Engineering a Better Future

Climate Emergency Task Group
End of Year Report 2021

The Institution of
StructuralEngineers

Forewords

We are eight years away from 2030, the date that the world is now targeting for the halving of global emissions. For most of us, a glance backwards to 2014 provides a sense of surprise as to how quickly time has passed – looking forwards, we should be in no doubt as to the scale of the challenge in meeting that target date.

None of us live in isolation from the impacts of others and it has been right for this Institution over the past couple of years to focus primarily on the provision of support to the structural engineering profession. As is evidenced by this end of year report, much has been achieved and for that we give thanks for the determination of those leading our efforts to turn a declaration of climate emergency into the tools of climate action.

The actions of our profession are of course intrinsically linked with those in other areas of expertise. It is the true integrated efforts of collaboration that will surely provide the multiplier effect needed to effect substantial and lasting change in the way the Built Environment professions approach their work. In this regard, it is also pleasing to report on shared progress with other organisations and the real sense that together we are stronger and bring more impact to the collective challengers in our sector.

The missing link is well thought through regulatory activity that can either reward positive change or penalise failure to respond. The mechanisms for these will vary around the world but here in the UK it is good to see this Institution joining others in thought leadership to explore the impacts of legislation as catalysts to climate action

Wherever in the world you are reading this annual report from our Climate Emergency Task Group there will be information that is relevant and thought-provoking in the context in which you are operating. Have your say, share your experiences, let us know what actions are being taken in your part of the world but please, do not leave this report without setting your own personal climate action objective in your professional life. Eight years will pass in a flash.

Martin Powell

Chief Executive, The Institution of Structural Engineers

It is a little over two years since the Institution formed a task Group to help drive change in the profession in response to the Climate Emergency recognised by the UK Government in 2019. This second annual report from the task group highlights the changes that have been taking place within and beyond the Institution. These changes have required hard work and determination from a vast number of our valuable IStructE members and from the sterling efforts of the staff of the Institution itself, for which we are truly grateful. The task group simply sets a framework, but the hard work comes from the many people who are determined that urgent change has to be made.

Inevitably, looking back makes us think about the changes that will be needed in the coming year and beyond. There is so much more to be done to transform our profession and the construction industry.

This year we have seen many organisations publishing “roadmaps to net-zero”, including the cement and concrete industry, steel producers and multiple clients. These commitments can only be realised if there is massive investment of time and money to find new ways to produce the zero carbon construction materials we need, new ways to capture the CO2 from the emissions of industrial processes, and new ways to plan and develop our cities that consider social and environmental imperatives. We will need government to play a role to ensure the climate is right for such investment and transition – planning requirements and building regulations will need to change and a carbon trading price must be set that will drive investment in the right direction. Our professional Institutions need to exercise their own influence to press for such change – I believe the IStructE is ready for this.

This report is a review of what has been happening, but I hope it makes us think about what more we can do to effect greater change, by bringing our personal values to bear in our professional lives no matter how hard this feels.

Dr Mike Cook

Chair, The Climate Emergency Task Group

Contents

Introduction

Over the last two years, the Institution of Structural Engineers has continued to drive change in the construction industry around the topic of sustainability and greenhouse gas ('carbon') emissions. In this time, the Institution's Climate Emergency Task Group (CETG), in conjunction with wider Institution activities, has built up a wealth of guidance and tools for our members and their collaborators to use, to help them to reduce the carbon emissions of their designs, most of which we have made freely available at www.istructe.org/climate-emergency. So please have a look at the **Sustainability Resource Map on page 18** to explore the full breadth of guidance currently available to members.

We are now looking forward to 2022, when we will use this guidance as the solid basis for **strengthening** the profession's capabilities, **broadening** our thinking beyond carbon, and **influencing** others to take bold steps of their own.

This report communicates the direction in which we seek to move in next, in a world where responding to the climate crisis continues to play an increasingly important role across all industries.

We hope that it provokes conversation about what good design constitutes to you, and how we can all play a role in getting there.

2022 Focusses

Strengthening

Making carbon reduction a standard part of every structural engineer's toolkit

This first focus is a direct extension of the work done to date by the CETG and Institution to normalise sustainability within structural engineering by embedding it in everything that we do.

