2025

SE 2050 Embodied Carbon ACTION PLAN

kpff

01

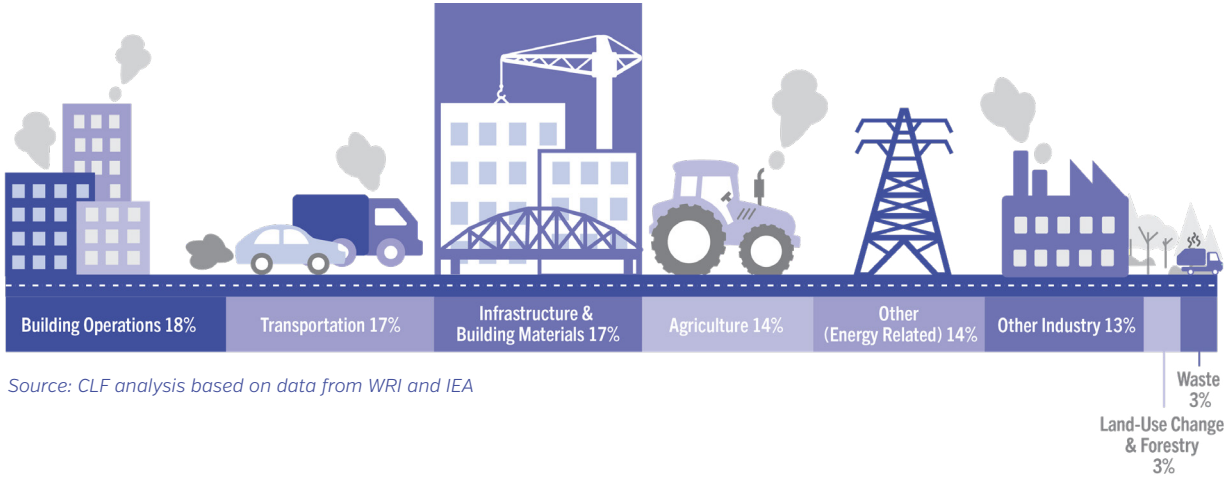
Introduction

KPFF recognizes and supports the SE 2050 Challenge vision statement that “all structural engineers shall understand, reduce, and ultimately eliminate embodied carbon in their projects by 2050.” As the SEI Board of Governors stated in their endorsement of the SE 2050 Challenge, we also “recognize the need for coordinated action across our profession to achieve the globally stated goal of net zero carbon by 2050.”

KPFF joined the SE 2050 Commitment in 2021, and we update our Embodied Carbon Action Plan (ECAP) annually to show what we have been doing during the past year and what our plans are for the next year.

The vision of SE 2050 directly aligns with the core values that have guided our organization successfully over the last 65 years. These values are relationships, trust, passion, excellence, and stability. The vision of the future contained within the SE 2050 program is one of **relationships** with our community locally and globally. It is a vision of providing **stability** and maintaining **trust** with future generations, recognizing that we play an essential role in reducing the embodied carbon (EC) that will impact future generations for the next 25 years and beyond. It exemplifies the **passion** we have as engineers to meet the challenges of today with new ideas and solutions. It requires the leadership and **excellence** to find and implement new carbon strategies that are truly effective and impactful.

Globally, the primary sources of greenhouse gas emissions are:



Source: CLF analysis based on data from WRI and IEA

Cover images: Portland International Airport, Ema Peter Photography

Project Highlight >>

Portland International Airport Terminal Core Redevelopment

Portland, OR

The Terminal Core Redevelopment project, a comprehensive expansion and modernization of Portland International Airport designed by ZGF Architects, both enhances the passenger experience and redefines possibilities in the sustainable design of aviation projects. The project includes a 200,000-square-foot expansion, a new 9-acre mass timber/steel seismically isolated roof, and a seismic retrofit of the existing terminal, all completed within and around a fully operational airport.

The Port of Portland made it a primary project goal to focus on sustainable materials and design, including the incorporation of mass timber into the new structures, the use of low-carbon concrete, and the reuse of the existing structure. By utilizing this multi-pronged approach to carbon reduction, the project avoided over 40 million kilograms of equivalent carbon emissions from the atmosphere when compared to a newly constructed baseline structure.

