

SE2050

EMBODIED CARBON ACTION PLAN 2025



SHIVEHATTERY
ARCHITECTURE+ENGINEERING



TABLE OF CONTENTS

INTRODUCTION 1

*About Shive Hattery
Commitment Letter
Committee Mission Statement
About Our Embodied Carbon
Reduction Champion +
Committee Members*

EDUCATION PLAN 6

Our Approach

REDUCTION STRATEGY 8

*Short-term Goals
Long-term Goals*

REPORTING PLAN 10

Calculating Embodied Carbon

ADVOCACY 12

Knowledge Sharing Narrative

CLOSING 14

Thank You

APPENDIX 15

Elective Documentation

introduction

Hampstead Woods Senior Living, Iowa City, Iowa

ABOUT SHIVE-HATTERY

Established in Cedar Rapids, Iowa, in 1895, Shive-Hattery has evolved from a civil engineering and surveying firm into a full-service architectural and engineering company. With over 550 professionals and 16 offices nationwide, we serve commercial, education, government, healthcare, and industrial markets.

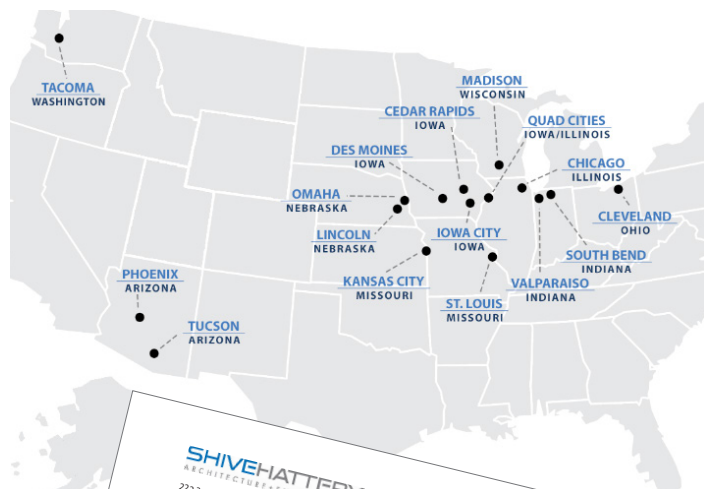
At Shive-Hattery, we prioritize our clients' needs, goals, and concerns. Our guiding principle, **"We design what matters to make our world a better place,"** informs every aspect of our work, from project execution to community engagement. By deeply understanding our clients' businesses, we provide tailored solutions that exceed expectations.

ABOUT OUR COMMITMENT

Here at Shive-Hattery, we are committed to reducing our environmental impact. As engineers, we hold a pivotal role in this commitment. Our work directly influences the Global Warming Potential (GWP) which is the metric used to measure and track embodied carbon. GWP is quantified in kilograms of CO₂ equivalent (kg-CO₂e). Embodied carbon is measured through the product stage, construction, use, and end-of-life stages. According to the World Green Building Council, "buildings are responsible for 39% of global energy-related carbon emissions: 28% from operational emissions, and the remaining 11% from materials and construction." By reducing embodied carbon from construction materials, we are playing a crucial part in addressing climate change.

SE2050 COMMITMENT LETTER

OUR OFFICES



scan to read





As stewards of the design process shaping the built environment, architects and engineers have the opportunity—and a moral responsibility—to reduce or reverse its negative impacts wherever possible.

SE2050 COMMITTEE MISSION STATEMENT

We are committed to reducing our environmental impact, we believe in transparency and accountability, and we want to share our efforts in pursuit of the goals of the SE2050 program.

We hope to inspire others to join us in our efforts to create a more sustainable and equitable future for all. Together, we can create a more inclusive and green future for ourselves and for generations to come.

OUR GOAL | To educate and advocate the need to reduce the carbon footprint of the built environment to net zero by 2050. This position we find ourselves in as engineers necessitates responsibility. If we, as professionals, design with the environment in mind, we can make incremental strides toward reducing major greenhouse gas emissions, limiting the global warming issue at hand.

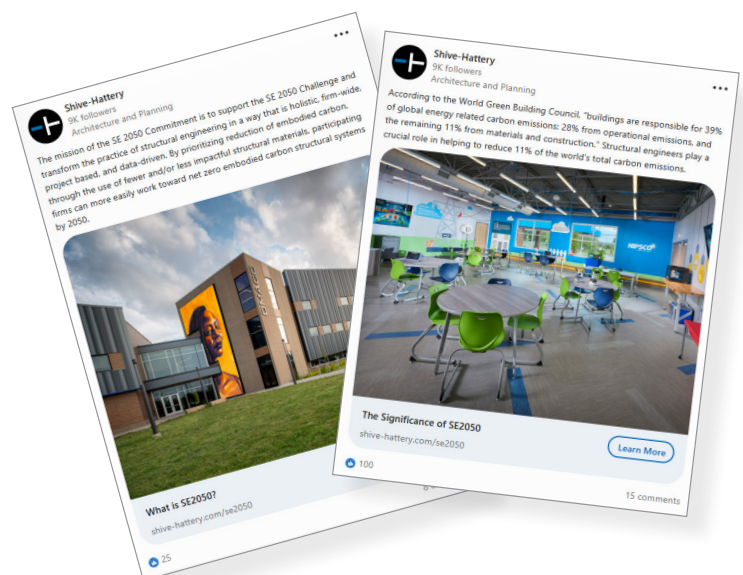
OUR CHALLENGE | The SE2050 Challenge states: *"All structural engineers shall understand, reduce, and ultimately achieve net zero embodied carbon across their projects by 2050."* As new signatories, we take this challenge to heart. Our goal at the start is to train current and new employees in ways to implement sustainable practices.

