Volume 64 • November 2023

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1915 Canakkale Bridge. Credit: COWI

Message from the President

David Harvey, P.Eng.

SEABC President

Bridge Engineering

Both SEABC's 2023 Pinnacle Lecture and our Special Guest Lecture earlier this month featured world class bridge engineers. Both Naeem Hussain and Peter Taylor delivered informative presentations and provided spectacular images of cutting-edge bridge designs – mostly, that they had been involved with. You should be aware that this is entirely coincidental and that we have not forgotten building structures – in fact our upcoming 2024 Pinnacle Lecture will feature Konrad Merz presenting on mass timber. This lecture will be all about building structures. While quite a few timber bridges exist, mass timber has limited applicability to new bridges.

I have always designed structures; however, the vast majority of my work has involved bridges of pretty well every type. I am inspired by all varieties of structural engineering, but without doubt bridges are my personal favourite. In fact, for both SEABC dinner events this year, I was on Cloud Nine!

For SEABC members that have not designed bridges, please be aware that there are distinct differences. Throughout history, both types of structure have been in use. Architecturally, buildings enclose space whereas bridges support spacial flow (directional movement). Both types of structure underpin economic activity, in that business cannot function without buildings to house its processes, or bridges, which enable the movement of goods to take place. In this newsletter I report on Peter's talk. You'll note that I am amazed by the achievements of the Canakkale Bridge team. At SEABC, we seek inspiring speakers, so let's have more. I invite those with spectacular achievements to step forward. Offer to share your achievements with your structural colleagues. Look out for announcements.

Regulatory Changes

The EGBC Annual Conference in October served to remind its members that our regulatory world has been significantly impacted by the BC Government's Professional Governance Act (PGA). You will have noticed that continuing education (CE) reporting requirements have become mandatory, and that registrants must prepare and record a CE plan annually. While no member will favour increased reporting, it is simply reflecting that we live in times of defined processes and increased accountability.

This all stems from government perception that a one-time professional qualification process linked to voluntary continuing professional development reporting was not providing sufficient public protection. The aftermath of well publicized cases, including Station Square, the Mount Polley mine tailings dam and the 2013 structural design of a 40-storey residential tower in Surrey, which all failed to meet the required standards, no doubt added to the government's unease.

Initial PGA requirements for EGBC registrants, including competency statements for every undertaking, were onerous and impractical which might have had severe consequences. EGBC worked hard to keep requirements to within the realm of feasibility. In my view, the EGBC effort succeeded. Another new requirement is ethical learning. What this does is leave an evidence trail that the required learning element has taken place for each registrant. Fortunately, EGBC provides us with a no-cost on-line webinar and test which can be carried out at any time, minimizing inconvenience.

Does this mean that the EGBC reporting system is the best it can be? Far from it – there are plenty of irritants. From my perspective, the lack of alignment with other regulators is a major issue. Several Canadian regulatory bodies have gone in different directions to achieve much the same thing (evidence of registrant competency). Although the same activities can be used for reporting to multiple regulators, making multiple submissions requires recategorizing and is unnecessarily wasteful. I would welcome a national reporting centre which each regulator can refer to. What is your view on this? Feel free to let us know.

Committee Reports

Young Members Group

Lois Tso

E.I.T.

YMG Capstan Station Tour

On November 1st, the YMG Committee hosted a site tour of the new Capstan Station that is currently in construction. This project is located on the corner of Capstan Way and No. 3 Road, in between the existing Bridgeport and Aberdeen Stations in Richmond along the Canada Line. The transit project will support the growing development in the Capstan area of Richmond and meet the City of Richmond's objective of creating a transit-oriented neighborhood. Representatives from RJC Engineers and PCL gave a detailed guided tour of the project site.

Due to its location, one of the project challenges included the poor local soil conditions typically found in Richmond. In addition, another challenge that the project team faced was the consideration of vertical and horizontal movements of the new structure due to the new station platform being built adjacent to an existing elevated guideway. In order to limit the impact on the Canada Line's operations and reduce construction time, the project team developed modular and pre-assembly options for this project.

Update to the YMG Roster

The YMG Committee is currently in the process of updating the volunteer roster for the upcoming new year. If you would like to get involved with volunteering as a part of the YMG Committee, please feel free to reach out to us on any one of our social platforms linked below! All volunteers of any commitment level are welcome.

LinkedIn- linkedin.com/company/seabc

Instagram- instagram/seabc_social

Email- ymg@seabc.ca

Vancouver Island Branch

Daniel Gao, P.Eng,

The Vancouver Island Branch holds monthly meetings to stay current with local events and topics and are always happy to have more of the community involved. Please reach out to one of our members noted below if you would like to join us or have any feedback.

1. **Daniel Gao (Chair)**, RJC Engineers
2. **David Binkley**, Herold Engineering
3. **Miles Cornwell**, RJC Engineers
4. **Michael Hind**, RJC Engineers
5. **Dean Hynes**, Herold Engineering
6. **James Macauley**, Glotman Simpson
7. **Vincent Malazo**, Glotman Simpson
8. **Stephen Pienaar**, Prokon Software Consultants
9. **Thor Tandy**, UNISOL Engineering

We held a "Structural Discourse and Social" event earlier in the year so that our members on the island could discuss current events in the engineering world and to get to know each other a bit better. We're aiming to do these more regularly in the future so stay tuned.

Planning around the Long-Duration Earthquakes event is well underway, and information will be released via the SEABC website shortly. This event will be a 4-hour session, held in Victoria, BC and will be broadcasted online to encourage attendance throughout BC. Our presenters are John Cassidy, John Sherstobitoff, and Carlos Venture so we're very much looking forward to this one!

Our current mission and members list are available at our webpage for access at any time:

seabc.ca/vi

On the Web

Ricardo Ruiz,
B.Sc., M.Sc.

Hope you all had a good and restful summer. There hasn't been much activity with the website but here are a few updates:

1. SEABC event postings and registration:

- YMG Tour – The Capstan Skytrain Station Tour on Nov 1
- Dinner Presentation – Design & Construction of the World's Longest Suspension Bridge on Nov 7

2. Industry event postings:

- Understanding Risk BC 2023: Cascading Hazards, Multihazard Solutions on Oct 11 to 12
- Earthquake Insights Seminar: Unveiling Discoveries and Preparedness Strategies on Oct 13

3. The SEABC September 2023 Term Courses started on Sep 12 and continues until Dec 7. Four (4) courses are offered for this term. For more details and to register, go to: seabc.ca/current-term

4. SEABC August 2023 Newsletter has been published and available on the website at:

seabc.ca/news/newsletter

We want to hear from you. We welcome your comments for improving the SEABC's website and other online services. Please send your suggestions to:

webmaster@seabc.ca

IStruct E News

David Harvey, P.Eng.