The 9-acre timber roof structure, composed of 3.5 million board feet of locally sourced mass timber, is the visual and sustainability highlight of the project. KPFF's design of the hybrid roof utilized mass plywood, arched long-span glulam beams, and a highly resilient design with seismic isolation bearings at the tops of the Y-columns.

The timber for the roof and interior concession structures was procured from a diverse array of local landowners and Pacific Northwest tribes within a 300-mile radius of the project site. ZGF led an unprecedented wood sourcing program, with each piece individually tracked to document forest conditions and to validate biogenic carbon sequestration.

This iconic expansion, which doubles the capacity of the airport, celebrates the beauty of the region and shows how valuable unique and creative structural solutions can be in achieving significant carbon reductions.

Images: Dror Baldinger

02

Embodied Carbon Leaders at KPFF

KPFF has two designated Embodied Carbon Champions for our firm: Molly Seto and Shana Kelley. However, **our leadership group for embodied carbon within our firm has had enormous growth** over the last few years. As we've expanded our focus on quantifying and making embodied carbon reductions on projects across our practice, several of our office locations have identified one or more leaders responsible for educating and advocating within their office. This distributed approach to leadership is essential in making sure we are constantly **growing our embodied carbon expertise** and that we are accounting for the regional differences of our projects.

SHANA KELLEY

Seattle, WA

MOLLY SETO

San Francisco, CA

REID ZIMMERMAN

Portland, OR

MATT HOFFMAN

Portland, OR

JANET RANF

St. Louis, MO

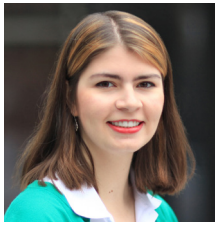
TYLER BICK

St. Louis, MO

CHAD SIMMS

Columbus, OH

ELLA YAZBECK



Seattle, WA

NICHOLAS MILEY

San Francisco, CA

KANE PITHEY

Los Angeles, CA

ALEX PLUMB

Los Angeles, CA

SARA ABOU KARROUM

Los Angeles, CA

MICHAEL DILLARD

Sacramento, CA

TAMARA CARDENAS

San Diego, CA

EMMA ELLRICH

Salt Lake City, UT

ERIC SCHAFFER

Des Moines, IA

03

Reduction Strategy

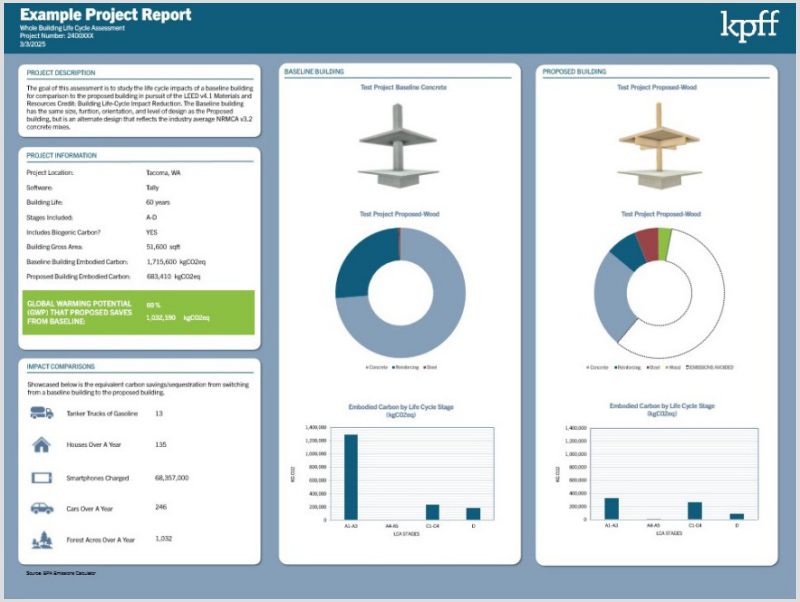
As we've implemented numerous reduction strategies on projects over the last few years, we've learned a great deal about how to **effectively and economically reduce carbon** both in our designs and in our specified materials.

This year we've developed both **short- and long-term goals** for reductions on our projects.

