AWARDS SPECIAL

Structural Awards 2022

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The Structural Awards 2022 – a new approach for a new era

This has been a particularly exciting year for The Structural Awards, with the introduction of a completely new format leading to a brilliant spread of winners. Tim Ibell (Chair of the Judging Panel) and Will Arnold (IStructE Head of Climate Action, and Judging Panel Member) reflect on the changes, most notably in response to the Institution's ongoing commitment to climate action.

The structural engineering industry is continually evolving, and so in 2021 the Institution set up a task group to undertake a review of the format of The Structural Awards, with the aim of better reflecting the Institution's vision and values. The backdrop was the equal footing on which the Institution has placed structural safety and sustainability.

Following this review, the task group made two significant changes to strengthen and enrichen the awards.

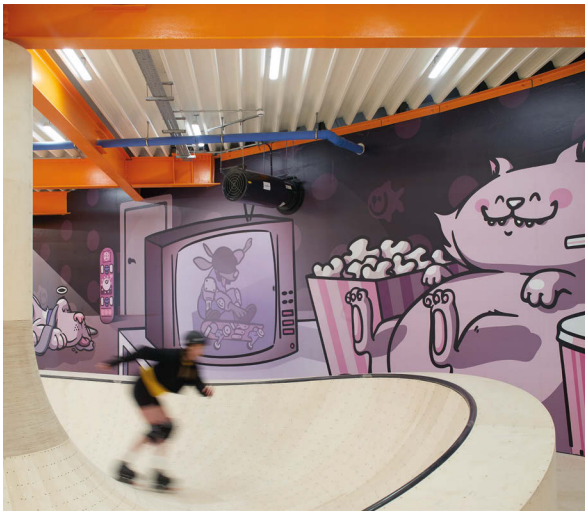
First, there are no longer entry categories – the awards have been decategorised. This was done because, under categories, the judges were required to choose just one winner from each (no matter how many award-worthy projects are entered into it), and had to overlook entries that fell between categories.

Decategorisation makes the awards more inclusive and fairer, as it enables a wider pool of entrants and a more diverse range of great engineering to be celebrated, as demonstrated by the shortlisting of projects such as the People's Pavilion and the Folkestone 51 skatepark (Figure 1).

Second, the task group then set out a definition for great engineering. We developed four key attributes: People, Planet, Process and Profession (Figure 2); four areas that all engineers should aspire to excel in, across all of their projects. More information on these can be found at www.istructe.org/structural-awards/shortlist/new-criteria/.

Entrants had to outline their project's excellence in reference to at least one of these four attributes; although demonstrating greatness across multiple attributes did not automatically increase the chances of shortlisting.

We believe that decategorisation and a focus on our four attributes of great engineering enabled entrants and judges to focus on what is most important.



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↓FIGURE 1: Shortlisted projects such as the People's Pavilion or Folkestone 51 might not have found a place in the categories of past years

'Planet' attribute

Only one of the four attributes was compulsory for entrants to respond to: Planet. Since 2019, the Institution has treated sustainability on a par with life safety, and in the same way that we would not expect an unsafe structure to be entered into the awards, we would also not expect to receive an entry in which the engineers were not able to demonstrate an understanding of the sustainability implications of their scheme.

We asked entrants to consider aspects such as efficiency of design, sustainability, resilience, response to local conditions, regeneration, circular economy principles, and alignment with the UN Sustainable Development Goals. In addition, all entries were required to submit quantification of the embodied carbon footprint of the structure using a version of The Structural Carbon Tool that we provided.

What was interesting to discover was that in demonstrating excellence in this category, entrants were typically also able to demonstrate excellence in another – highlighting the increased ability to reduce the environmental impact of a structure when designing for societal benefit, utilising exemplar engineering processes, and sharing as part of the wider engineering community.

Shortlisting

Each judge was allocated a 'random' set of submissions to consider, with any conflicts of interest being eradicated at this early stage. Every submission was initially read by five judges. Each judge was asked the simple question for each submission: Can excellence be found in any of the four attributes? If the answer was yes, then that project would be earmarked by that judge for shortlisting.

On average, it turned out that each judge recommended about half a dozen projects for shortlisting from their personal list of around 20 projects. This allowed the first judging meeting to concentrate discussion on projects

which received recommendations for shortlisting, and to create a final shortlist. In the end, we had a list of 41 projects which the judges felt exhibited excellence.

As part of the shortlisting process, the judges considered the self-reported carbon footprint of the projects in addition to reviewing the entrant's insights across the attributes that they chose to describe. As the carbon footprint numbers were self-reported, the numbers were only treated as indicative of climate impact, but they enabled the judges to gain a general insight to the impact of the submitted projects.

The indicative nature of the self-reported numbers also means that the numbers and the SCORS ratings will not be shared for any of the entrants.

However, this information meant that, for the first time ever, the judges understood each project's environmental impact alongside its technical prowess. Several projects with notably high carbon footprints, even allowing for inaccuracies in specific carbon quantities, were removed from the shortlist as the judging panel felt that the 'value for carbon' of these projects could not be justified. This step felt transformative to the judges, unanimously.

Out of the 41 shortlisted projects, about half achieved a SCORS C-rating or better, meaning that they had carbon footprints less than 250kgCO_2e/m^2 – a number 30% lower than the 'business as usual average' reported by Arnold *et al*.[1], and work undertaken by IStructE, LETI and RIBA to review a set of industry targets in 2021[2].

Winners

All unconflicted judges proceeded to consider the shortlisted projects at the finalists' meeting, looking for excellence in structural design through reference to the four attributes. There were no quotas for any of the attributes in any sense. The judges were asked to identify what was truly outstanding about potential winners and to vote for these projects through explicit reference to at least one key attribute. Usefulness to users, ingenuity of design, advocacy of our profession, collaboration and co-creation, and stretching as thinly as possible the precious use of carbon – these and more were discussed at length until the judging panel had settled on their winning projects, of which there were 10 this year.

The judges never chose winners purely based on their carbon footprint, but it was clear where engineers were touching the ground lightly. This was inevitably reflected in the projects chosen as the eventual award winners for 2022, with five out of the 10 award winners declaring a SCORS A-rating or better.

An A-rating on SCORS equates to A1–A5 upfront embodied carbon emissions (across the superstructure plus substructure) of less than 150kgCO_2e/m^2, less than half of the business-as-usual average referenced above. This is also in the range of what the average structural design is required to exhibit in 2030 if the structural engineering community is to play its part in helping the world stay below 1.5°C global warming[1].

It's also worth reflecting on the prevalence of reuse and retrofit projects among this year's award winners – five of the 10 projects. This came from a recognition of the fact that creative reuse of existing structures will play a key role in reducing emissions – particularly in the richer, more damaging countries of the world which already have an abundance of existing buildings and infrastructure.

Supreme Award

One of the most difficult decisions each year is choosing the winner of the Supreme Award. It is a cliché, but it really always is a nearly impossible decision. And it was no different this year. So, what are the additional things we look for which elevate a project from a winner to a Supreme winner?

The Supreme winner must have a message for all structural engineers. It must say, 'So, this really is indeed possible to achieve, after all.' This year, we have chosen two Supreme Award winners. It isn't becoming a habit, despite this being the second year in a row that we have awarded two. The judges genuinely had a perfect split-vote tie in their deliberations.

One project oozed creative biomimetic innovation using local material (bamboo in this case), while the other demonstrated how far retrofit can go when we extract every ounce from the existing structure. Both pushed the boundaries in different ways, and both provide inspiration for our community, particularly in showing how the value of the structural engineer can be enhanced still further when engaged at the very earliest stage.

Looking to the future

While the judges may have been looking at this year's awards entries in a new light compared with previous years, we recognise that most entries to the awards were designed during the late 2010s, when the term 'climate emergency' wasn't even in the common lexicon. We expect to see the trend towards thinking about our work in terms of positive outcomes on society and the environment flourish in coming years, as we start to see more and more entries that were conceived and designed in the 2020s.

We look forward to celebrating structural engineers playing a core role in collaborative design for societal benefit, unlocking the abundance of what is already present through a focus on place and reuse, and utilising our unique set of skills to leave a positive impact on the environment and all living things.

FIGURE 2: Four attributes for the new-look Structural Awards

REFERENCES

1) Arnold W., Cook M., Cox D., Gibbons O. and Orr J. (2020) 'Setting carbon targets: an introduction to the proposed SCORS rating scheme', *The Structural Engineer*, 98 (10), pp. 8–12

2) LETI, Royal Institute of British Architects, Whole Life Carbon Network and Institution of Structural Engineers (2021) *Embodied Carbon Target Alignment* [Online] Available at: www.leti.uk/_files/ugd/252d09_a45059c2d71043cdbcffc539f942e602.pdf (Accessed: October 2022)

Judging panel

Chairman

Prof. Tim Ibell

Tim was President of the Institution of Structural Engineers in 2015, and is a Fellow of the Royal Academy of Engineering. He has a passion for celebrating creativity within our profession, and for using this creativity to inspire students.

