EMBODIED CARBON ACTION PLAN (ECAP) MARTIN/MARTIN CONSULTING ENGINEERS

STRUCTURAL ENGINEERING INSTITUTE

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SE2050

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"All structural engineers shall understand, reduce and ultimately eliminate embodied carbon in their projects by 2050"



INTRODUCTION

Martin/ Martin, Inc is a full-service civil and structural consulting engineering firm built on experience and industry leadership cultivated since the 1940s. Headquartered in Denver, with nine office locations and a staff of more than 350, our engineers perform work throughout the Rocky Mountain Region and across the United States.

Martin/ Martin acknowledges its obligation to improve the health and resiliency of the planet and we are proud signatories of the SE2050 initiative. The future of our community and our client needs center on addressing climate change, including the significant emissions associated with the construction industry and structural materials. We are motivated to create change and establish sustainability and embodied carbon as a design constraint on our projects and we are intrigued by the creativity and engineering challenge required to solve these issues. SE2050 creates a framework that holds our firm accountable while also providing a platform that allows us to go beyond the minimum requirements of the program to pursue interests that align with our strengths and to meet the needs of our communities and clients.

We have seen a lot of change and growth in our sustainability efforts since becoming signatories of SE2050 in 2021. We regularly bring sustainability content to department and company wide presentations. We have submitted seventeen projects to the SE2050 database and have ten employees proficient in performing life cycle assessments. Most importantly we are starting to see more and more projects engaging with reduction strategies and targeting specific sustainability and embodied carbon goals.

EMBODIED CARBON ACTION PLAN KEY SECTIONS



EDUCATION, PG 4



REPORTING, PG 7







ADVOCACY, PG 12

ON THE COVER: Colorado State University (CSU) Hydro and Terra buildings, Denver, CO. The two buildings pictured are part of a larger redevelopment of the historic National Western Stockshow campus featuring multiple event venues, classroom and office space, and a hotel. The new campus is supported by a district energy system and a light rail connection.



SUSTAINABILITY LEADERSHIP

Michael Lyons, SE, LFA Sustainability Lead, SE2050 Champion

Michael has over 12 years of experience in the industry focusing both on sustainability and the design of midrise commercial buildings. He sees embodied carbon as an exciting



opportunity for the industry to develop as a design constraint. He is involved in many committees and professional organizations and currently serves as the co-chair of the SEI Sustainability and as the chair of the SEAC Sustainable Design Committee.

Kevin Haas, PE, SE, LEED AP Principal-in-charge, Sustainability

With 19 years of experience in structural engineering, Kevin is adept at blending steel, masonry, precast, and mass timber structural systems to support innovative and flexible designs that account for



diverse needs. His background in the evaluation of structural types, materials, and methods informs innovative approaches to engineering. He focuses on close collaboration with owners, stakeholders, and the design team to consider alternatives for addressing project goals, schedules, budgets, and sustainability.

SUSTAINABILITY ADVOCATES







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EDUCATION



Our education efforts are driven by a goal of ensuring every engineer in our company has the knowledge and tools available to them to support the sustainability needs of the projects they work on. We believe every engineer should have a basic understanding of the impacts of their project and what can be done to create reductions when challenged to do so.

While we have engineers with specific responsibilities to manage the sustainability initiatives of the department, the ultimate goal is to ensure as many as possible of the "over" 200 structural engineers working at our firm understand the sustainability implications of their projects at a similar level to other key project constraints. We want to ensure they know who to contact for support, how to execute reduction strategies, and how to communicate with the remainder of the project design team about these issues.

COMMITMENT TO CONTINUING EDUCATION

An essential tool for our education goals is a weekly continuing education class series. In 2024, we held two different sustainability presentations during this series including an updated sustainability 101, and a presentation focused on knowledge sharing from conferences that occurred throughout the year. Additional presentations in this series have also supported our education efforts by addressing topics such as mass timber construction, resilience and thermal bridging. Looking ahead to 2025, we intend to deliver an Intro to LCA lecture, a series of material reduction strategy classes, and incorporate the Sustainability 101 course into on-boarding.