SEABC President

A reminder that new Interim Professional Development (IDP) requirements come into effect for 2024. Key competencies reduce from 13 to 11 and requirements are updated. Carbon reduction – accounting for embodied carbon in structural design is introduced. The changes affect both interviewers and interviewees.

The Institution offers on-line carbon training modules, include learning tests, to support the changes. Completing the modules is required for PRI Interviewers. It is recommended for PRI candidates, although industrially trained candidates may bypass this step. The Chartered Membership exam questions will include an element to test candidates on their carbon reduction knowledge. A candidate must be able to design sustainably. The Embodied Carbon Basics course is available on-line, on demand, at IStructE.org, and is free for IStructE Members and Affiliates.

Passing the Chartered Membership exam can be used for Struct.Eng. registration with EGBC; and in combination with passing the IPD interview, to become a Chartered Structural Engineer by joining IStructE. Readers that are interested in sitting the IStructE examination should take note of these significant changes.

Gold Medal

Albert Williamson-Taylor - 2023 Gold Medalist

The Gold Medal of the Institution of Structural Engineers was recently awarded to Albert Williamson-Taylor, who has overseen the work of AKT II, the building design consultant he founded, for more than 25 years.

Highlights from Albert's portfolio of design authorship include the Bloomberg European and Google Headquarters in London, the inhabited Vessel sculpture in New York, the Google Mountain View campus in California, the Seed Cathedral for Expo 2010 in Shanghai, the Ummahat Al-Shaykh resorts in the Red Sea, the Masdar science city in Abu Dhabi, and the National Cathedral development in Ghana. His portfolio also includes the South Bank Tower and Hylo redevelopments in London, the Central Bank of Iraq in Baghdad and the Villaggio Vista residential development in Accra.

Albert says: "It's a privilege to be recognised by the IStructE; it's humbling that the principles of my design approach – and the ethos of AKT II – are recognised by such a globally prestigious institution. This award contributes to the ongoing motivation, for both myself, and my team, to continue innovating the engineering solutions for our planet's challenges."

Matt Byatt, President of the IStructE said: "Albert's passion for cutting-edge technology, innovation, and sustainable engineering are complemented by his respect for heritage. The Institution of Structural Engineers is delighted to recognise his contribution to structural engineering and to society."

Albert is indeed a worthy recipient of the 2023 IStructE Gold Medal.

Hylo Redevelopment, London – AKT II

Public Reviews of proposed revisions for NBC 2025 and CSA A23.3 Standard 2024

John Sherstobitoff, P.Eng.

Public reviews are a means to have the public see and provide feedback on proposed changes in code provisions or standards before they are finalized and implemented.

The material published for public review has been "finalized" and voted on by the committees that prepare the proposed revisions as suitable for the upcoming editions.

If there is no public feedback, the proposed revisions will be implemented (perhaps with very minor editorial adjustments).

All public review feedback must be considered by the committees, especially feedback that suggests the proposed revisions should be withdrawn, revised, etc. (negative feedback)

Available for review at this time is the draft 2024 CSA A23.3 standard regarding concrete.

- Open as of Oct 25

- Closes Dec 24

Link: CSA Public Review System

Available for review at this time are some proposed revisions for NBC 2025

Public Review – fall 2023 (cbhcc-cchcc.ca)

Link: public-review-fall-2023

Note: There are no revisions as proposed by the Standing Committee on Structural Design (SC-SD) or the Standing Committee on Earthquake Design (SC-ED) in this Fall 2023 review.

Public review for SC-SD and SC-ED proposed revisions will be in January 2024 (target opening date Jan 15).

Please consider reviewing this material and providing your feedback to the committees that prepared the proposed revisions.

Special Guest Lecture

David Harvey, P.Eng.
Struct.Eng

1915 Canakkale Bridge

SEABC recently held its inaugural Special Guest Lecture, when Peter Taylor presented the Canakkale Bridge, crossing of the Dardanelles Strait, Turkiye. Peter ran through the background to this world record breaking bridge and described the immense engineering challenges facing the design/build team.

Guest Lecturer, Peter Taylor

These included the world's longest span which was set at 2023 m for political reasons. This span was less than optimal for the crossing and resulted in longer than usual sidespans and a massive overall length of 4608 m. Also challenging was designing the bridge towers for ship impact – the Dardanelles Strait is a very busy international waterway and is trafficked by some of the world's largest freighters. Finally, Turkiye sits on the boundary between the Anatolian and Eurasian tectonic plates and is one of the most seismically active parts of the world. Granted a mere 15-year operating concession, the delivery team were highly motivated to deliver the project cost-effectively and they did just that. To deliver the gigantic structure for a mere $2.7B USD in the middle of a pandemic, they needed to save one year in construction time – unprecedented for a suspension bridge of this size. This they did by extending the main cables to connect with land-based rock anchorages that were only half the size of their marine equivalents. The team also elected to use prefabricated main cables (288 in the main span and 296 in the side spans) as opposed to aerially spun cables that take longer to install.

The massive main span adopted two separated aerofoil box sections to support the traffic lanes which provide very high aerodynamic stability – much needed at the exposed, windy site. This had been done previously for the Stonecutters cable-stay bridge in Hong Kong and the East Bay suspension bridge in Oakland, CA, but was the first application on very long suspension spans.

Peter contrasted the Canakkale design with previous world record suspension spans starting with the Golden Gate Bridge, and including the Severn Bridge, UK (which featured the world's first aerofoil box-section deck). Peter also described the eight special fluid viscous dampers that give large energy dissipation capacity to the ultra-slender bridge towers under earthquake. They are characterized by a load capacity of 5000 kN, a stroke of ± 1.25 m and a maximum design velocity of 1 m/s. The contractor's design team, led by Danish consultant COWI, leveraged the contractor's strengths to help achieve the project objectives.

One key detail was to bolt-up the stiffeners to field-splice the steel tower sections, which took subsequent field welding of the tower plates off the critical path and speeded up tower erection. Peter's presentation aptly described the extraordinary achievement of designing and constructing the Canakkale Bridge in record time.

His talk was well received by the enthusiastic audience. Peter, and his wife Gillian, were duly rewarded with an indigenous art speaker gift from SEABC.

Footnote. Credit the contractor's creative use of two Australian Marr cranes to speed up tower erection. The record-breaking construction featured one of Marr's M2480D Heavy Lift Luffers (the world's largest capacity tower crane with its lifting capacity of 330 tonnes) carry out the world's heaviest (155 tonnes) at-height (318 metres) craneage lift for the world's longest span suspension bridge. What a project!

1915 Canakkale Bridge, Turkiye: Photo credits – COWI

Marr 2480D HLL cranes in action at Canakkale Bridge

2024 Subscriptions Renewal

David Harvey, P.Eng.

Struct.Eng.