ANNOUNCEMENTS

We have publicized our pledge to join the SE2050 Commitment internally and externally.

Commitment statements were posted on our internal website notifying our fellow engineers and architects of our new endeavor, with a challenge to engage in this very important cause.

In the months following our announcement to join SE2050, we will post several informational external post on our social media accounts and our external corporate website. Our Embodied Carbon Action Plan will be posted to our website once complete, and we will continue to do so in subsequent years.





OUR EMBODIED CARBON REDUCTION CHAMPION



EDUARDO MORALES, PE
CHICAGO, ILLINOIS

Since joining Shive-Hattery's downtown Chicago office in 2021, Eduardo performs a dual role of lead structural engineer and structural sustainability lead for the firm helping to cultivate a culture of sustainability with like-minded individuals and similar passions.

Born in the mountains of Ecuador, and moving to the U.S. a few years after, nature has always been a constant in Eduardo's life. Preserving its beauty and accessibility is a passion of his. With this in mind, Eduardo received his bachelor's degree from University of Illinois Urbana-Champaign in 2016, and master's degree from Georgia Institute of Technology in 2017. Both degrees are in civil and environmental engineering with a focus on structures.

Kicking off Shive-Hattery's SE2050 structural committee as the champion, as well as becoming a member of the company-wide Goals and Metrics committee, he has learned how much our profession influences global emissions and needs to adapt.

Having designed a mass timber pavilion in Howard, Wisconsin – Eduardo is looking for more ways to incorporate mass timber into his design and is optimistic to be a part of the much needed change in our industry.

Howard Commons, Village of Howard, Wisconsin



OUR SE2050 COMMITTEE MEMBERS



JOE MCELHINEY, PE
BETTENDORF, IOWA

Joe is a dedicated professional at Shive-Hattery, working as a structural engineer, project manager, and engineering manager. He's committed to promoting sustainable design, encouraging his teams to integrate it into their work. Joe graduated in 2015 from the University of Wisconsin – Platteville with a bachelor's degree in civil engineering, focusing on structures and geotechnical

engineering. His upbringing in rural Iowa sparked a deep interest in the environment, driving his personal and professional efforts to reduce environmental impact and conserve natural resources. At Shive-Hattery, Joe excels at incorporating sustainability into heavy industry projects while meeting clients' unique needs and expectations, ensuring designs are both innovative and resilient.

Joe is also an active member of the company's sustainability initiative, contributing to the Practices and Processes committee, where he collaborates with colleagues to enhance sustainable design practices and promote continuous improvement across the organization.



BRE JENSEN
IOWA CITY, IOWA

Bre joined Shive-Hattery in 2018 as an architectural intern while working on her structural master's degree. Once graduated, she transitioned from the architectural team into a structural role as an Engineer. Throughout her time at Shive-Hattery, Bre has worked on a variety of projects ranging from industrial to healthcare/higher education to commercial with materials ranging from concrete to steel to wood. She has found her niche in the multi-family commercial realm where she is able to utilize both her architectural and structural backgrounds. Bre is excited to work alongside her fellow structural engineers in sustainability to provide Shive-Hattery with the knowledge base and tools to help reduce our carbon footprint and be more cognizant of the effects our structures have on our environments.



CHRIS FOJTIK
CHICAGO, ILLINOIS

Chris, born and raised near Chicago, has always appreciated both the natural world and the urban landscape. Now, he's focused on bridging the gap between reducing environmental harm and designing efficient structures. He earned his bachelor's degree in Civil Engineering, specializing in structures and mechanics of materials, from the University of Iowa in 2019. Chris began his career in industrial engineering, where he first encountered sustainable design in the biofuel industry, collaborating with clients to optimize processes and design structural supports with sustainably sourced steel. Since joining Shive-Hattery in early 2023, Chris has been eager to work alongside other structural engineers, continuing to promote sustainable design and contributing to the goal of achieving net zero emissions in structures by 2050.



COREY GREENSTEIN, PE
CHICAGO, ILLINOIS

Corey's passion for building and structural design began in hurricane-prone South Florida, where he developed an early fascination with how extreme weather impacts construction. Initially driven by a dream to design roller coasters, Corey earned his bachelor's degree in civil engineering with a focus on structures from Bradley University in 2013. Since joining Shive-Hattery's Chicago office in 2020, Corey has applied his expertise in precast concrete sandwich wall panels and post-frame buildings to a variety of projects. He's not only a detail-oriented structural engineer but also a passionate advocate for biophilic design. His enthusiasm for sustainability is reflected in his active role on Shive-Hattery's Sustainability Practices + Processes committee. Corey's positive attitude and strong communication skills make him a valuable asset to every team he joins.



