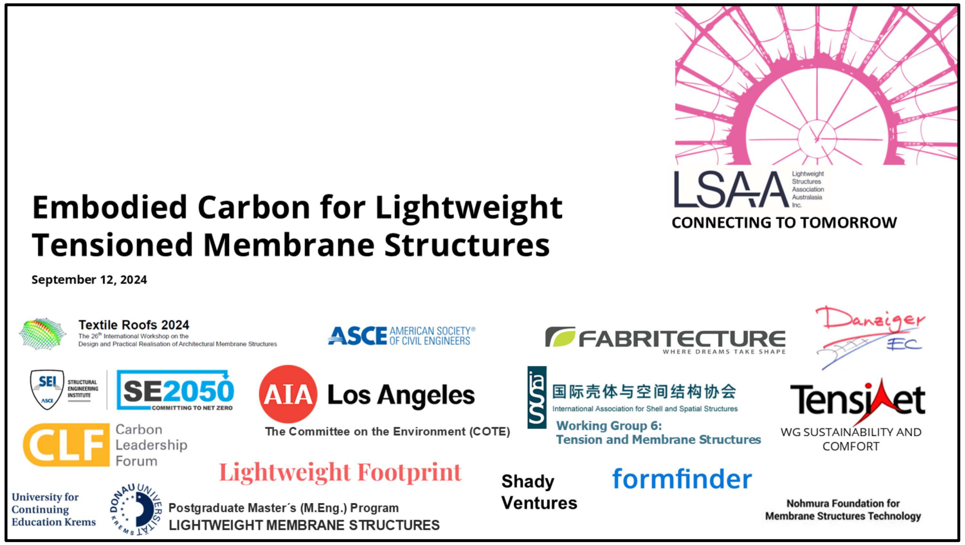
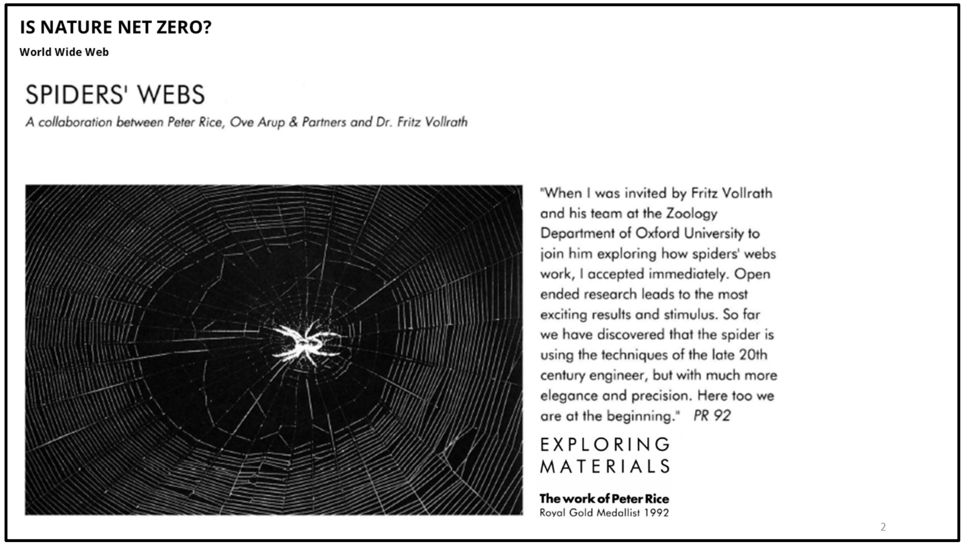


The Pathways towards Zero Carbon for Tensioned Membrane Architecture: ongoing actions and next steps

Lightweight structures should be more sustainable compared to conventional materials and methods of construction. How do we prove this? Lightweight Footprint are establishing a platform for the lightweight structures community to make embodied carbon reduction commitments. Attendees will leave with the knowledge of being able to:

1. Access current EPD data for tensioned membranes
2. Establish realistic and achievable embodied carbon targets for tensioned membrane structures
3. Declare your organization's commitment to reduce embodied carbon



Is nature net zero?

Peter Rice: *"…it will soon be possible to build very light, highly elastic structures which actively adapt to their changing environment"*

net zero (human concept) = a target of completely negating the amount of greenhouse gases produced by human activity, to be achieved by reducing emissions and implementing methods of absorbing carbon dioxide from the atmosphere.

2024:
- Develop website
- Invite to industry participants
- Template Declarations
- Launch Website
- ECAPs & Collect data

2025:
- Promote website
- Solicit more industry colleagues to join with commitment letters
- Improve & Maintain website
- Collect & manage data – embodied carbon tracking and comparison studies

"Make the design, the material will adapt"

Reduce the embodied carbon of lightweight structures

Lightweight Footprint

2 Year Plan - Nohmura Foundation Grant

Q1 2024 (January-March):

Engage website designer and establish website

Draft invitation to industry participants

Write template commitment letters - different commitment letters for designers (architects & engineers), suppliers, academics & researchers, organizations, etc.

Draft embodied carbon action plan (ECAP) examples

Q2 2024 (April-June):

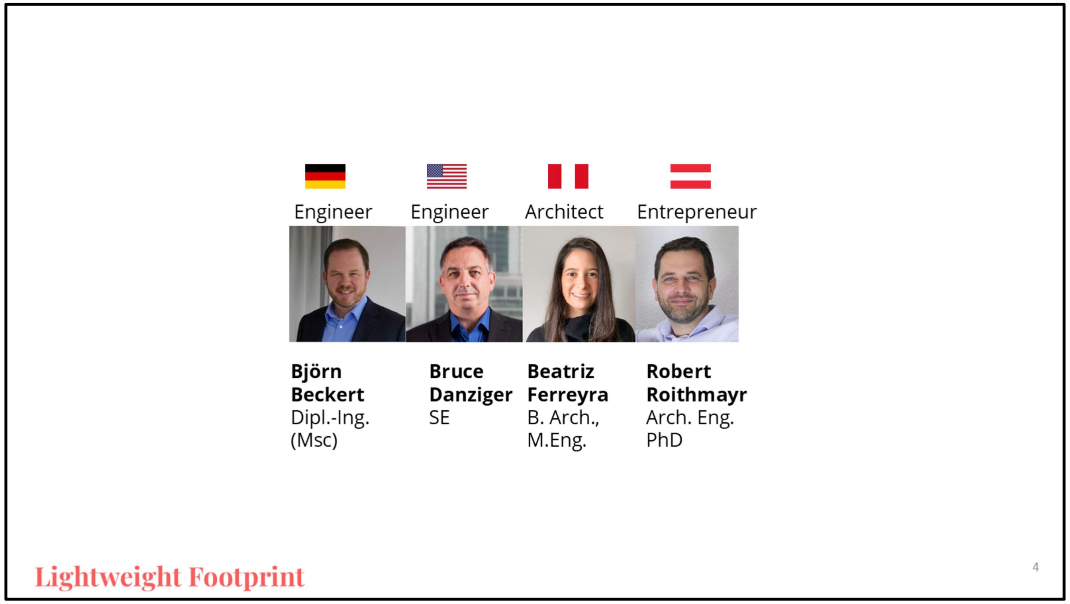
Continue to develop website
Solicit industry colleagues to join leadership team – at least five established industry partners
Q3 2024 (July-September):
Launch website, Promote website
Solicit industry to join with commitment letters, Circulate template commitment letters
Distribute embodied carbon action plan (ECAP) examples
Improve & Maintain website
Collect & manage data – embodied carbon tracking and comparison studies
Q4 2024 (October-December):
Promote website
Solicit more industry colleagues to join with commitment letters
Evaluate embodied carbon action plans (ECAP)
Improve & Maintain website
Collect & manage data – embodied carbon tracking and comparison studies
Q1-Q4 2025 (January-December):
Promote website
Solicit more industry colleagues to join with commitment letters

Improve & Maintain website
Collect & manage data – embodied carbon tracking and comparison studies
Innovation - making new green materials (durability challenge)

Opportunity to learn from developments and restrictions in Europe
Highest common denominator
If it works, it will work globally
Opportunity to learn from each other

What you could do, please:

IASS WG6 collaboration with Light Footprint
Ask industry for more data (we need data)
Collect more Case Study comparisons
Share your thoughts about this with Bruce
Do embodied carbon accounting on your projects
Help us set targets for maximum **kgCO2eq/m2**
Share your data with Lightweight Footprint
Mail@LightweightFootprint.org



Team

We are an international group of tensioned membrane designers and technical specialists for a couple of years focused on further developing quantifiable analysis (proof) of the environmental impacts of lightweight structures. We have been meeting monthly for over two years and I delivered one of the keynote presentations for the Tensinet symposium in Nantes this June. Tensinet is a mostly European based association for all parties interested in tensioned membrane construction. Here's a link to the Tensinantes symposium:

Tensinet Symposium 2023 at Nantes University - Sciencesconf.org

Keynote speakers TENSINANTES 2023

introducing Lightweight Footprint

Vision

Lightweight membrane structures are obviously sustainable – let's prove it

Mission

Provide quantitative scientific & engineering analysis to demonstrate the sustainable attributes of membrane structures

Plan

Determine the carbon footprint relative to the economic benefits considering different functions, programs and locations (case studies)

Deliverable

Produce calculations with material data from manufacturers

Mission/Vision

Lightweight Footprint

Good for you, good for me, good for the planet
Everyone has to do their part to reverse or at least stall rapid climate change

Set Targets
Understanding the impacts and committing to incremental reductions

Our Industry Impact
Industry empowered to change through innovation

Growth
By demonstrating benefits, promotes and grows industry

Attract talent
More smart, motivated and creative people will want to join the industry

Finally it will be proved
Quantitative engineering & science to support the industry's claims of sustainability

Value Proposition

Lightweight Footprint

Pitch

Environmentalist and/or Industrialist

8

champions of green building or lobbyists for the chemical industry

ANNEX XV RESTRICTION REPORT – Per- and polyfluoroalkyl substances (PFASs)

Sectors	Properties	Applications
	and friction property	fuel hoses, power steering, transmission, lubricants, and coatings
Chemical industry	Chemical resistance, mechanical property, thermal property, and weather stability	Coatings for heat exchangers, pumps, diaphragms, impellers, tanks, reaction vessels, autoclaves, containers, flue duct expansion joints, heavy-wall solid pipe and fittings
Electrical/electronic	Dielectric constant, flame resistance, and thermal stability	Electrical insulation, flexible printed circuits, ultrapure components for semiconductor manufacture
Architectural and domestic	Weatherability, flame retardancy, friction property, thermal stability	Water-repellent fabric, architectural fabric, non-stick coatings for cookware, and fiberglass composite for constructions
Engineering	Mechanical property, thermal stability, chemical stability, weatherability, and surface energy	Seats and plugs, bearings, non-stick surfaces, coatings for pipes, fittings, valve and pump parts, and gears
Medical	Surface energy, biological stability, mechanical property, chemical resistance	Cardiovascular grafts, ligament replacement, and heart patches

ICRL 1|2022 | 1

Fluoropolymers: The Safe Science That Society Needs

*Jaime Sales, Francisco Hernández, Deepak Kapoor and Marcel van den Noort**

Table A.57. Identified PFAS uses, technical function and examples of PFAS in building material/construction products based on literature and stakeholder input.

Use category	Sub-use(s)	Technical functions	Examples of PFASs
Roofing	Architectural membranes including fluoropolymer films (ETFE) and fabrics or fiber glass coated/laminated with fluoropolymers in e.g. stadium roofs, greenhouses, flexible solar panels	Durability, chemical and UV resistance, light weight, low maintenance, wetting during application of film	Fluorinated polymers e.g. PTFE, ETFE, FEP, PVDF Non-polymeric PFASs e.g. PBSF, HCFO-1233zd[1]
	Weatherproofing Membranes made of materials such as synthetic rubber, polyvinyl chloride (PVC), polyolefin, or other heavy-duty thermoplastics, and coated with a fluoropolymer layer. Used for e.g. flat-type roofs	Durability and stain resistance, moisture control and solar reflectivity	Fluoropolymers
Wires and cables	Electrical cable and wire insulation (in e.g. air conditioner units, computers, light fixtures and heated flooring), PTFE-impregnated plastic or a fiberglass-based tapes for electrical	Flexible, durable, temperature resistance	PTFE, PCTFE, ETFE, FEP, PVDF

PFAS

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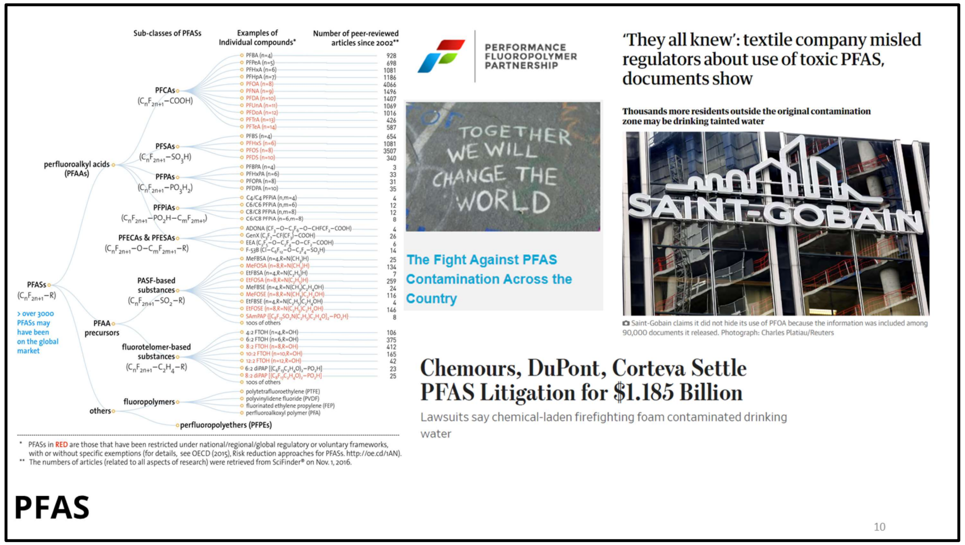
https://echa.europa.eu/documents/10162/d2f7fce1-b089-c4fd-1101-2601f53a07d1

https://heinonline.org/HOL/LandingPage?handle=hein.journals/icrl2022&div=7&id=&page=

The main fluoropolymers meet criteria to be identified as Polymers of Low Concern (PLC) as developed by the Organization for Economic Co-operation and Development (OECD). Existing scientific data demonstrates that, because of their unique set of properties, such as negligible solubility in water or high molecular weight, fluoropolymers cannot enter or accumulate in the human tissue, and they cannot degrade into other PFAS under intended conditions of use or under ambient environmental conditions. Therefore, it is considered that fluoropolymers do not pose a significant risk to water quality, human health, or the environment. Finally, potential indirect situations that may generate concerns related to PFAS emissions, such as the need to use fluorinated polymerization aids in the fluoropolymer manufacturing process, are being addressed by industry, with significant Progress made over the last years. Furthermore, the End-of-Life (EOL) phases of applications related to fluoropolymers are not expected to be of concern.



PFAS, forever chemicals, threat to industry

https://www.sixclasses.org/videos/pfas

https://pubs.acs.org/doi/full/10.1021/acs.est.6b04806

“Family tree” of PFASs, including examples of individual PFASs and the number of peer-reviewed articles on them since 2002 (most of the studies focused on long-chain PFCAs, PFSAs and their major precursors.).

https://defendourhealth.org/

https://www.theguardian.com/environment/2022/aug/05/saint-gobain-textile-company-toxic-pfas

Questions/comments:

1. Could REACH (or other regulations) restrict the use of any tensioned membrane products (PVC, PTFE, ETFE, etc.) based upon their chemistry?
2. From the Ferrari PVC EPD statements of the products not containing REACH list of substances with very high concern, would this make the product acceptable for REACH (or similar) restrictions?
3. Could we foresee in the near future that some of the products typically used for membrane structures will (or should be) restricted?
4. How should we address PFAs for PTFE, or phthalates for PVC plasticisers? Are there any similar or other potential issues for ETFE?
5. If EPDs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity; is there any reliable standard(s) including certification(s) to confirm that the materials used do not pose serious health risks nor seriously negative environmental impacts? Would manufacturer/supplier claims to comply with REACH regulations be sufficient?
6. PTFE is so widely used and relied upon in the tensioned membrane industry. Do we have serious concerns about the environmental impacts beyond greenhouse gases? We have been asking and waiting for the industry to give us

more and current EPD data and we could continue to wait or we could take a stronger position/statement?

MATRIX GWP [CO2eq/kg] BY TYPE OF MEMBRANE Excluding C & D

MATRIX GWP [CO2eq/kg] BY TYPE OF MEMBRANE [A1 - A3]

SOURCE	PES/PVC	FiberGlass/PTFE	ETFE System
[1]	4.02		
[2]	5.34		
[3]	4.83		
[4]			36.80
[5]			53.20
[6]			63.40
[7]		16.40	
Average	4.73	16.40	51.13

Sources:

[1] EPD - Serge Ferrari Tensile composite membranes. Registration number : 4-536:2021
Declare unit: 1m² Weight 1.144 kg

[2] EPD - Low & Bonar GmbH Mehgies VALMEX® FR 1000. EPD-MTX-20130019-IBA1-EN
Declare unit:1m² Weight: 1.05 kg (expired)

[3] EPD - Sioen Industries NV EPD-SIO-20220324-IBJ1-EN
Declare unit: 1m2 Weight: 0.9 kg/m²

[4] EPD - Texlon® Vector Foiltec GmbH, Nowofol, Dyneon GmbH. EPD-DVN-20210122-IBJ1-EN
Declare unit 1 m² Weight:3.89 kg/m²

[5] EPD - TensoSky® - System with Fluon® ETFE-FILM Taiyo Europe GmbH, AGC Inc.
Declare unit: 1 m2 Weight: 3.93 kg/m²

[6] EPD - Novum AFP-System Novum Membranes GmbH Issue 2017
Declare unit: 1 m2 Weight: 5.20 kg/m²

[7] EPD - PTFE coated glass fabrics for Tensile Architecture Verseidag EPD-SER-20240197-IBI1-EN
Declare unit: 1 m2 Weight: 0.75 to 1.60 kg/m² Thickness 0.007m

THIRD-PARTY VERIFIED EPD
ISO 14025 and EN 15804
Institut Bauen und Umwelt e.V.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 m2 PTFE coated glass fabric

Parameter	Unit	A1-A3	C1	C2	C3/1	C3/2	C4/1	C4/2	D
GWP-total	kg CO_2 eq	1.64E+01	6.08E-03	9.14E-03	2.71E-03	1.43E+00	1.53E-02	0	-1.02E-01
GWP-fossil	kg CO_2 eq	1.64E+01	5.74E-03	9.06E-03	2.69E-03	1.43E+00	1.53E-02	0	-1.02E-01
GWP-biogenic	kg CO_2 eq	0	0	0	0	0	0	0	0
GWP-luluc	kg CO_2 eq	2.77E-03	3.4E-04	8.33E-05	2.02E-05	6.78E-05	4.75E-05	0	-9.29E-06
ODP	kg CFC11 eq	2.94E-07	4.78E-15	1.17E-15	4.49E-15	6.89E-13	3.89E-14	0	-1.24E-12
AP	mol H^+ eq	3.97E-02	2.78E-05	5.77E-05	1.4E-05	3.87E-04	1.09E-04	0	-1.02E-04
EP-freshwater	kg P eq	2.09E-05	1.34E-07	3.29E-08	9.15E-09	2.92E-07	3.08E-08	0	-2.74E-07
EP-marine	kg N eq	7.72E-03	6.63E-06	2.83E-05	6.43E-06	1.02E-04	2.8E-05	0	-3.78E-05
EP-terrestrial	mol N eq	1.02E-01	8.42E-05	3.13E-04	7.11E-05	1.62E-03	3.08E-04	0	-4.02E-04
POCP	kg NMVOC eq	2.28E-02	2.22E-05	5.47E-05	1.75E-05	2.81E-04	8.46E-05	0	-9.72E-05
ADPE	kg Sb eq	9.69E-04	2.42E-09	5.92E-10	2.88E-09	5.97E-09	7.05E-10	0	-8.83E-09
ADPF	MJ	2.15E+02	5E-01	1.22E-01	5.29E-02	1.17E+00	2.04E-01	0	-1.58E+00
WDP	m^3 world eq deprived	7.31E-01	4.43E-04	1.09E-04	5.22E-04	1.9E-01	1.68E-03	0	-1.34E-03

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

Environmental Product Declaration (EPD)

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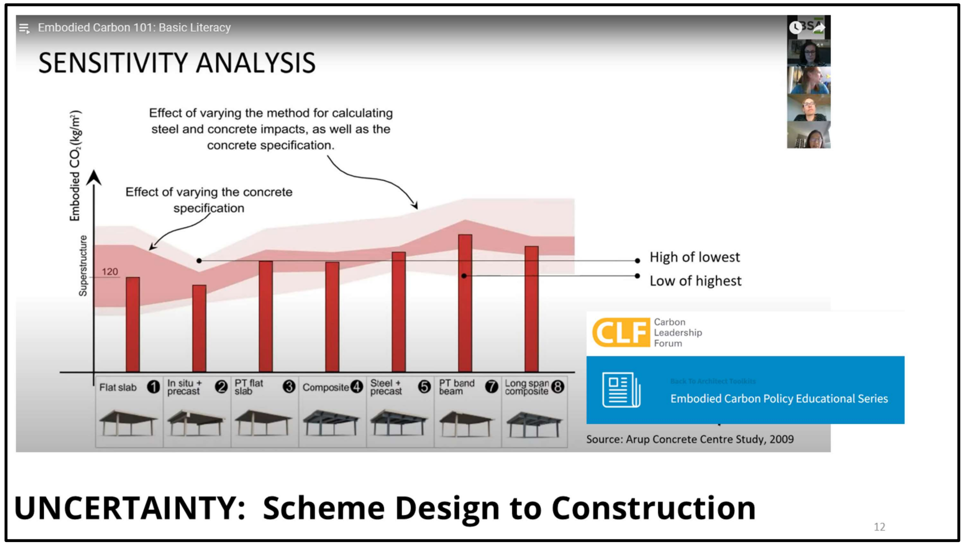
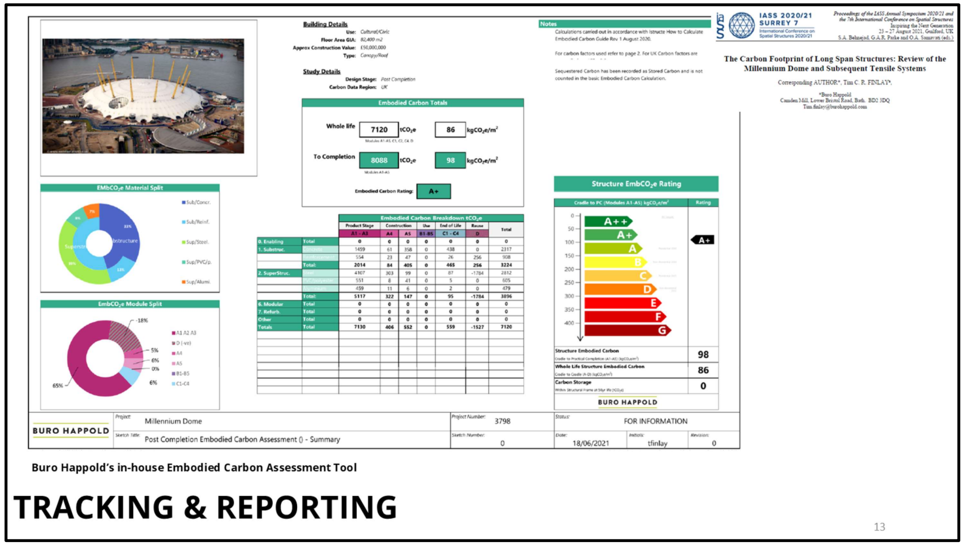
Environmental Product Declaration (EPD)
Functional Unit (FU)
Product Category Rules (PCR) & Assemblies
Global Warming Potential (GWP)



data reliability, sensitivity

Embodied carbon: structural sensitivity study

https://www.istructe.org/resources/case-study/embodied-carbon-structural-sensitivity-study/



Tools for Measuring Embodied Carbon
https://carbonleadershipforum.org/tools-for-measuring-embodied-carbon/

Part of Buro Happold's ongoing Embodied Carbon Research to achieve our climate emergency commitments

The Carbon Footprint of Long Span Structures: Review of the Millennium Dome and Subsequent Tensile Systems

Conclusions

This brief study of the embodied carbon with long-span roof structures

has led to the following
conclusions:

· The equivalent embodied CO2 for long-span tensile structures can be successfully assessed and compared against other similar structures

· The Millennium Dome assessment (particularly when combined with a PVC/polyester membrane) shows that exceptionally low embodied carbon values can be achieved through ultra-efficient structural design.

· Efficient structural geometry is key to driving embodied carbon down to the lowest realistically achievable levels

· The choice of tensile membrane has a very significant impact on the embodied carbon within a lightweight tensile system with PTFE/glass fibre having a particularly high embodied carbon impact. To achieve the greatest reductions in embodied carbon through tensile systems, lower embodied carbon membranes will have to be used.

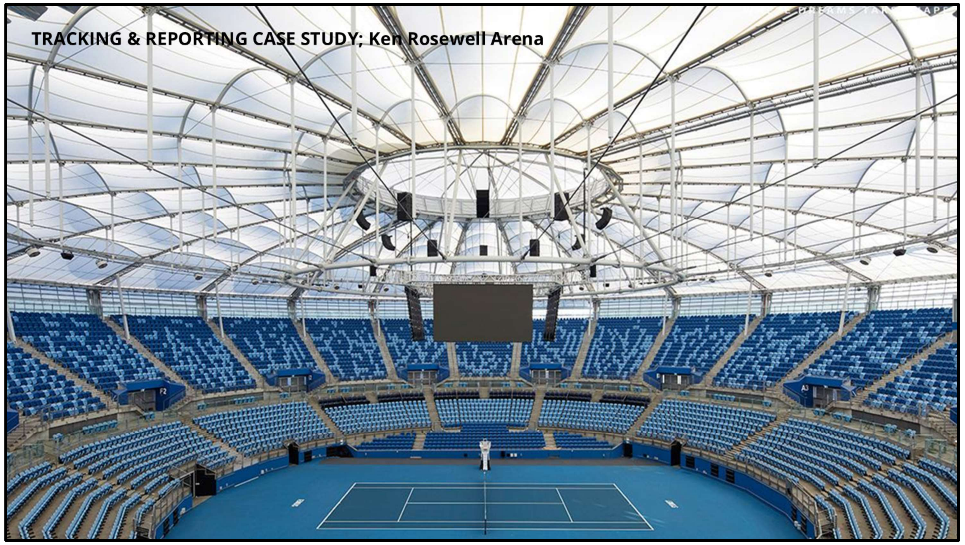
TRACKING & REPORTING CASE STUDY

For our case study the Ken Rosewall Arena was been chosen. Its an innovative cable tensioned structure with PTFE fabric panels.

Architect: Cox Architecture, https://www.coxarchitecture.com.au/project/ken-rosewall-arena-redevelopment/

Structural Consultant: Arup, https://www.arup.com/projects/ken-rosewall-arena-sydney

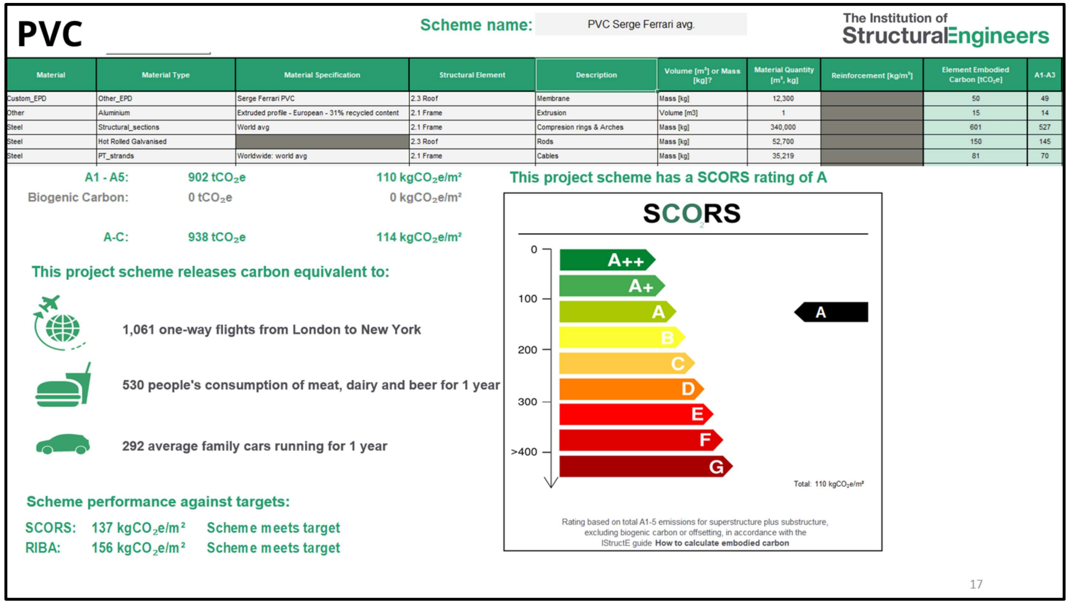
Special Contractor: Fabritecture https://fabritecture.com/project/ken-rosewall-arena/



Ken Rosewall Arena: cable system consisting out of uplift and gravity cables, compression struts and an outer compression ring.

TRACKING & REPORTING CASE STUDY

Site is in Sydney, Australia. Cables were manufactured in Italia, PTFE fabric manufactured in Japan, fabricated in the Philippines, steel manufactured in South China and then transported to site.



PVC Scheme name: PVC Serge Ferrari avg.

The Institution of StructuralEngineers

Material	Material Type	Material Specification	Structural Element	Description	Volume [m³] or Mass [kg]?	Material Quantity [m³, kg]	Reinforcement [kg/m³]	Element Embodied Carbon [tCO_2e]	A1-A3
Custom_EPD	Other_EPD	Serge Ferrari PVC	2.3 Roof	Membrane	Mass [kg]	12,300		50	49
Other	Aluminium	Extruded profile - European - 31% recycled content	2.1 Frame	Extrusion	Volume [m3]	1		15	14
Steel	Structural_sections	World avg	2.1 Frame	Compresion rings & Arches	Mass [kg]	340,000		601	527
Steel	Hot Rolled Galvanised		2.3 Roof	Rods	Mass [kg]	52,700		150	145
Steel	PT_strands	Worldwide: world avg	2.1 Frame	Cables	Mass [kg]	35,219		81	70

A1 - A5: 902 tCO_2e 110 $kgCO_2e/m^2$

Biogenic Carbon: 0 tCO_2e 0 $kgCO_2e/m^2$

A-C: 938 tCO_2e 114 $kgCO_2e/m^2$

This project scheme releases carbon equivalent to:

1,061 one-way flights from London to New York

530 people's consumption of meat, dairy and beer for 1 year

292 average family cars running for 1 year

Scheme performance against targets:

SCORS: 137 $kgCO_2e/m^2$ Scheme meets target

RIBA: 156 $kgCO_2e/m^2$ Scheme meets target

This project scheme has a SCORS rating of A

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TRACKING & REPORTING CASE STUDY

Structural Carbon emission were calculated for PTFE/Glass, but also PVC/PE, ETFE and glass. EPDs (Environmental Product Declarations) were required for these materials but also steel, cables etc. The used EXCEL tool is provided by the Institute of Structural Engineers, some EPDs (such as for steel) are already given. By quantifying the amount of used fabrics, steel tonnage for cable and steel structure the overall project Carbon footprint was calculated. The tool focus on A1-A5 (craddle to completion) rather than the entire which accounts for on average of 63% of the entire lifecycle of a structure.

https://www.istructe.org/
https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://www.istructe.org/IStructE/media/Public/TSE-Archive/2020/Setting-carbon-targets-an-introduction-to-the-proposed-SCORS-rating-scheme.pdf&ved=2ahUKEwiE5Zi869iFAxXHCTQIHW1YDW0QFnoECCEQAQ&usg=AOvVaw1NwYBXJq52VfsFVnNaiBzi

Scheme Rankings

Rank	Scheme	SCORS Rating & A1-A5 Emissions ($kgCO_2e/m^2$)
1st	PVC	A (110)
2nd	PTFE	A (128)
3rd	ETFE - Cushions	B (160)
4th	Glass 16mm	E (321)

TRACKING & REPORTING

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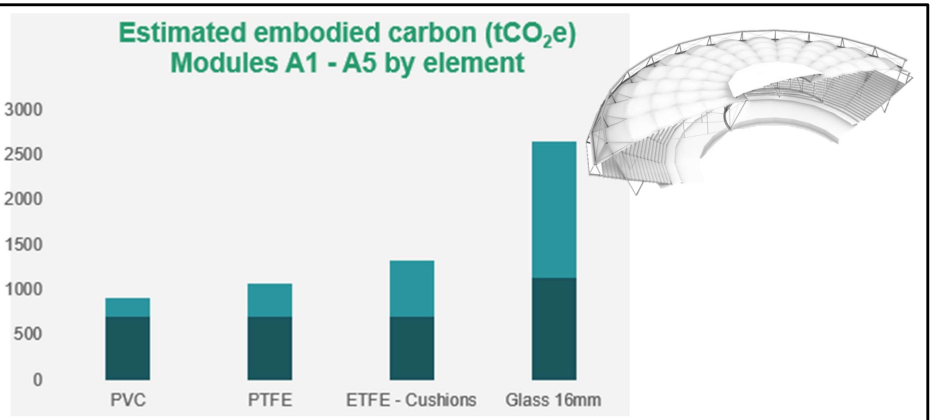
TRACKING & REPORTING CASE STUDY

In comparison with all other materials a PVC/PE fabric provides the lowest Carbon footprint value. This result is questionable as there are no current and updated EPDs available e.g. for PTFE. THe EPD certificate by Saint Gobain was taken for PTFE, but this certificate already expired and is no longer valid.



ESTIMATED EMBODIED CARBON (tCO2e) Module A1 – A5 by Elements

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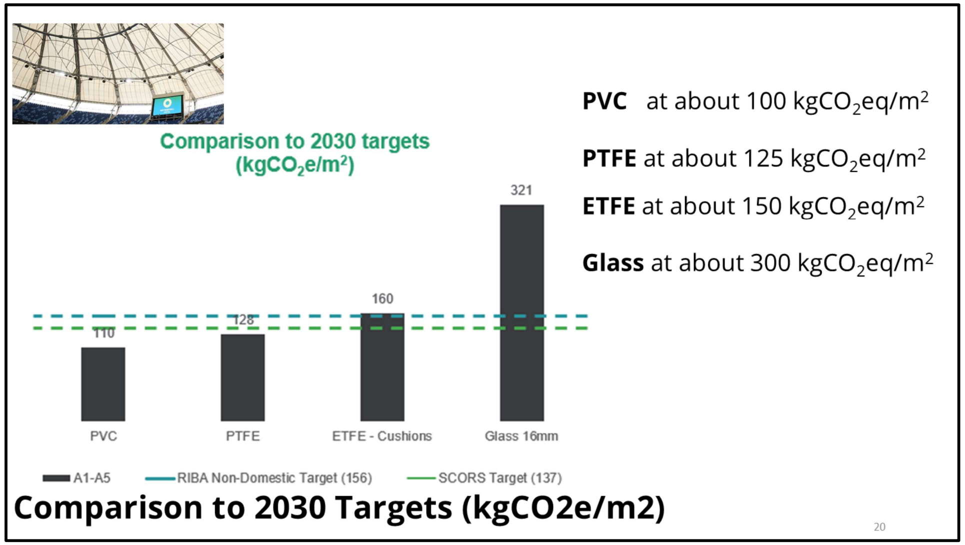
TRACKING & REPORTING CASE STUDY

Emission of cladding material in comparison to the emission values of the main structure (steel, cable).

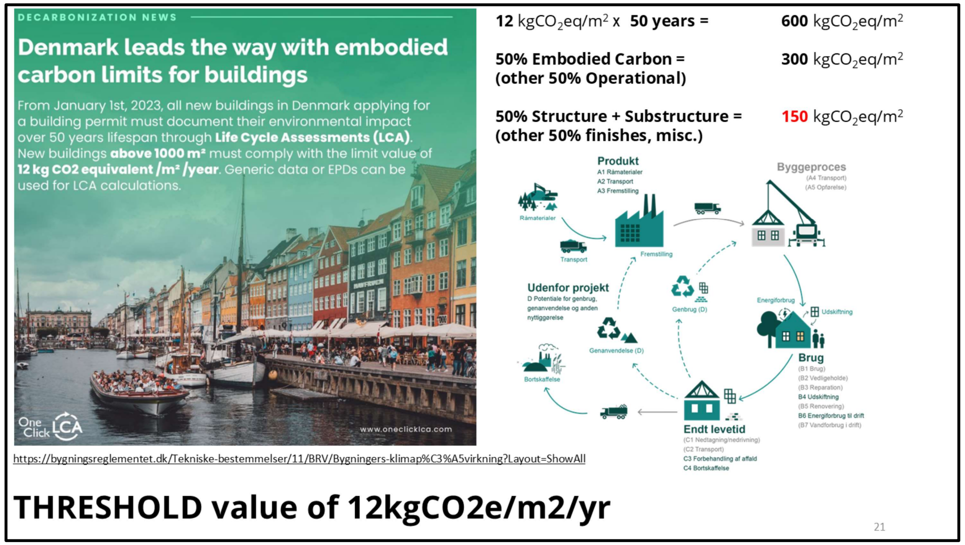


TRACKING & REPORTING CASE STUDY

Compared to the SCORS target by RIBA (Structural Carbon Rating Scheme by Royal Institute by British Architects), only ETFE and PVC cladding offers an A rating. SCORS focus on A1-A5 (cradle to completion) emissions rather A-C (lifecyle) emissions.

More and better data is needed.

Set targets for maximum embodied carbon for production stage (A1-A3) with industry dialogue to request their support in achieving the targets.



Danish Law

- 12kgCO2eq/m2/year
- For ~50 year life = 600kgCO2eq/m2
- 50% embodied, 50% operational = 300kgCO2eq/m2
- 50% structural (foundations & primary), 50% non-structural (secondary & architectural) = **150kgCO2eq/m2**

Denmark reference:

Denmark leads the way with embodied carbon limits for buildings

- From January 1st, 2023, Denmark became the first Nordic country to introduce embodied carbon limits into building regulations.
- All new buildings applying for a building permit (from January 2023), have to document the climate impacts through Life Cycle Assessments (LCA).
- New buildings **above 1000 m²** must comply with the limit value of **12 kg CO2 equivalent /m² /year**.
- New construction under 1000 m² requires LCA calculation without the threshold limit values

- The voluntary threshold limit is set at 8 kg CO_2 equivalent /m² /year
- Generic data or (Environmental Product Declarations) EPDs can be used for LCA calculations.

I believe that those limits are considering a 50 year life, so 50 years x **12 kg CO2 equivalent /m² /year** = **600 CO2 equivalent** /**m**²

This is based upon prescribed (not all) modules and phases in a building's LCA (reference EN15978):

Modules A1-A3, B4, B6, C3, C4 and D must be documented. See https://bygningsreglementet.dk/Tekniske-bestemmelser/11/BRV/Bygningers-klimap%C3%A5virkning?Layout=ShowAll

Section 1.2 Life cycle and consideration period & Table 2.1). Overview and description of the modules that must be included in the calculation of the climate impact:

- Product A1-A3 (Product Stage – does not include Construction Process Stage A4 – transport & A5 construction, installation process)
  - A1: Raw materials
    Climatic consequences as a result of processes for the extraction of raw materials and the use of secondary materials.
  - A2: Transport to manufacture
    Climatic consequences as a result of transport to the factory for the manufacture of the finished building product or the prefabricated system.
  - A3: Manufacturing
    Climatic consequences as a result of processes for manufacturing the finished building product or the prefabricated system.
- Use B4, B6 (Use Stage)
  - B4: Replacement
    Climatic consequences as a result of impacts related to the replacement of building parts.
  - B6: Energy consumption for operation (Operational Energy Use)

Climatic consequences as a result of the production of energy for building operations.

- End of life C3, C4 (Waste Processing & Disposal - does not include C1 Deconstruction Demolition & C2 Transport)
  - C3: Pretreatment of waste
    Climatic consequences as a result of waste treatment prior to recovery.
  - C4: Disposal
    Climatic consequences resulting from the disposal of waste, including pre-treatment prior to disposal.
- Outside project D (Supplementary Information Beyond Construction Works Life Cycle, Benefits and Loads Beyond the System Boundary)

D: Potential for reuse, recycling and other recovery
Potential environmental gains or burdens from reuse and recycling of building materials and other recovery such as energy recovery from burning.

Denmark leads the way with embodied carbon limits for buildings
[Bygningsreglementets vejledning om bygningers klimapåvirkning]

I reviewed the English version from the link and I searched for DS/EN15978:2012 "Sustainability within construction and construction - Assessment of the environmental quality of buildings - Calculation method" and found this useful summary:
[Danish energy consumption and climate impact Building Regulations Chapter 11]
and diagram:
https://www.designingbuildings.co.uk/w/images/4/41/Lifecycle_DB_med_

800_reposted.jpg
and this:
The sustainability of construction works - Designing Buildings
that includes:

The updated EN 15804+A2 adjusts the list of mandatory environmental impact categories to include a greater level of definition:

§ Climate Change - Total (CCT)

§ Climate Change - Fossil (CCF)

§ Climate Change - Biogenic (CCB)

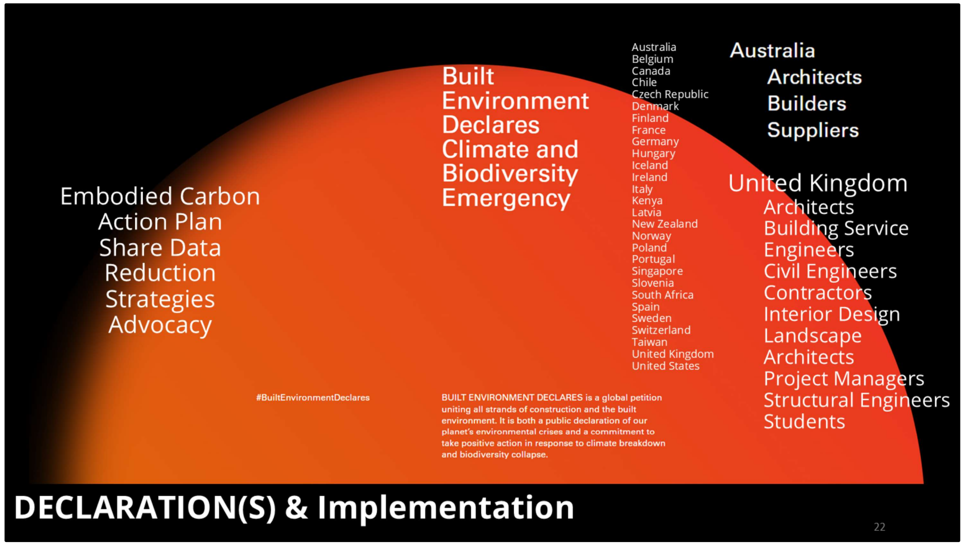
§ Climate Change - Land-use and Land Use Change (LULUC)

§ Ozone Depletion Potential (ODP) - Ozone Depletion

- Photochemical ozone creation potential (POCP) - Photochemical ozone formation
- Acidification - (AP)
- Eutrophication aquatic freshwater - (EPAF)
- Eutrophication aquatic marine - (EPAM)
- Eutrophication terrestrial - (EPT)
- Abiotic depletion potential for minerals and metals (ADPMM)
- Abiotic depletion potential for fossil resources (ADPFR)
- Water use (WU)

European Standard

CEN prEN 15978-1(MAIN) - Sustainability of construction works - Methodology for the assessment of performance of buildings - Part 1: Environmental Performance



https://builtenvironmentdeclares.com/

https://www.tess.fr/en/focus/construction-declares

We know that we have just over a decade to address these global emergencies, or we risk catastrophic damage to the natural world. Yet as the earth's life support systems come under increasing threat, the scale and intensity of urban development, infrastructure and building construction globally continues to expand, resulting in greater greenhouse gas generation and loss of habitat each year.

For everyone working in construction and the built environment, meeting the needs of our societies without breaching the earth's ecological boundaries will demand a paradigm shift in our behaviour. If we are to reduce and eventually reverse the environmental damage we are causing, we will need to re-imagine our buildings, cities and infrastructures as indivisible components of a larger, constantly regenerating and self-sustaining system.

Such a transformation cannot happen without a wide-ranging declaration of intent, followed by committed action, international cooperation and open source knowledge sharing. A united declaration will support more effective lobbying of policy makers and governments to show leadership and commit resources. The next few years will decisive in shaping our collective future - now is the moment to act.

Construction Declares can be used by everyone involved in the Built Environment sector: architects, designers, landscape architects, engineers, project managers, surveyors, developers and estate managers, contractors, suppliers, students, academics etc.

UK Architects Declare Climate and Biodiversity Emergency

https://www.architectsdeclare.com/

UK Building Services Engineers Declare Climate & Biodiversity Emergency

https://www.buildingservicesengineersdeclare.com/

UK Civil Engineers Declare Climate & Biodiversity Emergency

https://www.civilengineersdeclare.com/

UK Contractors Declare Climate and Biodiversity Emergency

https://uk.buildersdeclare.com/

UK Interior Design Declares Climate & Biodiversity Emergency

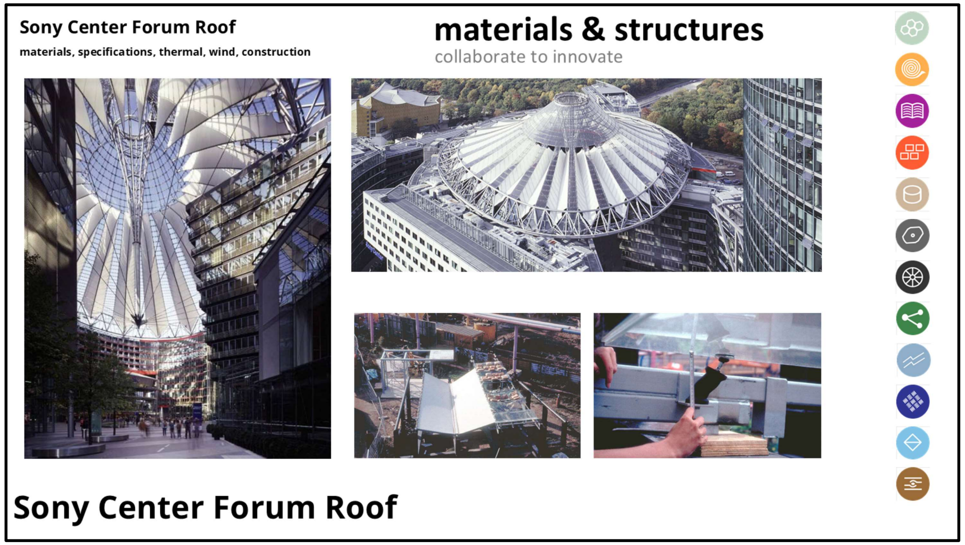
https://www.interiordesigndeclares.co.uk/

UK Landscape Architects Declare Climate & Biodiversity Emergency

https://uk.landscapearchitectsdeclare.com/

UK Structural Engineers Declare Climate & Biodiversity Emergency https://www.structuralengineersdeclare.com/

https://de.architectsdeclare.com/



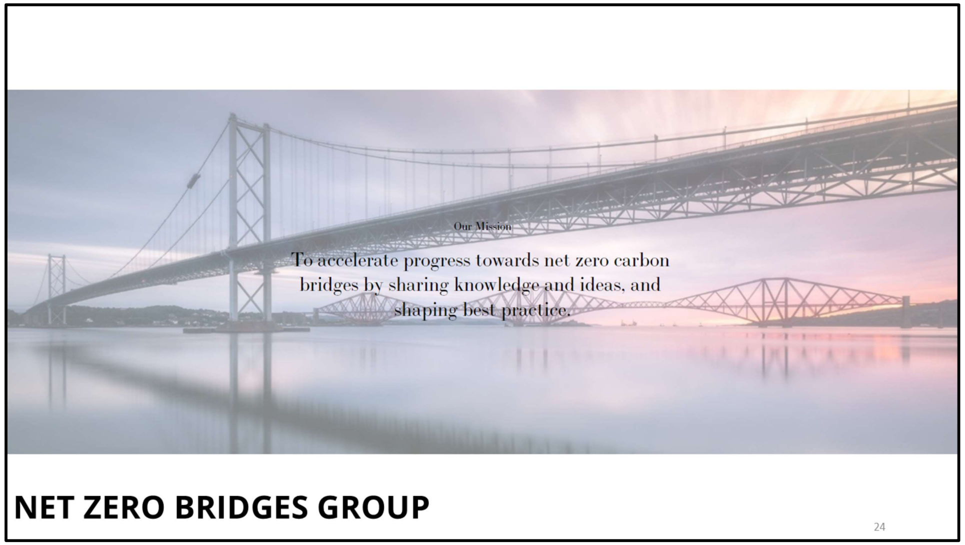
Bruce Danziger| structural engineer| 24-september-2015

materials, specifications, thermal, wind, construction

Collaboration

Sony Center Berlin – glass & fabric roof

Assistance with developing glass-to-cable details to allow for significant movements



Net Zero Bridges Group

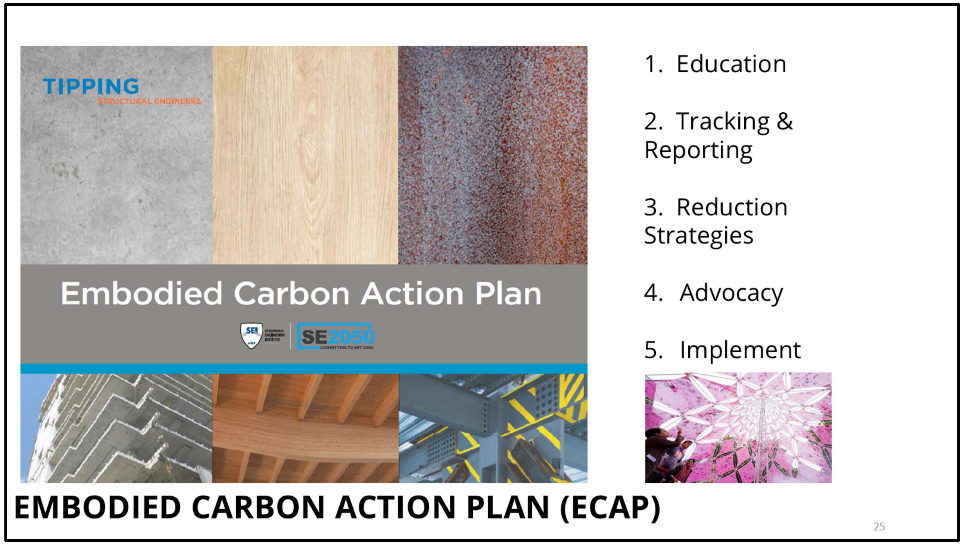
Cameron Archer-Jones (COWI), Brian Duguid (Mott MacDonald)

Library — Net Zero Bridges Group

- Climate Emergency: A need for bridge specific guidance?
- Climate change action timeline for bridge engineers - to Net Zero
- Accelerating progress towards Net Zero bridges
- Carbon Calculation Guide for Bridges DRAFT 1 Introduction Contents

NZGB members survey 2023 1. Introduction 2. Results

First article that came from the net zero bridges group: https://www.istructe.org/journal/volumes/volume-99-(2021)/issue-10/carbon-targets-for-bridges-proposed-rating-scheme/ (includes their benchmarking on bridges)



COMMITTING TO NET ZERO

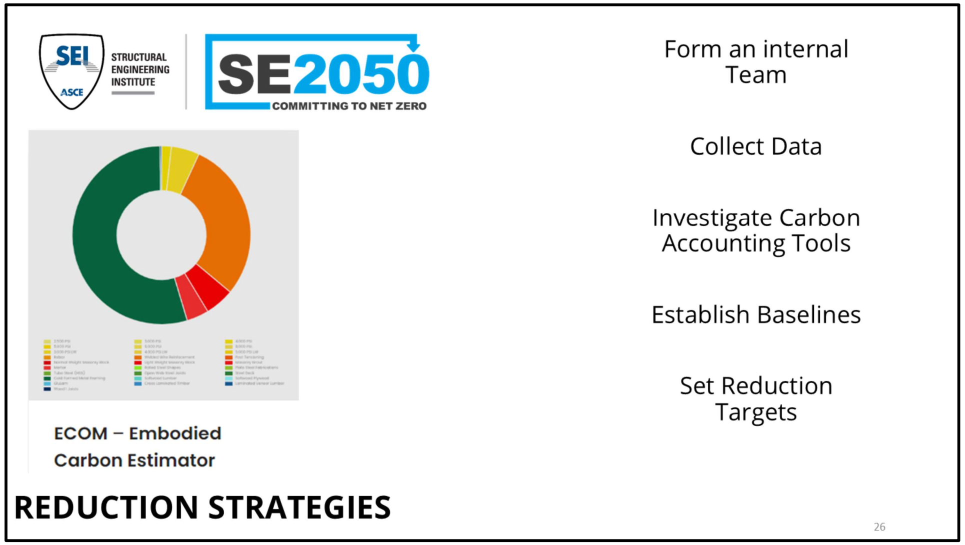
https://se2050.org/

Embodied Carbon Action Plans (ECAP)

https://se2050.org/ecap/

Program Requirements Guidance Document

https://se2050.org/program-requirements-guidance-document/



[2023 CLF North American Material Baselines Report - Carbon Leadership Forum]

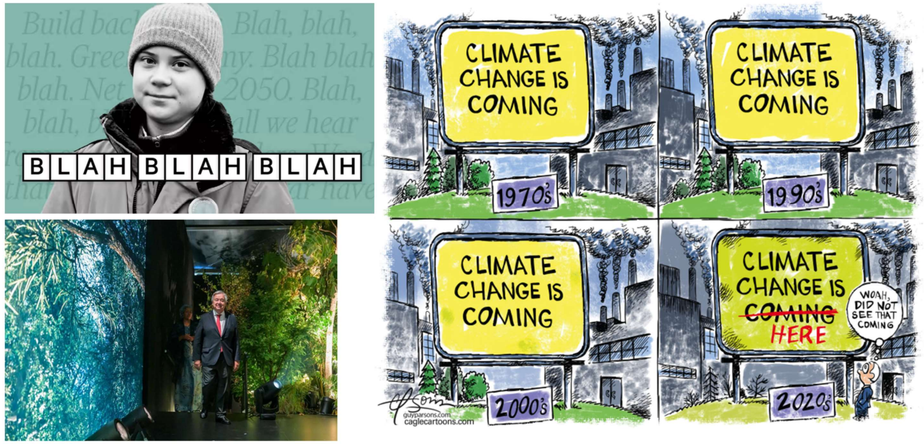
Final Report: https://carbonleadershipforum.org/download-page/?dlm-dp-dl=35677

Appendices: https://carbonleadershipforum.org/download-page/?dlm-dp-dl=35686

Table of values: https://carbonleadershipforum.org/download-page/?dlm-dp-dl=35678

Ask industry for more data (we need data)

Collect more Case Study comparisons
Share your thoughts about this with the industry
Do embodied carbon accounting on your projects
Help us set targets for maximum **kgCO2eq/m2**
Share your data



VOW, PLEDGE, DECLARE, COMMIT, PLAN & THEN IMPLEMENT (Entregable)

27

Vow to get to net zero as soon as you can
Declare: Join the movement
Commit: Make an ECAP and share data
Implement: Reduce impacts
Start with Why (How, & What later)
Stewardship

With extreme weather events accelerating, “humanity has opened the gates to hell,” said the Secretary-General, describing distressing scenes of farmers helplessly watching crops washed away by floods, the emergence of virulent disease due to rising temperatures, and the mass exodus of people fleeing historic wildfires.

Let's do this together…

Thank you

Lightweight Structures Association Australasia Inc.