Log in by December 31st to renew your membership for 2024 or to become a SEABC member. A group renewal option is available to assist firms wanting to bulk-renew their staff memberships. Subscriptions remain unchanged for next year. Go to: seabc.ca/about/membership

2023 Structural Awards

Hot off the press! The Institution of Structural Engineers has just announced the winners of this year's prestigious competition. The judging panel of 22 prominent structural engineers was faced with the unenviable task of teasing out the winners from a record number of top-drawer projects from across the world. And as in several previous years, there was a BC connection in the list of winners. Heartiest congratulations to Abbotsford based Structurecraft, who won the Supreme Award for Nancy Pauw Bridge, Banff, AB.

To read up on these amazing short-listed and winning projects, go to this link: Structural Awards 2023: or see the event report appended to this newsletter.

Remote Concrete Batching

Robert Bourdages, P.Eng.
LEED AP

When most engineers in urban areas specify a concrete design mix, they don't need to think too much about the logistics required for the concrete supplier to deliver the product as specified. It shows up on the job, gets tested and poured, and that's that.

However, at remote locations the story is quite different. The port project I am working on is in Montserrat, a tiny island in the Caribbean, West Indies. Aggregates and sand have been tested and sourced from the Dominican Republic, then transported by barge to site. Cement and admixtures are sourced from Puerto Rico and then transported to site by another vessel. Rebar is fabricated in Florida and Turkey and shipped in containers. Imported products are subjected to biosecurity protocols to avoid the introduction of invasive species.

A concrete batch plant and concrete recycling plant was purchased from Turkey and arrived in a thousand pieces. After the majority of elements were assembled, the vender is now on site to assist in the final assembly and commissioning. Power is supplied by diesel generator. Diesel is stored on site in a large tank to support the plant and other operating equipment.

A full-time plant manager is on site to maintain and operate the batch plant during the next year. A failure in the plant would shut down the production of both precast and cast in place concrete and delay the construction schedule. A variety of spare parts have been purchased and are on site to offset the most probable failure scenarios.

Material testing by the local testing lab does not have the capacity to support the volume of concrete required, therefore it was necessary to install an on-site testing lab complete with a cylinder testing equipment.

Quality assurance measures are in place to report on site cylinder breaks and slump tests, along with limited third-party testing.

Concrete trucks are to be imported to site, as the local suppliers are limited in capacity.

And finally, as this area is located within a seismic and hurricane prone region, it is necessary to secure everything for extreme winds, heavy rain, and ground motion. The cement products have been secured under waterproof canopies.

All this brings me to the appreciation of how difficult it is to produce quality concrete at remote locations. Engineers in urban areas can be thankful the infrastructure to produce concrete is already in place.

Concrete Batch Plant

Cement and Slag Storage

Certificate in Structural Engineering Program

Shannon Remillong,
CSE Program
Co-ordinator

Courses return to UBC Robson & Live Webcast January 2024!

We look forward to welcoming students into the classroom at UBC Robson Square this January 2024, while simultaneously offering the online format.

Registration is NOW OPEN through the SEABC website: SEABC January 2024 Term Courses.

Four courses will be offered with classes running ***Tuesdays through Thursdays,*** beginning the week of January 9th and ending the week of April 4th, 2024.

Four of the six courses will be online format ONLY, while the remaining two will be both online and in-person simultaneously.

The following courses will be offered in the January 2024 term:

E11 National Building Code Part 4: Structural Design

E22 Introduction to Heavy Timber Design

E25 Structural Health Monitoring

E10 Structural Analysis Fundamentals: A Refresher

Outlines for the four courses are available on the SEABC website and Classbit: seabc.class-bit

Course delivery:

Two courses will be offered LIVE webcast only; select courses will be simultaneously offered in-person at the UBC Robson campus.

Courses are once a week, 2 hours in the evening, either 4:00-6:00pm or 6:30-8:30pm PST.

Courses are 13 consecutive weeks.

Course fees:

Classroom: $500 + GST

Live Webcast: $700 + GST

Discounts

SEABC members: $50 per course reduction in tuition.

"Early Bird" registration: $50 per course reduction in tuition for registrations received and mail-in cheques postmarked on or by Friday, December 15, 2023.

Important Dates:

Registration open: Monday, November 6, 2023

Early-bird deadline: Friday, December 15, 2023

Registration close: Monday, January 8, 2024

First lecture: Week of Tuesday, January 9, 2024

Last lecture: Week of Tuesday, April 2, 2024

Withdrawal Deadline: Monday, January 22, 2024

Courses fill up fast so make sure to register early and take advantage of the savings!

Registration Inquiries and Requests/Suggestions: Please contact Shannon Remillong, Certificate Program Administrative Assistant, at: courses@seabc.ca

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Importing Guardrails to Canada from Jurisdictions Using IBC

Kevin Preston, P.Eng.

Our projects involve diverse teams with talent and specialties from all over the world. Some teams are more familiar with the International Building Code than the National Building Code of Canada, and while both codes have similar requirements for guardrails, they are not the same. Beware when specifying a pre-engineered guardrail system in Canada if the approvals were done in the United States because in some important ways, the Canadian standards are more stringent.

Consider the following example: You're designing the post for a guard rail system outdoors in a commercial occupancy in Canada. You have an ICC-ESR report for a guard stating that it meets the requirements of the International Building Code, latest version. Is it OK to use this guard? The answer is: "Not necessarily." There are a few important differences between NBC and IBC, importantly that we use different load cases, and the loading is slightly different. After calculating the moment at the base of the post, the Canadian codes require approximately 13% higher bending forces. This could be a problem if the ICC-ESR-approved guard rail was optimized to the U.S. market.

There are also a few prescriptive differences to consider in Canada as well:

- Deflection is limited to 40 mm.
- Guards generally can't be climbable.
- A continuous top cap is required on glass guards.
- In Ontario, there are rules on glass type designed to limit the risk of spontaneous breakage.

Guards in Canada are generally required to be non-climbable. Research has shown that determined individuals can climb over a guard even if it's designed to be non-climbable, which is why this isn't a requirement in the IBC.

Glass guards should be composed of laminated glass using at least two plies of minimum 6 mm heat strengthened or heat-soaked tempered glass and an ionoplast (stiff) interlayer. Polyvinyl butyrate (PVB) was designed to soften the impact of a passenger going through a car windshield, but with guards we want to keep their whole body on the protected side. PVB is soft and pliable like leather, while ionoplast is stiff and costs 5 to 10 times more per area unit.

The requirements for these safety devices can be difficult to navigate in the best of situations and are often overlooked. If you are taking responsibility for the guards and you find yourself in this situation, please be aware of these differences, and if you are delegating the design, make sure to check the subcontractor's consultant's work.