Short-Term: In order to set reduction targets, we will need to increasingly be tracking a larger portion of our projects.
To accomplish this, we have set a goal for this year to start using our in-house LCA spreadsheet in all KPFF structural offices.
This will allow us to increase our ability to **track embodied carbon on a larger portion of our projects**. We will also continue to further expand the requirements for EPDs in our specifications.

Long-Term: As we track both material-specific and project-wide reductions on projects, we will utilize this information to increasingly apply **GWP limits on materials that are tailored to the project region and type**. We are already implementing these limits in many regions, but as EPDs and lower-carbon material options become more widely available we will be able to apply limits in more locations and for more materials.

Reduction Highlight >>



In-House LCA Tool

KPFF has collaborated across multiple offices to create a simple in-house spreadsheet that allows engineers without extensive LCA backgrounds to compare structural systems and LCA outputs with different background assumptions. This tool will allow more projects to incorporate embodied carbon impacts into early design decisions and ensure that these calculations accurately reflect the results from any full LCA modeling implemented later in the project. It will also increase the quantity of projects that have an LCA, making it easier to compare trends and draw conclusions on performance for the future.

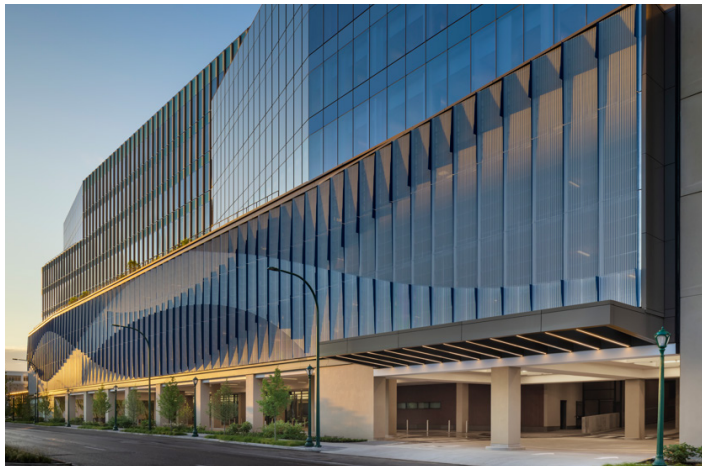
Structural System Selection

Many projects begin with specific environmental goals or considerations, addressing the embodied carbon impacts of different structural systems in requests for proposals and project interviews. These owners and architects expect **embodied carbon discussions** when we are exploring structural systems.

To guide teams in these early stages and have ready, relevant answers, we have focused on developing a comprehensive understanding of the impacts of structural system selection. We have done this by creating our own **in-house database of structural system life cycle assessments**. Even on projects without named sustainability goals, this database helps us guide conversations when making structural system choices.

UCSD PEPPER CANYON WEST STUDENT HOUSING

BOISE FIRESTATION #13



WASHINGTON UNIVERSITY AMBULATORY CANCER CENTER

Retrofits / Adaptive Reuse

A key reduction strategy that we are really excited about is adaptive reuse and retrofitting existing structures to create new spaces. **Retrofitting existing structures uses the carbon we have already spent** and can significantly increase the building's useful life. Retrofits have always been a part of our practice, but we are improving our ability to help clients quantify the environmental costs of retrofitting versus building new.

BY RETROFITTING EXISTING STRUCTURES, WE ARE ABLE TO UTILIZE THE CARBON THAT HAS ALREADY BEEN SPENT

Material Reuse

Even when reusing an entire structure is not an option, there are still opportunities to **incorporate elements from demolished projects in our new construction**.
A great example of this is the Federal Center South project in Seattle, where we used 200,000 board feet of wood framing from an existing structure demolished on-site. This is roughly equivalent to the yield of 4 acres of Washington forest. This work required extensive cataloging of the existing framing, unique and flexible detailing, and structural testing to fully capture the capacity of the existing wood.
We are continuously exploring new ways of detailing our current systems to consider **end-of-life reuse**. A great example of this exploration was on the University of Washington Health Sciences Education Building, where we studied the demolition of various vibration test models, which gave us great insight into what details kept the wood elements in the best condition for re-use.


