GRAEF

SEI STRUCTURAL ENGINEERING INSTITUTE ASCE

SE2050 COMMITTING TO NET ZERO

FIRST ANNUAL SE 2050

EMBODIED CARBON ACTION PLAN (ECAP)

April 2024

"OUR CORE PURPOSE IS TO
IMPROVE THE PHYSICAL ENVIRONMENT
FOR THE BENEFIT OF SOCIETY
IN A SUSTAINABLE MANNER."

OUR MISSION STATEMENT SINCE 2009

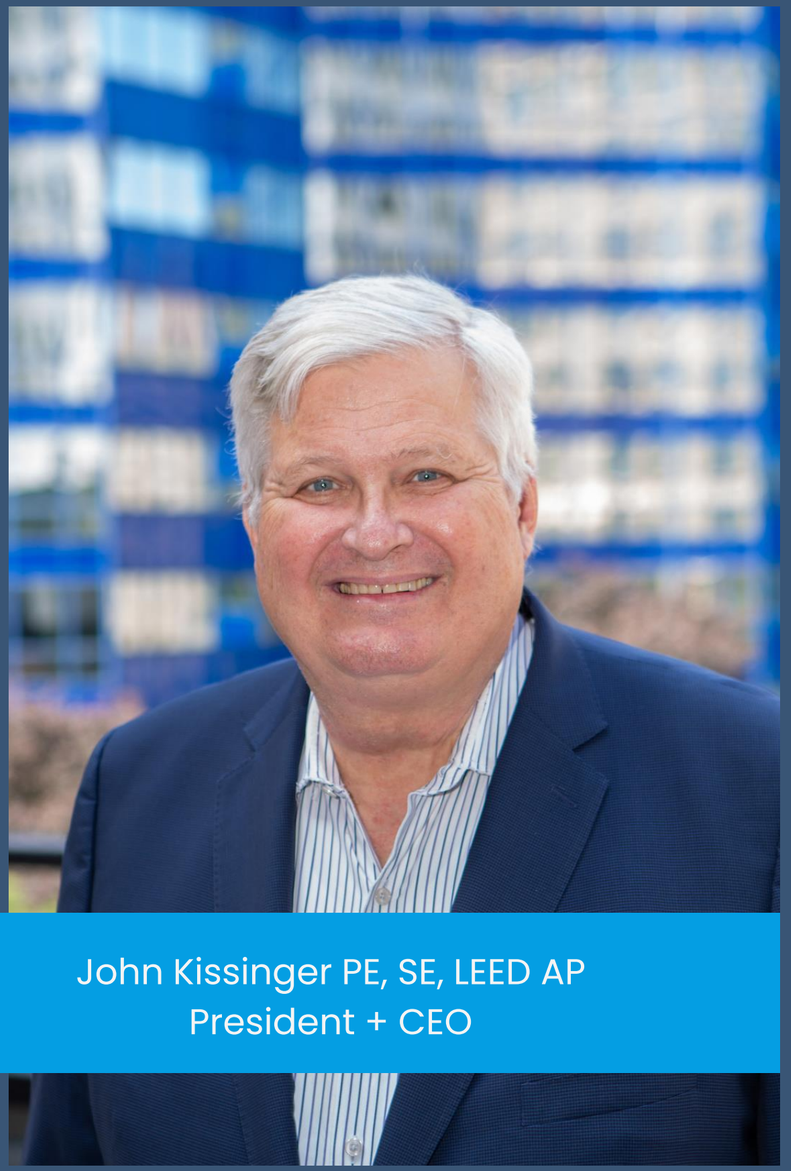
A LETTER FROM OUR PRESIDENT + CEO

It is with great pleasure that we announce GRAEF's pledge to the SE 2050 Commitment.

As of April 2023, we have joined a cadre of signatory firms to spread awareness about and work toward net-zero embodied carbon structural systems by the year 2050. SE 2050 has already attracted many of the leading structural engineering firms in the industry, and now GRAEF is proud to join this group of industry leaders.

We are committing to the SE 2050 Program because it is the right thing to do as a firm. We recognize the importance of collaborating across our industry to combat climate change and do our part as we champion sustainable design. We also realize that more and more clients and agencies will demand that we take steps to reduce embodied carbon as we provide structural engineering and design.

