DCI ENGINEERS

SEI STRUCTURAL ENGINEERING INSTITUTE ASCE

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.

SEI ASCE STRUCTURAL ENGINEERING INSTITUTE | SE2050 COMMITTING TO NET ZERO

WATERSHED | LIVING BUILDING PETAL

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: ETHAN MARTIN

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.

In addition to his hands-on sustainability work on projects like **The Bullitt Center (the nation's first Living Building),** Ethan has experience working in sustainability software programs like **Athena, EC3 and Tally**. Ethan is working to help build these programs into DCI's design processes, further helping ingrain sustainable practices into DCI's design vernacular. His partnership with the Principal in Charge of Sustainability, Roger Heeringa, and Sustainability Committee Chair, Jessica Martinez, will., will encourage a **balanced sustainability perspective** for applying mass timber, low carbon concrete, and recycled steel. Their collaboration will expand sustainability choices for clients through coordinating thoughtful structural solutions focused on optimizing the building's overall embodied carbon impacts.

ETHAN MARTIN, PE | DIRECTOR OF SUSTAINABILITY & MASS TIMBER
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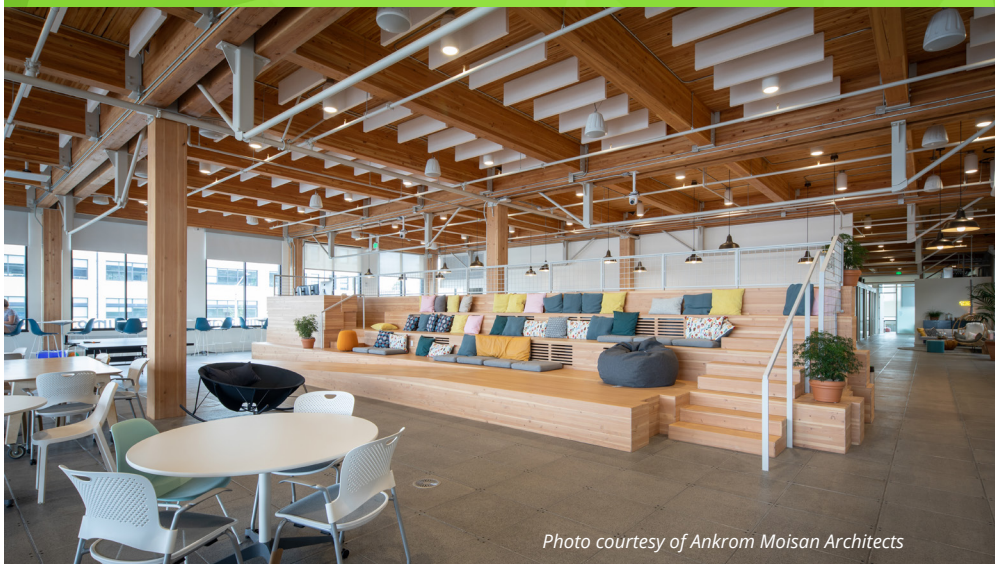

Photo courtesy of Ankrom Moisan Architects

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.

ROGER HEERINGA, PE, SE, LEED AP
PRINCIPAL IN CHARGE OF SUSTAINABILITY
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MEET DCI'S SUSTAINABILITY SPECIALIST

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 is actively involved with the Austin and Seattle Carbon Leadership Forum hubs where she provides **embodied carbon leadership from the structural perspective to impact meaningful change in the building industry.** She's also a member of the NCSEA Sustainable Design Committee where she collaborates with other structural engineers leading sustainability initiatives across the country to share best practices and push decarbonization of the building industry.

JESSICA MARTINEZ, PE, LEED GREEN ASSOCIATE
SUSTAINABILITY SPECIALIST
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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, the American Institute of Steel Construction, and WoodWorks—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 infrastructure to document the environmental impact of materials continues 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 developing and compiling educational resources for a curated learning path which includes general embodied carbon concepts, material-specific considerations and green building rating system assistance resources.

DATA 1

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 makes us advocates for its practice.**

DCI is sharing the importance of embodied carbon with our clients through several means and continue expanding these efforts over time. We are routinely providing our **AIA-approved Embodied Carbon presentation** to our clients and have created a **sustainability brochure** that educates readers on standard embodied carbon concepts and outlines our capabilities to promote sustainability on our projects.