100 STOCKTON PROJECT


FEDERAL CENTER SOUTH


UW HSEB TEST SPECIMENS

Material Specification

Once the structural system has been selected, the next opportunity to reduce embodied carbon is material selection. We have made the biggest impacts through **changing how we specify high EC intensity materials** such as concrete and steel. Several of our offices have implemented location-specific language requiring environmental product declarations (EPDs) and/or global warming potential (GWP) reductions on certain projects.

Keeping it Local

Embodied carbon reduction strategies need to vary depending on the location of the project. The knowledge base and information available regarding the embodied carbon of structural materials widely varies across the nation. This variability applies to information about local building materials as well as contractor knowledge. Each project's embodied carbon goals need to recognize this variability and be **customized for the project location**.
For example, many of our offices require reporting and reductions for embodied carbon in concrete submittals. Where EPDs are readily available, the specifications can be written to require a calculation of the reduction from a regional baseline. Where EPDs are not readily available, limitations on high embodied carbon constituents can be specified instead.

Being Flexible

We have learned to **stay flexible** when selecting embodied carbon reduction strategies. On multiple projects, specified materials became unavailable due to supply issues. For example, Type IL cement was unavailable from one of the main concrete suppliers in the Seattle area for a number of months due to shipping issues and a fly ash shortage in the San Francisco Bay Area. In these cases, we have to adjust and evaluate the impacts of the changes. In many cases we have been able to find alternate EC reduction pathways, such as the use of lower-carbon reinforcing steel or the use of alternative supplementary cementitious materials, to still maintain the reduction goals of the project.

04

Education

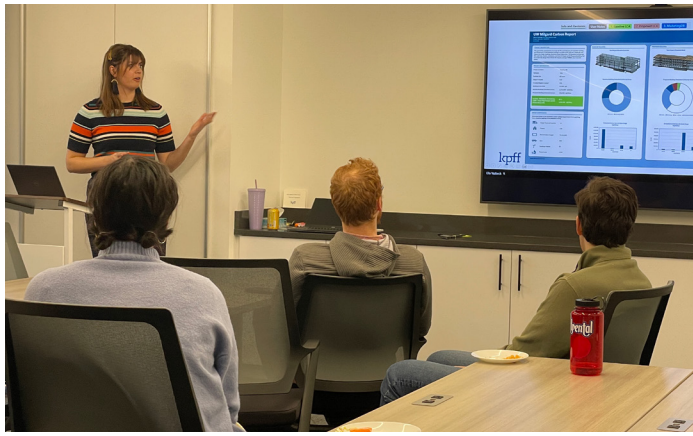
In 2021, during KPFF's first year as an SE 2050 Signatory, we created a Structural Sustainability group made up of **embodied carbon champions** from each office. This group meets in person every other year for an Embodied Carbon Summit to share information across our offices.

In addition to the internal **Embodied Carbon Summits**, KPFF provides avenues to share lessons and expertise to all our structural engineers. We have created a firm-wide portal for structural sustainability on our Microsoft Teams hub that is accessible by all KPFF employees as a means to broadcast sustainability messages. A resources section includes documents from SE 2050, as well as copies of internal presentations and resources. The **Question and Message Board** page allows structural engineers to share resources and get advice from engineers throughout the firm.

Some offices have started their own internal Sustainability Groups. These office Sustainability Groups are a great way to **engage our younger staff** who are passionate about sustainability. Some activities these groups have done in the past year include information sharing on life cycle assessment, social hours with fun embodied carbon trivia, and an interactive session exploring new concrete technologies.

Outside our offices, we have many employees who actively give and attend presentations hosted by the **Carbon Leadership Forum**, **ASCE**, local **Structural Engineering Association** chapters, and material suppliers.

LOCAL OFFICE SUSTAINABILITY GROUPS



EC CHAMPIONS SUMMIT

05

Advocacy

Our approach to **advocacy** for embodied carbon reduction over the last year focused on sharing our experiences, advocating on our local projects, and advocating in the wider industry.

As we have been developing our knowledge base for embodied carbon in structures, we have found ways to **share these lessons** in local and national organizations. As noted in the elective section, we participate in and present on embodied carbon topics related to structures both locally and nationally.

