

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.





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,









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 Sustainability Committee Chair, Jessica Martinez, 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.



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SUSTAINABILITY LEADERS

MEET DCI'S SUSTAINABILITY COMMITTEE CHAIR

Supporting DCI Sustainability is Project Manager 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 internal staff on the most recent research and education.

Her passion for sustainable design practices is second to none and has helped DCI embrace this way of design. She is chair of DCI's Sustainability Committee that, in addition to pursuing the SE2050 challenge, is exploring other materials and construction methods that adhere to a higher level of green standards.

Jessica leads the research of DCl's life cycle assessment software capabilities and has performed several integral studies that set the basis for the education of our staff. She also leads the internal low carbon concrete subgroup which includes updating company-wide specifications to facilitate sustainable concrete construction methods and materials.

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 assess sustainability reports and educational material from various industry organizations—such as the American Concrete Institute, the American Institute of Steel Construction, and WoodWorks—to assess 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.



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EDUCATION



EDUCATION

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.**

FIRM-WIDE EDUCATION PROGRAM & COMMITMENT TO SE2050

SE2050: Provide a brief narrative describing how your firm is promoting a firm-wide education program for embodied carbon reduction and the firm's commitment to SE2050.

DCI's Engineering Intelligence (EI) education program allows our nationwide firm to collaborate, coordinate, and educate across all of our offices. Our firm-wide sustainability group develops regular sustainability updates as well as company-wide presentations for staff. Each region of the nation has unique practices for sustainability and EI allows each office to tailor its sustainability needs while also sharing information and practices with sustainability members at each office. We have already presented Embodied Carbon 101 to the company, and distributed regular one-page bulletins via the Vault (intranet). We have also created handouts on specific topics for employees to reference, a companion guide to our Low-Carbon Concrete General Notes, and are posting new information as it comes onto Vault. More internal presentations and handouts are in the works in the coming months.

In addition, our sustainability group has been working on **client education**, including a clientspecific Embodied Carbon 101 presentation, handouts for sustainability of various materials, and marketing materials explaining our capabilities for improving project sustainability.

EMBODIED CARBON INTEREST GROUP

SE2050: Initiate an embodied carbon interest group within your firm and provide a narrative of their goals.

DCI has an internal **Sustainability Committee** that is composed of roughly 20 active members. The Committee has several goals, including:

- » Education of employees about lower-carbon design
- » Education of clients and promoting of DCI's capabilities
- » Development of LCA expertise
- » Development of resources for use on projects





TABLE OF SE2050 REQUIREMENTS: EDUCATION

SE2050 DEFINED TASK	REQUIRED OR ELECTIVE	COMPLETE	DCI'S IMPLEMENTATION
Distribute firm-wide announcement of your firm's pledge to join the SE 2050 Commitment. After the first year, make an announcement sharing your ECAP from the previous year.	Required	\checkmark	DCI began with internal messaging by posting the SE 2050 Commitment announcement to the firm's intranet (Vault) on Earth Day (April 22, 2021) and then distributed an external announcement to clients and industry partners.
Provide a brief narrative describing how your firm is promoting a firm- wide education program for embodied carbon reduction and the firm's commitment to SE 2050.	Required	~	Refer to page 8
Nominate an Embodied Carbon Reduction Champion for your firm. Include a brief profile (name, office, title, optional picture and bio) in your ECAP.	Required	\checkmark	Refer to page 4
Set a date within the first year to present an "Embodied Carbon 101" Webinar to your firm (present your own or use an existing from BSA or equivalent). Include this resource in your orientation/on-boarding programs.	Required	~	We presented an Embodied Carbon 101 presentation to DCI staff on June 19th, 2020. We are currently in the process of adding this to our existing on-boarding process for new employees.
Minimum (1) additional elective to educate your firm about embodied carbon and a narrative of its significance.	Required		 We have chosen the following electives because we find value in educating staff about the impact structural design has on embodied carbon. This is aimed to improve our practices moving forward. Please refer to the list of completed SE2050 defined electives below: » 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. » Share embodied carbon reduction strategies with your firm as outlined in Top 10 Carbon Reducing Actions for Structural Engineers document produced by SE 2050. » Attend a presentation or demo of an LCA-based tool used to calculate embodied carbon. » Initiate an embodied carbon interest group within your firm and provide a narrative of their goals.



