

ASPECT

STRUCTURAL ENGINEERS

EMBODIED CARBON ACTION PLAN 2021

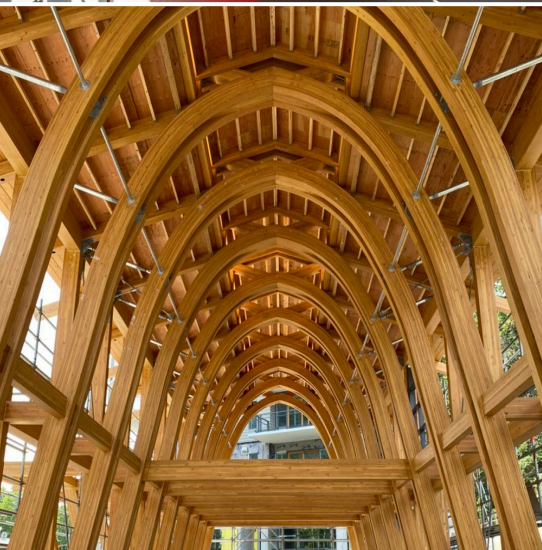


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INTRODUCTION

This **Embodied Carbon Action Plan** has been compiled in accordance with the SE2050 guidance. It has been written in checklist form with all requirements/electives outlined from the Program Requirements Guidance Document. This document will be updated annually to reflect targets achieved, changes to plans and lessons learned.

This version is the first and as such some of the requirements have not yet been met. It is our intention to meet these all within the first year of signing up to SE2050.



EMBODIED CARBON CALCULATION DATA

The results from embodied carbon calculations will be uploaded to SE2050 in Q3 and Q4 of 2021. Following training of engineers, we are hoping that the entire company will be able to carry out calculations and we will be able to produce results more consistently in 2022 and onwards.

EDUCATION

SE2050 Requirement	Date Achieved	Notes
Distribute firm-wide announcement of your firm's pledge to join the SE 2050 Commitment.	April 2021	Included as part of Sustainability update to whole company. Everyone is now aware of SE2050 and what our commitment is, though regular updates will be required.
Provide a brief narrative describing how your firm is promoting a firm-wide education program for embodied carbon reduction and the firm's commitment to SE 2050.		<p>Aspect has created a sustainability group which meets every 20 working days (Day 20). This group's primary function is to ensure that the company reduces the impact we have on the environment as structural engineers. It is doing this through the following tasks:</p> <ul style="list-style-type: none"> • Researching alternative construction methods/materials • Developing internal embodied carbon calculator (Canadian specific) • Altering the tool to have figures relevant to US and Europe • Researching specific areas within the carbon calculation to understand where the best/easiest savings can be made • Introducing embodied carbon calculations to building permit checklists and independent reviews • Spreading the word regarding embodied carbon and EPDs to the industry to encourage further progress • Regular company-wide updates to ensure everyone is aware of the current standards, methodologies etc. • Calculate enough of our own projects that we can understand where savings can be made • Researching concrete and cement alternatives

EDUCATION

SE2050 Requirement	Date Achieved	Notes
Nominate an Embodied Carbon Reduction Champion for your firm.	March 2021	Ross Jardine has been nominated.
Set a date within the first year to present the “Embodied Carbon 101” webinar to your firm. Include this resource into your orientation/onboarding programs.	November 2020	To be added to onboarding checklist for all new starters. Those who have started before this has been created, a link to the recorded sustainability and embodied carbon presentation is given so they can watch it in the first couple of months of working.
Minimum (1) additional elective to educate your firm about embodied carbon and a narrative of its significance*.	December 2020	See below.
SE2050 Elective	Date Achieved	Notes
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.	2020-2021	Ross Jardine is regularly attending CLF webinars – averaging 1 every two months. He also attended a roundtable discussion with CaGBC (Canadian Green Building Council) which discussed the opportunities and challenges in embodied carbon as part of environmental policy. Other members of sustainability group are also attending webinars but less frequently.
Share the SE2050 library of resources with technical staff.	March 2021	SE 2050 website and resources are shared on our internal intranet for easy access.
Nominate a minimum of (1) employee per office to participate in a CLF Community Hub.	December 2020	Ross Jardine is an active participant of CLF Vancouver and frequently posts on the forum.

