DCI ENGINEERS

SEI ASCE STRUCTURAL ENGINEERING INSTITUTE

SE2050 COMMITTING TO NET ZERO

EMBODIED CARBON ACTION PLAN (ECAP)

EXECUTIVE **SUMMARY**

DCI Engineers understands the **importance of sustainability,** its impact on our local communities and—as a whole—to the world. By signing on to the SE 2050 Commitment Program, **DCI Engineers is taking direct action in understanding, reducing and ultimately achieving Net Zero design of all of our structures by 2050.**

With 11% of global carbon emissions coming from building materials & construction, our engineers have an unprecedented opportunity and responsibility to change that number by way of the structure, providing one that will outlive the many cycles of tenant improvements and building system upgrades for years to come.

While 2050 might seem far away, there's much we can do right now (and have already done with multiple recent DCI projects) as we continue to work with industry partners to create new standards and find methods to achieve this goal.

Sustainable development of the built environment is the foremost challenge for our industry and provides us, as engineers, an **opportunity for innovation.** DCI understands and accepts the challenge of providing high-performance structures that demonstrate environmental, social, and economic responsibility.

We believe sustainable design can bring value to our clients in so many ways, which is why we aim to educate project stakeholders on its potential benefits.

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WHAT WE DO:

- **Life Cycle Assessment (LCA) and Embodied Carbon Analysis**
- **Structural System Selection for More Sustainable Materials, Such as Mass Timber, Low Carbon Concrete, and Recycled Steel**
- **Structural Optimization for Material Quantity Reductions**
- **Material Re-Use Evaluation**
- **Green Building Rating System Assistance**
- **Specifications and Supplier Coordination for Lower-Carbon Materials**

EXECUTIVE **SUMMARY**

BY INTEGRATING SUSTAINABLE COMPONENTS, PROJECT OUTCOMES INCLUDE:

- Enhanced/positive consumer and tenant feedback toward a brand and development
- Increased certainty in a changing regulatory environment where GWP limits and carbon tax credits are becoming more common
- Added market value and differentiation for building ownership
- Improved employee retention, mental and physical health, and productivity due to the biophilic effects associated with the thoughtful use of wood products
- Reduced atmospheric pollution through the use of recycled steel and low carbon concrete
- Positive economic impact & greater standing in communities

We all have a role in protecting our greatest investment—our future—and invite our industry partners to join us in this endeavor.

Sincerely,

DCI ENGINEERS

THE BULLITT CENTER | LIVING BUILDING CHALLENGE

SUSTAINABILITY **LEADERS**

MEET DCI'S EMBODIED CARBON CHAMPION:
Supporting DCI's embodied carbon reduction goals is Sustainability Specialist **Jessica Martinez**. Based in DCI's Seattle headquarters, Jessica helps DCI's individual offices engage in embodied carbon reduction initiatives. **Her "on the ground" efforts involve day-to-day discussions with clients and internal staff alike to advise on sustainable solutions for structural design.**

Her passion for sustainable design practices is second to none and has helped DCI embrace this way of design. In addition to pursuing the goals of the SE 2050 Commitment, she **leads the research of DCI's life cycle assessment capabilities** and has performed several integral studies that set the basis for the education of our staff. She serves as **DCI's go-to resource for low carbon concrete** and explores other materials and construction methods that adhere to a higher level of sustainability standards.

Jessica Martinez, in partnership with Arizona Dabrusin and Salma Syed, encourage a **balanced sustainability perspective** for staff to implement the use of lower carbon materials on their projects. Their collaboration expands sustainable choices for clients through coordinating thoughtful structural solutions focused on optimizing the building's overall embodied carbon impacts.

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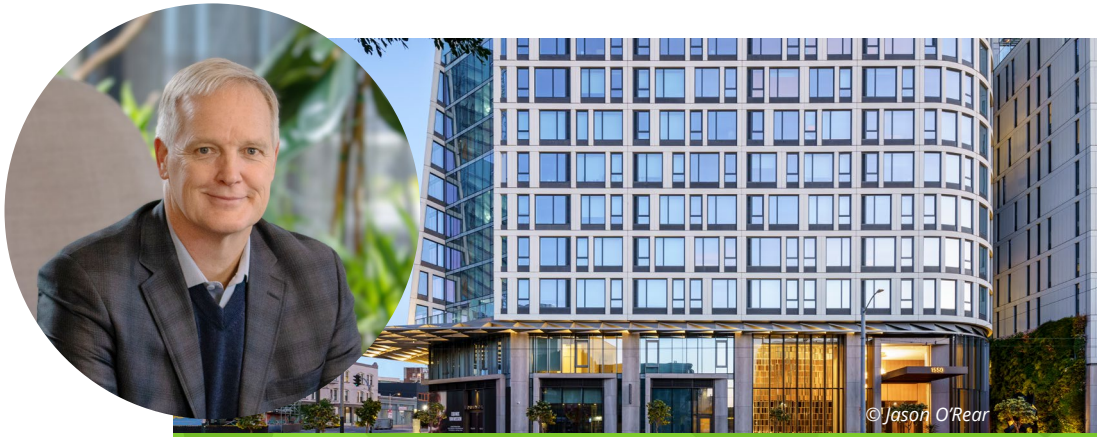
SUSTAINABILITY **LEADERS**

MEET DCI'S PRINCIPAL IN CHARGE OF SUSTAINABILITY

While he has served as the Principal in Charge on sustainable-forward projects throughout DCI's portfolio, **Roger Heeringa** stepped into a more official role by taking on the Principal in Charge of Sustainability in January 2022. Roger's personal interest was re-ignited when attending the CTBUH conference in 2021 where we learned 11% of global greenhouse gas emissions are attributed to building materials and construction. Since then, he's provided his guidance and years of leadership experience for the firm's sustainability technical committee and company-wide initiatives. These efforts center around DCI's **commitment to the SE 2050 Challenge** and the steps we need to take to get there.



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MEET DCI'S DIRECTOR OF SUSTAINABILITY & MASS TIMBER

Ethan Martin's comprehensive experience is unparalleled within the construction industry, having worked directly with developers, architects, contractors, and manufacturers on all facets of wood and mass timber construction, including sustainability, cost-benefit analyses, fiber optimization, best practices, building code analysis, and jurisdictional approval assistance. He developed the prescriptive, performance-based design approval process at the state level in Oregon, thereby **initiating tall mass timber buildings in the U.S.**, and he collaborated with state officials to set new precedents in prescriptive building codes, leading to **early adoption of CLT and tall mass timber buildings** in Oregon, Washington, Utah, and the City of Denver.

Ethan's willingness to pursue objectives not yet established by traditional means has **greatly influenced our industry's advancements in mass timber**, a sustainable building method that shows no signs of slowing. It's this same pioneering spirit that is so vital to incorporating sustainability practices across all materials and methods at DCI as the firm works to achieves net zero carbon emissions in our projects by the year 2050.

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SUSTAINABILITY **LEADERS**

MEET DCI'S SUSTAINABILITY ENGINEER & COMMITTEE CO-CHAIR

Arizona Dabrusin is DCI Austin's Sustainability Engineer. Arizona oversees DCI's SE2050 embodied carbon baseline submissions and co-chairs the company-wide sustainability committee, where he works with engineers across all offices to develop environmentally safe structural engineering services. Arizona's knowledge of the life-cycle assessments and embodied cardon are integral to DCI's SE2050 commitment to reduce negative environmental impacts from building design.

MEET DCI'S SUSTAINABILITY COMMITTEE CO-CHAIR

Salma Syed is a Structural Project Manager in DCI's Los Angeles office and co-chair of DCI's Sustainability Committee. Salma oversees the Sustainability Committee's internal and external education initiatives, which includes lunch-and-learn sessions about Mass Timber design, reducing carbon in concrete and more. Salma's passion for knowledge sharing has led her to present on embodied carbon and policy updates to architects and general contractors throughout Southern California.

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SUSTAINABILITY **LEADERS**

MEET DCI'S SUSTAINABILITY COMMITTEE

DCI's Sustainability Committee was formed in 2017 in an effort to **share knowledge and educate staff on sustainable building practices.** Our dedicated committee members meet monthly to collaborate on internal sustainability resources, coordinate internal and external educational content and discuss the latest sustainability trends within the building industry. The committee assesses sustainability reports and educational material from various industry organizations—such as the American Concrete Institute, American Institute of Steel Construction, and American Wood Council—to understand the implications of sustainability considerations on structural design. The committee also coordinates regularly with these organizations to maintain a well-rounded outlook on sustainable material selection.

Supporting DCI's sustainability efforts is our **in-house marketing team**. Comprised of marketers and communications specialists, the DCI Marketing group provides deliverables and other materials that **share, advertise and inform of DCI's sustainability efforts** both internally and externally.

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EDUCATION PLAN

EDUCATION PLAN

DCI Engineers' **commitment to education** is ingrained in our culture and firm values. With innovation at the forefront of everything we do, our people seek out opportunities for growth in knowledge and experience. This equates to better understanding where we can improve and how that transformation can **help make this world a better place.**

DCI's **Engineering Intelligence (EI) education program** allows our nationwide firm to collaborate, coordinate, and educate across all of our offices. Different regions of the country require a unique approach to sustainability as the infrastructure to documenting material environmental impacts continue to develop. EI allows each office to share best practices and tailor their sustainability approach accordingly.

We have already presented **Embodied Carbon 101** several times to our company and have a recording available for new hires and staff to revisit. In addition, we are providing **company-wide sustainability training** to help staff understand how we can contribute to our clients' sustainability goals and minimize the environmental impacts of our structural designs.

Our internal sustainability committee is also developing **material-specific sustainable design courses** for upload to our company learning platform, LINK. Once completed, these training videos will provide step-by-step instruction to engineers on sustainable design considerations for all major structural building materials.