For our local projects, we proactively discuss pathways to embodied carbon reduction with architects, owners, jurisdictions, and contractors. One of the biggest roadblocks to embodied carbon reduction is reticence to change construction methods. By sharing evidence of projects **successfully implementing low-carbon strategies** and selectively test-running new materials or systems, we continue to move the needle forward.

KPFF recognizes that in order for there to be a sea change in the reduction of embodied carbon in the built environment, **national building codes and design standards** will need to acknowledge and include embodied carbon. See the Advocacy Highlight to the right for examples of our national advocacy work.

Advocacy Highlight >>

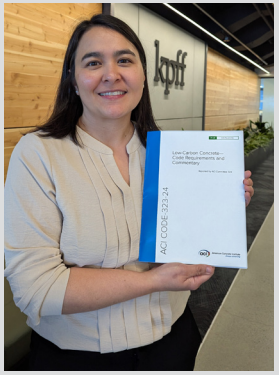
National Codes

Engineers in many of our offices have been contributing to the development of national codes and design standards that will help spread embodied carbon reductions across our industry including:

- Helped write the new national ACI 323 Low-Carbon Concrete Code and chaired the Sustainability Subcommittee for the ACI 318-25 Concrete Building Code, which has a new Sustainability and Resilience appendix.

- Serving on ASCE 7-28 code committee for a new chapter on Future Conditions to adjust design loads to account for climate changes.

- Advancing the use of mass timber by reducing barriers to implementation for real projects. This includes serving as a founding member of the REACTS Timber Structures Consortium, contributing to the U.S. Mass Timber Floor Vibration Design Guide, partnering on the NHERI/NSF TallWood 10-story mass timber shake-table test, and codifying mass timber rocking walls for use in high seismic regions.



06

Reporting

KPFF takes a flexible, **project-specific** approach to measuring, tracking, and reporting embodied carbon, using tools like Athena, Tally, OneClick, EC3, and our in-house spreadsheet, selecting the best fit for each project.

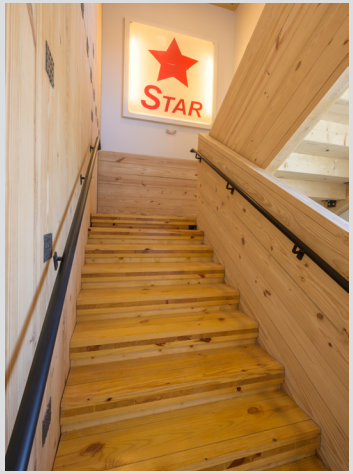
In 2022, KPFF began reporting embodied carbon to the SE 2050 database with projects from two of our offices. We've increased the number of projects reported every year, and in 2025 we've grown to reporting projects from seven different KPFF offices. The data submitted to SE 2050 is helping to create an **internal database** that tracks embodied carbon intensity across projects. We plan to track stages A–D, focusing on structural materials using the tools mentioned.

Many of our offices have also worked to track the impacts of locally available materials to better inform our life cycle assessments. For example, our San Francisco office has developed a **concrete database** with over 300 mixes from 15 years of projects, including EPD data when available. This helps project teams find appropriate low-GWP concrete mixes and allows us to continue innovating to reduce embodied carbon. We plan to continue **growing these material databases** in more locations over the next few years.

Project Highlight >>

Star Lofts

Des Moines, IA



Star Lofts, Iowa's first zero-carbon certified building, is a three-story mixed-use building featuring affordable housing located in the heart of Des Moines. The design used mass timber framing throughout and required concrete mixture cement reductions that varied based on the concrete applications, resulting in significant carbon reductions. This project is a great example of how low embodied carbon designs can be impactful on projects of all sizes and types.

Photo credits: WoodWorks / Brent Isenberger / Cutler Development

Project Highlight >>

HUB Community Center & Herz Gymnasium

San Francisco, CA

The Sunnydale HOPE SF development overall project spans over 50 acres and comprises 1,700 new homes replacing over 700 dilapidated public housing units with a vibrant new community designed to promote health, wellness, and sustainability. Central to this vision are the newly constructed HUB at Sunnydale and Herz Gymnasium, which serve as critical spaces for community activities.

