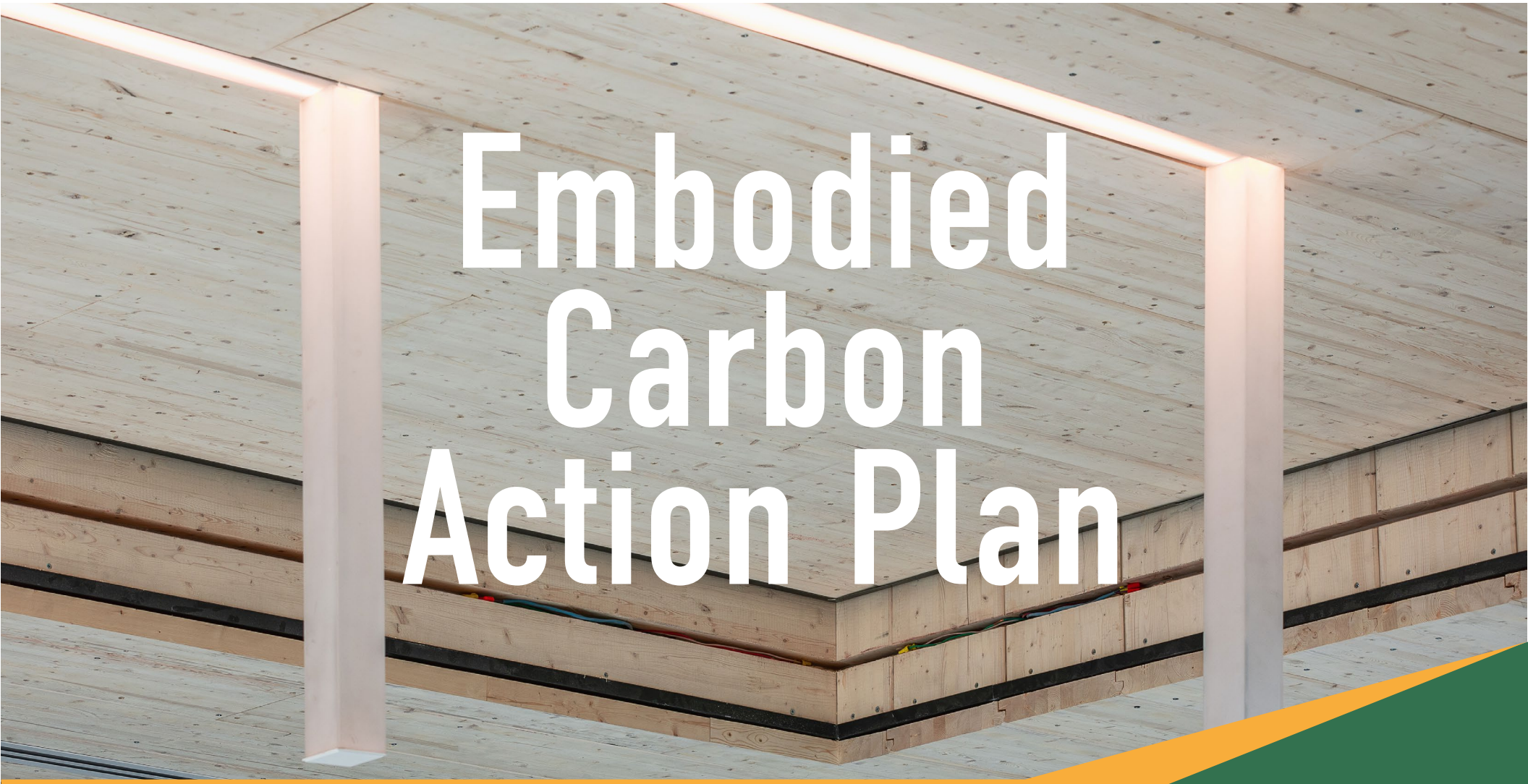
SE2050
COMMITTING TO ZERO

KL&A
Engineers & Builders



Embodied Carbon Action Plan

2022

INTRODUCTION

We are an integrated structural engineering and construction firm, based in Golden, Colorado with 4 offices throughout the Rocky Mountain Region, with over 100 employees. We are a firm built around the idea that structural engineers should return to a master builder role by taking ownership of the design of structural systems, cost estimating, and at-risk construction, and now – environmental impacts. Our mission to "revolutionize the way structures are designed and built" is exactly why we have prioritized the modernization of our practice to address the climate and environmental impacts of our design and construction. We are excited by our belief that structural engineers can and will step into a role of leadership and education with our architect and owner clients to create new avenues and priorities for decision making in our design practice.