IMAGE ABOVE: A group of Martin/Martin employees tour a local low carbon concrete innovator. Prometheus Materials is a Colorado-based company focused on bio-cement and bio-concrete technology; they currently produce zero-carbon concrete masonry units.



EDUCATION



ACCESS TO RESOURCES AND SUBJECT MATTER EXPERTS

Continued effort will be made to highlight key resources and information while also making subject matter experts on sustainability available to the company. We will continue to update and reference a 3-page, internal, sustainability guide which defines key terms, discusses how to approach sustainability on projects and includes a summary of key reduction strategies based on common structural materials. Key external and internal resources are organized and available in a search-able format on our intra-net, named after our founder, Milo S. Ketchum, who always challenged his engineers to use a minimum amount of structural material in the firm's designs. Recently, a Microsoft Teams channel was also established, for all employees to be able to ask questions on sustainability and receive a quick and detailed answer from a subject matter expert.

THE IMPORTANCE OF PROJECT LEVEL DECISION MAKING

It has become increasingly apparent that while our education efforts have resulted in increased awareness and knowledge of the basics of embodied carbon across the company, many of our engineers are still lacking the confidence and knowledge to guide their projects towards achieving emissions reductions. Moving into 2025, we are focusing on connecting the dots between lectures or webinars and the realities

of project work. One way we intend to do this is to include more involvement on specific projects through internal design charettes and sustainability oriented drawing and specification reviews. We are also surveying project managers and interviewing principals across the firm in order to inform future continuing education content specifically catered to these key decision makers. Our education efforts will engage with employees using a three prong approach: providing lectures, organizing key resources and engaging with them directly and pro-actively.

2025 ACTION ITEMS:

- Continue to evaluate effectiveness of engagement with satellite offices and work with these offices to ensure the education curriculum is adequately addressing their regionally specific needs.
- Present at least (3) times to the structural department on topics focused on embodied carbon and make the recordings available to all employees.
- Incorporate embodied carbon education into the on-boarding process for new employees.
- Train all of the department's structural engineers on the core concepts and skills required to measure, reduce and report embodied carbon.



IMAGE ABOVE: A group of Martin/Martin employees tour a local steel fabrication plant. Understanding the capabilities and constraints of trade partners is essential to effective implementation of innovative and low-carbon design strategies.

MARTIN/MARTIN SUSTAINABILITY GUIDE



STRUCTURAL SUSTAINABILITY GUIDE

This guide is for Martin/Martin structural engineers and is intended primarily for internal use. The goals of this guide are to inform and educate employees, equip them with the tools to discuss sustainability both internally and externally, and encourage them to be advocates for the company's sustainability vision and the efforts of the SE community at large to reduce carbon emissions.

SIGNIFICANCE TO OUR COMPANY AND THE INDUSTRY AS A WHOLE:

- Global perspective: There is consensus within the scientific community that anthropogenic climate change is both real and impactful to the stability and safety of humankind. Many communities are already experiencing the debilitating impacts of disasters either directly caused by, or exacerbated by, climate change. In order to limit the global average temperature rise to less than 2°C and avoid the worst impacts of climate change, drastic reductions in annual global greenhouse gas emissions are required.
- Industry perspective: The construction industry is responsible for more than 40% of global carbon emissions. This value includes infrastructure emissions and the embodied and operational emissions of buildings. The embodied carbon of building materials represents approximately 8% of global carbon emissions, driven primarily by the concrete, steel, and aluminum industries.

INCORPORATING SUSTAINABILITY GOALS INTO YOUR PROJECT

- 1 Project manager to set up meeting to discuss sustainability approach with the project principal.
- 2 Project principal to initiate discussion with the client about their sustainability goals for the project and explain Martin/Martin's sustainability specifications approach and available services (see below).
- 3 Include Michael Lyons in the discussion early and often, especially if the project team needs further direction, resources, education, or support at a client meeting.