One great example of this is the agreed updates to the Exam and Professional Review Interview that will be implemented in 2023. These have been revised to put sustainability and embodied carbon at the heart of the capabilities expected in a chartered structural engineer, and in 2022 we will communicate more details of the changes at this dedicated webpage: www.istructe.org/training-and-development/ipd/ipd-regulations.

The CETG continues to create resources to enable engineers to upskill in line with these requirements, including the launch of two carbon-focussed training courses. Our free on-demand Embodied Carbon Basics course (link) provides the perfect entry point for those looking to start incorporating carbon calculations onto every project, or a useful refresher for those wanting to spot-check their current knowledge. And our Net Zero Structural Design course is aimed at those who want to take their thinking further still (*sign up* at link). We are also developing a Sustainability Report template document, aligned with the Structural Plan of Work, to help embed sustainability into the design process, and communicate sustainable thinking to others.

Finally, we will continue to provide sustainability-focussed guidance in *The Structural Engineer* next year. As part of this, we are keen to publish project case studies that demonstrate engineering solutions to the climate crisis – from unlocking the reuse of existing assets or components, to concepts centred on efficient use of materials. If you have a case study you'd like to share in *The Structural Engineer*, please get in touch.

Broadening

Going beyond carbon

The Institution is proud of the diversity of its members around the world, and we recognise that this means that the focus between emissions and resilience will vary with location. This is aligned with the Glasgow Climate Pact that was agreed at COP26 (link), which highlighted the need to focus on mitigation of carbon emissions in conjunction with helping adapt the world to our changing climate.

Whilst our work over the last two years has focussed on embodied carbon, we must keep an eye on our broader responsibility as engineers, and work to understand how better to align CETG and Institution activities to a wide range of United Nations Sustainable Development Goals, and ultimately, towards regenerative outcomes.

Of particular relevance to this, the Structural Awards will be updated to reflect the Institution's drive to celebrate qualities aligned with this wider view of what great engineering looks like – and more importantly, what it really achieves. This revision will shift the emphasis away from scale, stature, and span, and towards celebrating how our work impacts on people, the planet, the profession, and the processes behind great design and construction.

And for those members whose firms have already made the commitment to calculate and reduce carbon on every project, we will strive to set the bar higher still. In the coming year, we will seek to provide wider thinking and guidance around topics such as the circular economy, biodiversity, regenerative design, and social value. As one example, work has started already on producing a circular economy design guide for structural engineers, which we will publish next year.

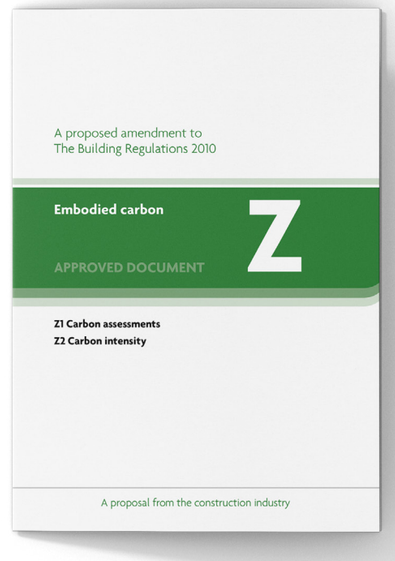
Influencing

Working across the construction industry

Finally, we must all continue to work beyond our own discipline, if the industry is to change rapidly enough to provide an effective response to the climate emergency.

In the UK, the CETG has played significant roles this year in the development of several important initiatives and reports, including Part Z (an industry proposal to regulate embodied carbon), the Construction Industry Council's climate action plan (link), and the UK Green Building Council's net zero roadmap (link). We have also facilitated conversations across firms, discussing routes to overcoming barriers to setting carbon targets (refer this article in January 2022's *The Structural Engineer*), and raising our levels of commitment at the Structural Engineers Declare Summit.

We will continue to champion these and similar initiatives during 2022, in order to ensure that structural engineers maintain an industry-wide voice on sustainability and climate change. Alongside this, we will work to ensure that the wider industry is aware of the work that we are doing to strengthen and broaden our offering as structural engineers, and help others to understand the benefits that early engineer engagement will bring when targeting projects with sustainability ambitions.



