering serves a wide array of projects across most of the Western United States ranging from commercial to residential, large and small scale. Our projects are built with every major structural material and vary from single room remodels to million-square-foot warehouses. With expertise in such a multitude of construction materials and methods, our experienced and diverse team of design professionals are excited and uniquely suited to expand into the world of sustainability.

This Embodied Carbon Action Plan (ECAP) outlines our firm's commitment to SE 2050. Our goal in creating this plan is to set a standard for our firm moving forward as an environmental leader in the building industry as well as advocate the necessity for sustainable construction practices to all our industry partners.

Background

SE2050 is a structural engineering industry movement towards net zero embodied carbon structural systems by the year 2050. It is composed of a group of structural engineering firms committed to tracking and reducing their projects' contribution to global emissions issues. The primary mechanism for that effort is the analysis and reduction of buildings' Embodied Carbon, which is defined as "the carbon dioxide (CO₂) emissions associated with materials and construction processes throughout the whole lifecycle of a building or infrastructure" (Carbon Cure Technologies, Inc, 2022).

Architecture 2030 reports that buildings make up a collective 39% of all annual global CO₂ emissions with 11% produced directly from building materials and construction (Architecture 2030, 2018). Of that 11%, 9% is produced by concrete, iron and steel (WoodWorks Wood Products Council, 2021).



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Data Sources: Global ABC Global Status Report 2018, EIA

However, as new technologies lead to quickly increasing efficiency in building operations, including demand reduction, renewable energy, and passive energy techniques, the main emissions source for buildings will increasingly be the embodied emissions from the building material components. By 2030, it is estimated that embodied carbon will comprise 72% of new construction carbon emissions (Architecture 2030, 2022), and it will become increasingly essential to address the impact of the structural materials we design with.

Given that the emissions associated with building materials are such a crucial and growing issue, it may be surprising that it is so ill-discussed. The primary issue is the lack of awareness of the issues, both within the industry and in the general public. There is also a sense of general reticence on the part of designers and contractors to change the apparently adequate methodologies that have been in place for years. Finally, given these issues, mentioning “sustainable practices” during design discussions often gives the impression of added red tape and expenses to a project, leaving contractors wary of getting on board.

Nonetheless, developers are beginning to recognize the appeal and long-term cost savings of green buildings. A study by the U.S. General Services Administration found that green buildings use 27% less energy, have 13% lower maintenance costs, and report 27% higher levels of occupant satisfaction than their classically designed counterparts (General Services Administration, 2008). As the data in favor of green design continues to build up, the sustainability movement will continue to gain ground and will eventually become standard practice. Now is the time for the structural engineering industry to commit to doing our part in reducing the global environmental impact of our work. It is important to understand that in the early stages of this effort, efficiency and knowledge will be scarce, and immediate impacts may be minimal, but that should not deter us from taking a stand and making a change. In time, efforts will accumulate and lead to larger, more meaningful shifts in standards and impacts.

Education

The first step in tackling any problem is to fully understand the issue. Where does Linchpin fit in? Our first task is to clearly define our role within this building lifecycle, which -- as a strictly structural engineering firm -- lies with controlling the construction materials and resources our structures use and how they are sourced.

Linchpin has established a Sustainability Committee within the firm, whose responsibility will be to research sustainable design practices and compile resources for internal use. The Committee will work to modify our design specifications and practices to reflect the most sustainable options available based on current research. The Committee will highlight any notable resources with the rest of the firm in our company-wide monthly meeting and continue to update our resources and specifications as our knowledge evolves.

*Understanding our
impact on carbon
emissions in the
structural design and
construction industry*

Our next task is to begin educating our industry partners about our efforts and ways that we can work together to achieve embodied carbon reduction in our structures. For more on this, see the *Advocacy* section of this report.

First Year Education Initiatives:

- Submit ECAP to SE 2050 and distribute it within the firm. The ECAP will also be available on our company website and shared with notable clients.
- Compile a resources library of information to help outline the role and opportunities we have in sustainability efforts, which will be shared with the rest of the firm. The committee will take the initiative to summarize our resources for ease of reference.
- Share a webinar reviewing the impacts of embodied carbon with everyone in the firm, followed by an open discussion and opportunities for questions and clarifications.
- Pursue LEED Green Associate status for Sustainability Committee members to learn more about holistic green building approaches and collaborative design methods to reduce building emissions.

Reporting

As part of the SE2050 initiative, firms will gather and report data about the embodied carbon in their projects through a Life-Cycle Assessment (LCA). This process involves compiling a detailed takeoff of material quantities and attributes for a project and using an analysis program to determine the total Global Warming Potential (GWP) that the building's structural materials comprise. This GWP data will be compiled and reported to SE 2050, along with the building type, size, occupancy, and other categorical data to build a database of projects for comparison and tracking.