We became a signatory to the SE2050 commitment in 2020 because we wanted to express publicly our commitment to reducing the environmental impact of our design and construction, and to join the collective industry effort around innovation and accountability. Through our shared efforts, knowledge, and learning, the challenge of reducing our industry's contribution became an "open-source" effort, which is necessary to have a real and timely effect on climate change.

At KL&A we have developed a small but mighty team of engineers to focus on embodied carbon and its reduction: Team Carbon. KL&A's embodied carbon knowledge base and expertise has started with Team Carbon, acting as company experts for structural engineers and consulting on projects.

TEAM CARBON

teamcarbon@klaa.com

KL&A'S 10 STRATEGIES TO REDUCE EMBODIED CARBON

1. Start Now
2. Big Rocks First
3. Innovate
4. Reuse Buildings & Components
5. More Biogenic Materials
6. Less Cement
7. Long Life, Loose Fit
8. Cost Matters
9. Market Evolution & Incentives
10. Open-Source Effort

EDUCATION

To effectively reduce the embodied carbon impacts of our projects, we as structural engineers, must understand how our decisions during design directly impact the outcome. In 2022, Team Carbon has continued to provide company training on various topics of embodied carbon and how to integrate reduction strategies into structural design and project processes. We also communicate Team Carbon updates periodically and long-term strategy at each all-company meeting, which occurs biannually. By the end of 2022, all project and client managers will participate in Team Carbon training to encourage a focus on embodied carbon in proposals, conceptual, and schematic design and identification of project and collaborative opportunities for reductions.

Internally to Team Carbon, we have developed a training series that covers LCA technical, Tally 101, Tally technical, and the carbon impacts of structural materials and their unique reduction opportunities. Every member of Team Carbon is trained to develop and interpret Structural Life Cycle Assessments using Tally as well as schematic design GWP estimates. All training sessions are recorded to allow for effective onboarding and company-wide access.

See the advocacy narrative below for information on external knowledge sharing and educational efforts.

EDUCATION

SE2050 ELECTIVES	KL&A RESPONSE	STATUS
Distribute ECAP within your firm upon publishing	We distribute our ECAP annually to our organization once it is published.	✓
Make (1) webinar focused on embodied carbon available to employees.	We hosted Kathryn Fernholz of Dovetail Partners to present to employees on forest health and mass timber. We have also presented an Embodied Carbon 101 lecture to all employees and a recording is available for company wide access.	✓
Have one representative of your firm (any employee) attend quarterly external education programs (e.g. webinar, workshop) provided by SE 2050, Carbon Leadership Forum (CLF), or other embodied carbon resources.	Multiple Team Carbon members attend embodied carbon focused presentations and conferences, such as Carbon Leadership Forum, Global Concrete Summit Sustainability, Engineering Change Lab USA, Getting to Zero, Advancing Mass Timber Construction 2021, International Mass Timber Conference.	✓
Share the SE 2050 library of resources with technical staff.	We've shared the SE2050 library of resources with technical staff at KL&A.	✓
Share embodied carbon reduction strategies with your firm as outlined in Top 10 Carbon Reducing Actions for Structural Engineers document produced by SE 2050.	We've shared the Top 10 Carbon Reducing Actions for Structural Engineers documents provided by SE2050 with technical staff at KL&A.	✓
Nominate a minimum of (1) employee per office to participate in a CLF Community Hub and/or task force.	Team Carbon members attend CLF Rocky Mountain Regional Hub meetings and were part of the discussion panel regarding lower embodied carbon concrete mix designs and alternative solutions for this Hub.	✓
Provide narrative outlining plans for minimum (2) firm-wide presentations per year on the topic of embodied carbon.	In 2022, Team Carbon provided further all company training on various topics of embodied carbon and how to integrate reduction strategies into structural design. We presented to the entire firm on the Top 10 Things Every Structural Engineer Should Know about Embodied Carbon and intend to begin material specific training sessions this year.	✓
Present the document, "How to calculate embodied carbon" to all technical staff.	Document will be distributed as part of Tally 101	In Progress
Minimum (1) employee attends a presentation or demo of an LCA-based tool used to calculate embodied carbon, such as Tally, Athena IEB, or One Click LCA.	Team Carbon members have attended presentations of LCA based tools used to calculate embodied carbon, such as Tally, Athena, and EC3	✓
Initiate an embodied carbon interest group within your firm and outline their goals.	See introduction section above for discussion on KL&A's Team Carbon.	✓
Provide a narrative of how the Embodied Carbon Reduction Champion will engage embodied carbon reduction at each office. (intended for multi-office firms).	KL&A has engineers in multiple offices, but operates as a single engineering profit center with projects routinely shared across office boundaries. The Team Carbon organization chart, training sessions, and action plans are designed to reach all offices equally.	✓

