ASPECT STRUCTURAL ENGINEERS

EMBODIED CARBON ACTION PLAN 2022

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SECTION 1 | INTRODUCTION

This **Embodied Carbon Action Plan** has been compiled in accordance with the SE2050 guidance. This is the second version and follows the initial plan outlined in August 2021. 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 learnt.



EMBODIED CARBON CALCULATION DATA

The results from embodied carbon calculations in period August 2021 – August 2022 will be uploaded to the SE2050 database in Q3 and Q4 of 2022. Following training of engineers, we are putting policies in place with the anticipation that the entire company will be able to carry out calculations and we will be able to produce results more consistently in 2023 and onwards.



SECTION 2 | 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.	Ongoing	 ASPECT has created a sustainability group with leads in all three offices (Vancouver, Toronto and Switzerland). 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: 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 companywide 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 Attending as many relevant and useful seminars, talks and CPD courses on sustainability and EC as possible Sharing what we have learnt with wider industry
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/on-boarding programs.	November 2020	Presentation given in November 2020. The recording of this, and all other sustainability presentations have been 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 joining the company.
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.
		Ross Jardine was also part of a group which put together a short video and infographics for developers aiming for Net-Zero tall multi- unit residential buildings.
		Paul Paquet also joined ASPECT in 2021 and has been attending CLF seminars in Toronto.
Share the SE 2050 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. Paul Paquet is a member of the Toronto regional hub as of 2021
Provide narrative outlining plans for minimum (2) firm- wide presentations per year on the topic of embodied carbon.	Q3/Q4 2022	 Q3 2022 - Update on ECC tool and current requirements in Canada and US Q4 2022 - Presentation to company showing our best and worst performing buildings (in terms of embodied carbon) and discussion on the reasons for these results.
Present the document, "How to measure and report embodied carbon" to all technical staff.	March 2022	A similar document from IStructE has been circulated. This is the same document which is the framework for our embodied carbon calculator. Revision 2 of this document is now available March 2022.
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. This was slimmed down in 2022 and is now one lead from each office.
Provide a narrative of how the Embodied Carbon Reduction Champion will engage embodied carbon reduction at each office. (intended for multi-office firms.	February 2022	Aim for previous year was to get someone in our Toronto and Switzerland office up to speed with the plan and calculation so they can champion the east coast and Europe. This has now been achieved and they are driving the sustainability engagement in their respective locations.



SECTION 3 | REPORTING

SE2050 REQUIREMENT	DATE ACHIEVED	NOTES
Provide a narrative on how your firm plans to measure, track, and report embodied carbon.	July 2022	 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 and given a sanity check before the relevant information is included in our internal ECC dataset Results are collected and batch uploaded to SE2050 We are working with University of Toronto to help put together a large database of building material use. This involves sending multiple projects to the university for them to carry out their own quantity calculations and embodied carbon calcs.
Describe the internal training for embodied carbon measurement you provided or will provide.	April 2021 and ongoing	 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
Submit project data to the SE 2050 database. See	Q3/Q4 2022	We will submit data in Q3/Q4 2022.

Guidance Document for details.



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SE2050 ELECTIVE	DATE ACHIEVED	NOTES
Submit all projects to the SE 2050 Database	Q3-Q4 2022	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.	March 2021	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 intension to encourage ambitious but achievable targets in early meetings on projects going forward. 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.



SECTION 4 | 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.		Plan for end of 2022 is to have 40 projects calculated internally so we have our own base to work from. With this information we will start to create our own internal studies, targets and aspirations for projects, highlighting trends and general approaches which are favorable for embodied carbon. 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). 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.
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.		 In the first year of SE2050 we have learnt some key take aways from the calculations, studies and seminars: Concrete is a major issue and should be tackled by reducing its use in building as much as possible, then by reviewing the material specification We have implemented GWP rate to our concrete specifications however this is not being reviewed properly by contractors or concrete suppliers yet as we have received no EPDs on tendered projects. We intend to pursue this further in the coming months. Early engagement in projects has proven to be really beneficial. We had input on a project prior to re-zoning which meant we could help determine the building shape and basic massing, eliminating some transfer elements and reducing over concrete volume. Lightwood frame buildings perform extremely well in terms of embodied carbon. We should be encouraging their use as much as possible over mass timber There is significant uncertainty about the construction activities stage of LCA. Further studies/assessment is required to gain greater accuracy
Minimum (1) additional elective you undertook to reduce embodied carbon in your designs, why you chose the elective and its significance*.	January 2022	We are currently working with one of the major global cement producers to develop a new approach to timber-concrete-composite systems and the concrete used in them. Goal is to reduce the

embodied carbon by 75% and increase the structural performance

and workability of concrete used.



