SE2050
COMMITTING TO NET ZERO

SOM

Embodied Carbon Action Plan
September 30, 2022

We’re Rising to the Challenge

Our commitment to sustainability

Structural engineers have an important role to play in mitigating climate change by reducing the impact the built environment has on our planet. SOM is proud to have joined leading engineers as a member of the SE2050 Commitment since 2020, leveraging our deep breadth of expertise in research and design to bring more sustainable building systems, materials, and technologies to the forefront. Working collaboratively, we’re playing our part to drive the transition to a net zero carbon built environment.


“Civilizations leave marks on the earth by which they are known and judged. In large measure the nature of their immortality is gauged by how well their builders made peace with the environment.”
Nathaniel Owings, 1969

Our Commitment

5/28/21
PRESS RELEASES

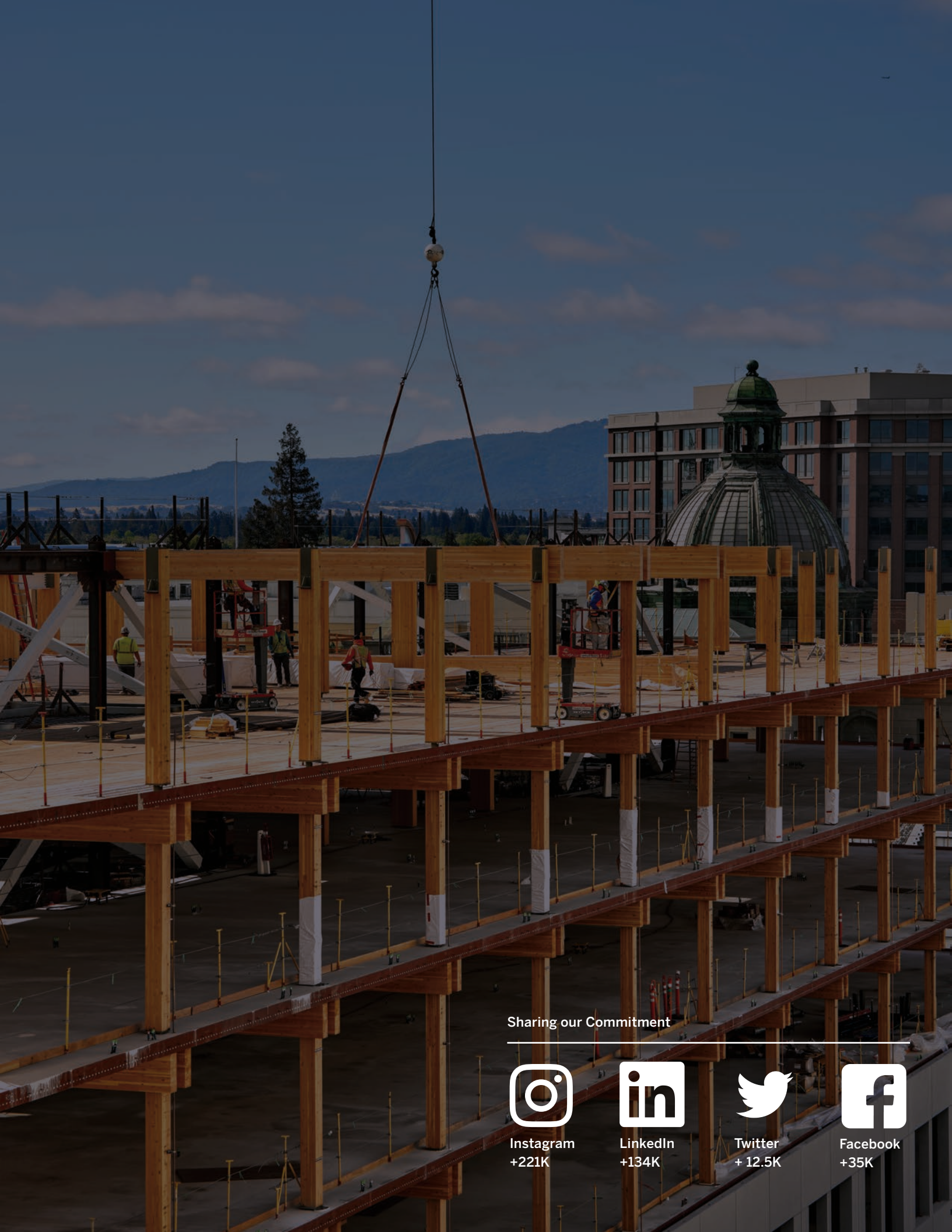
SOM Joins SE2050 Commitment to Carbon Neutral Structural Systems

SOM has joined leading structural engineering firms in signing the Structural Engineering Institute's (SEI) Structural Engineers 2050 (SE2050) Commitment. The initiative sets measurable goals to eliminate embodied carbon in structural systems by 2050. SOM is among the first architecture and engineering firms to commit to achieving substantive embodied carbon reductions within structural systems.

Making the SE2050 commitment further advances SOM's response to the most urgent challenge of our time: protecting the Earth's resources and leading the transition to a zero-carbon economy.

Strategies to reach net-zero embodied carbon include reducing and eliminating emissions from extracting, manufacturing, and transporting construction materials, all of which contribute immensely to global warming. The SE2050 program provides engineers with a platform to play an integral role in carbon reduction. The SE2050 committee will be sharing professional resources and educational opportunities to benchmark embodied carbon metrics, set targets, and track progress for firms that pledge to the program.

SE2050 adds to the list of climate action commitments that SOM has already made, including the AIA 2030 Commitment, the Architecture 2030 China Accord, and World Green Building Council Bringing Embodied Carbon Upfront.



Sharing our Commitment

Instagram
+221K

LinkedIn
+134K

Twitter
+ 12.5K

Facebook
+35K

SOM SE2050

September 30, 2022

Introduction

Quick Project Facts

85% Less Embodied Carbon

4% Cost Savings

Measured in the Life Cycle Analysis

- Optimized timber material volume
- Reduced piece count
- Reduced steel connections
- Reduced construction time
- Reduced floor-to-floor height

San Mateo County Office Building 3

The COB3 building will redefine the San Mateo County Government Center with an iconic, forward looking design that reflects the values of the community. With a mass timber/CLT structural system, ultra-low carbon footprint, and net zero energy goal - the design will set a new standard for a sustainable, generational, civic building beyond the Bay Area.

Skidmore, Owings & Merrill

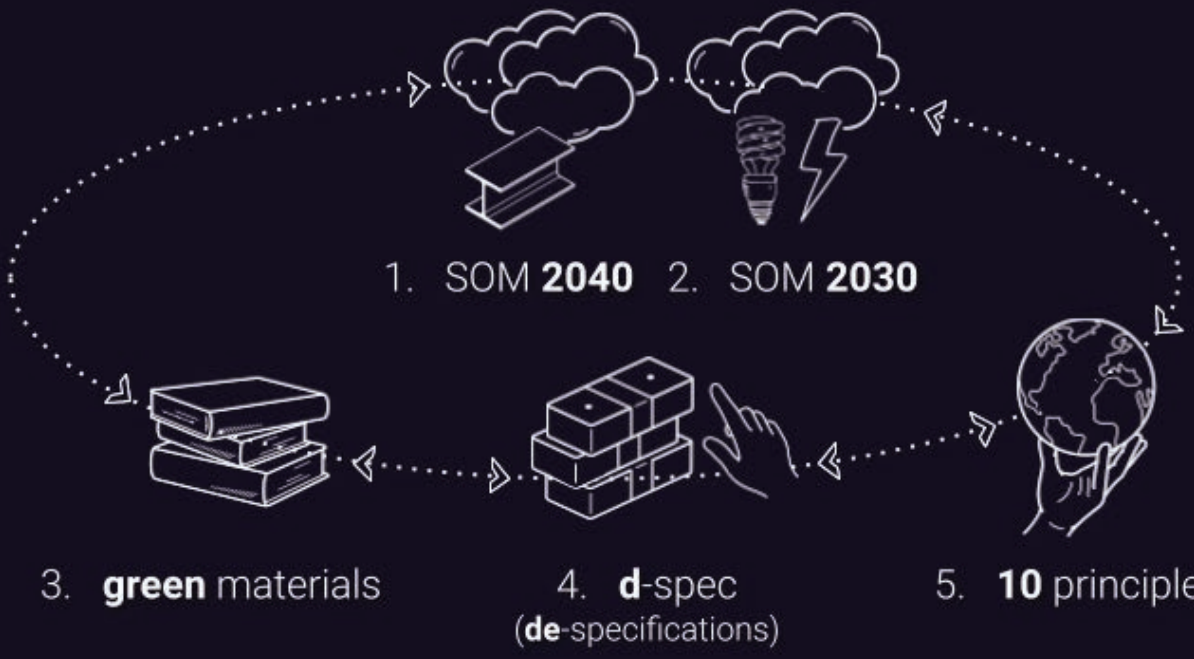
We are driven to answer the most urgent challenge of our time—to protect the Earth's resources and support the transition to a zero-carbon economy. We must take responsibility, individually and collectively, for the future of our planet. As architects, engineers, and planners, we are positioned to lead the charge by shaping buildings and cities to advance sustainable development.

SOM Climate Action Group

A collective of architects, designers, engineers and planners shaping a better future for our planet, by combating climate change and accelerating our actions for a sustainable low carbon future.

through

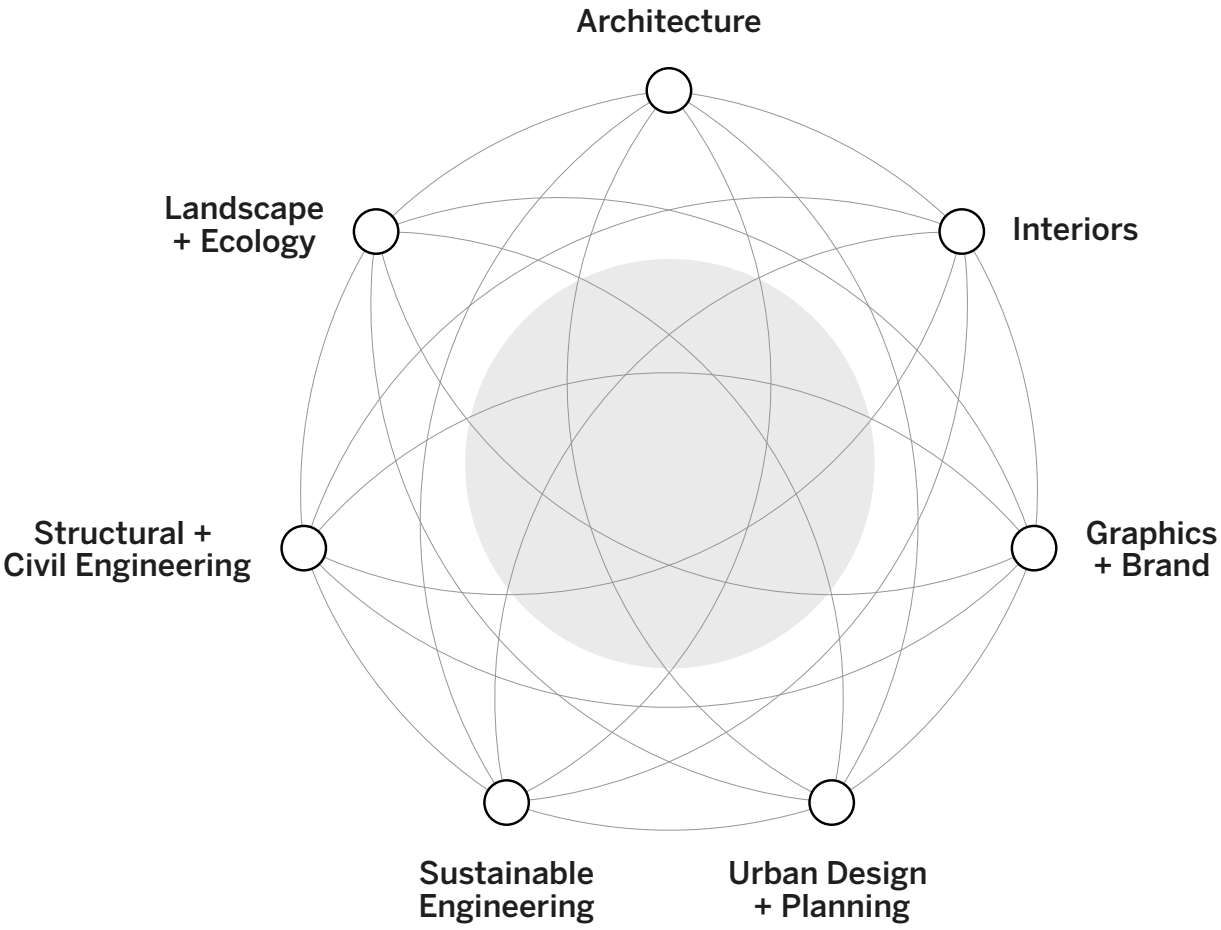
5 interconnected initiatives



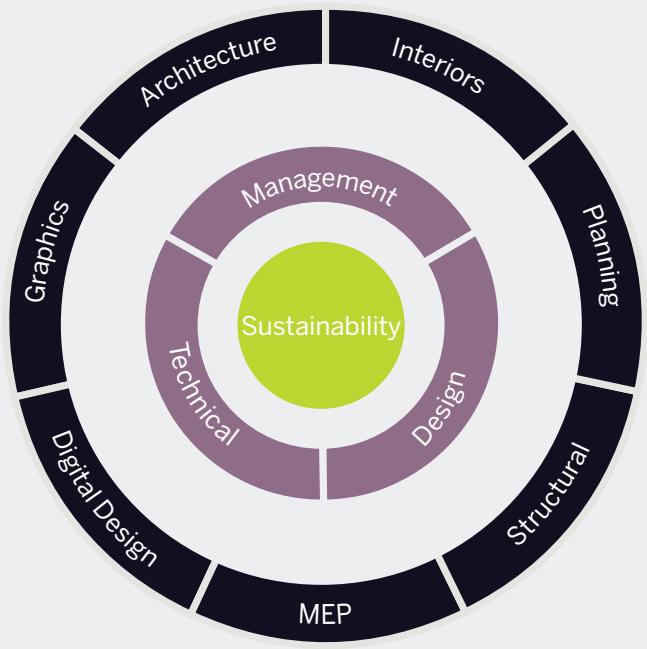
1. **SOM 2040:** Commitment to net zero embodied carbon in the designs of our wider portfolio by the year 2040
2. **SOM 2030:** Commitment to net zero operational carbon in our designs by the year 2030
3. **Green Materials:** Commitment to investing time and resources to the pursuit of new sustainable building materials
4. **D-Spec:** Commitment on improving our sustainable performance from a materials and construction standpoint
5. **10 Principals:** Underpinned by the UN Sustainable Development Goals for 2030, our design principles for sustainability and wellbeing (see page 14 for more details)

A Holistic Approach

As an integrated design practice, SOM is committed to evaluating and improving on embodied carbon performance not only across the firm's structural design group, but within the architectural, interior, urban planning and MEP design studios. Through this integrated approach we leverage our embodied carbon calculation methodology and reduction strategies across all disciplines and work collaboratively to further a common goal of net embodied carbon reduction in the built environment.

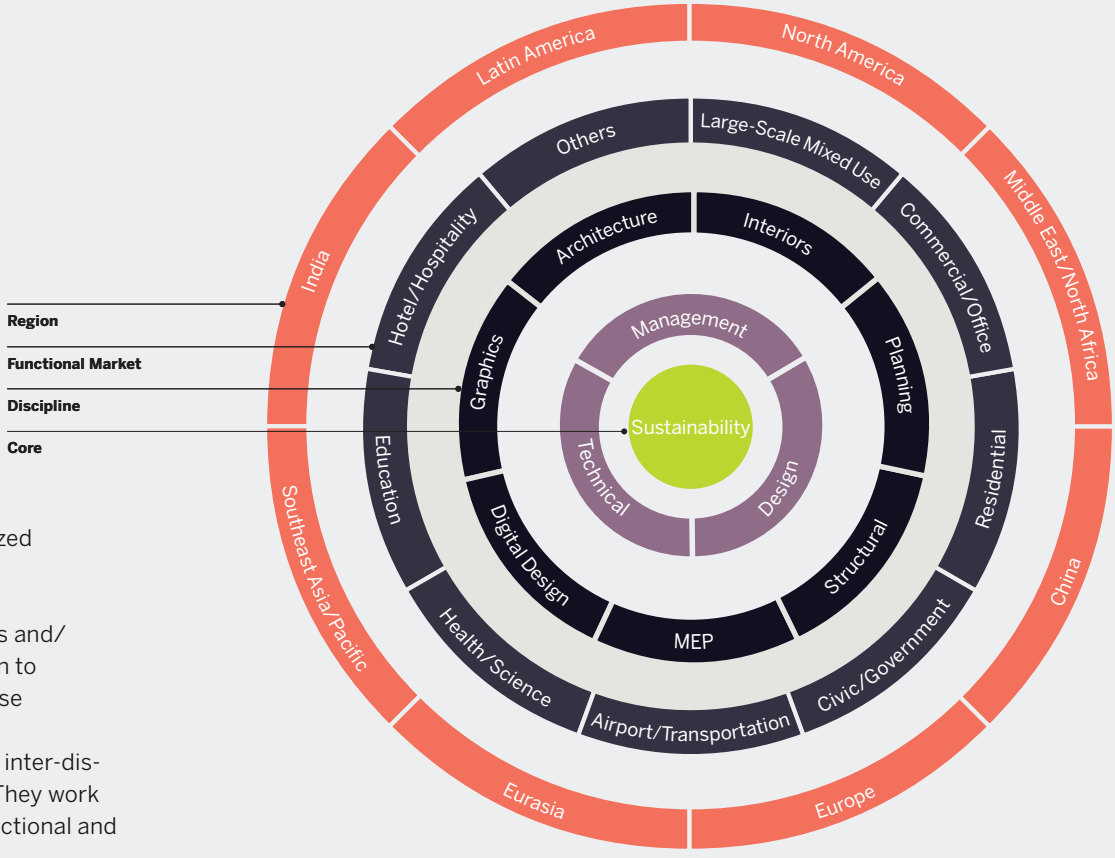


21st Century Staff Structure
Disciplines and Talent Accessible Firmwide



SOM's current structure is based upon the assembly of the best available firmwide international talent with specific functional expertise applied to highly program-driven projects. Enabled by advances in computational systems, digital communications and a "one-firm" partnership culture, this structure provides depth in specialist expertise; and breadth in intellectual cross-fertilization across diverse project typologies and geographies. The firm's core values in design, technical and management are applied to each discipline, firmwide, to promote consistent quality. The visual manifestation of the firm's overall design ethos, as established by the partners, is an important measure of the level of a project's success.

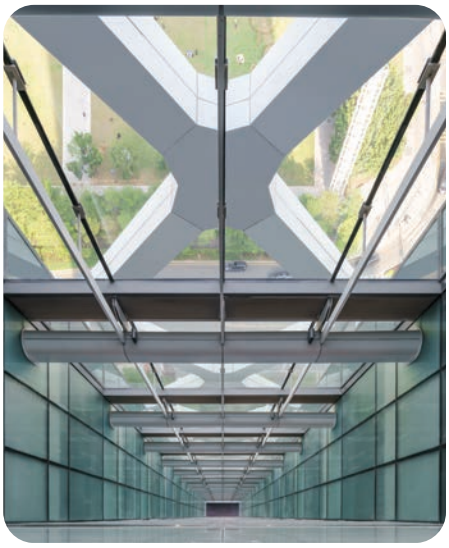
21st Century Project Organization



Each project is organized around a core team of Design, Technical and Management directors and/or partners. In addition to overall leadership, these individuals encourage cross-fertilization and inter-disciplinary innovation. They work across disciplines, functional and geographic markets.

Our 10 Design Principles

SOM is committed to developing sustainable built environments, and it recognizes the limitations of our planet's collective resources. Grounded in building and planning science, SOM's integrated environmental design approach is embedded in projects through rational and informed design decisions. Through research, analysis and innovation, we aim to create built environments that prioritize the wellbeing of our planet and people.

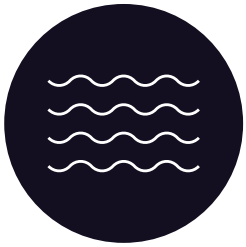


10 Design Principles for Sustainability and Wellbeing

ECOLOGY
Leverage and Protect Nature

ECONOMY + EQUITY
Provide Low Carbon Urbanism for All

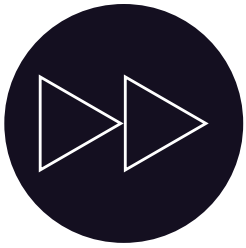
ENERGY + CARBON
Design and Deliver Net Zero Carbon Built Environments



WATER
Value Every Drop

RESILIENCY
Adapt for Climate Change

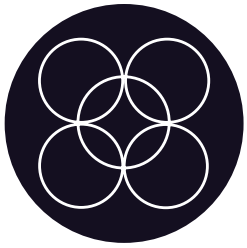
LIVABILITY + WELLBEING
Design Places where People Thrive



