

Embodied Carbon Action Plan



We are compelled by engineering possibilities.

We are open to new ideas and not bound by the rote application of rules.

We strive to bring our inquisitiveness to each project for the benefit of our clients. Holmes is an international design firm with employees around the Pacific Rim and beyond.

We believe projects become great by what you put into them. With inspired practicality, we reconcile the complex, competing interests and constraints, providing not just engineering but optimal solutions. In this way, we create more meaningful, integrated designs as a collaborative process in the vital pursuit of building great things.

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1.0 Introduction

(Re)Committing to Net Zero

In our third year of SE 2050, we're setting the foundation for sustainable strategies across the international Homes Group. This extends to all practice areas and markets (the United States, New Zealand, Australia, and Europe). We are putting efforts into unifying the business and working more closely together. To this end, we have designated our first sustainability leaders for the US and ANZ. We have also have expanded the Director of Mass Timber's role across the group. Through these appointments, Holmes is making real efforts to share resources, knowledge, and upskill our people in decarbonization.

As we take on more sustainable work, more of our people touch these projects and learn best practices for design and construction. We're growing a coalition of ambassadors who share knowledge with industry peers. We look forward to carrying this momentum into another year of commitment to reducing our embodied carbon.

With our industry peers, we champion the notion that structural engineers should lead embodied carbon discussions pertaining to structural decisions. Externally, our clients are asking us to take charge of structural embodied carbon: to measure, track, and reduce it. We are sought after and getting paid to implement Life Cycle Analyses (LCAs)on our projects.

"Since a building's structure comprises most of its embodied carbon, structural engineers must help minimize a project's environmental impact. We know how to reduce material quantities, source and specify materials, and align solutions with each project's goals. The more we share sustainable tactics and lessons learned across the international AEC community, the better."

-Megan Stringer, Assoc. Principal & Sustainability Lead



Chiles House: the first mass timber affordable housing built in Oregon.

2.0 Education



Where Curriculum Meets Culture

Holmes is executing an Implementation Plan for 2023 to upskill our staff on embodied carbon technology and tools. Our objectives remain:

- Infusing sustainability into our company culture.
- Providing all staff the knowledge and skill set to speak to sustainability and our role in carbon reduction.
- Performing LCAs as a service and receiving compensation.
- Securing more sustainable projects based on our expertise.

As part of this plan, we are presenting to staff on embodied carbon and OneClick LCA software. On a quarterly basis, we take a broader look at sustainability and how it applies across our service lines and locations. Topics include:

- Collateral of sustainability in our design services.
- Rebar quantity take-off spreadsheet.
- Comparisons of embodied carbon savings against operational carbon and vehicle emissions for single-family residential design.

We are organizing a sustainability library with technical resources, articles, presentations, and design guides centralized in one place. In addition, our employees attend external education programs and report back. This year we are developing an embodied carbon database and standardizing Revit modeling toward a consistent Structural Material Quantities (SMQ) collection.

We discuss embodied carbon reduction tactics and push for lower Embodied Carbon (EC) materials and designs on our projects. LCA software helps us evaluate various designs using national average Environmental Product Declarations (EPDs) and other vetted life cycle inventories. Mass timber continues to be a larger portion of our work, with many clients selecting timber for its assumed lesser carbon footprint. Going further, some of our clients seek to support forests that sustain the largest sinks of biogenic carbon. Our sustainability team sources and disseminates this range of biogenic carbon across geographic boundaries, harvest regulations, forest landowners, and forest certification programs.



Structural and fire engineers collaborate in the Holmes Portland office.

3.0 Reporting

Holmes has reported embodied carbon data on five projects this year, in some instances by client request. All projects listed incorporate strategies to reduce embodied carbon.

We recognize that the process of evaluating embodied carbon is imperfect and less accurate in early design. There are many unknowns and externalities at this stage. We conducted evaluations at various stages of design using OneClick LCA and the bill of quantities extracted from Revit. Read on for some project- and material-specific call-outs.

Confidential Tech Office

The Confidential Tech Office project was the last project to use Athena Impact Estimator for LCA software. We collected the bill of quantities from the contractor when the project completed construction in 2022. This project benefited from low-carbon concrete mixes.

The Nine

We will follow The Nine through future design phases to track its added embodied carbon scopes. Our aim is to estimate allowances for embodied carbon. We will evaluate how changes in embodied carbon values are reflected in progressing levels of detail with various methods for collecting quantities.

Table 1: Embodied Carbon Data of 5 Holmes Projects

Campbell Hall Viking Center

Campbell Hall is pursuing LEED MR credits for Building Life-Cycle Impact Reduction through the Whole Building LCA. Holmes analyzed Campbell Hall twice using different LCA software. The architect initially pursued LEED credits for the Whole Building LCA using Tally, so Holmes used Tally for that effort. Following completion, we used the same quantities and industry average data to analyze the project using OneClick LCA. We found the Global Warming Potential (GWP) kgCO2e/m² intensity was 34% higher using Tally.

