Sustainability Resource Map

Sustainability Guidance

1. Get Informed

1.1 Sustainability in structural engineering

Recommended Reading
The structural engineer's responsibility
What are you going to do about it? (climate action video)

Short Reads
A framework for change
Turning Climate Commitment into Action
Sustainability for bridge engineers part 1
Sustainability for bridge engineers part 2

Videos
Structural Engineers Declare: what it means for structural engineers
Structural Engineers Declare: what it means for IStructE
Key climate emergency actions for engineers and the Institution

Longer Reads
Addressing the biodiversity emergency: what role can structural engineers play?
Design for zero

External Content
MEICON
Achieving Net Zero Embodied Carbon in Structural Materials by 2050 (Structural Engineering Institute)

1.2 Sustainability in the built environment

Recommended Reading
Climate jargon buster

Short Reads
IABSE Henderson Colloquium 2020
Low-carbon outcomes in the built environment

Videos
Designing with nature
Engineering for the future, a resilience-based approach
A targeted approach to the UN Sustainable Development Goals
SMART Healthcare Facilities

External Content
Design Council - Beyond Net Zero
Halliday, S. (2019) Sustainable construction. 2nd ed. Abingdon: Routledge. [E-book
McLean, W. and Silver, P. (2021) Environmental design sourcebook: innovative ideas for a sustainable built environment. London: RIBA Publishing
Braham, A. and Cassilas, S. (2021) Fundamentals of sustainability in civil engineering. 2nd ed. Boca Raton, Florida: CRC Press. [E-book]
CIBSE (2020) Sustainability. 2nd ed. London: CIBSE. (CIBSE Guide, L).
LETI Climate Emergency Design Guide
LETI Embodied Carbon Primer

1.3 Beyond the built environment

Short Reads
A short guide to carbon offsetting
What is sustainability?
Carbon trading

External Content
Doughnut Economics, Kate Raworth
David Attenborough's A Life on our Planet
Allwood, J.M., Cullen, J.M. and [et al.] (2015) Sustainable materials without the hot air. Cambridge: UIT Cambridge Ltd. [Print and E-book]
UKFIRES, - Absolute Zero
Ashby, M.F. et al. (2016) Materials and sustainable development. Oxford: Elsevier

2. Low Carbon

2.1 Embodied carbon calculations

Recommended Reading
How to calculate embodied carbon
Software: The Structural Carbon Tool

Short Reads
A brief guide to calculating embodied carbon
An introduction to The Structural Carbon Tool

Videos
Minimising Energy in Construction (MEICON) overview lecture

Longer Reads
Measuring carbon – a small practice perspective
Seeing the bigger picture – industry emissions, your project and the performance gap
Embodied carbon assessment using a dynamic climate model: Case-study comparison of a concrete, steel and timber building structure (Structures journal)
Deriving embodied carbon factors from scratch

External Content
Trusson, M. (2020) Whole life costing for sustainable building. Abingdon: Routledge. [E-book]
RICS WLC assessment
Webster, M.D. (ed.) (2017) Structural materials and global climate: a primer on carbon emissions for structural engineers. Reston, VA: ASCE. [E-book]

2.2 Targets/ Benchmarking

Recommended Reading
Setting carbon targets: an introduction to the proposed SCORS rating scheme

Short Reads
Embodied CO2 of structural frames.
Capital vs lifecycle vs whole-life costs

Videos
Whole life carbon, targets, and project examples

Longer Reads
We signed the climate declaration – now what? Lessons from counting carbon
A comparative embodied carbon assessment of commercial buildings.
Carbon footprint benchmarking data for buildings
Carbon targets for bridges: a proposed SCORS-style rating scheme

External Content
LETI Embodied Carbon Target Alignment
LETI Embodied Carbon Primer

2.3 Concrete

Recommended Reading
Video: Carbon in concrete, steel and timber
How can we reduce the embodied carbon of structural concrete?

Short Reads
Blog: Specifying sustainable concrete
Marginal gains – carbon in concrete buildings
Recycled and secondary aggregates in concrete
Cementitious materials

Longer Reads
Fiberglass rebar: a proven and sustainable technology for concrete infrastructure

External Content
Concrete Centre: How to specify lower carbon concrete
Concrete Centre: Specifying Sustainable Concrete
Concrete Centre: Material Efficiency
Concrete Centre: UK Concrete and Cement Industry Roadmap to Beyond Net Zero

2.4 Steel

Recommended Reading
Video: Carbon in concrete, steel and timber
Developing a low-carbon economy for steel

Short Reads
Blog: Making your steel specification more sustainable

Longer Reads
Enabling steel's circular economy potential

External Content
Chatham House: Achieving Net Zero in the Steel Sector
SCI P427 Structural steel re-use: Assessment, testing, and design principles
SCI P428 - Guidance on Demountable Composite Construction Systems for UK Practice
SCI: Sustainability Guidance Webpage
SCI: The whole story from cradle to grave

2.5 Timber

Recommended Reading
Video: Carbon in concrete, steel and timber
Timber and carbon sequestration

Longer Reads
Timber Engineering Notebook (16 articles)
Design solutions for efficient timber buildings
Designing timber buildings for longevity

External Content
Video: TDUK - Timber and carbon

2.6 Other materials

Short Reads
Responsible sourcing

Videos
Carbon on site and in bridges
Structural engineering with bamboo
Novel materials series: Designing with rammed earth
Novel materials series: How to get novel materials adopted on projects: R&D to construction

Longer Reads
RICA – climate-positive design using locally sourced materials
Scaling low-carbon construction materials

2.7 Carbon wider reading

Recommended Reading
Making low-carbon material choices

Short Reads
How to carry out a carbon impact assessment of a structural consultancy office
Typical operational energy and carbon figures for buildings
Emissions trading schemes
How to read an EPD: basics for the structural engineer

3. Lean Design

3.1 Safety and Resilience

Recommended Reading
Structural safety when designing lean in the climate emergency

Short Reads
Lean yet resilient – designing for the future
Structural fire safety when responding to the climate emergency

3.2 Optioneering and Optimisation

Recommended Reading
Design for zero

Short Reads
Lean design: 10 things to do now

Videos
Layout optimisation of structures: doing more with less
Lean design principles and implementation

Longer Reads
What do we mean by efficiency? A holistic approach to reducing embodied carbon
Rationalisation versus optimisation – getting the balance right in changing times
Design solutions for efficient timber buildings

4. Zero Waste

4.1 Circular economy

Recommended Reading
Applying circular principles to the design process

Short Reads
Enabling steel's circular economy potential
Design for deconstruction
The reuse of structural components and materials
Practical application of circular economy principles
Three ways structural engineers can help create a zero-waste future

Videos
Video: Circular economy and the future of the engineer

External Content
SCI P427 Structural steel re-use: Assessment, testing, and design principles
SCI P428 - Guidance on Demountable Composite Construction Systems for UK Practice
The Ellen MacArthur Foundation website
Cheshire, D. The Handbook to building a circular economy (2021). London: RIBA Publishing
Baker-Brown, D. (2017) The Re-use atlas: a designer's guide towards the circular economy. London: RIBA Publishing. [E-book]
Circular Economy Guidance for Construction Clients – UKGBC

4.2 Reuse of existing structures

Recommended Reading
Video: The principles of reusing existing buildings
A short guide to reusing foundations

Short Reads
Blog: 8 vertical extensions you should know about

Longer Reads
Reuse, build less, build lean: low-carbon design for 22 Bishopsgate, London
P427 Structural steel re-use: Assessment, testing, and design principles
An introduction to refurbishment. Part 1: Identifying opportunities at the feasibility stage
An introduction to refurbishment. Part 2: Maximising the opportunities at the design stage
1 Triton Square, London – low-carbon development through reuse of an existing building
What can you do if you are convinced a structure will work but can't prove it to code?
Analysing existing structures: a brief introduction
Strengthening of existing buildings: an introduction
Vertical Extensions: Technical Challenges and carbon impact
Understanding existing buildings – five studies to complete before design work starts

External Content
LETI Climate Emergency Retrofit Guide

4.3 Conservation

Longer Reads
Conservation compendium. Part 7: Imposed load in historic buildings: assessing what is real
Conservation compendium. Part 16: The monitoring of movement in historic buildings and structures
Conservation compendium. Part 17: Filler-joist floors – development, capacity and typical defects
Conservation compendium. Part 18: Non-invasive quantitative appraisal of historic floor structures
Managing Health & Safety Risks (No. 32): Identifying and managing contaminated ground

4.4 Offsite manufacture

Longer Reads
Refocusing modern methods of construction on the climate emergency: a five capitals model for action

Videos
Modernising design for zero waste

4.5 Other

Short Reads
Blog: Minimising waste in design and construction

Longer Reads
Designing timber buildings for longevity

External Content
Guide to Improving Value by Reducing Error – GIRI

5. Influence the Brief

5.1 Building Less & Standardisation

Recommended Reading
Nothing is better than something

Short Reads
How can we create an engineering industry while building nothing?
Time for a structural change?

Videos
Minimal intervention: less is more

Longer Reads
A weight off your mind: Floor loadings and the climate emergency

5.2 Effecting Change

Recommended Reading
Video: Questioning and influencing the brief

Longer Reads
Measuring carbon – a small practice perspective
Racing to zero: isn't it time you committed to emission reduction targets
Persuasion and influence in a climate emergency
Profile: Jo da Silva
Profile: Kate Simonen
Interview: Dr John French (the client's perspective)

Videos
Video: The art of persuasion and collaboration
Video: The brief, policy and risk/resilience

External Content
LETI Client Guide for Net Zero Carbon Buildings
LETI Proposals for Energy Policy

6. Get Involved

6.1 Your role

Recommended Reading
Structural engineering innovation for a zero-carbon world: an R&D agenda to match the carbon budget

Longer Reads
Young engineers and the climate emergency
Own your agency: what part will you play in the climate revolution?
Don't let climate grief stop you taking action

6.2 Policy

Recommended Reading
Part Z: A proposed amendment to UK Building Regulations 2010

Longer Reads
Policy measures affecting the sustainability of structural engineering designs

External Content
LETI Draft London Plan Consultation Response
LETI Consultation on a definition for net zero carbon
LETI Royal Academy of Engineering: Decarbonising Construction report
RIBA Built for the Environment report
LETI Developing policy for a net zero capital

7. Project Write-ups

Longer Reads
1 Triton Square, London – low-carbon development through reuse of an existing building
RICA – climate-positive design using locally sourced materials
Nature's invention: The Enterprise Centre, University of East Anglia
Reuse, build less, build lean: low-carbon design for 22 Bishopsgate, London

Videos
Video: MASS Design Group's Impact Driven Approach to Design & Construction in Africa
Video: the Passivhaus residential development at Goldsmith Street
Video: Whole life carbon, targets, and project examples
Video: A livelihoods approach to construction in Zambia

Please Note: These resources are highlighted to the reader for their potential value/interest. Some have been produced by third parties. The Institution of Structural Engineers does not necessarily endorse (nor is it responsible for) any statement or opinion expressed within these.

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