REPORTING

Carbon accounting is an essential component of reducing the embodied carbon impact of structures. It is what helps us understand and identify hot spots, understand the impact and effectiveness of modifications and innovations, and guides us to make informed decisions related to mitigation strategies.

KL&A provides GWP estimates at the schematic design phase of sustainability minded projects to aid in material and system selections, as well as full Structural LCAs, always including recommendations and pathways to embodied carbon reductions. We have a robust library of product and industry EPDs, including comparisons and running GWP averages across our library, as well as calculated embodied carbon coefficients. We predominately use Tally LCA software to produce Structural and Enclosure LCAs. We actively encourage our architectural partners to develop the capabilities to also perform LCAs so that we can collaborate to best perform Whole Building LCAs. LCA results are always reviewed, interpreted, and manually modified as needed to provide a more accurate GWP quantification of a specific building and its components.

We are in the process of refining our internal KL&A database and increasing project quantity to better understand our embodied carbon impacts, reductions, and trends across building types, systems, materials, and design teams.

In 2021, we submitted five Structural LCAs to the SE2050 database. We will continue to submit and meet the LCA requirements of the SE2050 Challenge.

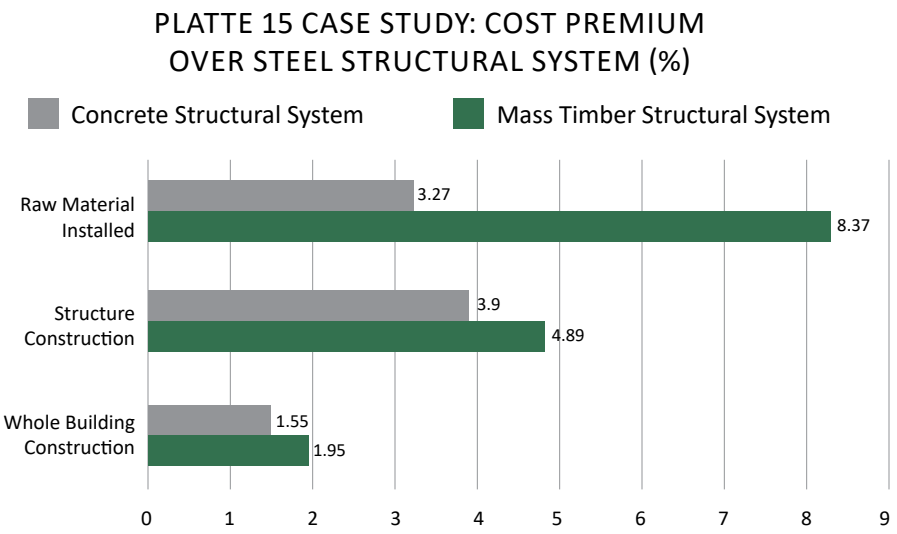
REPORTING

SE2050 ELECTIVES	KL&A RESPONSE	STATUS
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.	We completed (25) LCAs in 2021 and submitted (5) of them to the SE2050 database. We have completed (20) new LCAs this year and will submit (5) to the SE2050 database.	In Progress
Submit all of your firm's projects to the SE 2050 database	Given the large number and variety of projects completed annually, KL&A has elected to be selective, populating the database with those projects that will bring the most value and performing LCA's on projects to realize embodied carbon reductions.	
Report a greater percentage of projects than you did the previous year.	We plan to submit a minimum of (5), which is the amount we submitted last year. Pending internal database compatibility with SE2050 input we will submit more.	TBD
For a project submitted to the database, ask the Architect or Owner if the project has a carbon budget or if there are established project sustainability goals at the project kickoff meeting.	We've included an Embodied Carbon Reduction Criteria section in our schematic design narrative template that is used on all projects to help initiate early conversations and embodied carbon considerations on all projects.	In Progress
Propose other actions that promote the reporting of embodied carbon data and describe their value.	KL&A has created an internal database to track LCA's performed. This will allow us to develop benchmarks for project types, clients, and structural systems. We will use this benchmarking to set goals to reach net zero by 2050.	✓

REDUCTION

Before we can set appropriate quantitative embodied carbon reduction goals, we are first focusing on education and developing GWP quantification processes, documentation, and data collection. The foundational process standards and data tracking will allow us to determine benchmark embodied carbon quantities per building type, structural system, and material type for KL&A projects. Until refined benchmarks are understood, internal and external to KL&A, we will focus on embodied carbon reductions on individual projects and set appropriate and ambitious goals for each.