A Word on Mass Timber

Three listed projects utilize mass timber, which is touted as having a lower intensity of global warming potential. While these mass timber projects all fall below the Carbon Leadership Forum's benchmark median value, they are not always the lowest intensity. Note that mass timber projects do not include any reduction due to biogenic carbon sequestration.

| Project | Size (SF) | Usage | Phase LCA Evaluated | # of Stories | Vertical Gravity System | GWP Intensity (kgCO2e/m²) |
|-----------------------------|-----------|--------------------------|------------------------|--------------|-------------------------|------------------------------|
| The Nine | 220,000 | Office | Schematic Design | 9 | Wood: Mass Timber | 200 |
| OSU Cascades | 11,000 | Education | Construction Documents | 2 | Wood: Mass Timber | 223 |
| Confidential Tech Office | 300,000 | Office | Construction | 5 | Concrete | 308 |
| Campbell Hall Viking Center | 93,000 | Education | Construction Documents | 3 | Steel | 408 (547*) |
| Sandy Pine | 337,000 | Multi-Family Residential | Construction Documents | 12 | Wood: Mass Timber | 210 |

*GWP results in parentheses from Tally





Sandy Pine: Holmes' largest residential project to undergo an LCA. Rendering by LEVER Architecture.

4.0 Reduction



Higher Standards, Lower Carbon

Holmes lowers embodied carbon on projects through a variety of strategies. Below is an overview of recent efforts toward our goal of embodied carbon reduction.

Specifying Low-Carbon Materials

We are updating the Holmes General Notes Template to implement embodied carbon reduction in all materials as a requirement—not a suggestion. We started with the largest emitter: concrete. In the last year we have completed revisions to the concrete section of our specification template, now requiring lower overall GWP for concrete mixes. Not only has Holmes established a baseline cement replacement requirement, we have incorporated a matrix with options to comply per either cement volume or GWP limits.

We are taking a similar approach as we move on to steel, introducing limits on GWP for different steel shapes and sections. As the City of Seattle is petitioned to adopt carbon limits on concrete and steel, Holmes is monitoring this effort to ensure that our criteria are aligned with proposed jurisdictional requirements.

Establishing a Concrete Baseline

To quantify reduction, we need to first establish a baseline for comparison. Holmes is developing in-house tracking tools that tabulate SMQs for input into different LCA software databases. These tools are meant to be user-friendly for quick adoption by Holmes staff. Reinforcement take-off calculations for different concrete elements are under development within the structural SMQ/LCA space. While this is tedious work by nature, Holmes is building tools to streamline better estimate tonnages and therefore carbon emissions for each concrete element and overall structure.



The Seattle Storm Center for Basketball Performance targets a 40% GWP reduction for concrete mixes. Designed by ZGF and Shive Hattery, built by Sellen Construction.

5.0 Advocacy

Amplifying Our Voices

We initiate climate-conscious conversations and advocate for carbon reduction. Informed by lessons learned from built solutions, we're holding international dialogues with our project teams and the broader AEC community. This year, we are especially proud to have keynoted the New Zealand Structural Engineering Society's Conference with 'The Structural Engineer's Role in Getting to Net Zero.' It was an honor to return to our roots and present in the country where Holmes was founded!

Tapping into Single-Family Construction

Holmes has the opportunity to tailor our sustainable approach to engineering for the single-family residential sector. Single-family construction accounts for roughly one third of Holmes' projects, positioning us to advocate for sustainable solutions on projects we have already secured. We're confident that we can reach a wider clientele and create a larger impact by incorporating this practice.

In 2023, our vision is to utilize the tools we have already developed for larger commercial projects and alter them to suit the goals of single-family homeowners. For example, we are modifying existing presentations and brochures to summarize sustainable strategies that apply to a residential context. By educating our clients and identifying partners who share our values, we'll spread our knowledge on construction efficiencies, low-carbon building materials and technologies. We plan to expand on construction efficiencies relating to light-frame construction in particular. We'll identify high-emitting materials within a project and target solutions, such as low-carbon concrete, that cut the most carbon.

Spreading the Word

We continue to have a strong record of Holmes speakers at industry events. Even more regularly, we present to clients at informal lunch and learns on how we progress sustainability benchmarks. Our team members also contribute to building codes, design guidelines, and research projects that expand possibilities for sustainable construction. We are also increasingly paid to conduct LCAs after including this add service in our base contract.

BUILDING CODE & DESIGN DEVELOPMENT

- Marin County: Low-Carbon Concrete Code (first in the nation)
- CLT Diaphragm Design for Wind and Seismic Resistance
- US Mass Timber Floor Vibration Design Guide
- Nail-Laminated Timber Design & Construction Guides US & Canada
- NHERI TallWood-Research
- Project-Specific Testing including
 - Sandy Pine: Point-Supported CLT
 - Confidential Mass Timber Diagrid System

PROFESSIONAL COMMITTEES

- Carbon Leadership Forum
- NCSEA Sustainable Design Committee
- SEI Sustainability Committee
- SEI SE 2050 Committee
- SEO Code Advisory Committee (Mass Timber)
- SEAOC Sustainable Design Committee
- SEAONC Board of Directors, Sustainable Design Committee
- SEAOSC Sustainable Design Committee
- SEAW Sustainable Design Committee
- USGBC California Council of Experts & Los Angeles Chapter

SPEAKING OPPORTUNITIES

- A'23 AIA Conference on Architecture
- Advancing Mass Timber Construction Conference
- California Preservation Conference
- CLF Seattle Hub
- CLF Portland Hub
- International Mass Timber Conference
- New Zealand Structural Engineering Society Conference (Keynote)
- SEAC Fall Seminar
- SEAONC Association Meeting
- WoodWorks Design of Mass Timber Diaphragms & New CLT Diaphragm Design Guide

PROJECTS WITH PAID LCAS

- Campbell Hall
- The Nine
- Rowland Hall
- Killingsworth Creative Office
- Wolf Bay Seattle Residence

We're All in on Net Zero.

BACK SUPER