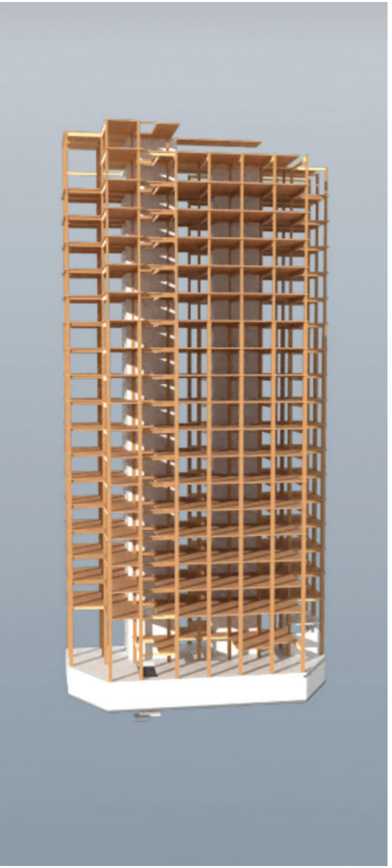
EMBODIED CARBON ACTION PLAN / 2024

setting the bar higher

Saying we “think like an owner” means that on every project we endeavor to create designs that are material-use efficient, easy to build, and fully aligned with the project goals. We don’t over-design — it’s bad for the budget and bad for the planet.

Coughlin Porter Lundeen has delivered sustainable design solutions since inception through various iterations of initiatives like LEED, LBC, WELL, etc. We have supported design and construction teams and kept current with these programs as they evolved (focusing on any structural or civil nuances) and understand the value they bring to the industry and to the world.

Alongside our AEC partners, we aim to lower the carbon footprint of the structures we design using a holistic and data-driven approach. When we collectively raise the bar the market responds. We are eager in our commitment to the SE 2050 Challenge and the impacts we can make on the built environment.



a measured approach

The building sector accounts for nearly half of greenhouse gas emissions — as structural engineers we can contribute in a pivotal way by tracking the materials we use in our structures to dial down carbon intensity. With the adoption of SE2050, we help project teams create whole building Life Cycle Assessments (LCAs).

Coughlin Porter Lundeen played a pioneering role with the implementation of the Embodied Carbon in Construction Calculator tool (EC3). Like LEED in its infancy, the EC3 tool gained traction and contributed to a significant rise in the number of manufacturers submitting Environmental Product Declarations (EPDs) so there is more transparency in our industry.

With enticing eco-conscious options like mass timber and more transparency with established materials like concrete and steel, coupled with modeling tools like Athena and Tally, we model and measure to reduce embodied carbon in our structures.

sustainability task force

Coughlin Porter Lundeen's **Sustainability Task Force includes 30 team members.** They leverage the latest trends and technologies and inspire an internal culture that encourages exploration and discovery of ways to improve design.

Laura Lindeman uses her strong analytical and design skills to provide effective and appropriate sustainable solutions for Coughlin Porter Lundeen projects.

She participated in the early adoption of the EC3 tool for the 3 million SF Microsoft Redmond East Campus Modernization and leads integration of this tool as a firm-wide standard for carbon tracking.

In support of the firm’s commitment to the SE2050 Challenge, Laura coordinates the tracking and reporting of project embodied carbon levels. She manages the assessment and calculation of the embodied carbon footprint for current projects and is responsible for setting future reduction goals. Her advocacy efforts include leadership of the firm’s Sustainability Task Group, membership in the NAIOP Sustainable Development Committee, and active involvement with the Carbon Leadership Forum Seattle Hub.

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structural embodied carbon benchmarking

PROJECT: Mercer International Middle School
MATERIAL: Mass timber and steel
SIZE: 3 Stories | 175,000 SF
COMPLETION: 2025

/ New steel-framed and mass timber multi-story building with capacity for 1,000 students in grades 6-8.

/ The 3-story classroom wing and the library feature mass timber: glulam beams and columns and CLT decking.

/ Sustainable strategies included choosing mass timber systems where possible and requiring EPDs for structural materials that showed GWP reductions from industry baselines.

/ The LCA helped verify our internal benchmarking for embodied carbon for a K-12 mass timber project.

PROJECT: CWU North Academic Complex
MATERIAL: Steel
SIZE: 4 Stories | 104,265 SF
COMPLETION: 2025

/ New College of Arts and Humanities building offers a 240-seat lecture hall, 20 classrooms, 110 faculty offices, and a dean's suite.

/ Mass timber features of glulam columns and beams plus CLT wall and roof panels in the central 4-story atrium are both a carbon reduction strategy and promote biophilia.

/ Increased concrete cure times specified for foundations and grade beams reduce the carbon intensity in concrete elements.

/ The LCA helped verify our internal benchmarking for embodied carbon for this higher education project constructed of steel.

structural embodied carbon benchmarking

PROJECT: 35 Stone
MATERIAL: Mass timber and concrete
SIZE: 5 Stories | 177,400 SF
COMPLETION: 2024

/ Through the City of Seattle's Living Building Challenge program, the building qualified for an additional 15 feet of height. Advanced sustainability measures include salvaged and locally sourced building materials, a 250,000-gallon rainwater cistern, rooftop beehives, and a 100-kVA solar panel array.

/ Targeting LBC performance petals Place, Beauty, and Materials.

/ Multiple structural options considered carbon sequestration, cost, and complex programming needs

/ The team chose a DLT floor system to significantly reduce the building's carbon footprint.

/ The LCA helped verify our internal benchmarking for a concrete and mass timber office project

PROJECT: Kimball Elementary School
MATERIAL: Steel
SIZE: 3 Stories | 93,335 SF
COMPLETION: 2023

/ Replacement school provides space for 650 PreK-5 students within a U-shaped, 3-story learning campus that steps down to a tall, single-story commons and gymnasium wing.

/ The structural system includes a buckling restrained brace (BRB) lateral system with composite steel floors and metal deck roof over steel joists.

/ Designing the building with an efficient structural layout was an important strategy to keep the embodied carbon intensity as low as possible.

/ The LCA helped verify our internal embodied carbon benchmarking for a K-12 steel project.

2024 embodied carbon action plan

EDUCATION

Coughlin Porter Lundeen is committed to continuously improving our firm-wide understanding of the environmental impacts of our projects. Civil and structural engineers work together within the Sustainability Task Group to determine best practices and educate the staff in some of the ways shown below.

/ Present to the company how we are promoting a firm-wide education program for embodied carbon reduction and the firm's commitment to SE 2050. The recorded presentation will be provided as a resource in our orientation/on-boarding programs.

/ Share embodied carbon reduction strategies with Coughlin Porter Lundeen as outlined in Top 10 Carbon Reducing Actions for Structural Engineers document produced by SE 2050.

/ Continuously update and distribute the SE 2050 library of resources to Coughlin Porter Lundeen technical staff.

/ Attend monthly external education programs provided by the Carbon Leadership Forum (CLF) and continue ongoing participation in the CLF Seattle Community Hub.

/ The Sustainability Task Group meets in-house periodically to learn and share sustainable practices on projects.

/ Share internal training guides for embodied carbon calculations.

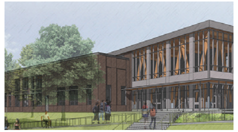
REPORTING

Tally in the primary life-cycle assessment (LCA) tool used in-house for measuring, tracking and reporting structural embodied carbon data. Our Tally LCAs are performed at the end of design close to 100% Construction Document issuance. We use material quantities from our structural Revit model and include life cycle stages A-D. Athena, Tally CAT, One Click LCA, and the EC3 tool are also used during different stages of design to help make informed carbon reducing decisions for our projects.

Coughlin Porter Lundeen states EPD requirements in our material specifications. We verify the availability of EPDs for our materials with the EC3 tool. EPDs must show Global Warming Potential (GWP) limit values in our material specifications. We use those GWP limit values in our embodied carbon calculations.

/ Submit four projects to the SE 2050 Database.

/ Internally compare embodied carbon emissions from multiple projects. Identify data which contributes the most in analysis and communicate findings to the firm.



Mercer International Middle School

Central Washington University North Academic Complex

35 Stone

Kimball Elementary School

EMBODIED CARBON REDUCTION STRATEGIES

As sustainable practices evolve, we seek creative solutions that provide both economic and environmental value. Coughlin Porter Lundeen embraces the expanded sustainable design role we can play in projects.

SHORT-TERM

/ Calculate Coughlin Porter Lundeen's average benchmark for embodied carbon for different building types, materials, and market sectors.

/ Modify standard structural specifications to allow longer concrete curing times for foundations, shear walls, and columns where possible.

/ Communicate embodied carbon impacts of different design options to clients with creative and effective data visualization.

/ Increase the use of mass timber in projects.

/ Request EPDs from manufacturers to make better informed structural material decisions.

LONG-TERM

/ Embrace carbon-reduced structural materials as they are adopted into code.

/ Perform life cycle assessment (LCAs) for most projects.

/ Produce several carbon-neutral designs.

ADVOCACY

Sustainability is a topic of growing importance to many clients. Coughlin Porter Lundeen leads conversations in early stages of design to help identify key contributing factors in minimizing embodied carbon.

/ Describe the value of SE 2050 to clients, focusing on how – together – we can collaborate to drive adoption.

/ Share the firm's commitment to SE 2050 on our company website and include in proposal language.

/ Start an embodied carbon community of practice and mentorship program within Coughlin Porter Lundeen.

