Embodied Carbon Action Plan

anthem
structural engineers

SEI ASCE STRUCTURAL ENGINEERING INSTITUTE | SE2050 COMMITTING TO NET ZERO

Mountain Modern - Silverthorne, CO

PROFESSIONAL • INNOVATIVE • RELIABLE

About Anthem & SE 2050 Goals

Anthem is committed to supporting the push towards more sustainable design practices across the construction industry. Anthem has signed onto the SE 2050 Challenge, a commitment in the structural engineering industry to reduce and eventually eliminate embodied carbon in projects by 2050. Our passion and commitment to providing our clients with the most innovative, yet low carbon-impact project solutions makes us a leader in the structural life cycle assessment market. We offer detailed embodied carbon impact reports, structural life cycle assessments, and education materials, completely integrated with your unique needs and requirements for any project type.

The Anthem team has 23 employees spread across California, Colorado, Minnesota, New York, North Carolina, Oregon, Virginia, and Washington, with physical office locations in the cities of Boulder, Steamboat Springs, and Golden, Colorado. The Boulder office serves as our home base and the headquarters of the Sustainability Team.

2010
year established

23
full-time staff

11
# of states licensed

3
office locations

PASSIONATE • CREATIVE • COLLABORATIVE

Anthem Structural Engineers combines innovation, creativity, and practicality to deliver complex designs, while offering personal, responsive client service across a broad range of project types including healthcare, industrial, luxury residential, multi-family, municipal, and commercial.

Our team is a dynamic, relationship-driven group of innovative problem-solvers committed to delivering creative and economical solutions that are good for our clients and beneficial for our environment.

Our team provides the best possible combination of:

- Broad structural experience
- Creative solutions
- Unmatched client service

Sheela Vedula, P.E.

Project Engineer

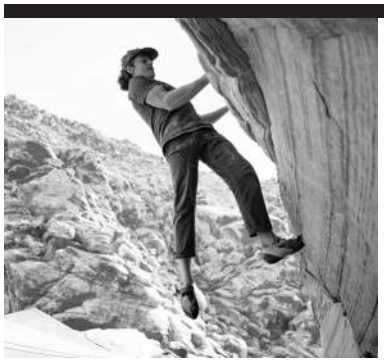
Embodied Carbon Champion

SE2050 Advocacy Lead

McKinley Forster, P.E.

Project Engineer

SE2050 Reduction Lead



Brenton Kreiger, P.E.

Project Engineer

SE2050 Reporting Lead

Samantha Taylor, P.E. LEED Green Associate

Project Engineer

SE2050 Education Lead

The Anthem Sustainability Team spans across four states, offering a unique advantage by allowing us to draw from a diverse range of policies, codes, and literature. This multi-state reach enables us to tap into varied expertise and to participate in Structural Engineers Association (SEA) committees unique to each region, enriching our approach to sustainability. We hold regular meetings to discuss key initiatives like SE 2050, life cycle assessments (LCAs), and other sustainability-focused topics. Additionally, we actively engage in our local seminars and events, staying connected with cutting-edge developments in sustainable structural engineering across our regions.

COMMITMENT LETTER

March 12th, 2024

Laura Champion,
Director, Structural Engineering Institute

Subject: **LETTER OF COMMITMENT TO THE SE 2050 PROGRAM**

Dear Laura,

Anthem Structural Engineers, a 20-person firm located in Bouder, Golden & Steamboat Springs Colorado, is hereby signing on to the SE 2050 Commitment Program. We support the vision that all structural engineers shall understand, reduce, and ultimately eliminate embodied carbon in their projects by 2050.

We are committed to helping the push towards more sustainable design practices across the construction industry. Anthem understands that embodied carbon reduction in structures is the key in the fight for a healthier Earth and combatting climate change. Our passion and commitment to giving our clients the most innovative, yet low-carbon impact solutions on our projects closely aligns with the SE 2050 mission statement. We truly believe that engineering, and its interaction with the built environment should no longer be an afterthought in design but become a precedent.

We therefore commit Anthem Structural Engineers to take the following steps which are part of the SE 2050 Commitment Program:

- Within six months and annually henceforth, we commit to reporting an Embodied Carbon Action Plan (ECAP) and permit the ECAP document or form be made public on the SE 2050 website.
- Within one year and annually henceforth, we commit to submit data to the SE 2050 project database in a collaborative effort to understand embodied carbon in structural engineering projects and to set attainable targets for future projects.