ROSE AYERS
WEST DES MOINES, IOWA

Rose is from a small Iowa town saturated by farmland and dairy operations. As a young adult, she was obsessed with the natural landscape surrounding her but unsure how to help keep Iowa beautiful. In 2002, she became a photojournalist to pursue her passion for photography. She later earned her BA in Marketing/Public Relations to help blend the visual and digital worlds of design. After 20 years in the creative field, her career finally brought her to Shive-Hattery. She matches her enthusiasm for water quality and a sustainable future with her ability to bring others' ideas to life through graphic design. Since 2022, she has helped the Shive-Hattery Sustainability Committee internally communicate goals and accomplishments and launch new information capture methods.



SUSTAINABILITY CHAMPIONS ACROSS SHIVE-HATTERY

We recognize the significant impact the design and construction industry has on the environment, with buildings and infrastructure accounting for a large portion of embodied carbon and greenhouse gas emissions. Embracing our role, we are committed to designing sustainable, environmentally-friendly structures that improve quality of life while contributing to a greener future.

As a full-service firm, Shive-Hattery has champions across disciplines dedicated to reducing embodied carbon and minimizing project carbon footprints. They lead efforts to optimize material usage, promote sustainable design, and implement low-carbon solutions, ensuring our projects exceed industry sustainability goals.

By joining the SE2050 Challenge, we aim to inspire others to join us in creating a more sustainable and equitable future, balancing structural integrity with environmental responsibility.



We take a front-line role to design sustainable and environmentally-friendly buildings and infrastructure that improve the quality of life for people and protect our planet.

-Jennifer Bennett, SE, PE
Shive-Hattery, President + CEO



Woven throughout Shive-Hattery's guiding principle, purpose and values is the sense of integrity. It unites all of our 550+ employees and drives a sense of service and accountability to ourselves, each other, clients, partners, neighbors and communities.

education plan

Valparaiso Boys and Girls Club, Valparaiso, Indiana

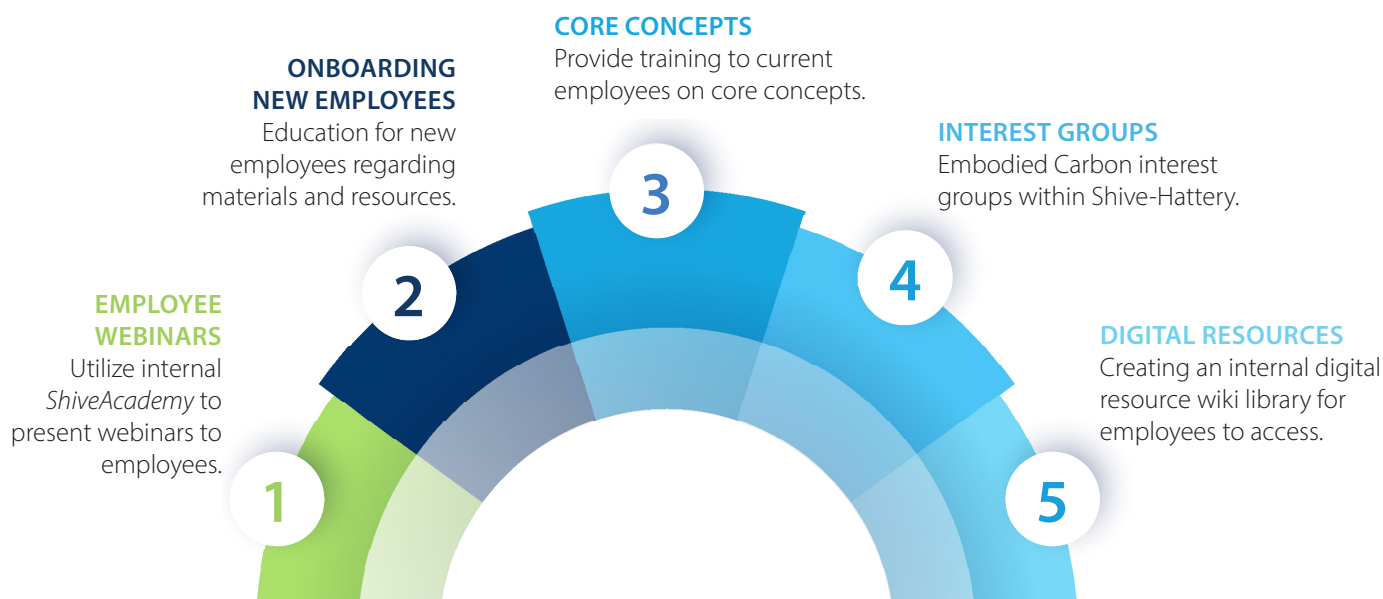
OUR APPROACH

Shive-Hattery initiated an all-discipline sustainability group in 2022, underscoring our commitment to building a more sustainable future across all areas of our work. Now, we're taking a focused step forward by emphasizing sustainability within structural engineering across the company. Our Embodied Carbon Reduction Champion, Eduardo Morales, in collaboration with the SE2050 group, is leading this important initiative. Together, we will work to educate our structural engineers on how our designs impact the environment, with a specific focus on reducing embodied carbon.