SPECIFICATIONS AND GENERAL NOTES*

- · Concrete specifications and mix table
- Steel specifications and material table
- Sustainability notes

* Note that the default values and language in the specifications and general notes should be reviewed with the project team and adjusted as needed to align with the project's sustainability goals and/or legislative requirements such as Buy Clean Colorado, CALGreen, or Denver Green Code.

MARTIN/MARTIN SUSTAINABILITY SERVICES

- Implementation of and education on embodied carbon reduction strategies
- Schematic design structural system comparison and establishing embodied carbon goals/ targets
- Structural system embodied carbon assessment
- Structural system life cycle assessment
- WBLCA partnership and coordination





Martin/Martin has been a signatory of the SE2050 initiative since 2021. The firm's sustainability vision is well aligned with the goals of the SE2050 program, led by the Structural Engineering Institute (SEI).

Requirements of M/M as a signatory firm:

- Educating our employees about embodied carbon and sustainability issues related to the built environment
- Contributing to a national database by measuring and reporting embodied carbon on a minimum of 5 projects per year
- Developing and implementing embodied carbon reduction strategies
- Collaborate with material suppliers to achieve embodied carbon reductions
- Submit an annual Embodied Carbon Action Plan (ECAP)

"All structural engineers shall understand, reduce, and ultimately eliminate embodied carbon in their projects by 2050"

www.SE2050.org

DESIGN CONSIDERATIONS TO REDUCE EMB Day this for a generative scare laders, then yeards with a member Generation of the state of the st

 Lay out buildings so column transfe are limited or eliminated
Set appropriate floor-to-floor heights to

Reuse existing buildings or components
Consider alternative or innovative
creative alternative or innovative

 Strategically locate columns to reduce long span framing conditions
Understand embodied carbon impacts of variou lateral systems

 Acknowledge the relatively higher carbon inte of basement and foundation structures
Scrutinize design criteria including services hill

Design for adaptability and deconstruction
Maximize design utilization and avoid addi

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TERMS TO KNOW

Global Warming Potential (GWP) Measurement of the cumulative radiative forcing effects of a greenhouse gas over a specified time horizon, often 100 years, and typically represented units of kg-CO2e (carbon dioxide equivalent). Embodied Carbon

The global warming impact of the manufacture, transport, installation, and disposal of the construction materials and products used in a building. Total embodied carbon can be further broken into categories of upfront embodied carbon use phase embodied carbon, and end-of-life ambodied rathon.

Operational Carbon The global warming impact of the operations of a building.

Life Cycle Assessment (LCA) A method of environmental accounting that tracks input from nature and outputs to nature considering processes that occur within the specified system boundary and time frame.

Embodied Carbon Assessment An LCA that considers only the embodied carbon of the system; the scope may or may not be limited to the primary structural components.

Whole Building Life Cycle Assessment (WBLCA) An LCA that typically considers all building systems and multiple environmental impact categories.

Environmental Product Declaration (EPD) An LCA and third party-verified report about a specific product or material's environmental performance.

CONSULTING ENGINEERS

WHAT IS NET-ZERO? HOW DO WE ACHIEVE IT?

According to SE2050.org, Net-Zero Embodied Carbon is when the upfront embodied carbon is reduced to the greatest extent possible. The remaining embodied carbon is then offset so that the emissions over the life cycle of the building are effectively eliminated.

As structural engineers, we can contribute toward the goal of achieving net-zero embodied carbon primarily by **reducing the embodied carbon in our structural systems**, which typically represent the most significant portion of a building's embodied carbon emissions.





Permit the use of CarbonCure and other en technology, when appropriate 1



REPORTING



Life Cycle Assessments (LCA) are an essential tool to quantify environmental impact and facilitate embodied carbon reductions. Our reporting and LCA efforts over the last year have focused on a combination of increasing access to data, improving clarity on when an LCA is needed, and increasing our understanding of LCA results to inform decision making.

WIDESPREAD EMBODIED CARBON ASSESSMENTS

A major initiative that was started in 2024 and will be implemented in 2025 is the development of a Revit tool that allows for streamlined and automated determination of material quantities for a project. This tool also allows us to incorporate allowances for both modeled and non-modeled scope and organizes the information in a way that facilitates an embodied carbon assessment. The embodied carbon assessment being performed by this tool is similar in scope and detail to an ECOM analysis performed through the SE2050 website. There are a few key items that we hope to achieve with the development of this tool including increasing access to LCA information for more of our engineers and allowing for better informed decision making in real time. The output of the tool will be organized in PowerBI to allow the user to graphically interpret their results and share them with the design team.

IMPROVEMENT AND INTERNAL EDUCATION

While we work towards making basic embodied carbon assessment proficiency more widespread across the department we also intend to reinvest in the individuals who have completed reporting requirements in years past. We intend to use the soon to be released *SEI Prestandard for Assessing the Embodied Carbon of Structural Systems* and other key resources from CLF, SEI, and IStructE to strengthen our knowledge in key LCA topics including uncertainty, functional equivalence, biogenic carbon, carbonation, and end-of-life assumptions. We also plan to develop at least one case study related to how LCA supported a project's sustainability goals and collaborate with the architect on the case study's development.

SE2050 DATABASE AND LCA AS A CONVERSATION STARTER

For last year's reporting requirements a total of 6 projects have been submitted to the database. The analysis focused on ensuring accuracy in the cradle-to-gate data and structural material quantities, but cradle-to-grave data was also calculated and will be reported as part of our submission. The projects that were submitted had an average cradle-to-gate embodied carbon intensity of 306 kg-C02e/m2 with a range between 137 kg-CO2e/m2 and 704 kg-CO2e/m2. An additional step that we plan to take this year is to write summary reports based on the submitted projects which will be shared and discussed with the original design teams. Project selection for this year was based primarily on projects that had the potential for the resulting data to facilitate a sustainability conversation with a satellite office, a curious project manager, or a curious client.

2025 ACTION ITEMS:

- Submit a minimum of (12) projects to the database utilizing our new REVIT tool and a cradle-to-gate scope.
- Submit a minimum of (6) projects to the database with a cradle-to-grave scope.
- Include all structural material quantities in our submissions to the SE2050 database.















WESTREET ICE CENTER

TULSA, OK

Martin/Martin provided structural engineering services on the adaptive re-use of a previous Macy's department store, to convert the building into a practice facility for the Tulsa Oilers hockey team. The space houses two ice sheets with an overlooking restaurant/bar area, stadium seating for 1,350 spectators, party rooms, locker rooms, and amenity spaces.

To fit the dual ice sheets into the space, 36 columns were removed and Martin/Martin designed a series of new long-span, built-in-place trusses to support the existing roof system. After the trusses were installed, the contractor demolished 56 bays of the second floor, creating two new high-bay ice rink spaces. The existing roof structure and roofing materials remained intact during this process. *Completed photos by Adam Murphy*.





EMBODIED CARBON REDUCTION STRATEGIES

In prior years, internal reduction strategy efforts have focused primarily on material based general notes and specification edits. Moving into 2025, we are committing to expanding our efforts to include guidance related to design efficiency, system selection and highlighting how design decisions and the coordination process impact the sustainability of a project.

DESIGN STRATEGIES AND CONNECTING THE DOTS

There are two components to consider when implementing design strategies in an effort to reduce the embodied carbon of a project. The first is to understand the tools available and items to consider. These are becoming increasingly well documented through resources such as the SE2050 design guidance. We also have summarized these in many internal resources, most notably our "Sustainability Guide" which is discussed in the education section of this action plan. The second component involves data - engineers must distill the various strategies down to ones that are both applicable and impactful for their project.

In 2025, we intend to develop a series of Design FAQs which highlight how common design decisions and coordination items impact a project's embodied carbon. We are expecting to study things such as the impact of column transfers, column splice locations, and widths of typical residential units on framing efficiency while brainstorming additional ideas specific to the projects we are working on. The goal is for these FAQs to show our engineers that what they do and the decisions they make on a daily basis have an impact. As outlined in detail in the reporting section, we are also working to put project specific data, in the form of simple embodied carbon assessment and material quantity tools, in the hands of all of our engineers.

SPECIFICATIONS, MATERIAL PROCUREMENT, AND CHAIN-OF-CUSTODY

While our primary focus this year is moving away from specifications and general notes, we simultaneously acknowledge that specifications always need continuous improvement in response to feedback from contractors on projects and the rapidly changing landscape of EPD data and material production. A new round of minor edits is already underway for our concrete and steel specifications based on some of this feedback and discussions with suppliers. We also intend to work with our wood subject matter experts this year to engage with wood suppliers on sustainability topics including chain-of-custody.

THE IMPORTANCE AND POWER OF PUBLIC POLICY

Similar to specifications, we will also continue to monitor changes to buy clean policies at the national, state, and local level. Public policy and standards adoption are a tool that can immediately create change and one that we need to be up to speed on to educate our clients and project teams. They also are valuable frameworks for projects with clients that are interested in sustainability and help us establish project sustainability goals. Of particular interest to our firm over the next year to review and incorporate into a project is Buy Clean Colorado, CALGreen, ACI 323, LEED V5 and the *SEI Prestandard for Assessing the Embodied Carbon of Structural Systems for Buildings.*

2025 ACTION ITEMS:

- Set clearly stated, firm-wide reduction targets in the short term and long term. We will focus on comparing our results to the benchmarking work being done by the SE2050 database and other organizations like CLF and determine any underlying reasons our data may differ from the conclusions of those reports/organizations.
- Develop and implement a work flow that makes it easier to make early design decisions based on embodied carbon. This elective is supported by the activity discussed in the reporting section.
- Compare different design options with embodied carbon as a performance metric during the project concept phase. Specifically, work with a project team to evaluate the potential for reuse of an existing building as a key conceptual reduction strategy compared to new construction.
- Incorporate sustainably harvested biogenic materials in at least one project. Specifically, we will work with a project team to gain a project wide understanding of the definition of sustainably harvested material that is appropriate to the project and acceptable to the design team. This action item is related to both reduction strategies and advocacy efforts strategy compared to new construction.







EXISTING BUILDINGS - A KEY REDUCTION STRATEGY

At Martin/Martin we have a long history of working with existing buildings. We have a dedicated team of over 40 architects and engineers who focus on existing building evaluation and repair projects and support the adaptive reuse and addition/expansion projects across the firm. We acknowledge the need for more reuse and adaptation projects to achieve the goals of SE2050.

TOP: General Services Administration Building 48 Modernization, Lakewood, CO; 2024 Completion; Conversion of a 150,000 SF warehouse into an office space and execution of a deep retrofit to facilitate the project's net zero operational goals.

LEFT: University of Colorado Hellems Arts and Science Building, Boulder, CO; 2025 Completion; A complete modernization of a 95,000 SF building originally constructed in 1929. Project scope included exterior envelope improvements, new building systems and interior space improvements.

BOTTOM: University of Colorado SPUR Campus - McConnell Building, Denver, CO; 2023 Completion; Conversion of a twostory warehouse initially constructed in the 1930s into an office space. This existing building was integrated into the design of the CSU SPUR Hydro building featured on the cover.









MASS TIMBER AND HYBRID WOOD - A KEY REDUCTION STRATEGY

Our clients and our engineers are growing increasingly interested in designing in wood, a material with an inherently lower carbon footprint (per unit of material). We actively encourage projects to consider wood as an alternative in schematic design phases and are motivated to support its implementation while minimizing additional cost and complexity. The interest in wood is proving to be location agnostic, as we see interest growing in our Denver headquarters, in the mountains outside Denver and throughout the U.S. at our satellite office locations.

TOP: Southeast Recreation Center, Aurora, CO; 2023 Completion; A 76,000 SF recreation center featuring exposed glulam roof framing in many of the spaces, including a "Canyon Roof" which features gracefully undulating beams the seemingly float above glass clerestory windows.

LEFT: Market Center of the Ozarks, Springdale, AR; 2024 Completion; A 45,000 SF food market constructed utilizing masonry bearing walls and a hybrid steel and CLT roof structure with folded plate elements.

