DLR Group
Architecture Engineering Planning Interiors

Executive Summary of DLR's Group Embodied Carbon Action Plan & SE 2050 Commitment

Introduction

In the building life cycle, embodied carbon is the carbon dioxide equivalent (CO_2e) or greenhouse gas (GHG) emissions associated with the non-operational phase of the project. This includes emissions cause by extraction, manufacture, transportation, assembly, maintenance, replacement, deconstruction, disposal, and end of life aspects of the materials and systems that make up a building. Hence, the dire need for reducing carbon emissions is becoming an essential movement for reversing climate change.

Embodied carbon assessments can encourage positive benefits of long-term thinking by design teams in which the whole lifetime, the longevity and future uses of a building, are taken into consideration.

Several states and local authorities, as well as other countries, have begun enacting legislative efforts to reduce the embodied carbon footprint. Building rating systems such as LEED and Green Globe, recognize embodied carbon measurement and mitigation as part of minimizing building life cycle impacts. Architecture 2030 was also recently updated to include embodied carbon reduction targets. As the industry increasingly seeks to manage embodied carbon, more opportunities for innovation and collaboration in new processes and products emerge. This collaboration and innovation allow for business opportunities to further reduce impact, lower cost, and create business differentiation.

As a result, measurement, management, and reduction of embodied carbon is increasingly becoming best practice.

SE 2050 Commitment Purpose:

Throughout the Architecture, Engineering and Construction industry, there are many new initiatives to help the fight against climate change. DLR Group is an initial signatory of the Architecture 2030 Challenge which commits to "All new buildings, developments, and major renovations shall be carbon-neutral by 2030." The 2030 Challenge has recently updated its targets to include embodied carbon reductions alongside the previous focus on operational carbon. Recently, the SE 2050 Commitment Program mission statement has further challenged the industry further by stating that "All structural engineers shall understand, reduce and ultimately eliminate embodied carbon in their projects by 2050." DLR Group would like to become a signatory firm for the 2050 Commitment Program. See enclosed and signed SE 2050 commitment letter (Appendix B).

DLR Initiative Purpose:

The purpose of this narrative is to highlight the Embodied Carbon (EC) Initiative that aligns with Vision 2025 Strategic Goal of *"Advocate for our planet, climate, and community"* and various FY24 Business Plan goals related to Arch 2030 and reductions in embodied carbon.

- Both the SE 2050 Challenge and Architecture 2030 address embodied carbon and the urgent need to reduce and ultimately eliminate embodied carbon in built construction.
- The initial stages of this initiative will center around research, education, and exploration of requirements, opportunities, barriers to implementing, measuring, and tracking embodied carbon reductions across the DLR Group Structural Discipline.
- Evaluate opportunities and costs associated with DLR Group signing the SE 2050 Challenge.
- Position the structural discipline as key contributors in the firm-wide pursuit of sustainability and climate advocacy.

Executive Summary

The recently established Embodied Carbon Task Force has been challenged with exploration of the current state of embodied carbon reductions in our industry, the challenges ahead, and how DLR Group Structural Discipline can contribute towards our Vision 2025 Sustainability goals. The initial stages of this initiative were centered around research, education, and exploration for the requirements, opportunities, barriers to implementing, measuring, and tracking embodied carbon reductions across the DLR Group Structural Discipline. Our research team has been actively collaborating with leaders in the DLR Group Sustainability Forum to align our strategic goals and learn from their expertise with Life Cycle Analysis and embodied carbon estimation tools. The structural engineers on the team have design experience in a wide variety of structural engineering systems and building types that has assisted in developing a comprehensive strategy that can be adjusted as needed for the wide variety of sectors and projects in DLR Group's portfolio. Significant research efforts have been conducted in this field on the fundamentals of embodied carbon in structural engineering design, but there is limited information available on the applicability and results from varying structural systems. Our research has focused on quantifying the embodied carbon characteristics of past DLR Group projects to establish a baseline of the embodied carbon equivalencies present in our current designs. The research phase of the initiative was also used to compare several estimating/tracking tools to determine best practices, and document successful strategies for embodied carbon reductions on future projects.

