



KFSE Embodied Carbon Action Plan (ECAP)

March 31, 2026

Introduction:

Kurt Fischer Structural Engineering, Inc (KFSE), is a 18-person firm with offices in Encino, CA, Irvine, CA, and Portland, OR. KFSE is proud to commit to the SE 2050 Program to reduce the impact of building construction on the environment. We support the vision that all structural engineers shall understand, reduce, and ultimately eliminate embodied carbon in their projects by 2050.

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Color Legend

Blue = SE 2050 Requirement or elective

Black = KFSE Response

Green = KFSE Completed Task

Gold = In progress, not completed

KFSE’s Embodied Carbon Reduction Plans from prior years can be found on the SE2050.org website.

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Education Plan

Action items for 2025:

- Nominate KFSE Carbon Champion for 2026:
Carl Kloos, S.E., LEED AP is continuing as KFSE's Carbon Champion. Carl is a Vice President and leads KFSE's Portland, OR office. He has 20 years of experience in structural engineering, and has been a LEED Accredited Professional since 2013. From 2017-2023 Carl was member of the Structural Engineering Institute's (SEI) Sustainability Committee, participating in the Disaster Resilience working group.
- Share (1) webinar focused on embodied carbon during our monthly lunch-n-learn series.
KFSE will show an embodied carbon focused webinar during our monthly lunch-n-learn series.
Not yet completed, we will schedule this in 2026.
- Nominate a minimum of (1) employee per office to participate in a CLF Community Hub and/or task force.
KFSE's Embodied Carbon Reduction Champion will join the Portland CLF hub for 2025.
Completed 5/21/2025 – KFSE's Embodied Carbon Reduction Champion (Carl Kloos) joined the Portland CLF Hub. He also presented to the hub on embodied carbon and building adaptive reuse.

Action items for 2026:

- Share (1) webinar focused on embodied carbon during our monthly lunch-n-learn series.
KFSE will show an embodied carbon focused webinar during our monthly lunch-n-learn series.
- Share embodied carbon reduction strategies with your firm as outlined in Top 10 Carbon Reducing Actions for Structural Engineers document produced by SE 2050.
KFSE will share the SE 2050 Carbon Reduction Strategies with our team.

Additional potential electives for future years:

- 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.
 - Completed for 2023, KFSE has regularly attended the Quarterly SE 2050 Signatories calls.
 - Completed for 2024, KFSE has regularly attended the Quarterly SE 2050 Signatories calls.
 - Completed for 2025, KFSE has regularly attended the Quarterly SE 2050 Signatories calls.
- Share the SE 2050 library of resources with technical staff.
- Share embodied carbon reduction strategies with your firm as outlined in Top 10 Carbon Reducing Actions for Structural Engineers document produced by SE 2050.
- Nominate a minimum of (1) employee per office to participate in a CLF Community Hub and/or task force.
- Provide narrative outlining plans for minimum (2) firm-wide presentations per year on the topic of embodied carbon.
- Present the document, "How to calculate embodied carbon" to all technical staff.
- Minimum (1) employee attends a presentation or demo of an LCA-based tool used to calculate embodied carbon, such as Tally, Athena IEB, or One Click LCA.
- Initiate an embodied carbon interest group within your firm and outline their goals.

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- Provide a narrative of how the Embodied Carbon Reduction Champion will engage embodied carbon reduction at each office. (intended for multi-office firms).
- Propose other actions promoting embodied carbon education and describe their value.

Reporting Plan

Each year KFSE will:

- 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. Offices less than 5 FTE are excluded.

KFSE will submit (2) projects to the database each year (We have 1 office over 5 FTE).

- Completed for 2023. Analysis for (2) projects ready for upload on 7/25/2023
- Completed for 2024. Analysis for (2) projects ready for upload on 3/14/2024
- Completed for 2025. Analysis for (2) projects uploaded 3/26/2025
- Completed for 2026. Analysis for (2) projects uploaded 3/20/2026

Additional potential electives for future years:

- Submit all of your firm's projects to the SE 2050 database.
- Report a greater percentage of projects than you did the previous year.
- 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.
- Propose other actions that promote the reporting of embodied carbon data and describe their value.

Embodied Carbon Reduction Plan

Action Items for 2025:

- Update your specifications to incorporate embodied carbon performance. Include embodied carbon in your submittal review requirements.
We extensively overhauled our concrete general notes and specifications in 2024 to include performance based concrete specifications and adding a section for embodied carbon budgets. For 2025 we made some tweaks to the concrete specification. We had a goal of working on other material specification sections, but will continue with improvements for 2026.
- Communicate the embodied carbon impacts of different design options to clients with creative data visualization. Include these visualizations in your Elective Documentation.
Completed in 2025. This past year we made some improvements to the embodied carbon score card, in particular revising to use Gross Floor Area instead of total occupiable area. This puts our embodied carbon results in line with the SEI "Prestandard for Assessing the Embodied Carbon of Structural Systems for Buildings" that was released in 2025. We also used the scorecard in multiple presentations throughout the year.