Our sustainability team frequently shares our embodied carbon work externally through industry-wide forums by giving presentations and sharing knowledge with local Carbon Leadership Forum hubs, SEA chapters, and AIA COTE committees. In addition, our internal mass timber division also promotes the potential carbon benefits of mass timber as a structural system in the industry 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 certification structures, our teams have been integrating materials and design-build practices that reduce waste. **The SE 2050 Challenge further allows us to pursue even deeper standards for building green.**

This year we are **reevaluating our approach to reducing embodied carbon in project work 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 concrete, but now we are taking this a step further to refine our approach and apply these concepts to all materials we specify.

We will follow the update of our general notes with company-wide learning sessions to **empower all staff to feel confident about implementing embodied carbon reductions strategies in their projects**. These strategies include reduction through utilizing existing structure whenever possible, encouraging lower impact material selection, and exploring opportunities for further structural design optimization.

As our staff continues to incorporate these new concepts into their practice, 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** once construction documents are complete then refine with either product- or region-specific EPDs as applicable. Not every project location will feasibly have access to product-specific EPDs as the market continues to develop, so tracking our reduction in materials is critical to measuring our progress in these regions. For projects with **unique sustainability goals**, we will consider the appropriate software from our library (Athena, Tally, EC3, OneClickLCA) based on the available project data and desired level of analysis to monitor embodied carbon at major project milestones.

We primarily focus on reporting **cradle-to-gate embodied carbon impacts** because these are the stages we have most control over during the design process. We are working with contractors to measure the construction stages and we estimate the other stages as necessary to give our clients the most complete embodied carbon assessment possible while the industry refines the measurement accuracy for impacts beyond the gate.

FIFTEEN FIFTY
Jason O'Rear

ELECTIVE DOCUMENTATION

ELECTIVES: EDUCATION

SE 2050 DEFINED TASK	DCI'S IMPLEMENTATION
Distribute ECAP within your firm upon publishing.	DCI has shared our ECAP with all internal staff and it is available for access on our internal website, Vault.
Make (1) webinar focused on embodied carbon available to employees.	We partnered with the Carbon Leadership Forum on April 4th, 2022 to present Embodied Carbon 101 to our entire staff. We have a recording of this webinar available for staff on the Vault.
Have one representative of your firm (any employee) attend quarterly external education programs (e.g. webinar, workshop) provided by SE 2050, Carbon Leadership Forum (CLF), or other embodied carbon resources.	Over the past year, DCI staff has attended numerous educational events focused on sustainability and embodied carbon. Aside from our frequent attendance to local CLF & AIA COTE presentations, additional educational programs include: » SEAOSC Technical Summit I: Sustainability in Structural Design » NCSEA & ASCE Webinars » Environmental Life Cycle Assessment in Design International Symposium » Living Future '22 Conference » International Mass Timber Conference » NRMCA Concrete Innovations Webinars » Steel Tube Institute & AISC Webinars
Share embodied carbon reduction strategies with your firm as outlined in Top 10 Carbon Reducing Actions for Structural Engineers document produced by SE 2050.	We have shared this information as part of our Embodied Carbon 101 presentation and are compiling educational resources for our employees through a sustainability-focused curated learning path for access on our intranet. Embodied carbon concepts are also being introduced into our material-specific structural design learning paths for full integration.
Nominate a minimum of (1) employee per office to participate in a CLF Community Hub and/or task force.	DCI has elected Sustainability Committee Members participating in the Austin, Los Angeles, Portland, Rocky Mountain, 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 re-introduced the EC 101 presentation for our staff and provided follow-up training for our staff to incorporate these concepts into their typical workflow. Over the next year, we will present a concrete mix design class focused on facilitating efficient performance parameters and an overarching design class focused on introducing embodied carbon reduction strategies across all materials.

ELECTIVES: EDUCATION

SE 2050 DEFINED TASK	DCI'S IMPLEMENTATION
Minimum (1) employee attends a presentation or demo of an LCA-based tool used to calculate embodied carbon, such as Tally, Athena IEB, or One Click LCA.	Our internal sustainability committee hosted a presentation from One Click LCA to examine this software in comparison to others we've used like Athena and Tally.
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.
Provide a narrative of how the Embodied Carbon Reduction Champion will engage embodied carbon reduction at each office	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.

