SE 2050

EMBODIED CARBON ACTION PLAN

2026

INTRODUCTION

> "**We are committed to understanding the needs of our clients and communities and adapting to changing conditions.** We believe that doing our part to curb climate change by educating all of our employees and reducing embodied carbon will enable us to better serve our clients and communities for years to come."
>
> *– Stacy Bartoletti, CEO , Degenkolb Engineers*

At our core, Degenkolb's purpose is **to engineer a better future for our clients and communities**, and we are committed to being part of the climate solution. Since signing onto the SE 2050 Commitment in 2021, we have been actively working to reduce the environmental impact of our projects by embedding embodied carbon awareness into our practice, strengthening internal knowledge and tools, and collaborating with clients and industry partners to support lower-carbon outcomes. On our projects, every connection matters, because small decisions made early and thoughtfully shape everything that follows. In the same way, reducing embodied carbon depends on intentional choices at every stage of design. Through this Embodied Carbon Action Plan, we are formalizing our approach to **educating** our staff, tracking and **reporting** our impact, **reducing** embodied carbon on our projects, and **advocating** for change in our industry.

2025 YEAR IN REVIEW

- In 2025, Degenkolb expanded embodied carbon education across the firm, leveraging embodied carbon experts in each office. We grew our Embodied Carbon Interest Group, new hire orientation, and internal resource hub.
- EnviCASE, our publicly-available embodied carbon estimation tool, is being used by all of our offices on a variety of projects types, and now includes A4 & A5 life cycle stages.
- We launched an internal LCA requirement for our large projects, engaging more project teams in embodied carbon tracking and reduction.

2026 KEY ACTIONS

- Perform **embodied carbon assessments** on all major projects
- Expand local **education** and **adoption**
- Collect **lessons learned** and **case studies**

SE 2050 MISSION STATEMENT

All **structural engineers** shall understand, reduce and ultimately eliminate **embodied carbon** in their projects by 2050.

2025 LESSONS LEARNED

- **EDUCATION:** Employees engage most effectively when information is shared in a variety of formats and reinforced over time. Building baseline knowledge across the firm requires both accessible resources and opportunities for continued learning. We aim to provide more direct project support through our local embodied carbon experts.

- **REPORTING:** As our reporting tools and workflows continue to mature, we are learning that the value of embodied carbon reporting depends on both technical capability and ease of use. Expanding internal guidance helps teams apply embodied carbon assessment more consistently across project types.

- **REDUCTION:** Every project in construction provides a wealth of lessons learned about decisions made during the design. As we work through construction on projects that used our updated standard specification language, we are circling back to our template specifications and constantly keeping our guidance up to date.

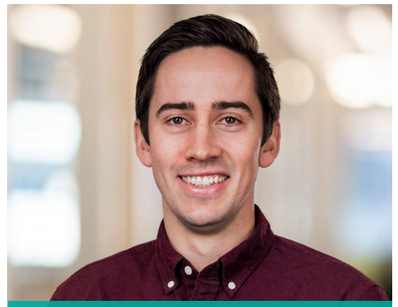
- **ADVOCACY:** Interest in embodied carbon continues to grow across the AEC industry. Sharing practical examples and project experience helps make advocacy efforts more relevant and actionable for our partners.

PEOPLE

Degenkolb's Sustainable Design Committee manages the firm's involvement in SE 2050 by leading our firm-wide embodied carbon education program, developing our LCA capabilities, updating our specifications and standard design practices, and advocating for embodied carbon reduction.

ELENA GOOD
Embodied Carbon Reduction Champion
Associate, Oakland

ARIANE ROSARIO
Reduction Team Lead
Senior Engineer, San Francisco



RYAN WHITE
Education Team Lead
Senior Engineer, San Francisco

COREY BECK
Reporting Team Lead
Design Engineer, Oakland

VINCENT WENZEL
Advocacy Team Lead
Senior Engineer, San Francisco

SEATTLE

Kyle Steuck *Principal*
Amy Inhofer *Senior Engineer*
Benjamin Terry *Design Engineer*
Austin Anderson *Designer*
Grace Dojan *Designer*

DETROIT

Michelle Atto *Senior Associate*
Sarah Lipton *Senior Engineer*

SACRAMENTO

Charlie Chi *Senior Engineer*

SAN FRANCISCO

Ray Pugliesi *Senior Principal*
Claire Killian *Design Engineer*
Joseph Rodgers *Design Engineer*
Morgan Michna *Senior Marketing Specialist*
Connor Gilligan *Designer*
Lewis Nolf *Designer*
Rui Guan *Designer*
Thais Emond *Designer*

OAKLAND

Brendin Randall *Design Engineer*
Priya Helle *Design Engineer*
Jennifer Terada *Designer*
Stefan Lemme *Designer*