TABLE OF SE2050 REQUIREMENTS: EDUCATION

SE2050 DEFINED TASK	REQUIRED OR ELECTIVE	COMPLETE	DCI'S IMPLEMENTATION
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.	Elective	<u>~</u>	Over the past year, DCI staff has attended numerous educational events. Some of these include: Living Future '20 and '21 Greenbuild '20 NCSEA Webinars CLF Presentations (Seattle, Vancouver, Rocky Mountain, Austin) GoGreen Seattle '20 and '21
Share embodied carbon reduction strategies with your firm as outlined in Top 10 Carbon Reducing Actions for Structural Engineers document produced by SE 2050.	Elective	<u>~</u>	We have shared this information as part of our EC 101 presentation and via regular bulletins.
Nominate a minimum of (1) employee per office to participate in a CLF Community Hub and/or task force.	Elective	~	DCI has elected Sustainability Committee Members participating in the Austin, Los Angeles, Portland, Rocky Mountain, San Francisco, and Seattle CLF Hubs.
Attend a presentation or demo of an LCA-based tool used to calculate embodied carbon.	Elective	~	Our staff has attended several events, including multiple sessions at the Living Future Conference, EC3 demonstrations, and an NCSEA webinar
Initiate an embodied carbon interest group within your firm and provide a narrative of their goals.	Elective	\checkmark	Refer to page 8



REPORTING



REPORTING

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.

TRACKING EMBODIED CARBON DATA

SE2050: Provide a narrative on how your firm plans to measure, track, and report embodied carbon data.

DCI uses Revit as our primary drawing production software and so Tally, along with EC3, are the main tools we plan to use for tracking embodied carbon. We have already run LCAs for multiple projects and continue expanding this data collection throughout our company's overall design portfolio. Data is sourced from a representative sample across offices, materials, and project types. The results will be shared with the SE2050 database as well as DCI's internal database of projects.

INTERNAL TRAINING

SE2050: Describe the internal training for embodied carbon measurement you provided or will provide.

DCI Engineers' **Engineering Intelligence (EI)** education program allows us to train our nationwide offices on embodied carbon. Our committee leads have developed a **100-level program** for DCI employees that may not regularly work with sustainability but need to understand the basics on how embodied carbon is measured. This complements bulletins and other resources that are already shared with employees via the Vault. **Our committee holds** regular, intensive discussions on how we are measuring embodied carbon including best practices, software updates, new research and then publishes regular bulletins on how we are adapting and advancing our sustainability goals.





TABLE OF SE2050 REQUIREMENTS: REPORTING

SE2050 DEFINED TASK	REQUIRED OR ELECTIVE	COMPLETE	DCI'S IMPLEMENTATION
Provide a narrative on how your firm plans to measure, track, and report embodied carbon data.	Required	\checkmark	Refer to page 12
Describe the internal training for embodied carbon measurement you provided or will provide.	Required	\checkmark	Refer to page 12
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.	Required	In Progress	We have compiled a list of potential projects, client contacts to request quantity takeoffs, and are reviewing best practices to normalize the data across a variety of construction types, occupancies, and unique features. In the first year after submitting this ECAP, we will submit at least (5) projects to the database.



EMBODIED CARBON REDUCTION STRATEGIES





EMBODIED CARBON REDUCTION STRATEGIES

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 SE2050 Challenge further allows us to pursue even deeper standards for building green.**

EMBODIED CARBON REDUCTION GOAL

SE2050: Set an EC reduction goal for the coming year and an implementation narrative. Qualitative goals focused on education are appropriate for the first year.

In the first year, DCI Engineers is developing process/procedure documents to best accumulate project data across our nationwide offices as developing a repeatable and consistent measuring system will be critical moving forward. **Once our baseline measuring process is developed**, we have selected projects to target moving forward to develop a best practices and tools for meeting a sustainable carbon reduction goal.

EMBODIED CARBON LESSONS LEARNED

SE2050: Provide a project case study in your ECAP sharing embodied carbon lessons learned.

