

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

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.



DAN GOFF, PE

STRUCTURES PROJECT MANAGER

Dan is a sustainable design committee member for the Structural Engineers Association Metropolitan-Washington Chapter.



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, external sustainability focused articles presented in StructureMag, and enterprise-wide Knowledge Center presentations to team bonding and Lunch & Learns.

Progress:

GOAL	PROGRESS	DESCRIPTION
In August 2021, we hosted an enterprise-wide Knowledge Center presentation on the SE 2050 Commitment and announced our involvement internally. From there, our goal is to expand our knowledge of sustainable practices and implement tools that help new hires and interns in our mission.	Ongoing	The structures group does lunch and learns, both internally and externally that involve sustainable design. This includes attending meetings from various groups (DVASE, CLF Leadership Forum, SEAMW, and more) as well as implementing studies for best practices. New hires are shown tools to perform embodied carbon calculations and the importance of it, ultimately encouraging them to join the SE2050 effort.
Upon completion of this ECAP, we will publish our plan on our internal SharePoint page for all staff to reference.	Complete	Every year when the ECAP is published, we share the document on our internal Sustainability SharePoint site in addition to our external website.
Get awarded a Life Cycle Analysis project where the focus is on sustainable design	Complete	Awarded and completed a "Preservation Alliance Award" winning project for the re-use of two cast-in-place residential towers.
Currently, our Embodied Carbon Champions attend Carbon Leadership Forum education sessions. We will broaden this to all Structural Engineers in our firm.	Ongoing	Continue to implement a minimum of sustainability-focused seminar every quarter as well as spread this information to the rest of the group the following week during a lunch and learn. We also attempt to attend conferences that are sustainably focused to better our understanding of industry standards when it comes to carbon accounting. This is an on-going task that we will continue to build upon.
Have our DC office officially become a "structural office". Will provide more flex on projects and increase project requirements from 2 to 4.	Complete	Bala's DC office is officially considered a structural office. Bala will report a minimum of 4 projects into the SE2050 database this cycle.
Get awarded a Mass Timber project where a LCA will be performed on the structure	Complete	A project was studied to be Mass Timber including the carbon accounting savings associated with the change. The option was unfortunately not chosen; however, designs were conducted in order to account for the embodied carbon.

New Goals

1. Implement performance based specifications that specify low carbon concrete and GWP percentage reduction based on the 2023 CLF Baseline values for concrete and steel construction.
2. Host internal Bala Lunch and Learn for elevated code requirements due to climate change.
3. Use a Mass Timber design for an entire project duration past concept.

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 had the opportunity to present to these groups on embodied carbon. We hope to continue to have these opportunities in 2026. Outside of structural specific groups, we also participate in the Carbon Leadership Forum's Philly Hub, local USGBC chapters, SEAOP, and SEAMW in DC.
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	Bala offers carbon accounting on all projects at the proposal stage. We have collaborated with clients and received buy in to study this on their projects (confidential client).
To be awarded an LCA project that coincides with our design schedule.	Complete	Bala was awarded a design project that includes both embodied and operational carbon studies throughout the design process and construction (confidential client).
Highlight sustainable research topic on our external website that we will be conducting in the summer of 2025.	Complete	Bala's own Steve M. Anastasio published articles on both resiliency and de-constructability projects to StructureMag.
Continue doing Carbon and Coffee talks with clients and expand this into the Philly region. Good way to bring up next steps for how we can implement strategies discussed on the project.	Ongoing	Bala will continue to do the Carbon and Coffee talks with clients in order to raise awareness on the SE2050 commitment and strive for more sustainable designs. Whether for new construction, resiliency, or adapt-reuse projects.
Our commitment to the SE 2050 Challenge is already highlighted on our Sustainability and Structures webpages.	Complete	Every year we update our internal SharePoint as well as external web-pages to show we are committed to the SE2050 challenge.
Annually, we will report our progress toward our SE 2050 goals on LinkedIn and other social media platforms.	Ongoing	We will post the results of the embodied carbon footprint in April after the completion of the embodied carbon analysis. These results will be posted on our company's Linked-In Page.
In addition to publishing annual progress, we will highlight projects that focus on embodied carbon on LinkedIn and other social media platforms.	Ongoing	We highlighted our involvement in the confidential LCA project as well as provided a structure brochure for our SE2050 commitment.

New Goals

1. Write a one-pager on the importance of SE2050 commitment from both a sustainable perspective as well as a business case to build the argument for sustainability.
2. Conduct a research project on CMU and concrete shear walls from a sustainable perspective.

REPORTING

Bala plans to implement accurate 3D modeling strategies that will allow ease of model transfer into an LCA tool such as One-Click. In addition to the accurate modeling, BALA will request contractors to receive material takeoffs (ideally) and products EPDs (realistically) for all structural materials used on a project. For all projects in the CA phase, submittals will be the main component for retrieving the material quantities of structural materials. For all projects that are still in the design phases, BALA will rely on accurate modeling and One-Click EPD database to complete the LCA of a building. This would be for phases A1-A5 regardless of the phase of design the building is in. An internal spreadsheet was also developed to be more confident with our LCA that was conducted via One-Click.