ORANGE COUNTY

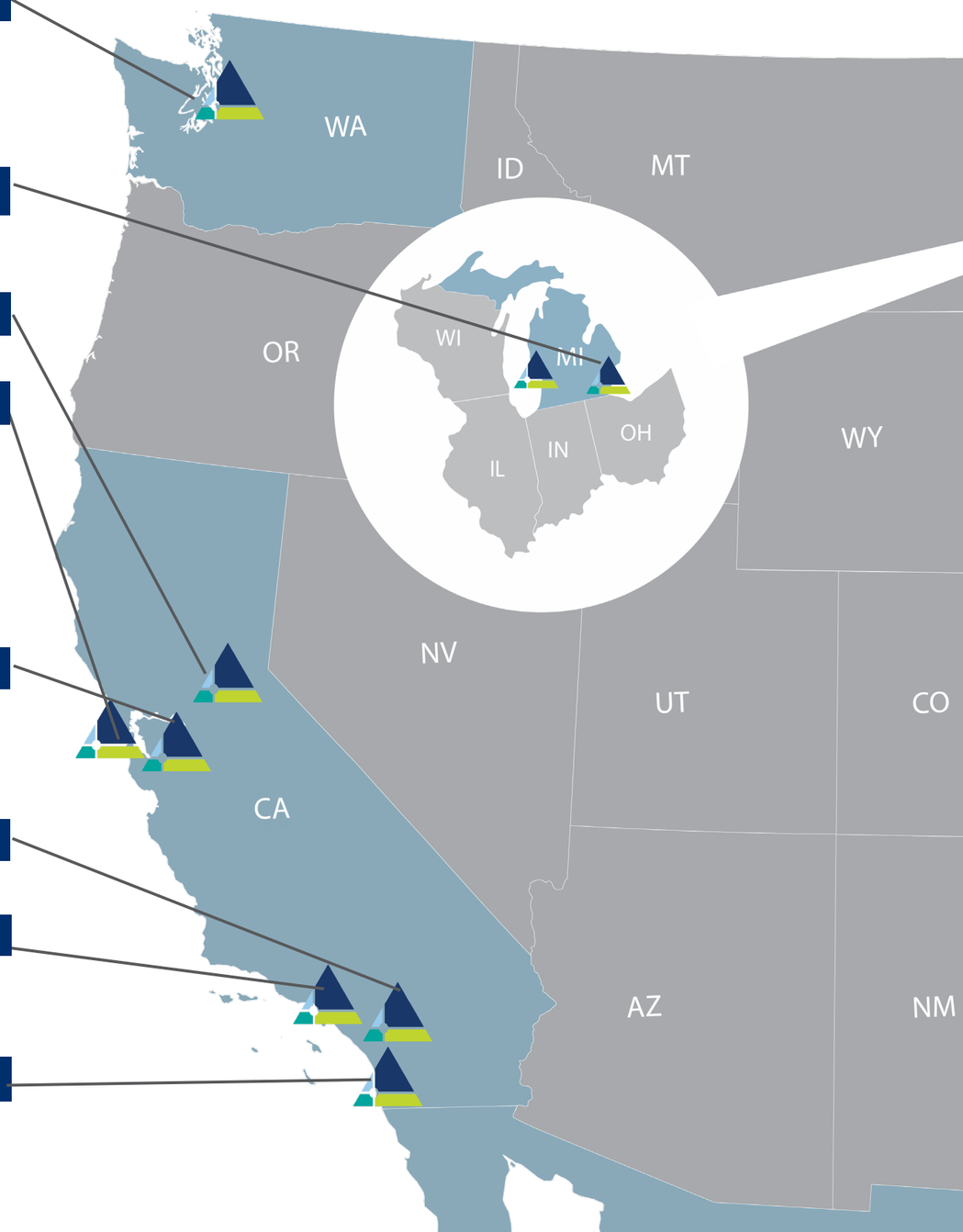
Eden Kim *Designer*

LOS ANGELES

Evelyn Li *Senior Engineer*
Chris Ramirez *Designer*
Soumaya El Moumni *Designer*

SAN DIEGO

Candice Hanna *Design Engineer*
Marissa Padua *Designer*



EDUCATION

Educating our employees and connecting them with resources remains a critical part of advancing embodied carbon reduction across our practice. We believe meaningful change starts with firmwide understanding, and we are committed to giving every Degenkolber a baseline knowledge of embodied carbon and reduction strategies so they can help advance lower-carbon outcomes on every project.

- We continue to **grow our Embodied Carbon Interest Group (ECIG)** as an open forum for all Degenkolbers to learn about embodied carbon topics. In 2025, we brought an external presenter to grow our knowledge base beyond the firm. In 2026, we aim to continue increasing engagement with diverse meeting formats. Additionally, we've lined up additional external presenters to hear firsthand about new and upcoming strategies for embodied carbon reduction.
- We regularly **maintain and update our internal digital resource hub**, and maintain a calendar of external conferences, events, and webinars to encourage participation.
- Our newly launched internal LCA requirement is **increasing the number of project teams engaged in LCAs**. To support this, our embodied carbon experts in each office are the go-to local experts to answer questions, review LCAs, and provide feedback on relevant reduction strategies.
- We are collaborating on an **expanded selection of sustainable design presentations** at our next internal Degenkolb conference coming up this spring. Potential topics will include project examples, case studies, education recaps, and more.