We have incorporated an Embodied Carbon Reduction Criteria section into our template schematic design narrative to start the conversation early with the Architect and Ownership group. This will also be included in our standard proposals in the near future. We're hopeful that these intentional early conversations will at the very least help educate external partners but will also help identify opportunities for collaborative reductions.



LESSONS LEARNED:

CONCRETE

In 2021, KL&A revised our concrete specifications to performance based specs, to allow concrete contractors and suppliers to finesse mix designs to reduce their embodied carbon. The industry is gaining awareness of the embodied carbon impact of cement and the importance to develop industry wide strategies to address this structurally significant material.

We are experiencing more projects that request concrete mix design consulting, which is facilitated by our material and Team Carbon experts. Mix designs are addressed in collaboration with design teams, contractors, and suppliers to consider material availability, cost, construction sequencing and schedule, and architectural objectives. Initiating these conversations early in the design process across the entire project team, is key to increasing the likelihood that a project will realize embodied carbon reductions.

MASS TIMBER

As mass timber supply and demand continues to grow in North America, KL&A is excited by the opportunity for structural, sustainable, and construction innovation. Mass timber has the potential to greatly reduce our industry's embodied carbon impact, due to its inherent ability for regrowth and its natural ability to sequester carbon, known as biogenic carbon.

Often, the material costs of mass timber prohibit its use when compared to traditional structural systems. KL&A is addressing this barrier to adoption by facilitating system comparisons at schematic design of embodied carbon and pairing this with holistic cost estimates to consider material, construction schedule, labor, equipment, and finish savings. To the left, is an excerpt from our Platte Fifteen LCA Case Study showing the cost premium of concrete and mass timber structural systems over a steel structural system for that particular project. As shown, once you look at the cost with a wider lens it becomes more clear that there is a relatively insignificant cost premium for mass timber compared to the GWP savings. See the Platte Fifteen LCA Case Study, published in 2021 for a more in depth discussion of GWP and Cost comparisons.

CIRCULAR ECONOMY CASE STUDY

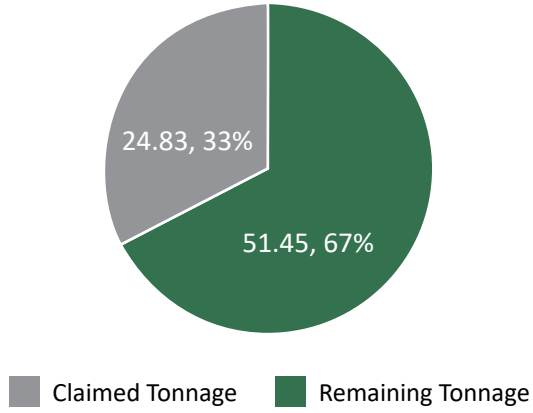
A Colorado municipality is endeavoring to deconstruct an existing hospital building, constructed in the 1950's, and reuse and recycle as much of the interior finishes and core and shell as possible. KL&A has inventoried 76 tons of structural steel which will be deconstructed, salvaged, and stockpiled for use on new construction projects. The inventory will be expanded later this year to include an additional 60 tons of structural steel from the existing building. Facilitating an inventory database allows for new construction projects to integrate specific steel pieces into their layout and structural designs prior to obtaining the steel.

Utilization of the stockpile has already begun on the design of two projects for the same municipality and being considered for local private projects as well. KL&A is the structural engineer of record for some of these new construction projects and has indicated within the construction documents the locations of the salvaged steel, specification requirements for reuse of the material, and facilitated coordination between the municipality, contractors, and fabricators to integrate the salvaged material successfully into their project.