Research Plan

The research team has analyzed approximately 8 recently completed and under-construction projects designed by DLR Group structural engineers with a variety of scales, building types, and structural systems to determine the embodied carbon in the structural elements of each building using either Tally, Beacon, or EC3. From these findings on past DLR Group projects, a baseline reference was developed to show current embodied carbon quantities on typical DLR Group projects. Establishing a starting baseline was a critical first step to tracking any future reductions in embodied carbon as part of the Architecture 2030 and SE 2050 Challenges. During the life cycle analyses of those projects, the research team has learned how: to interpret structural EPDs (Environmental Product Declarations), evaluate the strengths/weaknesses of each estimating/measuring software program, and document best practices and lessons learned. The team has utilized the project Life Cycle Assessments, LCAs, and the compiled documentation to develop internal training all DLR Group Structural Engineers as well as further collaboration with the Sustainability Forum.

Research Team

The research team primarily consists of structural engineers and key contributors from the firm.

- Primary Structural Team
    - Murad Hamdallah – Structural Engineer (CLE)
    - Hunter Wheeler – Structural Designer (DEN)
    - Monica Duran – Structural Engineer (OVP)
    - Jessica Miller – Structural Engineer (DAL)
    - Parisa Asadollahi – Structural Engineer (LAX)
    - Jasmine Puthuvelil (CHI)
    - Shane Campagna (OMA)
    - Alex Mejia (SEA)

- Key Contributors
    - Prem Sundharam – Applied Research leader (PHX)
    - Mike Lindsey – Architect, Tally Power User (ORL)
    - Scott Birney – Structural Engineer, Engineering Sustainability Leader (CHI)

Each member of the primary structural team will perform 1-2 structurally focused LCA studies on past projects to compile enough data to compare various structural materials, project types & scales, and locations of projects in terms of the embodied carbon performance. Our key contributors will help provide guidance on data interpretation and help establish baseline standards.

Supplemental Information

Continual research and development will be required to improve embodied carbon design standards. This grant will provide the funds to propel the team to gather data and formulate best practices for DLR Group. As we pursue the larger goal of embodied carbon elimination, input, and support from DLR Group design and client leaders will be critical. Our structural designs must continue to support the architectural design and client priorities while maintaining embodied carbon reduction and elimination practices at the forefront. We do not anticipate securing additional structural design fees to complete the embodied carbon studies in the initial stages of the project to find the most sustainable design. For DLR Group to provide a truly complete package of sustainable design that clients are expecting, we must evolve our structural engineering practice to include a proactive approach to eliminating embodied carbon by 2050

These efforts towards reducing embodied carbon will show clients that DLR Group is prioritizing sustainable design options and are willing to elevate the human experience through design by committing to the fight against climate change. The Embodied Carbon Task Force is integrating a variety of teams including structural engineering, high performance design, architecture, and interior design. Our research helps DLR Group create a standard for embodied carbon in our designs, assist the education of all teams and sectors to be carbon conscious, and position DLR Group to meet the goals of Architecture 2030 and SE 2050.

Two training sessions were held in Q1 of FY24 to train DLR Structural Engineers on how to run LCA analysis using Tally and optimize material selections using EC3.

DLR Group Structural FY24 ECAP

This plan should be a considered a firm-wide strategy and long-term planning to ensure goals, values and practices are aligned across the firm for developing sustainable design best practices and reduce embodied carbon in DLR's integrated design.

This plan should serve as a measurement framework with a continual focus on evaluation, adaptation, and improvement; as well as an information-sharing platform that enables communicating firm values to clients and peers.

Proposed Actions:

1. Leverage knowledge and experience gained during the Structural Engineering Life Cycle Analysis of different projects reported in FY23 and the grant research under the R&D Grant work in FY22/21.
2. Identify an EC Champion and a representative for every region as an active member in EC Structural Task-force Team who will be responsible for communicating EC strategies to each office within that region.
3. Coordinate embodied carbon reduction strategies and LCA standard procedures across disciplines to provide consistent and reliable reports for DLR Group Decarbonization efforts.
4. Publish and share a guide for "Structural Design Strategies for Embodied Carbon Reduction" to include strategies by project phase for concrete, steel, masonry, and timber.
5. Identify and implement low or no-cost strategies for embodied carbon reduction such as SCM use in standard concrete mixes and update specification sections as required.
6. Incorporate embodied carbon data into INDEPRO and GTZ Dashboard in cooperation with the HPD team.
7. Incorporate LCA best practices into our ST Revit Model Template to ensure proper and consistent modeling of elements, structural families, structural material properties, etc.
8. Maintain presence on ASCE/SEI Sustainability Committee and the SE2050 Subcommittee.
9. Submit embodied carbon data, obtained from structural projects and their BIM models; to the SE2050 Database on an annual basis (5 projects minimum per region).