ACTIONS

2025

- ✓ Continued to host and increased engagement in firm-wide Embodied Carbon Interest Group (ECIG)
- ✓ Expanded onboarding education
- ✓ Expanded our internal resource hub
- ✓ Hosted first external presenter

2026

- ▸ Support project teams with local embodied carbon experts
- ▸ Host additional external presenters
- ▸ Incorporate embodied carbon into intern education
- ▸ Hold end-of-project LCA reviews with lessons learned

BEYOND

- ★ Provide every Degenkolber with baseline knowledge and access to resources for embodied carbon reduction on every project
- ★ Engage in industry sustainability committees in all of our geographic regions

THE **EMBODIED CARBON INTEREST GROUP** ORGANIZED A FIRMWIDE **JEOPARDY GAME** AND ASKED QUESTIONS RELATED TO CURRENT SUSTAINABILITY POLICIES, RECENT ENVIRONMENTAL NEWS, AND WORK DONE BY THE SUSTAINABLE DESIGN COMMITTEE. THE SEATTLE OFFICE WON THE EMBODIED CARBON JEOPARDY GAME, EARNING A BOX OF COOKIES AND 25 TREES PLANTED IN THEIR HONOR.

REPORTING

Degenkolb understands the **importance of quantifying the embodied carbon in our designs**. As we continue to collect data related to buildings' embodied carbon, Degenkolb is focused on better understanding, in both a new-design and retrofit setting, the leading contributors to these emissions. By refining our understanding, we can set targeted, proactive goals focused on reducing our environmental impact.

- **Degenkolb is a growing company with offices and projects of all different sizes.** In addition to requiring each office to submit (2) LCAs per year, Degenkolb initiatied a new fee-driven LCA policy requiring all large projects to submit an LCA at some point during design.
- Each LCA performed is collected in an internal database. In 2026, we are **building out a visualization tool to display embodied carbon data across all of our projects**. Teams can use it to set reduction targets and compare their LCA results to similar projects.
- **Degenkolb will continue to maintain and adapt a publicly available embodied carbon calculator (EnviCASE) to support SE 2050's shared goal of eliminating embodied carbon in projects.** In 2025, Degenkolb expanded the tool to consider A4 & A5 stages and temporarily sequestered carbon in biogenic materials.
- Degenkolb is **actively developing case studies** to compare the embodied carbon impact of projects with similar design requirements designed by offices across the firm.

ACTIONS

2025

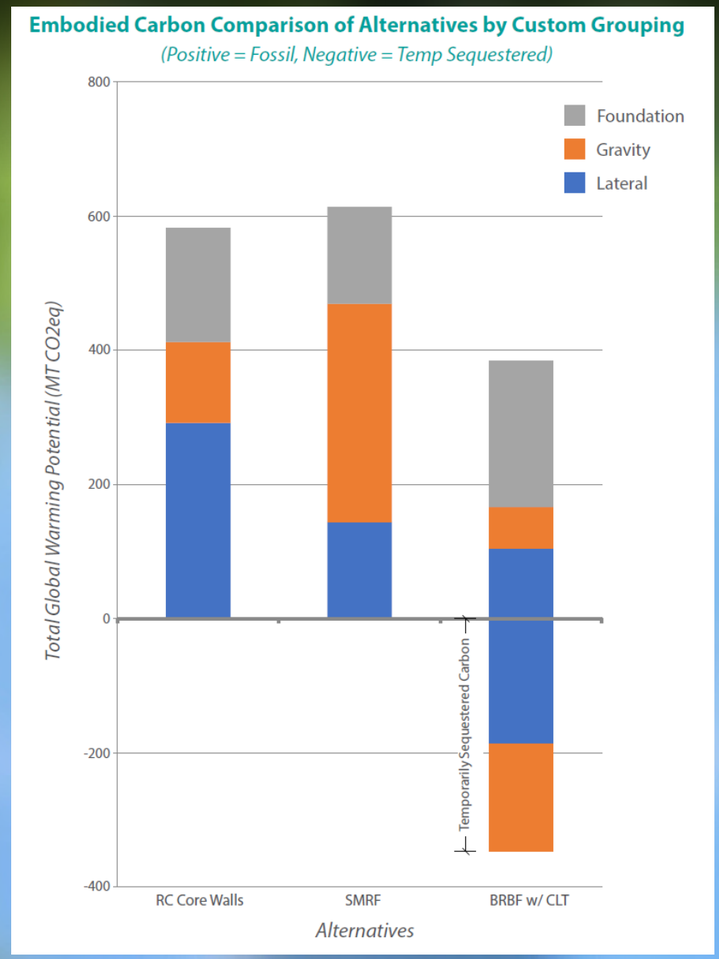
- ✓ Submitted 2+ projects per US office to the SE 2050 database
- ✓ Grew internal database for quantifying company's carbon impact