EDUCATION

SE2050 Elective	Date Achieved	Notes
Provide narrative outlining plans for minimum (2) firm-wide presentations per year on the topic of embodied carbon.	April 2021	1st presentation has been given outlining our plan and the bespoke embodied carbon tool. 2nd presentation to be given toward end of Q3.
Present the document, "How to measure and report embodied carbon" to all technical staff.	February 2021	A similar document from IStructE has been circulated. This is the same document which is the framework for our embodied carbon calculator
Initiate an embodied carbon interest group within your firm and provide a narrative of their goals.	January 2021	Sustainability group was formed in January 2021.
Provide a narrative of how the Embodied Carbon Reduction Champion will engage embodied carbon reduction at each office. (intended for multi-office firms.		We are aiming to get someone in our Toronto office up to speed with the plan and calculation so they can champion the east coast. Similarly with our European office.

REPORTING

SE2050 Requirement	Date Achieved	Notes
Provide a narrative on how your firm plans to measure, track, and report embodied carbon.	November 2020 and ongoing	<ul style="list-style-type: none"> • We have a live internal embodied carbon calculation tool that can be used on any project. • If it has been modelled in 3D (Revit) then the material quantities can be obtained easily through a schedule included in every new project • If not 3D then hand calcs (aided by spreadsheets) can determine material quantities • The results from the tool can be used internally or can be issued externally in report form • The ECC report explains the entire process and why it is being done. It's also where any comparisons can be made between schemes, material types, locations etc. • The results are reviewed by the sustainability team before the relevant information is included in our internal ECC dataset • Results are collected and batch uploaded to SE2050
Describe the internal training for embodied carbon measurement you provided or will provide.	April 2021 and ongoing	<ul style="list-style-type: none"> • The tool is saved on our internal intranet, along with guides on how to use it • An internal education seminar was done when the tool was released explaining how to use it and why we're doing the calculations. This was done on Zoom and is recorded so can be accessed at any time • If any project requires an EC calculation, then the project engineer is to reach out to the sustainability team for guidance on using the tool • As more projects require this, we're anticipating that it will become more routine and project engineers will be able to carry out the calculations without guidance

REPORTING

SE2050 Requirement	Date Achieved	Notes
Submit project data to the SE 2050 database. See Guidance Document for details.	Q3/Q4 2021	We will submit data in Q3/Q4 2021.
SE2050 Elective	Date Achieved	Notes
Submit all projects to the SE 2050 Database	Q3/Q4 2021	To be submitted.
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.		<p>This has been asked of several projects and although we have had positive feedback and clients are keen to discuss sustainability, official goals have not been set. Generally, there is a goal of being as sustainable as possible, but within the limitations of the project scope. It is our intention to encourage ambitious but achievable targets in early meetings on projects going forward.</p> <p>In addition to this, we are involved in the writing of a client's list of requirements for several Design Build projects and are specifically looking at including embodied carbon reductions and sustainability incentives. These will be considered alongside cost and build time as part of the tender scoring process.</p>

EMBODIED CARBON REDUCTION STRATEGIES

SE2050 Requirement	Date Achieved	Notes
Set an embodied carbon reduction goal for the coming year and an implementation narrative. Qualitative goals focused on education are appropriate for the first year.		<p>First, we plan on getting at least 20 projects calculated so we have our own base to work from. Then, we will be aiming for all our new projects to be below the average of the original 20. This is quite arbitrary, but it is a reasonable way to start and learn from previous projects. We are also going to compare new projects against other benchmarking data (including IStructE SCORS and RIBA) with the aim of keeping the embodied carbon rate of the structure in A1-5 to below 150kgCO₂e/m² (this is an approximate target A rating on SCORS).</p> <p>We intend to review this regularly as the targets will likely shift each year with more information on materials and hopefully as policies dictate certain requirements on reporting.</p>
For second year's ECAP and beyond, provide a narrative about what you have learned about embodied carbon reduction in the past year. Describe successes and misses to help the program improve.		To be complete in year 2.
Minimum (1) additional elective you undertook to reduce embodied carbon in your designs, why you chose the elective and its significance*	January 2021	See below.