We performed a retroactive LCA on 1 De Haro, a San Francisco project our firm designed. First, we reviewed the impacts of utilizing an all-concrete structure versus a mass timber-concrete-steel hybrid system and found moderate embodied carbon reductions if biogenic effects are not considered, and significant reductions if biogenic effects are considered—meaning the procured materials must be sustainably sourced in order to capture maximum carbon savings. Then, we also considered the use of two different sets of concrete mixes in the structure: one mix demonstrated slightly above average sustainability performance and the other mix far exceeded typical sustainability standards. In comparison to the regional baseline in this area, both sets yielded reduced carbon impact. However, the high-grade mixture was able to attain a much greater reduction due to the amount of cement replacement incorporated into the foundation mix design. The impacts of using low-carbon concrete is comparable to the impact of switching structural systems if biogenic carbon is not included. For more information on this case study, refer to the Appendix.





EMBODIED CARBON REDUCTION STRATEGIES

EMBODIED CARBON COMPARISON STUDY

SE2050: Complete an embodied carbon comparison study during the project concept phase.

As a part of our **schematic design analysis**, we performed a **preliminary life-cycle assessment** to consider the embodied carbon associated with multiple concrete structural design options. The design options included a two-way post-tensioned slab spanning between wide-shallow beams, a two-way conventionally reinforced slab spanning between wide-shallow beams and a one-way pan joist system spanning between conventional beams. Based on our initial analysis, the wide shallow beam with PT slab option provides the lowest environmental impact due to its lower mild-reinforcement requirements and associated concrete quantities. We provided this information in our schematic structural narrative for the architect to consider in subsequent design decisions.









TABLE OF SE2050 REQUIREMENTS: EMBODIED CARBON REDUCTION STRATEGIES

SE2050 DEFINED TASK	REQUIRED OR ELECTIVE	COMPLETE	DCI'S IMPLEMENTATION
Set an EC reduction goal for the coming year and an implementation narrative. Qualitative goals focused on education are appropriate for the first year.	Required		Refer to page 15
For second year's ECAP and beyond, provide a narrative about what you have learned about embodied carbon reduction in the past year. Describe successes and misses to help the program improve.	Required	In Progress	This will be included in subsequent updates to the ECAP.
Minimum (1) additional elective you undertook to reduce embodied carbon in your designs, why you chose the elective and its significance.	Required		 We have chosen the following electives so we can continue developing our knowledge of best practices and implement these strategies in our future designs. Please refer to the list of completed SE2050 defined electives below: Provided a project case study in ECAP sharing embodied carbon lessons learned. Completed an embodied carbon comparison study during the project concept phase. Incorporated biogenic materials on at least one project (annually). Integrated embodied carbon mitigation strategies in our General Notes.
Provide a project case study in your ECAP sharing embodied carbon lessons learned.	Elective	\checkmark	Refer to page 15
Create a project-specific embodied carbon reduction plan.	Elective	<u>~</u>	We created a comprehensive framework for a large residential development to monitor and communicate the embodied carbon associated with the structural system throughout all design phases. This plan included the early coordination of efficient structural design, detailing connections for deconstructibility and tailoring of project specifications.



TABLE OF SE2050 REQUIREMENTS: EMBODIED CARBON REDUCTION STRATEGIES

SE2050 DEFINED TASK	REQUIRED OR ELECTIVE	STATUS	DCI'S IMPLEMENTATION
Complete an embodied carbon comparison study during the project concept phase.	Elective	\checkmark	Refer to page 16
Participate in a LEED, ILFI Zero Carbon, or similar project design charrette and speak to potential design considerations impacting embodied carbon.	Elective	<u>~</u>	DCI participated in multiple design charrettes regarding a large residential development. These charrettes resulted in the initiative to develop a mass timber design as well as introduce various milestones for tracking the impact of our material selection throughout the design process.
Incorporate biogenic materials on at least one project annually.	Elective	~	DCI regularly utilizes mass timber as a primary structural system. We have a large portfolio of mass timber projects to date, including 1 De Haro, the first commercial mass- timber building in the State of California, and have more mass timber projects in progress. This is a key area of focus for DCI in the future.
Integrate embodied carbon mitigation strategies in your General Notes.	Elective	~	DCI has produced low-carbon General Note language for concrete, including target GWP values and EPD submittal requirements, and is working on similar updates for other materials.







