



SE2050 NET ZERO COMMITMENT

Embodied Carbon

ACTION PLAN 2023

ENTUITIVE

Contents

EMBODIED CARBON ACTION PLAN 2023

- 1 SUSTAINABLE PERFORMANCE STEWARDSHIP:
FROM COMMITMENT TO ACTION
- 2 SE 2050 COMMITMENT PROGRAM OVERVIEW
 - 2.1 EDUCATION PLAN
 - 2.2 KNOWLEDGE SHARING NARRATIVE
 - 2.3 REDUCTION STRATEGY
 - 2.4 REPORTING PLAN
- 3 ELECTIVE DOCUMENTATION:
ENTUITIVE COMMITMENT
 - 3.1 **EDUCATION** GOALS & ACTIONS
 - 3.2 **REPORTING** GOALS & ACTIONS
 - 3.3 **REDUCTION** GOALS & ACTIONS
 - 3.4 **ADVOCACY** GOALS & ACTIONS
- 4 LESSONS LEARNED





Sustainable Performance Stewardship

FROM COMMITMENT TO ACTION

Entuitive is proud of our commitment to SE 2050, building towards net zero embodied carbon structures. Our commitment to sustainability is the most tangible demonstration of our core purpose to build a better world.



Our leadership in Sustainable Performance will enable our clients to reach their performance aspirations and will attract some of the most passionate talent in our industry – in other words, more people like us.

It is imperative that in every aspect of our work, we are thinking and designing with sustainability in mind.

As of January 2022, Entuitive is a proud signatory of the Structural Engineers 2050 Commitment, and our Sustainable Performance Stewardship Group will continue to take on the role of driving down carbon emissions across the firm.

The Stewardship Group will continue to collaborate with our internal Knowledge Centres and Technical Groups to incorporate embodied carbon metrics into design aids, develop guides and provide resources to design teams on process and low carbon strategies, and perform targeted research and case study work to identify low embodied carbon solutions in collaboration with our industry peers. We will also continue to provide relevant learning and development opportunities for all staff at Entuitive.

Our 2023 Embodied Carbon Action Plan (ECAP) reports on our efforts completed to date, as well as ongoing initiatives we are working on, and new initiatives we will take on this year, all focusing on the SE 2050 themes: **EDUCATION, REPORTING, REDUCTION, AND ADVOCACY**. Within this action plan, we have outlined our vision for a net-zero carbon future and we have drafted our implementation strategies for how to move forward.

The Sustainable Performance Stewardship Group encourages questions, feedback, and ideas on this ECAP report.

We look forward to building a more sustainable world with you.



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SE 2050 Commitment

PROGRAM OVERVIEW

The Structural Engineers 2050 Commitment, created in response to the Carbon Leadership Forum’s (CLF) SE 2050 Challenge, is designed to ensure substantive embodied carbon reductions in the design and construction of structural systems by the collective structural engineering profession, with the goal of ultimately eliminating embodied carbon in their projects by 2050.

The following is a summary of our strategies and plans to tackle embodied carbon reductions based on the SE 2050 four areas of commitment.

2.1

EDUCATION PLAN

Since its inception, the Stewardship Group has taken several actions to provide educational resources to Entuitive staff. Through internal newsletters, webinars, and Lunch & Learns, staff are provided with resources educating them on what embodied carbon is and how it can be reduced through design.

The Stewardship Group worked with an external consultant in 2020 to develop Embodied Carbon 101 and 201 webinars which all staff were encouraged to attend, and which are now mandatory onboarding videos for all new hires.

In 2022, the Stewardship Group surveyed staff to gauge the general understanding of embodied and operational carbon. Based on the results, the group is developing an in-depth embodied carbon education program which will be available to all staff and will be mandatory for key staff. The program is expected to launch later in 2023. Recordings of the series will be available for all staff.

The Stewardship Group has also developed Advisory Documents, Technical Notes, Project Sustainability Guides (completed for structural and ongoing for our building envelope services), EPD Guides, Carbon in Structure and Envelope Primers and general Cheat Sheets relating to strategies and standards that address embodied carbon. These are available to all staff at Entuitive and have gone through iterations to determine what is needed most by their users.

The Stewardship Group will continue to provide internal Lunch & Learn sessions focused on sustainability with the majority focused on embodied carbon solutions in design and materials.

2.2

KNOWLEDGE SHARING NARRATIVE

Entuitive is committed to accelerating sustainability in the built environment and leveraging our relationships with clients, other consultants, contractors, and the community at large to broaden the understanding of embodied carbon in the architecture, engineering, and construction (AEC) industry, including the need to reduce emissions. Our Stewardship Group is involved in numerous studies and ongoing conversations with clients and industry partners, providing education opportunities through L&Ls and conference presentations. Our group is also actively involved in conversations with architects, contractors, and manufacturers to accelerate the adoption of low embodied carbon practices on projects, including the use of product specific EPDs and setting GWP limits for structural materials.

One of the members of the Stewardship Group was one of the founding members of the CLF Toronto Hub, and another is a member of the CLF Ottawa Hub, both of which organize embodied carbon learning events for the Toronto and Ottawa community. Recently, one of the members of the Stewardship Group, also a member of CLF Ottawa, arranged a seminar inviting students and industry professionals from the University of Ottawa to increase embodied carbon literacy.

The Stewardship Group also works with teams within Entuitive to conduct structural and envelope embodied carbon studies which we publish on our website and promote on social media to be publicly available for anyone to learn from.

Our Embodied Carbon Champion presented on what Entuitive is doing to reduce the embodied carbon of our work at an SE 2050-focused CLF Toronto Webinar in April 2022, along with two other signatory firms.

2.3

REDUCTION STRATEGY

In order to achieve reductions on our projects, we identified that we needed to provide design teams with the knowledge and resources of various low carbon design decisions they can implement on their projects. In our first year, we focused on expanding our embodied carbon educational goals through the development of 7 Embodied Carbon Lectures which will be rolled out in 2023. These targeted training sessions were developed with the intention of growing the embodied carbon knowledge base and LCA skillset across the firm.

In 2023, we are developing an embodied carbon section of our Structural Schematic Design report which will include a list of potential embodied carbon reduction strategies impacting both design choices and material choices. We are also in the process of updating our concrete and steel specifications, and general notes, to include language to limit the GWP of those materials in our projects. In 2021 we had updated our concrete, steel, and timber specifications to include an optional section for EPDs.

In previous years, the Stewardship Group had undertaken an effort to measure embodied carbon of all of our new-build structural and envelope projects at 100% CD. This was a huge undertaking and provided some meaningful data which has been summarized into a visual database, however our plans going forward have shifted to educating more design staff on how to complete LCAs and looking for project opportunities to measure embodied carbon at multiple stages of design to demonstrate reductions and to share that information with our clients.

2.4

REPORTING PLAN

Our path to net zero emissions will require consistent and yearly embodied carbon reductions plans and strategies. To track our progress, we will measure the embodied carbon of our projects and report the results to SE 2050. In 2022, we reported LCA data for 2 projects. We will aim to increase that number each year, and in 2023 will submit LCA data for at least 3 projects. In 2023, we will target performing LCAs at SD and CD for at least 3 projects, and at the end of the year we will send an announcement out to staff summarizing the data and highlighting the trends.

Entuitive uses OneClick LCA to perform our LCAs, and we also have access to Athena Impact Estimator. We have developed our own early parametric tool, CarbEN, to assess the embodied carbon of different structural schemes in concept design, and we are currently working with a group of structural engineering firms and an architect to develop a more accessible and easy-to-use early stage assessment tool for structural engineers.

LCAs are completed with region-specific data, and product or plant-specific data where available and where the information is known. Our LCAs look at the whole life cycle, within the limitations of available data within the software we use (for example OneClickLCA does not have C1 emissions data for North America, therefore they are estimated for similar regions in Europe). We regularly reach out to material manufacturers to request EPDs of their data and to ask if they have lower carbon options. We also use the EPD databases in OneClick and EC3.

We have developed strategies and processes to better utilize our Revit models to extract material quantities in a more efficient manner for easy import into OneClick. We have updated our BIM process to make sure a sufficient level of detail is captured in the Revit model to facilitate the LCA. We have also developed a material quantity takeoff tool to help us extract quantities from PDF drawings before structural Revit models are prepared. We had previously set a target to measure embodied carbon at 100% CD for our projects, however we are shifting that goal to measure at SD and CD so that we can have a more meaningful impact on the project earlier on, and so that we can track what the final outcome was.

Comprising an existing 14-storey concrete frame tower and a five-storey steel framed block connected by a two-storey concrete link building, MacKimmie Block and Tower is the tallest building within the University of Calgary's main campus.

The block and tower originally served as a library but were repurposed for administrative and classroom spaces, including 500 new study spaces for the faculties of Nursing and Social Work. The redevelopment included adding two floors to the existing tower, replacing the existing cladding system with an energy efficient system, and improving the quality of the interior light.

The complex is striving for certification with the Canada Green Building Council's new Zero Carbon Building Standard, aiming to reduce and eliminate carbon emissions by designing passive controls and minimizing energy usage while optimizing interior comfort.

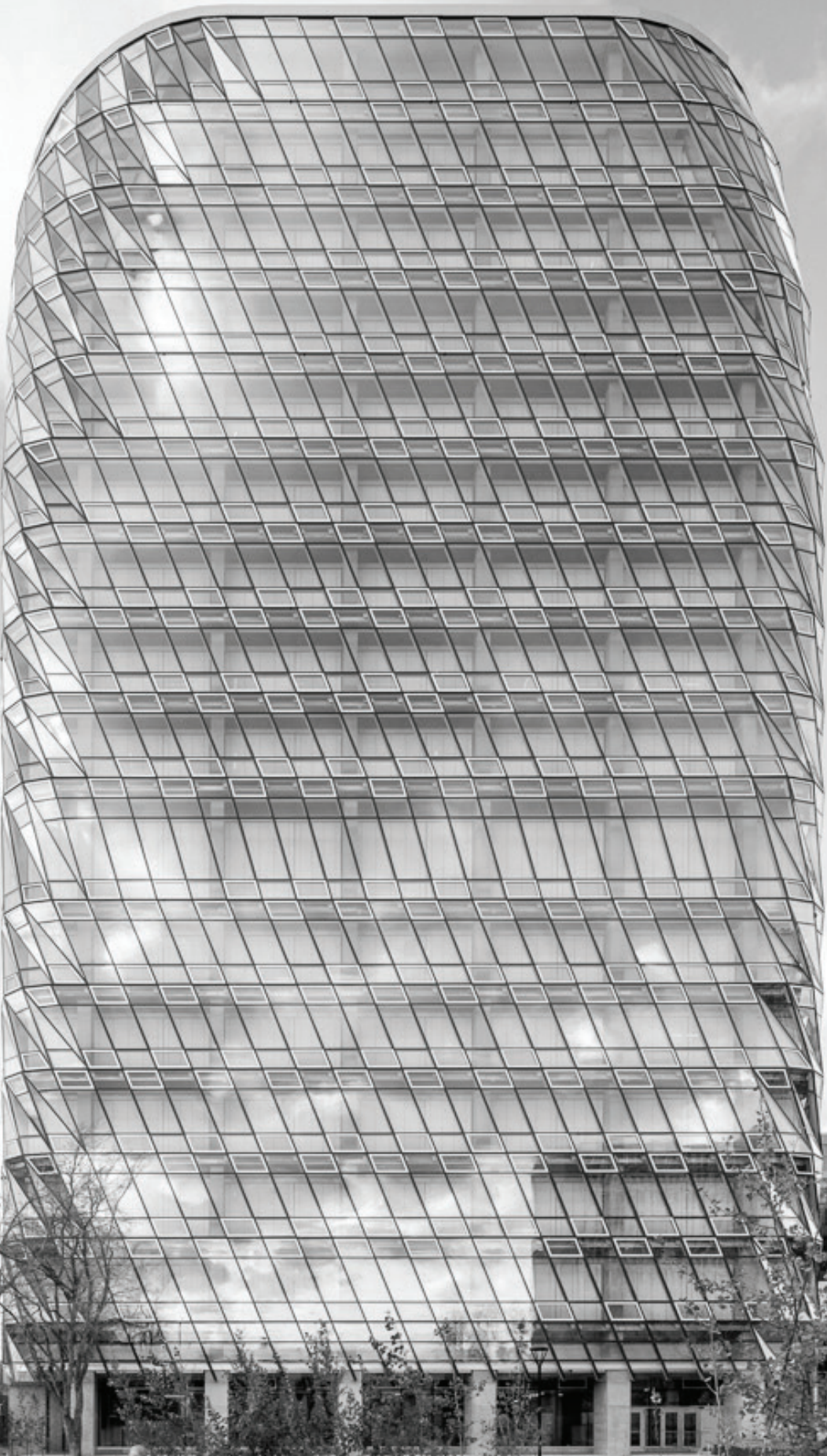
The MacKimmie Block & Tower Redevelopment Project has been awarded multiple times to date, including:

Award of Excellence - Buildings
Canadian Consulting Engineers

Green City Award
Mayor's Urban Design Awards

Award of Excellence
Consulting Engineers of Alberta (CEA)

Tree of Life Award
Canadian Consulting Engineers



MacKimmie Block & Tower Redevelopment
CALGARY, CANADA



Elective Documentation

ENTUITIVE'S COMMITMENT

Our commitment to sustainability is the most tangible demonstration of our core purpose to build a better world. We recognize that leading embodied carbon decision making requires commitment from every member of the Entuitive family.

In 2023, our commitment to the 4 pillars of the SE 2020 Elective Documentation reporting are summarized in details to follow.

3.1

EDUCATION GOALS & ACTIONS

REQUIREMENTS	IMPLEMENTATION	STATUS
Distribute firm-wide announcement of your firm's pledge to join the SE 2050 Commitment.	<p>We have announced our commitment to SE 2050 through our company-wide newsletter, which is also posted on our intranet site.</p> <p>Our Marketing & Communications team announced our commitment on our social media posts (i.e., LinkedIn, Instagram, etc.) externally for our clients and public.</p> <p>In addition, we will make our annual ECAPs available on our Sustainable Performance webpage which will be accessible publicly upon publishing.</p>	<div><div></div><div>2022</div></div>
Nominate an Embodied Carbon Reduction Champion for your firm. Include a brief profile (name, office, title, optional picture and bio) in your ECAP.	Emily King, Associate, in our Toronto office is selected as the company's Embodied Carbon Reduction Champion based on her continued commitment to decarbonizing buildings and infrastructure, and commitment to attaining net-zero carbon emissions of all projects.	<div><div></div><div>2019</div></div>
Provide a narrative of how the Embodied Carbon Reduction Champion will engage embodied carbon reduction at each office.	<p>The Embodied Carbon Reduction Champion leads the Sustainable Performance Stewardship Group and is regularly in contact with staff from all offices either to contribute directly to projects to reduce embodied carbon, or to work with the rest of the Stewardship Group to provide education sessions and resources to all staff.</p> <p>There are Stewardship Group members located in other offices including Vancouver and Ottawa, which act as Regional Champions, and are equipped to promote our ECAP, and present opportunities for continuing education sessions. Our company has a One Company philosophy that allows us to work as one, regardless of region/location.</p>	<div><div></div><div>ONGOING</div></div>
Present at least (1) webinar focused on embodied carbon and make a recording available to all employees. This could be created internally, pulled from an external source (with permission), or pulled from a publicly available source such as the Boston Society of Architecture. Include this resource in your orientation and on-boarding programs.	<p>The Stewardship Group organized for Embodied Carbon 101 and 201 webinars to be presented to all staff in 2020, and the two videos have since become part of our onboarding process for all new staff.</p> <p>The presentation slides and video recordings are stored on the company drives and intranet webpage, accessible to all staff.</p> <p>In 2023 and 2024, the Stewardship Group will present an Embodied Carbon Education Series, covering topics such as Introduction to Carbon, Speaking to Clients, Strategies for Structure, Strategies for Envelope, Material Practices and Case Studies. The series will be available to all staff and mandatory for certain staff. Recordings will be available to all staff.</p>	<div><div></div><div>2020</div></div>

ELECTIVES	IMPLEMENTATION	STATUS
Incorporate embodied carbon education in your onboarding process for all new employees.	Embodied Carbon 101 and 201 webinars are part of the on-boarding process for new staff.	<div><div></div><div>2022</div></div>
Initiate an embodied carbon interest group within your firm and outline their goals.	<p>The Stewardship Group serves the role of embodied carbon interest group, disseminating knowledge and providing education opportunities to staff to reduce embodied carbon in their designs.</p> <p>Their goals are:</p> <ul style="list-style-type: none">○ Provide technical resources on the topic of embodied carbon○ Incorporate embodied carbon metrics into design aids○ Provide education materials on the topic of embodied carbon for new hires○ Participate in research studies that advance the industry's understanding on embodied carbon○ Create partnerships with other organizations to tackle embodied carbon challenges	<div><div></div><div>2019</div></div>
Engage with a CLF Regional Hub. This could mean: Attending presentations or working sessions and reporting back to the firm Co-chairing a hub	In 2021, two of our Stewardship Group members co-founded the Toronto Chapter of CLF and served until the end of 2022. In 2022 one of our Stewardship Group members joined the CLF Ottawa chapter and helps to organize regular webinars and events focused on reducing embodied carbon. All Entuitive staff are encouraged to attend.	<div><div></div><div>2021</div></div>
Provide narrative outlining plans for minimum (2) firm-wide presentations per year on the topic of embodied carbon.	Our Education Series L&L will incorporate multiple presentations on the topic of embodied carbon, due to launch later in 2023 and continue into 2023	<div><div></div><div>ONGOING</div></div>
Share the SE 2050 library of resources with technical staff.	We have a folder on our server accessible to all staff containing external education materials, a library of our own resources, and a link to the SE 2050 library of resources.	<div><div></div><div>2022</div></div>
Share embodied carbon reduction strategies with your firm as outlined in Top 10 Carbon Reducing Actions for Structural Engineers document produced by SE 2050.	<p>The Stewardship Group has developed Cheat Sheets with embodied carbon reduction strategies, a structural Project Sustainability Guide, a BES Project Sustainability Guide, a GWP in EPD Guide for Envelope, One Page Primers on Sustainability Building Standards, LCA tools, and resources. We have shared these with our structural engineering and technical teams. In addition, the ECAP will be shared and discussed with all staff.</p> <p>These technical resources will continue to be updated regularly, as necessary.</p>	<div><div></div><div>2021 - 2023</div></div>

3.2

REPORTING GOALS & ACTIONS

REQUIREMENTS

Submit a minimum of (2) projects per U.S. office with structural engineering services to the SE 2050 Database.

IMPLEMENTATION

We will report embodied carbon LCA data for at least two projects to the SE 2050 Database in 2023, pending approval to do so from the clients/owners.

STATUS



ONGOING

ELECTIVES

Incorporate our Structural Project Sustainability Guide into our QC Reporting process.

IMPLEMENTATION

To encourage the uptake of the Structural Project Sustainability Guide we developed, which shows teams how to account for embodied carbon at multiple stages of design and which describes detailed embodied carbon reduction strategies in design, we will incorporate a sign-off of the Guide in our QC Reporting process in 2023.

STATUS



ONGOING

3.3

REDUCTION GOALS & ACTIONS

ELECTIVES

Update your specifications to incorporate embodied carbon performance. Include embodied carbon in your submittal review requirements.

IMPLEMENTATION

Our specifications currently include a section requesting EPDs for concrete, steel, and timber materials, however the section is currently optional, and its inclusion is dependent on the project.

Our cast-in-place concrete specification currently includes an optional section on carbon-capture concrete; however, its inclusion is dependent on the project.

In 2023, we will work towards incorporating performance based metrics into our concrete specifications to include GWP reduction targets over the industry-average EPDs.