Parameter	Canada	USA
Load Case	1.25*D + 1.5*L + 0.4*W; or 1.25*D + 1.4*W + 0.5*L	LRFD 1.2*D + 1.6*L; or LRFD 1.2*D + W + L
Point Load	1000 N (225 lbf)	890 N (200 lbf)
Line Load	750 N/m (51 lbf/ft)	730 N/m (50 lbf/ft)
Guard Height	1070 mm (42.13 in)	1067 mm (42 in)
Moment at Base*	1720 N*m	1520 N*m

** assumes 0.5 kPa wind load and 1 m post spacing*

Mark Your Calendar

Emotional Intelligence and Team Effectiveness

Date: Tuesday, December 5, 2023
Location: Webinar
Time: 8:15 AM–8:30 AM Pacific Time: Login
8:30 AM–12:30 PM Pacific Time: Webinar
For more info: egbc.ca/Events

Ethics in Practice: Professional Conduct Between Submitting Professionals and Authorities Having Jurisdiction

Date: Wednesday, December 6, 2023
Location: Webinar
Time: 11:45 AM–12:00 PM Pacific time: Registration
12:00 PM–1:00 PM Pacific time: Webinar
For more info: egbc.ca/Events

Stormwater Detention Planning and Design

Date: Thursday, December 7, 2023
Location: Webinar (25 seats available)
For more info: egbc.ca/Events
Note: Bring laptop to the session.

Project Claims and Disputes on Engineering and Construction Projects

Date: December, 7 2023
Location: Webinar (3 seats available)
Time: 8:15 AM–8:30 AM Pacific Time: Registration and login. 8:30 AM–4:30 PM Pacific Time: Webinar
For more info: egbc.ca/Events

Upcoming Seminars, Webinars and Events

Geothermal Energy in Western Canada

Date: Friday, December 8, 2023
Location: Webinar
Time: 8:45 AM–9:00 AM Pacific time: Login
9:00 AM–11:00 AM Pacific time: Webinar
For more info: egbc.ca/Events

Indigenous Peoples, Collaboration, and Projects

Date: Monday, December 11, 2023
Location: Webinar (198 seats available)
Time: 8:45 AM-9:00 AM Pacific time: Registration
9:00 AM-11:30 PM Pacific time: Webinar
For more info: egbc.ca/Events

Final Words

Editorial Information

The SEABC Newsletter is published by the Structural Engineers Association of British Columbia. The current and past issues are available on the SEABC website at www.seabc.ca.

The Newsletter is edited and managed by the SEABC Communications Committee.

- Committee Chair: David Harvey
- Newsletter Editor: Catherine Porter
- Editorial Assistant: Mark Budd
- Webmaster: Ricardo Ruiz

Submissions are welcomed and all SEABC members are encouraged to actively contribute to the Newsletter. Submissions, letters to the Editor, questions and comments can be sent to: newsletter@seabc.ca.

The Committee reserves the right to include or exclude submitted material and in some cases, edit submitted material to suit overall space requirements. If content is not to be edited, please advise so at submission time.

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Pre-paid rates per edition:

- $270 (quarter page), $360 (half page) or $450 (full page) plus GST. Rates include a banner advert on the Events page of the SEABC website.
- 50-word “Available for Employment” ads are free.

Please address advertising enquiries to: newsletter@seabc.ca.

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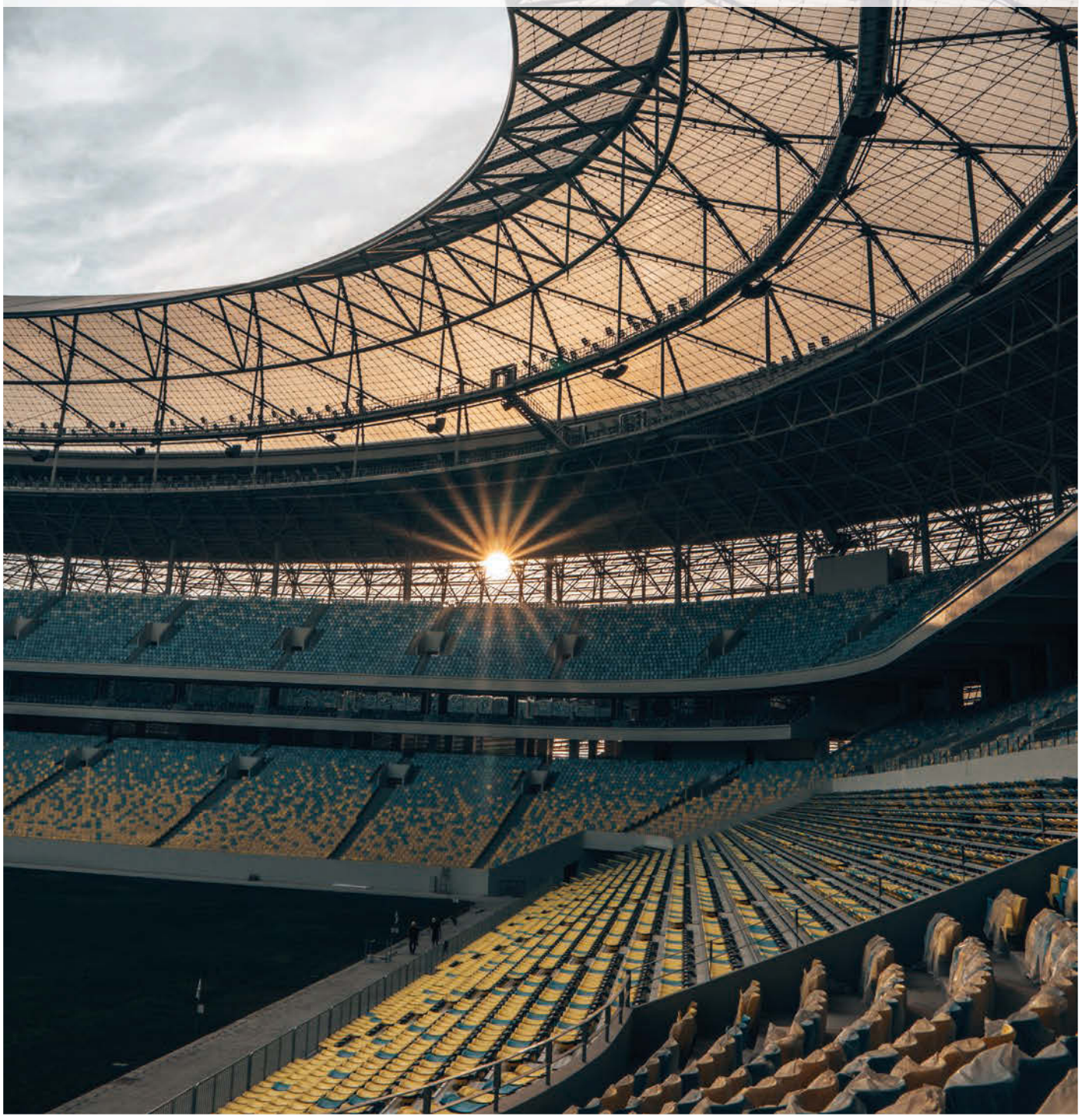
AWARDS SPECIAL