EMBODIED CARBON REDUCTION STRATEGIES

SE2050 Elective	Date Achieved	Notes
Incorporate data visualization into your ECAP. How are you looking at data to make informed design decisions and communicate design options to your clients?	March 2021	See two sample pages from our EC report which is issued to clients/architects. One of the key elements of this report is the comparisons sheet which gives the reader some context to the numbers which otherwise might be meaningless on their own.
Complete a system embodied carbon design comparison study during the project concept phase.	March 2021	This has been done on multiple projects in design phase to compare a concrete building v a concrete timber hybrid building as has helped sway a client to choose a more favorable material in terms of carbon, even if there was a cost impact.
Incorporate biogenic materials on at least one project annually.	January 2021	Most of our projects include wood products, so we're doing good there!

ADVOCACY

SE2050 Requirement	Date Achieved	Notes
Provide a narrative about how you plan to share knowledge and data to accelerate adoption of embodied carbon reduction.	Ongoing	<ul style="list-style-type: none"> We are committed to sharing Data with SE2050 as well as with IStructE who are running a similar scheme We are also approaching and being approached by various architectural firms which we are collaborating with to share our understanding and give our expertise on the structural elements We are encouraging all engineers to speak to contractors and suppliers to get them to consider sustainable options and highlight the need for EPDs
Describe what SE2050 is to clients. At your option, attach any associated marketing materials.	Ongoing	We include a section on collaboration and data sharing within the ECC report which is issued to clients. This talks about our commitment to SE2050 and has direct links to SE2050.org. An online article (website/linked/social media) will also include this and is to be issued this year.
Declare your firm as a member of the SE2050 Commitment on boilerplate proposal language.	Ongoing	This is included in our proposals and will be included on our published article and on the website this year.

ADVOCACY

SE2050 Elective	Date Achieved	Notes
Provide a narrative about how you plan to share knowledge and data to accelerate adoption of embodied carbon reduction.		<p>We are planning on publishing an article outlining what embodied carbon is, how it's calculated and the tool we have built. This is not at all groundbreaking information but it's more to encourage others to think about it and be aware of the process. It will be published on our website and social media.</p> <p>Following that we will give regular updates on our progress with reductions and how we are addressing the challenges we face as engineers and in the industry.</p> <p>We will also share articles from other engineers, architects and the industry generally to promote embodied carbon reduction.</p>
Start an embodied carbon community of practice or mentorship program in your office.		Included as part of the sustainability group.
Publish a case study or article on embodied carbon.		Article has been written and due to be published soon (as of May 2021).

EXTRACTS FROM EMBODIED CARBON REPORTS

The proceeding pages show extracts from our Embodied Carbon Report which is issued to clients/architects, or whoever is interested in the information.

Cement Replacements (CR) and potential savings are given below, including anticipated cost implications and impact on curing times.

CR:	% CR	CO2 Reduction	Cost Implication	Curing Time
Fly Ash	15-29%	5-25%	Low	Similar
	30-40%	15-35%	Low	Similar
Slag Cement	25-34%	10-30%	Low	Similar
	35-50%	20-40%	Low	Longer
ECO Pact	Propriety mix	30-90%	Moderate-High	Longer

A comparison between the proposed building with standard concrete mixes and 30-40% Fly Ash and 35-50% Slag Cement is given in the results.

WHAT IS COVERED IN THIS CALCULATION?

The calculation covers the structural elements only and includes but is not exclusive to those given in the lists below.