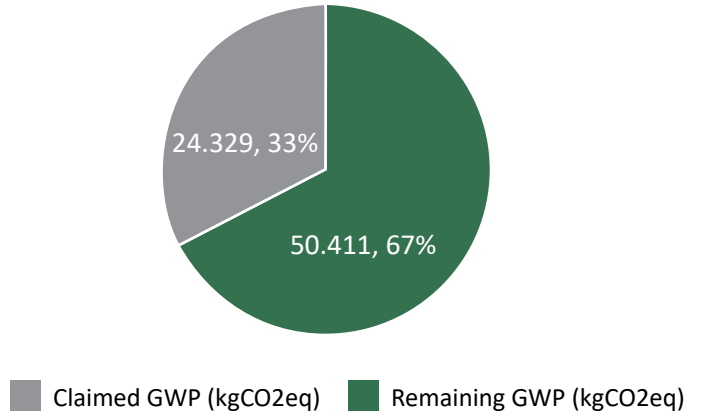
By salvaging the existing steel material and directly reusing it in new construction projects, the material's functional life is extended, avoiding embodied carbon impact from manufacturing new material. The avoided embodied carbon was estimated for the municipality's inventory. The 76 tons of inventoried steel is equivalent to the electricity used by 14 homes for one year or 16 passenger vehicles driven for one year.

The objective of this project is to not only reduce embodied carbon and waste, but to also illustrate the potential for a municipality to facilitate a local circular economy.

WIDE FLANGE MEMBERS TONNAGE



WIDE FLANGE MEMBERS EMBODIED CARBON



The estimated GWP credit accounts for Stage A1 (mill product manufacturing) and excludes A2 (transportation to fabricator) and A3 (fabrication). The reason being that the salvaged material will still need to be transported to a fabrication facility and go through a typical fabrication process for new construction.

REDUCTION

SE2050 ELECTIVES	KL&A RESPONSE	STATUS
Communicate the embodied carbon impacts of different design options to clients with creative data visualization. Include these visualizations in your Elective Documentation	KL&A currently includes "context" within our embodied carbon reports, comparing the building and component GWP to that of cars' emissions, home electricity, etc. This helps communicate the quantitative impacts of our buildings to clients and owners. Data graphics are also included in our reports, typically focusing on GWP, material quantities, and their relationship to each other. KL&A supports SE 2050's encouragement of data visualization, as it is important that embodied carbon quantification and literature is accessible and understandable by a larger and non-technical audience.	✓
Project case study sharing embodied carbon reduction successes and lessons learned	See circular economy case study above.	✓
Create a project-specific embodied carbon reduction plan.	KL&A has multiple projects that are seeking embodied carbon reductions. Reduction plans are unique to each project depending on specific materials used, certification aspirations, and ownership goals. Reduction strategies are discussed throughout this ECAP.	✓
Complete an embodied carbon comparison study during the project concept phase.	KL&A has provided numerous comparative studies of varying structural systems and their associated GWP to aid in schematic design decisions.	✓
Participate in a LEED, ILFI Zero Carbon, or similar project design charrette and speak to potential design considerations impacting embodied carbon.	KL&A is currently participating in a project that is seeking ILFI Core certification. KL&A is helping to quantify the embodied carbon and meet 20% reductions.	In Progress
Calculate your firm average benchmark for embodied carbon.	We are working to complete this by EOY 2023.	In Progress
Update your specifications to incorporate embodied carbon performance. Include embodied carbon in your submittal review requirements.	Our concrete specifications were updated in 2021 to encourage submission of EPDs during the submittal review process and moved to a performance based spec. In the near future we will be making similar updates to our steel and wood specifications.	In Progress

REDUCTION

SE2050 ELECTIVES	KL&A RESPONSE	STATUS
Collaborate with your concrete supplier to reduce embodied carbon in a mix design.	See lessons learned section above.	✓
Work with a contractor during material procurement to meet an embodied carbon performance criteria on at least (1) project.	KL&A has active projects that are seeking embodied carbon reductions in the concrete mix designs. KL&A is working directly with the contractors and concrete suppliers to develop GWP targets.	✓
Have an Environmental Product Declaration (EPD) created for a project	KL&A requests EPD submissions through our material specifications. The intention is to encourage material suppliers to develop EPDs if they have not already.	✓
Incorporate biogenic materials on at least one project.	KL&A is adept at wood light frame and mass timber structural design. We have numerous projects per year that incorporate biogenic construction materials like dimensional lumber, cross laminated timber, and glulam.	✓
Submit a Circular Economy Narrative describing how the project supports the circular economy. This can be done by incorporating re-use or design for deconstruction into at least one project.	See circular economy case study above.	✓
Report weight and method of transportation of structural material. Track how much is processed for recycling/salvage and sent to landfill, including material generated during demolition and construction activity. Include at least four material streams (e.g. concrete, metal, wood, gypsum wallboard, paper and cardboard, plastic).	KL&A will not pursue this elective at this time. See “Circular Economy Case Study” in our Reduction Section for reference to a project that we are facilitating deconstruction to salvage structural steel.	
Integrate embodied carbon mitigation strategies in your General Notes.	Embodied carbon mitigation strategies have been incorporated into our concrete material general notes. We plan to make edits to our steel and wood general notes in tandem with making specification updates for those two materials.	In Progress