Structural Awards 2023

www.istructe.org/structuralawards #StructuralAwards



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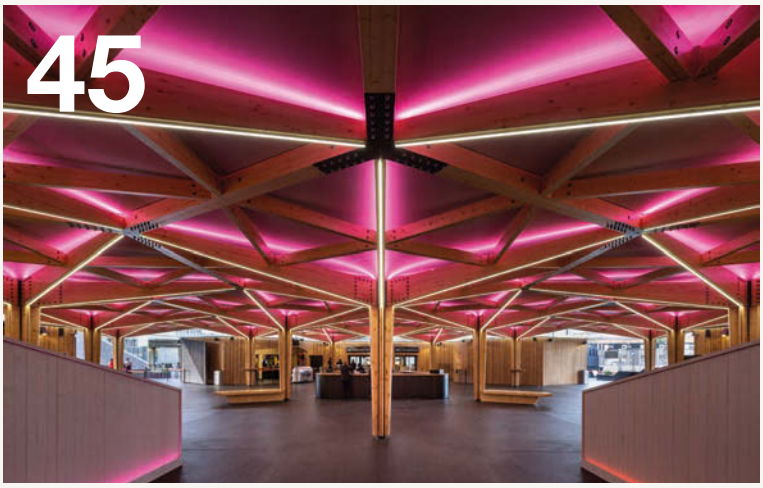
www.istructe.org/structuralawards

Winners

Supreme Award winner



Judging panel

Chair

Prof. John Orr

John is a Professor of Structural Engineering in the Department of Engineering at the University of Cambridge.

Ishan Abeysekera

Ishan is a Senior Engineer in Arup's Advanced Technology and Research Department and an expert in timber engineering.

Will Arnold

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 guidance.

Dr Katherine Cashell

Katherine is an Associate Professor in Structural Engineering in the Department of Civil, Environmental & Geomatic Engineering at University College London.

Mike 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 also a visiting professor at Imperial College London.

Kayin Dawoodi

Kayin is co-lead of Tyréns Sweden's Concept Design Department, championing creative design collaboration and education.

Prof. Jiemin Ding

Prof. Ding is the Chief Engineer of Tongji Architectural Design (Group) Co., Ltd. He was awarded the IStructE Gold Medal in 2018.

Ian Firth

Ian is a leading expert in bridge design and construction and a Past President of the Institution of Structural Engineers.

Susan Giahi-Broadbent

Susan is a Senior Divisional Director working with Jacobs since 2016, leading a variety of challenging infrastructure and building projects.

Tanya de Hoog

Tanya is a founding director of Thornton Tomasetti's London office and President-elect of the Institution of Structural Engineers.

Dr Katherine Ibbotson

Katherine is Director for WSP in the UK's Strategic Advisory Net Zero team.

Tim Ibell

Tim was President of the Institution of Structural Engineers in 2015, and is Dean of the Faculty of Engineering & Design at the University of Bath.

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.

Eric Kwok

Eric is a Technical Director at Goldwave Steel Structure Engineering and is passionate about structural engineering.

Toby Maclean

Toby 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.

Michelle McDowell

Michelle is a consultant with over 35 years' experience of design and delivery of many challenging, innovative and award-winning projects. She was awarded an MBE for services to the construction industry in 2010.

Dr Andrew Minson

Andrew is Director of Concrete and Sustainable Construction at the Global Cement and Concrete Association.

Sam Price

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

Roger Ridsdill Smith

Roger is the Head of the Structural Engineering team at Foster + Partners.

Kristina Scheibler-Frood

Kristina is an Associate Director within the AECOM London and South East Structures team, leading the design and construction stages of major projects.

SawTeen See

SawTeen is President of See Robertson Structural Engineers and provides consulting design services. She has extensive experience in tall building design and long-span structures.

Albert Williamson-Taylor

Albert is a co-founder of the interdisciplinary engineering practice AKT II and IStructE Gold Medallist in 2023.

Read full biographies of all the judges at www.istructe.org/structural-awards/judges/.

Exciting and inspiring

In his first year as Chair of the Structural Awards Judging Panel, John Orr reflects on the inspirational quality of this year's winners, and shares his thoughts on how the range of entries could continue to develop in the future.

In 2022, the Structural Awards format was updated to reflect the importance that we, as a profession, now place on the impact that our work has – on the climate, on society, and on our profession. Core to this is the need for our profession to take ownership of sustainability, just as we take ownership of safety.

The new-style awards introduced four key attributes of Planet, Process, People and Profession, representing crucial areas that we can all aspire to excel in (Figure 1), and we ask entrants to describe their project's impact in terms of one or more of these areas. Entries are no longer placed into categories, transforming the Structural Awards, making them more inclusive, fairer, and better enabling the judging panel to celebrate all kinds of creative structural engineering.

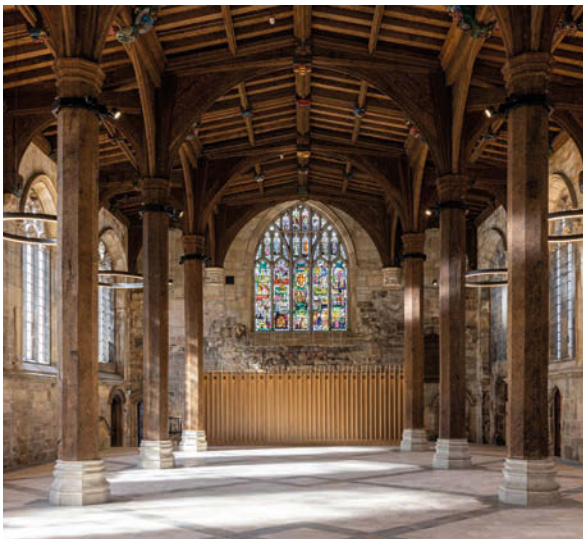
Planet

The importance of sustainability to the Institution is reflected in the requirement that all submissions must address the *Planet* attribute. We ask 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 are required to submit a quantification of structural embodied carbon, using The Structural Carbon Tool[1]. This reflects one of the key principles of *How to calculate embodied carbon*[2], that we must calculate embodied carbon on all projects, and use this calculation to evaluate and inform design decisions.

In the past year, I have been lucky to visit engineering firms around the

↓FIGURE 2: Shortlisted projects featured bridges, new-build projects, refurbishment projects and stadia



JAMIE RADCLIFFE

MATTHEW MONTGOMERY

TOMONARI SATO

STACIE JACKSON

world, and I have seen first-hand how carbon, and wider sustainability considerations, are driving exciting innovation in design.