The Work Of The Climate Emergency Task Group

Setting standards

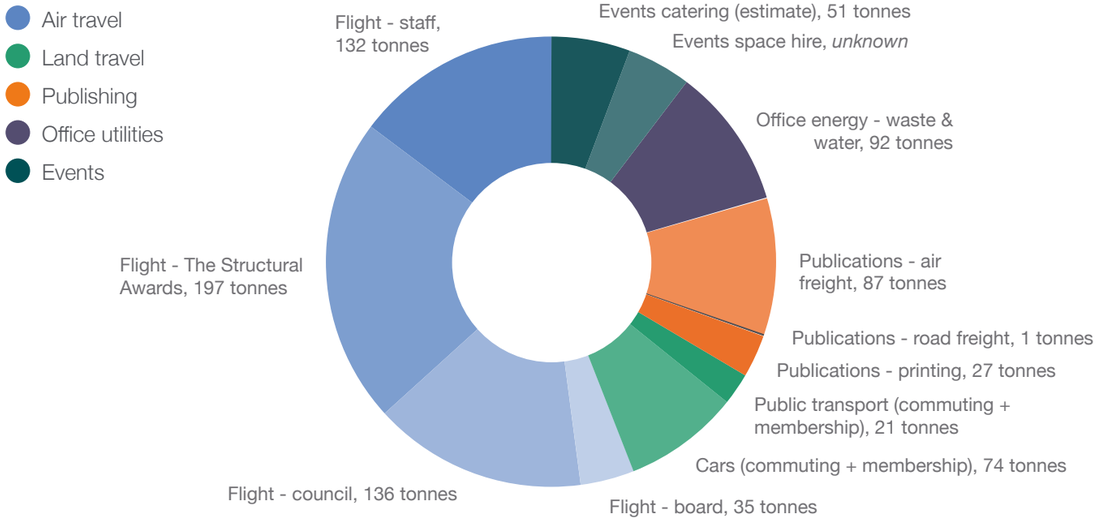
In 2021 we:

- Contributed to the Institution's review of the Professional Review Interview (PRI) and Membership Exams, and Code of Conduct. Agreed changes to PRI and Exam will be implemented in 2023, and the updated Code of Conduct will be live from January 2022, better embedding sustainability within all three.
- Continued to work to bring universities up to speed with the updated Joint Board of Moderators (JBM) requirements for accredited engineering degree courses, to embed sustainability into Further Education teaching. For more information on the revised requirements, visit link.
- Completed an audit of the Institution's own (pre-pandemic) carbon footprint, tracking the breakdown between different Institution activities.

> The assessment of our 2019 carbon footprint has prompted us to consider the ways in which we can most effectively operate as a global institution.
>
> We must steer our work in a direction which has global outreach whilst reducing the carbon impact of our activities on the planet.
>
> **Will Arnold** - *CETG Member and Head of Climate Action, IStructE.*

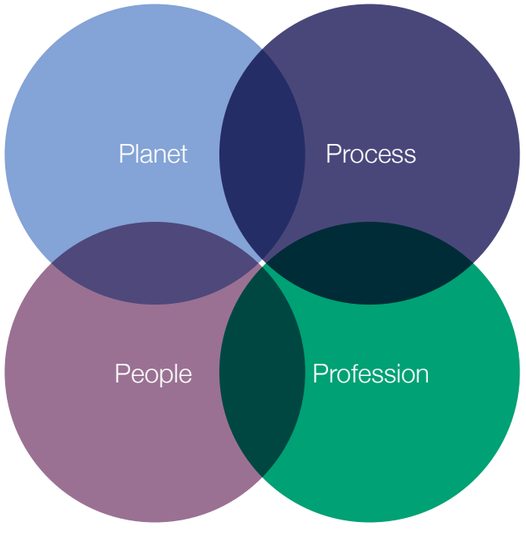
IStructE carbon footprint estimate 2019

Total: approx 900 tC02e



In 2022 we will:

- Work with the Institution to launch a website at www.istructe.org/training-and-development/ipd/ipd-regulations dedicated to the revised PRI and Exam requirements.
- Contribute to an Institution review of Continued Professional Development (CPD) requirements, including the standards it sets for sustainability.
- Finalise work done with the Structural Awards team to move focus away from scale, stature, and span, and instead move to celebrating how our work impacts on people, the planet, the profession, and the process of design and construction.
- Agree improvement targets to reduce the Institution's carbon footprint over the coming years and consider offsetting remaining emissions.



We ask you to:

- Work with your graduates to help them prepare for the revised PRI and Exam requirements, and work with your chartered engineers to help them achieve the same competency level.

> The Joint Board of Moderators has positioned the Climate Emergency central to the education of civil/structural engineers, and is presently rolling out implementation of its new guidelines through workshops and events to bring the whole education community along with required change.
>
> Part of the inspiration for students, graduates and, indeed, experienced structural engineers are exemplar design examples to illustrate that which is possible as we move to net zero.
>
> The Structural Awards are changing to achieve just this spark, by moving away from the tallest or longest towards exciting attributes which matter most in the Climate Emergency.
>
> **Tim Ibell** – *CETG Member and Dean of the Faculty of Engineering and Design, University of Bath.*

Guidance

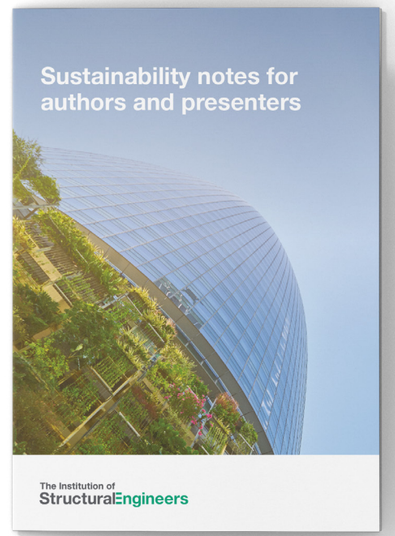
In 2021 we:

- Published 36 guidance notes and articles on sustainability in *The Structural Engineer*. For a full list of sustainability guidance published by the CETG to date, plus other recommended Institution and external resources, refer to the **Sustainability Resource Map on page 18**.
- Held a two-day 2021 Climate Emergency Conference, for which recordings can be viewed at the links below:
  - Clients, legislation and risk/resilience
  - Whole life carbon, carbon targets, and 3x project case studies
  - Carbon in steel, concrete and timber
  - Carbon on site and in bridges
  - Circular economy and the future of the engineer
  - (Note that the 2020 Conference recordings are also still available to access from last year's End of Year Report, link).
- Published *Design for Zero*, presenting practical advice on reducing carbon emissions on every project, including real-life case studies to accompany the theory. Available to buy online at link.
- Published *The Structural Carbon Tool*, an open-source excel-based tool, developed in collaboration with Elliott Wood. The tool is free to download at www.istructe.org/the-structural-carbon-tool, allowing quick carbon emissions estimates to be made on every design.
- Launched the *Embodied Carbon Basics* e-learning course, available now at link. This free, on-demand course covers carbon calculations, relevant information about key materials, and related topics such as Environmental Product Declarations (EPD).
- Launched the *Net Zero Structural Design* course for near-chartered and chartered structural engineers who are looking to develop their own low carbon design approaches, with registrations now open at link for the first cohort in February 2022.

> I'm very proud to have led the development of The Structural Carbon Tool which has provided IStructE members and beyond with an easy way of measuring and reducing carbon on their projects.
>
> Elliott Wood chose to donate the tool to the industry to help facilitate the step change needed to put carbon on a par with safety on every project and reduce the huge carbon footprint of the construction industry.
>
> **Penny Gowler** – *CETG Member and Head of Sustainability, Elliott Wood.*

In 2022 we will:

- Embed sustainability throughout the Institution's Learning and Development (L&D) activities. We have already produced guidance for authors and presenters (link), and will continue to work with those delivering L&D to help them understand the role of sustainability within their topics.
- Continue to publish high-quality guidance advocating a sustainable approach to design in response to the Climate Emergency – both through *The Structural Engineer* as well as blog posts and online events. As part of the ongoing drive to normalise sustainable design, the Institution will encourage as many authors as possible to discuss the sustainability of their projects.
- Publish a guide to designing structures within a Circular Economy, including reusing buildings, reusing structural components, and designing for end-of-life.
- Start to outline guidance around setting carbon targets on projects and in firms, to complement *How to calculate embodied carbon and Design for zero*.



We ask you to:

- Get in touch if you would like to contribute a project write-up of any scale that has particular sustainability features that you would like to see showcased in *The Structural Engineer*.
- Look at the Sustainability Resource Map on page 18, start filling gaps in your own knowledge, and then share the document with other engineers and collaborators.

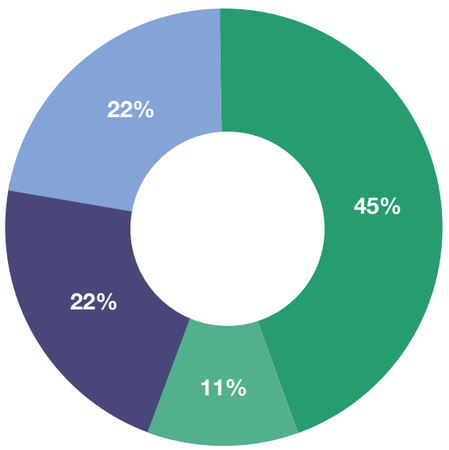
> The Sustainability Resource Map is a collaboration between the CETG and the Institution's Sustainability Panel that collects and categorises nearly 200 pieces of recommended guidance.
>
> We hope that members find this useful to understand the wide range of resources that exist to help them bring sustainability into their work.
>
> **Rossella Nicolin** – *CETG Member and Technical Director, Laing O'Rourke.*

Support The Profession

In 2021 we:

- Collaborated closely with Structural Engineers Declare to identify ways in which we could continue to support one another.
- Hosted the 2021 Structural Engineers Declare Summit, inviting declared firms to share their own experiences of implementing the change that we need to see. Attendees were asked how they could commit to doing more next year, with the most popular responses being around measuring and sharing carbon data as standard on projects.
- Facilitated a roundtable workshop on the topic of setting carbon targets, to facilitate open discussion around the barriers to setting project-level and company-wide targets for firms to aim for between now and 2030. Notes from the workshop were published in The Structural Engineer in January 2022: https://www.istructe.org/journal/volumes/volume-100-(2022)/january-2022/company-wide-carbon-targets/
- Set up the Sustainability Open Spaces initiative to facilitate local conversations around sustainability, for engineers who wanted to hear from others outside of the firms they worked in. For more information on how to join your local SOS group, visit https://istructe.org/sustainability-open-spaces.
- Worked with other organisations including Built Environment Declares and the Climate Framework to set out a plan for developing a multi-disciplinary open-source content sharing platform.

> The CETG plays an important role, in collaboration with Structural Engineers Declare, to bring the profession together to share knowledge and experience - encouraging and educating each other to make collective progress in responding to all aspects of the climate emergency.
>
> Through events such as the Carbon Targets Round Table and the SED Summit we have achieved strong engagement from across the profession, resulting in direct benefit to the individuals and practices that have attended these events, as well as generating valuable feedback to the CETG which will influence our areas for strategic focus.
>
> **Ed Clark** – *CETG Member and Director, Arup.*



Carbon Targets Roundtable Survey
Number of firms who...

- ...have set targets for use on every relevant project
- ...are developing a set of targets, or have optional targets
- ...don't have targets, but require carbon calculations on every project
- ...don't have mandated targets or calculation requirements in place

In 2022 we will:

- Facilitate further open discussions between firms on sustainability-related issues, to better accelerate industry progress in tackling difficult topics such as carbon targets, including continuing to grow the network of Sustainability Open Spaces groups, both in the UK and internationally.
- Host further Structural Engineers Declare events such as a 2022 Summit, to continue to check in on progress since the declaration went live in 2019.
- Explore the need for guidance related to climate emergency oriented business practices, such as business models or scopes of work related to a 'build less' approach to engineering practice.
- Develop an in-house training offering with the Institution, on the topic of carbon calculations and net zero structural design, to support individual firms' upskilling needs.

We ask you to:

- Progress the conversation in your own firm about raising ambition further through your processes, commitments, work-winning priorities etc.
- Share information with others across the industry – from carbon calculation results to business models to connection details – industry progress will be all the stronger for it.

> I would like to say thank you to the network of enthusiastic volunteers who started SOS groups in 2021 to support engineers in their region to face the challenges of reducing carbon emissions and more sustainable design.
>
> I hope that in 2022 we see these groups grow, both with engineers who are seeking confidence and those who are keen to share their knowledge.
>
> **Mike Sefton** – *CETG Member and Associate Innovation Engineer, Expedition.*

Collaborate and Influence

In 2021 we:

- Launched “What are you going to do about it?”, a four-minute climate action video focussing on the need to take our professional responsibility seriously and commit to doing things better across the built environment.
- Strengthened our international links, presenting on sustainability virtually at conferences and events held in Singapore, Australia, Canada and New Zealand.
- Supported the writing of Part Z and Approved Document Z (www.part-z.uk), an industry-proposed amendment to the UK Building Regulations, that demonstrates how whole life carbon assessments and embodied carbon limits could be brought into regulation. Over 130 firms have now supported the need for such regulation, and support continues to grow.
- Presented to UK government on the topic of embodied carbon, speaking to MPs at the Environmental Audit Committee, as well as to a number of government departments including BEIS and DLUHC.
- Hosted events as part of COP26, including a public panel discussion around what is needed to halve emissions in construction by 2030 (recording at link).
- Worked with the RAEng and National Engineering Policy Centre on setting the sustainability agenda for all engineering degree qualifications, by setting new accreditation requirements and forming a working group on sustainability in Higher Education.
- Worked closely with other industry partners on a range of important cross-discipline initiatives that included:
    - the UK Green Building Council (UKGBC) whole life carbon roadmap (link) - outlining the actions required to take the industry to net zero;
    - the Construction Industry Council (CIC) climate action plan (link) - providing a common set of actions for all professional institutions;
    - the Built Environment Carbon Database (www.becd.co.uk) – which, once launched, will be used as a common repository to record carbon emissions for completed projects.

> I am very proud to have featured in the Institution’s climate action film, representing not just the Institution and the CETG, but also the younger members of the industry.
>
> It is vital that members at all career stages are represented in these important conversations, to ensure that actions and commitments consider the views of the future leaders of the profession.
>
> Looking into 2022 I would encourage everyone - even if you are at the start of your career - to challenge, encourage and share your knowledge and opinions on sustainability in our industry.
>
> **Niamh McCloskey** – *CETG Member and Structural Engineer, Curtins*

In 2022 we will:

- Strive to reach more of our members around the world, through events, conferences and training opportunities. We already have plans made to speak in both India and the USA early in the year.
- Seek to strengthen existing links with other built environment bodies including the RIBA, CIBSE, CIC, RAEng, NEPC and UKGBC; as well as broader Institutions such as Chatham House.
- Work to understand how we align the activities of the CETG and the Institution across the United Nations Sustainable Development Goals.
- Work with the Institution to appoint a Technical Director to enable the development of further policy positions and thought leadership activities across the most important topics related to structural engineering and our global membership.
- Continue to support the Part Z initiative in the UK, and help raise awareness at government level of the industry’s support for embodied carbon regulation.

We ask you to:

- Be bold and speak up beyond your scope or your project to influence others to help achieve a more sustainable built environment.
- Make decisions that are appropriate to the fact that 2030 is now less than eight years away, and that we must halve emissions in everything we do by the time we get there.

> No one person or institution is able to have the massive impact that is needed to change the way our built environment impacts on the planet and the lives of future generations.
>
> Only by working with other institutions, businesses, industries and government can we hope to play a significant role in the transformation of our construction industry to ensure we build a better, sustainable, regenerating world.
>
> It is exciting that the IStructE continues to show a lead and to build its collaborative relationships to be ever more valuable.
>
> **Dr Mike Cook** – *CETG Chair, Consultant, Buro Happold, and Visiting Professor, Imperial Colleage London*

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

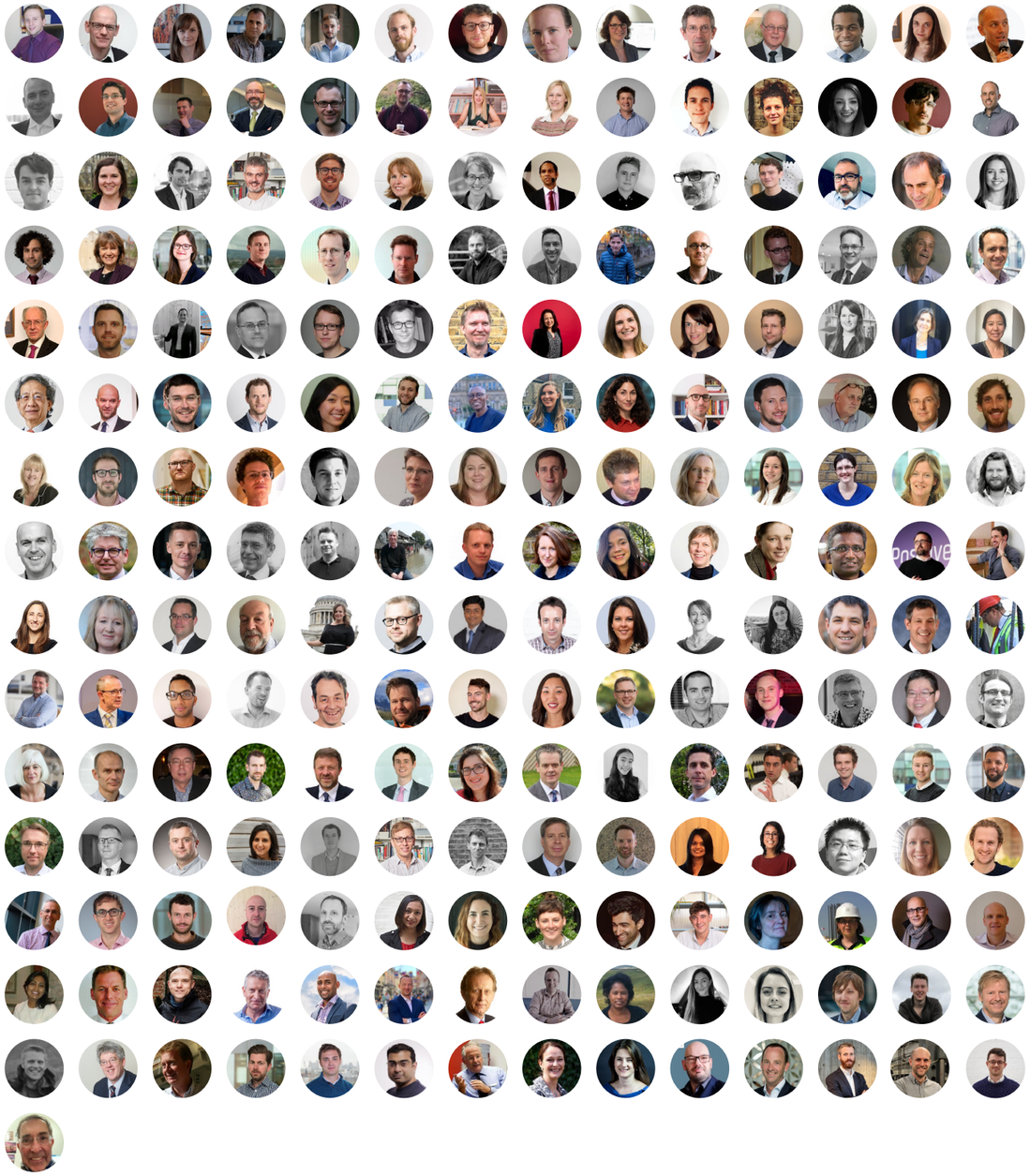
Videos
Video: MASS Design Group's Impact Driven Approach to Design & Construction in Africa
Video: the Passivhaus residential development at Goldsmith Street
Video: Whole life carbon, targets, and project examples
Video: A livelihoods approach to construction in Zambia

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.

Zoom in to click the links and use Ctrl+F to search

Thank You

Finally, we would like to thank all those who have helped move the debate forwards since the Institution's Board made the decision in 2019 to place sustainability on a par with life safety. To all those who have written, reviewed, spoken, debated, presented, organised, arranged, or enabled – thank you.



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and anyone else that we may have missed!

We hope that this report has helped communicate the CETG's ambitions for 2022. If there are aspects of our plans that you can contribute to, and would like to volunteer some time to do so, please get in touch at climateemergency@istructe.org.

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