2026

- ▸ Develop submittal guidelines for embodied carbon calculation
- ▸ Publish internal case studies comparing embodied carbon impact of similar buildings
- ▸ Collect LCA data for large projects using fee-based requirements

BEYOND

- ★ Perform LCAs for all relevant Degenkolb projects
- ★ Use database to set EC targets on each project
- ★ Advise clients on potential EC savings for different structural schemes or retrofits



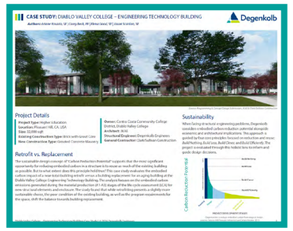
DEGENKOLB LEVERAGED INTERNAL CRADLE TO GATE LCA TOOL, ENVICASE, TO CONDUCT AN EMBODIED CARBON COMPARISON BETWEEN ALTERNATIVE BUILDING SYSTEMS DURING PRE-SCHEMATIC DESIGN. FOR THIS CASE, THE TOOL SHOWS THE ABILITY FOR MASS TIMBER TO OFFSET BUILDING'S FOSSIL CARBON, THROUGH THE CARBON TEMPORARILY SEQUESTED AND STORED IN THE WOOD MATERIAL DURING THE LIFE OF THE BUILDING, BY UP TO 90%.

DEGENKOLB.COM/ENVICASE-TOOL-DOWNLOAD/

EACH YEAR, DEGENKOLB AIMS TO SUBMIT MORE PROJECTS TO THE SE2050 DATABASE. WITH THE INTRODUCTION OF OUR INTERNAL LARGE PROJECT LCA REQUIREMENT, WE AIM TO INCREASE THE NUMBER AND VARIETY OF PROJECTS DOING LCAS.

REDUCTION

Degenkolb is committed to pioneering sustainable development practices by integrating innovative strategies into our projects. With our new LCA mandate starting in 2025, we are beginning to standardize benchmarks to minimize carbon footprints across select projects. By publishing case studies and leveraging lessons learned from case studies, we expand on the internal and external reduction efforts. These efforts reflect our resolve to lead the industry in embodied carbon reductions.


CASE STUDY: DIABLO VALLEY COLLEGE – ENGINEERING TECHNOLOGY BUILDING

Degenkolb

Project Details

Sustainability

Retrofit vs. Replacement

- This year, **Degenkolb is working to publish several case studies**: retrofit vs replacement embodied carbon comparison, new hospital building construction embodied carbon comparisons, and a circular economy study. The *Retrofit vs Replacement Case Study* is attached to this ECAP and highlights the importance of an LCA to fully capture the carbon emissions associated with an extensive retrofit scheme.
- We are implementing an LCA mandate on specific projects to gather data in order to standardize internal carbon benchmarks to encourage **implementing embodied carbon reduction across projects**.
- Degenkolb continues to **update sustainable project specification requirements** using new industry standards and innovations, and internal lessons learned.
- Degenkolb **created and developed an internal circular economy intranet page** for education and visibility purposes within the company.

ACTIONS

2025

- ✓ Developed internal circular economy resource page
- ✓ Ongoing updates to material specific internal resource pages for project teams
- ✓ Ongoing development of hospital building case study
- ✓ Implement LCA mandate for large projects

2026

- ▸ Publish a retrofit vs replacement case study
- ▸ Publish a circular economy case study for Bay Area project
- ▸ Complete new hospital building database case study
- ▸ Update material specifications, including lessons learned, new industry resources, and project specific limitations

BEYOND

- ★ Perform LCAs on all relevant projects
- ★ Establish benchmark requirement for all projects with LCAs

DEGENKOLB'S UC DAVIS HEALTH CALIFORNIA TOWER TEAM ATTENDED THE **TOPPING OUT CEREMONY FOR THE NEW HOSPITAL TOWER**— SIGNIFYING A MAJOR PROJECT MILESTONE.

ADVOCACY

KNOWLEDGE SHARING

Advocacy is an essential part of how Degenkolb supports sustainability and the goals of SE 2050. By sharing our practical experience from all kinds of projects, we help partners understand what low-carbon design looks like in action. Engaging with external groups, we aim to make decarbonization a shared priority that strengthens our communities and aligns with Degenkolb's long-standing commitment to resilient engineering.

- We **promote our sustainability initiatives** by sharing our ECAP, conference involvement, and project successes on our website and social media.
- Members of Degenkolb's Sustainable Design Committee are **involved with external sustainability committees** including SEI, SEAONC, AISC, CLF, and REACTS Consortium. Through our external committee work, we are proud to have contributed to the following publications and resources:
  - *ASCE: Prestandard for Assessing the Embodied Carbon of Structural Systems for Buildings*
  - *AISC: Specification Strategies for Structural Steel Embodied Carbon Reduction*
  - *AISC: Sustainable Steel Design Strategies and Rules of Thumb*
- We continue to share what we're learning externally, with recent presentations at Greenbuild, NASCC, the SE 2050 Signatory Summit, ASCE/SEI Structural Congress, architecture offices, and several of our alma mater universities. Over the next year, we'll keep **building on that momentum by seeking out new speaking opportunities at conferences, client offices, and local events** so we can connect with an even broader group of partners. We're also increasing our involvement in local working groups to help move the conversation on embodied carbon forward at the community level.