Judging

Judging for the awards is a multistage process, and as chair of the panel I am deeply indebted to all the judges for the time and effort they put into reviewing and discussing every entry we received. The process was as follows. Each panel member was first given a selection of submitted projects to review, distributed carefully to remove any potential for conflicts of interest. Each submitted project was reviewed independently by five of our judges, who had the task of identifying which projects demonstrated excellence against one (or more) of the key attributes. Each judge typically marked five or six projects from their allocation as being deserving of shortlisting.

Once all the judges had completed their reviews and made their recommendations for shortlisting, the IStructE team, led by Louise Tingley, collated the data and compiled a list of all the projects, ranked in order of the number of times they had been recommended for shortlisting. This list formed the basis of the panel's first meeting. At this meeting, our task was to collectively decide on a shortlist of projects that we all agreed demonstrated excellence against the key attribute(s).

This task is difficult, but exciting, given the range of projects and quality of the submissions we receive. This year, 35 projects made it to the final shortlist – eight bridges, 12 new-build projects, 11 refurbishment projects, and four stadia **(Figure 2)**. The judges were then asked again to review all the shortlisted projects and identify which they felt deserved to win an award. It's worth remembering that our awards are given for the best projects – there is no quota for structural typologies, or for number of projects aligning with each of the four attributes. We focus solely on identifying which projects we regard as the best.

Votes for winning projects were again collated and this list was used as an indication of the feeling across the panel. Each shortlisted project was discussed in detail by the panel. As chair, I was struck by the range of world-class expertise on the panel, and the wonderful insights that this brought to the judging process.

This year, 11 projects were selected by the panel as winners. Each provides an exciting demonstration of inspiring excellence in structural engineering.

The final stage of the judging process was to select the Supreme Award winner – the best of the best. This year's winner is revealed on **page 54**.

Future

The Structural Awards now have a renewed focus on the impact and influence of our work as engineers. As we look to next year, I offer some thoughts on what I would like to see in future submissions.

We often focus on reducing our impact, particularly when talking about carbon. This can sometimes feel rather negative – we are constantly asking how we can be *less bad*. McDonough and Braungart in *The upcycle*[3] offer a more positive reframing, and instead challenge us to think how we can be *more good*. The journey of being more good doesn't end at zero, but goes on forever, and allows us to address and improve in all aspects of sustainability. The August 2023 issue of *The Structural Engineer* provides insight into ways in which a regenerative approach to design can move us in this direction.

In Design for zero[4], the first step in a hierarchy of improving our carbon impact is to *build nothing*. This apparently obvious statement in fact requires a huge amount of creative thinking to answer – can the brief be met, and the environment made better, by doing nothing? This might make for an interesting submission to the Structural Awards! Will anyone take up the challenge next year?

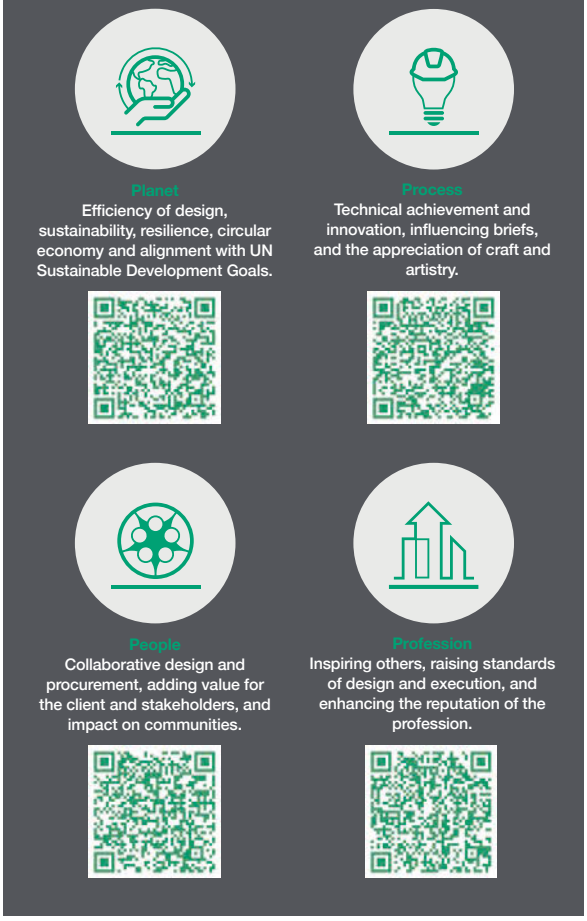
Unlocking this kind of creativity might mean thinking differently about the design problems we face. I'd like to see more submissions where an unconventional team in training and expertise have come together, in a way that celebrates the role and expertise of the chartered structural engineer as an expert designer, to *put the right material, in the right place, at the right time*.

I'd also like to see more projects that demonstrate how design is informed by fabrication (and vice versa), and how both ends of the process have been advanced to improve safety, sustainability, circularity and productivity in our famously slow-to-change sector. Projects that advance in this way could also aim to demonstrate the potential for scalability, ensuring that good ideas can be adopted widely and quickly.

Finally, I was reminded recently that there has only been one female recipient of the IStructE Gold Medal in the past 100 years. I'd like to see more female-led projects, and evidence from project teams that they are addressing the perception among young people that structural engineering is a male-dominated domain.

Read on in the rest of this issue to find out about this year's winning projects. I encourage you to start thinking now about your submissions for the Structural Awards 2024.

FIGURE 1: Four judging attributes for Structural Awards



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3) McDonough W. and Braungart M. (2013) *The upcycle: beyond sustainability – designing for abundance*, New York, NY: North Point Press

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Location Amsterdam, The Netherlands

HAUT

Awarded for the development of a novel timber-concrete composite solution in high-rise residential design

PROJECT TEAM

- **Structural engineer:** Arup
- **Client:** Lingotto
- **Principal contractor:** J.P. van Eesteren
- **Architect:** Team V Architectuur
- **Timber specialist:** Brüninghoff
- **Building economics:** Skaal

IN BRIEF...

- Standing 21 floors tall, HAUT is one of the tallest timber hybrid buildings in the world reaching 73m above the river Amstel in Amsterdam's new Amstelkwartier district.
- The design for HAUT, developed in 2016 when timber high-rise was still unexplored territory, proves the viability of large-scale timber residential buildings.
- The foundations, two-level basement, core, and ground and first floor were constructed in concrete – necessary to guarantee a solid and waterproof 'plinth' in wet and windy Amsterdam. For the 20 levels above that, timber was predominantly used.
- The extensive use of timber reduced the embodied carbon of the structure to about half that of a conventional high-rise building and achieved a SCORS A rating.