ADVOCACY

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.

ACCELERATING ADOPTION OF EMBODIED CARBON REDUCTION

SE2050: Provide a narrative about how you plan to share knowledge and data to accelerate adoption of embodied carbon reduction.

DCI is sharing the importance of embodied carbon with our clients through several means and plan to expand these efforts over time. We are providing our Embodied Carbon presentation to current and potential clients (see next section), and have created one-page handouts on carbon reduction for specific materials. In addition, our mass timber division is promoting the potential carbon benefits of mass timber as a structural system. We also participate in industrywide forums, including CLF hubs, local SEA's, and conferences.

VALUE OF SE 2050

SE2050: Describe the value of SE 2050 to clients. How can we collaborate to drive adoption? At your option, attach any associated marketing materials.

DCI regularly includes this information in SOQs that we provide to our clients. In addition to explaining our capabilities, we make an effort to explain the value of sustainable design on a project and the potential benefits to clients and users.







TABLE OF REQUIREMENTS: ADVOCACY

SE2050 DEFINED TASK	REQUIRED OR ELECTIVE	COMPLETE	DCI'S IMPLEMENTATION
Provide a narrative about how you plan to share knowledge and data to accelerate adoption of embodied carbon reduction.	Required	 Image: A second s	Refer to page 20
Describe the value of SE 2050 to clients. How can we collaborate to drive adoption? At your option, attach any associated marketing materials.	Required	\checkmark	Refer to page 20
Declare your firm as a member of the SE 2050 commitment on boilerplate proposal language.	Required	\checkmark	See attached external announcements in Appendix.
Share your commitment to SE 2050 on your company website.	Elective	In Progress	New website is launching soon and will feature our commitment to SE 2050. We have shared our commitment on Vault—DCI's internal network.
Give an external presentation on embodied carbon that demonstrates a project success or lessons learned (Tip: Get connected at a CLF local hub near you!).	Elective	<u>~</u>	DCI has developed an AIA-approved external client presentation on embodied carbon and has presented this to multiple clients to date. See Appendix for excerpts of this content. We will continue to present this for additional clients as opportunities arise.
Share education opportunities with clients.	Elective		In addition to the embodied carbon presentation mentioned above, we are also developing educational materials for our clients, including handouts on mass timber systems and low-carbon concrete.
Share your best case studies in your ECAP	Elective	\checkmark	Refer to Appendix





APPENDIX



SUSTAINABILITY CASE STUDY: WATERSHED

This is DCI's second International Living Future Institute's (ILFI) certified project through Living Building Petal

Certification, following Seattle's Deep Green Pilot Program, a City of Seattle pilot program that requires stringent energy and water conservation efforts. Located next to the Aurora Bridge in Seattle's Fremont neighborhood, Watershed is a sevenstory office building with 5,000-sf of ground level retail. The building also **treats more than 300,000 gallons of polluted stormwater** from the bridge and nearby Troll Avenue through a series of stepped bioretention planters, while the building's roof also collects and reuses stormwater.

UNIQUE CONDITIONS:

- » The seven-story office building is a combination of concrete and steel structural systems
- » The building's steel braced frames at the perimeter run down to the concrete foundation at the podium level in lieu of typical reinforced concrete shear walls. At the first floor, the steel braced frame columns are encased in concrete in order to provide gravity support for the post-tensioned concrete slab at the podium, which is not a typical configuration for steel buildings.
- » Self-tinting electrochromic glass is used for the building's glazing, which reduces solar heat gain and glare while maximizing thermal comfort and maintaining views and daylighting

- » LOCATION: Seattle, Washington
- » ROLE: Structural Engineer
- » ARCHITECT: Weber Thompson
- » DEVELOPER: COU, LLC
- » CONTRACTOR: Turner Construction
- SOMPLETION DATE: Spring 2020
- » TOTAL SQUARE FOOTAGE: 61,000-sf
- HEIGHT: 7 Stories
- » MAŢERIĄL: Steel, Concrete