2025

2026

BEYOND

ACTIONS

- ✓ Developed internal resources
- ✓ Shared sustainable successes on social media
- ✓ Presented at peer firms and conferences
- ✓ Launched updated website

- ▸ Participate in AEC-industry groups
- ▸ Broaden knowledge sharing opportunities at conferences, offices, and universities

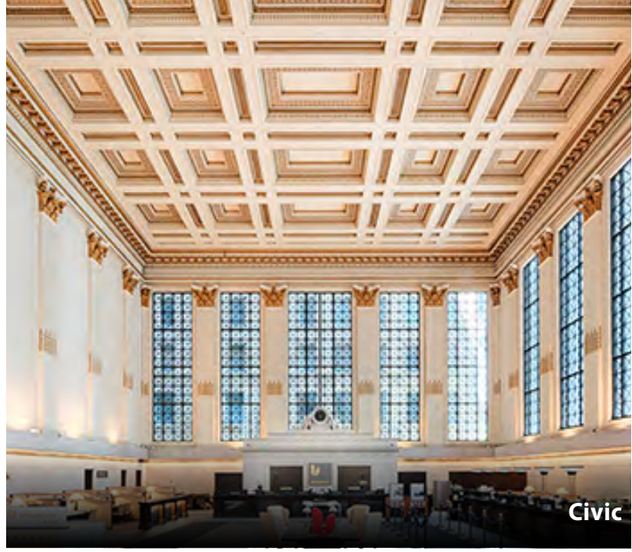
- ★ Continuously improve our PM Sustainability Toolbox
- ★ Contribute to the wider body of knowledge about EC
- ★ Work with government bodies and policy makers

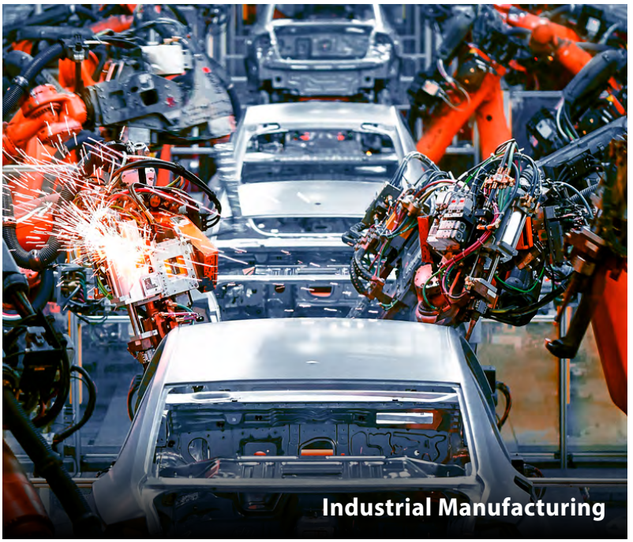
AT TOWARDS ZERO CARBON 2025 IN BOULDER, COREY BECK, REPORTING LEAD, HIGHLIGHTED HOW **DEGENKOLB IS TURNING COMMITMENT INTO ACTION**— ADVANCING SUSTAINABLE DESIGN THROUGH FIRMWIDE EDUCATION AND **EMPOWERING OUR ENGINEERS TO HELP BUILD A BETTER FUTURE.**

Degenkolb


Design

Healthcare

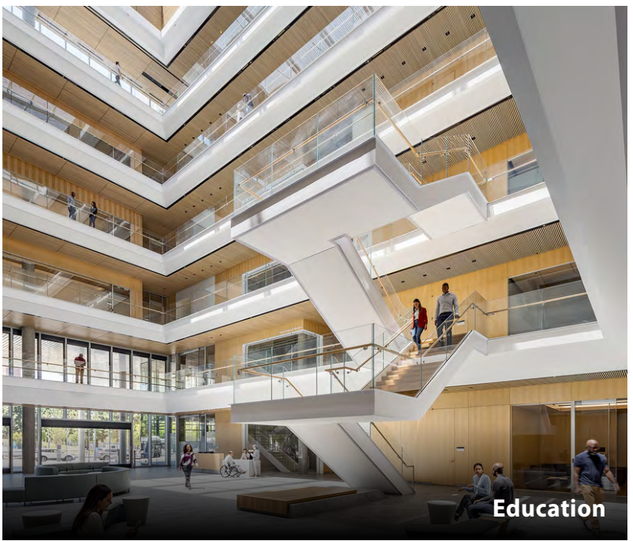

Civic


Industrial Manufacturing

- sustainability@degenkolb.com
- degenkolb.com/sustainability/
- @degenkolbengineers
- LinkedIn
- se2050.org/
- EnviCASE