Tim has been Professor of Structural Engineering at the University of Bath since 2003, including a year's interlude as the Sir Kirby Laing Professor of Civil Engineering at the University of Cambridge in 2017/18.

Will Arnold

As Head of Climate Action, Will leads the Institution's response to the climate emergency, bringing this action into all aspects of our work, including the publication of best-practice emergency guidance. Prior to his current role, he was a practising structural engineer at Arup for over 10 years, where he was responsible for key aspects of ambitious architectural projects across the world from the UK to Taiwan and Rwanda.

Will is Chair of the CIC's 2050 Group, and helps lead the Institution's Climate Emergency Task Group. In 2017, he was presented with the Institution's Young Structural Engineering Professional Award for his design work while at Arup.

Louisa Brown

Louisa is a Senior Structural Engineer at Arup in Amsterdam with over 10 years' experience in the UK and Europe. Working predominantly within the healthcare, science and industry sectors, she has built up expertise in delivering functional specialist buildings in an efficient and sustainable way.

Louisa is a chartered structural engineer and an active member of the Institution of Structural Engineers as a member of the Technical Products Panel and former Council member and Young Members Panel Chair.

Dr Michael Cook

Mike is a consultant to Buro Happold, having been a partner of the practice since 1994 and Chairman from 2011 to 2017. He is well known in the industry for his significant contribution to designing innovative buildings. Mike is a former Vice-President of the Institution and is now Chair of its Climate Emergency Task Group. He was awarded the Institution's Gold Medal in 2020.

In 2009, Mike received the IABSE Milne Medal for his contribution to structural design, and in 2017 he received an honorary Doctorate of Engineering from the University of Bath. He is a Fellow of the Royal Academy of Engineering and Adjunct Professor of Creative Design in the Department of Civil Engineering at Imperial College, London.

Kayin Dawoodi

Kayin is co-lead of Tyréns Sweden's Concept Design Department, championing creative design collaboration and education. Prior to moving to Sweden, he worked at Arup for close to 10 years. He has a background in architectural and structural design of unusual design-led projects worldwide as well as connections at leading universities.

He is the current IStructE Representative in Sweden, co-founded the Bridges to Prosperity UK Charitable Trust and was the 2014 winner of the Young Structural Engineering Professional Award.

Prof. Jiemin Ding

Professor Ding is the Chief Engineer of Tongji Architectural Design (Group) Co., Ltd. Throughout his career, he has demonstrated dedication to excellence in structural engineering design. Professor Ding specialises in steel structures, super-high-rise buildings and long-span complex structural systems.

He has completed the structural design for more than 10 high-rise buildings above 250m and more than 80 sports buildings. Professor Ding is a council member of the Institution of Structural Engineers and he was awarded the IStructE Gold Medal in 2018.

Martin Knight

Martin is one of the leading UK architects specialising in the design of bridges and transport infrastructure and is a Fellow of RIBA and the Institution of Civil Engineers and an Honorary Fellow of IStructE.

He founded international bridge designers Knight Architects in 2006 and his practice has completed more than 50 bridges in the UK and internationally, including the award-winning Merchant Square Bridge in London, the iconic Lower Hatea River Crossing in New Zealand, and the 270m-long Ulm Kienlesbergbrücke in Germany.

Eric Kwok

Eric is a Technical Director at Goldwave Steel Structure Engineering and is passionate about structural engineering. He received his professional training in the UK and has over 23 years of experience in major international practice. He is a chartered structural engineer and a Fellow of the IStructE, and has extensive design and construction experience across projects in Europe, the Middle East, the Americas, South East Asia and the PR of China.

His work includes the HZMB-Passenger Clearance Building roof structure. Other master works include: Wembley Stadium, Sutong Bridge, HAECO Hanger No. 3A, Marri Processing Plant, Olmsted Dam Development, KWH Hospital Steel Structure and Yuen Long Footbridges erection.

Michelle McDowell

Michelle is a Principal and Chair of Civil & Structural Engineering at BDP, with over 35 years' experience of design and delivery of many challenging, innovative and award-winning projects.

In 2010, Michelle was awarded an MBE for services to the construction industry. She is a fellow of the Royal Academy of Engineering and in 2011 was named Veuve Clicquot Business Woman of the Year. In 2012, she was named the ACE's Engineering Ambassador of the Year and in 2020 was given a Lifetime Achievement Award by Women in Construction and Engineering. She is currently leading the Palace of Westminster Restoration and Renewal project for BDP.

Toby Maclean

Toby is a structural engineer and established Allt environmental structural engineers in 2020, a firm concentrating on addressing the urgent need to decarbonise the built environment with a particular emphasis on carbon embodied in structures.

Toby's career so far has been one based on providing practical yet technically sophisticated and holistic solutions to diverse projects in the built environment and concentrating on design from first principles. Having served a stint with Arup after graduation, Toby spent five years based in the studio of an architect/artist, before establishing TALL Engineers in 2005. After merging TALL with Entuitive in 2016, Toby remained as UK Director until leaving to concentrate on Allt.

Dr Andrew Minson

Andrew is Director of Concrete and Sustainable Construction at the Global Cement and Concrete Association. He is currently chair of the Design Practice, Risk and Structural Safety Committee of the Institution of Structural Engineers and a member of the Engineering Leadership Group.

He had 10 years with Arup in building engineering where he worked in multidisciplinary teams on international projects, before 14 years leading The Concrete Centre in the UK.

Angeliki Palla

Angeliki Palla is a Structural Engineer at O'Connor Sutton Cronin (OCSC). Originally from Greece, she studied Civil Engineering at the National Technical University of Athens, before completing postgraduate studies in General Structural Engineering at Imperial College, London.

She began at OCSC in 2017 and has played an integral part in residential and commercial projects. Angeliki is an active member of the Institution, former Chair of our Young Members Panel and a STEM Ambassador.

Paul Fast

Since establishing his own structural engineering consultancy in 1985, Paul Fast has worked on iconic buildings in North America, Europe, Asia and the Middle East.

With offices in Frankfurt, New York, Seattle and Vancouver, his firm has become a leader in the design of hybrid structures, which include the Grandview Heights Aquatic Centre, winner of the 2016 Supreme Award, the 18-storey TallWood House at the University of British Columbia, and the 2010 Richmond Olympic Oval.

Paul was the recipient of the 2021 Gold Medal, the IStructE's highest accolade.

Ian Firth

Ian is a leading expert in bridge design and construction. During his career he has been involved with world-famous bridge projects like the strengthening of the Severn Bridge, Erskine Bridge and West Gate Bridge, and the concept design of Stonecutters' Bridge in Hong Kong, as well as many smaller pedestrian bridges such as the Inner Harbour Bridge in Copenhagen, Taplow Bridge near Maidenhead and the Sail Bridge in Swansea.

Ian is also a leading advocate of bridge-building charity Bridges to Prosperity and a Past President of the Institution of Structural Engineers.

Tanya de Hoog

Tanya is a founding director of Thornton Tomasetti's London office. Her professional experience spans Europe, the Middle East, Southeast Asia and Australia, where she has worked on a diverse range of projects that focus on engineering creativity and innovation with an intent to foster good design.

Celebrating the contribution structural engineering can make to society, promoting continued education and the application of sound engineering principles to emerging technologies are of significant importance to Tanya.

Susan Giahi-Broadbent

Susan is a Senior Divisional Director working with Jacobs since 2016. She is a chartered engineer, Fellow of the Institution of Structural Engineers and the Chartered Institution of Highways & Transportation. She is an active member of both institutions, contributing to councils, committees and panels.

Susan has accumulated three decades of technical expertise and leadership roles on a variety of challenging high-profile infrastructure and building projects in the UK, Asia and Africa. The majority of her work over recent years has involved multidisciplinary transportation schemes with more focus on bridges.

Tristram Hope

Tristram is a chartered structural engineer and Fellow of the Institution of Structural Engineers, with 35 years of experience in multidisciplinary building engineering design and management, having worked with several of the UK's leading practices, including BDP, Buro Happold and Arup. He is Founder and Director of independent construction consultancy Thisolutions Ltd, where he works with a wide variety of clients, principally in investigative and advisory roles.

Tristram chairs the Industrial Advisory Board for the Department of Civil and Structural Engineering at the University of Sheffield.

Dr Katherine Ibbotson

Kat is Director for WSP in the UK's Strategic Advisory Net Zero team. With over 10 years' experience in leading carbon reduction strategies and net-zero services within infrastructure, Kat's net-zero leadership and experience is rooted in taking a holistic approach to complex systems, bridging the gap between policy and embedding practical action, facilitating and enabling the connections across sectors and technical disciplines.