Action Items for 2026:

- Update your specifications to incorporate embodied carbon performance. Include embodied carbon in your submittal review requirements.
Continue to update specifications for other materials not yet updated.
- Create a project-specific embodied carbon reduction plan.

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We hope to have a project this year that would make sense for a project specific embodied carbon reduction plan.

Additional potential electives for future years:

- Set clearly stated, firm-wide reduction targets in the short-term (5 years)
- Project case study sharing embodied carbon reduction successes and lessons learned
- Create a project-specific embodied carbon reduction plan.
- Complete an embodied carbon comparison study during the project concept phase.
- Participate in a LEED, ILFI Zero Carbon, or similar project design charrette and speak to potential design considerations impacting embodied carbon.
- Calculate your firm average benchmark for embodied carbon.
- Collaborate with your concrete supplier to reduce embodied carbon in a mix design.
- Work with a contractor during material procurement to meet an embodied carbon performance criteria on at least (1) project.
- Have an Environmental Product Declaration (EPD) created for a project.
- Incorporate biogenic materials on at least one project.
- Submit a Circular Economy Narrative describing how the project supports the circular economy. This can be done by incorporating re-use or design for deconstruction into at least one project.
- Report weight and method of transportation of structural material. Track how much is processed for recycling/salvage and sent to landfill, including material generated during demolition and construction activity. Include at least four material streams (e.g. concrete, metal, wood, gypsum wallboard, paper and cardboard, plastic).
- Integrate embodied carbon mitigation strategies in your General Notes.
- Propose other embodied carbon reduction strategies and describe their value.

Advocacy Plan

Action Items for 2025:

- Share your commitment to SE 2050 on your company website.
 - KFSE will add a section about SE 2050 to our website in 2025.
- Describe the value of SE 2050 to clients. How can your design teams collaborate to reduce embodied carbon?
 - Partial credit for 2025. We discussed embodied carbon and SE 2050 with several architects. Though we did not have a lot of success with achieving collaboration focused on embodied carbon reduction.
- Discuss SE 2050 and Carbon Reduction in a presentation to an architecture firm
 - KFSE's Embodied Carbon Champion gave multiple presentations in architect's offices focusing on Adaptive Reuse and its benefits for embodied carbon. Presentations were given to four Portland area firms.
- Give an external presentation on embodied carbon that demonstrates a project success or lessons learned (Tip: Get connected at a CLF local hub near you!).
 - 5/21/2025 - KFSE's Embodied Carbon Champion gave a presentation to the Portland Hub of CLF, focusing on Adaptive Reuse and its benefits for embodied carbon

Action Items for 2026:

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- Describe the value of SE 2050 to clients. How can your design teams collaborate to reduce embodied carbon?
KFSE will continue to discuss the SE 2050 commitment with clients.
- Discuss SE 2050 and Carbon Reduction in a presentation to an architecture firm
KFSE will look to present to another architecture firm with including SE 2050, Carbon Reduction, and adaptive reuse in 2025.
- Give an external presentation on embodied carbon that demonstrates a project success or lessons learned (Tip: Get connected at a CLF local hub near you!).
In 2026 KFSE will look to present to Portland's Sustainable Building Monthly.

Additional potential electives for future years:

- Give an external presentation on embodied carbon that demonstrates a project success or lessons learned (Tip: Get connected at a CLF local hub near you!).
- With the owner or client, discuss a facility- or product-specific EPD requirement for structural materials.
- Share education opportunities with clients.
- Encourage industry and policy change by promoting and using low-carbon and carbon-sequestering materials.
- Start an embodied carbon community of practice or mentorship program in your office.
- Mentor a firm new to the embodied carbon space.
- Propose alternative methods for advocacy and describe their value.

Lessons Learned/Progress Update

Getting started in SE 2050, the first big task was to determine what method and tools we would use to calculate the embodied carbon for our project. This took longer than expected, but we were able to report our first two projects in July of 2023 (actually uploaded in December due to Database website being down). Our second two project were ready for reporting in March 2024. Our third set of projects were uploaded in March 2025.

To calculate the embodied carbon for our projects, we decided to use a combination of in-house Revit aids and excel combined with EC3. The in-house Revit aid allowed us to calculate the material quantities for primary framing members and slabs. We combined this with additional excel tools to efficiently determine the remaining material quantities for each selected project.