ADVOCACY

We wholeheartedly believe in knowledge and experience sharing, and advocacy through education. The design practice of reducing embodied carbon in our infrastructure requires immediate implementation, therefore, it is crucial that we all balance business competition with collective advancement and innovation. Accessibility of the information will be an important component to accelerate the speed of implementation, industry wide. We will actively participate in SE2050, its database, and its directives.

We are collaborating with our architectural clients through education and encouragement of embodied carbon reductions in our projects. We see client collaboration as a key component of our success to reduce the impacts of our designs – through efficiency of program layouts, system selection, product selection, collaborative LCAs, and owner/developer education. The more consultants who encourage, pursue, and succeed in embodied carbon reductions, the more industry innovation will occur, reinventing the status quo of architectural and engineering consulting services and our role in climate solutions.

KL&A continues to present on the topic of embodied carbon at industry conferences, seminars, and client offices both locally and nationally. To date, we have completed 18 presentations in 2021, and 10 in 2022. In our presentations we attempt to address embodied carbon reduction strategies, associated costs, and the GWP background data – with the goal to provide perspective of practical and actionable solutions.

ADVOCACY

SE2050 ELECTIVES	KL&A RESPONSE	STATUS
Describe the value of SE 2050 to clients. How can your design teams collaborate to reduce embodied carbon? Please attach any associated marketing materials.	See narrative above for discussion on how we are collaborating with clients to reduce embodied carbon.	✓
Declare your firm as a member of the SE 2050 Commitment with boilerplate proposal language.	We plan to include this declaration as well as an embodied carbon reduction section into our template proposal.	In Progress
Share your commitment to SE 2050 on your company website.	KL&A has declared our commitment through our website, marketing materials, and client and industry presentations. Discussing the SE2050 and Arch2030 commitments is an element of our advocacy and education plan.	✓
Give an external presentation on embodied carbon that demonstrates a project success or lessons learned (Tip: Get connected at a CLF local hub near you!).	As mentioned previously, KL&A presents regularly on the topic of embodied carbon, incorporating our case studies and project successes of the constructed Platte Fifteen project, existing building design, and building component reuse.	✓
With the owner or client, discuss a facility- or product-specific EPD requirement for structural materials.	On multiple projects, KL&A has discussed the use of industry average versus product specific EPDs with the project teams, client, and owner.	✓
Share education opportunities with clients.	KL&A regularly shares industry references such as Carbon Leadership Forum, Arch2030, SE2050, and MEP2040 with our clients and owners. See our “Education” Section for more information about how we are educating others.	✓
Encourage industry and policy change by promoting and using low-carbon and carbon-sequestering materials.	KL&A was actively involved in the early adoption of the 2018 IBC provision of mass timber building types in Denver, Colorado, making it the third jurisdiction in the U.S. to allow taller mass timber construction, thus encouraging broader use of biogenic structural materials. KL&A is involved in the CLF Rocky Mountain Hub and is participating in their legislation working group, aimed at embodied carbon policy in Colorado. KL&A has participated in crafting draft legislation through ACEC, SEAC, and CLF for Colorado policy. Team Carbon members are involved in ACEC CO legislative committees.	✓
Start an embodied carbon community of practice or mentorship program in your office.	As mentioned previously, KL&A has formed a group called Team Carbon which facilitates knowledge sharing, training, and project implementation with the larger organization.	✓
Mentor a firm new to the embodied carbon space.	KL&A has been meeting with a local firm to discuss concrete reduction strategies from the structural engineer’s perspective and formed a SEAOC committee to facilitate collaboration across firms in Colorado.	✓

REVOLUTIONIZING THE WAY STRUCTURES ARE DESIGNED AND BUILT

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