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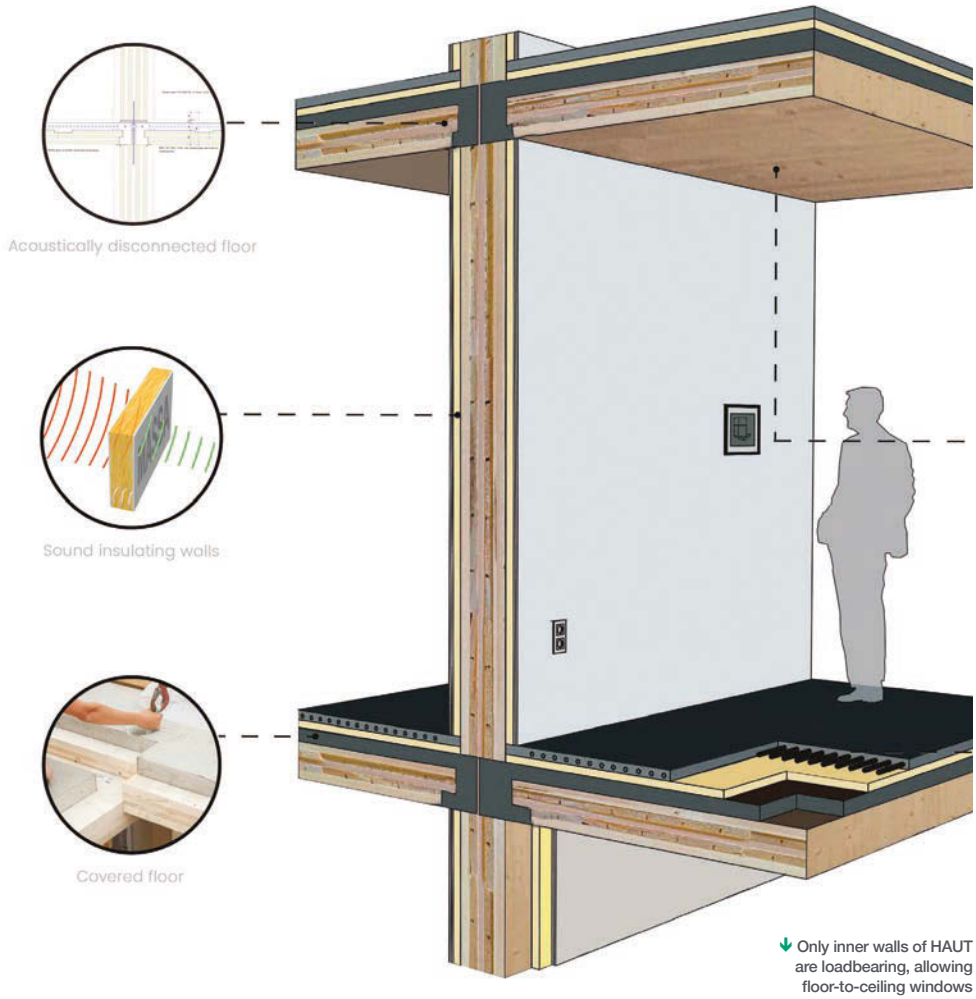


↓ Only inner walls of HAUT are loadbearing, allowing floor-to-ceiling windows

↗ Gravity system consists of loadbearing timber walls supporting timber-concrete composite floors

← HAUT was certified BREEAM Outstanding

JUDGES' COMMENTS

Utilising timber as a main structural material in this 73m high-rise residential building was a strong driver in the reduction of embodied carbon. The use of bespoke precast timber hybrid floorplates is a potentially important step in the normalisation of these techniques and has the potential to benefit timber projects globally.

HAUT was certified BREEAM Outstanding – an acknowledgement awarded to only a handful of high-rise residential buildings globally, and the first residential project in the Netherlands to achieve this sustainability certification. The successful construction of this project has demonstrated the feasibility of a timber hybrid high-rise, benefiting timber structure industries globally.

© HOUT BOIS

Location London, UK

9 Millbank

Awarded for diligence and rigour in maximising reuse

PROJECT TEAM

- ➜ **Structural engineer:** Walsh
- ➜ **Client:** St Edward Homes
- ➜ **Principal contractors:**
  FDL Contractors
  St Edward Homes
- ➜ **Architect:** Scott Brownrigg

IN BRIEF…

- →| 9 Millbank is a complex development in the heart of a conservation area in Westminster, London, consisting of three buildings: the refurbishment of an existing Grade II-listed building; a smaller building to be retained and refurbished; and Millbank Quarter, a 10-storey building to replace an existing office building.
- →| The previous engineer's scheme had recommended full demolition and removal of existing basement structure. The team adopted a circular economy approach to reuse and repurpose all of the existing building instead of just retaining the facade.
- →| Reusing existing foundations on both buildings saved on the breaking out of approx. 23 700t of concrete and 3555t of embodied carbon – the equivalent carbon produced by heating 1000 homes per year.

JUDGES' COMMENTS

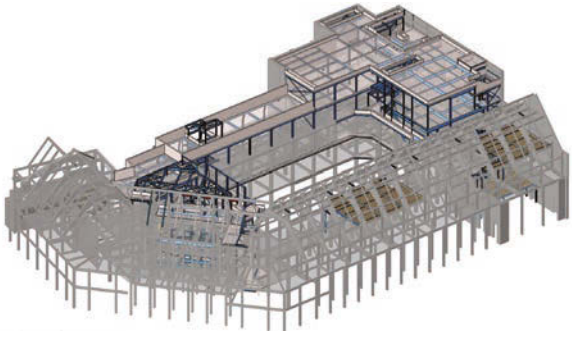
The team fully embraced the circular economy approach by reusing and repurposing all of the existing 9 Millbank building instead of just retaining the facade. They respected, retained and reused ground structures of historical engineering significance, including the superstructure and power station substructure, documenting these for generations to come.

Thorough research yielded impactful outcomes. The project team have demonstrated excellence in research and site investigation, which minimised risks, reduced costs, reduced programme and deliver a more sustainable approach.

© ST EDWARD HOMES

↗ Former Imperial Chemical House Building exterior

> **THE TEAM FULLY EMBRACED THE CIRCULAR ECONOMY APPROACH**



↓ Upwards extension used steel frame and lightweight composite concrete slabs

↑ Historic raft foundations of former power station

Location Banff, Alberta, Canada

Nancy Pauw Bridge

Awarded for engineering artistry in the creation of a light-touch, low-profile timber bridge

PROJECT TEAM

- **Structural engineer:** StructureCraft
- **Client:** Town of Banff
- **Principal contractor:** StructureCraft
- **Geotechnical engineer:** Thurber Engineering Ltd
- **Landscape architect and lighting designer:** Ground Cubed
- **Environmental consultants:** Avens, Ram Consulting

IN BRIEF…

- Nancy Pauw Bridge over the Bow River in Banff was designed to be graceful, unobtrusive and natural, fitting in with both the beautiful surroundings and the Rocky Mountains.
- The timber arch bridge needed to be a low-profile design with a maximum slope of 5% and give clearance for flood conditions but not alter the paths of ever-present elk passing across the river.
- The team analysed and designed a special tuned mass damper, involving a simple carriage with weathering steel plates suspended by splayed cables from the bridge.
- StructureCraft engaged both a wildlife ecologist and an environmental engineer to create a site-specific environmental protection plan. The decision was made to not only clear span, but slightly over-span, to reduce the impact footprint to negligible.