We looked at other methods, but since our clients have not yet been requesting this information, we settled on using EC3 since it is free to use and thus not an additional overhead cost. We are hoping to team in the future with clients that are involved in AIA 2030, and when that happens, we will likely shift to a program like Tally when our carbon reporting becomes a client deliverable.

The next step was to import the data to EC3, which was a straightforward process. After that, we got the embodied carbon data, downloaded the data into an excel file, and then uploaded to the SE 2050 Database.

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In our first two years, our calculations were based on the combined gross floor and roof plate area. In 2025, the SEI “Prestandard for Assessing the Embodied Carbon of Structural Systems for Buildings” was released. In the Prestandard, the IBC defined “Gross Floor Area” is used to determine the carbon intensity. To align all of our data with the building area used in the Prestandard, KFSE has revised all of our carbon intensities and resubmitted to the SE 2050 database.

The eight projects we chose to submit to SE 2050 are shown below:

1634 20th Street (224.1 kgCO₂e/m²) – 114,790 sf, 5 over 2, light framed on concrete podium with 1 level subterranean parking. 78 units of affordable housing. Santa Monica, CA. Submitted 2023. Revised 2025.

Trancas Canyon Residence (423.5 kgCO₂e/m²) – 3,500 sf 1-story single family residence, with concrete flat slab roof and concrete walls. The project was built entirely of concrete following the Malibu fire which completely destroyed the prior house on this site. Malibu, CA. Submitted 2023. Revised 2025.

Manhattan (247.6 kgCO₂e/m²) – 104,143 sf, 5 over 2, light framed on concrete podium with 1 level subterranean parking. 60 units. Los Angeles, CA. Submitted 2024. Revised 2025.

Gooseberry Trails (104.4 kgCO₂e/m²) – 50 units of townhomes up to 3 levels. All light framed wood construction. One 4-unit 7,895 sf, 3-story structure with daylight basement from the development was submitted. Portland, OR. Submitted 2024. Revised 2025.

Jalmia Drive (215.1 kgCO₂e/m²) – 2-story Single family residence with 2,250 sf basement consisting of a light framed wood floor and roof and wood sheathed shear walls. Los Angeles, CA. Submitted 2025.

Mission Street (132.3 kgCO₂e/m²) – 45,606 SF. 8-story residential structure with retail at the ground level. 7" P.T. concrete floor slabs with concrete shear walls and 24" mat foundation. San Francisco, CA. Submitted 2025.

Woodlark Hotel (87.8 3 kgCO₂e/m²) - Adaptive reuse conversion of 10-story office building to hotel. 47,203 sf. The building provided 84 keys, and entailed a full code seismic upgrade consisting of new special reinforced concrete shear walls. The existing building was built in 1912. Submitted 2026.

222 W 6th Street (20.0 3 kgCO₂e/m²) - Adaptive re-use conversion from office to residential for a steel moment frame building built in 1987, 7 years prior to the Northridge earthquake. 272,339 SF. The retrofit will utilize the Durafuse Shear Haunch connection, which allows for the existing frames to remain, with out any added steel elements to the exterior. Submitted 2026.

Our eight reported projects can be seen in the diagrams below from the SE 2050 website (Figures 1&2).

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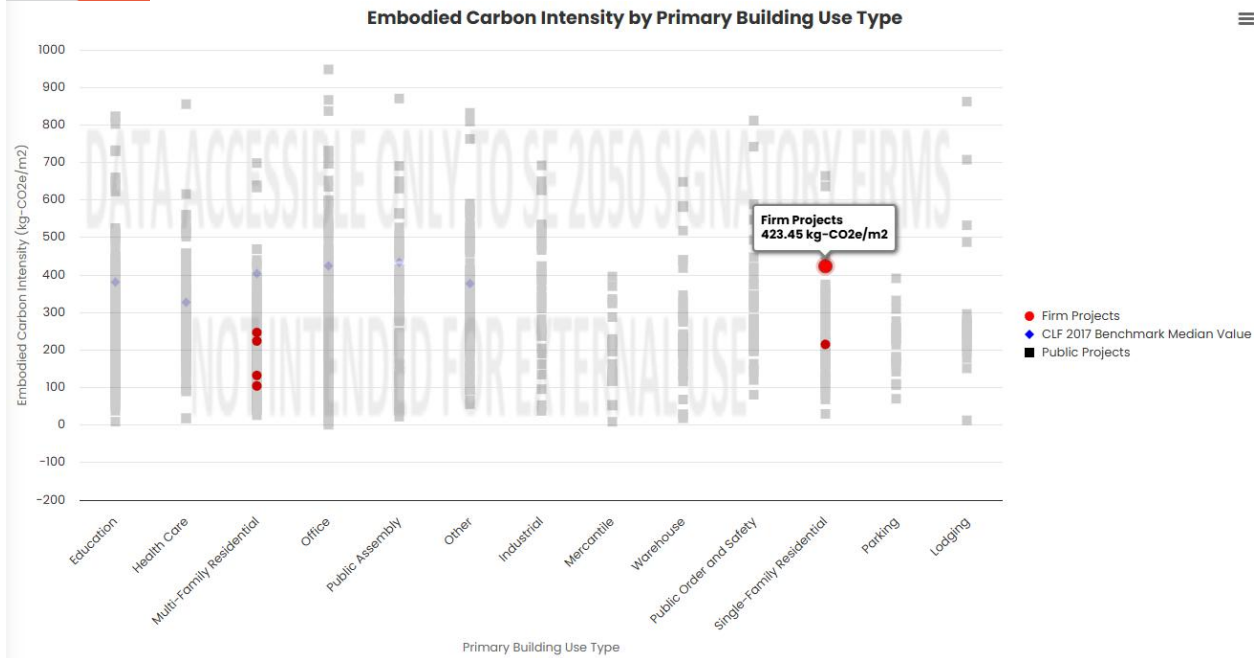