Kat has supported clients across several sectors, delivering a variety of services from infrastructure resilience and net-zero transformation, through to target setting and quantification, whole-life carbon management, assurance, and review.

Sam Price

Sam founded Price & Myers with Robert Myers in 1978. He has structured many award-winning new buildings, with a particular interest in theatres and concert halls.

He has advised on a number of cathedrals, and is a member of the Cathedral Architects Association. He has lectured at Cambridge, Glasgow, Trieste, Bergen, Hong Kong, and Vancouver. He was for 12 years a member of the Architectural Panel of the National Trust.

Roger Ridsdill Smith

Roger is the Head of the Structural Engineering team at Foster + Partners. He is a Fellow of the Institution of Structural Engineers and a licensed Professional Engineer and Structural Engineer in the USA.

He was awarded the Royal Academy of Engineering Silver Medal in 2010, and the IABSE Milne Medal in 2017.

Nick Russell

Nick is a Consultant at Perega, an 80-strong consulting organisation specialising in civil and structural engineering, glass engineering and building surveying. His extensive experience spans many sectors, including expert witness, commercial, retail, industrial, education, residential and major losses. Nick's primary role at Perega is in advising on training of staff.

Nick has a passion for conceptual design and in making structures as effective as possible. He is a Past President of the IStructE and a Fellow of the Institution of Civil Engineers and the American Society of Civil Engineers. He also holds visiting professorships at the universities of East London and Surrey and is immediate past chair of the Joint Board of Moderators.

Kristina Scheibler-Frood

Kristina is a Chartered Civil and Structural Engineer at AECOM working in the London structures team. Over the last eight years she has been involved in the design and construction stages of major projects, specialising in retained facades, listed buildings and deep basements. Projects have included No 1 Palace Street, a luxury residential development and North West Cambridge, a highly sustainable new suburb of Cambridge.

Kristina is also committed to engaging with students of all ages and the wider community to promote the engineering industry. In recognition of her work, Kristina was awarded the IStructE's Young Structural Engineering Professional Award 2019.

SawTeen See

President of See Robertson Structural Engineers SawTeen See is President of See Robertson Structural Engineers and provides consulting design services; she is partly retired.

SawTeen was the Managing Partner of Leslie E. Robertson Associates (LERA) from 1991 to 2017. She has extensive experience in the structural design of the full spectrum of building types, with particular expertise in tall building design and long-span structures. SawTeen was the partner-in-charge of the structural engineering of iconic structures including the Shanghai World Financial Center, the Lotte World Tower in Seoul and the Merdeka PNB 118 Tower, Kuala Lumpur.

Peter Terrell

Peter is Chairman of the Board of the Institution of Structural Engineers. He is founder and President of Terrell Group Consulting Engineers. After early years with Ove Arup, Peter set up as sole practitioner in 1982 in Paris, building a practice that is today recognised as one of the leading structural engineering consultancies in France, with over 100 employees.

He has been at the forefront of many successful projects, including the Doha Tower (CTBUH Best Tall Building Worldwide 2012) and the DR Byen Concert Hall in Copenhagen.

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Location London, UK

1 Triton Square

Awarded for: Showcasing the power of circular economy principles across all aspects of a project.

PROJECT TEAM

- ➜ **Structural designer:** Arup
- ➜ **Client:** British Land
- ➜ **Principal contractor:** Lendlease
- ➜ **Architect:** Arup

IN BRIEF…

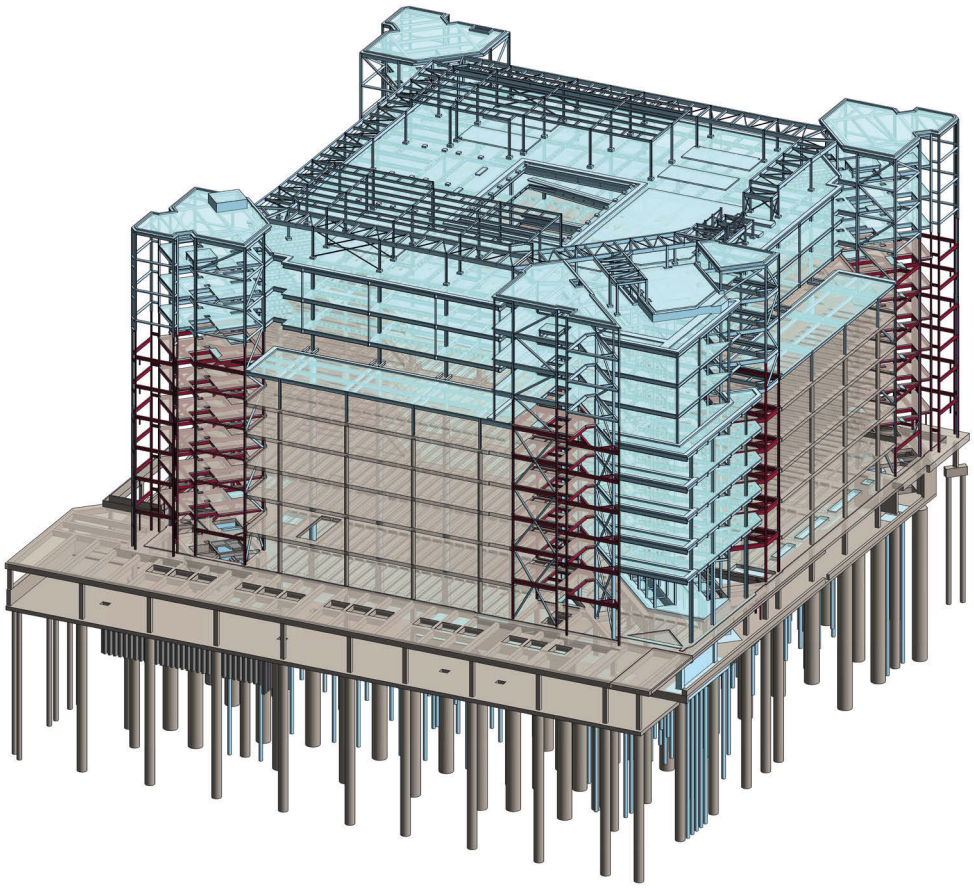
- →| The client and design team saw the potential to increase this 1990s building's size and transform it for today's workstyles – opting for refurbishment to save time, money and carbon.
- →| The original 1990s scheme was a 72m × 72m square building with six storeys above ground and a single-storey basement, following a 9m × 9m grid.
- →| The new scheme involved extensive modifications to the existing structure, including part in-filling the central and entrance atria and adding three new floors on top, resulting in a near doubling of the office area.
- →| As well as minimising the actions on the structure through lightweight new construction and optimised loading allowances, the new scheme introduced a range of innovative strengthening solutions to steel and concrete columns, stability elements and the existing piled foundations.

JUDGES' COMMENTS

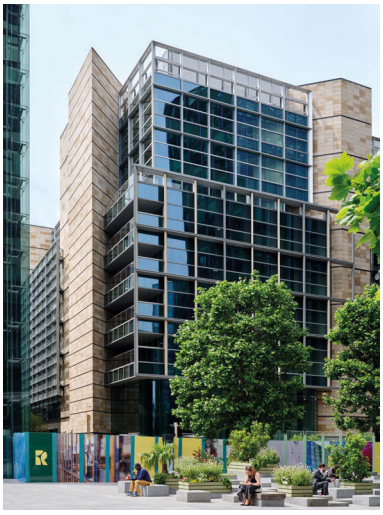
An excellent project-wide approach to minimising carbon and negative impacts. The structural team adopted a comprehensive raft of measures and demonstrated a noteworthy willingness to minimise strengthening of the existing building through precise investigation and analysis.

As a result, the project is a valuable reference to the industry at large for reuse of buildings and the profession will benefit greatly from the lessons learned.

The completed building sets a benchmark for the environmental targets that can be reached now and improved upon in the future.



↗ 3D view showing proposed new structure in blue, existing structure in grey



↙ Completed building sets benchmark for environmental targets

↗ FRP-wrapped concrete column

Find out more

Read more about this project in the March 2021 issue of *The Structural Engineer*: bit.ly/3fLBXpf

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Metropol Parasol, Seville, Spain
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Location Dubai, United Arab Emirates

Expo 2020 Dubai Sunshades

Awarded for: Innovative form-finding and detailing in response to complex environmental conditions.