Shive-Hattery's structural engineers are strategically located across our offices, servicing all market sectors, allowing us to integrate sustainable practices throughout various regions. The SE2050 group is

committed to ensuring that our engineers are not only aware of our sustainability goals but are also equipped with the practical tools and knowledge necessary to achieve them. **To facilitate company-wide buy-in, the group plans to visit each office in person, fostering face-to-face engagement and deeper collaboration.**

During these meetings, we will share our ambitious goals for the SE2050 initiative, offer insights into the innovative tools and strategies we have developed, and provide hands-on training to enhance our collective expertise. **By empowering our structural engineers with this knowledge, we are not only supporting their professional growth but also reinforcing our commitment to sustainable design.** This initiative is a crucial part of our broader strategy to integrate sustainability into every aspect of our work, ensuring that we contribute positively to the communities and environments we serve.





A NOTE FROM OUR EMBODIED CARBON REDUCTION CHAMPION



EDUARDO MORALES, PE
CHICAGO, ILLINOIS

As our company's Embodied Carbon Reduction (ECR) Champion, I hope to emphasize the importance of educating our Shive-Hattery structural engineers about embodied carbon in our designs and how it affects our daily lives.

While nominating one ECR Champion would be great, our goal for our SE2050 group is for everyone to become ECR Champions. We plan to go to each office throughout our company and provide face-to-face knowledge-sharing interactions with our many different structural teams. During these meetings, we would answer any questions they may have and provide them with the resources available to allow them to join us in becoming Embodied Carbon Reduction Champions.

As new structural engineers join our company, we plan to provide them with training on embodied carbon reduction and have them incorporate this into their daily work to create a new baseline with sustainability in mind throughout the structural realm.

SE2050 ACADEMY EMPLOYEE WEBINAR SERIES

Shive-Hattery provides employees with many resources internally and externally for knowledge sharing. We will continue to provide those opportunities while also specifically providing webinars or individuals to come talk to our groups about sustainability in the structural realm.

ONBOARDING PROCESS

Shive-Hattery has begun utilizing programs for Life Cycle Analysis (LCA). While training new employees, we will begin incorporating this into their initial training.

TRAINING OF EXISTING EMPLOYEES

Existing employees of Shive-Hattery will be provided the information and knowledge base to be able to measure, reduce, and report embodied carbon using technology integrated into our everyday systems.

OUR INTERNAL STRUCTURAL SUSTAINABILITY GROUP

The Shive-Hattery sustainability group includes all disciplines across the company. A specific focus group on Embodied Carbon will be integrated and made available for all to join.

SE2050 RESOURCE PAGE

Shive-Hattery already has a sustainability page on our internal website. We will create a sub-page to specifically provide information on structural engineering sustainability.



Healthcare Foundation of LaPorte, LaPorte, Indiana



University of Illinois
Health Specialty Care
Building, Chicago, Illinois

reduction strategy

OUR GOALS

At Shive-Hattery, we work on projects across various sectors, from schools and hospitals to industrial facilities.

When it comes to reducing embodied carbon, every project has the potential to benefit from one or more reduction strategies. Whether implementing immediate solutions or developing long-term goals, our commitment is to minimize embodied carbon in every project possible with the ultimate goal of achieving net-zero emissions by 2050.

HOLISTIC APPROACH ACROSS ALL PROJECT TYPES

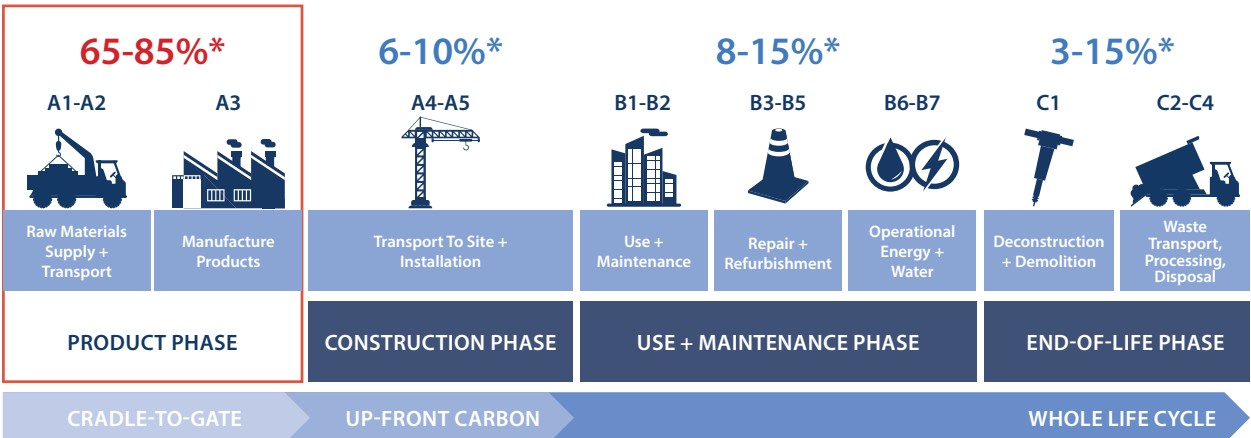
We recognize that each project presents unique challenges and opportunities when it comes to reducing embodied carbon. Our approach is not one-size-fits-all; instead, we tailor our carbon reduction strategies to align with the specific needs, functions,

and goals of each project. By understanding the distinct characteristics of different unique project, we can optimize our design and material choices to achieve the most significant carbon reductions.