Figure 1 - Embodied Carbon Intensity for KFSE Projects through 3-26-2025 (not yet transferred to new database)

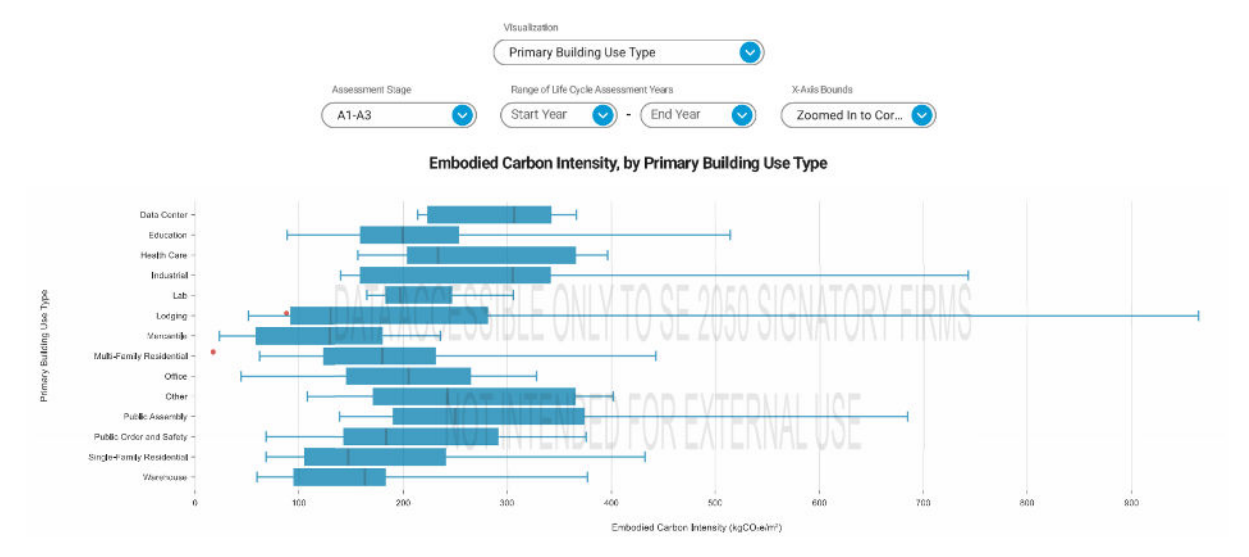


Figure 2 - Embodied Carbon Intensity for KFSE Projects Uploaded in 2026

As expected, the all-concrete single family residence was one of the more carbon intensive single family residences in the database. Otherwise, we are pleased to see that our three multifamily projects are on the lower end of the carbon intensity range. The two podium projects have an intensity of 161 kgCO₂e/m² & 186 kgCO₂e/m². As expected, the all light framed wood townhomes have the lowest carbon intensity of 96.4

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kgCO₂e/m². Most of the carbon is from the foundations, including the concrete walls in the basement for the daylight basement.

To summarize our carbon intensity findings for clients, we have developed an Embodied Carbon summary sheet. An example can be found in Appendix A.

The example in Appendix A of our 2024 ECAP shows the 1634 20th st project, which is 5 levels of wood over 2 levels of concrete podium with one level of subterranean parking. Wood framing accounted for 54% of the gross area, while concrete was the remaining 46%. As expected, the wood framing, while occupying more area, is a small fraction of the carbon intensity vs the concrete floors. Wood framing accounted for only 8% of the embodied carbon while concrete and rebar accounted for the remaining 92%. It's known that light framed wood construction is less carbon intensive than concrete, but this serves as a good reminder that whenever possible it is better from an embodied carbon standpoint to reduce the number of concrete levels in podium construction.