STATUS



2021



ONGOING

Communicate the embodied carbon impacts of different design options to clients with creative data visualization.

Include these visualizations in your Elective Documentation.

We conduct early embodied carbon material assessments as part of a low carbon strategy for clients on several projects. These reports are developed during the concept design stage to inform our clients of potential EC reduction opportunities in envelope and structural materials (based on both locally and remotely available materials).

The format is a standard report, however we intend to update our reporting templates to be more visual.



ONGOING

3.3

REDUCTION GOALS & ACTIONS CONT'D

ELECTIVES

Compare different design options with embodied carbon as a performance metric during the project concept phase. Explain what you did and what the results changed (if anything).

IMPLEMENTATION

On a new recreation centre in Alberta, the client was interested in comparing a structural steel system and a mass timber system in SD. LCAs of both proposed designs were conducted and reported back to the client. The timber design had lower GWP than the steel option. At the time of this report a decision had not been made on which system to select, though the client seemed very interested in the timber option.

STATUS



2023

Participate in a LEED, ILFI Zero Carbon, or similar project design charrette and speak to potential design considerations impacting embodied carbon.

Our Sustainable Performance Consulting team regularly hosts Zero Carbon workshops on projects and presents low embodied carbon strategies to the entire design team. At least one of our structural projects in 2022 presented Good/Better/Best options for the structural design speaking to embodied carbon and cost impacts.



2022

Incorporate biogenic materials on at least one project.

We currently have several projects in various stages of design and construction which incorporate mass timber or stick frame timber in the structural design.



ONGOING

Project case study sharing embodied carbon reduction successes and lessons learned.

Create a project-specific embodied carbon reduction plan.

In 2022, we completed a comprehensive study with a multi-disciplinary team on a hypothetical net zero carbon MURB in Toronto. Our team tackled the structural design and embodied carbon LCA work.

The results from our study can be found on our website. The entire Low Carbon Now study can be accessed on BDP Quadrangle's website here.



2022

Create an Embodied Carbon/ Zero Carbon section in our Structural Schematic Design report template.

In 2023, we will update our SD report template to include a section on embodied carbon/zero carbon which will speak to the importance of targeting reductions in structures and will propose several strategies which the project engineer can select from based on what would be most appropriate for their project. This will start the conversation earlier in the project with the architect and design team on embodied carbon reduction strategies to investigate as design progresses.



ONGOING

3.4

ADVOCACY GOALS & ACTIONS

REQUIREMENTS

Describe the value of SE 2050 to clients. How can your design teams collaborate to reduce embodied carbon? At your option, attach any associated marketing materials.

IMPLEMENTATION

In 2022, we updated our marketing collateral to make it clear that we are signatories to the SE 2050 Commitment and have provided a brief description of the importance of making the commitment.

We will include a slide in all our future presentations indicating that we have signed the SE 2050 Commitment and describe what that entails and encourage support from the groups we present to.

STATUS



2022



ONGOING

Publicly declare your firm as a member of the SE 2050 Commitment however you see fit.

The Sustainable Performance page on our website indicates our commitment to SE 2050. We also posted about it on LinkedIn.

We will update our boilerplate proposal documents to include mention of our commitment to SE 2050 and a brief overview of the commitment.



2022



ONGOING

ELECTIVES

Give an external presentation on embodied carbon that demonstrates a project success or lessons learned.

IMPLEMENTATION

In 2022, we delivered two client-focused embodied carbon L&Ls, and one conference presentation on low carbon concrete. We presented at a timber-focused conference in the fall speaking on studies looking at timber, fire engineering, building envelope, embodied carbon, and operational carbon.

In collaboration with the Low Carbon Now multi-disc team, and through the CLF Toronto Chapter, we presented our structural embodied carbon findings of the Low Carbon Now study to the Toronto community in person, and to the larger community online. The results of the study showed design changes that can be made to the structural design of MURB to reduce material volume, as well as lower carbon materials that can be used to further reduce embodied carbon.

STATUS



2022



2023



ONGOING

Engage with structural material suppliers in your region to communicate the importance of EPDs and low-carbon material options.