MOBILITY
Promote Sustainable Connectivity

MATERIALS + RESOURCES
Specify Responsibly and Prioritize Efficiency

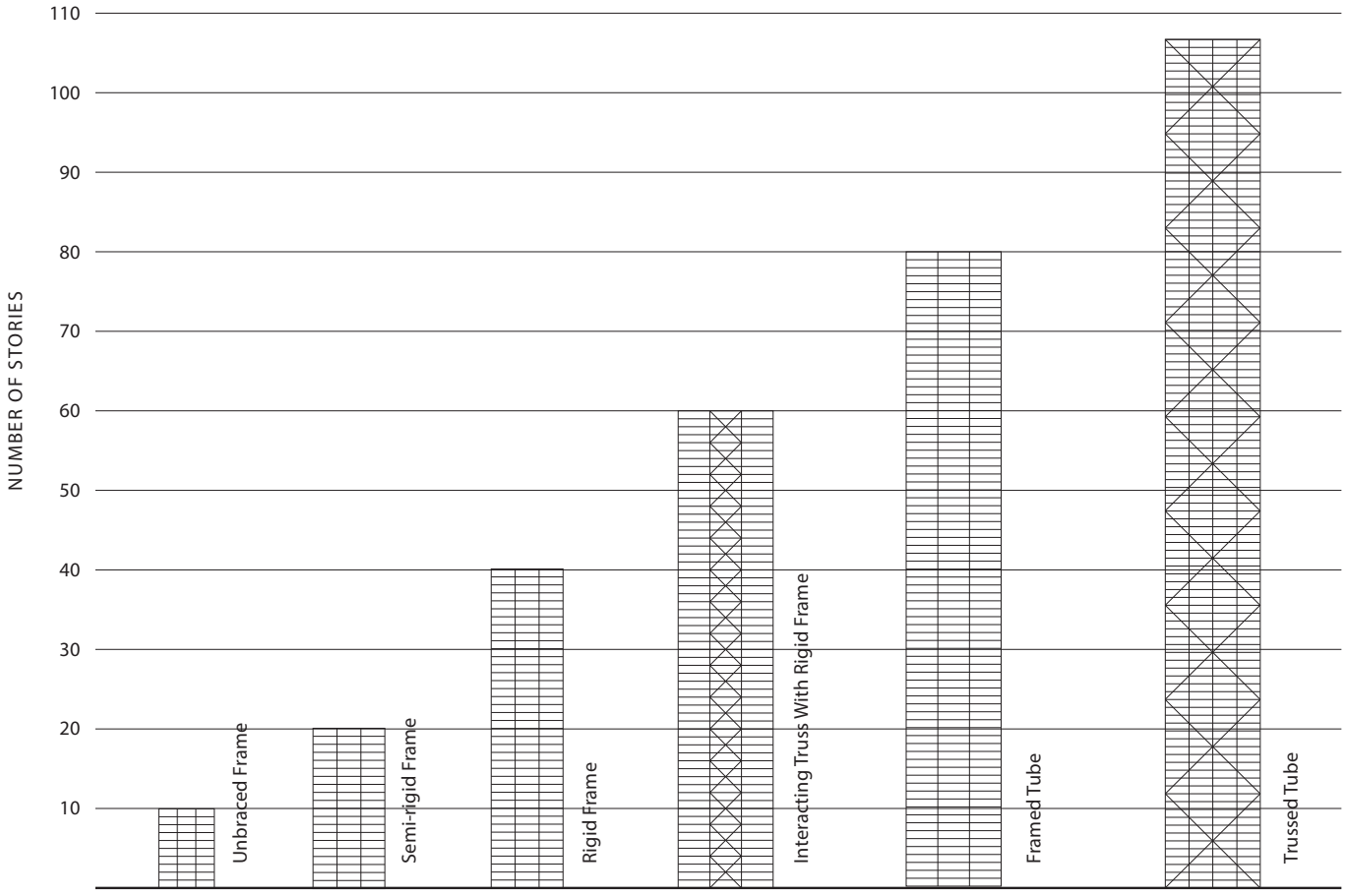
WASTE
Do more with Less



HERITAGE + IDENTITY
Cultivate Authentic Connections

Legacy of Structural Sustainability

Structural optimization has been a core means by which SOM has achieved sustainable buildings. This is seen in the pioneering work of Fazlur Khan in the 1960s and 1970s. The braced tube system of 875 North Michigan Avenue (formerly John Hancock Center) and the bundled tube system of the Willis Tower allowed incredible heights to be reached with remarkable material efficiency.



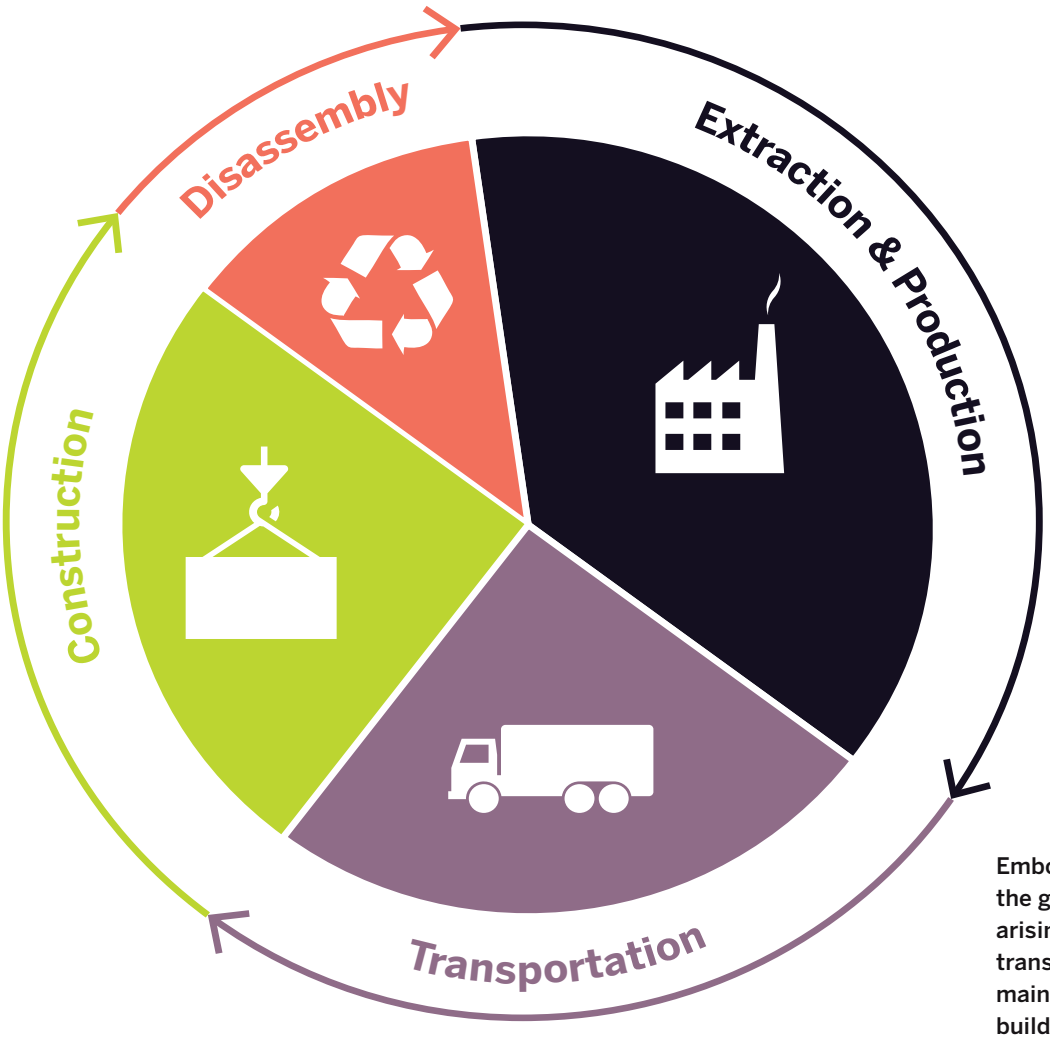
A historic collaboration between architects and structural engineers, the 100-story 875 North Michigan Avenue (formerly John Hancock Center) represents the first use of the exterior diagonalized tube structural system.

In 1969, one of SOM's founders, Nathaniel Owings, said "*Civilizations leave marks on the Earth by which they are known and judged. In large measure, the nature of their immortality is gauged by how well their builders made peace with the environment.*" As an environmental activist as well as a business leader, he spoke of the responsibility that our firm has to protect our planet's limited resources. Our work has been guided by this conviction for decades.

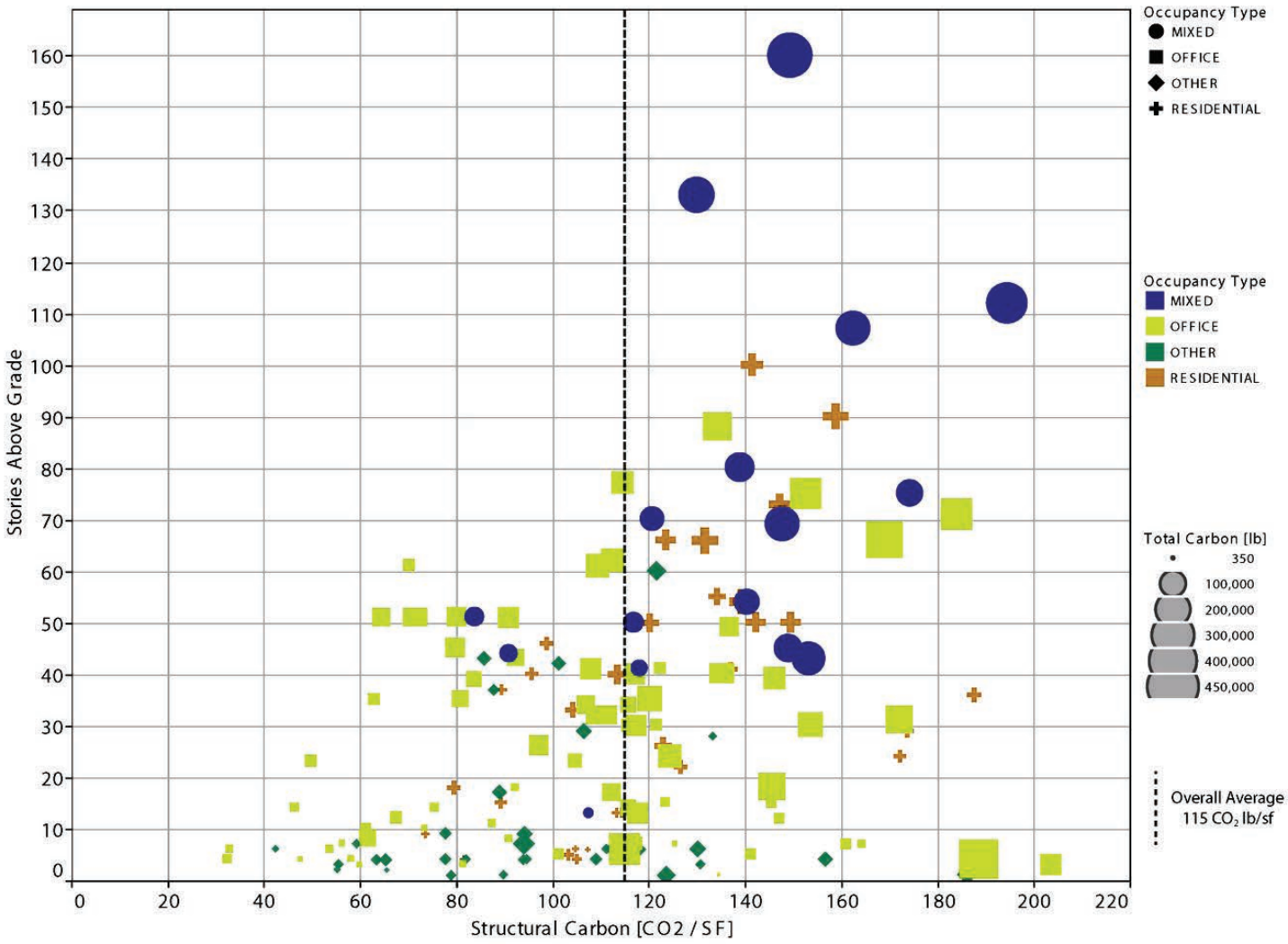
We believe that great buildings come through a dialogue between engineers and architects, working as a design collective with the shared aspiration of achieving simplicity, structural clarity, and sustainability. The incorporation and commitment to sustainable building ideas has been an integral part of SOM's design approach. Today, we are staffed with 295 LEED® accredited professionals who have extensive knowledge of the industry's progressive efficiency design solutions and strategies.

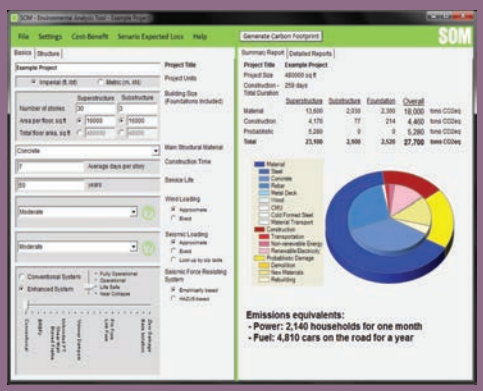
Efficiency & Optimization Tools

Embodied carbon is a significant percentage of global emissions. As engineers and designers it is urgent for us to take action. In our contemporary work we use a range of optimization tools and techniques that capitalize on modern computing to conceive new forms and efficient material placement.



Embodied carbon refers to the greenhouse gas emissions arising from the manufacturing, transportation, installation, maintenance, and disposal of building materials.

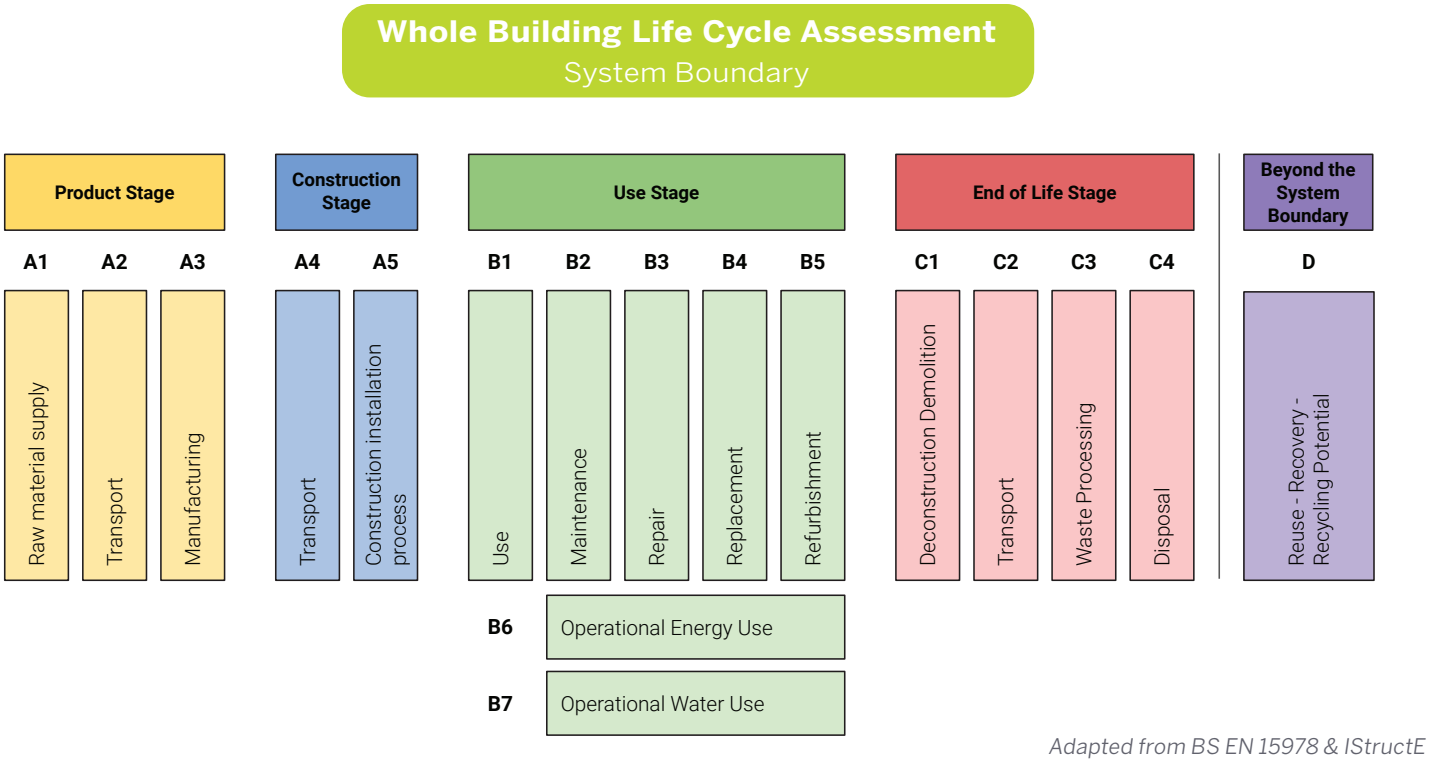




SOM has kept detailed records of the structural material quantities of our projects for many years. This provides useful benchmarks for efficiency based on project types, structural systems, and location. As the theories of embodied carbon and project life cycles have become better understood, we have developed tools that help us track and evaluate these in our projects. The EA Tool is a simple yet robust software program, created by structural engineers at SOM, that has been available as a free resource for the industry for over a decade. The program allows designers to estimate embodied carbon starting with a very minimal amount of information about a building.

Structural Life Cycle Group

Leading the sustainability efforts for our firmwide structural engineering teams is the Structural Life Cycle Group. The group aims to advance our sustainable design principles over the entire lifespan of a structure. The Group's mission is to advance environmental performance of structural systems, advocating for more integrated design solutions, the implementation of innovative materials and construction practices.



Adapted from BS EN 15978 & IStructE

SOM

STRUCTURAL LIFE CYCLE

EMBODIED CARBON + HIGH PERFORMANCE DESIGN

SOM SE2050 Champions

Effective results starts with a realistic and detailed work plan that is proactively managed throughout the process. We have assembled a team of experts that bring extensive experience with sustainability, material efficiency, and environmentally responsible structural systems.

David Horos, LEED® AP, SE, PE
Principal, Structural Engineering

Jeremy Kirk, PE, SE
Structural Engineering Associate

Matthew Streeter, PE
Structural Engineering Associate

Nicole Wang, PE
Structural Engineering Associate

Christopher Horiuchi, SE
Structural Engineering Associate

Karl Micallef
Structural Engineering Associate

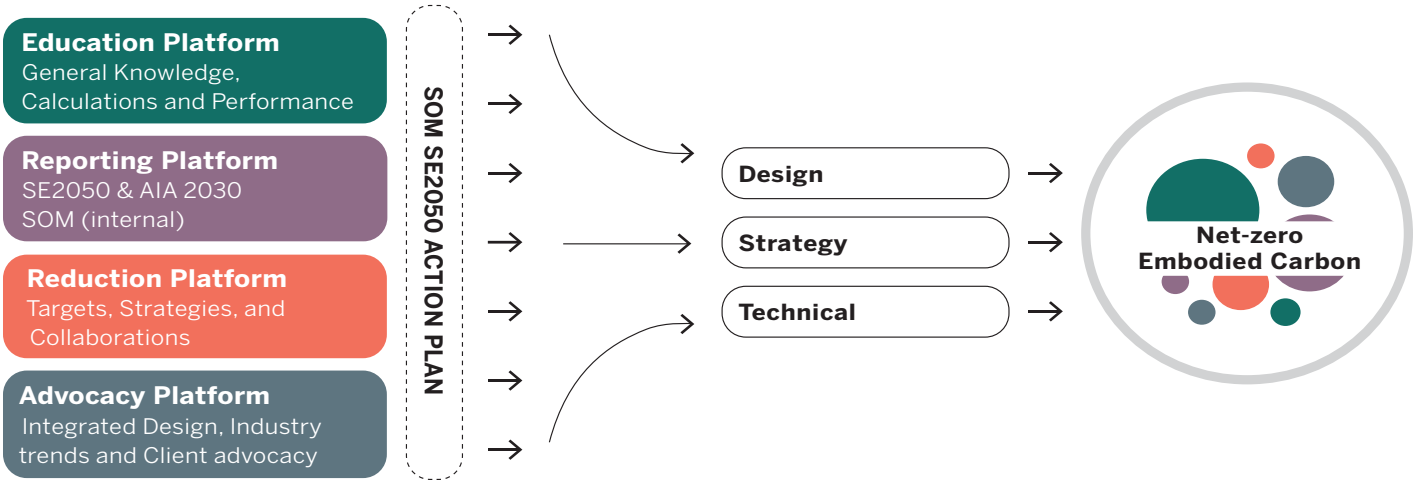
Eunice Leung, PE
Structural Engineering Professional

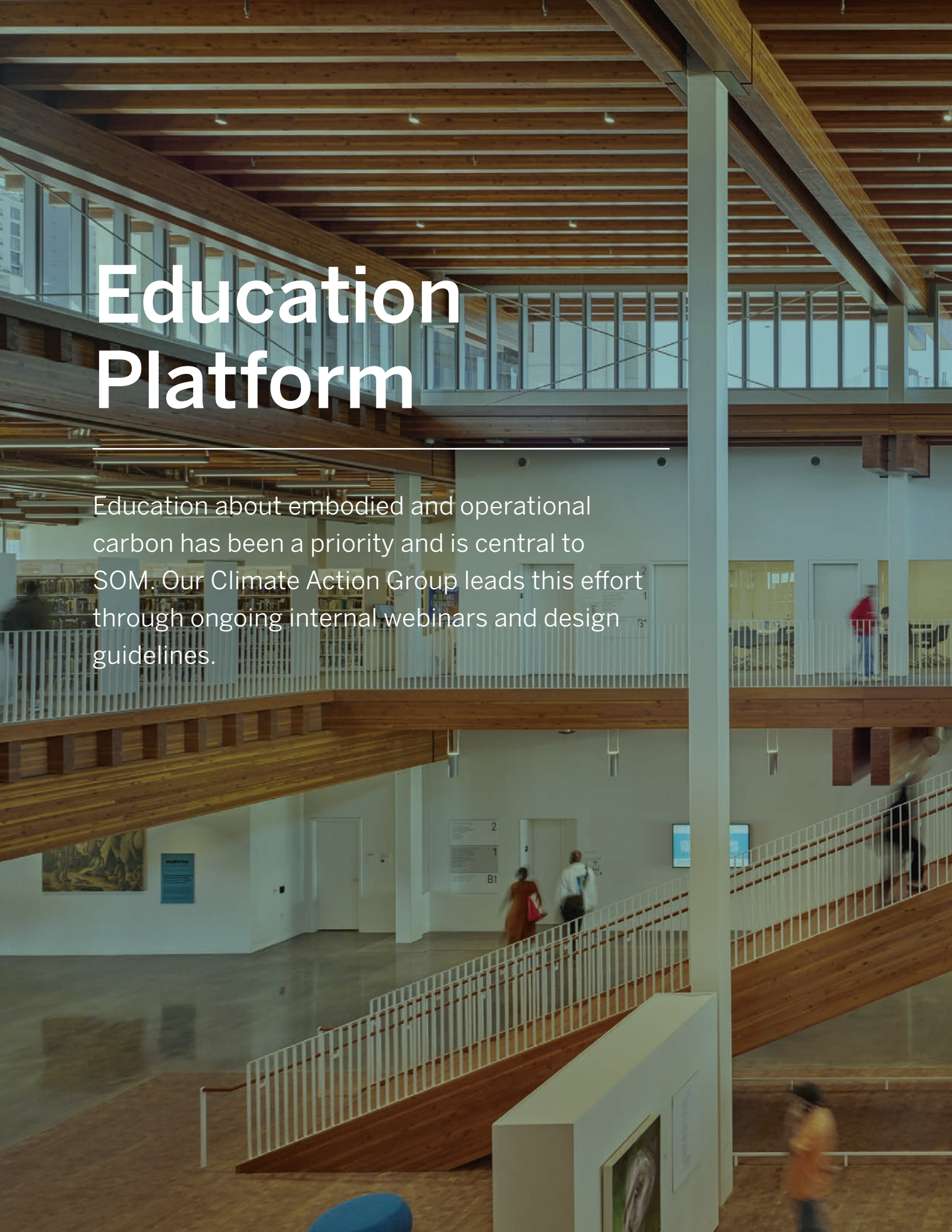
Courtney Kim
Structural Engineering Professional

SOM SE2050 Action Plan

Our commitment for the coming years is to formalize SOM's embodied carbon reduction strategies within the structural engineering practice in several ways. Here we present the general layout of each platform that will help inform and guide our action plan and commitment.

This Action Plan documents ongoing as well as new efforts within our firm to reduce the carbon footprint of our work. Additionally, this Action Plan will be used as a firmwide aid to guide our design practice towards more sustainable design solutions to achieve our goal of net zero embodied carbon by 2050.





Education Platform

Education about embodied and operational carbon has been a priority and is central to SOM. Our Climate Action Group leads this effort through ongoing internal webinars and design guidelines.

Low Embodied Carbon Materials

The LEED® Platinum certified Billie Jean King Main Library in Long Beach, California utilizes timber construction and features rooftop photovoltaic cells, daylighting strategies, controlled air ventilation systems, and extensive glazing with architectural overhangs for solar protection.

Education Platform

Our commitment for the coming years is to formalize our Action Plan within the structural engineering practice.

These three pillars make up the basis of the education platform for our embodied carbon action plan.

General Knowledge

Objectives:
We focus on general knowledge required to understand what contributes to embodied carbon within a structural system. Our goal is to provide clear definitions of parameters used to calculate embodied carbon throughout the lifecycle of a structure.

Internal Deliverables:
We will create and present our own embodied carbon webinar on a an annual basis to all designers within the firm. The purpose of this webinar is to provide an outline for performing the LCA process as well as to highlight any developments that have been made in the materials science/design/construction industry which may have an impact on our sustainable design practices.

Calculations

Objectives:
The goal is to provide detailed guidance on calculating embodied carbon on a given project at all stages throughout the design process. This includes guidelines on regional carbon factors for various materials as well as best practices for estimating quantities. These calculation processes are in line with industry accepted standard practices for calculating embodied carbon for a given LCA module.

Tool Evaluation & Internal Deliverables:
SOM is periodically monitoring and evaluating commercially available LCA calculation tools to ensure accuracy and efficiency in our EC calculation processes. Additionally, SOM has been and will continue to develop internal tools for calculating embodied carbon to be used to make informed design decisions. As part of this development, we are providing annual educational presentations and user guides to inform SOM designers on how to implement both internal and commercially available tools for LCA calculations.

Performance and Reduction

Objectives:
The goal is to inform designers on the leading reduction strategies being implemented on various projects across the firm. This pillar is also being utilized to educate teams on lessons learned from past projects, whether it be to highlight structural systems which were successful in reducing embodied carbon compared to traditional systems, or to identify projects which fall short of there EC goals and what aspects of the design led to this shortcoming.

Internal Deliverables:
Webinars relating to reduction strategies and EC performance as it relates to internal and industry wide EC benchmarks are incorporated in the quarterly embodied carbon webinar described in the General Knowledge pillar.


The Institution of StructuralEngineers
How to calculate embodied carbon
IStructE Guide
Life Cycle Assessment of Buildings: A Practice Guide
Published by:
The Carbon Leadership Forum
Funded by:
CHARLES PANKOW FOUNDATION
DEQ
SKANSKA
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Sustainability Guidelines
FOR THE STRUCTURAL ENGINEER
EDITED BY
Dirk M. Kestner, P.E.
Jennifer Goupil, P.E.
Emily Lorenz, P.E.
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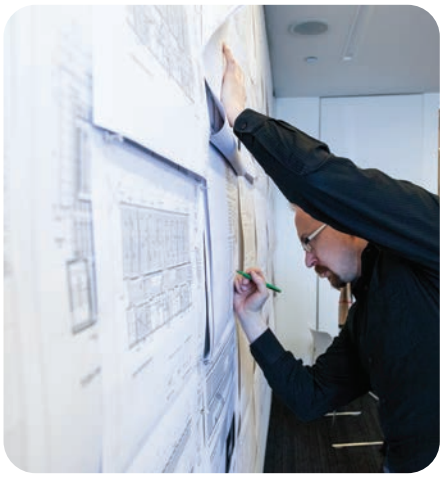
ASCE
SEI
Structural Materials and Global Climate
A Primer on Carbon Emissions for Structural Engineers
ASCE




PLUMBING
FP

Reporting Platform

Tracking and reporting of embodied carbon is critical for both internal design optimization and for the industry as a whole, to understand how we can make the most effective reductions that impact the built environment.

Reporting Platform

We have created internal spreadsheet tools for calculating Embodied Carbon (EC). These tools are used by the structural engineering teams on each project both for comparing embodied carbon schematic options as well as for documenting embodied carbon at major milestones. SOM has also developed the EC 101 tool that informs design decisions not only for structural systems, but for other design considerations, to achieve a holistic approach to embodied carbon reduction.

SE 2050

Scope:
SOM reported ten projects in total from our North America offices in the first year of reporting for SE2050. We aim to not only continue exceeding the target of minimum of two projects reported from each office, but also report a greater percentage of projects than the preceding year, but may be limited based on available EPD data, project location or project phase. Our initial reporting will focus on project locations for which reliable EPD values are available. Our aim is to build our understanding of EPD values across all global regions and monitor how these values are improved as new materials and manufacturing processes become available. SOM will also limit reporting to projects which have progressed up to, or beyond the schematic design phase.

Strategy:
As part of our SE2050 reporting strategy, SOM has established structural system component categories which are consistent with SE2050 reporting guidelines. Establishing a consistent component categorization strategy, allows for easier data interpretation and comparison across the industry. After the first round of reporting, SOM hopes to receive feedback from SEI regarding reporting categories which can be refined moving forward to improve data aggregation processes. Prior to reporting, SOM will plot all results against select building metrics to identify any potential outliers and understand the cause of this deviation.

Tools:
SOM will utilize commercially available tools which are LEED verified to perform embodied carbon calculations for SE2050 reporting. SOM will also use internally developed EC calculation tools, however internal tools must be verified using commercially available software accepted by industry peers.

AIA 2030

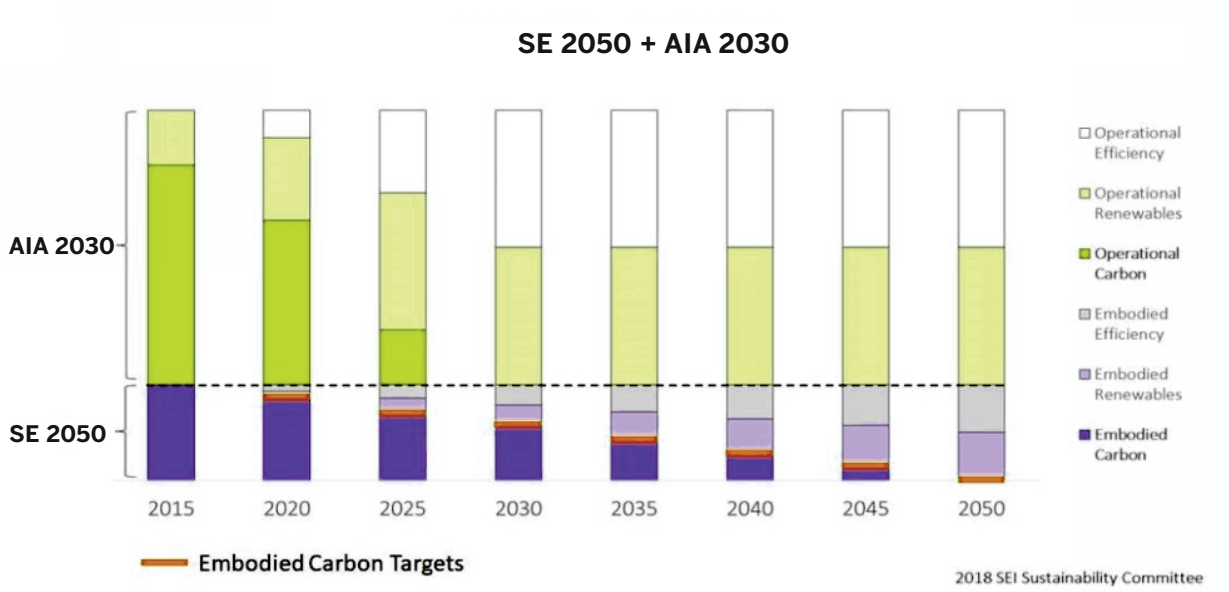
Scope:
As part of SOM's commitment to AIA2030, embodied carbon information on various projects shall be provided during the AIA2030 reporting process. SOM structures contributed for the first time to the reporting process during the year 2020 reporting cycle, during which we calculated embodied carbon for 45 projects across four different offices. During the year 2021 reporting cycle, 53 additional embodied calculations were completed and reported. Structural system components categories for AIA2030 reporting will not be broken down into as much detail as will be done for SE2050 reporting. AIA2030 reporting currently focuses on identifying the scope of the project included in the calculation. SOM will continue on this path until more detailed reporting is required/requested.

Strategy:
Similar to EC Reporting Pillar, AIA2030 reporting will also include a back check prior to issuance to ensure outliers are identified. Quantities for AIA2030 will be subdivided into three main categories (Foundation, Substructure & Superstructure).

SOM - Internal Evaluations

Scope:
To ensure SOM is making progress towards our embodied carbon targets we will engage in periodic embodied carbon tracking at the internal level. Our goal is to have design teams calculate embodied carbon at the end of each phase for all active projects within the structures group. By doing so, we can evaluate a given project's embodied carbon progression from the concept phase to the construction document deliverable to ensure reduction strategies are being implemented and overall reductions are being achieved. This internal tracking program also allows us to compare a given project's EC performance at a certain stage with past projects as well as measure it against objective EC targets. Further, we have been, and will continue to use these internal tracking mechanisms to identify which aspects of various structural systems are successful at reducing EC in our design, and to inform our reduction strategies moving forward.

Strategy:
SOM will continue to utilize internally developed tools to track embodied carbon over the duration of a project. These tools will feed into a larger database of all projects that will allow for rapid visualization EC performance across all offices/projects. This parent database will also serve as an educational tool to highlight embodied carbon success stories as well as give designers a clear reference of reasonable embodied carbon targets for a given project typology.