SUSTAINABILITY CASE STUDY: WATERSHED

AWARDS:

- 2021 AISC IDEAS² Merit Award -\$15M - \$75M
- » 2021 Architizer A+ Award Popular Choice Award
- » Salmon Safe 2019 Hero of the Salmon
- » 2017 NAIOP Washington Office Development of the Year
- » Seattle 2030 District 2017 Vision
 Awards Award for Water

CHALLENGES:

DCI's International Living Future Institute (ILFI) project:



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Building materials must be sourced from a 500mile radius of the project's site and materials used cannot be listed on the program's red list

Watershed met three of the program's seven 'petal' standards: materials, beauty, and place

A difficult aspect of new construction projects in Seattle is the complex entitlement process, which can require multiple approval meetings. When designs aren't approved, it can mean costly delays to the schedule and budget. Watershed received approval in just two meetings (one Early Design Guidance, and one Design Review meeting).

INNOVATIVE WAYS TO ACHIEVE SUCCESS: Advised GC to use the previous building's

- Advised GC to use the previous building's foundation walls for Watershed's temporary shoring. The design choice eliminated 100 tons of concrete waste for the project and significantly reduced site shoring costs for the project.
- » Engineers integrated castellated beams into the building design which saved 20% to 30% in material weight. The shape of castellated beams also helped with directing more natural light into the interior space and simplifying the routing of mechanical/electrical systems. These structural elements contributed to the client's overall building sustainability goals.



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Applied **lean construction practices**, such as coordinating a more efficient brace frame installation





SUSTAINABILITY CASE STUDY: THE BULLITT CENTER

- » LOCATION: Seattle, Washington
- » ROLE: Structural Engineer
- » ARCHITECT: Miller Hull Architects
- » DEVELOPER: The Bullitt Foundation
- » CONTRACTOR: Schuchart
- » COMPLETION DATE: 2013
- > TOTAL SQUARE FOOTAGE: 52,000-sf
- » HEIGHT: 6 stories
- » MATERIAL: Wood, Steel

The Bullitt Center is **one of the nation's first mid-rise commercial buildings to achieve "living building" status, a new benchmark for environmental sustainability**. The Bullitt Foundation and its partner's intentions for the project was to promote innovative sustainable building technologies and practices in Seattle's urban neighborhoods, the Northwest, and around the world.

The Center serves as a community resource for urban sustainability education to help reduce the environmental impact of building construction and operations. The development of the six-story, mixed-use building has set a new standard for performance-based design and increases the awareness of new approaches to sustainable design and construction. The goals for the Center were ambitious and forward thinking. In addition to meeting LEED® Platinum standards and the 2030 Challenge, the most exhilarating challenge was the intent to achieve the goals of The Living Building Challenge. The Challenge is performance-based and evaluated after one year of the building's operation. It has 20 imperatives, including: responsible site selection; 100% on-site renewable energy generation, 100% of water needs provided by harvested rainwater, and on-site waste management. The Bullitt Center was named one of ENR Northwest's 2013 Best Projects Winners in the category of Green Project.



DCI provided structural engineering services for The Center. The building was framed with wood and steel above the second floor and has concrete slabs, columns, and walls on the first and second floors. The majority of the roof consists of a photovoltaic array that is supported on a structural steel grid. The building also includes two exposed staircases and exterior decks with planters for water storage and filtration.

The Center was a game-changer. While none of the individual green technologies contained in the 55,000-sf office building are unique, no one had ever used them so comprehensively to create a truly self-sufficient structure. And building the **"greenest commercial building in the world"** wouldn't have been possible without the innovative structural design solutions of DCI.

The Bullitt Center is one of only 21 other buildings on the planet to meet the "Living Building Challenge"—a gold standard for green buildings.



SUSTAINABILITY CASE STUDY: THE BULLITT CENTER

HERE'S & LOOK AT SOME OF THE WAYS DCI HELPED REALIZE THE LOFTY GOALS OF THE BULLITT CENTER:



ENERGY

Bullitt Center's energy had to be **produced** on-site. Concerned about being able to gather enough energy in notoriously gray Seattle,

designers called for an array of five solar panels that stretch beyond the perimeter of the roof. The 14,000-sf collection required a complicated steel system with 26-foot cantilevers in each direction. Despite the complexity, the steel system was remarkably easy to construct—structural steel was layered and connected with bolts, requiring very little field welding by construction crews.



