

# BALA

SE 2050

## EMBODIED CARBON ACTION PLAN





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Bala Consulting Engineers is pleased to submit the following Embodied Carbon Action Plan outlining our commitment towards reducing the embodied carbon of our structural designs to net zero by 2050.

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# INTRODUCTION

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Structural engineering is the backbone of every building and on the front lines of design and construction in every project. With concrete and steel, comprising a significant portion of a building's total emissions, Structural Engineering plays a paramount role in addressing embodied carbon within the built environment. Bala is dedicated to transforming structural design and advancing towards a more sustainable future. Substantive embodied carbon reductions in the design and construction of structural systems will require a collaborative effort amongst engineers, manufacturers, contractors, and designers; and we are excited to be a part of advancing this multi-industry effort.

## About Bala

Bala Consulting Engineers is a multi-discipline engineering and design organization comprising over 200 engineers, designers, and support personnel. Bala unifies structural engineering with our other engineering disciplines, enabling us to provide a wide range of services spanning all project phases and various industries including: corporate office buildings, healthcare facilities, municipal buildings, residential structures, religious institutions, parking structures, educational facilities, warehouse facilities, pharmaceutical manufacturing and laboratories.

***We believe sustainable design is essential design. As engineers we take our role seriously in influencing a more sustainable standard of structural design for the built environment.***

## Our Embodied Carbon Champions



**DYLAN J. LEE**  
**STRUCTURAL PROJECT ENGINEER**

As a key member of our structural engineering team, Dylan enthusiastically leads our internal research, documentation and advocacy on reducing embodied carbon in structural designs. He has developed our internal Embodied Carbon Calculator tool which will be used alongside EC3 to track and report embodied carbon in our designs.



**ELIZABETH K. LARSEN, M.S.**  
**SR. SUSTAINABILITY ENGINEER**

Elizabeth shapes Bala's services in the sustainability consultancy market and supports projects across our portfolio by providing design best practices and research. She will drive the implementation of embodied carbon education and advocacy as well as overseeing reduction strategies and reporting for SE 2050.



**STEVEN M. ANASTASIO, PE,  
SE, LEED AP**  
**DIRECTOR OF STRUCTURES**

As our Director and Growth Leader, Steven is committed to growing relationships and strengthening our operations as we strive to eliminate embodied carbon in our projects. He will drive client advocacy, education, and our project implementation to accelerate reduction of embodied carbon.



# EDUCATION

## Education Plan

At Bala, we believe that education and knowledge sharing is a lifelong pursuit. This comes in various forms - ranging from formal mentorship programs and enterprise-wide Knowledge Center presentations to team bonding and internal Lunch & Learns.

**We are promoting firm-wide education and understanding on embodied carbon through the following actions:**

GOAL	PROGRESS	DESCRIPTION
In August 2021, we hosted an enterprise-wide Knowledge Center presentation on the SE 2050 Commitment and announced our involvement internally.	Ongoing	We hosted an Operational & Embodied Carbon Knowledge Center for the entire enterprise. We had approximately 20% attendance from all employees and 100% attendance from our Structural Practice Group. This is part of a larger ongoing education initiative, and we plan to host another session focused on Embodied Carbon in 2024.
Upon completion of this ECAP, we will publish our plan on our internal SharePoint page for all staff to reference.	Complete	Our ECAP is housed on our internal Sustainability SharePoint site in addition to our external website.
We will be playing the "Embodied Carbon 101" Webinar in December during one of our regularly scheduled Structural Lunch & Learns. This training will also be required for all new-hires as part of their training process.	Ongoing	We presented the "Embodied Carbon 101" training to the Structural Practice Group. For new hires, we have taken a more hands-on approach with personal training from our Embodied Carbon Champion. With time, we will automate the process further, but for now, personal training has been helpful.
By January 1st, 2023, we will roll out and share the SE 2050 Library of Resources with all Structural Engineers.	Complete	Each engineer in the Structural Practice Group can calculate the embodied carbon of a building based on education previously provided during Lunch & Learns and through using the EC3 Tool for EPDs.
Currently, our Embodied Carbon Champions attend Carbon Leadership Forum education sessions. We will broaden this to all Structural Engineers in our firm.	Ongoing	We will attend a minimum of one sustainability-focused seminar each quarter and communicate the main takeaways to the rest of the Structural Practice Group the following week during regularly scheduled Lunch & Learns.
We currently participate in the Carbon Leadership Forum's Philadelphia hub and plan to expand that participation to NYC as well.	Complete	We have expanded our participation in local groups not only to New York with SEAoNY, but also to Boston with SEAMASS and their Low Carbon Concrete Group, to Washington, D.C. with SEA-MW and their Sustainable Design Committee and have continued our participation with DVASE and their Sustainable Design Committee in Philadelphia.
We will present the "How to Calculate Embodied Carbon" document and presentation, in addition to educating all Structural Engineers on using our internally developed Embodied Carbon Calculator.	Complete	We have transitioned in the last year from using our internal Embodied Carbon Calculator to using TallyCAT and OneClick LCA to ensure more consistent results. We are training our engineers on the new software as needed for projects.