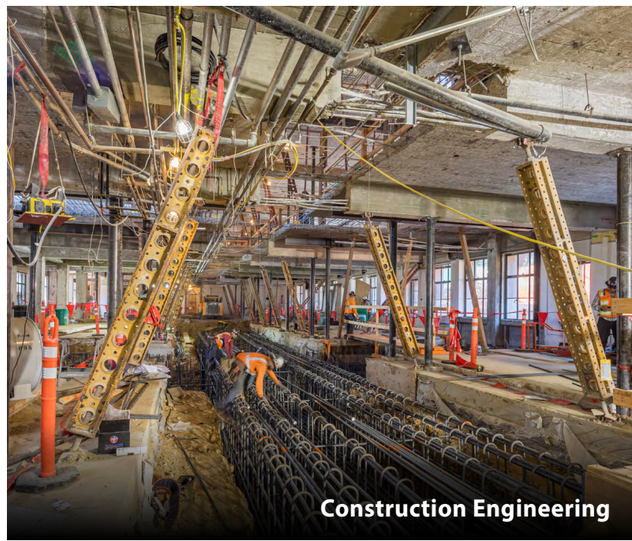

Forensics


Specialty Systems


Education


Science & Technology


Federal


Construction Engineering

CASE STUDY: DIABLO VALLEY COLLEGE – ENGINEERING TECHNOLOGY BUILDING

Authors: *Ariane Rosario, SE | Corey Beck, PE | Elena Good, SE | Jason Scanlan, SE*

Source: Programming & Concept Design Submission, JKAE & Clark/Sullivan Construction

Project Details

Project Type: Higher Education
Location: Pleasant Hill, CA, USA
Size: 32,000 sqft
Existing Construction Type: Brick with Grout Core
New Construction Type: Grouted Concrete Masonry

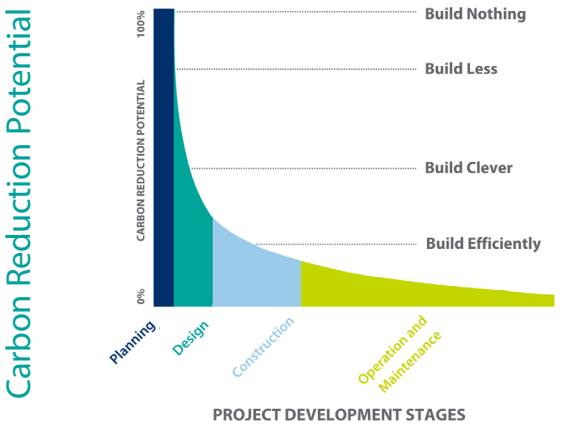
Owner: Contra Costa Community College District, Diablo Valley College
Architect: JKAE
Structural Engineer: Degenkolb Engineers
General Contractor: Clark/Sullivan Construction

Retrofit vs. Replacement

The sustainable design concept of "Carbon Reduction Potential" supports that the most significant opportunity for reducing embodied carbon in a structure is to reuse as much of the existing building as possible. But to what extent does this principle hold true? This case study evaluates the embodied carbon impact of a near-total-building retrofit versus a building replacement for an aging building at the Diablo Valley College Engineering Technology Building. The analysis focuses on the embodied carbon emissions generated during the material production (A1-A3) stages of the life cycle assessment (LCA) for new structural elements and enclosure. The study found that while retrofitting presents a slightly more sustainable choice, the poor condition of the existing building, as well as the program requirements for the space, shift the balance towards building replacement.

Sustainability

When facing structural engineering problems, Degenkolb considers embodied carbon reduction potential alongside economic and architectural implications. This approach is guided by four core principles focused on reduction and reuse: *Build Nothing, Build Less, Build Clever,* and *Build Efficiently*. The project is evaluated through this holistic lens to inform and guide design decisions.



Opportunities to reduce embodied carbon from stage of design process. Source: HM Treasury: Infrastructure Carbon Review, 2013

Build Nothing: Growing Needs

The existing Engineering Technology Building is a one-story building, consisting of exterior reinforced masonry walls with wood and steel roof trusses. The college has determined that the existing facility can no longer meet the needs of the curriculum and students, and that an expansion or replacement is needed. Specifically, a greater ceiling height is needed for labs, as well as additional square footage for updated programming.

The project location is in Pleasant Hill, CA, where moderate-to-high seismicity is expected. The existing structure was designed in 1969, prior to modern seismic detailing requirements. Therefore, per California Building Code (CBC) requirements, expansion of the structure triggers a need to evaluate and retrofit the building to modern code requirements.

For this reason, both a seismic retrofit option and a replacement option of the existing building were evaluated. Both options will allow the college to increase the square footage of the building as shown below. However, due to the type of building and program needs, much of the existing building will need strengthening or partial replacement to meet demands. For example,new programming requires a greater ceiling height and increases rooftop loading. Therefore the existing roof structure must be removed and replaced. Additionally, extensive modification to the existing footprint is required to allow for adequate room spaces. The exception is the existing enclosure: the design team hoped to reuse parts of the existing skin in the event of a retrofit. The Retrofit Option and Replacement Option graphics below delineate the required scope items that were included in the LCA for each scheme.