NORTHLAKE COMMONS

KNOWLEDGE SHARING NARRATIVE

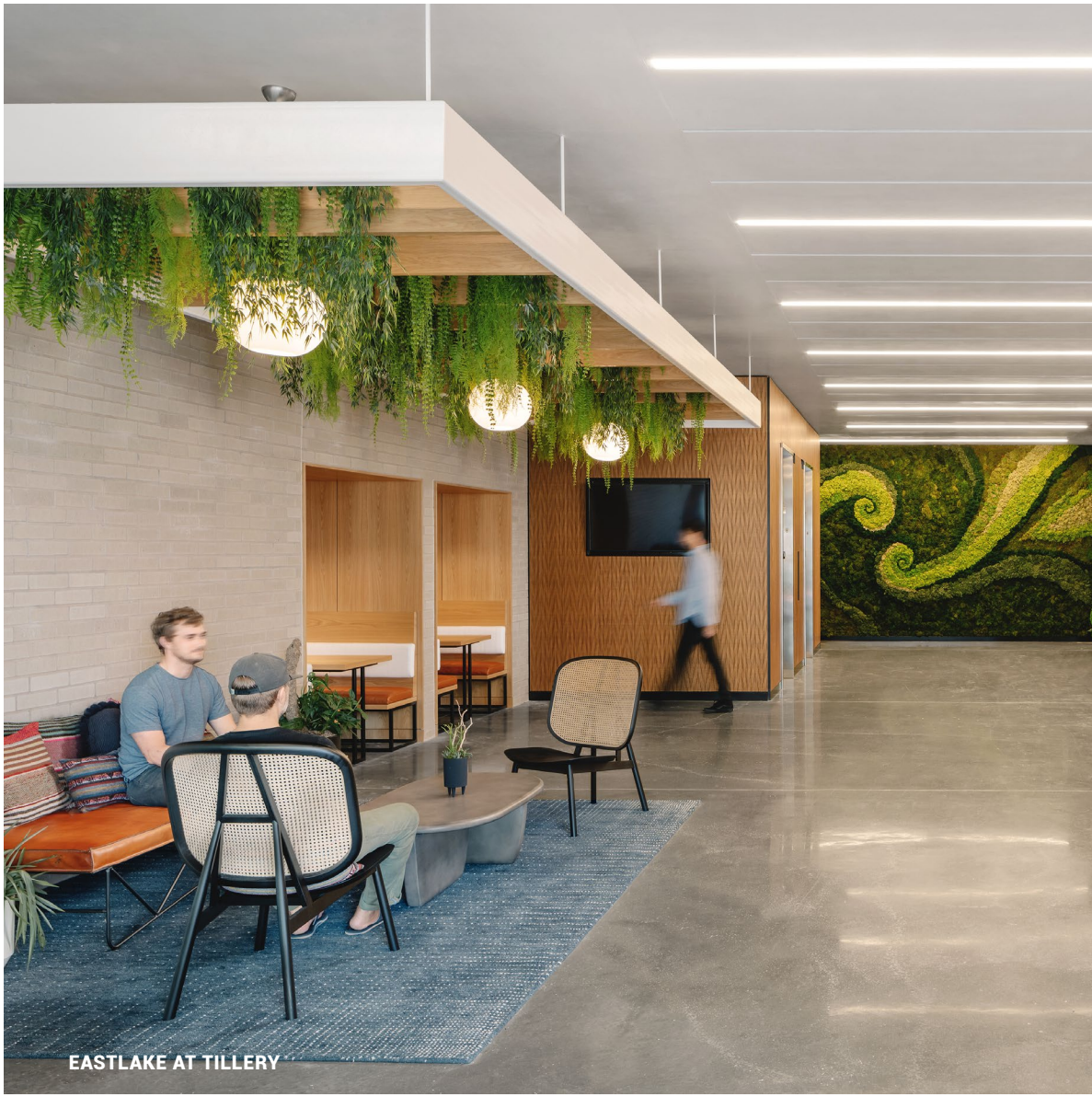
KNOWLEDGE SHARING NARRATIVE

Advocacy starts within. In order to educate our project partners, we need to adopt sustainability as a standard across DCI's design disciplines. This includes helping staff understand why it matters and how that effort translates externally. **Having a culture of sustainability is what enables us to advocate for its practice.**

DCI is sharing the importance of embodied carbon reduction with our clients through a variety of channels and will continue to expand these efforts over time. We routinely provide our **AIA-approved Embodied Carbon, Mass Timber, and CALGreen presentations** to our clients and have created a sustainability brochure with the intent of educating the industry on standard embodied carbon concepts while outlining DCI's capabilities to promote sustainability on our projects.

Our sustainability team frequently shares our embodied carbon work externally by giving presentations and sharing knowledge with local CLF hubs, SEA chapters, and AIA COTE committees. In addition, our internal mass timber division also promotes the potential carbon reduction benefits of mass timber as a structural system to accelerate the use of this material at a larger scale.

We intend to continue sharing our successes and lessons learned with clients, the design community, and the public every year through our embodied carbon action plan, project coordination discussions, and public speaking opportunities.



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REDUCTION STRATEGY

REDUCTION **STRATEGY**

DCI's history with sustainable design traces back to some of our first projects. In addition to designing for LEED-certified structures, our teams have always emphasized the use of materials and design-build practices that reduce waste. **The SE 2050 Challenge encourages us to pursue even more stringent standards for building green.**

This year we are **reevaluating our approach to reducing the embodied carbon associated with out projects based on lessons learned** and further development of knowledge pertaining to sustainability over the past year. Last year, we updated our general notes template to encourage procurement of low carbon building materials, and we also created an internal low carbon concrete sub-committee which produced and is up-keeping product information sheets for the various concrete technologies entering the market.

Moving forward, we plan to develop sub-committees for the other major building materials and produce similar product information sheets for internal distribution. We will also continue to share embodied carbon reduction tactics such as existing material re-use, low-impact material selection, and structural design optimization to empower all of our engineers to feel confident about implementing embodied carbon reduction strategies on their projects.

As our staff continues to incorporate these new concepts into their day-to-day work, we are implementing a sustainability QC process to ensure projects are reviewed at major design phases for consideration of embodied carbon reduction strategies.

REPORTING PLAN

REPORTING PLAN

In order to understand the standards of performance, we must have a baseline to measure against. By tracking and collecting quantitative data, DCI will be able to **accurately understand our performance** and ability to integrate such design standards.

To **establish our embodied carbon baseline**, we are examining our company-wide portfolio over the past decade to understand our prevailing markets and **create a representative sample set while we establish the infrastructure to perform LCAs on all our projects**.

We will calculate structural material quantities by utilizing OneClickLCA to analyze BIM (building information modeling) files such as Revit models and then refining data with either product or region-specific EPDs as applicable. Not every project location will feasibly have access to product specific EPDs so tracking our reduction in materials is critical to measuring our progress in these regions. We aim to work with contractors and suppliers to request EPDs for procured materials whenever possible to continue developing the market. For projects with **unique sustainability goals, we will consider the appropriate software from our library (Athena, Tally, EC3, OneClickLCA)** based on available project data and desired level of analysis to monitor embodied carbon at major project milestones. Our goal is to measure embodied carbon for a minimum of (5) projects a year, with the larger goal of accounting for our entire portfolio.

We primarily focus on reporting **cradle-to-gate embodied carbon impacts** because these are the stages we as engineers have the most control over during the design process. We are coordinating with contractors to measure impacts from construction in addition to our reporting of other stages to provide clients with the most complete embodied carbon assessment possible while the industry refines measurement accuracy for impacts beyond the gate.

FIFTEEN FIFTY
Jason O'Rear

ELECTIVE DOCUMENTATION

ELECTIVES: **EDUCATION**

SE 2050 DEFINED TASK	DCI'S IMPLEMENTATION
Make (1) webinar focused on embodied carbon available to employees. [R]	Our sustainability committee presented an Introduction to Embodied Carbon in the Building Industry to all staff on July 12th, 2023, which we recorded and have made available for reference on our internal website, Vault.
Incorporate embodied carbon education in your onboarding process for all new employees.	We have developed an internal Introduction to Embodied Carbon in the Building Industry presentation which we deliver yearly. This presentation is mandatory for new hires and optional for existing employees who want to refresh their sustainability knowledge.
Train all of your firm's structural engineers on the core concepts and skills required to measure, reduce, and report embodied carbon.	We have shared this information as part of our Introduction to Embodied Carbon in the Building Industry presentation and are developing material-specific sustainable design courses for upload to our company learning platform, LINK.
Engage with a CLF regional Hub. This could mean: • Attending presentations or working sessions and reporting back to the firm • Co-chairing a hub	DCI has elected Sustainability Committee Members participating in the Austin, Los Angeles, Yellowstone, San Francisco, and Seattle CLF Hubs.
Provide a narrative outlining plans for minimum (2) firm-wide presentations per year on the topic of embodied carbon.	This year we had Don Davies, former president of MKA, present to our firm on Embodied Carbon and Changing our Decision-Making Process on April 27th, 2023. We also presented an Introduction to Embodied Carbon in the Building Industry to all staff on July 12th, 2023.