ELECTIVES: **REPORTING**

SE 2050 DEFINED TASK	DCI'S IMPLEMENTATION
Submit an annual minimum of (2) projects per U.S. structural office but need not exceed (5) total projects for the firm to the SE 2050 database	We will submit at least (5) projects that we've analyzed over the past year to the SE2050 database by March 2023.
Report a greater percentage of projects than you did the previous year	Our goal is to submit additional projects that exceed the number we previously reported which will represent a sample set of our company-wide portfolio.
For a project submitted to the database, ask the Architect or Owner if the project has a carbon budget or if there are established project sustainability goals at the project kickoff meeting	We are currently tracking embodied carbon on a number of projects where we asked our clients about their sustainability goals . We are planning to include these projects in our submission to the SE 2050 database over the next year.

THE BULLITT CENTER

ELECTIVES: REDUCTION

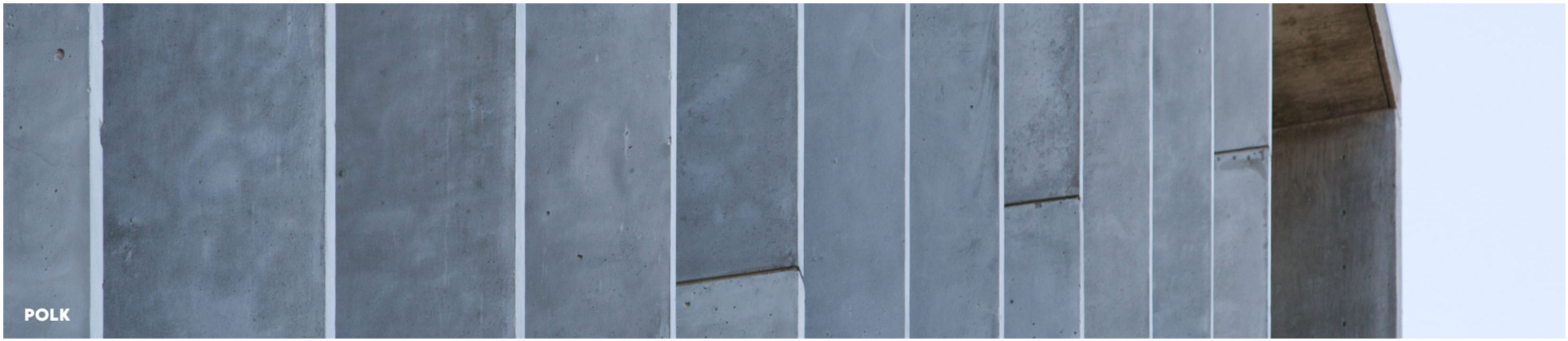
SE 2050 DEFINED TASK	DCI'S IMPLEMENTATION
Communicate the embodied carbon impacts of different design options to clients with creative data visualization. Include these visualizations in your Elective Documentation.	With the help of our marketing department, we've had the opportunity to communicate the 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.
Project case study sharing embodied carbon reduction successes and lessons learned.	Refer to the appendix for our case studies.
Create a project-specific embodied carbon reduction plan.	We have developed a standardized framework to monitor and communicate the embodied carbon associated with the structural system throughout all design phases. This plan involves the early consideration of efficient structural design approaches, routine coordination with the design team to identify embodied carbon reduction opportunities and collaboration with the general contractor to procure materials that align with our sustainability targets. We've custom-tailored this framework for project-specific considerations depending on the structural system chosen, presence of a contractor during the design process and client's sustainability goals.
Complete an embodied carbon comparison study during the project concept phase.	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 charettes over the past year 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.
Calculate your firm average benchmark for embodied carbon.	We are examining our company-wide portfolio over the past decade to understand our prevailing markets and create a representative sample set that reflects our firm average embodied carbon benchmark.