Build Less: Exploring Retrofits

The design team explored several preliminary retrofit schemes for strengthening the existing non-ductile masonry walls of the building:

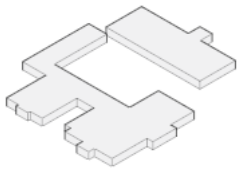
1. Steel Special Concentrically braced frames (SCBF)
2. Reinforced concrete masonry unit (CMU) walls
3. Reinforced concrete shear walls

A preliminary LCA revealed that the SCBF option resulted in the lowest embodied carbon impact, and was therefore chosen for the comparison study against a similar braced frame building replacement option.

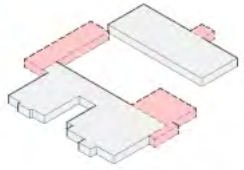
The results of the LCAs for the design options are presented in *Embodied Carbon Comparison of Alternatives in Custom Grouping* (see page 3). The retrofit embodied carbon equated to approximately 730 mt of CO2eq compared to 770 mt CO2eq for the replacement option. This results in a 5.5% carbon savings for the replacement option. This 40-metric ton carbon savings is likely within the margin of error for such an analysis.

The embodied carbon comparison between the retrofit and replacement schemes reveals both benefits and trade-offs. Excluding façade impacts, the retrofit scheme reduced the required embodied carbon impact of metal decking, gravity framing, and concrete slabs compared to the replacement scheme due to reuse. The sum of these categories amounts to 385 mt CO2eq vs 436 mt CO2eq for the retrofit and replacement option, respectively, or about a 50 mt CO2eq (12%) decrease. However, the embodied carbon impacts of additional bracing, new foundation

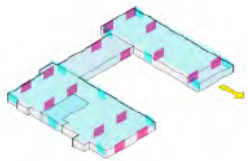
Retrofit Option



Existing Building

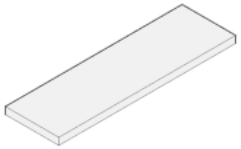


Existing Building Demolition

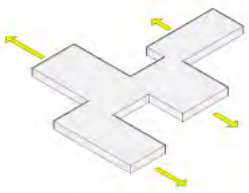


- Roof replacement
- Building addition
- New foundations and slab on grade as required
- Partial façade with CFS support
- Anchorage

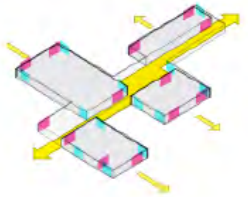
Replacement Option



Required Program Area

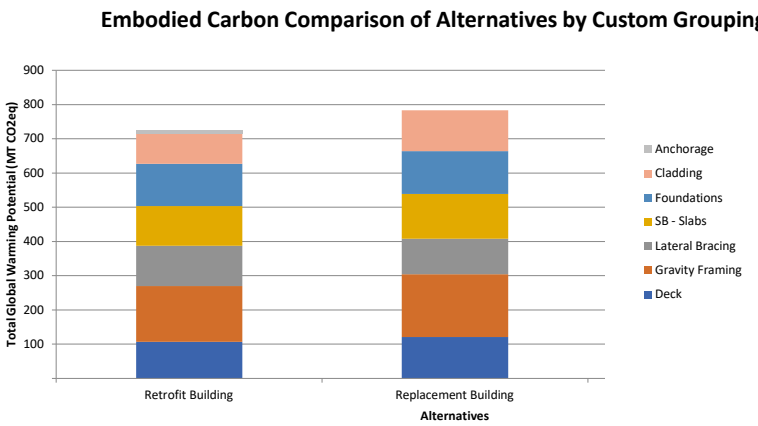


Required Program Area



- New gravity and lateral system
- Foundations
- Slab on grade
- Façade elements with CFS support

Source: Concepts, JKAE Architecture



Source: Degenkolb EnviCASE tool

work, and new anchorage of the façade in the retrofit option resulted in higher embodied carbon impact when compared to replacement: about 220 mt CO2eq vs 183 mt CO2eq, respectively, or 37 mt (13%) higher. This is due to the constraints of working around existing elements, as well as the extensive support system required for the existing façade.

The largest relative carbon savings was associated with the preservation of the existing façade in select areas. Preserving the façade initially resulted in a carbon savings of about 30 mt CO2eq, though the required anchor upgrades reduced that savings to about 20 mt CO2eq.

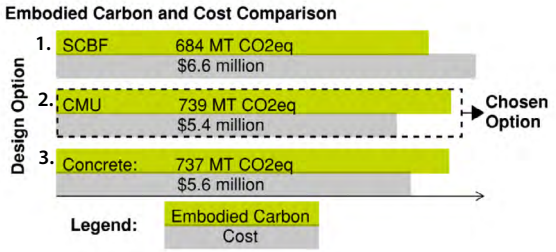
Ultimately, the embodied carbon reductions associated with the retrofit were deemed insufficient to offset the extensive replacement and strengthening required. When considered alongside the enhanced flexibility provided by new construction, the decision to demolish and replace the existing building was selected.