Reviewing and tracking embodied carbon impacts and trends for various structural systems

Over time, the goal is that sustainability initiatives in structural design reduce and eventually eliminate the embodied carbon in our structures, and that trend can be traced through reporting history. Reporting will also allow analysis of the most impactful initiatives and the most and least sustainable building types to inform industry professionals about the most worthwhile efforts toward green building.

The limits of our ability to report a project's embodied carbon footprint is closely tied to the client's interest in such data. While internally we are committed to reducing material usage through involved structural design, the feasibility of performing a full LCA on a project will be evaluated on a case-by-case basis and will be somewhat dependent on owner and architect buy-in for the time being. It is our hope that we will eventually develop an efficient, streamlined process that will allow us to perform at least cursory LCAs on most, if not all, projects that we produce.

First Year Reporting Initiatives:

- Communicate with current and future clients about Linchpin's stance on sustainable design for *all* projects, opening the doors for client involvement on their project specifically.

- Publish Carbon Emission Reports for a number of select projects that are produced by Linchpin, including those projects submitted to SE 2050. Four projects are required (two per office) to be submitted to the SE 2050 database. Unless the opportunities arise, we do not intend to exceed this goal this year; however, Linchpin intends to use these four projects as a baseline for future projects of equivalent scope.
- For our inaugural reporting cycle, Linchpin intends to use the ECOM reporting tool provided by SE 2050 to create a baseline standard of practice and familiarize ourselves with the analysis and reporting process. In the following cycle, we intend to explore the different outputs and advantages of the other life-cycle-analysis tools available and compare them to determine our optimal analytical output moving forward.
- Develop and standardize material takeoff procedures and schedules in Revit that can be implemented for any project of any size. We will not have a specifically dedicated BIM manager performing embodied carbon analytics, but all our engineers are Revit-savvy and enthusiastic about learning new tricks to expand their capacities in BIM software. The goal is that all employees will have the opportunity to learn how to use material takeoff schedules to their advantage and report their project's specifications to a database for future reference.

Reduction

Working towards the goals of the SE 2050 commitment program, Linchpin will develop strategies to reduce the embodied carbon in the structures we design. In our first year, we will utilize resources provided at se2050.org to educate ourselves and identify strategies to implement. One of our initial goals is to rewrite our concrete specification to reduce embodied carbon; this may be accomplished in part with collaboration with concrete suppliers and industry partners. Additionally, we are in the early planning stages of a commercial building that aims to achieve a high level of LEED accreditation.

Specifying low-carbon materials and implementing life-cycle analysis to optimize material specification

First Year Reduction Initiatives:

- Update concrete specification to performance-based design and explore options of replacing Portland Cementitious materials with equivalent supplementary materials (such as fly ash).
- Update all materials specifications to request (but not require, yet) Environmental Product Declarations (EPDs) from manufacturers, fabricators, and suppliers, to begin the conversation regarding material impacts and lower-carbon options.
- Explore options for local material sourcing.
- Aim to specify partially grouted CMU walls when appropriate to reduce material and improve design efficiency.
- Work with concrete suppliers to understand their capacity to provide concrete mixes designed to reduce embodied carbon and familiarize ourselves with the Environmental Product Declarations of manufacturers.

- When possible, make an effort to specify wood construction to take advantage of carbon sequestration.
- Participate in a LEED project design, particularly in the early stages of design collaboration.

Advocacy

To achieve the goals of the SE 2050 commitment program, our industry as a whole must evolve. To help this evolution, Linchpin will advocate for the program in various ways including the addition of boilerplate proposal language, sharing our commitment to SE 2050 on our company website, and collaboration with project design teams to reduce embodied carbon. As previously mentioned, we have established a sustainability committee within our firm, the committee holds monthly meetings and weekly work sessions. Knowledge gained on embodied carbon and reduction strategies in the first year will be used to facilitate discussion on the importance of sustainability with our clients and partners.

Communicating with clients, designers, and the public to build awareness of our efforts and the impact of the industry

First Year Advocacy Initiatives:

- Update our proposals to include language declaring our firm as a member of the SE 2050 Commitment. This will provide an opportunity to open up dialogue with our clients on the matter.
- Add the SE 2050 logo to our company website, sharing our commitment to the program.
- We have a number of established clients who have an interest in sustainability; as we educate our team on sustainable design solutions, we will collaborate with project design teams to implement designs to reduce embodied carbon.
- As one of the first steps after pledging to SE 2050, we established a sustainability committee within our firm.
- Pursue LEED accreditation for committee members in order to establish credibility and expand knowledge.
- Begin reaching out to area materials suppliers to open avenues of conversation about lower-carbon material options.

Conclusion

It is vital that the structural engineering industry take an active role in addressing the global emissions associated with our projects. By educating ourselves about the issues and available opportunities, documenting and reporting our progress, and advocating to our industry partners to develop collaborative approaches, we can begin to create real change in our industry. We look forward to sharing our accomplishments and takeaways after our first year in this program.

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