We have ongoing conversations with concrete suppliers in the different regions where we work to ask about lower carbon concrete options and for EPDs of those mixes. We also reach out to steel manufacturers to try to get the same data.

ELECTIVES

Engage with local, state, and federal governments to communicate the importance of low-embodied carbon procurement and construction policies, and provide expert testimony to this effect.

IMPLEMENTATION

In 2022, we were an Advisory Committee member for the study on Embodied Carbon Benchmarks for Part 3 Buildings in the Greater Toronto-Hamilton Area which has since informed changes to the Toronto Green Standard.

Starting in 2022, we are a Technical Advisory Group member for CaGBC's research project Burying Carbon in Buildings: Advancing Carbon Capture and Utilization in Cementitious Building Materials

Starting in 2022, Advisory Group member and Sponsor of U of T's Centre for the Sustainable Built Environment, which aims to influence policy around embodied carbon.



2022



ONGOING



ONGOING

Declare your firm as a member of the SE 2050 commitment on boilerplate proposal language.

We will update our boilerplate proposal documents to include mention of our commitment to SE 2050 and a brief overview of the commitment.

Would your firm be committed to sharing it's commitment to the SE 2050 program on proposals (where appropriate)?



ONGOING

With the owner or client, discuss a facility- or product-specific EPD requirement for structural materials.

We have provided embodied carbon material assessment reports and/or engaged in project conversations with the client and design team regarding procuring low carbon structural materials for several projects so far in 2022. Part of these discussions have included the EPD section in our specs requesting facility- or product-specific EPDs for the project. From this, we have learned that the availability of EPDs is very region-dependent, and not all markets can support these requests at this time. By asking for these documents, we are demonstrating a need for this information from manufacturers.

We have completed developing product LCAs and preparing EPDs for 4 concrete-based products.



2022-2023

Lessons Learned

The Stewardship Group, as well as Entuitive as a whole, has continued to advance our knowledge of embodied carbon in structures and what we can and should be doing to achieve meaningful reductions while also educating our industry peers and project design partners on best practices. We have learned the following lessons on our journey:

- ✓ Measuring embodied carbon of our structures at 100% CD allowed us to assess how the project performed, however it missed the opportunity for earlier intervention. Therefore, we are working towards incorporating LCAs at the SD stage where possible.
- ✓ Performing LCAs throughout a project can be time consuming, therefore, where budgets do not allow for performing multiple LCAs, we have developed a Project Sustainability Guide for structural projects which provides resources and design strategies engineers can use to minimize quantities and use lower carbon materials.
- ✓ Uptake of different tools and resources developed by the Stewardship Group can be varied, therefore incorporating the Project Sustainability Guide into our QC review and sign-off process will help ensure accountability from design teams.
- ✓ The level of understanding of embodied carbon across the firm was varied, therefore launching a targeted survey and then developing an education series based on the feedback was helpful to determine targeted areas for further education for all staff.

Entuitive studied the feasibility of a Passive House EnerPHit retrofit at this 18-storey residence. Our team reviewed the building envelope and structural components and determined remedial and retrofit work required to meet Passive House criteria and City Housing's new programming requirements.

During the design phase, Entuitive was responsible for designing building envelope details that performed at Passive House levels, while considering tight budget limitations and an aggressive timeline to meet funding requirements. Fibreglass window frames were proposed as a cost-saving measure, and Entuitive obtained a code variance from the City to allow this innovative approach for one of the first times in Ontario.

Entuitive extensively modelled envelope clear field and thermal bridge conditions, working iteratively with the Passive House Consultant to develop details that met rigorous standards, and providing substantial supporting documents for Passive House Certifier reviews.

Our team also created an air leakage testing plan, which included guarded floor blower door tests to verify air tightness as construction progressed, and a final whole building air leakage test to achieve Passive House certification. We reviewed shop drawings and conducted site reviews during the construction phase.

The Ken Soble Tower is one of the largest EnerPHit projects in the world.

Ken Soble Tower - Passive House Retrofit (EnerPHit)

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