Build Clever: Balancing Sustainability and Cost

After choosing to proceed with the replacement option, the structural design and embodied carbon impacts for three new building replacement lateral schemes were assessed.

1. Special Concentrically braced frames (SCBF)
2. Reinforced concrete masonry unit (CMU) walls
3. Concrete shear walls

LCAs and cost estimates of the replacement building were performed. See the *Embodied Carbon and Cost Comparison* figure for the summarized results. Although the SCBF scheme resulted in about 8% less embodied carbon than the CMU or concrete scheme, the cost was almost 20% greater. Given the replacement scheme budget constraints, the additional cost associated with the SCBF scheme was not feasible. Therefore, the CMU block option was chosen.

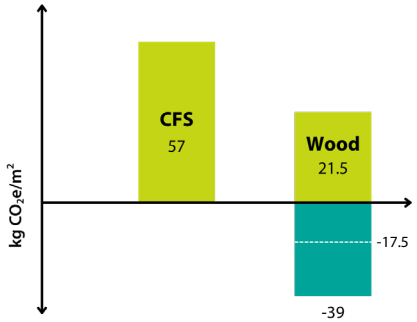


Build Efficiently: Façade Study

During the schematic design phase of the project, one proposed replacement building option considered a new façade system for the building. The façade consisted of a 1" thin brick, supported by the option of either cold formed steel (CFS) stud or sawn wood studs. An LCA was performed on the two assemblies to determine which has a greater environmental impact. The finishes, siding, and studs were considered as contributing to the LCA for this study.

The analysis found that the embodied carbon from procurement to production (A1-A3) was around 60% lower for the wood framed option than the CFS option (21.5 kg/CO2e/m2 vs 57 kg/CO2e/m2). The comparison can be seen in the figure *Embodied Carbon per Square Foot of Façade Including Biogenic Carbon Contribution* (see page 4).

However, when considering the biogenic carbon temporarily stored in the wood, the overall embodied carbon impact of the wood stud becomes net negative at -17.5 kg/CO2e/m2. Unlike the steel, the wood stores carbon atoms in its' structure and sequesters them whilst installed in the building. If at the end of the building life, the wood is burned or decomposes, this carbon is emitted back into the atmosphere at that time. However, if the wood is repurposed after use, or placed in a gas-capturing landfill, the carbon could be sealed within the wood for longer. End of life conditions were not assumed for this LCA and thus end-of-life carbon savings were neglected.



Embodied Carbon per Square Meter of Façade
Including Biogenic Carbon Contribution

In addition, the global warming impact of carbon in the atmosphere is dependent on the time it's in the atmosphere. The longer we can prevent a greenhouse gas from entering the atmosphere, the less it will warm our atmosphere today, giving us more time to adopt new policies and reduce long-term emissions.

The use of wood framing for the support of the façade is therefore more sustainable, though the uncertainty of end-of-life does not allow us to take advantage of the biogenic carbon storage. Additionally, if this façade system was selected, additional trade-offs such as maintenance, fire protection, cost, and durability of the backing material would need be considered. Although the façade in this study was not implemented into the final design of the building, it highlights the importance of material choice when considering overall embodied carbon impact. The final façade consisted of exposed CMU brick, which was already accounted for in the overall building LCA.

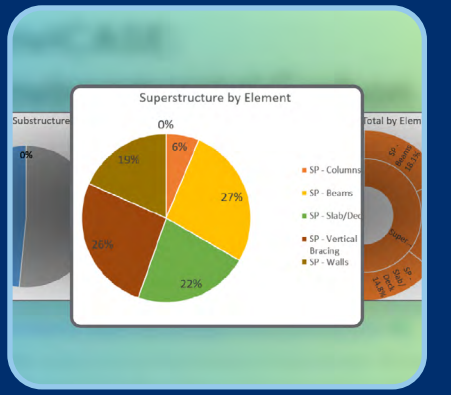
Embodied Carbon Reduction

This study is an example of when a retrofit option does not result in significant carbon savings. Due to an inefficient building footprint, inadequate ceiling height, high seismic demands on the lateral system and façades, and large new rooftop loads, much of the existing building had to be strengthened or replaced. The small carbon savings, coupled with the additional complications of working in an existing building resulted in a replacement option best serving the needs of the College. Generally, retrofit continues to be a carbon-saving option when scope is limited to structural strengthening only.

Embodied Carbon Accounting for Structural Engineers

This study was performed using Degenkolb's LCA tool, Envicase. Import structure data via Revit or analysis model, and easily compare results. EnviCASE is available for download for free on the Degenkolb website.

Learn more about EnviCASE



Source: Programming & Concept Design Submission, JKAE & Clark/Sullivan Construction