Substructure:	Foundations	Superstructure:	Columns
	Slabs on Grade		Beams
	Basement Walls		Slabs/Floor Plates
	Grade beams		Stairs and Ramps
	Pile Caps		Structural Walls
			Bracing Elements

The calculation covers Cradle to Practical Completion - LCA modules A1-A5 (Product, Transport and Construction). These are the only modules calculated as they are the most easily and accurately quantifiable and they are what we can directly influence. Information on the end-of-life scenarios for materials cannot be appropriately determined by structural engineers.

HOW IS EMBODIED CARBON CALCULATED?

The calculations are in essence very simple. Volumes or weights of all the structural materials are obtained through building models or take offs from drawings. These quantities are used to determine carbon values for modules A1-A3, A4 and A5 (Production, Transport to Site and Construction respectively).

A1-A3 PRODUCTION:

Quantities of each material are multiplied by relevant Global Warming Potential (GWP) rates to get the embodied carbon for production. This rate includes the mining, harvesting, or extracting of the raw materials, the transport from extraction to the location for manufacture, and the energy used to produce it. The GWP rates are published by manufacturers and industry associations in the form of Environmental Product Declarations (EPDs) which follow the same regulated procedure for accounting and reporting values.

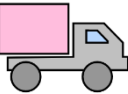
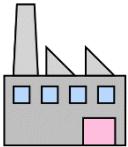
Unless otherwise noted, global warming potential (GWP) rates for materials in this calculation are based on industry averages from the relevant EPDs (EPDs and further information on the calculation can be made available on request).

A4 TRANSPORT:

Similar to the production module, the transport value is determined through a rate per unit weight of material which is based on the assumed distance between production facility and site, and the method of transport.

A5 CONSTRUCTION:

Embodied carbon in construction accounts for the site activities (including fuel for machinery, power for site offices, lighting etc.) and the construction waste. The rate applied to site activities is based on an assumed overall construction cost and the waste rates are applied to each material. Although these are quite vague estimates, the value of construction based embodied carbon remains a small proportion of the total embodied carbon, and therefore the rough estimates are deemed adequate.



RESULTS – SUMMARY

Below are the main results from the embodied carbon calculation. Refer to the information sheets provided for explanations on how the calculations are made and what the results mean. Values are estimates and should be used as approximations to aid design decisions only.

Modules A1-A5 (Substructure and Superstructure)

TOTAL EMBODIED CARBON = 3,075,943 kgCO₂e

This is equivalent to:



1875 people’s consumption of meat, dairy and beer for 1 year



3770 one-way flights from New York to London



770 average family cars running for 1 year



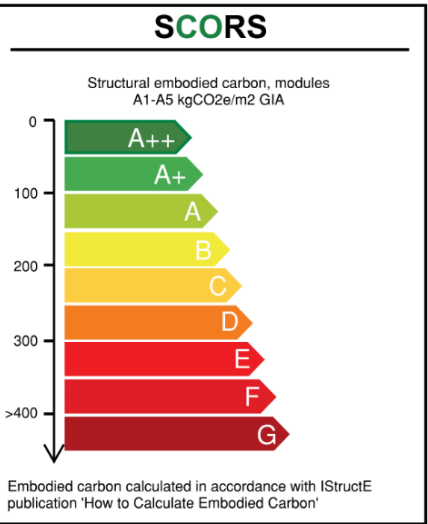
161,086 mature tress absorbing CO2 in 1 year

EMBODIED CARBON RATE = 192 kgCO₂e/m² GIA

(Total Embodied Carbon divided by Gross Internal Floor Area)

SEQUESTERED CARBON = -93 kgCO₂e/m² GIA*

*see Sequestration section in proceeding information sheet for clarification on this value



IStructE – Setting Carbon Targets - An Introduction to the Proposed SCORS Rating Scheme³.

SCORS rating: B

This building is rated **B** on the Structural Carbon Rating Scheme (SCORS) which is **below** average and is currently within targets for net zero at 2050. By 2030 all buildings will be targeting A rating.

The average building is currently rated D.