STRATEGIES

- **MATERIAL SELECTION** - Provide different material options with embodied carbon as a consideration for each case. Include recycled and biogenic materials whenever possible.
- **PERFORMANCE TRACKING** - Create internal metrics and goals for our company to strive toward per project discipline (i.e. commercial, industrial, etc.)
- **TAILORED STRATEGIES** - Work with the client on each individual project to provide unique building reductions and project specific opportunities.

PERCENT OF TOTAL EMBODIED CARBON EMISSIONS WITHIN THE CONSTRUCTION LIFE CYCLE



* Percent of total embodied carbon emissions

Source: Rocky Mountain Institute (RMI), "Embodied Carbon 101: Building Materials" March 2023, <https://tinyurl.com/ybpfv64>



SHORT-TERM GOALS (0-2 YEARS)

In the near term, we aim to establish company-wide benchmarks for typical projects to meet specific CO₂e criteria and to incorporate new sustainable products or technologies into a select number of projects within the first year.

MATERIAL SPECIFICATIONS

- Prioritize materials with lower embodied carbon without compromising quality or performance.

BENCHMARKING AND TRACKING

- Start tracking metrics to monitor progress and identify areas for improvement.
- Set measurable CO₂e targets for various project types, creating a baseline for future comparisons.

INNOVATION AND INTEGRATION

- Incorporate sustainable products or technologies in as many project as we can throughout each year.
- Evaluate the performance and carbon impact of these innovations for future implementation.

LONG-TERM GOALS (2-5+ YEARS)

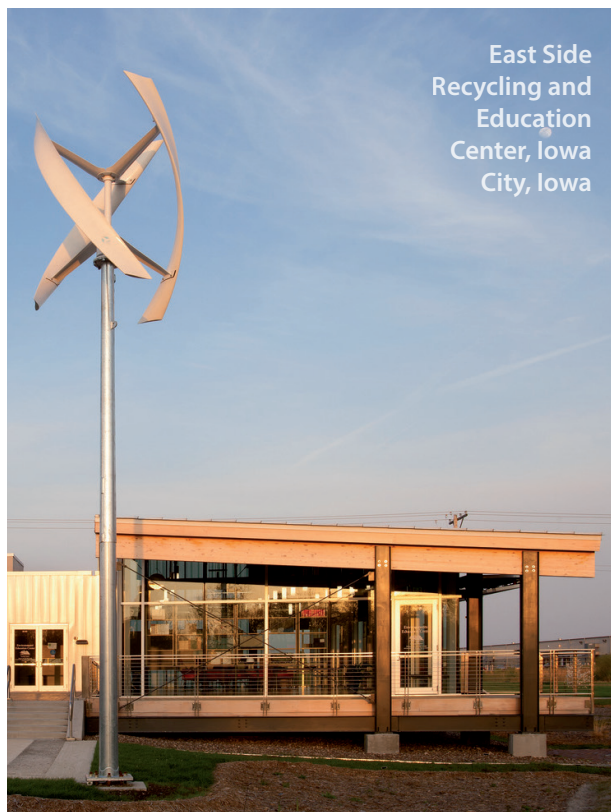
We aim to develop and integrate a workflow to prioritize embodied carbon reduction at key project milestones. This includes utilizing real CO₂e data to inform decisions for project teams and stakeholders, and ensuring sustainability is a core consideration throughout the project life-cycle. Additionally, we aim to focus on developing material specifications that either reduce or set limits on carbon emissions.

WORKFLOW INTEGRATION

- Establish clear decision points in the project timeline where reduction efforts are evaluated and implemented.
- Engage stakeholders early to ensure that CO₂e data drives design decisions and material choices.

LIFE CYCLE ANALYSIS (LCA)

- Conduct LCAs on primary and secondary structures to assess their carbon footprint.
- Use LCA results to guide material selection and design decisions, focusing on long-term sustainability.



East Side
Recycling and
Education
Center, Iowa
City, Iowa



City of Hills, Public Use Bandshell, Hills, Iowa

(Bottom Left Photo) AWARD: 2012 Grand Place Award for Engineering Excellence in Building + Systems Category by American Council of Engineering Companies - Iowa

reporting plan

Broadlawns Community Clinic at
Drake University | Des Moines, Iowa

MEASURE, TRACK + REPORT EMBODIED CARBON DATA

For Shive-Hattery, accurately measuring and tracking embodied carbon is a critical component of our commitment to sustainability. By monitoring these metrics, we can ensure our efforts are consistently aligned with our long-term goals and that we're making tangible progress year after year.