PROJECT TEAM

- **Structural designer:** Webb Yates Engineers
- **Client:** Bureau Expo Dubai 2020
- **Principal contractor:** Pfeifer
- **Architect:** Hopkins Architects
- **Cost consultant and project manager:** Turner & Townsend
- **Main works contractor:** AFC
- **Wind tunnel testing:** RWDI
- **Mechanical engineering consultant:** Eadon
- **Programme management:** CH2MMace

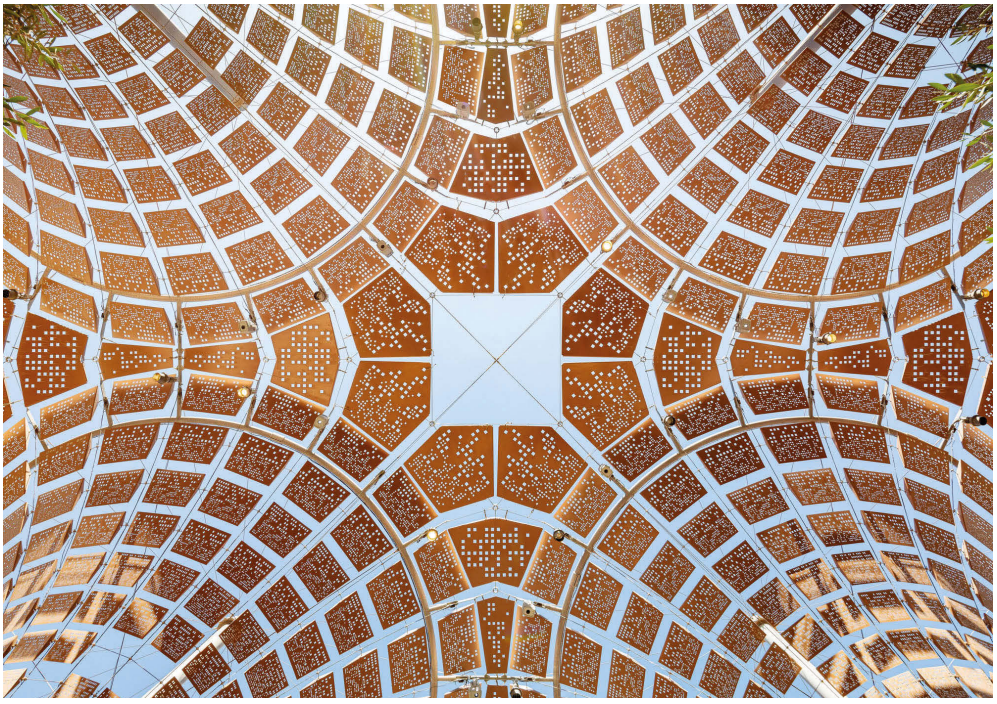
IN BRIEF…

- Expo 2020 Dubai Sunshades comprises 50 shading structures on a small but visible site for the expo, which ran from October 2021 to March 2022.
- The structure was formed by suspending a thin steel cable-net from a steel mast and pulling it tight to the base. From this net, thin perforated aluminium panels were hung, carefully balanced to follow the shape of the net, and form the shading element of the structure.
- The cable-net was form-found and tensioned to create an efficient and stiff structure, meaning the panels pivot out of the way of strong winds, reducing the design wind pressure on the structure.
- The design called for an easy-to-install pivot that would be tolerant of repeated panel swinging when subjected to loads in various directions, panel flex, cable movement and wear over the structure's life.

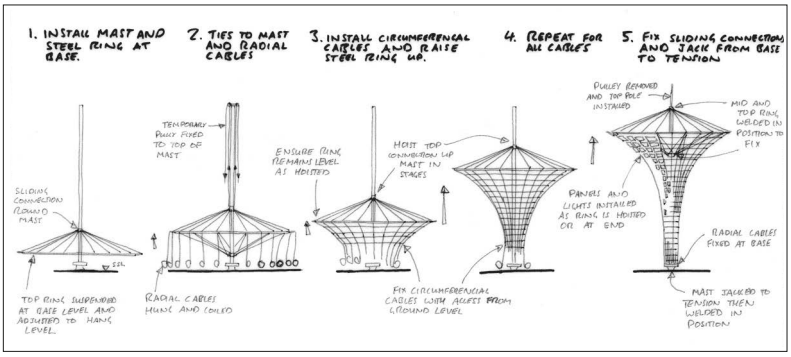
JUDGES' COMMENTS

These simple and elegant structures served many aesthetic and practical functions and are beautifully detailed.

The rigorous testing, analysis and design of the aerodynamics of the swinging panels required high levels of analysis and wind-tunnel testing to investigate and understand wind effects. These complex dynamic issues were successfully dealt with, offering the benefit of dynamic analysis for future projects.



↑ Expo 2020 Sunshades viewed from below



↗ Construction sequence

↙ Panels were rigorously tested to understand wind effects

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Location London, UK

HYLO

Awarded for: Full exploitation of an existing structure to maximise retrofit potential.

PROJECT TEAM

- ➜ **Structural designer:** AKT II
- ➜ **Client:** CIT Group
- ➜ **Principal contractor:** J Coffey Group and MACE
- ➜ **Architect:** Horden Cherry Lee
- ➜ **M&E consultant:** RHB Partners
- ➜ **Quantity surveyor:** Arcadis
- ➜ **Planning consultant:** DP9

IN BRIEF…

- →| HYLO absorbs and transforms the former mid-rise Finsbury Tower to become a modern, high-rise development; the existing building extends upwards by 70%, with 13 new storeys added to its existing 16 floors, and all while reusing its existing frame and foundations.
- →| A significant volume of concrete was saved through the substantial reuse of the existing structure. The site's leasable area doubled (from approx. 12 000 to 25 800m^2) while saving just over a third of the 'upfront' carbon (around 35%) in comparison with the equivalent new construction.
- →| In-depth finite-element modelling was performed on the existing structure, using a time-dependency analysis, to assess the structure at every stage of its lifecycle, from its original construction through to the proposed demolition, the new loading, and the long-term settlements and creep.
- →| The existing superstructure was enhanced with targeted column strengthening made of high-strength concrete, together with steel jacketing, to help minimise their required area within the tower's floorplates. The steel jackets are also exposed to form a striking interior feature.

JUDGES' COMMENTS

A highly intelligent, well-integrated retrofit-first extension of city office space. This project is a fantastic example of how we can meet the requirement for creating sustainable cities and communities.

Enormous amounts of works were required to carry out inspection, investigation and analysis of the condition of the existing building and, as a result, the existing structure and foundations could be utilised.

Through a granular analysis of the existing structure, most of the new loads were strategically directed into areas with spare capacity, allowing a minimal intervention of column strengthening and additional foundations. This saved around 35% in 'upfront' carbon when compared with an equivalent new build.

FRITZIE MANOY/AKT II

FRITZIE MANOY/AKT II

↑ HYLO after project completion

← Former mid-rise Finsbury Tower before project start

AKT II

➜ Targeted column strengthening using steel jackets

Location Wellington, New Zealand

Rankine Brown Library

Awarded for: A technically impressive and well-communicated response to save a public building after earthquake damage.

PROJECT TEAM

- **Structural designer:** Beca
- **Client:** Te Herenga Waka – Victoria University of Wellington
- **Principal contractor:** LT McGuinness
- **Architect:** Athfield Architects
- **Steelwork subcontractor:** MJH Engineering Ltd
- **Building services:** Beca
- **Quantity surveyor:** RLB
- **Fire engineering:** Holmes Fire

IN BRIEF…

- After New Zealand's Kaikōura earthquake (magnitude 7.8) an assessment of Te Herenga Waka – Victoria University of Wellington's 10-storey Rankine Brown library building was undertaken. The building's north and south lift shafts were noted as seriously damaged, with cracks easily big enough to fit a cricket ball.
- Prompt installation of temporary supports secured the damaged lift shafts as soon as possible after the main shake – further damage could have seen the building written off.
- Undertaking construction in an occupied building while supporting eight storeys of reinforced concrete lift shafts demanded a particularly innovative approach. The lift pits were widened to accommodate new steel-framed lift shafts supported on six super-low-friction slider bearings, which move laterally with the building while continuing to support gravity loads.
- Construction waste was minimised by reusing the temporary steelwork needle beams and temporary propping frames for the perimeter columns.

JUDGES' COMMENTS

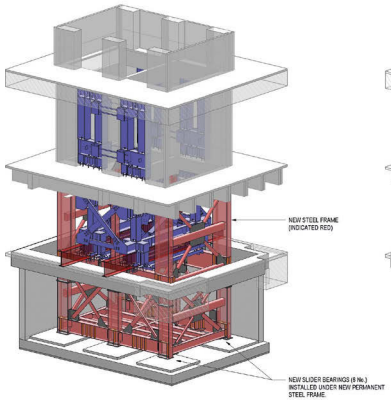
Great pains have been taken to restore this library following earthquake damage and the efforts to justify the building through repairs and upgrade are admirable, providing enormous savings on the alternative of new construction.