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 are updating our short-form specification template to include options to implement global warming potential limits for all materials we specify. 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.	On DCI's concrete projects, we thoroughly review the concrete mix design submittals for opportunities to suggest embodied carbon reduction strategies. For example, taking advantage of the maximum amount of allowed cement replacement and extended test ages. We also encourage suppliers to explore alternate cements, high strength aggregates, recycled carbon dioxide injection and carbon neutral/negative concrete innovations to further reduce their product's environmental impacts.
Work with a contractor during material procurement to meet an embodied carbon performance criteria on at least (1) project.	We are working on several projects with high sustainability goals that are entering the construction phase and require coordination to procure low carbon materials to align with our targets. For example, on a concrete tower we recently used concrete material estimates from our structural Revit model to assist the general contractor in comparing mix designs and EPDs from various concrete suppliers that would satisfy the project's specific embodied carbon performance criteria.
Integrate embodied carbon mitigation strategies in your General Notes.	We are updating our short-form specification template to promote reduced impact procurement for all materials we specify and reflect the lessons we learned over the past year. The language will provide various options for the engineer to consider based on the region's infrastructure and ability to support sustainability goals for each project.

ELECTIVES: ADVOCACY

SE 2050 DEFINED TASK	DCI'S IMPLEMENTATION
Describe the value of SE 2050 to clients. How can we collaborate to drive adoption? At your option, attach any associated marketing materials.	We regularly include this information in our proposals, SOQs and design discussions. In addition to explaining our capabilities, we've also created an AIA-approved presentation and sustainability brochure to explain the value of sustainable design on a project and the potential benefits to clients and users.
Declare your firm as a member of the SE 2050 commitment on boilerplate proposal language.	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.
Share your commitment to SE 2050 on your company website.	DCI's new website highlights sustainability as a key value of DCI's culture and shares our commitment to the SE 2050 program.
With the owner or client, discuss a facility- or product-specific EPD requirement for structural materials	Over the past year, we've coordinated with owners and clients alike to implement facility- or product-specific EPD requirements and even GWP limits when appropriate. In regions where the necessary infrastructure is still developing, we work closely with general contractors and material suppliers to communicate the value of procuring facility- or product-specific EPDs and differentiating from the industry average.
Encourage industry and policy change by promoting and using low-carbon and carbon-sequestering materials	Sustainability leaders within DCI have worked intensively to promote low-carbon and carbon-sequestering materials through participation in public speaking events, white papers and industry groups advocating building decarbonization. We've worked closely with groups such as the City of Austin, Sound Transit and AHJs across the country to push the envelope on the acceptance of Portland Limestone Cement in specifications and building codes that allow taller mass timber structures.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LESSONS LEARNED


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LESSONS **LEARNED**

While establishing the groundwork for our embodied carbon baseline last year, 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 impacts of our materials through procurement alone for reduction. Even though we continuously strive to encourage thoughtful procurement, we realized **our biggest opportunity to contribute meaningful embodied carbon reduction is through reuse of existing materials, utilization of hybrid 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 capturing 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.


WATERSHED

APPENDIX

SUSTAINABILITY CASE STUDY: **BUSH SCHOOL**

The project adds a three-story, mass timber framed structure to the Seattle school campus, adding 11 classrooms, administrative offices, study lounges and a 400-person auditorium. Not only does the new structure expand and add new space for the high school, it helps connect the campus with improved accesibility from the lower campus to the upper campus.

As a **net zero energy facility**, the Bush School is **the first Passive House school on the west coast.**