Accurately capturing and reporting embodied carbon data enables us to showcase the positive influence our offices have on the industry, setting a standard for others to follow.

CALCULATING EMBODIED CARBON FOR STRUCTURAL MATERIALS

We are committed to leveraging Environmental Product Declarations (EPDs) supplied by our manufacturers to accurately assess the embodied carbon of structural materials. EPDs are crucial tools that provide comprehensive insights into the environmental impact of materials throughout their entire life cycle, from raw material extraction to manufacturing, transportation, and disposal.

By utilizing EPDs, our design teams can make informed comparisons between different products, facilitating smarter choices that align with our sustainability goals and promoting transparency in our construction practices. Furthermore, incorporating EPDs into our decision-making process underscores our dedication to sustainable design and allows us to communicate our efforts effectively to clients and stakeholders, demonstrating our leadership in minimizing environmental impact within the construction industry.

OUR MULTI-OFFICE APPROACH

Our SE2050 committee, a group of structural engineers from a majority of our engineering offices, plays a crucial role in our collective effort to track and report embodied carbon. **Our SE2050 champions meet monthly to plan how all offices should be reporting and measuring all embodied carbon.**

Each SE2050 committee member is trained on Tally® LCA app for Autodesk® Revit and how to find and use any EPDs required for their projects. At the conclusion of each year, our SE2050 committee plans to release a yearly report breaking down projects analyzed by location and sector.



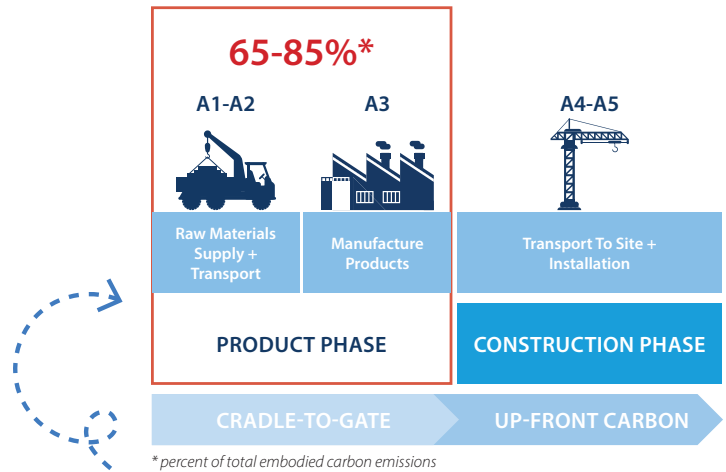
QUANTIFYING EMBODIED CARBON WITH LIFE CYCLE ANALYSIS SOFTWARE

Shive-Hattery relies on Tally for all Life Cycle Analysis. Tally provides comprehensive LCA data that is instrumental in making informed decisions to reduce environmental impact. Its integration with Revit makes sustainability assessments at any stage during the project more efficient and accessible. When engaging in discussions during the schematic design Tally® can quickly provide material analysis options for any stakeholder.