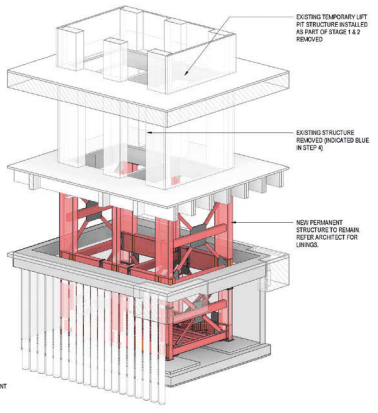
The design implemented improvements beyond code requirements under severe working constraints as the library remained in use throughout.

There was impressive communication of the engineer's role in the process at a digestible level for everyone involved to understand. This communication of the complex works to building users throughout the project stands out as a good example of the importance of our profession: teamwork, communication, collaboration and responsiveness.

↑ Rankine Brown library remained open during post-earthquake repair works

↗ Damaged lift shafts during engineering inspection in hours after Kaikōura earthquake





↗ Left: shows construction of steel-framed lift shaft on six super-low-friction slider plates. Right: shows temporary supports removed and load transferred to permanent structure. Highlighted blue are temporary supports, red indicates permanent structure

Location Stuttgart, Germany

Stadtbahnbrücke

Awarded for: Research-informed innovation of novel high-performance materials.

PROJECT TEAM

- ➜ **Structural designer and architect:** schlaich bergermann partner
- ➜ **Client:** SSB Stuttgarter Straßenbahnen AG
- ➜ **Principal contractor:** Adam Hörnig Baugesellschaft mbH & Co. KG and MCE AG
- ➜ **Carbon hangers:** Carbo-Link AG and Fehraltdorf
- ➜ **Component testing and carbon expertise:** Empa (Federal Laboratories for Materials Testing and Research Institute)
- ➜ **Structural checking:** Consortium Nellingen
- ➜ **Geotechnical engineering:** VEES | PARTNER
- ➜ **Geotechnical reviewer:** Moormann Geotechnic Consult
- ➜ **Further cooperation:** Material Testing Institute

IN BRIEF…

→| A new double-track crossing of the A8 highway was built in an exposed elevated position. The light rail arch bridge, *Stadtbahnbrücke*, consists of a central main span and two approach spans. The main span is connected by an 80m network arch and two protruding truss frames, which continue the swing of the slender arches – the span between the footings is 107m.

→| The three most important design objectives were minimal disruption of traffic, an appealing design as well as a robust and long-lasting structure. The network arch bridge was chosen to ensure a subsequent 'roll-in' could be realised from the construction site beside the highway.

→| The light rail line features hangers made entirely of carbon-fibre polymer composite. The use of elaborate cushioning measures becomes unnecessary due to the higher tensile and fatigue strengths of carbon tension members, and couplings are no longer required.

→| The hangers are connected by means of built-in components, which are integrated into the edge girder of the arch segment as upright sheet metal disks. The hanger forces are transferred to the edge beam of the superstructure via concrete dowels. In addition, head bolts were arranged near the edge and dimensioned for the load transfer of the hanger forces.

SBP – ANDREAS SCHNUBEL

↗ Stadtbahnbrücke in use

➜ Roll-in of network arch bridge

SBP – ANDREAS SCHNUBEL

↗ Carbon-fibre polymer composite hangers were used

JUDGES' COMMENTS

A worthy demonstration of new materials and new applications. The resulting design embodies a combination of well-known techniques and new cutting-edge technology to provide a graceful, highly efficient take on the classic cable-hanger arched bridge.

The development of the bonded carbon-fibre composite members was the result of material science research and a very rigorous testing regime, involving over a million stress-test cycles, to demonstrate the suitability of this hybrid material for use in these circumstances.

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Location London, UK

London South Bank University – London Road Building

Awarded for: Transformative sustainable design through minimal intervention.

PROJECT TEAM

- ➜ **Structural designer:** Eckersley O'Callaghan
- ➜ **Client:** London South Bank University
- ➜ **Principal contractor:** Wilmott Dixon Interiors
- ➜ **Architect:** Wilkinson Eyre Architects
- ➜ **MEP engineer, combined services, acoustic, town and country planner:** BDP
- ➜ **Fire safety consultant:** Tenos
- ➜ **Landscape architect:** Churchman Landscape Architects
- ➜ **Building control consultant/ approved inspector:** JHAI Ltd
- ➜ **Carbon fibre subcontractor/ designer:** CCUK Composites Construction
- ➜ **Drainage and facade:** Eckersley O'Callaghan

IN BRIEF…

- →| London Road Building is a refurbishment and extension project of an existing four-storey reinforced concrete-framed building from the 1970s with an overall internal area of 20 000m^2.
- →| The new design includes lecture theatres, library, sports facilities and catering areas and is part of a wider campus redevelopment. The building originally had an extremely cellular layout unfit for modern use.
- →| Existing structure verification, carbon-fibre strengthening, further modifications and new structural additions were performed to justify and reuse the building's original concrete frame.
- →| The structural embodied carbon value of the project per gross internal floor area is five to six times lower than that of an equivalent new-build concrete-framed structure of this scale.

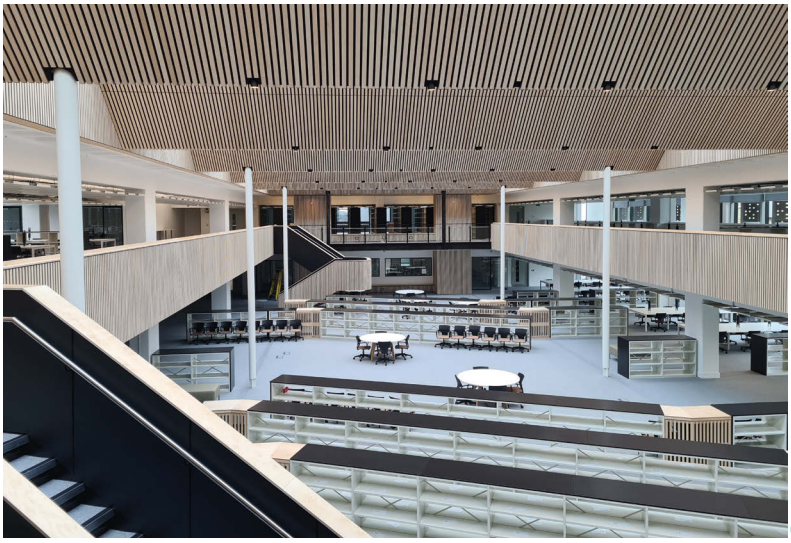
JUDGES' COMMENTS

A retrofit-first approach to sustainable building design has transformed an outdated concrete building into a vibrant new student centre. The project team enabled minimal intervention based on detailed analysis of the existing structure, extending its design life by another 50 years and also achieving a great visual improvement.

Great care was taken to minimise the carbon footprint of construction by refurbishing and saving as much of the existing materials as possible. The SCORS A+ rating is fantastic for such a major project.

SIMON YEUNG

↗ Retrofit of London Road Building sought to minimise carbon footprint of construction



ECKERSLEY O'CALLAGHAN

➜ Large hanging floor infill over sports hall: new library area with feature stairs

➜ Carbon-fibre shear strengthening to existing waffle slab

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FUNDRAISING REGULATOR

Location Bali, Indonesia

The Arc, Green School

Awarded for: Advancing the structural application of low-carbon materials.

PROJECT TEAM

- ➜ **Structural designer:** Atelier One
- ➜ **Client:** The Green School, Bali
- ➜ **Principal contractor:** PT Bamboo Pure
- ➜ **Architect:** Ibuku
- ➜ **Bamboo master craftsman:** Jorg Stamm
- ➜ **Lighting:** Studio Nimmersatt
- ➜ **Photographer:** Tommaso Riva
- ➜ **Testing coordinator:** James Wolf

IN BRIEF…

→| The Green School was looking for a replacement for its existing gymnasium that had reached the end of its life, and the new structure was required to utilise the existing foundations.

→| In response, the Arc was designed: a 14m high × 19m span roof consisting of a series of bamboo bundle arches connected by bamboo lattice anticlastic saddles, topped with a bamboo mat surface. The structure's strength would come from its form, with the arches and saddle surfaces acting compositely.