We are excited to take this important step forward as a firm as we join this coalition to advocate for sustainable structural design.



John Kissinger PE, SE, LEED AP
President + CEO

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INTRODUCTION

On the Map

GRAEF is an ENR Top 500 planning, design, and engineering firm with ten offices located in Wisconsin, Minnesota, Illinois, Florida, and the Turks and Caicos Islands. Established in 1961 with deep hometown roots, GRAEF has grown to become a prominent multi-disciplinary firm.

As a team of passionate, innovative professionals, we support the industry vision that structural engineers shall understand, reduce, and ultimately eliminate embodied carbon in our projects by 2050.

As a participant in the SE 2050 Commitment Program, we are collaborating internally and externally to educate, advocate, and engage to reduce embodied carbon. We aim to do our part to contribute to an industry culture that promotes sustainable design.

OUR CORE VALUES

LOYALTY

TO OUR EMPLOYEES

SERVICE

SUPERIOR SERVICE TO OUR CLIENTS

QUALITY

IN ALL OF THE WORK WE DO

INTEGRITY

IN ALL OF OUR BUSINESS ACTIVITIES

GRAEF FOUNDERS, 1961

SUSTAINABILITY LEADERSHIP

Meet our Structural Sustainability Champions

NATALIE GEORGIEFF PE

Resilience & Sustainability Engineer

SE 2050 Embodied Carbon Co-Champions

MINNEAPOLIS, MN

GEORGE CARR PE

Structural Engineer

SE 2050 Embodied Carbon Co-Champions

MILWAUKEE, WI

JASON GROSS PE SE

Structural Engineer & Project Manager

MILWAUKEE, WI

MEGHANN RIEDNER PE SE

Structural Engineer & Project Manager

MADISON, WI

DAN KILBERT PE LEED AP

Principal | Structural Engineer

MILWAUKEE, WI

JUSTIN BITTENBENDER

Structural Designer

MILWAUKEE, WI

JUSTYCE DIXON

Marketing & Communications Leader

MILWAUKEE, WI

EDUCATION

Embedded within the core values of GRAEF is the firm's commitment to quality work performed with integrity. Taking ownership of the projects being produced and the legacy that this work leaves behind is paramount to upholding our integrity. GRAEF is dedicated to the betterment of public health and safety, which is an ethical underpinning in all work that we perform, and we understand that reducing embodied carbon is an important public health issue. Evaluating the role that engineers play in the global initiative to reduce carbon emissions is a health and safety commitment in which we must participate.

In order to engrain embodied carbon solutions into our design processes, education initiatives will utilize the existing collaborative infrastructure within the firm. We will continue to share intra-office knowledge and resources with all team members to encourage and support engineers in understanding their role in reducing embodied carbon. In addition to incorporating Life Cycle Analyses (LCAs) into our design process, we will be placing the SE 2050 library of resources onto the Vine (GRAEF's intranet) for easy access by all staff and work to share embodied carbon reduction strategies across the firm. By developing these strategies using the "Top 10 Carbon Reducing Actions for Structural Engineers" document, we will work to promote carbon reduction for all projects.

Each region of the nation has unique practices for meeting sustainability goals and sharing information across all offices will encourage novel approaches to the most challenging projects. Formulating solutions to reduce carbon will require full integration of LCA into our design process and ensuring all engineers understand the steps required will help us meet carbon reduction goals. By engaging sustainability champions across our offices, we can ensure a cohesive and consistent approach to carbon reduction. GRAEF has already taken this step by initiating an embodied carbon interest group within the firm to develop a narrative of goals and share within the firm's monthly structural technical meetings.

Our Embodied Carbon Co-Champion, Natalie Georgieff, developed and delivered an introductory SE 2050 & Embodied Carbon 101 presentation across the firm, and this material will be incorporated into future orientation programming for new employees. In addition to developing carbon summary sheets for projects onto the Vine on a regular basis, GRAEF will continue to inform our staff about ongoing carbon reduction goals including presenting the document "How to Calculate Embodied Carbon" to all technical staff.

REPORTING

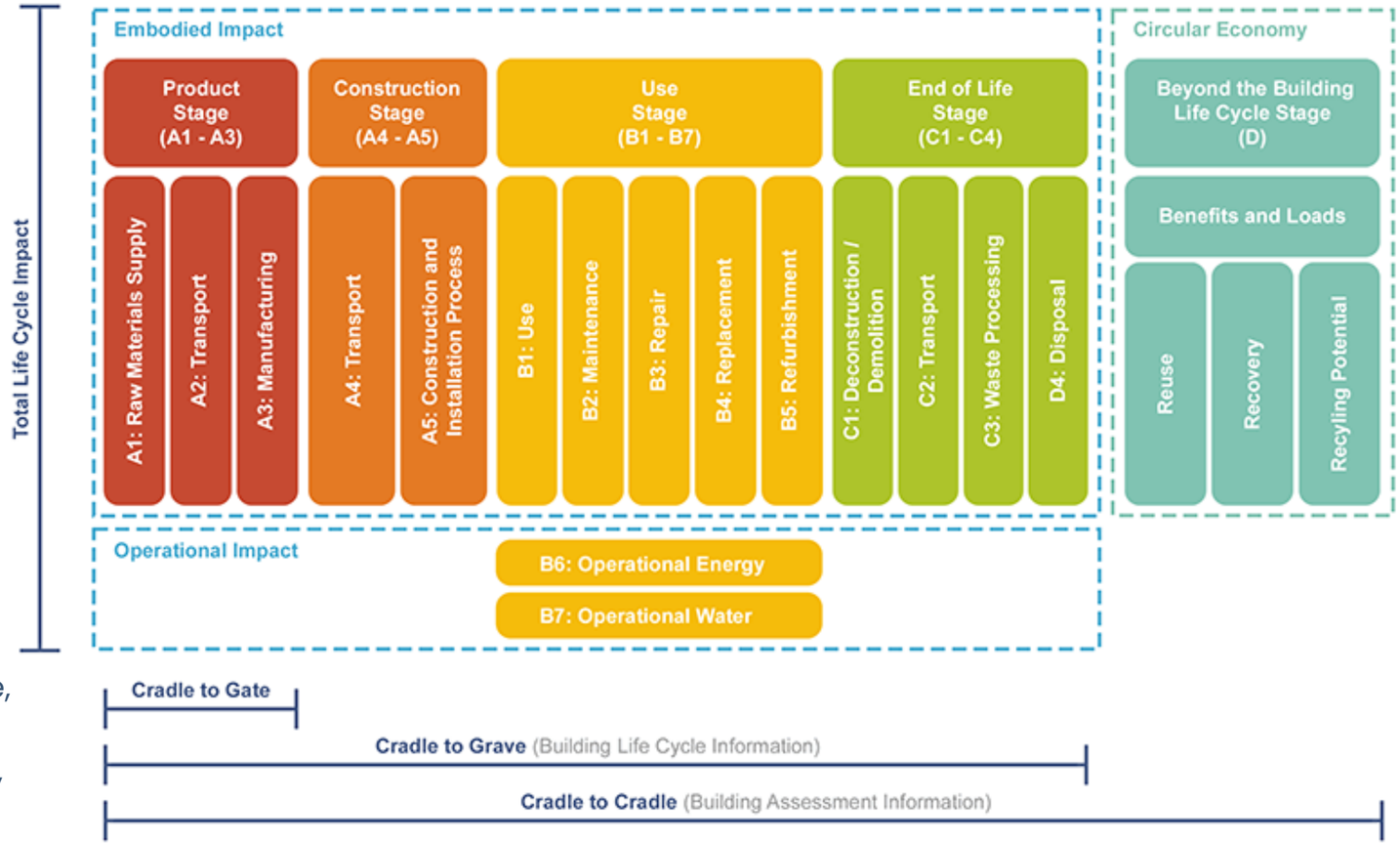
5 PROJECTS

GRAEF will focus on tracking and reporting embodied carbon on a minimum of 5 projects to help establish a baseline during the first program year. The Embodied Carbon Champion will engage office leaders from each office location with structural engineering services to identify potential clients and/or projects to use as case studies to establish our workflow and carbon baselines.

After the first year, we will report on what we learned about embodied carbon reduction from the previous year and how we will update our strategy for carbon analysis, reporting, and reduction.

REPORTING

LIFE CYCLE STAGES (ISO 14040, EN 15978) *Image originally published in 2021 by BNP Media through the Building Enclosure Blog*



GRAEF will utilize a variety of software and tools to measure, track, and report embodied carbon data on a minimum of 5 projects per year, employing data from product-specific, plant-specific, and/or region-specific Environmental Product Declarations (EPDs) when available.

The tools and methodology for calculating embodied carbon and the scope of the LCA will be dependent on the project stage, project size, and project goals, but will include Cradle-to-Gate Life Cycle Stages [A1-A3] at a minimum. For most projects, Life Cycle Stages will envelope Cradle-to-Grave Life Cycle Stages [A1-C4] and will not include Module D or Biogenic Carbon. For earlier design stages, material quantities will be calculated “by-hand” in Microsoft Excel. For projects further along in development, material quantities will be tabulated in REVIT via itemized schedules or exported from REVIT to an LCA software/tool.

Please see Table 1 on the following page for a summary of our proposed carbon analysis and reporting plan with the LCA software and tools we plan to utilize.

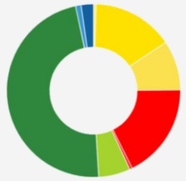
Software / Tool	Project Stages	Life Cycle Stages LCA Scope	Data Inputs	Data Output
ECOM - Embodied Carbon Estimator (se2050.org/ecom-tool) 	Early design through Construction	A1-A3 (Cradle-to-Gate)	Building Structural Material Quantities (estimates based on preliminary structural member sizes)	GWP (Global Warming Potential) in pounds or kilograms of CO_2 equivalent
Embodied Carbon in Construction Calculator (EC3) Tool + TallyCAT EC3 + tallyCAT	Design Development through Construction	A1-A3 typically, including A4 and A5 if data is available	Estimated Material Quantities (from 3D modeled structural elements in Revit model, if available), Selection of EPDs	GWP as well as other Environmental Impact Indicators via online platform, including a variety of auto-generated graphics
Tally (Revit Add-in) tally	Design Development through Construction	A1-C4, excluding A5 in some cases (Cradle-to-Grave)	3D Modeled Structural Elements in Revit Model, Assigned Structural Material Properties (either in Revit or Tally)	GWP as well as other Environmental Impact Indicators via an Excel spreadsheet and PDF file including variety of auto-generated graphics

TABLE 1: GRAEF'S EMBODIED CARBON CALCULATION SOFTWARE AND TOOLS

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REDUCTION

For the first year of the program, we will focus on establishing an embodied carbon baseline based on regional/industry benchmarks and “business-as-usual” for a minimum of 5 projects. During this process, we will develop our workflow for tracking embodied carbon and we will adjust our reduction goals for program year 2 based on what we learned about embodied carbon reduction strategies.

FIRST **YEAR**

FIVE **PROJECTS**

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ADVOCACY

GRAEF will work to incentivize industry-wide change through education and advocacy. Sharing our commitment to SE 2050 on our company website is one step in advocating to our clients and industry partners the importance in reducing embodied carbon in all projects. Through extensive participation in industry organizations, GRAEF will share our experiences performing Life Cycle Analyses and embodied carbon reduction strategies used on projects. In order to advocate the use of these tools, open-sourced sharing of lessons-learned will be necessary in driving industry change.

Internal data collection will help to drive improved and detailed metrics involving embodied carbon. In developing informative data sets to educate clients, GRAEF plans to share that knowledge externally throughout the industry by further educating on embodied carbon through specific project examples, material carbon comparisons, and case studies.

As we grow our embodied carbon knowledge and expertise within the firm, we will inform clients on the environmental impacts of design decisions early in a project. By communicating embodied carbon reduction opportunities through informative marketing materials and early design conversations around carbon reduction targets or project sustainability goals, we hope to educate clients on what is possible and how big of an impact we can make in the path toward decarbonization.

With industry demand of materials transparency on the rise, it will be imperative to collaborate with building materials manufacturers, fabricators, and producers to ensure carbon-smart product choices. GRAEF has already begun to implement a performance-based concrete specification which allows for lower embodied carbon mixes to be implemented on projects. Through steadfast engagement of contractors and material suppliers during design, we will continue to drive market trends toward a net-zero carbon future.