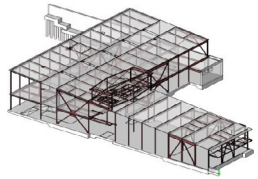
The HUB Community Center is a new 30,000-square-foot, two-story building that houses a community center open to the public, while the Herz Gymnasium is a new 12,000-square-foot, single-story facility that includes a gymnasium space, supporting office areas, and a multipurpose room.

As recipients of the GovOps/Woodworks Grant through the 2019 California Mass Timber Building Competition, these two projects exemplify the potential of mass timber to address critical state issues like wildfire prevention, forest health, and sustainable housing development. By replacing the original steel and concrete design with CLT floors and roofs, supported by glulam columns and beams, the team reduced the total structural embodied carbon by 50% for the HUB and 11% for Herz Gym. In addition, KPFF used their local knowledge to specify concrete that further reduced the embodied carbon an additional 14% for the HUB and 32% for Herz Gym with no additional cost to the project. These projects further the neighborhood's commitment to low-impact development but also position the broader Sunnydale HOPE SF project as an educational and inspirational showcase for sustainability and innovation in California's growing mass timber industry.

HUB COMMUNITY CENTER

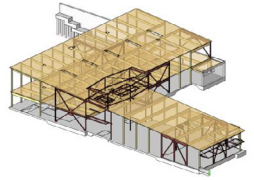
Structural Materials Comparison Only
Inclusive of Biogenical Carbon using Tally

BASELINE



Steel framed w/ conc over metal deck/bare metal deck roof
Steel SCBF lateral System w/ Mat Foundation

AS-BUILT



CLT over glulam framing
Steel SCBF lateral System w/ Mat Foundation

64% TOTAL GWP REDUCTION

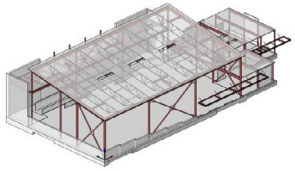
50% GWP Reduction switching to mass timber

14% GWP Reduction due to KPFF low carbon concrete mixes

HERZ GYM

Structural Materials Comparison Only
Inclusive of Biogenical Carbon using Tally

BASELINE



OWSJ & steel framing with bare metal deck roof
Steel SCBF lateral System w/ SOG over isolated footings

AS-BUILT

CLT over glulam framing
Steel SCBF lateral System w/ SOG over footings

43% TOTAL GWP REDUCTION

11% GWP Reduction switching to mass timber

32% GWP Reduction due to KPFF low carbon concrete mixes

07

Electives

We have reviewed the electives we included in our 2024 ECAP and we were able to achieve all those listed. See below for the electives we have selected to focus on this year.

Reduction (1 required, 4 recommended)

✓ Set clearly stated, firm-wide reduction targets in the short-term (<1 year) and long-term (>5 years).

See our Reduction Strategy section of this report.

✓ Submit a Circular Economy Narrative describing how a project supports the circular economy. This can be done by incorporating re-use or design for deconstruction into at least one project.

See our Reduction Strategy: Retrofits/Adaptive Reuse and Material Reuse sections of this report.

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

We continue to expand the use of requirements for EPD submittals and GWP reduction calculation in specifications on multiple projects.

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

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

Our new in-house LCA spreadsheet, which aggregates background data from several different LCA programs, allows us to do quick comparisons between different structural systems during the concept phase. During this phase, cost estimates are typically produced that include rough takeoffs of material quantities, which allow the carbon footprint to be determined along with the cost. We have had several projects utilize this approach during concept design and these studies have often been influential in the final structural system type selected.

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

✓ Collaborate with your concrete supplier to reduce embodied carbon in a mix design below an acceptable baseline (e.g. NRMCA regional baseline values).

This year, many of our offices have had direct coordination with concrete suppliers regarding EPDs and what approaches can be taken to reduce the GWP of our typical mixtures.

✓ Incorporate sustainably harvested biogenic materials in at least one project.

Many of our projects incorporate timber structural members that are certified to be sustainably harvested by FSC, SFI, or through project-specific material tracking.

Education [2 required, 4 recommended]

✓ Provide a narrative of how the Embodied Carbon Reduction Champion will engage embodied carbon reduction at each office.

See the Education section in this ECAP for more information about how our embodied carbon leads across our offices collaborate and educate our engineers.

✓ Present at least [1] webinar focused on embodied carbon and make a recording available to employees.

This past year, we've been focusing on sharing expertise from across our offices and we plan to continue sharing knowledge across offices this year. We're also coordinating having outside experts present to several of our offices at once.

✓ Initiate an embodied carbon interest group within your firm and outline their goals. This group may more broadly address sustainability, but they must include embodied carbon.

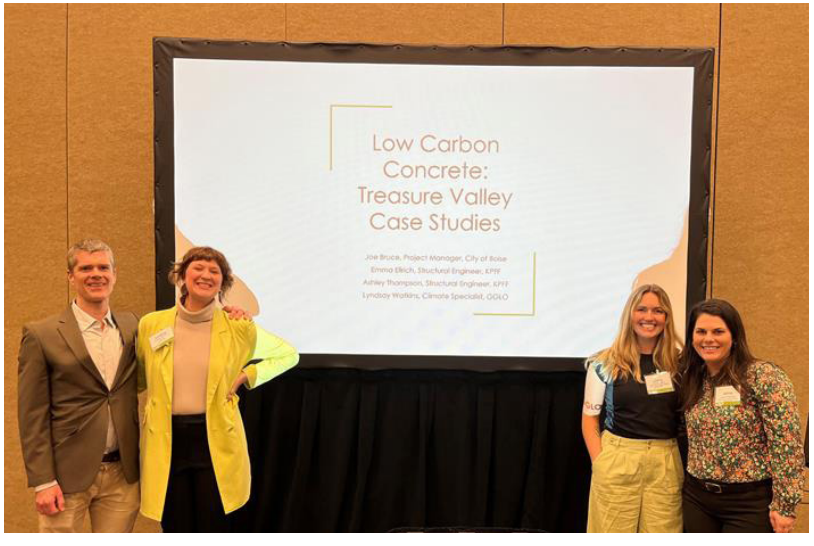
See our Education Plan section for a description of internal KPFF Sustainability Groups.

✓ Create an Embodied Carbon digital resource wiki and/or forum on your firm's internal website for staff to create, share, and discuss embodied carbon educational resources.

Our firm-wide MS Teams page has a Structural Sustainability page that is accessible by all KPFF employees. Engineers post resources to this page and give advice on the Q&A board.

✓ Engage with a CLF Regional Hub.

Several of our employees regularly attend CLF regional hub meetings and events, with several people acting as leaders for their regional hubs. We have people attending meetings of the Los Angeles, San Francisco, Portland, Seattle, Nebraska, and Nashville CLF regional hubs. Some of our people are even actively working to start new CLF hubs in their areas.



KPFF engineers Emma Ellrich and Ashley Thompson presenting low-carbon case studies in collaboration with representatives from the City of Boise and GGLO

Advocacy [2 required, 4 recommended]

✓ Describe the value of SE 2050 to clients.

KPFF regularly features our commitment to SE 2050 in our marketing materials, proposals, and our communications with clients.

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

When we first joined the SE 2050 commitment, a blog post describing the program and our work in adopting the commitment was posted on our website here: https://www.kpff.com/blog/news/post/kpff-is-a-signatory-of-se-2050.

As we further develop and grow with the commitment, we will continue to post progress updates on our website at https://www.kpff.com/news/.

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

✓ Engage with structural material suppliers in your region to communicate the importance of Environmental Product Declarations (EPDs) and low-carbon material options.

✓ 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.

See the Advocacy Highlights in this report for details on how we've been working to advance embodied carbon provisions in national codes and also advocating for policy changes in the markets we work in.

Advocacy Highlight >>

Support for Policy Change

In addition to supporting code development, KPFF engineers are also active in our communities, working to educate and advocate for change.

A great example of this is a presentation that Emma Ellrich and Jordan Terry in our Mountain West office gave to the Salt Lake City Community Reinvestment Agency and the Salt Lake City Sustainability Department this past year. The presentation focused on the latest guidelines for low-carbon buildings (LEED v5, ACI 323) and barriers to success that have been observed when working to implement low-carbon standards. It also pointed to innovation with examples of low-carbon requirements in various jurisdictions around the nation. The presentation focused on successful case studies, which generally started with transparency (benchmarking or just reporting values) prior to moving to reductions, and focused on how similar practices could be implemented on projects.