MATERIALS

Living Buildings must not contain 14 potentially toxic chemicals that are often included in construction materials, including lead, mercury,

creosote, chlorofluerocarbons (CFCs), and cadmium. All wood in the project must be certified by the Forest Stewardship Council as having come from sustainable forestry practices, be salvaged or harvested on-site.

Developers must account for all of the embodied carbon in its construction materials through a carbon offset program. The wood used in the Bullitt Center contains approximately 545 metric tons of carbon, the equivalent of the annual carbon emissions of 421 passenger vehicles. Using timber to carry such large loads required extremely detailed engineering of connections. The design accounts for eventual shrinkage of the timber beams over the years.



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WATER

Living Buildings collect and recycle water, discharging any excess water in a way that simulates a forested lot. Achieving these water

use goals was achieved with a **roof garden** on the third level, where graywater is deposited into a garden of local flora that purifies the water before it is deposited into the aquifer. That garden might not have been possible without a large upturned concrete beam. DCI's creative engineering made it possible for the beam to simultaneously serve as the framing for the garden, as well as a transfer beam that eliminated the need for columns on the second level.



INDOOR QUALITY

Daylighting is central in the Bullitt Center, both for aesthetic and temperature regulation purposes. A cutting edge computer system runs the

facility, regulating interior temperature by automatically

opening or closing window shades. The Living Building Challenge also calls for operable windows in every inhabitable space in the building. Having such large windows wouldn't have been possible without careful attention being paid to the building's timber framing system. Upturned beams at the perimeter maximize the reach of sunlight into the building and strategically placed columns allow for the tallest windows possible.







EMBODIED CARBON CASE STUDY: 1 DE HARO

1 De Haro is a 170,000-sf, four-story office building in San Francisco's Design District and is comprised of three levels of mass timber construction (cross laminated timber [CLT] and glulam framing) over one level of concrete. While its upper three levels are for office usage, the ground-level concrete podium is for light industrial work. The milestone project holds multiple titles, including the first CLT building in the City of San Francisco and the first multi-story mass timber building in California.

The structure was topped out in February 2020 and the building was ready for occupancy in Summer 2021.



MASS TIMBER & CONCRETE FOCUS

With site soils, the project team needed to reduce the weight of the structure, so we explored the option of mass timber. Mass timber also provided

a sustainable component to the project as it equates to roughly 2,000-metric tons of stored carbon. Where concrete was required for the building, the project team chose to study the effects of lower-carbon concrete with a retroactive Life Cycle Assessment.



LCA MEASUREMENTS

DCI performed a retroactive Life-Cycle Assessment (LCA) on 1 De Haro. DCI reviewed the individual impacts of substituting low-carbon concrete mixes,

as well as using a mass timber-concrete-steel hybrid system instead of an all-concrete structure. When comparing the two structural systems, exclusive of biogenic carbon, we found a GWP reduction of 8-15% was associated with using the hybrid system. If we included the benefits of biogenic carbon, this difference would be much greater.

- » LOCATION: San Francisco, California
- » ROLE: Structural Engineer
- » ARCHITECT: Perkins & Will / Pfau Long Architecture
- » / DEVELOPER: SKS Investments
- CONTRACTOR: Hathaway Dinwiddie
 Construction
- » COMPLETION DATE: Summer 2021
- » TOTAL SQUARE FOOTAGE: 170,000-sf
- » HEIGHT: 5 Stories
- » MATERIAL: Mass Timber, Concrete







EMBODIED CARBON CASE STUDY: 1 DE HARO

During procurement, DCI received two different sets of concrete mix submittals for the cast-in-place concrete portion of the building: one mid-grade set with 15-30% cement replacement and one high-grade set with 70% cement replacement in the foundations, plus 20-50% for all other applications. All high-grade mixes also contained the carbon injection admixture, CarbonCure. When compared to the NRMCA Pacific Southwest Baseline, the cradle-to-gate GWP of the entire structure was reduced by 5% with the mid-grade concrete mixes and 15% with the high-grade concrete mixes.