Website

Knowledge Sharing

Client Education + Engagement

Contractor Engagement

THANK YOU
STAY IN TOUCH

“We are proud to do our part as GRAEF engineers to fight climate change one road, one wall, one slab, one step at a time.”

414 / 259 1500

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graef-usa.com

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NATALIE GEORGIEFF PE
Resilience & Sustainability Engineer
Embodied Carbon Co-Champion
MINNEAPOLIS, MN

GEORGE CARR PE
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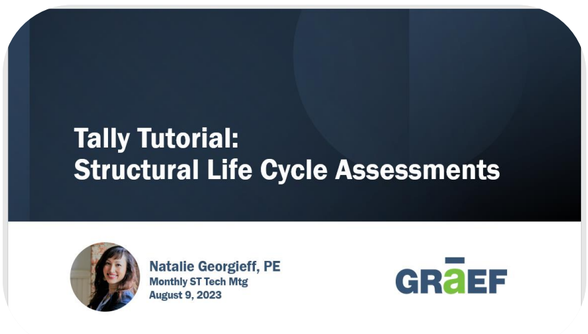
EMBODIED CARBON ACTION PLAN

APPENDIX

DOCUMENTATION OF SE 2050 PROGRAM REQUIREMENTS AND ELECTIVES

SE 2050 Program Task	Status	Required or Elective	Implementation Notes
Education:			
Provide a narrative of how the Embodied Carbon Champion will engage embodied carbon reduction at each office.	☑	Required	(reference page 8 of this document)
Present at least (1) webinar focused on embodied carbon and make a recording available to employees.	☑	Required	Lunch and Learn webinar presented on May 31, 2023.
Initiate an embodied carbon interest group within your firm and outline their goals. This group may more broadly address sustainability, but they must include embodied carbon.	☑	Elective	GRAEF's Structural Sustainability Committee initiated in November 2022 (see below for members and reference page 6 of the ECAP for more details).
Engage with a CLF Regional Hub.	☑	Elective	Committee members are currently engaged in the CLF Minnesota Hub and CLF Wisconsin Hub.
Train your firm's structural engineers on the core concepts and skills required to measure, reduce, and report embodied carbon. (Ref. SE 2050 Resources)	☑	Elective	Tally Tutorial: Structural LCAs webinar presented to the firm on August 9, 2023.
Create an Embodied Carbon digital resource wiki and/or forum on your firm's internal website for staff to create, share, and discuss Embodied Carbon educational resources.	In Progress	Elective	Resource and knowledge-sharing internal resources are currently in development.

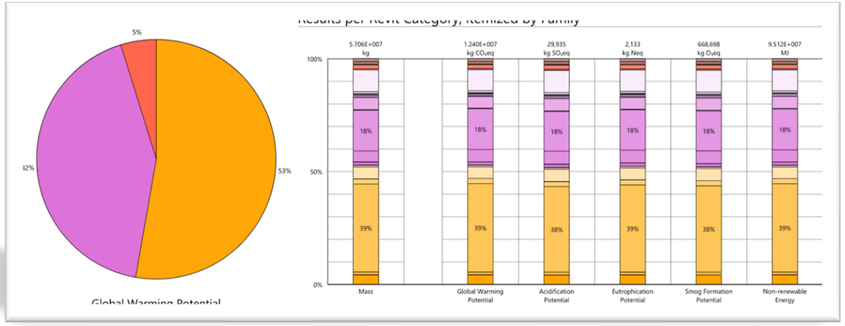
TABLE 2: GRAEF'S DOCUMENTATION OF SE 2050 REQUIREMENTS AND ELECTIVES (continued on following pages)

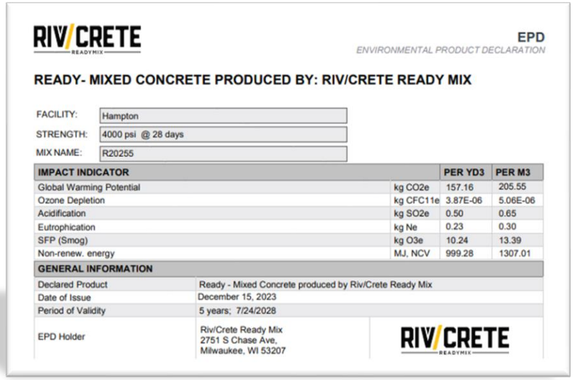


DOCUMENTATION OF SE 2050 PROGRAM REQUIREMENTS AND ELECTIVES (CONT'D)