Material	Optional Supplier Carbon Reducing Strategies	Material Use	% of Total Carbon in Baseline	Coughlin Porter Lundeen Carbon Reduction Strategy	Suggested GWP Reduction from 2021 CLF Baseline	Limit Availability	Total Carbon Reduction with Strategy (kg CO2e)	Equivalent to X acres of US forest sequestering carbon for 1 year
CONCRETE	Use type 1L cement Replace % of cement with SCMs	Foundations	7%	Extend cure time from 28 to 56 days	range of 10-40% reduction (35% recommended - 234 kgCO2e/cy)	490 mixes between 4 suppliers in WA	32,000	**38**
		Slab-on-grade	13%	*Not able to make structural changes because contractor needs high early strength for construction*	range of 10-40% reduction (25% recommended - 270 kgCO2e/cy)	746 mixes between 8 suppliers in WA	56,000	**66**
		Slab on metal deck	6%	Extend cure time from 28 to 56 days	range of 10-40% reduction (35% recommended - 234 kgCO2e/cy)	490 mixes between 4 suppliers in WA	27,000	**32**
		Precast walls	11%	Extend cure time from 28 to 56 days	range of 20-45% reduction (35% recommended - 303 kgCO2e/cy)	313 mixes between 3 suppliers in WA	64,000	**76**
		Misc. MEP pads	2%	Extend cure time from 28 to 56 days	range of 10-40% reduction (35% recommended - 234 kgCO2e/cy)	490 mixes between 4 suppliers in WA	10,000	**12**
		Linac walls	17%	Extend cure time from 28 to 56 days Reduce f'c from 5000 psi to 3000 psi or as required for exposure class	range of 10-40% reduction (35% recommended - 189 kgCO2e/cy)	74 mixes between 2 suppliers in WA	66,000	**78**
STEEL	Increase recycled content Utilize Electric Arc Furnaces	WF steel framing	14%	Provide an efficient beam layout to minimize steel beam tonnage	range of 20-50% reduction (35% recommended - 0.501 kgCO2e/lb)	13 options with EPDs in USA	70,000	**83**
		HSS steel framing	6%	Increase fy from 46 to 50 ksi	range of 5-35% reduction (25% recommended - 1.02 kgCO2e/lb)	26 options with EPDs in USA	18,000	**21**
		Metal deck	13%	Provide an efficient beam layout to minimize metal deck tonnage	range of 0-30% reduction (15% recommended - 1.2 kgCO2e/lb)	8 options with EPDs in USA	20,000	**24**
		Reinforcing bar	8%	Increase fy from 60 to 80 ksi where quantity can reduce	range of 0-50% reduction (35% recommended - 0.501 kgCO2e/lb)	33 options with EPDs in USA	48,000	**57**

In this building, where is most of the embodied carbon?

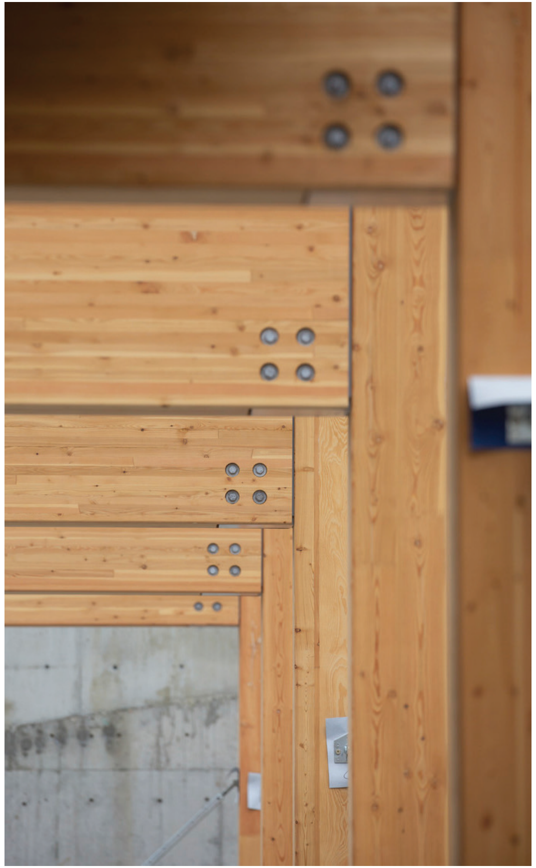
What can Coughlin Porter Lundeen do to reduce the embodied carbon?

What is a realistic carbon reduction goal range for this material used?

What carbon savings would this reduction goal achieve?

For Microsoft's East Campus Modernization, the team was able to achieve a 30% reduction in embodied carbon as compared to the baseline building by specifying performance-based concrete mix designs. This allowed mixes to reach their design strength at 56 or 90 days instead of the industry standard 28 days.

Using a low-cement concrete mix reduced the carbon footprint by 595,000 kg CO2e, equal to CO2 emissions from burning 1,400 barrels of oil.



sustainability for all

With projects struggling to stay within tight budgets in order to stay viable, people often assume sustainable design choices are off the table.

We believe that sustainability should be considered at every price point. This is the only way we can reach our SE2050 goals and truly make a positive impact on our environment.

We know how important it is to look at each project within its individual goals and constraints. Some projects can implement ultra-sustainable structural systems of mass timber and low cement concrete. Others will allow only approaches that don't increase cost, such as designing the building with an efficient layout to reduce overall material use, extending cure time for concrete items where it doesn't impact schedule, and specifying lower carbon materials that are readily available in our market.

This all-inclusive approach has taught us how to make all of our projects more sustainable, not just the ones with high price tags.