# ADVOCACY

A critical component to the success of the SE 2050 commitment is buy-in from clients and other design professionals. As part of our advocacy efforts, we plan to start every project off with a discussion about embodied carbon, educate clients on the importance of and strategies to achieve sustainable design, participate in local structural engineering working groups, and promote this work via email, social media, and through proposals.

**Our initiatives regarding external knowledge sharing and advocacy are below:**

GOAL	PROGRESS	DESCRIPTION
Since committing to the SE 2050 Challenge, we have joined a local Structural Engineering consortium dedicated to discussing embodied carbon.	Complete	We actively participate in various Structural Engineering organizations. We previously have had the opportunity through our participation to present to these groups on embodied carbon. We hope to continue to have these opportunities in 2024. Outside of structural-specific groups, we also participate in the Carbon Leadership Forum's Philly Hub and in local USGBC chapters.
On all projects moving forward, we plan to start conversations about embodied carbon early and bring it up often. We shall talk to architects, owners, general contractors, manufacturers, and other stakeholders about our commitment to this challenge.	Ongoing	Our commitment to reducing embodied carbon is included in all of our proposals. A next step would be to create more tailored one-pagers regarding the impact embodied carbon has on our environment and what we can do about it on our projects to provide to owners and architects at the beginning of a project.
We plan to add language to our Structural proposals to highlight our commitment to the SE 2050 Challenge.	Complete	We include, in every proposal, language about our commitment to the SE 2050 Challenge and our focus on embodied carbon in our project portfolio.
All Structural Engineers' email signatures will include our commitment to SE 2050.	Incomplete	We plan to renew this goal for 2024. We will work with IT Team to develop a protocol for its inclusion in our email signatures.
We plan to host a client roundtable in 2023 focused on embodied carbon and other key issues facing the Structural Engineering and built environment industry.	Ongoing	Instead of hosting a large roundtable, we have found that individual and specific conversations about embodied carbon has been more productive. We plan to continue this advocacy method into 2024.
Our commitment to the SE 2050 Challenge is already highlighted on our Sustainability and Structures webpages.	Complete	Our commitment and our ECAP is linked on our external webpages.
Annually, we will report our progress toward our SE 2050 goals on LinkedIn and other social media platforms.	Incomplete	In 2024, we plan to report our progress towards our SE 2050 goals. We have previously promoted our participation in the Challenge and will continue to promote this initiative through social media.
In addition to publishing annual progress, we will highlight projects that focus on embodied carbon on LinkedIn and other social media platforms.	Incomplete	In 2024, we hope to increase the interest in embodied carbon reduction in our clients. Once we have a few projects utilize this service, we plan to highlight their reduction efforts on LinkedIn.



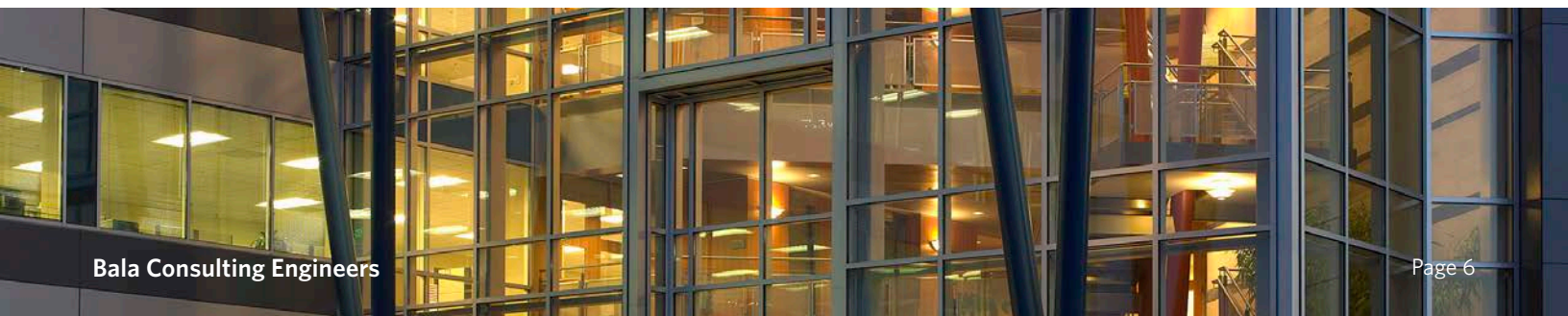
# REPORTING

The old adage that “what’s measured gets managed” applies heavily to our success in reducing the embodied carbon of our designs. To truly reduce, we have to measure and report our emissions and iterate over time. An established baseline is essential in these efforts and we see our first few years as critical on our path to reduce embodied carbon.