[R] *Required Task*

ELECTIVES: **EDUCATION**

SE 2050 DEFINED TASK	DCI'S IMPLEMENTATION
Provide a narrative of how the Embodied Carbon Reduction Champion will engage embodied carbon reduction at each office. [R]	To ensure DCI's approach to embodied carbon mitigation is well-established across our entire company, we are establishing local sustainability leaders within each office to aid in embodied carbon reduction strategies for each major project. We have updated our fee proposal templates and standard general notes to include baseline carbon reduction strategies for all projects. Our core group of local leaders assist each local office and its employees on best practices to implement embodied carbon reductions in support of their office's unique sustainability project goals in addition to locally available material sourcing. The local leaders are already engaging with local CLF hubs, SEA chapters, and a variety of industry groups to share best practices related to embodied carbon reduction strategies.
Initiate an embodied carbon interest group within your firm and outline their goals.	DCI has an internal Sustainability Committee that is composed of roughly 30 active members coming together from each of our offices. The committee has several goals which include education of staff and clients on the importance of embodied carbon, refinement of our life cycle assessment capabilities, and development of embodied carbon resources for staff use on projects.
Create and Embodied Carbon digital resource wiki and/or forum on your firm's internal website for staff to create, share, and discuss Embodied Carbon educational resources.	We have developed the Education and Project Resources pages on our internal website, Vault, to include recorded webinars, presentation slides, and various informational resources/tools for use in embodied carbon education and tracking. We also have a forum on Vault where employees can ask the Sustainability Committee technical questions. These posts appear on the website's home page and are accessible to all staff for future reference.

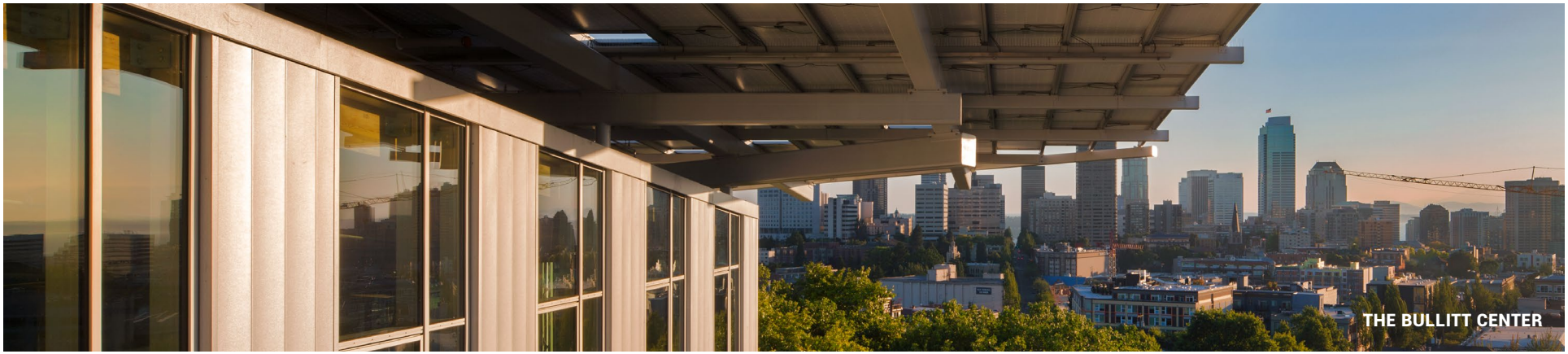
[R] *Required Task*

DATA 1

ELECTIVES: **REPORTING**

SE 2050 DEFINED TASK	DCI'S IMPLEMENTATION
Submit a minimum of (2) projects per U.S. office with structural engineering services to the SE 2050 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 SE 2050 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. [R]	To date, we have submitted (16) projects to the SE2050 database representing (5) offices across our firm. These are meant to be representative of the most common project types in our portfolio.
For multi-office firms, describe how each office is measuring and reporting embodied carbon. For single-office firms, describe how different project teams or managers are measuring and reporting embodied carbon.	We are internally tracking project types across all of our offices to ensure that as we continue submitting further projects, they are representative of our portfolio and office locations. Our sustainability department is working with leaders from each office to identify projects that align with that goal and then conduct life-cycle assessments with the same criteria to ensure reporting is uniform across our internal database and the SE2050 database.
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	After comparing embodied carbon emissions data from multiple projects across our firm, we have identified the following categories of information to be some of the most important: square footage, primary horizontal/ vertical gravity system, foundation type, building use type, and typical spans. We have presented these takeaways to our firm in the form of project case studies and various educational documents.

[R] *Required Task*


THE BULLITT CENTER

ELECTIVES: **REDUCTION**

SE 2050 DEFINED TASK	DCI'S IMPLEMENTATION
Communicate the embodied carbon impacts of different design options to clients with creative data visualization. Include these visualizations in your Elective Documentation.	With the help of our marketing department, we've had the opportunity to communicate the importance of embodied carbon during the design process through creative data visualizations. See the attached graphics in the appendix that we've included in our sustainability brochure for education of our clients and peers.
Develop and implement a workflow that makes it easier to make early design decisions based on embodied carbon	We have developed an internal embodied carbon tool that analyzes the A1-A3 global warming potential and biogenic carbon impacts of structural materials for conceptual and schematic level designs so we can compare embodied carbon of different designs early on and meet client sustainability goals.
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).	One example involves a 12-story office building where we explored three different structural systems during the conceptual phase to determine the most efficient use of embodied carbon for the development's net zero carbon goals. The structural system options included an all-concrete frame, all-mass timber frame, and delta-beam hybrid frame over a concrete podium.
Participate in a LEED, ILFI Zero Carbon, or similar project design charrette and speak to potential design considerations impacting embodied carbon.	We've participated in several design charrettes that focus on achieving the goals of a variety of sustainability goals, such as LEED, Living Building Challenge and Net Zero Carbon. During these meetings, we speak to project-specific design considerations that impact embodied carbon and bring additional ideas to the table that capitalize on other sustainable building concepts such as occupancy health and happiness.

**One reduction elective required, however we have the flexibility to choose which task we pursue.*

ELECTIVES: **REDUCTION**

SE 2050 DEFINED TASK	DCI'S IMPLEMENTATION
Update your specifications to incorporate embodied carbon performance. Include embodied carbon in your submittal review requirements.	We have updated our short-form specification template to include options to implement global warming potential limits for materials we specify such as: concrete, steel, rebar, and wood. The language will provide a range of compliance requirements based on the region's infrastructure and ability to support sustainability goals for each project.
Collaborate with your concrete supplier to reduce embodied carbon in a mix design. Discuss what you found and what it means in your market.	On DCI's concrete projects, we thoroughly review the concrete mix design submittals for opportunities to suggest embodied carbon reduction strategies. We've collaborated with concrete suppliers on several projects to reduce embodied carbon over the NRMCA regional baseline by employing strategies such as extended test ages, cement replacement, alternate cement types, high strength aggregates, and carbon neutral/negative concrete innovations. We have found that by providing GWP limits and allowing the supplier's to explore various means of achieving them, we can meet or exceed those embodied carbon reductions with little cost implications to the client.

**One reduction elective required, however we have the flexibility to choose which task we pursue.*

ELECTIVES: **ADVOCACY**

SE 2050 DEFINED TASK	DCI'S IMPLEMENTATION
Describe the value of SE 2050 to clients. How can your design teams collaborate to reduce embodied carbon? Please attach any associated marketing materials. [R]	We frequently emphasize the importance of SE 2050 and embodied carbon reduction as early as during the project pursuit, while moving through design discussions and even playing an active part during procurement. In addition to collaborating early and often with project design teams to yield meaningful reductions, we also offer AIA-approved presentations, brochures and one-pagers to explain the value of embodied carbon reduction to colleagues and potential clients.
Publicly declare your firm as a member of the SE 2050 Commitment however you see fit. [R]	Our structural and civil boilerplate proposal language declares DCI as a member of the SE 2050 Commitment and urges our clients to engage in building decarbonization. DCI's new website highlights sustainability as a key value of DCI's culture and shares our commitment to the SE 2050 program.
Give an external presentation on embodied carbon that demonstrated a project success or lessons learned. Get connected at a CLF regional hub near you and be sure to post the recording.	We gave over 25 presentations last year to architects, contractors, structural engineers, developers, and students which include various case studies we've compiled to communicate project successes and lessons learned to inform future development.
Engage with structural material suppliers in your region to communicate the importance of Environmental Product Declarations(EPDs) and low-carbon material options.	We are fortunate to have several projects in regions where local suppliers are actively providing EPDs, but in areas where the infrastructure is still developing, we include language in our general notes that encourage the procurement of EPDs. We've worked with several contractors, fabricators, and suppliers to inform on basic embodied carbon concepts and the importance of EPDs.

[R] *Required Task*

LESSONS LEARNED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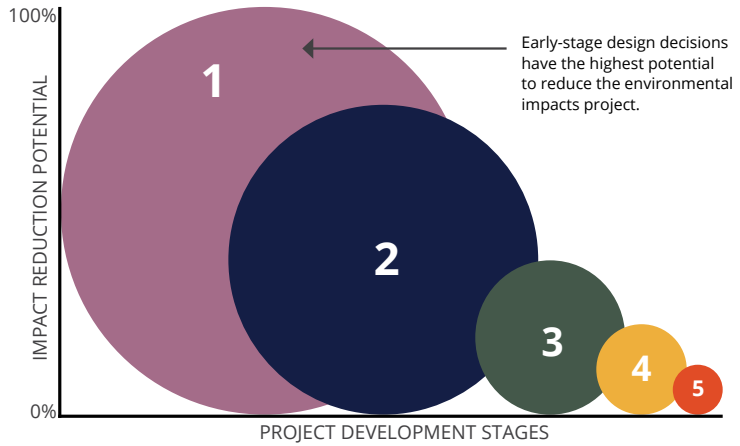
LESSONS **LEARNED**

While establishing the groundwork for our embodied carbon baseline, we realized several of our projects are in regions where infrastructure to produce environmental product declarations is still developing and learned we cannot rely on reducing the impacts of our materials through procurement alone. Even though we continuously strive to encourage thoughtful procurement, we realized **our biggest opportunity to contribute meaningful embodied carbon reduction is through integrative design early on.** Coordinating with the project team in early design phases creates more opportunities for reuse of existing materials, comparing different structural systems, and selection of lower-impact materials.

In addition, we learned a lot about the varying level of detail that can go into LCAs and EPDs. Although understanding the more granular concepts of embodied carbon is essential to communicating the accuracy of our analyses, **the ability to see the bigger picture is critical to capture meaningful reductions.** Looking ahead, we will continue targeting the most impactful contributors and searching for innovative ways to reduce our embodied carbon footprint by working collaboratively with our design teams, contractors, and peers to explore best practices.

IMPACT REDUCTION POTENTIAL BY DEVELOPMENT PHASE



APPENDIX

SUSTAINABILITY CASE STUDY: 1510 WEBSTER

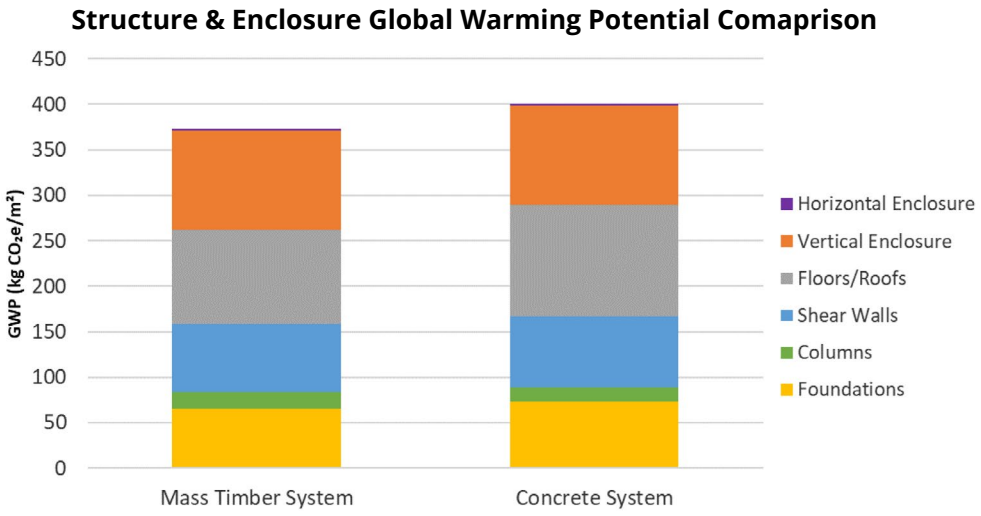
The 19-story, mixed-use, high-rise building in Oakland, CA provides 236 apartments, retail, commercial spaces, and a covered public plaza. 1510 Webster became the **first high-rise in the United States to utilize point-supported mass timber and mass plywood panels (MPP)**.

MASS TIMBER SOLUTION:

Early involvement in the conceptual design phase allowed DCI to advocate for mass timber over traditional concrete framing,which not only **resulted in embodied carbon savings but provided cost and scheduling savings that helped the owners achieve affordable housing goals**. The MPP system went through laboratory testing to determine the punching shear and flexible capacity, deflections, and vibration performance. These results allowed for increased panel spans, fewer columns, and thinner deck profiles. **Mass timber provided an embodied carbon reduction that aligned with the architect/developer's sustainability goals**.

- LOCATION: Oakland, California
- STRUCTURAL ENGINEER: DCI Engineers
- ARCHITECT: oWOW
- OWNER: 1510 Webster LLC
- CONTRACTOR: oWOW
- COMPLETION DATE: Targeting 2024
- TOTAL SQUARE FOOTAGE: ~193,286-sf
- HEIGHT: 19 Stories
- UNITS: 182
- MATERIAL: Mass Plywood Panel (MPP)

DCI conducted a comparative whole-building life cycle assessment—in partnership with WoodWorks—to measure the embodied carbon savings and anticipated biogenic carbon storage associated with the mass timber building.



SUSTAINABILITY CASE STUDY: **1510 WEBSTER**

As compared to an all-concrete baseline, 1510 Webster's mass timber system reduced the **project's overall structural embodied carbon footprint by 7% by excluding biogenic carbon and 64% when including biogenic carbon**. Due to the lighter weight of the mass timber system the **volume of concrete in the foundations was reduced by 11%** in comparison to the concrete system.

ADDITIONAL PROJECT HIGHLIGHTS:

- 1510 Webster became the first prescriptive high-rise Type IV-A building in North America and tallest mass timber building in the world located in high-seismic region.
- The mass timber portion of the building was constructed in less than 4 months and resulted in the building topping out over a month ahead of schedule.
- The developer realized $30 million in net project cost savings compared to a traditional concrete project of this scale. A portion of that savings resulted from the beamless sytem alleviating routing challenges of mechanical, electrical and plumbing, which is typically troublesome for beam-framed wood systems.

COLLABORATION:

- Significant cost and site work was saved by re-purposing the existing basement walls to function as temporary shoring and soil retention.
- The laboratory testing of the MPP system resulted in expanding the column grid from 10x10 to approximately 12x15-foot grid, which reduced the number of columns by approximately 47 per level.
- By utilizing a point-supported MPP system and collaborating with the architect, DCI was able to ensure the floor-to-floor heights of the mass timber were identical to a concrete solution. This allowed for the same enclosure system on both building designs.

SUSTAINABILITY CASE STUDY: THE ARTISE

The Artise is a 25-story office tower in Bellevue's central business district appealing to high-tech businesses and professionals. The 1,040,000-sf tower will consist of a steel framed gravity system and unique performance-based lateral system consisting of buckling restrained mega braces and intermittent special moment frames. This innovative lateral system for the above-grade portion then utilizes a stepped diaphragm at level 1 where lateral forces are transferred to the basement walls, which allows the entire basement level to be open, unobstructed space.

DESIGN CONSIDERATIONS:

The building utilized performance-based design to increase resiliency and reduce cost while maintaining open floor plates to attract high-tech tenants. To achieve those open spaces at the office and parking levels, the team coordinated with the architects to develop a unique super brace system along the perimeter capable of skipping floors requiring intermittent specialty moment frames that collected local lateral forces at skipped floors and transmitted them down back into the super brace system. When the building's occupancy category transitioned from category 2 to category 3 (more than 5,000 occupants) to offer further leasing flexibility, the engineers added fluid viscous dampers in parallel with the super brace system to reduce building drift.

By utilizing this innovative lateral system along the perimeter, DCI saved an estimated **25% of steel tonnage** in the structural frame. By eliminating approximately a quarter of the steel framing required for a traditional steel-framed office layout, the project **reduced its embodied carbon by an estimated 11%** as well as substantial cost savings.

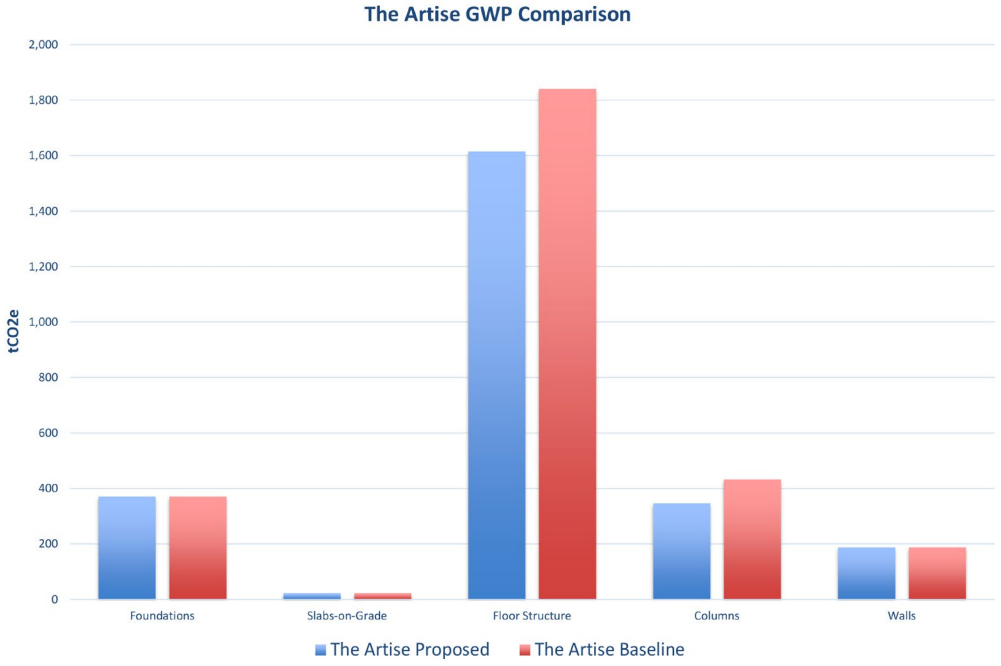
Additionally, because there were no traditional concrete cores or interior braced frames, the parking plans were optimized to eliminate an entire below-grade level.

- LOCATION: Bellevue, Washington
- STRUCTURAL ENGINEER: DCI Engineers
- ARCHITECT: NBBJ
- OWNER: Schnitzer West, LLC
- CONTRACTOR: Sellen Construction
- COMPLETION DATE: 2023
- TOTAL SQUARE FOOTAGE: 1,040,000-sf
- HEIGHT: 25 Stories
- MATERIAL: Steel, Concrete

SUSTAINABILITY CASE STUDY: THE ARTISE

ADDITIONAL PROJECT HIGHLIGHTS:

- This project marks the first time a fluid viscous damper system has been used in Bellevue
- The site is located near a new light rail transit station for easy public transit use. A “living street” along the south side was designed purposefully to activate the streetscape and enhance pedestrian and bike travel. Additionally at the ground floor is a 7,522-sf retail space and a public plaza.
- By eliminating an extra level below grade while maintaining the desired parking stalls, DCI also avoided contaminating an underground aquifer below the building.
- The project is designed to achieve LEED Gold v4 standards.



SUSTAINABILITY CASE STUDY: TIMBERVIEW VIII

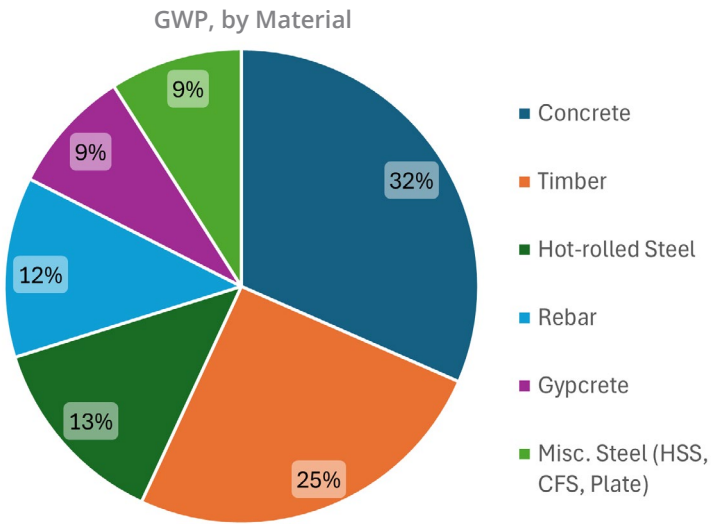
Timberview VIII is an eight-story, mass timber, 105-unit affordable housing building with ground level retail space and a partial below-grade concrete basement. The residential building contains a mix of studio, one-bedroom, two-bedroom, and three-bedroom units. The structural system is a combination of CLT panels supported on glulam beams and columns, plus full height steel buckling restrained braced frames for the lateral system.

SUSTAINABILITY HIGHLIGHTS:

Using mass timber reduces the environmental impact significantly, even when not accounting for biogenic carbon storage. The structural system's total cradle-to-grave embodied carbon footprint is approximately 1,036 metric tonnes of CO_2e (t CO_2e), the bulk of which is concentrated in the foundation, the below grade concrete construction, and mass timber elements. Concrete foundations and their reinforcement comprise 31% of total GWP, followed by mass timber floor decks and framing with a 25% share. The most impactful materials across all structural elements - concrete, timber, and hot-rolled steel - are responsible for 32%, 25%, and 13% of GWP, respectively, as seen in the *"GWP, by Material"* figure.

ADDITIONAL HIGHLIGHTS:

- Considering permanent biogenic carbon storage would provide a net negative GWP impact of -916 tCO_2e, reducing the project's overall (net) GWP to 120 tCO_2e. (F1)
- Based on EPA data for the social cost of carbon (SC-CO_2), potentially $174,000 would be saved considering permanent biogenic carbon storage at end-of-life. (F1 & F2)



F1: OneClickLCA was used to calculate the embodied carbon of the building, and we referenced Athena Impact Estimator's biogenic carbon reporting practices (64% permanent biogenic carbon storage was assumed for all timber elements). At the time this case study was published, most LCA software's end-of-life assumptions for wood products are primarily based on conventional stick-frame construction and are not expected to reflect mass timber products because there is not historical data to reference for the future decommissioning of mass timber buildings.

F2: Source: EPA Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances (2023), Table ES.1, 2020 Emission Year and 2.0% Discount Rate.

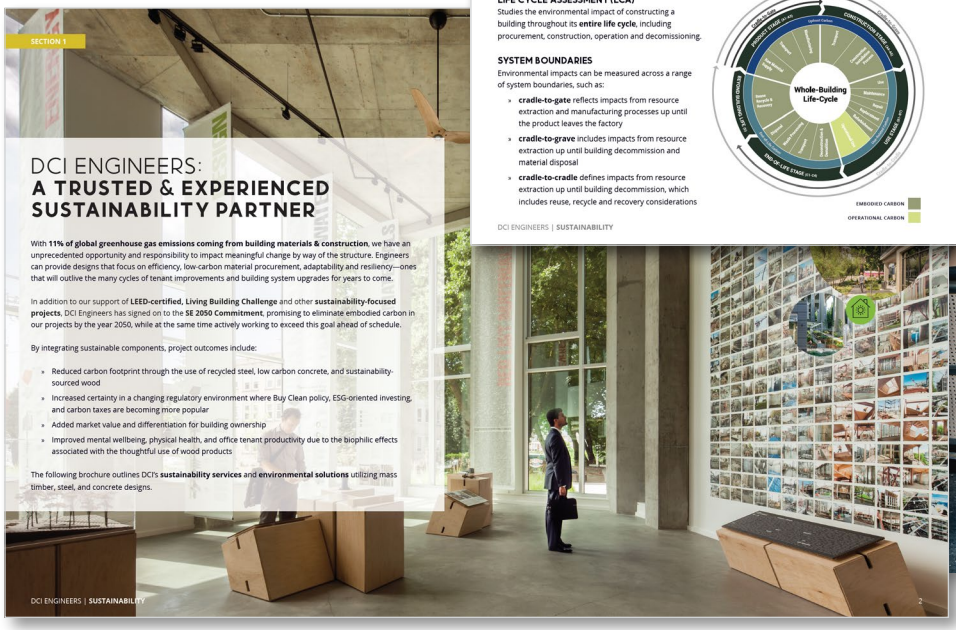
- LOCATION: Portland, Oregon
- TIMBER SPECIALTY ENGINEER & STRUCTURAL EOR: DCI Engineers
- ARCHITECT: Access Architecture
- OWNER: C&J Property Development, LLC
- CONTRACTOR: Truebeck Construction
- COMPLETION DATE: September 2024
- TOTAL SQUARE FOOTAGE: 78,200-sf
- HEIGHT: 8 Stories
- NUMBER OF UNITS: 105
- MATERIAL: Mass Timber, Steel