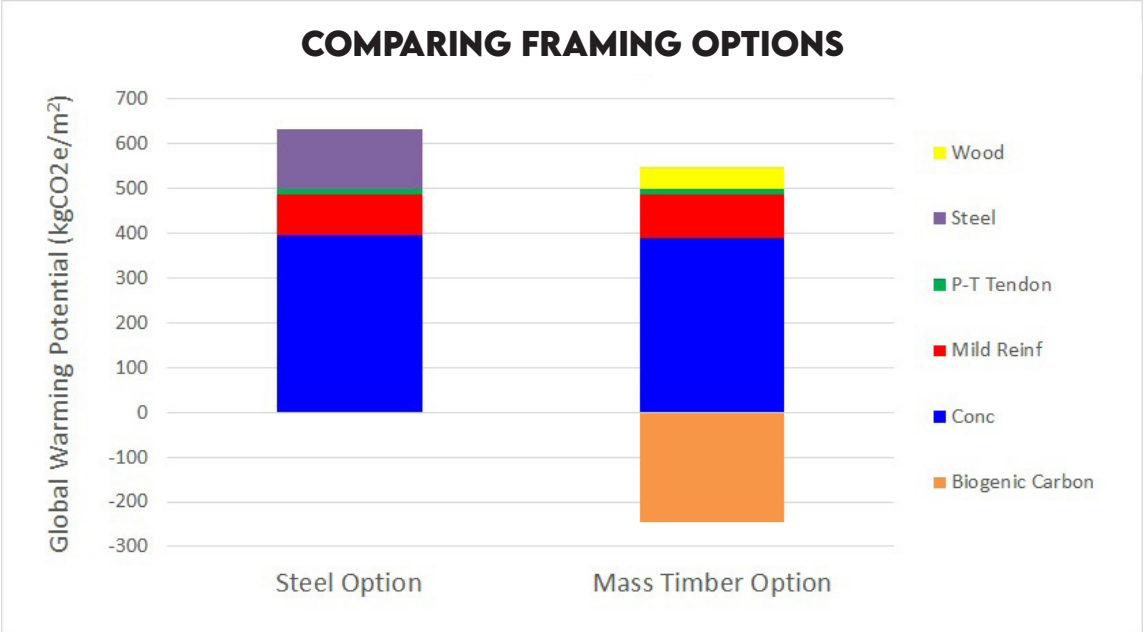
- LOCATION: Seattle, Washington
- ROLE: Structural Engineer
- ARCHITECT: Mithun
- OWNER'S REP: Bloom Projects
- CONTRACTOR: Exxel Pacific
- COMPLETION DATE: 2022
- TOTAL SQUARE FOOTAGE: 20,500-sf
- HEIGHT: 3 Stories
- MATERIAL: Mass Plywood (MPP)

MASS TIMBER SOLUTION:

During the schematic phase, steel and mass timber framing was considered for the two classroom levels above grade. The steel system consisted of composite steel floors supported by wide-flange beams and HSS columns. The mass timber system was comprised of **exposed mass plywood panel (MPP)** supported by **glulam beams** and columns.

Mass timber provided an **embodied carbon reduction that aligned with the school's high sustainability goals**. The material offered an **improved carbon footprint** and achieved the same column bay spacing, which was desirable for classroom usage.

When comparing these material options directly, the project's overall structural embodied carbon footprint reduced by 13% when excluding biogenic carbon and 52% when including biogenic carbon. The concrete gravity supporting elements below reduced by 20% due to the lighter weight of the mass timber system in comparison to the steel system.



SUSTAINABILITY CASE STUDY: **BUSH SCHOOL**

In addition to **exposed mass timber** in the student lounge and entry, the roof of the lounge is designed to accommodate a future green roof.

Using a mass plywood panel solution also provided cost and schedule savings over T&G boards, which was originally proposed for the project.

ADDITIONAL PROJECT HIGHLIGHTS:

- Long-span concrete beams and shallow PT slab at the gymnasium provide clear height for the below-grade gym/multi-purpose auditorium and efficiently transfer the classroom levels above.
- A flat roof structure on the south end supports solar panels and mechanical equipment, which are hidden from the courtyard and main entry via the gabled roof on the north side.
- The design features mass plywood panel benches and counters in the corridor break-out collaboration areas.
- The site featured a steep landscape (a 50-foot grade differential). The assembly level, including the gym/ multi-purpose auditorium and food service, is nested into the hillside to help with thermal loads.

COLLABORATION:

DCI worked with the team to **save the "exceptional trees"** located throughout the site. DCI designed the student lounge slab on grade to cantilever over an inset footing to avoid impacting one tree's root zone.

An approximately 19-foot-tall basement level on a steep slope with pedestrian access required significant coordination with the architect, contractor and shoring designer, allowing for some high-impact feature landscaping and architectural elements at the pedestrian access point.

SUSTAINABILITY CASE STUDY: NEWARK CIVIC CENTER

The $88.5M Newark Civic Center—**the biggest public development project in the City of Newark in the past century**—is a revitalized two-story city hall, expanded two-story library, and new single-story police station to serve the growing community. The cohesive 84,130-sf development consists of three modern, safe, energy-efficient buildings, as well as a new central plaza, which will serve as a multi-function community event space and public destination. The project's design stemmed from a careful analysis of the site and its history. In fact, as an homage to the history of Newark, stained-glass artwork from the existing City Hall was reused at the entry to each of the new buildings.

PROJECT DETAILS:

The Newark Civic Center project scope involved the demolition of an existing building and miscellaneous site improvements. The project team coordinated layout efficiencies and standardized building grid systems per the design criteria. DCI designed the framing systems, floor slabs, steel braced frames, moment frames, spread footing foundations, and details. The police building was designed to perform at a **seismic importance factor of 1.25** per code requirements to reduce damage to the structure, architectural components and MEP equipment in the event of seismic activity. All three buildings utilized buckling-restrained braces for the seismic force resisting system which inherently offers greater resiliency to the structure.

The Newark Civic Center was completed in 2021 and achieved LEED Silver certification earlier this year. The project delivery type was design-build, which allowed Webcor to start construction a month earlier than planned and complete the structure in just 10 months from design kick-off (April 2019-February 2020).

- LOCATION: Newark, California
- ROLE: Structural Engineer
- ARCHITECT: Perkins & Will
- OWNER: City of Newark
- CONTRACTOR: Webcor Builders
- COMPLETION DATE: 2021
- TOTAL SQUARE FOOTAGE: 84,130-sf
- HEIGHT: 1-2 Stories
- MATERIAL: Steel, Concrete

SUSTAINABILITY CASE STUDY: NEWARK CIVIC CENTER

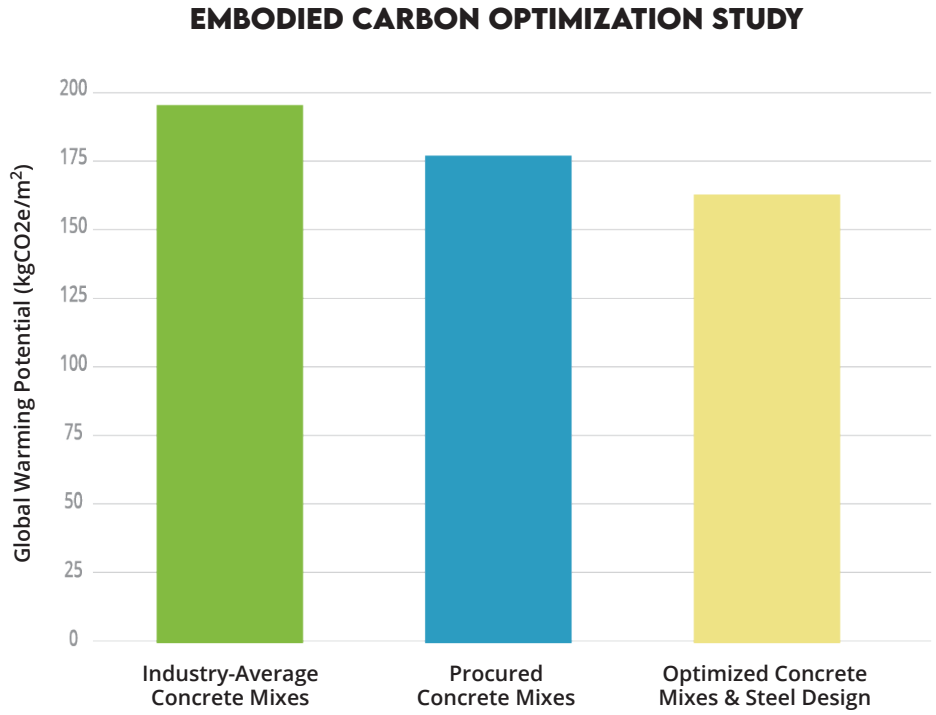
LIFE-CYCLE ASSESSMENT:

DCI collaborated on a **retroactive life-cycle assessment optimization study** with the original project team to understand how to better assess and implement embodied carbon reductions for the structure and envelope. DCI, Perkins&Will and Webcor combined their unique perspectives to **recognize past limitations and mistakes to break down typical communication barriers and promote successful outcomes in the future.**

For the structural portion, we revisited our drawings to consider opportunities to facilitate lower carbon concrete and optimize steel framing designs to reduce the overall embodied carbon associated with the cluster of buildings. The process focused mainly on utilizing less carbon-intensive structural steel shapes, minimizing concrete strengths and extending concrete test ages.