We look forward to joining this coalition and industry effort to achieve the goals of the SE 2050 Program.

Sincerely,
Anthem Structural Engineers

Daniel Knapp, P.E.
Principal

Derek D. Henderson, P.E.
Principal

INTERNAL ANNOUNCEMENT

On March 19th, 2024 the Sustainability Team hosted an internal SE 2050 virtual information session. During this meeting we made an official announcement to all employees of Anthem Structural Engineers that we have committed to SE 2050. We shared resources and addressed our firm-wide goals as they relate to embodied carbon reduction and education. This opened a dialogue with the Anthem team and began outlining our trajectory as we collectively move ahead in this sustainability commitment.

To: Staff
Subject: Anthem Sustainability Team 🌲 Updates
Attachments: SE2050 Commitment Letter_Signed.pdf; SE2050 & LCA & Tally Presentation Slides.pdf

Hello Anthem Team!

Anthem Structural Engineers commitment we have made joining SE 2050 states that: *"All Structural engineers shall understand, reduce and ultimately eliminate embodied carbon in their projects by 2050."* Earlier this year we formally committed to SE 2050 and had Dan and Derek sign a formal commitment letter indicating our dedication to this cause and that we as a company are making the push towards more sustainable design practices. Anthem's Sustainability Team has been working very diligently over the past year to work on adhering to all the rules and requirements for signing onto this SE 2050 commitment. I have attached a copy of our signed commitment letter for those who wish to view it! I have also attached a variety of other resources for those who wish to begin educating themselves on all the different terminology as it relates to sustainability and reducing embodied carbon.

Please feel free to reach out to me if you have any other questions about what the Sustainability Team is up to!

Additional Resource Links:
SE 2050 ECAPs → https://se2050.org/signatory-firms/ (A place to view other companies ECAPs!)
Carbon Leadership Forum → https://carbonleadershipforum.org/clf-policy-toolkit/ (A place to view quick 2-4 page documents defining all these new Sustainability Terms you may not have heard of before)

Sheela Vedula, P.E.
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Sustainability Manager
Ph: (303) 848-8497 x711
Website | LinkedIn | Instagram

anthem
structural engineers
BOULDER | GOLDEN | STEAMBOAT SPRINGS

Education Plan

At Anthem Structural Engineers, we are committed to continuously improving our firm-wide understanding of the environmental impacts of our projects. Because sustainable design is not taught in the traditional engineering curriculum, we are first gaining insight on the fundamentals and building blocks, then working towards mastering increasingly nuanced topics regarding embodied carbon reduction strategies and measurements.

Our Embodied Carbon Champion, Sheela, is leading the initiative to promote embodied carbon reduction strategies across all Anthem teams and offices. Each team will appoint a representative to join our Sustainability Team, facilitating effective communication and resource sharing. This team will be responsible for researching and implementing diverse methods and tools for reducing embodied carbon.

Recent updates in the ongoing professional development of Sustainability Team members includes Sheela's attendance of the Embodied Carbon Bootcamp and Symposium at the University of Colorado Boulder and Samantha's LEED Green Associate accreditation. Next on the horizon is an internal Embodied Carbon 101 training session to be presented and recorded for future reference and made available to all staff members. Moving forward, Anthem is actively engaging embodied carbon scholars and thought leaders to present information and education sessions to our team. These presentations along with the resources provided by the Embodied Carbon Champion will help facilitate meaningful discussions and knowledge sharing amongst the staff.