AIA 2030™

SE2050 COMMITTING TO NET ZERO

SEI ASCE STRUCTURAL ENGINEERING INSTITUTE

Reduction Platform

In the first year of SOM's commitment to SE 2050, we undertook a comprehensive study of the embodied carbon in a great majority of our projects. We evaluated these based on various characteristics, including height, occupancy type, and structural material. This information has been used to set benchmarks and achievable targets for the following years. Entering the second year of our commitment to SE2050, we will continue studying new projects to introduce more efficient materials and systems.


A building that
disappears into
the landscape

Reduction Platform

Benchmarking & Targets

Objectives:
The goal of establishing embodied carbon benchmarks and targets is to establish a reduction roadmap and timeline that allows for EC reductions which are consistent with the reality and constraints that exist within the industry. As a firm we have a history of innovative design resulting in new and increasingly efficient structural systems. We will continue on this path of innovation, however EC reduction targets must be viewed through an objective lense. Therefore, we will establish targets which are consistent with industry wide targets as well as the ultimate goal of net zero structural embodied carbon by 2050.

Internal Deliverables:
Our aim is to internally publish these structural embodied carbon targets on an annual basis. As part of this publication, we will evaluate our previous years performance against the targets for that same time period to evaluate our success at achieving these goals.

Reduction Strategies

Objectives:
As a group, we are working to define realistic reductions strategies that are consistent with the embodied carbon targets described in the previous section. These strategies will include but are not limited to: new materials research, structural systems optimization, more sustainable material specifications, innovative construction techniques and systems integration. It is our hope that through the combination of these strategies, we can start to achieve our embodied carbon reduction targets.

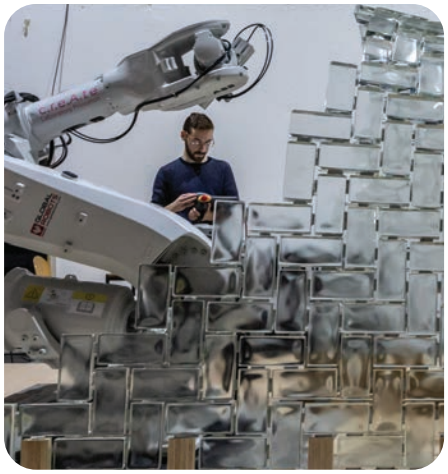
Internal Deliverables:
As part of our annual embodied carbon webinar, we will outline the leading embodied carbon reduction strategies for various structural systems and project typologies to ensure all potential reduction practices are available to our project engineers.

Collaborations

Objectives:
As described in the previous sections, one of SOM's strengths as a design firm is the integrated nature of our practice. Through collaboration across our various design disciplines, we aim to leverage integrated systems as much as possible in future designs to reduce construction waste and raw material usage. Our targets and strategies for embodied carbon reduction will continue to develop in collaboration with the other design disciplines to ensure wholistice embodied carbon reduction is being achieved over the entire scope of a project.

Internal Deliverables:
Internally, SOM has developed our own Climate Action Group which meets regularly to review carbon performance and potential reductions strategies for both embodied and operational carbon. SOM structures will continue to be involved with and lead discussion within this internal committee as they relate to embodied carbon performance and reduction strategies.

The Additive Manufacturing Integrated Energy (AMIE 1.0) Demonstration Project



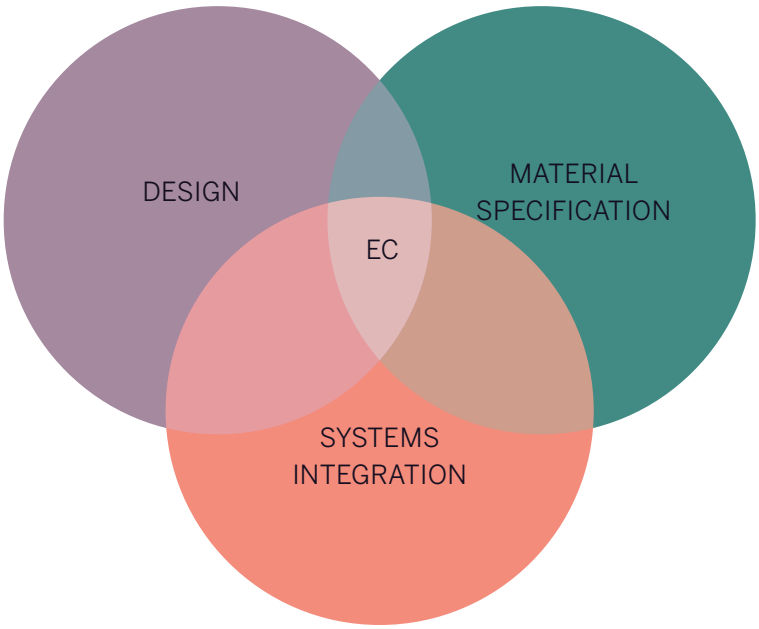
Robotic Construction - The Glass Vault Digital Fabrication, Demonstration Project

3D-Printed Concrete Barracks U.S. Army Corps of Engineers

Timber Tower - Research to Minimize the Embodied Carbon Footprint of Buildings

SPLAM - A Full-Sale Structural Framing System Prototype that Reduces Material Use

Stereoform Slab - Optimized Structure That Reduces Embodied Concrete



As designers our primary influence on the sustainable performance of a building system results from decisions made during the design, materials specification and systems integration processes. It is at the intersections of these design processes that we have the potential to affect significant embodied carbon reduction in the built environment.


+ Allá del horizonte
Mesa redonda
++++
Beyond the horizon
Round table
++++
+ Allá del horizonte
Mesa redonda
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Advocacy Platform

SOM is committed to change within our own firm and promoting our goals. Our internal communications reach all of our staff and encourage thoughtful actions. Our commitment to net zero and environmental stewardship are conspicuously shown throughout our external communications, routinely promoting sustainable solutions to our clients. Our goal is to influence and lead the global industry.

Advocacy Platform

Integrated Design Advocacy

Objectives:
Within our firm we constantly engage in conversations with our colleagues in other disciplines to champion and explore the benefits of interdisciplinary design. With each new project, we challenge the traditional processes and design flows, looking for opportunities to improve sustainability.

It is our goal as an integrated design practice to evaluate the potential for integrated design techniques on all new and ongoing projects. As we have seen from past experience, significant embodied carbon savings can be achieved through the integration of building systems, and the potential for savings increases by considering integrated design strategies early in the design process. Through this platform we will also evaluate past integrated design approaches implemented by SOM or other industry leaders to identify which integration strategies result in optimal carbon savings.

Internal Deliverables:
Success stories are presented in office and firm-wide meetings to reinforce this key aspect of our design ethos. Our structural group is highly involved with the firmwide initiatives related to sustainability, and are developing discipline-specific actions that parallel the global ideas (i.e. the Ten Principles).

Client Advocacy

Objectives:
Highlight and strive for economic benefits through sustainable design practices. Our marketing and external communications make it clear to our clients the high value that SOM places on sustainability and embodied carbon reduction. We seek opportunities to work with like-minded clients, allowing us to to leverage our knowledge and experience in this realm as a resource to assist clients and projects.

Through this pillar we aim to develop consistent sustainable design drivers which are presented to our clients from the earliest stages of the design process to ensure our commitments as a firm are reelected in our client relationships.

Internal Deliverables:
Provide teams with sustainable design narrative for project specific design criteria and locations that are based on past experience. This will include compiling regional specific information about local construction practices and material availability to ensure our sustainable design drivers are implemented within a context derived from the project location.

Industry Advocacy

Objectives:
As an industry leader, it is critical that SOM is plugged into the latest sustainable practices from both the design industry as well as the construction industry. By engaging with other design industry leaders, we hope to establish knowledge sharing pipelines to ensure that successful design approaches are being implemented across the broader design community. As part of this effort, structural engineers from SOM have committed to leadership positions on committees in SE2050 and continue to engage in other sustainable design communities such as Carbon Leadership Forum.

Similarly, it is important that our group engage with general contractors and builders to not only identify new sustainable materials and construction practices, but also to understand the feasibility of implementing sustainable design solutions in practice.

Internal Deliverables:
To achieve the above industry advocacy goals, SOM will continue engaging with the sustainable design communities with the hopes of hosting and/or participating in inter-practice sustainable design workshops that allow knowledge sharing across firms.


The future
today

Annual Update

Holistic Design Approach

Pearl River Tower in Guangzhou, China was the first supertall building certified LEED® Platinum by the U.S. Green Building Council. The building redefines what is possible in sustainable design by incorporating the latest green technology, architecture, and engineering advancements. A feature of the project are the wind turbines located at openings up the height of the structure that reduce wind lateral loads and generate clean power.

Path to Net Zero

As a firm, we continue to push our understanding of sustainable design solutions within several different categories that range from new materials research to improving on standard design specifications and practices as well our accounting for carbon on individual projects and a broader database of projects. Below is a summary overview of some of the components our firm has been focusing on in each of these categories.

Research

- Continued research into new materials:
  - More sustainable cementitious replacement, such as GGP
  - Biogenic material applications
  - Resilient steel materials
- Continued research of active and passive carbon sequestration technologies
- Continued research of modular and prefabricated design options which improve material efficiencies

Database

- Developed embodied carbon benchmarks using past project information and targets based on global environmental carbon reduction requirements
- Utilized a database that leverages past projects to identify successful systems and advocate for these systems on new projects
- Collected and cataloged EPDs from suppliers and manufacturers of commonly used structural materials

Specifications

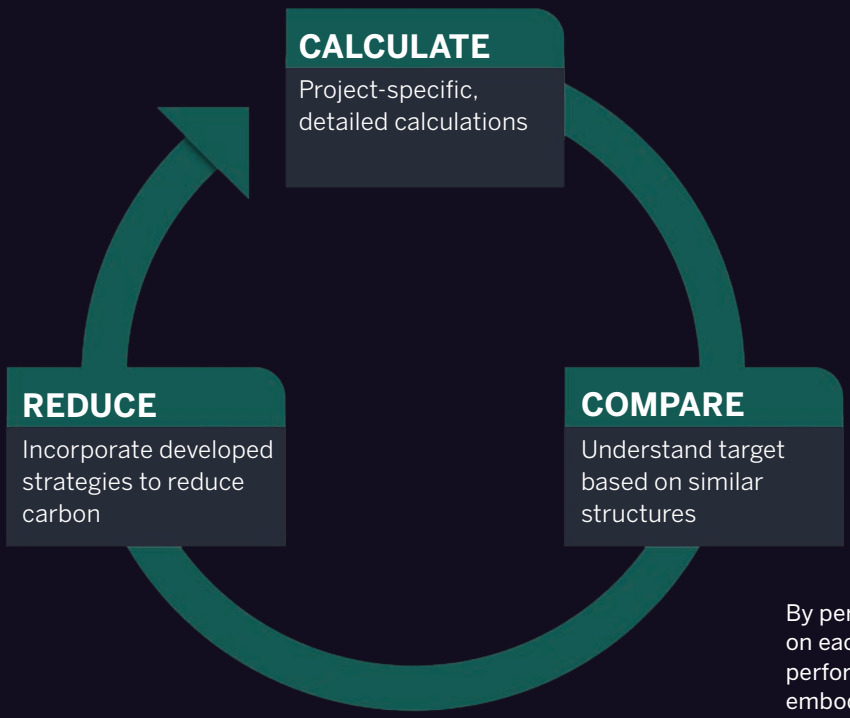
- Updated specification to include a carbon budget for each material division
- A specified minimum amount of recycled content for structural steel and rebar on each project
- Specified more sustainable cementitious replacement on projects