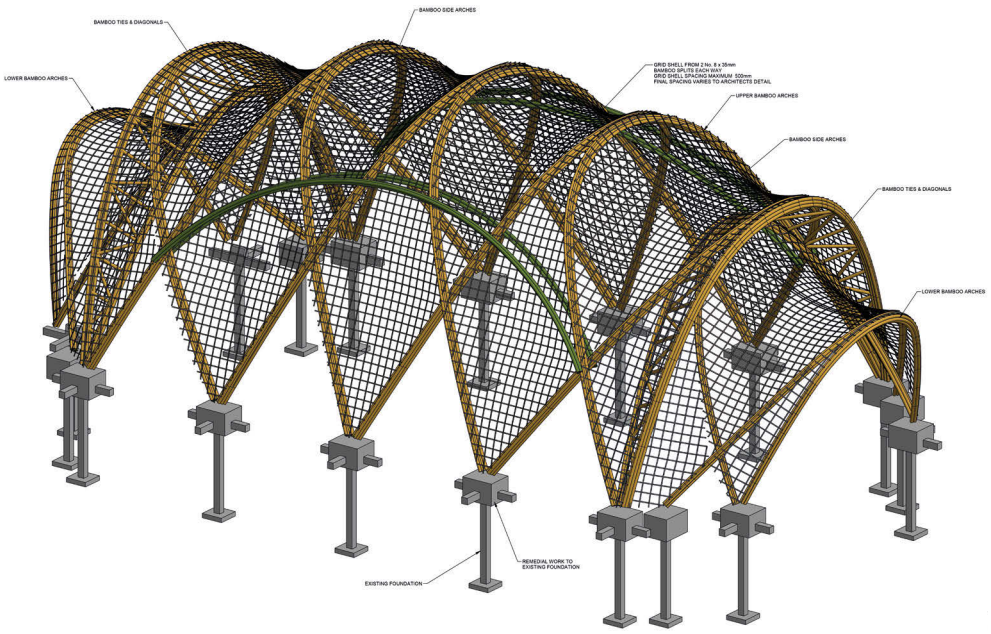
→| For the Arc, whole culms harvested from near the site were used. This meant that the emissions due to processing and transportation were minimal. The quantity of bamboo required was drastically reduced due to the structurally driven form, with the arches and saddle surfaces all contributing to the strength. Combined with the use of existing foundations, the resulting carbon footprint of the building is negligible.

→| Developing relationships with local craftspeople in Bali – and learning from the bamboo expertise that has been handed down through generations – the team was able to introduce new typologies and structural principles to them. This two-way information exchange was a hugely satisfying experience for all involved.

JUDGES' COMMENTS

This dramatic roof structure is a breathtaking use of sustainable, locally harvested bamboo. The project was beautifully detailed following years of research into the material's unique properties. The result is a very low-carbon structure superbly executed, showcasing the fantastic artistry and workmanship of the engineers in the varied structural forms.

The project demonstrates the exciting potential of bamboo as a mainstream building material. Architects and engineers alike should be inspired.



↗ The Arc's roof structure rests on existing foundations

➜ Structurally driven form reduced quantity of bamboo required

↘ Locally harvested bamboo was used for structure

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IMAGES SHOW PROJECTS BY WALKER DENDLE TECHNICAL RECRUITMENT CLIENTS SHORTLISTED FOR THE STRUCTURAL AWARDS 2013–2022

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Location London, UK

The Gramophone Works

Awarded for: Exemplar use of timber at scale in a retrofit project.

PROJECT TEAM

- **Structural designer:** Heyne Tillett Steel
- **Client:** Resolution Property
- **Principal contractor:** Graham
- **Architect:** Studio RHE
- **Quantity surveyor:** Quartz Project Services
- **Surveyor:** Anstey Horne
- **Sustainable timber contractor:** B&K Structures

IN BRIEF…

- The Gramophone Works is a new landmark canal side commercial scheme comprising a mix of refurbished, extended, and new-build contemporary office spaces in West London.
- The low-carbon development has successfully refurbished an existing building and extended it from two to six storeys, adding a further 60 000sq.ft (5500m^2) of commercial office space. It is believed to be the biggest mass timber office structure constructed in the UK.
- The building has also been designed to promote reuse within a circular economy through the design of connections facilitating future disassembly, allowing for members and floorplates to be recycled for future developments.
- High levels of insulation are incorporated into the design to mitigate heat loss, along with solar reflective glazing, shading fins and louvres. On the roof, photovoltaic solar panels contribute to the building's energy supply.

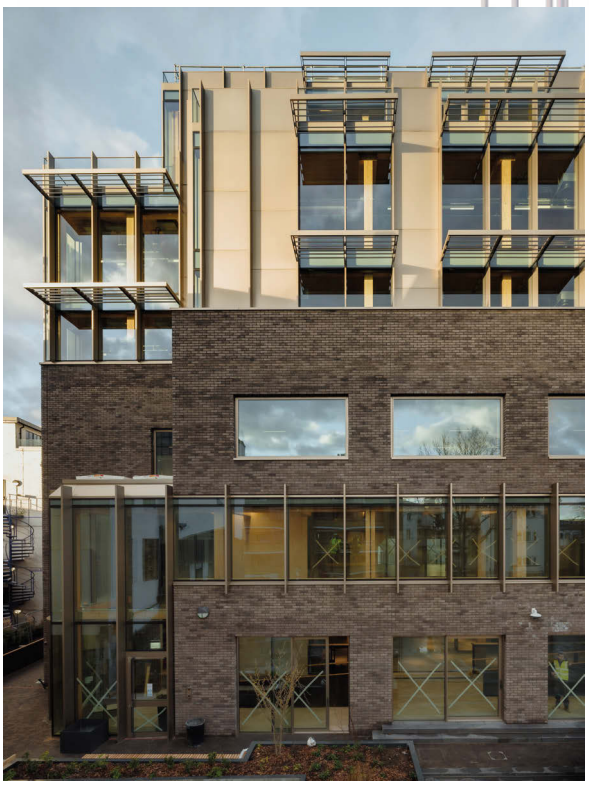
JUDGES' COMMENTS

This major reuse project champions the use of mass timber in the commercial sector to create an adaptive space which is responsive to the end user's needs.

A lightweight CLT and glulam structure has been used to extend the existing concrete frame, increasing the building from two to six storeys and adding 60 000sq.ft.

© HTS

↙ 3D model of timber structure



© TIM CROCKER

← Exterior of building showing extension from two to six storeys

↓ Exposed timber connections inside building

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Specifying timber as opposed to a heavier building material such as steel or concrete has allowed for minimal strengthening to the existing foundations which have been reused to support the additional four storeys.

Exemplar low-carbon thinking.

Oasys

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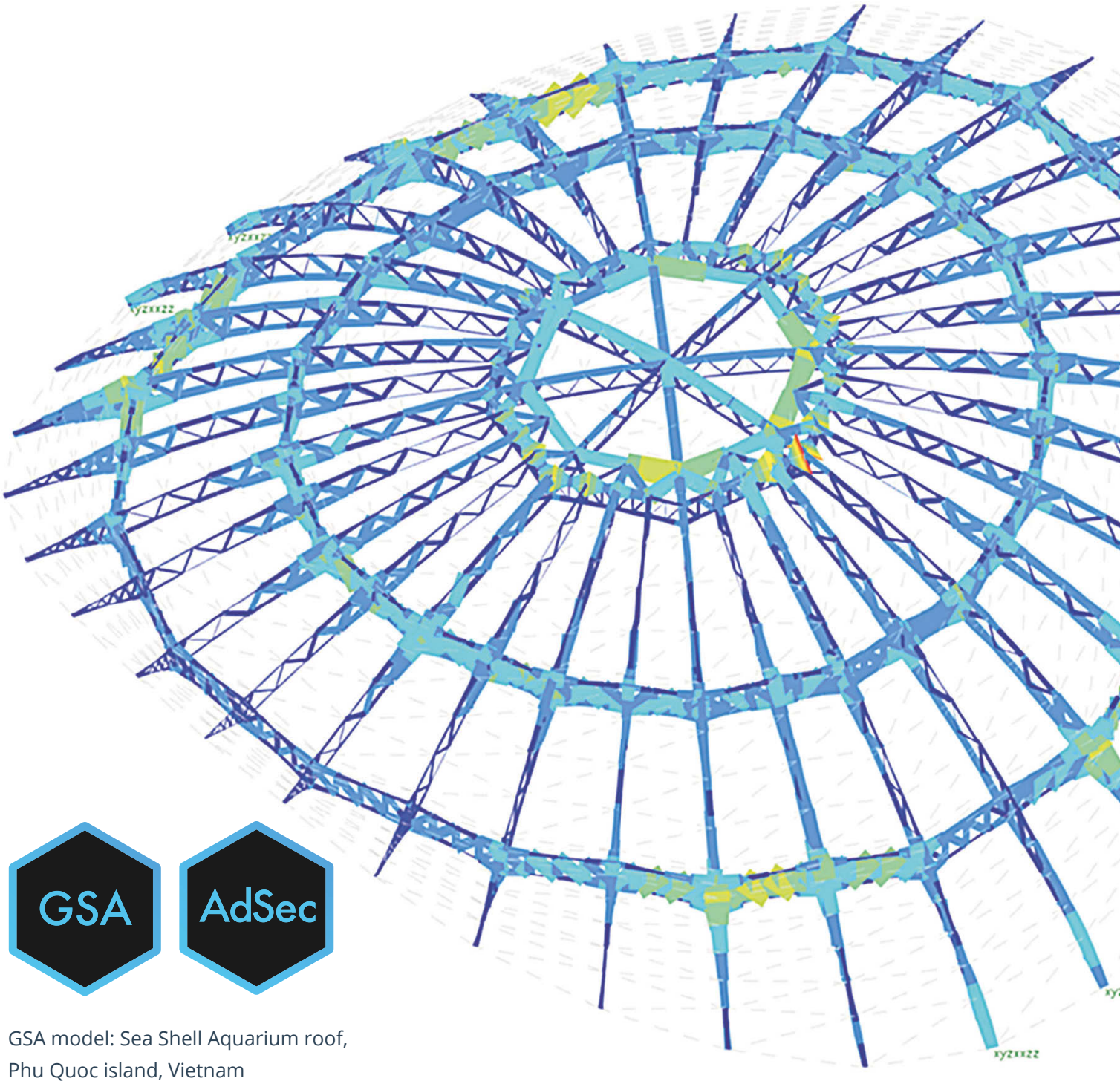

GSA AdSec

GSA model: Sea Shell Aquarium roof,
Phu Quoc island, Vietnam

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Location Chengdu, China

Tianfu Agricultural Expo Main Hall

Awarded for: Structural elegance through integrated design and construction.

PROJECT TEAM

- ➜ **Structural designer (roof vault structures):** StructureCraft
- ➜ **Structural designer (base building):** China Architecture Design & Research Group
- ➜ **Client:** Sichuan Tianfu Agriculture Expo Investment Ltd
- ➜ **Principal contractor:** Beijing Urban Construction Group Co Ltd
- ➜ **Architect:** China Architecture Design & Research Group
- ➜ **Parametric design consultant:** Mule Studio
- ➜ **Manufacturer:** Hasslacher Norica Timber

IN BRIEF…

- →| At over 75 000m^2, the Tianfu Agriculture Exposition is the largest timber project in Asia, and one of the largest timber projects in the world. This series of five vaults uses unique Vierendeel-inspired trusses – a hybrid of timber chords and steel webbing – achieving clear spans up to 110m and heights up to 44m.
- →| The wave of the building provided challenges for the engineering team on a very tight schedule. Housing museums and displaying agricultural products from the region, the roofs of these halls are clad with ethylene tetrafluoroethylene (ETFE) but are open-ended, encouraging a direct connection with the surrounding farmland.
- →| The result is a unique series of long-span timber structures, created through cooperation of team members on three different continents in a year and a half throughout the Covid-19 pandemic, showcasing a sustainable solution and a world-class attraction through innovative engineering and design.
- →| An additional challenge was that engineers were unable to visit China throughout the duration of the project, due to the pandemic. Remote working, quality control/assurance, and structural inspection techniques, including use of SaaS platforms, enabled a 'living' shop drawing process. This ensured engineers could track the status, quality and accuracy of each pre-assembled piece throughout its construction lifecycle.

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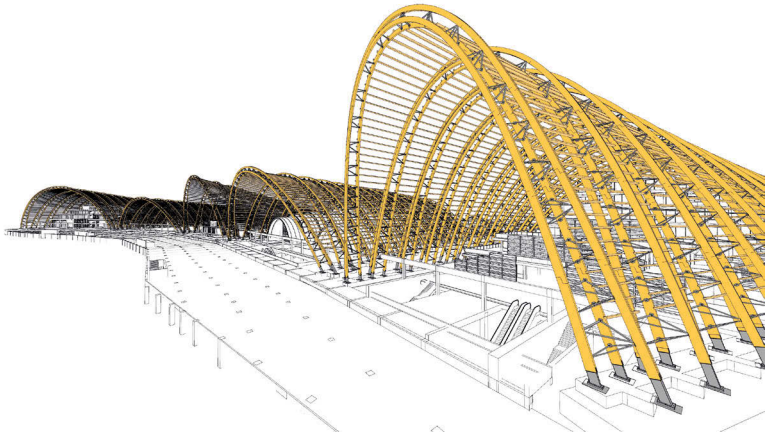
↗ Exposition is surrounded by agrarian land



↗ Design of glulam roof structure with steel trusses

JUDGES' COMMENTS

The design of the Vierendeel-inspired timber chord and steel webbing structure with ETFE membranes is aesthetically pleasing and seemingly melts into the surrounding environment. Thoughtful detailing of the unique shear-key connection is innovative and able to withstand seismic force.

Computational design aided the geometry design process. An integrated workflow enabled the design data to be directly used by the manufacturer, streamlining the processes of fabrication ensuring clear communication. The CNC manufacturing process further increased the accuracy of assembly of all components and ensured an efficient erection process with minimised wastage.

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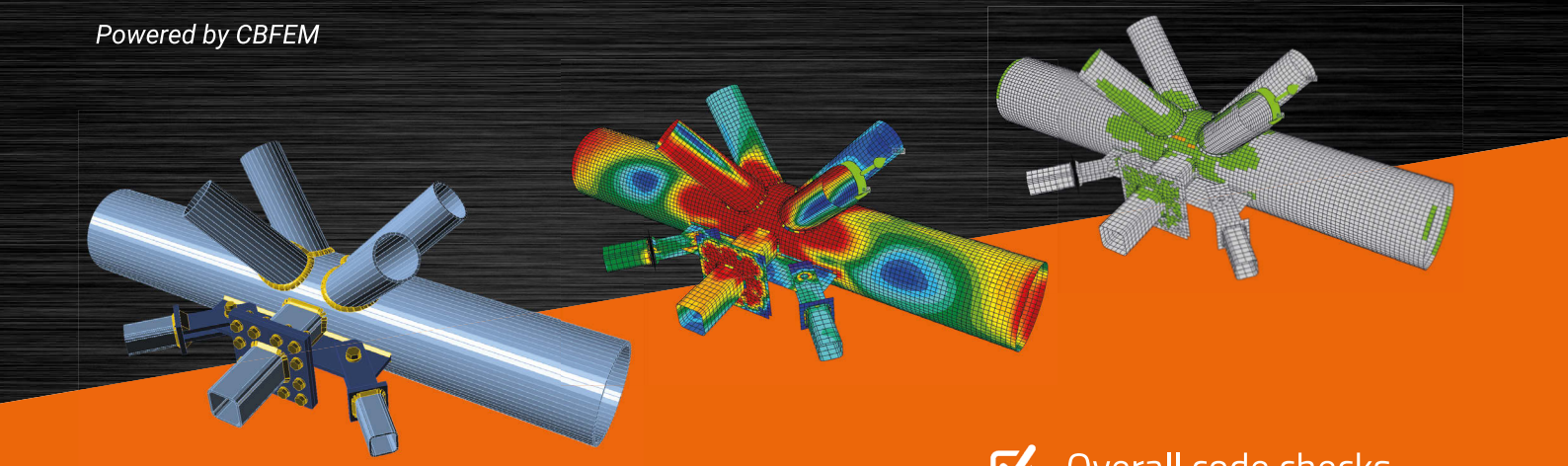

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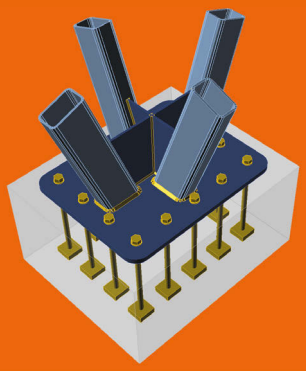

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Location Geneva, Switzerland

United Nations New Office Building

Awarded for: Creative sustainable design at scale that responds to the unique environment.