SE 2050 Program Task	Status	Required or Elective	Implementation Notes
Reporting:			
Submit a minimum of (2) projects per U.S. office with structural engineering services to the SE 2050 Database. You are not required to submit more than (5) total projects across your firm.	In Progress	Required	LCA project data submission is planned for 2024.
Compare the embodied carbon emissions from multiple projects across your firm. Analyze and document what data or pieces of information are most important and communicate the findings to your firm.	In Progress	Elective	We plan to compare global warming potential (GWP) for the five projects analyzed in the past year and will continue to analyze data for our next round of selected SE 2050 projects. We plan to communicate our findings to the firm at future technical meetings.
Reduction:			
Develop and implement a workflow that makes it easier to make early design decisions based on embodied carbon.	In Progress	Required	The Structural Sustainability Committee is collaborating with BIM leaders to develop a streamlined workflow.
Collaborate with your concrete supplier to reduce embodied carbon in a mix design below an acceptable baseline (e.g. NRMCA regional baseline values). Discuss what you found and what it means in your market.	☑	Elective	GRAEF collaborated with RivCrete Ready-Mix to optimize mix designs for select current and future projects.
Have an Environmental Product Declaration (EPD) created for a project. Get a project or client to require the creation of an Environmental Product Declaration (EPD) that did not exist before.	☑	Elective	GRAEF and RivCrete set carbon reduction goals and created EPDs for various mix designs on a recent project.
Communicate the embodied carbon impacts of different design options to clients with creative and effective data visualization.	☑	Elective	Our project design team created carbon impact visualizations of different mix design options.

TABLE 2: GRAEF'S DOCUMENTATION OF SE 2050 REQUIREMENTS AND ELECTIVES (continued on following page)





RIV/CRETE READYMIX

EPD
ENVIRONMENTAL PRODUCT DECLARATION

READY- MIXED CONCRETE PRODUCED BY: RIV/CRETE READY MIX

FACILITY: Hampton
STRENGTH: 4000 psi @ 28 days
MIX NAME: R20255

IMPACT INDICATOR		PER YD3	PER M3
Global Warming Potential	kg CO2e	157.16	205.55
Ozone Depletion	kg CFC11e	3.87E-06	5.06E-06
Acidification	kg SO2e	0.50	0.65
Eutrophication	kg Ne	0.23	0.30
SFP (Smog)	kg O3e	10.24	13.39
Non-renew. energy	MJ, NCV	999.28	1307.01

GENERAL INFORMATION	
Declared Product	Ready - Mixed Concrete produced by Riv/Crete Ready Mix
Date of Issue	December 15, 2023
Period of Validity	5 years; 7/24/2028
EPD Holder	Riv/Crete Ready Mix 2751 S Chase Ave, Milwaukee, WI 53207

RIV/CRETE READYMIX

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DOCUMENTATION OF SE 2050 PROGRAM REQUIREMENTS AND ELECTIVES (CONT'D)

SE 2050 Program Task	Status	Required or Elective	Implementation Notes
Advocacy:			
Publicly declare your firm as a member of the SE 2050 Commitment however you see fit (e.g. on your website, LinkedIn, or other social media).	☑	Required	https://graef-usa.com/graef-joins-se-2050-commitment-a-sustainable-engineering-initiative/
Describe the value of SE 2050 to clients. How can your design teams collaborate to reduce embodied carbon? Please attach any associated marketing materials	☑	Required	See marketing info sheet (Committing to Net Zero) directly below. Additional marketing materials are currently being developed.
Give an external presentation on embodied carbon that demonstrates a project success or lessons learned. Get connected at a CLF regional hub near you and be sure to post the recording.	☑	Elective	Presented on project successes at the 2023 WSPE Discovery Conference in April of 2023.
Engage with structural material suppliers in your region to communicate the importance of Environmental Product Declarations (EPDs) and low-carbon material options.	☑	Elective	Shared EPDs and project success with members of ACI Wisconsin and discussed importance of EPDs and low-carbon material availability.

TABLE 2: GRAEF'S DOCUMENTATION OF SE 2050 REQUIREMENTS AND ELECTIVES (continued from previous page)