After implementing the low carbon concrete and steel optimization strategies, we **observed an overall 13% structural embodied carbon reduction** when compared to the original design drawings and associated industry-average concrete carbon intensities. When comparing to the actual concrete mixes used on the job, the optimized mixes **demonstrated 7.5% overall structural embodied carbon reduction** because the actual concrete mixtures used on the job were already less impactful than the industry average.

This study gave us perspective on our ability to reduce embodied carbon on a project of this size, optimize structural design and **coordinate these concepts with the rest of the project team**. Be on the lookout for the full-length case study created with Perkins&Will and Webcor soon to learn more about our collaboration to **successfully execute these embodied carbon reductions across all disciplines**.



SUSTAINABILITY CASE STUDY: 303 BATTERY

Dubbed the **most sustainable apartment building in the world**, 303 Battery is a 15-story residential, net zero energy, high-rise tower constructed from **Sustainable Living Innovation's (SLI) proprietary**, prefabricated MEP integrated components. Located in Seattle's Belltown neighborhood, 303 Battery has 112 living units (27 are affordable housing); 1,900-sf of retail space; roof deck amenity level and solar panels; and one below-grade level. All SLI high rise buildings have the distinctive exoskeleton framing of structural beams and columns. For 303 Battery, the engineering team designed the basement reinforcing, mild reinforcing overframing, floor framing, roof, shoring plans, structural BRB frame elevations, and revised concrete/brace frame/column/foundation details. This structural design is **DCI's first performance-based fire design for high-rises** which involved thermal and stress analyses, with fire scenario and temperature data with our fire consultant.

SLI—A CASE STUDY FOR SUSTAINABILITY:

SLI is an ongoing concept that is being developed and will continue to develop in the future to **improve and adopt new ideas or concepts based on our past experiences or the market needs**. DCI works with the design team to meet their goals in achieving a repeatable product. Some of our biggest challenges as structural engineers is to make assumptions for future projects and do hypothetical checks before we actually have a project in hand, and a good amount of our work is to come up with estimates to cover future projects and site conditions while balancing these assumptions, so we don't unrealistically overdesign these elements—all while still managing to produce an efficient and sustainable product.

- LOCATION: Seattle, Washington
- ROLE: Structural Engineer
- ARCHITECT: CollinsWoerman
- OWNER: EQR (Equity Residential)
- CONTRACTOR: SLI Contractor Co.
- COMPLETION DATE: Targeting 2022
- TOTAL SQUARE FOOTAGE: 96,000-sf
- HEIGHT: 15 Stories
- NUMBER OF UNITS: 112
- MATERIAL: Concrete, Hot-rolled Steel & Cold-Formed Steel

At the start of SLI, the idea was to design one floor that works for all unit sizes, one connection that covers the worst cases, one corbel beam that covers it all.

SUSTAINABILITY CASE STUDY: 303 BATTERY

This approach optimized the speed and cost of manufacturing due to the repetitive nature of the structural elements. However, looking ahead to future projects, DCI and the rest of the SLI team are revisiting their strategy to optimize the structural design in a way that allows more size variation without requiring unique details, optimizes the overall use of material and therefore reduces the building's carbon footprint.

SLI'S 303 BATTERY PROJECT:

The main idea behind the SLI system is **speed of construction—repetition and reuse of the designed elements** (floor panels, wall panels, beams, columns, stair and elevator modules...etc). The 303 Battery project used cold form steel studs as floor panels with top and bottom steel sheets as the diaphragm element. This required diaphragm testing as the code does not cover this assembly since the screws had to go though gypsum board rather than directly attaching to the steel sheet. With the assistance from our fire consultant, DCI worked on designing the corbel beam to meet the required fire rating and provide the stiffness and structural demands it needs. The idea of this beam is to embed a WF inside a HSS and infill with lightweight concrete to provide the fire rating for the inner WF beam.

For the **solar panel system**, DCI worked with the SLI team to provide a balcony railing that is designed to receive solar panels on all balconies on the west and south façade. More solar panels were added to the roof canopies and were extended outside the building footprint to maximize their use and to add an aesthetic look to the roof, which helped the building achieve its **zero net energy rating**.