10. Submit EC Reduction Proposals in collaboration with HPD and architectural disciplines.
11. Provide resources to the Structural Discipline on the rapidly emerging embodied carbon policies across the United States and the world.
12. Submit embodied carbon data, obtained from structural projects and their BIM models; to the SE2050 Database on an annual basis (30 projects at a minimum).
13. Submit EC Reduction Proposals in collaboration with HPD and architectural disciplines. The targeted reduction will be between 10% and 20% in GWP through careful building material selections and specifications.

Milestones & Resources – The How

1.	Establish a summary of EC policies to be incorporated into EC Strategies	Q2
2.	Publish "Structural Design Strategies for Embodied Carbon Reduction"	Q2
3.	Train DLR's Structural Engineers on EC analysis and reductions	Q2 thru Q4
4.	Incorporate LCA best practices into ST Revit Model	Q3
5.	Implement specification updates for low or no-cost options (Draft Spec Sections)	Q3
6.	Incorporate embodied carbon in GTZ Dashboard	Q4
7.	Publish Embodied Carbon Action Plan to the SE2050 annually	Q4, Q1 '25
8.	Provide minimum regional targets for reporting projects for the SE 2050 database under the responsibility of the regional EC Champion.	Q4
9.	Submit projects data to the SE2050 Database annually	Q4, Q1 '25

Resources:

- Monthly meetings to maintain momentum from FY23/24.
- Personnel and budgeted time to complete above milestones and a minimum of 5 LCAs per region for submittal to SE2050.
- Licensing access to software programs (Tally).
- Availability of interdisciplinary team to provide training and coordination from other discipline work across DLR Group.
- Creative Services team to assist with documentation and strategic communication (internal/external).
- MS Teams/ MS Office software for tracking and communications.
- Video conferencing software to discuss specific items and/ or future training/ lessons learned.

FY 24 Results

To be recorded at the end of the FY, ahead of the discipline summit. Record what was accomplished from the anticipated scope and milestones.

Next Steps

- Leverage discipline capabilities to provide SD level estimates and recommendations to drive early design decisions with data regarding embodied carbon equivalencies.
- Create visibility and SOQ for structural embodied carbon capabilities for RFP, marketing efforts, pursuits, and project structural narratives.
- Communicate embodied carbon implications in tandem with labor and materials cost discussions during feasibility forecasting across client and discipline types (Predesign and Conceptual Phases).
- Update DLR Group Standards/Best Practices & LCA Methodology Guide in parallel or closely following SE 2050 LCA Methodology Guide (to be published by SE2050 Committee in 2024).
- Expand the embodied carbon initiative to include internship opportunities for students seeking real world experience. With the guidance and expertise of the structural team, interns could participate in the early

stages of new projects to research new approaches to positively impact the embodied carbon footprint of DLR Group projects.
- Establish a defined mechanism/process with the structural leads to explore opportunities for LCA/EC reductions within the awarded projects.
- EC champions to meet quarterly to discuss updates of EC/LCA strategies, policies, pursuits, projections, and targets.

Reporting Plan

As previously indicated under the long-term action plan, the embodied carbon reporting and recording platform should show data for structural (and architectural) material quantities and their embodied carbon impacts for all DLR's projects.

In the first year of platform implementation, DLR reported 5 projects as there was a learning cure during data reporting, recording and upload to the SE2050 Database.

In the Second year of platform implementation, DLR ran LCA on report 25 projects in different phases.
In the third year of platform implementation, DLR ran LCA on report 30 projects in different phases.

A successful high-quality reporting platform under DLR's ECAP includes the following:

A. The responsible project architect and structural engineer responsible for reporting and recording the required data, both oversee data management and uploads for their own projects.
B. Data upload timeframe: uploading within one week of submitting Construction Documents.
C. Assignment of a project team member for quality control over the uploaded data.
D. This reporting/recording platform is consistent with the SE2050 commitment to facilitate data mitigation, reporting and uploading to the SE2050 commitment program.