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	Continue to push for design projects to have a sustainable portion to them such as a LCA. Throughout the year, multiple LCAs were conducted that are independent to the SE2050 projects we submitted.
We will contact and suggest that concrete suppliers to provide product-specific data, rather than relying on region-specific data when possible.	Ongoing	Directly talk to and coordinate with manufactures on mix designs as well as requesting EPDs. This is an on-going commitment.
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	With an internal baseline established and having the knowledge to reduce carbon in our designs, we continue to strive to get client sign off on all projects to conduct an LCA.
At a minimum, we will report 4 projects for the SE 2050 Database (2 per office) from our 2025 portfolio.	Complete	Bala's DC office is officially considered a "structural office". Four projects will be included in our submission to the SE2050 database.

New Goals

1. Submit a minimum of (6) projects to the SE2050 database for global warming potential intensity by building. Our NYC office is to be considered a "structural office" as well.



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 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, an internal LCA spreadsheet 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 internal LCA spreadsheet.
- 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 an internal LCA spreadsheet.
- 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

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)

- Transition to performance-based specifications that will reference 2023 CLF baseline values.
- Update our specifications to request material takeoffs and EPD's in the submittal review process.
- Implement low carbon specifications on a minimum of (2) structural projects.
- Reduce the Global Warming Potential Intensity by 5% compared to our senior living embodied carbon baseline.

Long Term Goals (>5 years)

- Implement and prove a 15% reduction in our structural design based on optimization and specifications.
- Have an EPD created for a project with coordination from local manufacturers.
- Incorporate sustainably harvested biogenic materials in at least one project.
- Be awarded a Mass Timber project, to completion, that includes a full building Life Cycle Analysis.

REDUCTION

GOAL	PROGRESS	DESCRIPTION
Identify an internal baseline for our projects using previously submitted data to SE2050. This will be broken into different building sectors. We can then start to show the reduction in carbon across our projects for all different building sectors.	Complete	Have enough data to establish a baseline for senior living projects and warehouses. Residential and commercial buildings still require more data. Ideally a minimum of 4 projects to establish a true baseline.
Once our baseline is set, we will work to identify a reduction target for future years.	Ongoing	Bala intends to conduct LCAs on residential and commercial buildings to establish a comfortable baseline for those sectors. Healthcare and warehouses are ready to start reduction strategies.
A key goal is to educate owners using case studies and by providing low-carbon alternatives.	Ongoing	Interns that are interested in sustainable design will work with structural engineers to identify key areas of research similar to what we did in the past with normal versus lightweight concrete. Next research topic will be a comparison of CMU versus Concrete Shear Walls.
Going forward, all concrete specifications will request Environmental Product Declarations (EPDs) as a submittal for review.	Ongoing	This will be implemented into our specifications along with performance based specifications to reduce from the 2023 CLF baseline values.
Update to performance-based specifications that reference the 2023 CLF baseline values and specify a percentage reduction from these baseline values. We will use region specific values that correlate to where the project is being constructed.	Ongoing	Current confidential project should have this goal complete by next year and Bala's 2027 ECAP.
We will pull together carbon reduction case studies regarding our previously completed adaptive reuse projects.	Ongoing	This will go along with our internal baseline. With the help of sustainably motivated interns, we will review past projects to see areas where we could have optimized the design for a reduction in carbon across the project. As a learning tool, they will do their own LCA with the help of One-Click and/or our internal spreadsheet to see the possible reduction with performance based specifications and optimizing low-impact structural members.

New Goals

1. Using a baseline for senior living projects (healthcare) from past projects, reduce the embodied carbon intensity by 5% minimum as a starting point.



LESSONS LEARNED

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

- Re-use of a building structure is one primary way to reduce embodied carbon. Innovative ways to re-use existing buildings is at the forefront of sustainability. The most sustainable thing one can do is to build upon what was already established rather than demolish and build new.
- Optimization is another key to reducing the carbon impacts of a building. We need to assess the risks of each structural element and optimize the design to where it is structurally acceptable to do so. Slab on grade and perimeter frost walls are areas we have identified to help reduce the quantity of concrete on a project.
- Concrete remains the target, specifically the mix design. Through performance-based specifications and coordination with the manufacturers, a reduction of global warming potential is possible; however, as design professionals we must be flexible in how this low carbon concrete is achieved. Manufacturers will have to rely on locally sourced materials to do this work economically and sustainably.
- Reducing damage due to natural events is also important for designers as they understand climate change and its impact on code prescribed design guidelines, maintaining the built environment, and reducing the carbon costs for remediation and rebuilding. Resilience is a key part in our sustainable future so that the structures we build will last.



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



BALA