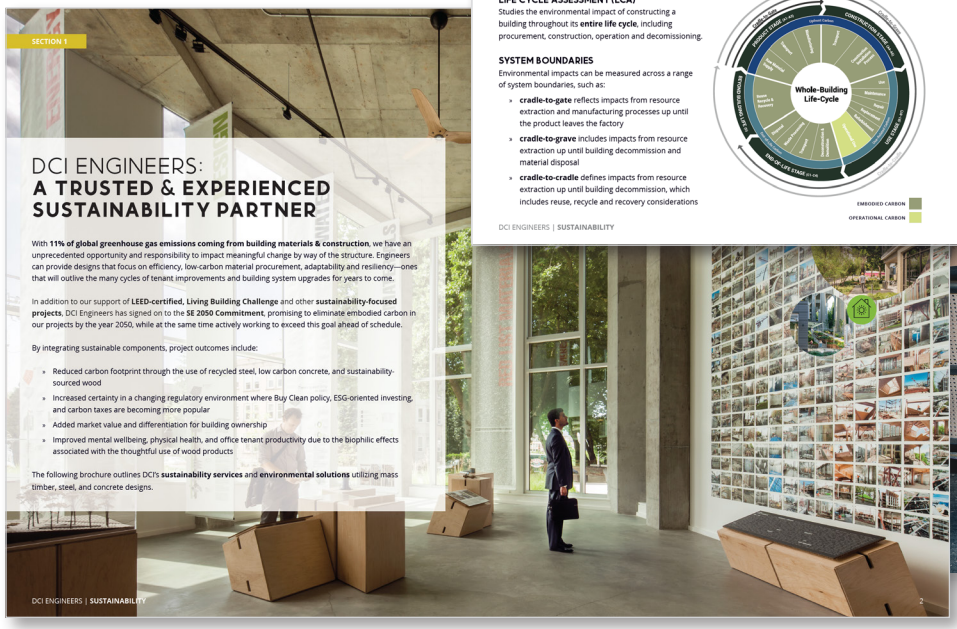
As any new idea, a learning curve is required to meet the objectives and goals that were set for the project schedule. The installation, which had to be delayed multiple times—due to the COVID 19 pandemic, along with the material shortage that followed—started slow as expected and picked up a very encouraging pace towards the last half of construction. This provided a preview to installation efficiency for SLI's future projects.

MARKETING **MATERIALS**

DCI'S SUSTAINABILITY BROCHURE:

This document is intended to educate readers 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:

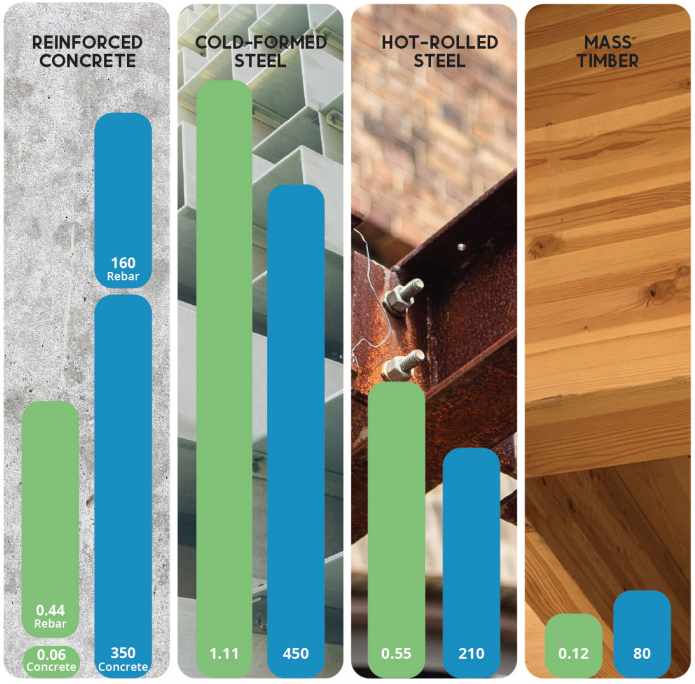
These graphics show the cradle-to-gate industry-average GWP per pound of material versus the overall GWP content of the beam's analyzed for a 20-foot span.

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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