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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?	July 2022	Extract of concrete general notes has been included at the end of this report. ASPECT now include GWP maximums with all concrete specifications. Targets have been determined through CRMCA industry wide EPDs and will be updated as new EPDs are issued. It is acknowledged that some suppliers will not have EPDs or the resources to determine GWP of mixes. In these situations, the introduction of this performance specification allows for the conversations with suppliers to begin and will raise awareness of GWP, and the desire/requirement of lower impact mixes.
Complete a system embodied carbon design comparison study during the project concept phase.		Not done in period since last ECAP but this was done on multiple projects in 2021 comparing 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.	2022	As 2021, most of our projects include wood products, so we're doing good there!



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SECTION 5 | 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	 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 We are actively involved with CLF and are considering speaking at local and national events We are committed to providing projects for University of Toronto Study on building materials and embodied carbon 		
Describe what SE 2050 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 SE 2050 Commitment on boilerplate proposal language.	Ongoing	This is included in our proposals and will be added to our website.		
SE2050 ELECTIVE	DATE ACHIEVED	NOTES		
Provide a narrative about how you plan to share knowledge and data to accelerate adoption of embodied carbon reduction.		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. 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. We will also share articles from other engineers, architects and the industry generally to promote embodied carbon reduction.		
Start an embodied carbon community of practice or mentorship program in your office.		All new engineers will be carrying out embodied carbon calcs to get them well versed with the process and driving the sustainability agenda for the company.		
Publish a case study or article on embodied carbon.		An updated article on our approach and what we have been doing so far will be published in Q3 2022.		



APPENDIX – CONCRETE GENERAL NOTES EXTRACT

	TYP. STRUCT COMPONENT, SHOWN ON D	JRAL OR AS RAWINGS	MIN. 28 DAY STRENGTH, MPa	MAX. AGGREGATE mm (in)	EXPOSURE CLASS	MAX. ALLOWABLE GWP ⁷ (kgCO₂e/m ³)	
	Interior		25	20 (3/4")	N 1	215	
Slabs on Grade	Exterior		32	20 (3/4")	C2 ²	260	
Olade	Interior parkir areas	ng/vehicle	25	20 (3/4")	C4 ³	215	
	Spread and s	trip footings	25	20 (3/4")	N 4	215	
Foundations	Raft foundation	on, interior	30	20 (3/4")	N	235]
	Raft foundation parking/vehic	on, as le surface	50	20 (3/4")	C-XL 5	370]
	Interior, non-	parking	Per plan, 30 MPa min.	20 (3/4")	Ν	Table A	
Suspended Slabs. Slab	Exterior without membrane, non-parking		Per plan, 30 MPa min.	20 (3/4")	F1 ⁶	Table A	N
Bands, and Beams	Exterior with membrane, non-parking		Per plan, 30 MPa min.	20 (3/4")	F2 7	Table A	BEL(
	At parking/vehicle areas (interior or exterior)		Per plan, 35 MPa min.	20 (3/4")	C1 ⁸	Table A	BLES
	Interior		Per plan, 30 MPa min.	20 (3/4")	Ν	Table B	F. TAI
Columns and Walls	Exterior		Per plan, 30 MPa min.	20 (3/4")	F2 ⁹	Table B	REI
	At parking/vehicle areas (interior or exterior)		Per plan, 35 MPa min.	20 (3/4")	C1 10	Table B	
	Interior		20	14 (9/16")		215	
Concrete	Exterior		32	14 (9/16")	See note 9.c	260	1
11 3	For use with steel decking		25	14 (9/16")		215]
Concrete Masonry	Grout		12.5	10 (3/8")	-	-	
TABLE A (SU	SPENDED ELI	EMENTS) 🧲	TABLE B (CC	LUMNS AND	VALLS) 11		
	MAX. ALLOV (kgCO	/ABLE GWP ₂e/m³)		MAX. ALLOV (kgCO	/ABLE GWP ₂e/m³)		
STRENGTH	EXPOSURE CLASS		STRENGTH	EXPOSURE	CLASS		
(MPa)	N	F1,F2,C1	(MPa)	N	F1,F2,C1		

GWP VALUES SELECTED FROM CRMCA EPDS. THESE ARE EQUIVALENT TO MIXES THAT WE CONSIDER CAN BE ACHIEVEABLE FOR THE APPLICATION.

THE INCLUSION OF GWP ON OUR CONCRETE SPECIFICATIONS IS TO START THE CONVERSATION WITH THE SUPPLIER. LARGER SUPPLIERS ARE AWARE OF THIS AND CAN ACCOMMODATE IT BUT SMALLER SUPPLIERS ARE STILL IN THE EARLY DAYS OF UNDERSTAND AND ACCOUNTING FOR GWP.

SUSPENDED ELEMENTS GENERALLY WILL REQUIRE MORE CEMENT THAT SCMs

TO ENSURE THAT EARLY STRENGTH IS ACHIEVED