Calcaire Residence - Boulder, CO

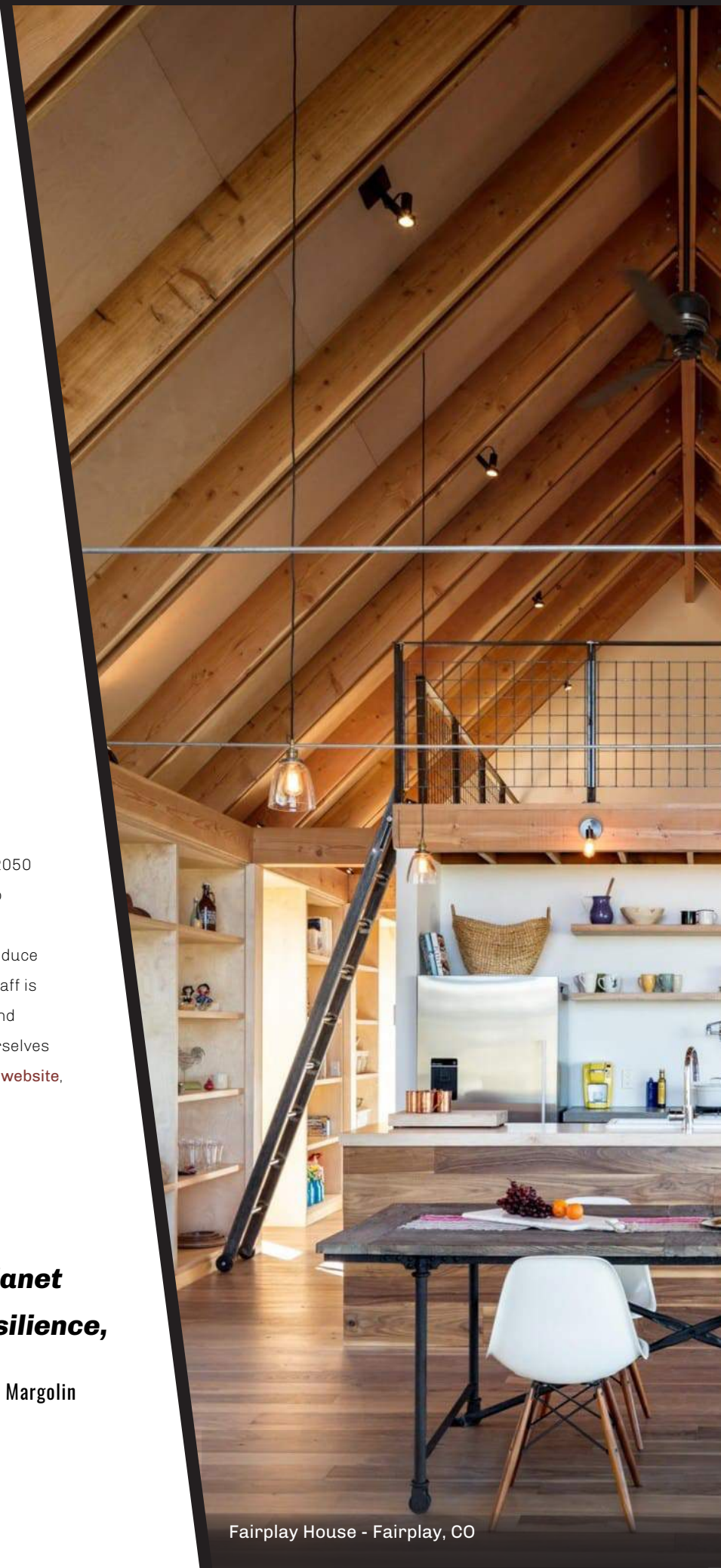
Advocacy

As part of our commitment to the SE 2050 initiative, Anthem Structural Engineers aims to educate our clients on the importance of sustainability in structural engineering. We are leveraging multiple platforms to promote our embodied carbon reduction strategies and engage clients in meaningful discussions about their projects. Our Sustainability Team will continue to have discussions with contractors and material suppliers, encouraging open communication about the impact of choosing lower embodied carbon materials. Anthem is also integrating Life Cycle Assessment (LCA) services into our project proposal language to catalyze early discussions and promote questions from clients with the hope of LCA integration into all future projects. In addition to discussing and identifying target areas to reduce carbon emissions at every project kickoff meeting, we have created an LCA Questionnaire as well to facilitate these conversations.

Knowledge Sharing

Anthem is actively enhancing our online presence in the SE 2050 space. We currently have a dedicated page on our website to highlight our embodied carbon initiatives, showcasing our commitment and strategies. We are also collaborating to produce informative content for digital and social media platforms. Staff is encouraged to repost this content to broaden our visibility and expand our reach. Anthem has already publicly declared ourselves as a member of SE 2050 on several platforms, including our website, Instagram, and LinkedIn pages.