2025 project analysis:

Counterintuitively, Mission Street which is all concrete was on the lower end of the GWP intensity for the multi-family residential sector. This project had very thin PT slabs at 7", so the efficient use of concrete turned out to result in a relatively low embodied carbon intensity. Our other multi-family residential projects typically had 12" mild reinforced slabs for the lower levels and 16" slabs for the podium, so while they had 5 floors of light framed construction the vast majority of the embodied carbon was in the lower-level podium structure and the efficiency of the light framed wood was outweighed by the embodied carbon of the podium.

In 2025, we also encountered an interesting result when looking at the area that is used in the denominator to determine the GWP Intensity. Per the soon to be released Prestandard on embodied carbon determination, we used Gross Floor Area. However, for projects with significant usable area that is outside the building envelope this can penalize the GWP intensity significantly. In our 2025 ECAP we have included a quick study investigating this.

2026 project analysis:

In appendix A we have included our Embodied Carbon Summary Sheet for the two projects that we uploaded this year.

For these two projects we captured the extremes for the embodied carbon of adaptive reuse projects, with one project involving a full new lateral system, and the other project involving limited connection retrofitting. Both projects are on the west coast and have a required retrofit as part of the project requirements. To compare the adaptive reuse projects to new construction, we used the 2022 CLF Benchmark study as a baseline to compare the retrofit to an equivalent multi-family project with new construction.

The first project is the Woodlark Hotel, which is the adaptive reuse office to residential conversion of a 10-story non-ductile concrete building in Portland, Oregon. Due to inadequate seismic separation with an adjacent building, the retrofit was designed to 125% of current full code seismic forces. As a concrete building, a stiff special reinforced concrete shear wall lateral system was used to reduce the drifts to make drift compatibility work. As a result, there was relatively a lot of concrete added to the building for the retrofit. The building was completed in 2018, which was prior to our teams use of performance based concrete specifications, so none of the concrete used was a slow embodied carbon mix. When comparing to

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the CLF benchmark, the Woodlark had 35% of the embodied carbon in a new project, so even with the very heavy retrofit it saved 65% of the structural embodied carbon.

The second project is 222 W 6th Street. This project is a 13-story pre-Northridge steel moment frame. For the retrofit, we employed Durafuse connections to fix the deficient moment frame connections and also added dampers in a few locations. The resulting retrofit was only 2% of the equivalent CLF new construction baseline. The project had a total embodied carbon of 6.9%, mostly due to added steel for a new pool deck and balconies.

From the above, we found that a seismic retrofit is likely going to require between 2% to 35% of the structural embodied carbon of an equivalent new construction. As the maxim, “the greenest building is the one that is already built” is still very true even when a seismic retrofit is required.

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Appendix A – Embodied Carbon Summary Sheets for Projects Uploaded in 2026

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STRUCTURAL ENGINEERING

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Structural Embodied Carbon Summary (Primary Structure Only)

Project Name: [Woodlark Hotel](#)

Engineer: [JH/CK](#)

Project Number: [13064.00](#)

Date: 5/13/2025

Project Information

Architect: [R&A](#)

Phase: [Built](#)

LCA Stages: [A1-A3](#)

Location: [Portland, OR](#)

Gross Floor Area: [47,203 SF](#)

"Gross Floor Area," per the IBC definition, includes all area enclosed by the exterior walls of the building; roof/exterior wall area excluded

Summary: [Adaptive reuse conversion of 10-story office building to hotel. The building provided 84 keys, and entailed a full code seismic upgrade consisting of new special reinforced concrete shear walls. The existing building was built in 1912.](#)

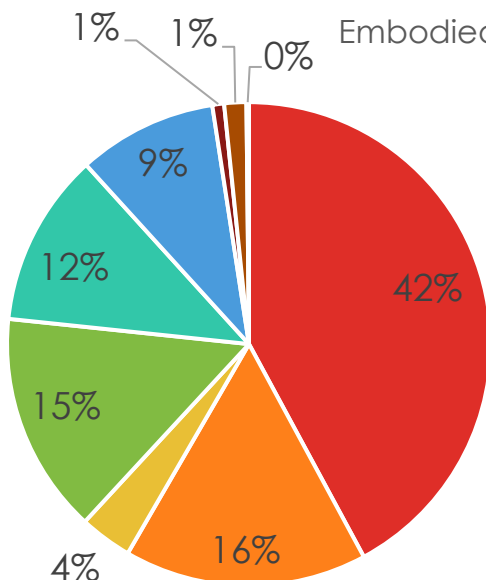
LCA Results

Embodied Carbon By Material:

CONCRETE WALLS	187600 kg-CO ₂ e
CONCRETE FOUNDATIONS	72400 kg-CO ₂ e
MISC. CONC (INCL. BM & COL)	15600 kg-CO ₂ e
CONC. OVER METAL DECK	65900 kg-CO ₂ e
REINFORCING BARS	51700 kg-CO ₂ e
STRUCTURAL STEEL FRAMING	41500 kg-CO ₂ e
STRUCTURAL STEEL DECK	3500 kg-CO ₂ e
LIGHT GAUGE FRAMING	6600 kg-CO ₂ e
STRUCTURAL CEMENT BOARD	700 kg-CO ₂ e

Embodied by Masterspec Division:

03 30 00 C.I.P. Concrete	341600 kg-CO ₂ e
03 21 00 Reinf. Bars	51700 kg-CO ₂ e
05 12 00 Structural Steel	41500 kg-CO ₂ e
05 31 00 Steel Decking	3500 kg-CO ₂ e
05 40 00 C.F. Framing	6600 kg-CO ₂ e
06 16 43 Gyp. Sheathing	700 kg-CO ₂ e



Embodied Carbon by Material

- CONCRETE WALLS (187600 kg-CO₂e)
- CONCRETE FOUNDATIONS (72400 kg-CO₂e)
- MISC. CONC (INCL. BM & COL) (15600 kg-CO₂e)
- CONC. OVER METAL DECK (65900 kg-CO₂e)
- REINFORCING BARS (51700 kg-CO₂e)
- STRUCTURAL STEEL FRAMING (41500 kg-CO₂e)
- STRUCTURAL STEEL DECK (3500 kg-CO₂e)
- LIGHT GAUGE FRAMING (6600 kg-CO₂e)
- STRUCTURAL CEMENT BOARD (700 kg-CO₂e)



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Structural Embodied Carbon Summary (Primary Structure Only)

Project Name: [Woodlark Hotel](#)

Engineer: [JH/CK](#)

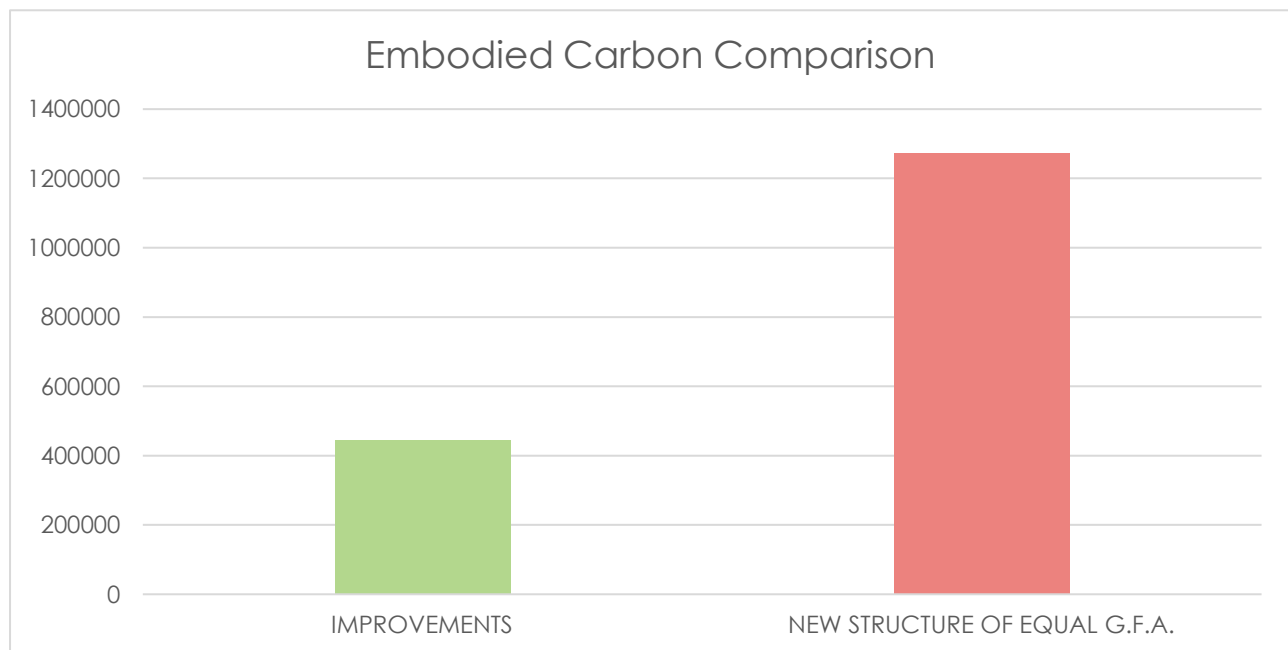
Project Number: [23094.00](#)

Date: 5/13/2025

Comparison of Improvements to Benchmark

The CLF 2017 Baseline estimate of a structure with an equivalent G.F.A. has been used for this comparison; an embodied carbon takeoff of the entirety of the existing structure has NOT been performed for the purposes of the comparison below

EMBODIED CARBON FOR:	MAGNITUDE	UNIT
2022 CLF BENCHMARK MULTIFAMILY (SE, A1-A3) INTENSITY	290 kg-CO ₂ e/m ²	
IMPROVEMENTS	445500 kg-CO ₂ e	
NEW STRUCTURE OF EQUAL G.F.A.	1272000 kg-CO ₂ e	



Assessment of Carbon Efficiency of Retrofit (in lieu of New Structure)

"DELTA" (savings):	1272000 kg-CO ₂ e	(Carbon emissions of equiv. new structure)
-	445500 kg-CO ₂ e	(Carbon emissions of improvements)
=	826500 kg-CO ₂ e	

Improvements / New Benchmark	=	35.0	%
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Structural Embodied Carbon Summary (Primary Structure Only)

Project Name: [222 W 6th Street](#)

Engineer: [JH/CK](#)

Project Number: [23094.00](#)

Date: 5/13/2025

Project Information

Architect: [KFA](#)

Phase: [Plan Check](#)

LCA Stages: [A1-A3](#)

Location: [San Pedro, CA](#)

Gross Floor Area: [272,339 SF](#)

"Gross Floor Area," per the IBC definition, includes all area enclosed by the exterior walls of the building; roof/exterior wall area excluded

Summary: [Adaptive re-use conversion from office to residential for a steel moment frame building built in 1987, 7 years prior to the Northridge earthquake. The retrofit will utilize the Durafuse Shear Haunch connection, which allows for the existing frames to remain, with out any added steel elements to the exterior.](#)

LCA Results

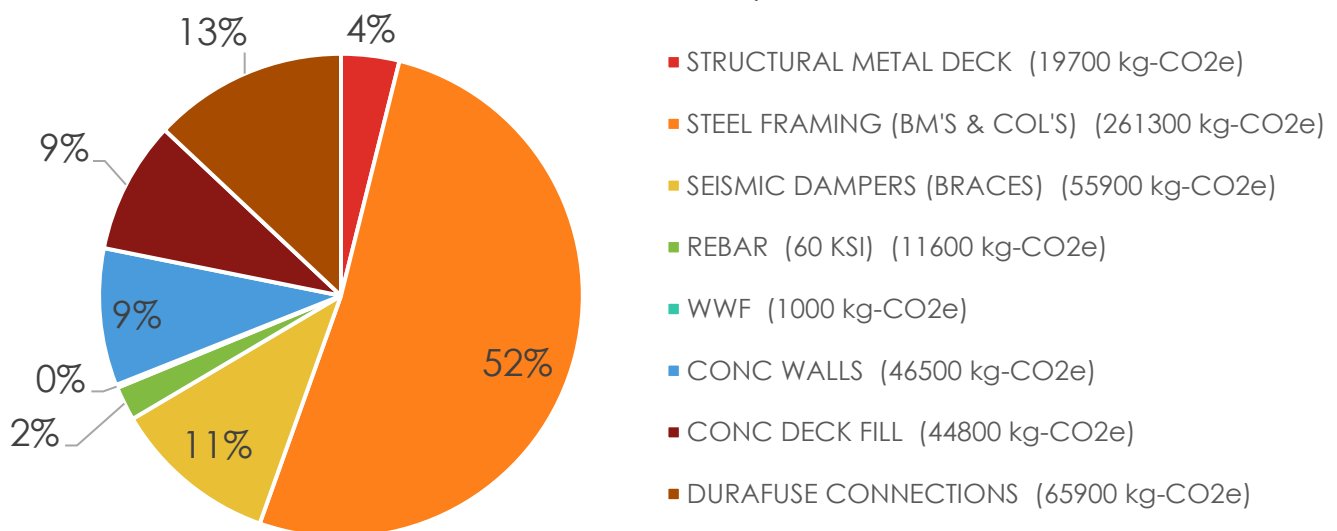
Embodied Carbon By Material:

STRUCTURAL METAL DECK	19700 kg-CO ₂ e
STEEL FRAMING (BM'S & COL'S)	261300 kg-CO ₂ e
SEISMIC DAMPERS (BRACES)	55900 kg-CO ₂ e
REBAR (60 KSI)	11600 kg-CO ₂ e
WWF	1000 kg-CO ₂ e
CONC WALLS	46500 kg-CO ₂ e
CONC DECK FILL	44800 kg-CO ₂ e
DURAFUSE CONNECTIONS	65900 kg-CO ₂ e

Embodied by Masterspec Division:

05 31 00 Steel Decking	19700 kg-CO ₂ e
05 12 00 Structural Steel	383100 kg-CO ₂ e
03 21 00 Reinf. Bars	11600 kg-CO ₂ e
03 22 00 W.W.F. Reinf.	1000 kg-CO ₂ e
03 30 00 C.I.P. Concrete	91300 kg-CO ₂ e

Embodied Carbon by Material





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Structural Embodied Carbon Summary (Primary Structure Only)

Project Name: [222 W 6th Street](#)

Engineer: [JH/CK](#)

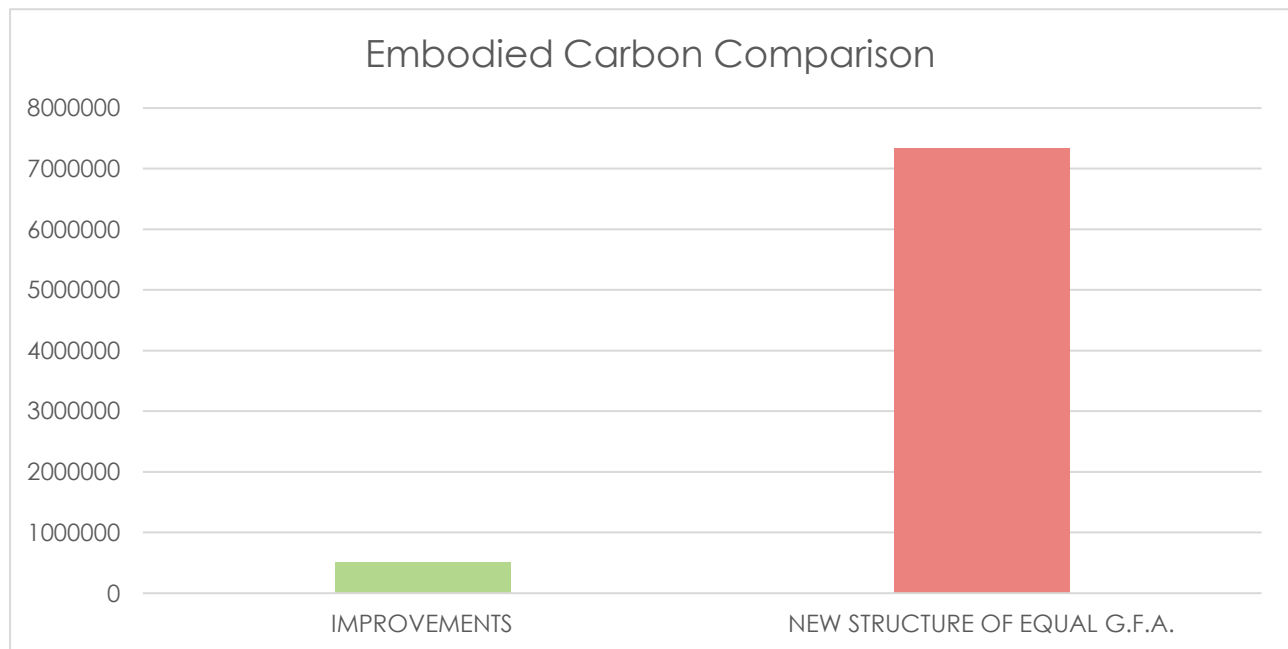
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Comparison of Improvements to Benchmark

The CLF 2017 Baseline estimate of a structure with an equivalent G.F.A. has been used for this comparison; an embodied carbon takeoff of the entirety of the existing structure has NOT been performed for the purposes of the comparison below

EMBODIED CARBON FOR:	MAGNITUDE	UNIT
2022 CLF BENCHMARK MULTIFAMILY (SE, A1-A3) INTENSITY	290 kg-CO ₂ e/m ²	
IMPROVEMENTS	506700 kg-CO ₂ e	
NEW STRUCTURE OF EQUAL G.F.A.	7337000 kg-CO ₂ e	



Assessment of Carbon Efficiency of Retrofit (in lieu of New Structure)

"DELTA" (savings):	7337000 kg-CO ₂ e	(Carbon emissions of equiv. new structure)
-	506700 kg-CO ₂ e	(Carbon emissions of improvements)
=	6830300 kg-CO ₂ e	

Improvements / New Benchmark	=	6.9 %
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