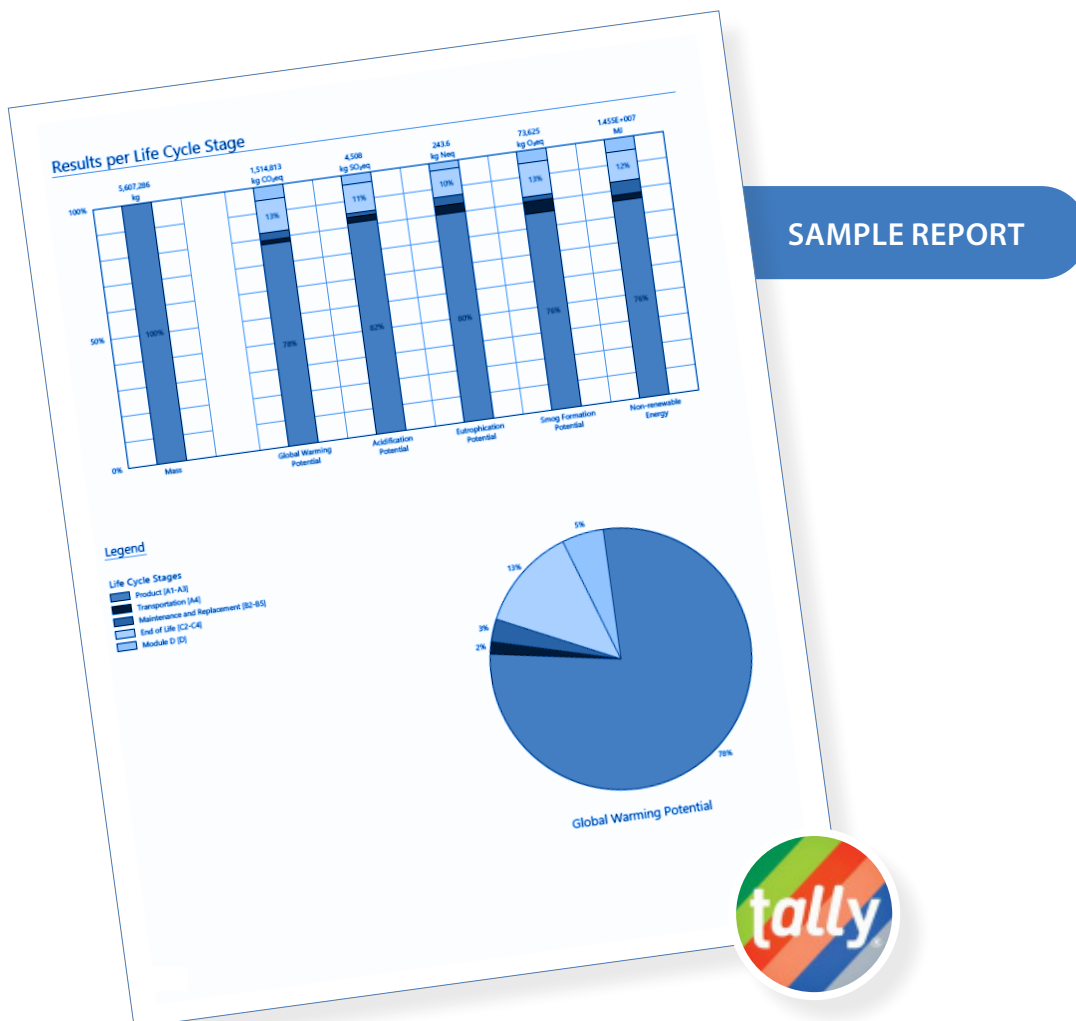
CALCULATING MATERIAL QUANTITIES DURING PROJECT STAGES

Shive-Hattery aims to have consistent material quantities from projects across all our offices. Our project teams use standard Revit modeling practices, as governed by our in-house Revit Managers. This allows Tally® to easily and accurately report all material quantities. With Tally's Revit Plug-in, we can track the quantities at any and every stage of the project life cycle.

LIFE CYCLE ASSESSMENT PHASES



As engineers, we have the most impact to embodied carbon during the product phase, we CAN make a difference.



SAMPLE REPORT

advocacy

Howard Commons Grand Opening, Village of Howard, Wisconsin

THE VALUE OF SE2050

We recognize the significant impact embodied carbon has on the global environment. Structural engineers play a crucial role in helping to reduce 11% of the world's total carbon emissions¹. As key members of the design team, it is the structural engineer's duty to ensure that buildings and structures are safe to inhabit. As a company, we are taking it upon ourselves to extend that responsibility to include strategies relating to the reduction of embodied carbon emission associated with structures.

One of the goals of our commitment to SE2050 is to share this perspective with our clients. This includes clients with ambitious sustainability goals and those just beginning to learn about the importance of reducing carbon emissions in construction.

PUBLIC DECLARATION

Shive-Hattery developed public launch campaign to announce our participation in the SE2050 Commitment. The knowledge sharing campaign includes:

- Shive-Hattery.com/SE2050 page launch - includes commitment letter and note from the CEO.
- Social media posts across all participating platforms - announces our participation and includes link to webpage for more details.

ENGAGING SUPPLIERS

As a company, we plan to engage structural material suppliers on the importance of Environmental Product Declarations (EPDs) and low-carbon options. We strive to effectively engage structural material suppliers, fostering a culture of sustainability that promotes the use of EPDs and low-carbon options within the industry.



Increase awareness regarding EPDs.



Foster collaboration with suppliers to encourage development and production of low-carbon options.



Advocate for EPDs across the industry.



Provide case studies showcasing successful examples where EPDs led to positive project outcomes.



Explore opportunities for joint initiatives to focus on creating new low-carbon materials or improving existing.

¹American Institute of Architects, "ROI: Designing for reduced embodied carbon," November 2023, <https://tinyurl.com/yx22aurx>



Seattle Storm WBA Practice Facility, Seattle, Washington

KNOWLEDGE SHARING NARRATIVE

Shive-Hattery continuously strives to design for a more sustainable future and embodied carbon reduction is at the core of our approach. Our strategy for communicating our efforts externally needs to revolve around transparency, collaboration, and continuous learning.

When our engineers and architects discuss embodied carbon with clients at the beginning stages of a project, it's crucial to frame the conversation in a way that aligns with the client's goals and values. By having this conversation early, engineers and architects can ensure embodied carbon reduction is embedded into the project from the start, paving the way for a successful and sustainable project.

Company-wide we share case studies that bring our projects to life, demonstrating how our strategies can be applied to different types of projects. We encourage collaboration and invite feedback from our peers and clients, fostering a community that's just as passionate about sustainability as we are.