Advocacy

DLR Group Embodied carbon Task Force and champions have been advocating for embodied carbon reductions, internally within DLR as a firm and externally on social media as well. The advocacy was presented in the form of internal design shares, discussions and articles posted on DLR's intranet and on LinkedIn. Examples are presented in Appendix Aat the end of this ECAP document.

Appendix A

Internal Firm-Wide Discussion Dated 3/22/2024

Grace Corsi Mar 22

San Diego Climate Strategy Workshop

On Tuesday the 19th, the #sandiego office participated in our Climate Strategy workshop! Team members engaged in thoughtful, nuanced, and passionate discussion to develop climate strategies through the examples of five local projects, including Zimmerman Elementary School, Cubberly Elementary School, San Marcos Middle School, and Hardy Elementary School.

Firm-Wide Strategy key terms Post Dated 4/22/2024

Brittany Carl Moser Apr 22

Climate Strategy Key Terms

As we strive to build our expertise as professional stewards of our environment(s), it helps to ***learn the lingo.***

The Climate+Environment Forum will be rolling out an extensive glossary of terminology to enable you to confidently:

- **Execute** Climate Strategies,

- **Speak knowledgably** with our clients

- **Be leaders** in our industry.

Here are a few key Climate Strategy terms that will appear on Square 1 (this page will continue to be updated):

- ***Greenhouse gas (GHG) emissions:*** **release of gases that trap heat in the atmosphere, increasing atmospheric/global warming**; these gases come from: 1) energy generation, including by combustion of fossil fuels for automobiles, electricity production, and heating, 2) chemical reactions for materials production, 3) refrigerant leakage, and 4) inefficient land management.

- ***Carbon dioxide equivalent (CO2e)*****: the metric for GHG emissions**; the equivalent metric tons of CO2 emissions (tCO2e) with the same "global warming potential" (GWP) as all emitted GHGs from the project.

- ***Net zero carbon:*** **when the GHG emissions associated with a project (the "carbon footprint") equal the reductions, resulting in zero net project impact.** Net zero "operational" carbon refers to GHG emissions from energy used to operate a building, whereas "embodied" carbon is from GHG emissions from materials extraction, manufacturing, transportation, and disposal, as well as building construction and demolition, and "total" carbon is the sum of operational and embodied carbon.

- ***Decarbonization:*** **reduction or elimination of human-made GHG emissions from a project**; this can be applied to all stages of a building's life cycle, including materials extraction, manufacturing, transportation, and disposal, as well as building construction, operation, and demolition.

- ***Energy use intensity (EUI):*** **the measured amount of operational energy use by a project for operations in one year**, in units of thousand British thermal units per gross square foot of floor area per year (kBtu/sf/yr). *This is typically the "site energy use" as metered at on-site, not including the "source energy use," which encompasses energy losses from generation and transmission of the energy to the project site.* While EUI refers to the *measured* annual energy consumption, "predicted EUI" (pEUI) refers to the *modeled* or estimated annual energy consumption.

Internal Firm-Wide Design Share Dated 4/23/2024

Danny Ahkiam Apr 23

San Quentin Rehabilitation Center: Climate Strategy Story (PT. 1)

Building off the firm-wide climate strategy workshops last month, the C+E forum is going to dive into several project stories about how our climate toolkit is being deployed.

Kicking that off: let's talk about the San Quentin Rehabilitation Center, where values of Decarbonization and Social Justice have inspired an approach to remove 62% (!) of the embodied carbon from the structural systems of the new campus, and produced the greenest design of any DLR Group structural project in California.

Project Overview

The SQRC project is a 81,000 gsf community college campus within the secure walls of the San Quentin prison. Darrell has previous talked about the process to win the project and the ethos behind it. We're amidst the DD phase of the project while also beginning site demolition and prep work. Just four short, short weeks away from bidding concrete and rebar and five months away from the first building foundation pour ... so the project is moving fast, with 50 DLR Group folks contributing so far, and many of our designers burning the midnight oil!

My favorite overview of the project is the physical model that lives at the project office in Sacramento, with the new campus in the upper right: