

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

Introduction

In the building life cycle, embodied carbon is the carbon dioxide equivalent (CO₂e) or greenhouse gas (GHG) emissions associated with the non-operational phase of the project. This includes emissions caused 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 allows 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 FY21 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 will center 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 is 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 will allow us to develop 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 will focus 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 will also be 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 plans to analyze approximately 5-10 past 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, we plan to develop a baseline in terms of current embodied carbon quantities on typical DLR Group projects. Establishing a starting baseline is a critical first step to tracking any future reductions in embodied carbon as part of the Architecture 2030 and SE 2050 Challenges. As we complete the life cycle analyses of our past projects, the research team will also learn 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. We will utilize 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)
 - Scott Birney – Structural Engineer (CHI)
 - Hunter Wheeler – Structural Designer (DEN)
 - Diana Gonzalez – Structural Designer (PHX)
 - Nicole Huffert – Structural Designer (SEA)
 - Natalie Georgieff – Structural Engineer (MIN)
- Key Contributors
 - Prem Sundharam – Applied Research leader (PHX)
 - Lindsey Piant-Perez – Architect, Global Sustainability Leader (ORL)
 - Jill Maltby-Abbott – Architect, Sustainability Forum Member (SEA)
 - Mike Lindsey – Architect, Tally Power User (ORL)

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 teams including structural engineering, high performance design, architecture, and interior design. Our research will help 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.

Refer to the DLR Group Structural FY21 Initiative Scoping Document outlining the overall goals of the initiative beyond the work outlined in this R&D grant proposal.

DLR Group Structural FY21 Initiative Scoping Document

Proposed Actions:

1. Establish Embodied Carbon Task Force comprised of Structural Engineers and DLR Group Sustainability experts.
2. Submit application for R&D Grant to complete Baseline Life-Cycle Analyses (LCA) and/or specific product embodied carbon optimization of 5-10 representative projects across the structural group (by region, material, and structural systems).
3. Establish/strengthen relationships across Sustainability Forum and gain understanding of ongoing, internal efforts towards sustainability to understand existing knowledge throughout DLR Group as well as how the structural initiative will coordinate with the overall sustainability efforts in the firm.
4. Understand requirements of SE 2050 Challenge and how they overlap and/or differ from Architecture 2030 requirements.
 - a. Create draft version of Embodied Carbon Action Plan (ECAP).
 - b. Participate in SE 2050 Committee meetings.
5. Establish Documentation guidelines for tracking embodied carbon reductions on projects. Complete Baseline LCAs and/or product optimizations utilizing Tally, EC3, and Beacon tools. Summarize and present results with assistance of Creative Services for internal communication.
6. Document lessons learned for Tally, EC3, and Beacon to facilitate future training of other structural designers. Utilize knowledge gained in combination with internal DLR Group knowledge to determine preferred option or options for measuring embodied carbon equivalencies of structural scope on projects.
7. Establish core team of structural engineers with understanding of ECAP and Strategies implementation and documentation to serve as a resource to the national structural group in the efforts to reduce and ultimately eliminate embodied carbon.

FY 21 Milestones:

Action
Outline

[1]	Establish Embodied Carbon Task Force	Q1
[2]	Submit R&D Grant Application for Baseline LCAs	Q2
[3]	Complete Baseline LCAs	Q3
[4]	Finalize LCA results for internal discipline share	Q4
[5]	Participate in SE 2050 Committee Meeting [Hamdallah, Birney]	Q3
[6]	Determination of preferred option/options for future LCAs	Q4

Initiative Goals Beyond FY 21:

- Determine and evaluate process to provide SD level estimates and recommendations to drive early design decisions with data regarding embodied carbon equivalencies.
- Provide clear, compelling business case for signing SE 2050 Challenge in FY22.

Required Resources:

- Personnel and budgeted time to complete Baseline LCAs and accompanying interpretation/compilation of results.
- 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 21 Results:

(A place to record notes at the end of the year on what was accomplished and what some potential next steps are for the upcoming years)

Embodied Carbon Action Plan (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.

Short Term Goals (6 – 12 months):

1. EC startup group to work together to better understand the impacts of our design decisions and the effects they have on our environment.
2. Understand carbon reduction strategies and share it with your discipline and office.
3. Educate colleagues within your discipline on how to measure and report embodied carbon
4. Review and remind others of the 2030 Commitment/Carbon Neutrality
5. Share and participate in the SE 2050 Commitment within the firm through intranet announcements, design shares and project initiatives. See example of DLR's Group internal announcements dated June 30th in Appendix A.
6. Create draft framework and guidelines for Embodied Carbon Reductions
7. Learn about benchmarks for different material.
8. Learn the EC3 tool which allows benchmarking, assessment, and reductions in embodied carbon per material category, focused on the upfront supply chain emissions of construction materials.
9. Learn Tally as a Revit add-on for material selection, design option comparisons, and whole building LCA.
A. Select a project (or two) to demonstrate how to use Tally in Revit and run the module
10. Learn about the Embodied Carbon Order of Magnitude (ECOM) an online estimator tool that resides under the SE2050 commitment website.
11. Explore other resources such as Carbon Leadership Forum tool for setting baseline, Beacon, ASCE/SEI Sustainability Guidelines for the Structural Engineer
12. Leverage the knowledge of EC to the firm by frequently posting a topic on SQ1 to infuse the embodied carbon idea and language into our teammates.