> ***"Let's rewrite the story of our planet and ensure that it's a tale of resilience, sustainability, and hope."***
>
> Jamie Margolin



Fairplay House - Fairplay, CO

Material Specialties

- Timber
- Steel
- Masonry
- Glass
- Concrete
- Passive Houses
- Cold-formed steel
- Tilt-up concrete
- Precast concrete
- Post-tensioned concrete
- Mass timber (NLT, CLT)
- Modular Panelized Systems

Embodied Carbon Reduction

The first year of Anthem's Embodied Carbon Action Report (ECAP) is focusing on two main strategies for reducing embodied carbon in our projects. The first is educating both internally and externally on embodied carbon and ways to reduce it within our designs. The second focus is developing and implementing standards with the goal of reducing embodied carbon.

Strategy 1 The first step to reducing embodied carbon is educating Anthem's engineers on what embodied carbon is and strategies to reduce the embodied carbon in our designs. Once we have an internal understanding of how to reduce embodied carbon, we must extend this to our clients using the Embodied Carbon Questionnaire. We are also utilizing the Tally plugin for Autodesk Revit to give our clients a graphical data representation of structural impacts. This allows the client to visually see how the material selections and design decisions impact the embodied carbon of the project. The Anthem Sustainability Team developed a series of standard processes for measuring and reporting embodied carbon, depending on the phase at which carbon reporting is accepted into the project.

Strategy 2 To achieve our second focus, we begin by identifying a baseline of embodied carbon from a variety of previously completed projects. Once completed, we implement target Global Warming Potential (GWP) limits for both structural concrete and steel components used within a project and require all concrete specifications to provide an Environmental Product Declaration (EPD) within the submittal review.

Anthem's long-term reduction strategy focuses on implementing design strategies within our projects to reduce the embodied carbon of our structures while maintaining the design intent and the client's vision. This is achieved by providing design options within the Design Development phase of the project, utilizing Tally and the design options functionality within Revit. Additional strategies Anthem will implement include specifying concrete mix designs that have lower embodied carbon, implementing more wood and renewable materials (such as cross-laminated timber) where possible within projects, and continuously advocating for more sustainable design elements within our projects to both owners and architects.

THE ANTHEM LCA PROCESS

1 Pre-Design

If Anthem is brought in during the Pre-Design phase of a project, the first task is to define the desired Life Cycle Assessment (LCA) scope with the client using a standardized questionnaire. This helps us define the general building properties and whether the LCA will report on structural, structural and enclosure, or whole building elements. In the Pre-Design phase, we also clarify the software version and intended level of development for Building Information Modeling (BIM). We synchronize this with our in-house BIM team to ensure a smooth analysis in future phases.