PROJECT TEAM

- **Structural designer:** Skidmore, Owings & Merrill
- **Client:** United Nations
- **Principal contractor:** Implenia
- **Architect:** Skidmore, Owings & Merrill
- **Local architect:** Burckhardt+Partner
- **Local structural engineer:** INGENI
- **Lighting consultant:** Nulty Lighting
- **MEP consultant:** RAPP Technique du Bâtiment SA
- **AV/IT/Security:** Shen Milsom & Wilke LLC
- **Landscape architect:** Oxalis Architectes Paysagises
- **Accessibility:** Handicap Architecture Urbanisme
- **Wood supplier:** JPF Ducret
- **Facade supplier:** Sottas SA

IN BRIEF…

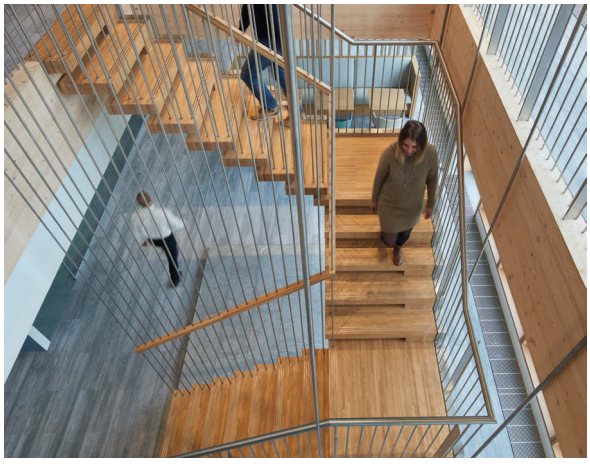
- Strategically responding to a sloping site, the new UN administrative building is perceived as a series of cascading terraces discreetly placed into the Parc de L'Ariana. A careful balance was struck to not compete with the historic Palais des Nations. Two inner courtyards add to the overall effect of a building working in harmony with the natural context of the lake and mountains.
- The new building creates an additional area of approx. 24 000m² to accommodate 1400 staff. Open-plan, activity-based neighbourhoods offer staff a new way of collaborating, working and sharing knowledge. Courtyards and roof terraces, accessible from every floor, ensure that green, outdoor areas are available to all staff.
- The project brings elegant structural engineering front and centre, showcasing structural timber detailing as an integral part of the architectural expression. By utilising visually exposed structural members and elegant details throughout, the building becomes a celebration of structural engineering and demonstrates that the benefits of sophisticated engineering go well beyond providing a safe commodity structure.

ALL IMAGES: UNOG/SOM/DAVE BURK

↖ New UN office building built into slope

← Exterior was designed to not compete with nearby Palais des Nations, the first UN building in Geneva

↓ Stairs use unadorned structures to express architectural aesthetics



JUDGES' COMMENTS

This project has a clear focus on both the environment and the end user. An innovative hybrid timber and concrete structural slab and beam system solution was adopted and significantly reduced the embodied carbon emissions. The timber landscape stairs and the perimeter columns directly use unadorned structures to express the architectural aesthetics.

A fantastic example of timber-concrete composite being used at scale.

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Location London, UK

HYLO

Awarded for: Full exploitation of an existing structure to maximise retrofit potential.

PROJECT TEAM

- **Structural designer:** AKT II
- **Client:** CIT Group
- **Principal contractor:** J Coffey Group and MACE
- **Architect:** Horden Cherry Lee
- **M&E consultant:** RHB Partners
- **Quantity surveyor:** Arcadis
- **Planning consultant:** DP9

IN BRIEF…

- HYLO absorbs and transforms the former mid-rise Finsbury Tower to become a modern, high-rise development; the existing building extends upwards by 70%, with 13 new storeys added to its existing 16 floors, and all while reusing its existing frame and foundations.
- A significant volume of concrete was saved through the substantial reuse of the existing structure. The site's leasable area doubled (from approx. 12 000 to 25 800m^2) while saving just over a third of the 'upfront' carbon (around 35%) in comparison with the equivalent new construction.
- In-depth finite-element modelling was performed on the existing structure, using a time-dependency analysis, to assess the structure at every stage of its lifecycle, from its original construction through to the proposed demolition, the new loading, and the long-term settlements and creep.
- The existing superstructure was enhanced with targeted column strengthening made of high-strength concrete, together with steel jacketing, to help minimise their required area within the tower's floorplates. The steel jackets are also exposed to form a striking interior feature.

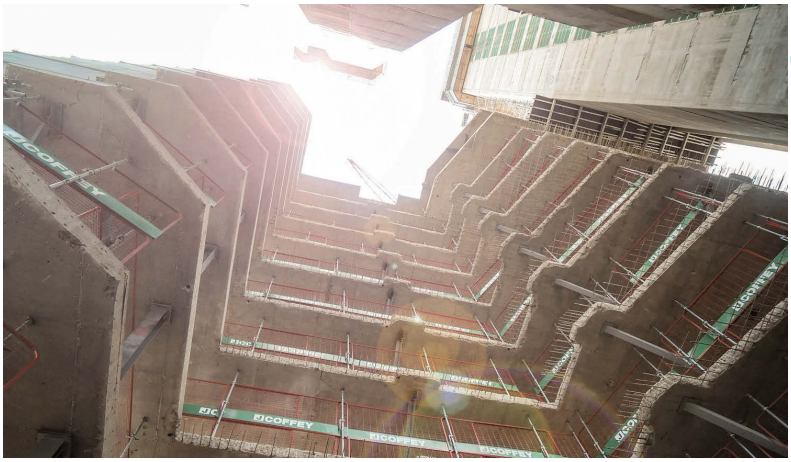
JUDGES' COMMENTS

HYLO could only have been achieved through masterful structural engineering. A 13-storey building was added on top of an existing 16-storey building, with only the most essential strengthening works necessary to the existing frame and foundations. This was achieved through redirecting load paths, and allowed the designers to exploit the inherent spare capacity in the original structure – in essence, they cashed in on the previous carbon footprint to save carbon on the extension. A quite brilliant example of structural retrofit.

JAN FRIEDLEIN/AKT II

↑ External view of HYLO

> **A QUITE BRILLIANT EXAMPLE OF STRUCTURAL RETROFIT**



AKT II

→ Retained floorplates from former Finsbury Tower

Location Bali, Indonesia

The Arc, Green School

Awarded for: Advancing the structural application of low-carbon materials.

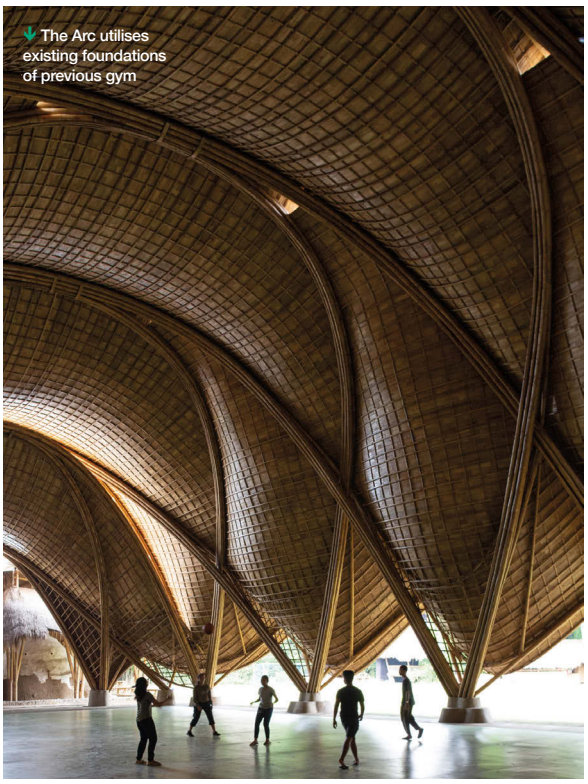
PROJECT TEAM

- **Structural designer:** Atelier One
- **Client:** The Green School, Bali
- **Principal contractor:** PT Bamboo Pure
- **Architect:** Ibuku
- **Bamboo master craftsman:** Jorg Stamm
- **Lighting:** Studio Nimmersatt
- **Photographer:** Tommaso Riva
- **Testing coordinator:** James Wolf

IN BRIEF…

- The Green School was looking for a replacement for its existing gymnasium that had reached the end of its life, and the new structure was required to utilise the existing foundations.
- In response, the Arc was designed: a 14m high × 19m span roof consisting of a series of bamboo bundle arches connected by bamboo lattice anticlastic saddles, topped with a bamboo mat surface. The structure's strength would come from its form, with the arches and saddle surfaces acting compositely.
- For the Arc, whole culms harvested from near the site were used. This meant that the emissions due to processing and transportation were minimal. The quantity of bamboo required was drastically reduced due to the structurally driven form, with the arches and saddle surfaces all contributing to the strength. Combined with the use of existing foundations, the resulting carbon footprint of the building is negligible.
- Developing relationships with local craftspeople in Bali – and learning from the bamboo expertise that has been handed down through generations – the team was able to introduce new typologies and structural principles to them. This two-way information exchange was a hugely satisfying experience for all involved.

Structure's strength comes from arch and saddle surfaces working together



The Arc utilises existing foundations of previous gym

> MARVELLOUS DEMONSTRATION OF ARTISTRY, TECHNICAL KNOW-HOW AND A DRIVE TOWARDS NET ZERO

JUDGES' COMMENTS

The Arc Gymnasium is an extraordinary project. It brings together local materials, fundamental research and creativity-charged structural engineering expertise to produce something of pure delight. Not only does it demonstrate how we might consider the spectacular use of natural building materials for major projects, but it also lays out the path, via research, which can lead to the confident use of such materials. This is a marvellous demonstration of artistry, technical know-how and a drive towards net zero.