Long Term Goals (Beyond 12 months):

1. Further develop the drafted framework for Embodied Carbon Reductions into a firm-wide accepted guideline.
2. EC startup group to evolve to a larger group of experts who can educate and mentor others within the firm.
3. Incorporate Embodied Carbon calculations into the concept design phase, so that the architects, engineers, and owners can really understand the impact that their design might have on the environment and use this understanding to design a better and more environmentally responsible building.
4. Use Embodied carbon management as a proxy for cost management, providing an additional means of value engineering at early design stages.
5. Identify who is responsible for recording and reporting of embodied carbon reductions for both structural and architectural material quantities. (Suggestion: One of the Project architects and one of the project structural engineers, not the engineer of record nor the project director/project manager).
6. Create embodied carbon reduction platform for reporting and recording embodied carbon reductions in material selections for each project.
7. Share and provide access to the platform of the recorded embodied carbon data on past project to leverage knowledge, experience and carbon reduction strategies across the firm for future projects.
8. Participate as a signatory sponsor and be a partner with the SE 2050 Commitment

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 is only required to provide 25% of their projects as there will be data reporting, recording and upload learning curve.

A successful high-quality reporting platform within the ECAP shall include the following:

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

Appendix A

Internal Firm-Wide Announcement Dated 6/30/2021



Lloyd Ramsey

PROMOTED

DLR Group commits to SE 2050 Challenge!

I'm pleased to report that DLR Group has committed to the [Structural Engineers 2050 Challenge](#), put forth by the [Carbon Leadership Forum](#).

SE 2050 challenges structural engineers across the AEC industry to meet embodied carbon benchmarks and higher reduction targets on a pace for zero embodied carbon in structural systems by the year 2050. Inspired by the AIA 2030 Commitment, SE 2050 complements existing and developing initiatives supported by building owners and architects.

DLR Group is an initial signatory of the [Architecture 2030 Challenge](#), which commits that all new buildings, developments, and major renovations shall be carbon-neutral by 2030. Recently, the 2030 Challenge updated its targets to also include embodied carbon reductions.

As outlined in our commitment letter, DLR Group commits to:

- Include embodied carbon in DLR Group's Sustainable Action Plan, for SE 2050 and as part of our commitment to Architecture 2030. The goal is to make embodied carbon an item to be studied by not only our structural team, but Integrated Design teams.
- Within one year and then annually, 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.

structural engineering x carbon task force

structural-specific visioning and SE2050 feasibility

To aid in these efforts, DLR Group has established a structural engineering x carbon task force. This group of structural engineers and architects is leading the way in the essential transition to net zero embodied carbon and beyond to net-positive carbon-sequestering design. The task force is in the process of applying to the SE 2050 Commitment Program to become a signatory firm and officially make our commitment public. Stay tuned!

Structural engineers have an unprecedented challenge and an incredible opportunity to contribute to the sustainable design of our buildings. We can be leaders in the growing market of climate-smart building design and low carbon construction. To respond in a proactive way requires a considerable understanding of the environmental impacts of today's systems to inform tomorrow's decisions.

This milestone has not been possible without the hard work of Scott Birney, Natalie Georgieff, Diana Gonzalez, Murad Hamdallah, Nicole Huffert, Mike Lindsey, Jill Maltby-Abbott, Lindsey Perez, Prem Sundharam, and Hunter Wheeler.

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Appendix B

DLR Group – SE 2050 Commitment Letter Dated 6/04/2021

Please see next page





Architecture Engineering Planning Interiors

DLR Group Services

6457 Frances Street, Suite 200
Omaha, NE 68106

Friday, June 4, 2021

To: Laura Champion, Director, Structural Engineering Institute

From:

Re: Letter of Commitment to the SE 2050 Program

Dear Laura:

DLR Group is a 1200-person integrated design firm with offices around the globe 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.

Please refer to the narrative provided in as an attachment.

Therefore, DLR Group commits to take the following steps which are part of the SE 2050 Commitment Program:

- We will commitment to including Embodied Carbon not only for SE2050, but also as part of our commitment to Architecture 2030, in our firmwide Sustainable Action Plan. Our goal of its inclusion within our Sustainable Action Plan is to make Embodied Carbon an item to be studied by not only our structural team, but our Integrated Design teams.
- 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,
DLR Group

A handwritten signature in blue ink, appearing to read "Lloyd Ramsey".

Lloyd Ramsey, Principal
Global Engineering Leader

A handwritten signature in blue ink, appearing to read "Lindsey Piant Perez".

Lindsey Piant Perez, AIA, LEED Fellow
Global Sustainability Leader