2 Schematic Design

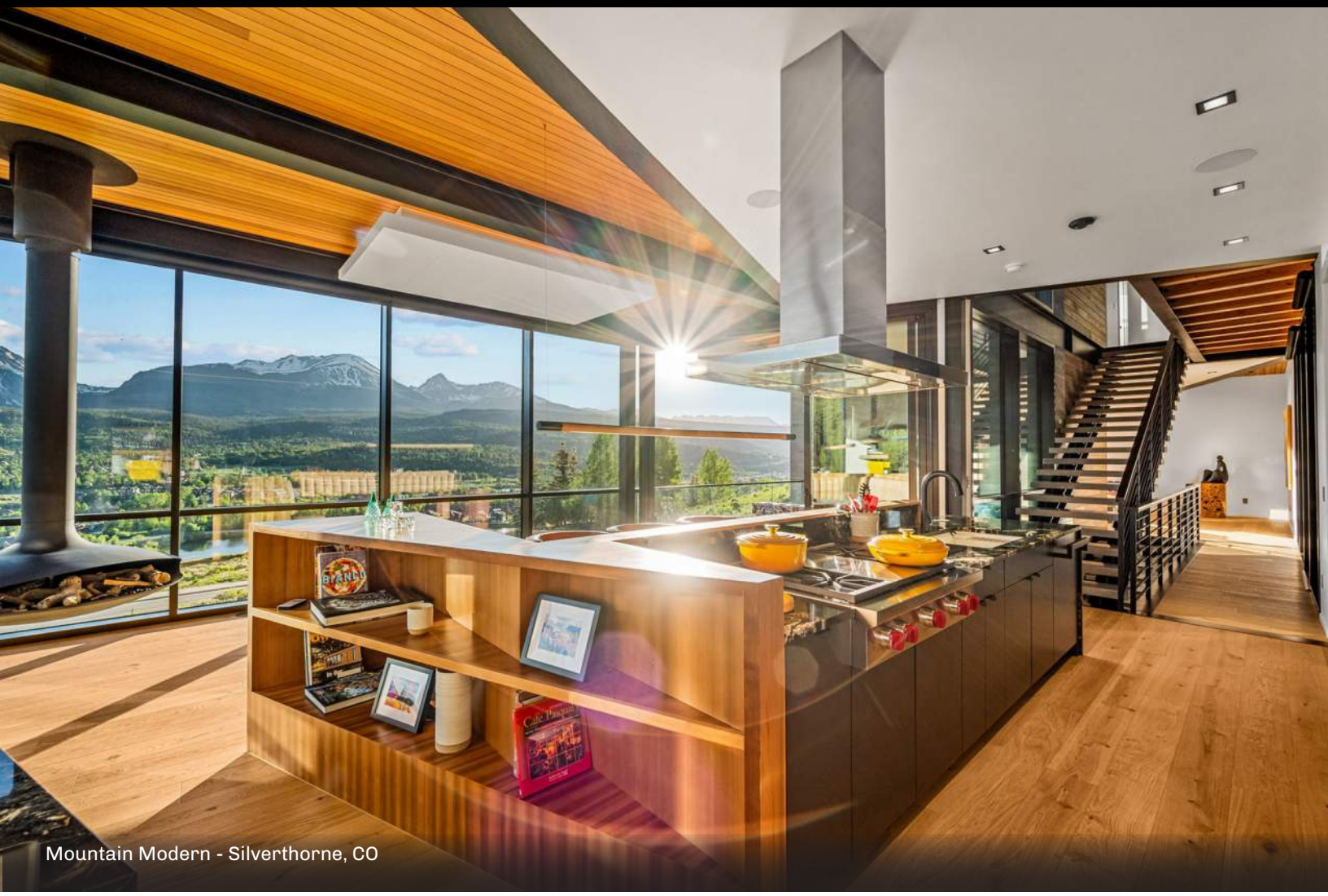
Most commonly, Anthem is engaged during the Schematic Design phase of the project. In this case, the same steps apply – use a questionnaire to understand building properties, confirm LCA scope, and synchronize modeling processes. Toward the end of the Schematic Design phase, with the initial structural systems modeled, Anthem uses Tally (Revit plugin) to generate a baseline model. This model serves as a reference to frame proposed changes with actual data to advocate for a more sustainable design. Regardless of the final design decisions (e.g., a more carbon-intensive material is chosen), Anthem tracks this entire process for reference in future projects.

3 Design Development

During the Design Development phase, Anthem continues to use Tally as the architectural and structural features are developed. The baseline model informs the level of carbon savings, and each carbon footprint iteration can be compared along with cost and time to reach a more optimal final product. Throughout this process, Anthem works closely with the architect to maintain carbon accounting and to ensure that material definitions are consistent throughout the project. At the end of the Design Development phase, another LCA is generated to serve as the new baseline moving into the Construction Documents and Administration phase.

4 Construction Documents & Administration

In the Construction Documents and Administration phase, the impact of sustainability-driven design changes on a large scale is unlikely. However, because embodied carbon reporting is not yet a commonplace practice in structural engineering, Anthem believes that the final step of documenting and reporting the process is equally important. When the final architectural and structural elements are modeled, we generate a final LCA report for the project. This report serves as a data point for quantifying embodied carbon, and a benchmark for evaluating the carbon impact of design decisions in future projects.



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Reporting

The Anthem Sustainability Team believes that a data-driven approach to embodied carbon reporting is key to making meaningful progress in structural engineering. By quantifying the carbon footprint of materials and construction processes, we can make informed decisions that lead to substantial reductions in emissions. Carbon accounting provides the foundation for tracking improvements, establishing benchmark projects, and ultimately driving the industry toward sustainable practices and carbon neutrality.

We are utilizing the Tally® plugin for Autodesk Revit to give our clients a graphical representation on how different design decisions throughout the course of a project have an impact on the embodied carbon of the structure. We have included some sample images from our reported projects in the subsequent pages. Tally enables our team to perform cradle-to-grave analyses of structures across manufacturing, transportation, maintenance, replacement, and end-of-life stages.

Tally also provides options to portray impacts associated with construction, operational energy, and biogenic carbon. Anthem is detailing the Life Cycle Stages based on the default Tally parameters and will report: The Product Stages [A1-A3], Transportation Stage [A4], Maintenance and Replacement Stages [B2-B5], End of Life Stages [C2-C4] as well as Module D [D] information. If requested by the client, Anthem will report data from biogenic carbon separately as additional information.

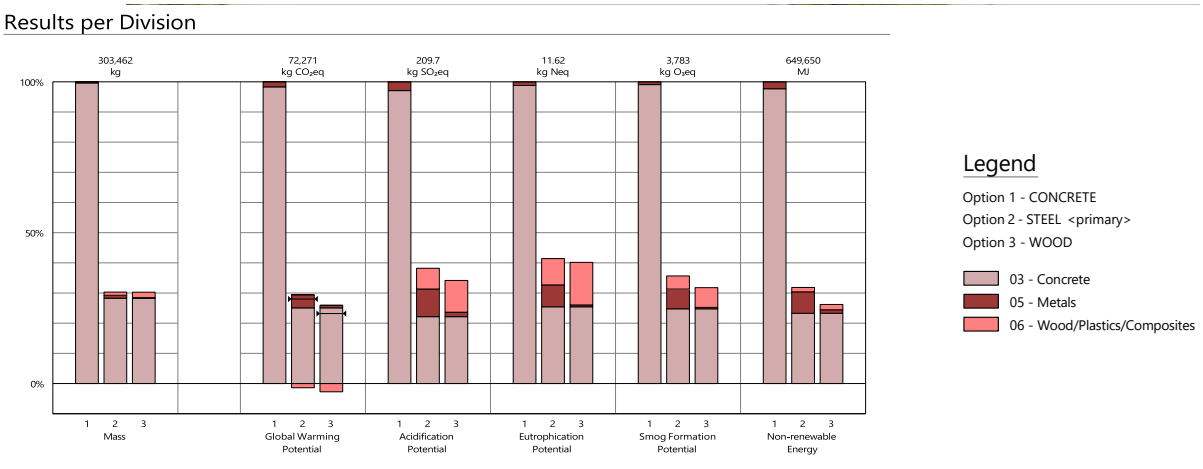
LIFE CYCLE ASSESSMENT PROJECTS

Project 1: Spruill Residence

Anthem provided engineering services for a detached garage on the Spruill Residence project in Boulder, Colorado with Ruggles Mabe Studio. The simple, modular design intention served as a great example project that the Anthem Sustainability Team used to quantify embodied carbon based on primary material choice (e.g., wood, steel, or concrete). This analysis became a benchmark for the LCA process at Anthem and solidified the capability of the sustainability team.

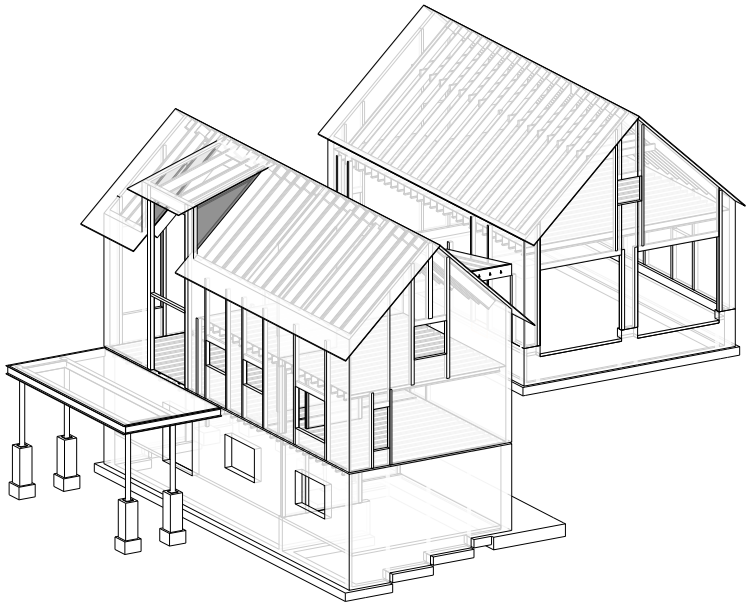
The Anthem team kept the deep foundation system the same between all three designs and ran a comparative analysis on the structure above ground to determine which would be the least carbon intensive from a structural perspective. Analyzing only the structural components that are typically modeled in Revit, such as the beams, columns, and sheathing, while excluding things not commonly modeled, such as anchors, bolts, nails, and washer; the Anthem team uses this comparative study as a basis for explanation on future projects.