BOTTOM: Steamboat Springs Base Village, Steamboat Springs, CO; 2023 Completion; A multi-phase redevelopment of the base village involved construction of a two-story mass timber restaurant, a mass timber stage, and a canopy over an escalator.





ADVOCACY



We will call attention to embodied carbon reduction to our clients and industry partners through SE2050. We will also engage with our clients and material suppliers to further our understanding of the full picture of sustainability including their constraints and goals. Facilitating shared knowledge through a common goal will help all of us achieve a more sustainable and promising future.

ARCHITECTS AND BUILDING OWNERS

As an engineering consulting firm, our clients are always our first priority. They are also increasingly interested in guidance and data relative to embodied carbon. Historically we have provided new and existing clients with an AIA accredited presentation on sustainability. We plan to continue this advocacy effort by updating our existing presentation and adding a new AIA class with a working title of *Embodied Carbon and Design* which intends to focus on actionable and impactful strategies that can be made on projects. This new class reflects where we hope to head with our advocacy efforts, building strong working relationships, and an understanding with our clients on how embodied carbon can be addressed.



STRUCTURAL ENGINEERING AND THE CONSTRUCTION INDUSTRY

Martin/Martin places high value on thought leadership and sharing our knowledge with the structural engineering industry. We have a long history of involvement in code and standards development and education. We are committed to supporting engineers through leadership roles in the SEAC (Colorado) Sustainable Design Committee and SEI's Sustainability Committee. We also plan to actively participate in SE2050 outside of our firm requirements, NCSEA's Sustainable Design Committee, and CLF regional hubs near our office locations (including Rocky Mountain, San Francisco, and Atlanta).

MATERIAL SUPPLIERS

Through our sustainability efforts and project experience we have developed many industry contacts with contractors and material suppliers. In acknowledgment of the rapidly changing landscape related to concrete materials and ready mixed

LCAS AND EPDS AND Buy clean, oh my!

LEARN HOW EVER-GROWING Sustainability Policies can Affect Your Next Project

STRUCTURAL ENGINEERING SUMMIT 2024

DESIGN CRITERIA AND DESIGN CONSTRAINTS FOR SUSTAINABILITY AND EMBODIED CARBON

STRUCTURAL ENGINEERING SUMMIT 2024





ADVOCACY



concrete production we plan to reengage with many of our local ready mix suppliers in 2025 to understand where the industry is headed and how they are reacting to buy clean policy requirements.

We also intend to engage with wood suppliers in support of design efforts around mass timber and to understand the EPD landscape and chain of custody.

2025 ACTION ITEMS:

- Continue to describe the value of SE2050 to our clients and collaborate with them on their embodied carbon and sustainability goals.
- Publicly declare our firm as a member of the SE2050 commitment through sharing of this ECAP document on LinkedIn and with key clients.
- Engage with structural material suppliers in our region to communicate the importance of Environmental Product Declarations (EPDs) and low-carbon material options.
- Give an external presentation on embodied carbon through SEAC and/or NCSEA.



Case Studies in Mass Timber Architecture

1 LU | HSW

A deep dive into designing with mass timber by examining multiple mass timber projects. Each case study will provide an in-depth review of the gravity and lateral framing system. Discussion topics will include examples of wood-to-wood connections, a summary of the wood procurement process, and descriptions of the wood type and appearance grade.

AIA CONTINUING EDUCATION COURSE



Sustainable Design

1 LU|HSW

This class will provide a deeper understanding of sustainable practices, designs, tools, and materials for civil and structural engineering projects. It will also outline sustainable civil and building certifications and provide an update on relevant local legislation for future public projects.





MISSION STATEMENT

Exceptional engineering solutions through our culture of integrity, service, creativity, and quality to benefit our clients, employees, and community.



Sustainability is embedded in everything we do, and we acknowledge our obligation to improve the health of our planet.

Corporate Investment Embodied Carbon Reduction Strategies Life Cycle Assessment Civil Site Solutions Mass Timber Existing Buildings Adaptive Reuse Colorado Water Reuse Law