Early phase evaluation

- Researched local material options early on during a project to ensure the right materials are being selected based on site and regional constraints
- Discussed with local builders and work with client groups to establish carbon goals

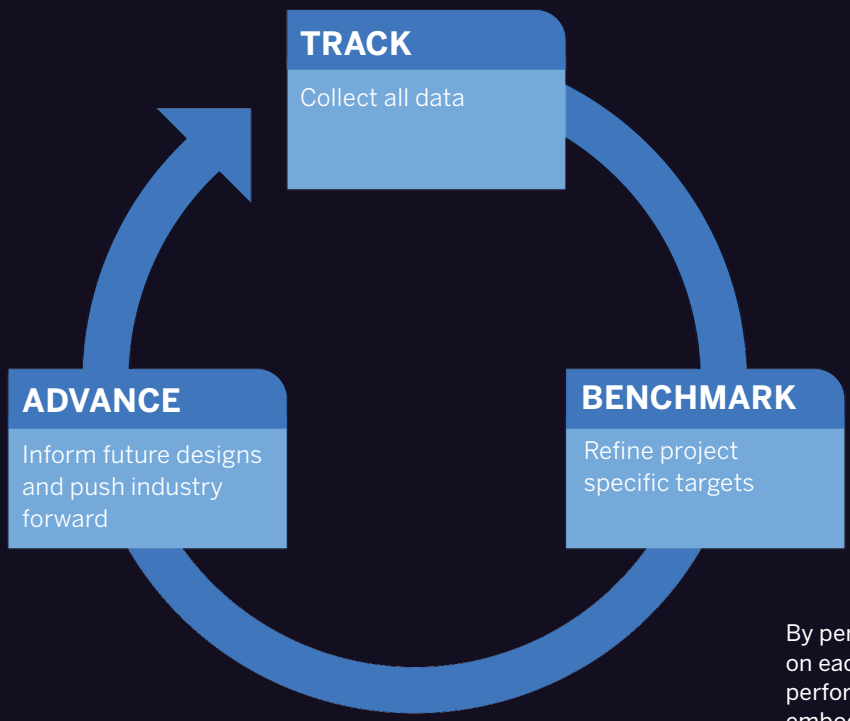
Biogenic material applications

- Continued incorporating composite timber systems to reduce the amount of concrete



Project Process

By performing this consistent calculation process on each project, mechanisms for tracking carbon performance can be implemented, allowing embodied carbon benchmarks and targets to be defined and provided to design teams, as well as ensuring future projects are informed of carbon performance on past projects.



Firmwide Process

By performing this consistent calculation process on each project, mechanisms for tracking carbon performance can be implemented, allowing embodied carbon benchmarks and targets to be defined and provided to design teams, as well as ensuring future projects are informed of carbon performance on past projects.

Education

Over the past year, we have aimed to provide educational opportunities to our design teams to ensure all team members have a clear understanding of how to calculate embodied carbon as well as what LCA modules are currently our focus for these calculations. These have taken the form of in-person sessions and firmwide webinars to present potential workflows and standard assumptions in order to ensure a consistent approach is being used. The below lists identify some of the lessons we've learned, accomplishments we've achieved, and new goals for the upcoming year as they relate to the educational platform of our ECAP.

Lessons Learned

- While most designers have a good grasp on calculating quantities, they still need guidance on deciding the correct embodied carbon factors to apply to each material based on their global region and material grades and composition.
- Education cannot stop at the internal level; we must constantly continue the effort to extend these opportunities to clients and contractors in order for them to appreciate the environmental benefits of different systems or materials options.

Accomplishments

- We have expanded our research into appropriate carbon factors for the main global regions. We have also established regional average values that can be used for embodied carbon calculation during early phases of design.
- Since signing onto the SE2050, we have given ten presentations to our structural engineering group and the larger firm aimed at providing better guidance for calculating embodied carbon and sharing realistic strategies for reducing embodied carbon.

March, 2021: Firmwide structural presentation - EC calculation tools evaluation
May, 2021 : Firmwide structural presentation - In house EC calculation + benchmarking & target discussion
May, 2021: Leadership presentation - Benchmarking, targets & principles
September, 2021: Firmwide structural presentation - Structures carbon group, 1 year summary
January, 2022: Firmwide structural presentation - Carbon reduction roadmap
February, 2022: Firmwide structural presentation - In house carbon calculation tool overview
February, 2022: Firmwide presentation to Architects and Planners - In house carbon calculation tool functionality and process
March, 2022: NY office winter design forum - In house carbon calculation tool functionality and process
March, 2022: Climate Action Group presentation - Structural aspects of SOM 10 principles
May, 2022: Firmwide structural presentation - Carbon Reporting update (AIA2030, SE2050)

- At least one representative from SOM has been attending quarterly external education programs provided by SE 2050, Carbon Leadership Forum (CLF), or other embodied carbon resources
- At least one of our SE2050 champions from each office will participate in a CLF Community Hub.

New Goals

- We will compile reports of research as educational documents for our design teams.
- Our embodied carbon reduction champions will establish a mandatory internal carbon performance review at each office to ensure targets are being met and reduction strategies are implemented.
- An Embodied Carbon lecture will be taught annually by SOM engineers in the curriculum at a top academic institution.

SE2050 **action** plan

people:	projects:	practice:
training + tools	**targets + specifications**	**performance + tracking**

Reporting

A crucial part of our ability to reduce embodied carbon is contributing carbon data to industry wide databases such as SE2050 and AIA2030 to ensure our designs are being captured along with the broader design community. Over this past year we have worked to leverage both internal and commercially available tools to produce consistent and accurate life-cycle assessment of our projects, and submit them to these reporting platforms. As part of this process we have tried to internally track our progress at calculating embodied carbon on active projects as well as what members of the team are actively performing these calculations.

Lessons Learned

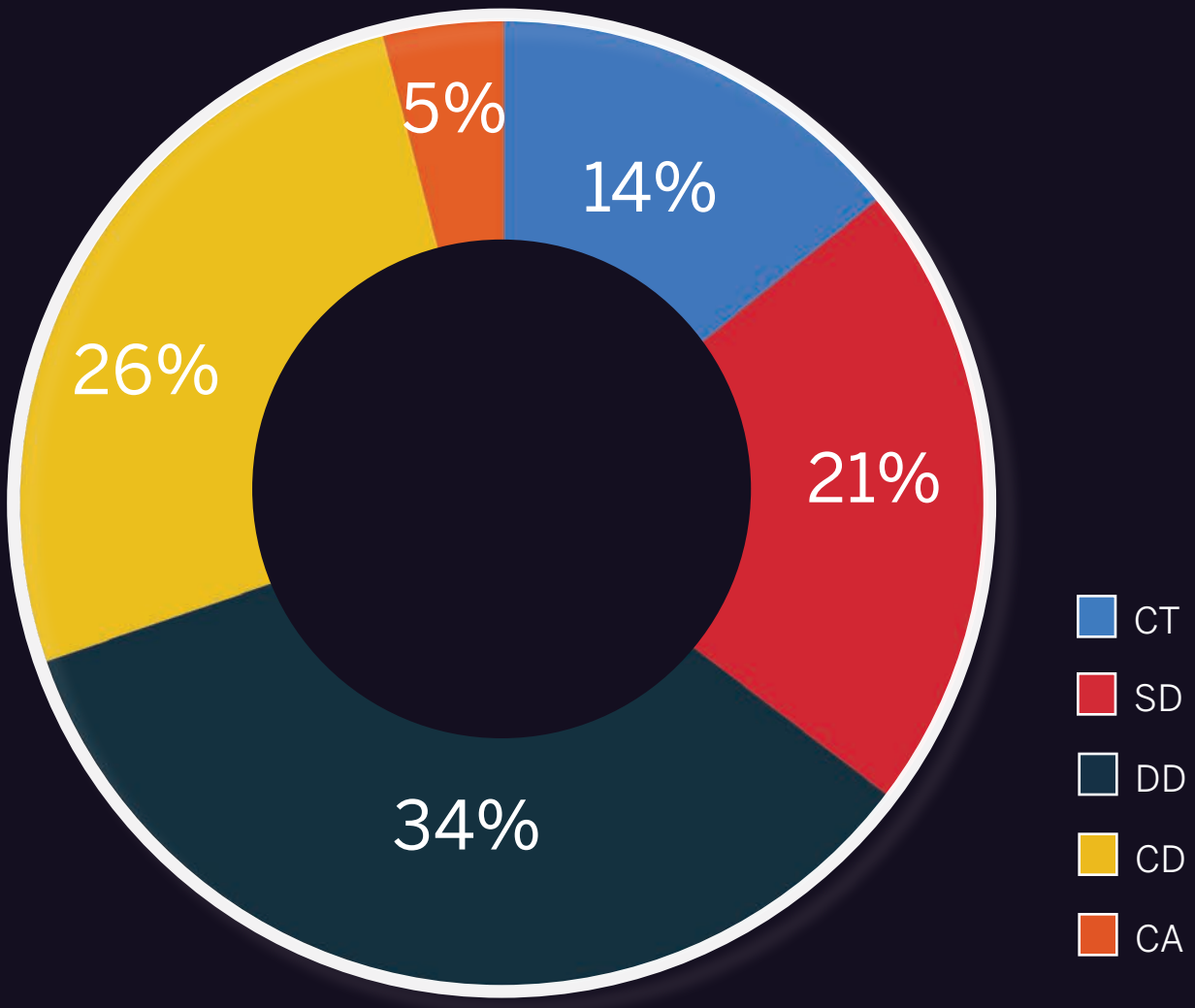
- A more rigorous review and vetting process is required for any carbon calculation work-flow to ensure consistency of results.
- It is helpful to have teams provide detailed systems notes to identify why a project's carbon performance might be unexpectedly high or low.
- Calculation of embodied carbon at each major design milestone is key to keeping a project on track and informing design decisions.

Accomplishments

- We have launched an internal carbon calculation tool that allows us to ensure all projects with embodied carbon calculations are following the same procedure
- Since joining SE2050 our group has calculated embodied carbon on close to 90% (~108 systems) of all active projects.
- Our group has successfully reported 10 projects to SE2050 and provided embodied carbon data for AIA2030 reporting on 44 systems in reporting for year 2020 projects and 63 systems for year 2021 projects.
- We have started to retroactively calculate embodied carbon on recently completed and historic project work using our standard calculation process

New Goals

- We are working to establish standard Revit modeling practices which are tied to embodied carbon calculation. This will allow for a more accurate and efficient calculation of material quantities and embodied carbon of a project.
- We will continue to develop plugins to allow for easier quantity calculations at each phase of the design process.
- We will incorporate One Click LCA in calculation process for later phase design
- We aim to reach 100% on EC calculation of all new projects.



Embodied Carbon Calculation Distribution by Design Phase

[↑] The distribution of design phases of roughly 108 SOM projects for which their embodied carbon has been calculated.

Our goal is to have every project's embodied carbon calculated -- for all applicable phases in order to track a project's carbon performance as the design evolves.