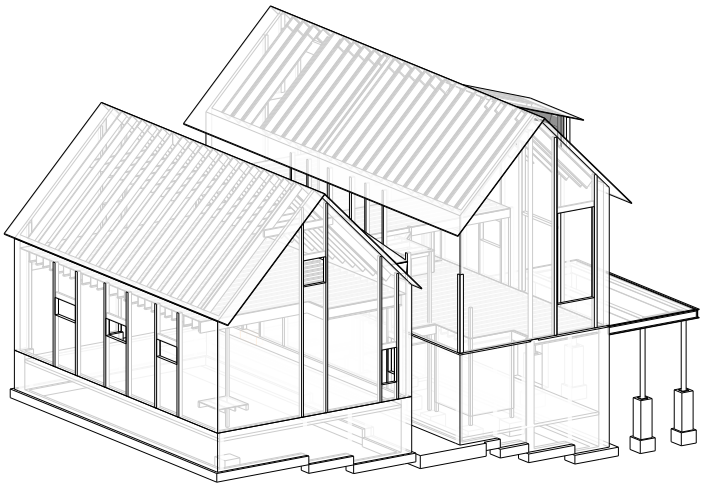
As indicated in the figure below, by changing the superstructure above ground between a primarily wood, steel, or concrete building, the amount of embodied carbon emission varies significantly. The output from Tally® highlights how the wood structure performs better than the completely concrete structure. For the purposes of submitting data to the SE2050 database, however, only the original wood structure data was reported.



LIFE CYCLE ASSESSMENT PROJECTS

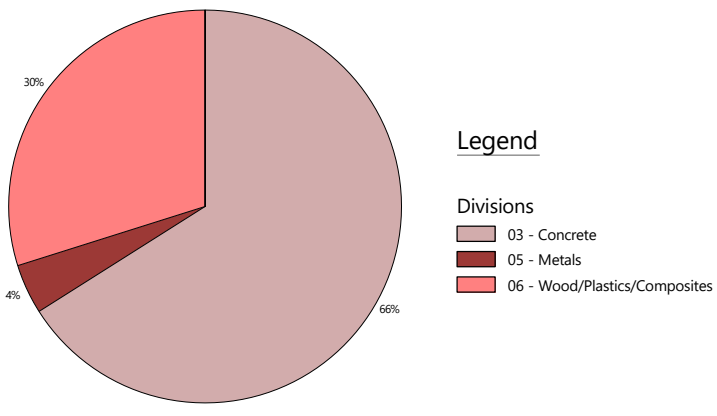
Project 2: Bobcat Lane





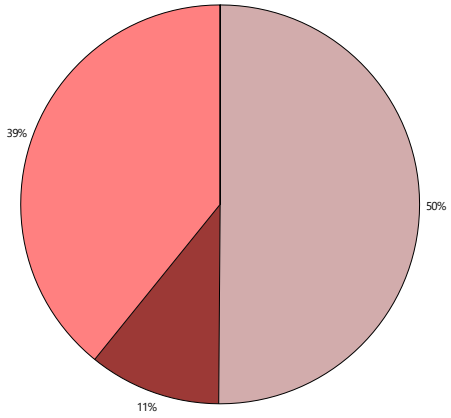
Anthem provided engineering services for a single-family home with a detached garage in Fairplay, Colorado. This structure utilized double stud walls on the exterior of the building to increase the building's efficiency. This project offered the Anthem Sustainability Team valuable insights into how architectural and efficiency design choices impact the structural LCA process. The Anthem Sustainability Team used this project as an example of how non-structural elements can have a significant impact on the emissions of a project.

It is typical for most structural engineers who perform an LCA on a building to restrict their modeling to only structural elements. Therefore, common items like over-framing or non-bearing walls are typically ignored and not always included in the emissions reports. For this project Anthem modeled in some non-structural items such as the double stud walls and roof sleeper systems to gain a better understanding of the impacts of non-structural items into the emission of the overall building. The figures below represent the differences between a building considering these elements and a building omitting them. For the purpose of submitting data to the SE2050 database, however, only the structural elements were reported.



Global Warming Potential

ORIGINAL MODEL
(67,188 kgCO2e)



Global Warming Potential

MODEL INCLUDING
NON-STRUCTURAL ITEMS
(105,207 kgCO2e)

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SE2050 COMMITTING TO NET ZERO

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