GOAL	PROGRESS	DESCRIPTION
We will utilize EPDs and the EC3 Tool to estimate the embodied carbon emissions of each project. Our scope will include stages A1-A5, unless otherwise requested by a client.	Ongoing	For the projects reported to the SE 2050 Database, this protocol was followed. We hope to have more projects included in the future and some that are driven by client desire.
We will contact and suggest that concrete suppliers provide product specific data, rather than relying on region-specific data when possible.	Incomplete	With our updates to our specifications, we plan to reach out to concrete manufacturers and start this conversation with them.
At project kickoff meetings, we will start the conversation on embodied carbon and optimization, inform client manufacturers about providing EPDs, and ask the architect and/or owner if a carbon budget has been set up for the project.	Ongoing	We believe these conversations will be aided with our current initiatives focused on developing a high-level modeling Dynamo Script, our case study one pagers, and our specification updates.
At a minimum, we will report 4 projects for the SE 2050 Database (2 per office) from our 2023 portfolio.	Ongoing	With one office over 5 employees, we reported 2 projects in 2022 and plan to report 3 projects in 2023.



In line with our reduction strategies, we have also developed a project implementation guide that identifies specific points of advocacy, measurement, tracking and reporting of embodied carbon through the project process, across all stages from pre-design to project completion. *Our project implementation guide is illustrated on the following page.*



# Project Implementation

## Engineering Design Process

### Pre-Design & Project Kickoff

- Discuss embodied carbon with the project owner and design team upfront. Highlight the need for a goal and collaborative design thinking.
- Benchmark and set a goal for total Global Warming Potential (GWP) using OneClick Carbon Designer 3D or the EIPC Tool based on project location, size, building classification, and industry standards.

### Schematic Design

- Analyze structural system options with high-level tools such as OneClick Carbon Designer 3D or our in-house Dynamo script.
- Spark optimization conversations with the project owner about best possible construction methods, materials, component weights, and material costs.
- Discuss the scope of embodied carbon reduction with the client. We will recommend AI-A3 at a minimum. (MEP team working adjacently on Modules A&B)

### Design Development

- Complete an embodied carbon model by the end of DDs with either the EC3 Tool, OneClick LCA, or TallyCAT.
- Draft specifications to ensure low-GWP materials are used and EPDs are requested.
- Owners can opt out of the environmental specifications if they want, however, they must opt out, rather than just allowing them to opt in.
- Utilize the EC3 Tool to gather industry EPDs to inform material and manufacturer decisions in the final version of the specifications.

### Construction Documents

- Complete and share at the end of CDs a final designed embodied carbon model using the EC3 Tool, OneClick LCA, or TallyCAT.
- Include language in our specifications to ensure local, low-GWP materials are used and EPDs and material takeoffs are requested.
- Material quantities will come from Revit. We will also supply any additional time allowance in order to factor in miscellaneous metals and connections into our calculations.

### Contract Administration

- As part of the submittal process, we will review and approve the provided EPDs and material takeoffs for our final embodied carbon model.
- Update models with appropriate takeoffs and EPDs as supplied by manufacturers and/or GC. When completed, share with the project owner, the final results of the embodied carbon modeling and reduction strategies.

### Deconstruction & End of Life

- Continue to promote our Deconstructability AIA presentation and blog for wider spread education on the topic.
- Consider analyzing Modules C/D especially for Adaptive Reuse projects.

# REDUCTION

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As Structural Engineers, we have a unique opportunity to make a direct and lasting impact on the future of our planet. It is estimated that embodied carbon will be responsible for almost half of new construction emissions between now and 2050. Through implementing strategies focused on reducing these emissions, we can help to significantly mitigate the climate crisis. **Our reduction strategies are as follows:**

## Short Term Goals (<1 year)

- Update our specifications to promote low-GWP concrete.
- Update our specifications to incorporate embodied carbon performance criteria, e.g. 10% lower embodied carbon than the national average.
- Update our specifications to request material takeoffs and EPDs in the submittal review process.
- Continue to report embodied carbon on projects such that we can develop a baseline performance with which to set reduction targets from.
- Finish developing our Dynamo Script to provide clients with upfront modeling of embodied carbon during early Concept or Schematic Design phase decision making.

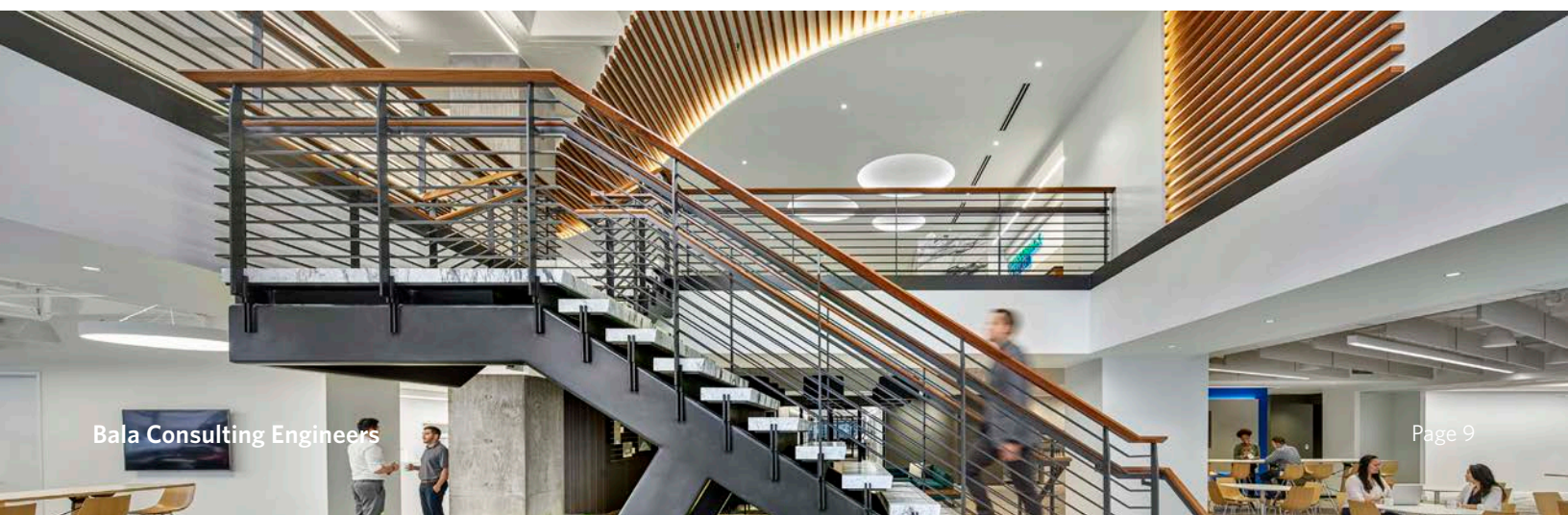
## Long Term Goals (>5 years)

- Once a baseline embodied carbon intensity is set for more project types, we plan to reduce the intensity of our projects each year. We anticipate that this will largely be logarithmic with larger decreases happening early on with reduction getting tougher over time.
- Have an EPD created for a project.
- Incorporate sustainably harvested biogenic materials in at least one project.



# REDUCTION

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# LESSONS LEARNED

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Through our research, case studies, attendance at conferences, and project work, we've learned a lot. Some of our key takeaways are as follows:

- Coordination is key between the trades for utilizing Cross-Laminated Timber (CLT) and Mass Timber elements. For instance, CLT panels are prefabricated resulting in openings and slab edges needing thorough coordination. Mass Timber cannot be forced into a pre-determined grid and requires early coordination efforts from the project team.
- Contractor experience matters with respect to cost and efficiency. The more inexperienced a contractor is with CLT construction, the more conservative bids are.
- Concrete remains the target, specifically the mix design. The most realistic implementation is replacing Portland cement with slag, fly ash, pozzolan, or LC3 concrete to lower global warming potential.
- NWC vs. LWC - We did a study on NWC and LWC buildings based on different increments of building's stories. Embodied carbon can be an additional benefit when choosing between NWC and LWC. Although LWC is more carbon intensive than NWC, it appears the benefits of using LWC can outweigh this carbon intensity when looking at the entire structural system (framing, columns, foundations, etc.). This is due to the lighter weight which has a compounding effect in design for both gravity elements and seismic lateral load.
- Transportation of Mass Timber elements will have a large impact on carbon footprint. Since CLT is carbon friendly, the transportation of these elements can have a major impact on the entire life cycle analysis.





**We are creating lasting change  
by joining together. We are  
committed to achieving net zero  
embodied carbon structures by  
2050.**



**BALA**