DCI found that utilizing **low carbon concrete** for this development is comparable to the impact of switching structural systems if biogenic carbon is not included. The low-carbon concrete mixes made the biggest impact at the foundation where we had the opportunity to maximize the amount of cement replacement. The **global warming** potential associated with the high-grade foundation mixtures was nearly half of the mid-grade and NRMCA Pacific Southwest Baseline mixtures.



KEYS TO SUCCESS

The upfront work of mass timber allows better coordination among trades where a 3D model is used as the deliverable. With connections detailed and routing established ahead of time for MEP, **more accurate cuts for materials result in less waste.**

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PROJECT HIGHLIGHTS & TAKEAWAYS (DESCRIBE LESSONS LEARNED, CHALLENGES, SOLUTIONS)

- » Utilizes some of the longest single-span cantilever floor plates in North America via a timber concrete composite floor assembly with spans of up to 25 feet.
- » In addition to its sustainability components, mass timber construction allowed the structure to go up faster than a traditional site build.
- » Upfront trade coordination and shared models **reduce changes in the field** and the alteration/cutting of materials which result in additional loss.





SE2050 COMMITMENT



"Our formal support of the SE 2050 Commitment allows us to share our research and knowledge on embodied carbon as well as combine our efforts with like-minded groups to reduce the impact of the built environment pollution on our planet. While architects have been committed to the AIA 2030 Challenge focusing on operational energy for years, the focus now turns to the structural community on embodied carbon."

> Ethan Martin, Director of Sustainability & Mass Timber DCI Engineers

EXTERNAL MESSAGE SHARED:

In celebration of Earth Day, DCI is proud to officially announce our commitment to the SE 2050 Challenge. By signing on to the SE 2050 Commitment Program, DCI is taking direct action in understanding, reducing and ultimately achieving Net Zero status in our projects by 2050.

With 11% of global carbon emissions coming from building materials & construction, our engineers have an unprecedented opportunity 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 as we continue to work with industry partners to create new standards and find methods to achieve this goal. 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

We all have a role in protecting our greatest investment—our future and invite our project and industry partners to learn more about the SE 2050 Challenge and how DCI is leveraging smart, sustainable design.



MARKETING MATERIALS

VAULT (DCI INTRANET) INTERNAL ANNOUNCEMENT FROM DCI CEO JEFF BRINK:

On behalf of DCI's Executive Management Team, I am thrilled to announce Ethan Martin, Associate in our Portland office, has been promoted to **Director of Sustainability and Mass Timber**.

Ethan joined DCl in 2020 to help us **expand our growing mass timber portfolio**. Prior to his arrival at DCl, Ethan was working on **milestone sustainability projects throughout the country including DCl's Bullitt Center**. Ethan's experience in sustainability software programs like Athena, EC3, and Tally will lend to the implementation and execution of these tools company-wide, further helping ingrain sustainable practices into DCl's design vernacular.

In addition to his on-the-job project experience, Ethan utilized performance-based design to drive the development of the mass timber prescriptive process at the state level in Oregon. This work became the basis for the implementation of high-rise mass timber in the International Building Code. Ethan has also collaborated with state officials to facilitate early adoption of CLT and tall mass timber buildings in Oregon, Washington, Utah, California, and the City of Denver.

Ethan's willingness to pursue objectives not yet established by traditional methods has greatly influenced our industry's adoption of mass timber. It is this same pioneering spirit that is so vital to incorporating sustainability practices across all materials and methods here at DCI as we achieve net zero carbon emissions in our projects by the year 2050.



Backing Ethan in his leadership role is a team of dedicated **Sustainability and Mass Timber Committee members** who are actively working to move DCI into this exciting realm of design.

As a Thought Leadership firm, **DCI is on pace to lead our project partners towards a new standard for design practice.** I look forward to Ethan's leadership and direction to help us all get there.

Jeff Brink, CEO / Principal



SUSTAINABILITY PARTNERS

Pursuing sustainable practices cannot be done alone.

DCI is proud to partner with companies that believe in building a better world. Often times these are for the pursuit of "project firsts," where there is no road map—only those who are willing to blaze the trail.