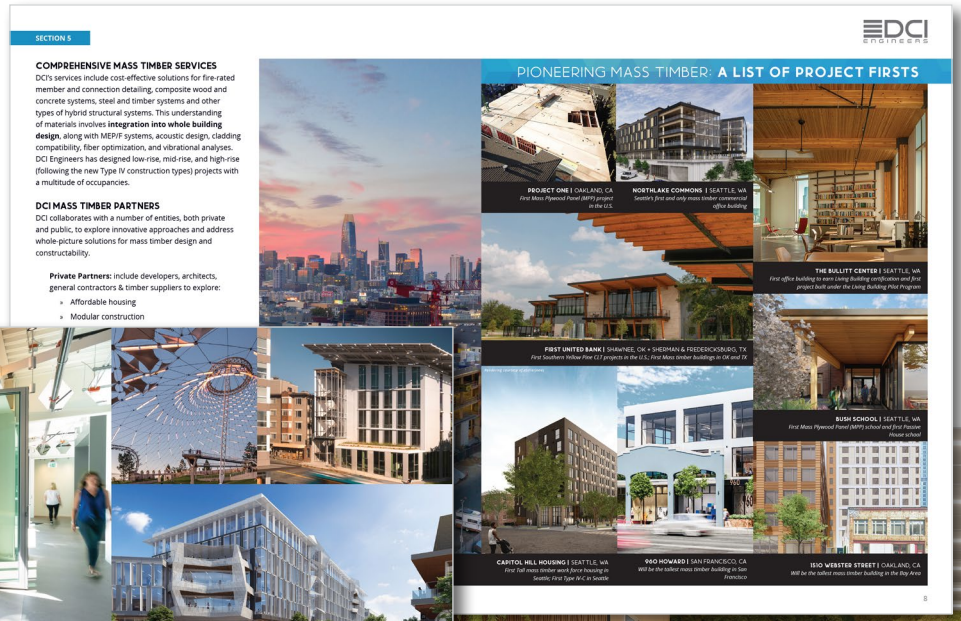
MARKETING **MATERIALS**

DCI'S SUSTAINABILITY BROCHURE:

This document is intended to educate the industry on structural **sustainability concepts** and share the **capabilities DCI is able to offer our clients**.

SCAN TO DIVE INTO DCI'S
SUSTAINABILITY
BROCHURE





MARKETING **MATERIALS**

This page of our sustainability brochure helps communicate how **different materials** used to design the **same structural element** can have a **significant impact on embodied carbon** to clients in a creative way.

MATERIAL COMPARISON **OVERVIEW**

A REAL-WORLD APPLICATION TO COMPARE GLOBAL WARMING POTENTIAL (GWP)

A simple beam analysis will provide an idea of how the different materials used to design the same structural element can have a significant impact on GWP. The GWP metrics are selected from industry-average EPDs from the National Ready Mix Concrete Association (NRMCA), American Institute of Steel Construction (AISC), Steel Framing Industry Association (SFIA) and the American Wood Council (AWC).

GLOBAL WARMING POTENTIAL (GWP) IN KGCO2EQ:

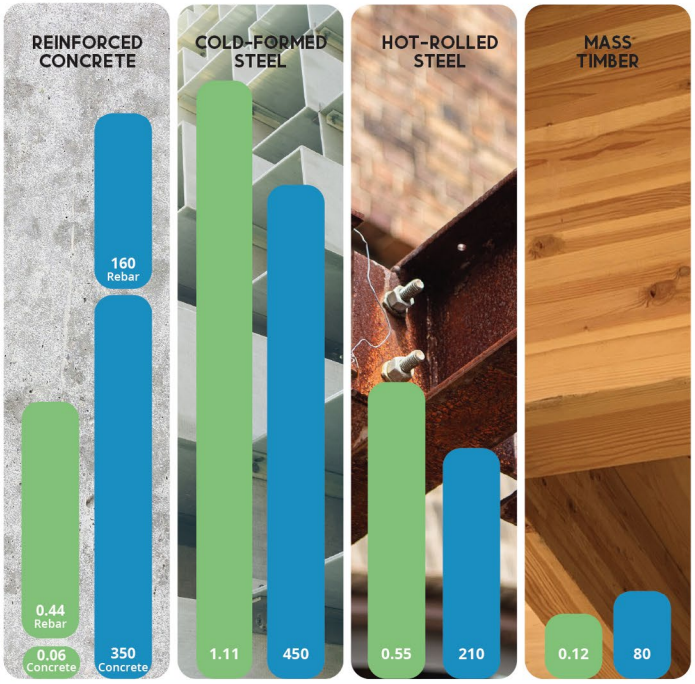
These graphics show the cradle-to-gate industry-average GWP per pound of material versus the overall GWP content of the beam's analyzed for a 20-foot span.

Note that while concrete has the lowest carbon intensity per pound, the weight associated with the concrete section far outweighs the other materials. Plus, the need for concrete reinforcement proves a considerable impact when studying the GWP of the full design. However, it's important to keep in mind each structural material has its own unique characteristics, for example concrete's fire resistance and long-term durability, so it's necessary to select materials with all relevant factors in mind.

KEY:

Average GWP per pound (kg CO2eq/lb)

Overall GWP for a beam of equal structural performance (kg CO2eq)



Depth: 12 in
Conc Weight: 5800 lb
Rebar Weight: 275 lb

Depth: 16 in
Weight: 380 lb

Depth: 16 in
Weight: 380 lb

Depth: 16.75 in
Weight: 530 lb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