KPFF engineer Emma Ellrich presenting at a conference

Reporting [1 required, 2 recommended]

✓ 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, but we encourage you to submit as many as possible.

We continue to increase the number of projects we submit every year to SE 2050 as well as the number of our offices contributing.

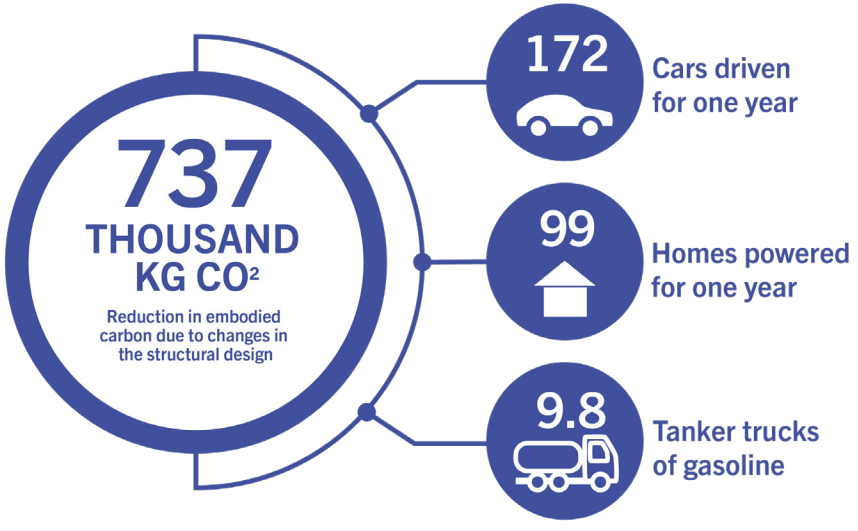
✓ For multi-office firms, describe how each office is measuring and reporting embodied carbon.

Each office individually tailors their approach to measuring and reporting embodied carbon for their market and project types. LCA results for individual projects are uploaded to our in-house tracking spreadsheet, and Molly Seto in our San Francisco office coordinates uploading our data yearly to the SE 2050 database. See our Reporting section for more information.

✓ Propose other actions that promote the reporting of embodied carbon data and describe their value.

Internal training for embodied carbon measurement:
We have given presentations to several KPFF offices regarding the measurement of embodied carbon of both specific materials and of a whole building. We will continue to provide resources and presentations for the measurement of embodied carbon, to ensure that more reporting takes place.

LCA Tools: As we roll out our in-house LCA spreadsheet, it will be easier to incorporate embodied carbon calculations more often and earlier in a wide variety of projects.



Embodied carbon reductions achieved on the HUB Community Center and Herz Gymnasium projects described in the Project Highlight of this report

08

Lessons Learned

During 2024 we focused on scaling up the carbon reduction strategies that we found most effective in our early years of the SE 2050 commitment.

Things we learned this year include:

- Investing our efforts toward **code development** and **local advocacy** can have far reaching impacts. We're incredibly proud of our accomplishments on projects, but **impactful reductions at scale** are not possible until embodied carbon consideration is incorporated across the industry.
- Making the **consideration of embodied carbon early in designs** requires easy-to-use and reliable LCA tools. We're excited to incorporate embodied carbon estimates in early design with our new **in-house carbon calculation spreadsheet**.
- **Engaging engineers at all levels** is important to ensure that embodied carbon is part of our designs today and into the future. **Interactive activities** to get engineers of all levels thinking critically about our **design approaches and new materials** have added some fun and connection in many of our offices.
- As we collect more **data about the carbon footprint of our buildings**, we're beginning to see trends and indicators of what the **most effective reduction strategies** are. We're starting to use this data to inform our design choices today and we're excited to continue learning as we expand our data collection.

Seattle
Tacoma
Lacey
Spokane
Cour D'Alene
Portland
Eugene
Sacramento
San Francisco
Los Angeles
Irvine
Newport Beach
Long Beach
San Diego
Austin
Boise
Salt Lake City
Madison
Des Moines
St. Louis
Chicago
Indianapolis
Lexington
Louisville
Cincinnati
Nashville
Washington DC
Birmingham
New York City

kpff

KPFF is an Equal Opportunity Employer
www.kpff.com