EXTERNAL COMMUNICATIONS

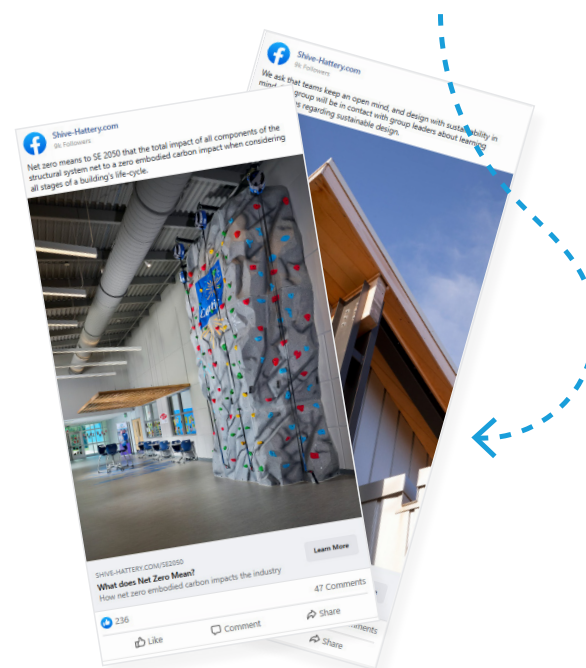
SHIVE-HATTERY.COM

Our firm's website is a prime platform for showcasing our commitment to sustainability. We will create a dedicated section on embodied carbon reduction, featuring case studies, success stories, and ongoing projects. In addition, we plan blog posts to dive deeper into specific topics, such as innovative materials or industry trends, and offer insights from project team members.

SOCIAL MEDIA

Platforms like LinkedIn, Twitter, and others allow us to reach a broader audience, including industry peers, clients, and the general public. We plan to share quick updates, infographics, and short videos that highlight our achievements and educate followers on the importance of embodied carbon reduction. Other efforts include industry publications and speaking engagements to encourage additional collaboration regarding our efforts.

By making our embodied carbon reduction work a shared journey, we are not just building better buildings—we are **DESIGNING WHAT MATTERS, TO MAKE THE WORLD A BETTER PLACE.**



THANK YOU

Shive-Hattery is deeply committed to reducing our carbon footprint through collaborative and conscientious design practices. We recognize that to make a meaningful impact, our efforts must extend beyond internal initiatives—we must advocate for and actively engage in industry-wide change. This begins with transparent advocacy and rigorous reporting of our reduction efforts, which not only hold us accountable but also serve as a model for others. However, we understand that education is the cornerstone of lasting transformation. By equipping our teams and clients with the knowledge and tools to prioritize sustainability, we can drive broader adoption of low-carbon practices across the industry.

As we progress toward our commitment to the Structural Engineers 2050 (SE2050) Challenge, which aims for net-zero embodied carbon in structural systems by 2050, **we remain optimistic about the future of low-carbon construction.** Through innovation, collaboration, and education, we are not only contributing to a more sustainable built environment but also paving the way for a greener, more resilient industry.



As design professionals, we are committed to protect the health, safety, and welfare of the public – a commitment in clear tension with that impact. We strive, therefore, to not simply follow design practices that are currently standard, but also to help make them better – to lead practice toward true sustainability. We are doing so by measuring performance and setting measurable goals in each key environmental category, by researching and implementing new tools and practices and by organizing to lead change within the organization and in communities we serve.

-Grant Nordby, AIA, Architect



APPENDIX

ELECTIVE REQUIREMENT SELECTIONS

EDUCATION

1. *Provide a narrative of how the Embodied Carbon Reduction Champion will engage embodied carbon reduction at each office.*
2. *Present at least (1) webinar focused on embodied carbon and make a recording available to employees. (Include this resource in your orientation and on-boarding program.)*
3. *Incorporate embodied carbon education in your onboarding process for all new employees.*
4. *Train all of your firm's structural engineers on the core concepts and skills required to measure, reduce, and report embodied carbon. (Ref. SE2050 Resources)*
5. *Initiate an embodied carbon interest group within your firm and outline their goals. This group may more broadly address sustainability, but they must include embodied carbon.*

REPORTING

1. *Submit a minimum of (2) projects per U.S. office with structural engineering services to the SE2050 Database. You are not required to submit more than (5) total projects across your firm, but we encourage you to submit as many as possible! Firms are expected to follow with the spirit of the SE2050 Program in determining how many total projects your firm must submit. You do not need to consider offices that only offer construction administration services or offices with fewer than (5) full-time employees.*
2. *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.*

REDUCTION

1. *Set clearly stated, firm-wide reduction targets in the short-term (<1 year) and long-term (>5 years).*
2. *Develop and implement a workflow that makes it easier to make early design decisions based on embodied carbon.*
3. *Compare different design options with embodied carbon as a performance metric during the project concept phase. Explain what you did and what the results changed (if anything).*
4. *Incorporate sustainably harvested biogenic materials in at least one project.*

ADVOCACY

1. *Describe the value of SE2050 to clients. How can your design teams collaborate to reduce embodied carbon? Please attach any associated marketing materials*
2. *Publicly declare your firm as a member of the SE2050 Commitment however you see fit (e.g. on your website, LinkedIn, or other social media).*
3. *Engage with structural material suppliers in your region to communicate the importance of Environmental Product Declarations (EPDs) and low-carbon material options.*



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