Reduction

This past year has focused heavily on establishing a database of past and ongoing projects that will allow our team to identify internal carbon trends for various project typologies to establish clear benchmarks and goals for our design teams. In parallel, we have been working to define an embodied carbon reduction roadmap that will enable us to achieve long term goals. It is critical that we as a firm, and industry, have a clearly defined set of targets over time so these can be presented as design constraints to clients and contractors alike.

Lessons Learned

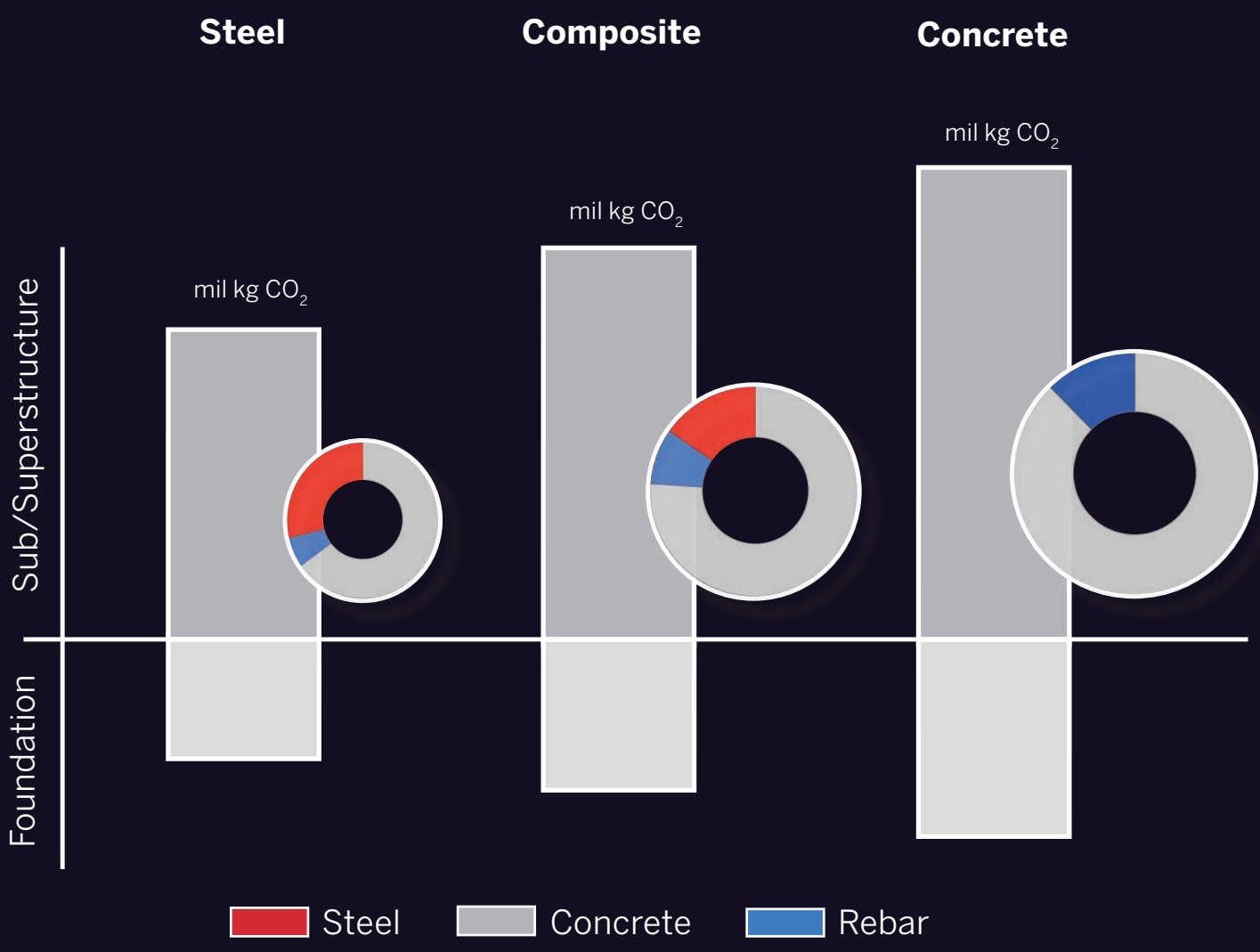
- It is beneficial to work closely with other consultants on the team and get clients on board for sustainability early on in the project.
- Contractor and client's hesitation to be the first to implement a new system or material delays the application of innovative sustainable design measures.
- Some bold moves will be required to achieve the ultimate net-zero reduction target.

Accomplishments

- Our group has begun outlining a reduction roadmap to achieve our goals of net zero embodied carbon. This includes short term goals, medium term and long term actions items. Refer to our new goals section for an overview of this reduction roadmap.
- We developed a tool that allows for easier comparison of design options, that can be used to make informed design decisions and communicate design options to clients.

New Goals

- **Short Term Goals (6 - 12 months)**
  - Establish and distribute protocol for calculating embodied carbon on every project.
  - Calculate the structural system embodied carbon on all active projects
  - Develop internal database for monitoring carbon performance and trends
  - Establish internal embodied carbon benchmarks and targets for various structural system types and sizes
  - Incorporate minimum % of recycled content for all structural steel and rebar materials on our projects
- **Medium Term Goals (1 - 5 years)**
  - Update all structural specifications to include a carbon budget for all projects
  - Incorporate ground glass pozzolans as cementitious replacement on more projects
  - Demonstrate embodied carbon reductions on 50% of projects relative to benchmark
  - Incorporate additional building life cycle stages into embodied carbon calculations, targets, and reporting
  - Incorporate more post tensioned floor system on East coast projects to reduce concrete quantities
- **Long Term Action Items (5 - 10 years)**
  - Demonstrate embodied carbon reductions on 75% of projects relative to benchmark
  - Assist in development of design standards and code requirements for new carbon sequestering and biogenic materials
  - Incorporate new carbon sequestering structural materials in active projects
  - Reduce year-over-year firmwide EC average by 5%



Embodied Carbon Calculation Distribution by Material Use

[↑] A key to understanding the path toward embodied carbon reductions is to perform apples-to-apples comparisons of potential systems on each project to ensure the most carbon-efficient system is chosen for a given project. Similarly, it is just as critical to advocate these carbon benefits to clients, contractors, and the construction team to ensure all involved stakeholders embrace the most efficient system.

Advocacy

In addition to the other platforms, over the past year we have been working to define clear strategies for communicating our carbon goals to clients and contractors while identifying sustainable design strategies that are appropriate based on the project budget and logistical constraints as well as the region of the world it will be constructed. This has included presenting design options through the lens of carbon performance while engaging with contractors to establish cost premiums and savings for each potential design solution. In many ways, our success in achieving our goals is directly linked in our ability to get buy-in and approval from contractors and owners alike.

Lessons Learned

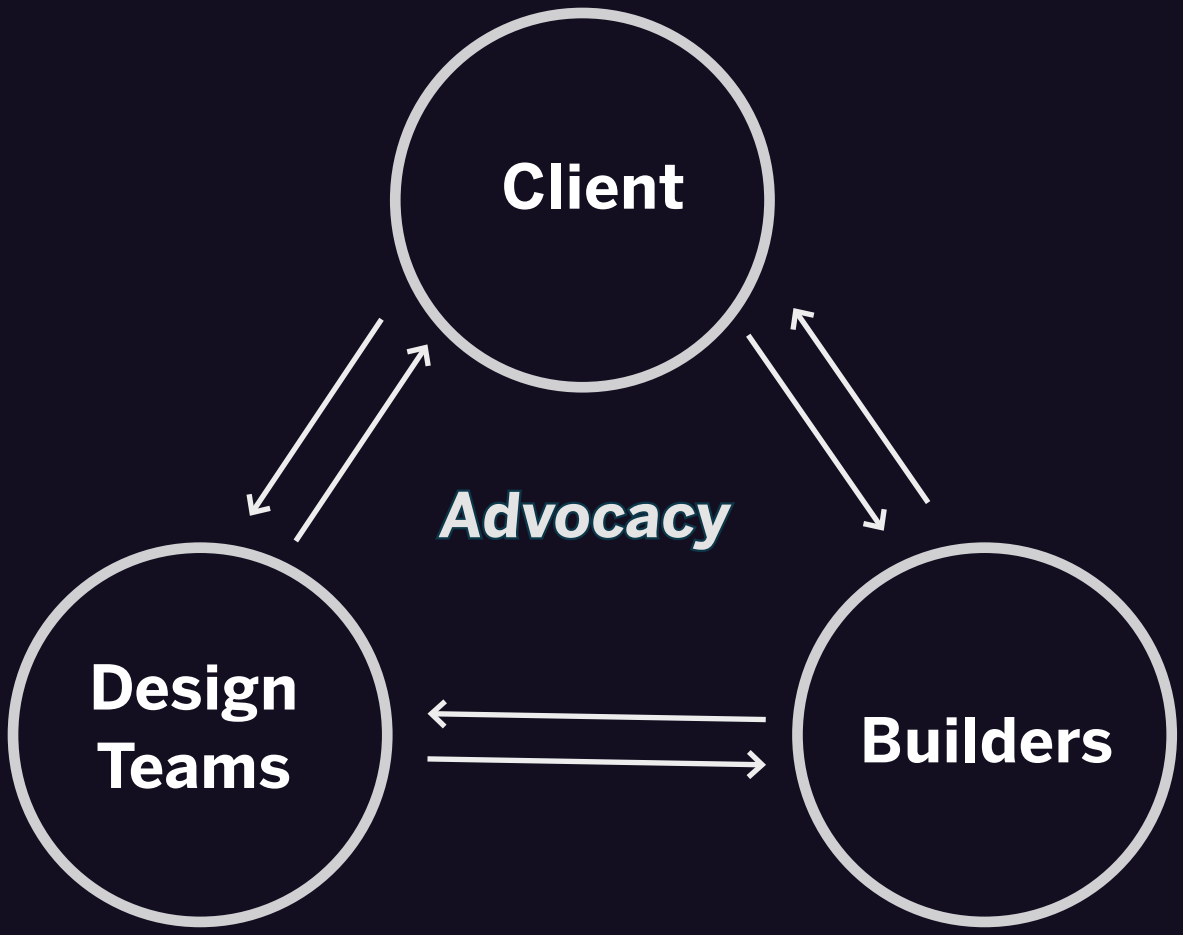
- Clients are interested, but are still very conscious of budget constraints. How to tell the story to clients that the upfront premium is worth it in the long-run remains an important question.
- Contractors apply added cost to sustainable design options from the start. As designers we must understand which of these costs are real, and which are a result of discomfort with new construction materials and practices.
- The earlier we can start discussing sustainable design strategies with contractors, the better.

Accomplishments

- We have presented embodied carbon performance for various structural system options to clients when informing structural design on real projects.
- We engaged with material suppliers to understand what sustainable options are available for both steel and concrete.
- We are sharing education opportunities with clients.

New Goals

- We will present embodied carbon performance to clients for all projects and express the benefits of different design options.
- We will update all structural specifications to include a carbon budget for all projects.
- We will advocate for more efficient column grids on projects
- We will require more projects to include structural materials with facility-specific or product-specific EPDs.
- We will encourage industry and policy change to incentivise availability of low-carbon and carbon sequestering materials.



[↑] To truly advocate for sustainable design solutions, we must be willing to have two way discussions with both clients and builders to do our best to align our goals and identify the most appropriate sustainable deisgn solutions for a given project.

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