© JORDAN KIRYLCHUK

↑ Bridge was designed to fit in with natural surroundings

© JORDAN KIRYLCHUK

→ Erection of bridge sections was carried out in matter of hours

↓ Central pin locks two bridge sections together

© JORDAN KIRYLCHUK

> **“A FANTASTIC EXAMPLE OF TECHNICALLY ADEPT ‘LIGHT-TOUCH’ ENGINEERING**

JUDGES’ COMMENTS

This spectacular timber arch bridge has an 80m clear span. The technical challenges of the incredibly shallow arch were expertly overcome by the engineers. Vibration damping was well considered, and an innovative tuned mass damper installed.

The project team has responded to the considerable structural, environmental and ecological challenges to deliver a bridge that celebrates the natural environment of Banff through the use of natural materials. A fantastic example of technically adept ‘light touch’ engineering.

Location Hunan Province, China

Youshui Bridge

Awarded for pushing the boundaries of asymmetric long-span bridge design

PROJECT TEAM

- **Structural engineer:** China Railway Siyuan Survey and Design Group Co. Ltd
- **Client:** China Railway Siyuan Survey and Design Group Co. Ltd
- **Principal contractor:** China Railway Siyuan Survey and Design Group Co. Ltd
- **Architect:** Wen Wangqing
- **Project owner:** Huai-Shao-Heng Railway Co. Ltd
- **Contractor:** China Construction Fifth Engineering Division Corp. Ltd

IN BRIEF…

- Spanning 292m across the Youshui river valley, the Youshui high-speed railway bridge is the world's longest-span asymmetric arch bridge.
- The concrete-filled steel tube (CFST) arch structure reduces mountain excavation and vegetation destruction and protects the ecological environment in the mountainous area.
- Prefabricating and assembling the arch rib, columns and the main girder shortened the construction period and minimised the environmental impact.
- The opening of the Zhangjiajie-Jishou to Huaihua high-speed railway has cut the travel time from Changsha to Furong Town from six to 2.5 hours.

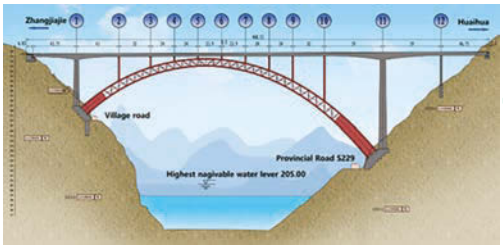
JUDGES' COMMENTS

With the topography, geology, and existing road conditions fully considered, this bridge is designed with an innovative large-span concrete-filled steel tube trussed arch, providing safety and comfort for high-speed train rides. Representing an important milestone in the history of bridge engineering in China, it exemplifies the construction of high-speed railway arch bridges in mountainous areas.

The arch feet were carefully placed to avoid unnecessary construction infrastructure and to also protect the natural environment, while the erection process involved an impressive catenary hoist system.

YAN AIGUO

↗ Arch rib of bridge is two-segment double-tube CFST truss horizontally



YAN AIGUO

↖ Feet of arches were positioned to avoid steep mountains

YAN AIGUO

➔ Journey times were cut from six to 2.5 hours between Changsha and Furong Town

Location London, UK

Battersea Power Station

Awarded for raising the standard for retrofit and facade retention at scale

PROJECT TEAM

- **Structural engineer:** Buro Happold
- **Client:** Battersea Power Station Development Company
- **Principal contractor:** Mace
- **Lead architect:** Wilkinson Ayre
- **Heritage architect:** Purcell
- **Building services:** chapmanbdsp
- **Project manager:** Turner & Townsend
- **Cost consultant:** Gardiner & Theobald
- **Temporary works designer:** RKD
- **Steel contractor:** William Hare
- **Concrete contractor:** Mitchellson
- **Piling contractor:** BAUER Technologies
- **Brickwork contractor:** PAYE

IN BRIEF…

- The Grade II* listed Battersea Power Station has been sympathetically transformed from a much-loved industrial relic into a vibrant 21st century destination. The visionary redevelopment of the 2 495 000sq.ft building was carried out as Phase 2 of an eight-phase, 42-acre regeneration of this former brownfield site.
- A key driver for the project was to maximise the conservation of the original fabric, especially as previous failed regeneration attempts included significant elements of demolition.
- In some instances – such as the dismantling and reconstruction of geometrically identical chimneys – light touch conservation was not possible. This was necessary to protect the public from the risk of ongoing spalling, which could not be remediated with certainty.
- Two vast tree-shaped steel structures each support 30m × 30m of office floorplate over eight storeys, while also serving as architectural focal points within the column-free atrium.

↙ Transformed Battersea Power Station is open to public

↗ Boiler House's tree-shaped steel structure supports

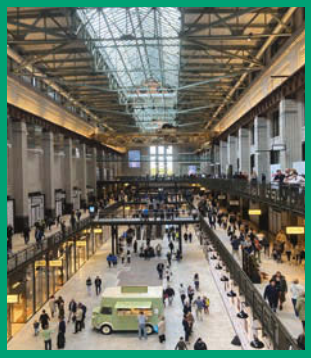
JUDGES' COMMENTS

An impressive retrofit of a derelict, complex structure, requiring careful planning, inspection and testing of the existing foundation and structural frame. The existing foundations and structure have been strengthened and retained where possible, while featuring excellent construction detailing to satisfy current building codes and to meet the building's new requirements.

> "AN IMPRESSIVE RETROFIT OF A DERELICT, COMPLEX STRUCTURE

Find out more

Read more about this project in the October 2023 issue of *The Structural Engineer*: https://doi.org/10.56330/ZBEO8463



↑ Shopping centre was developed in Turbine Hall

Location London, UK

Holbein Gardens

Awarded for advancing industry knowledge of steel reuse in buildings

PROJECT TEAM

- **Structural engineer:** Heyne Tillett Steel
- **Client:** Grosvenor
- **Principal contractor:** Blenheim House Construction
- **Architect:** Barr Gazetas
- **Consultants and contractors:**
  Gerald Eve
  HDR
  TFT Consultants
  Todd Longstaffe-Gowan

IN BRIEF…

- Holbein Gardens is a retained and extended 1980s concrete-framed commercial building with a modern sustainable workplace and increased floor area.
- The building includes a two-storey upward extension, with a roof terrace over an existing four-storey building plus basement.
- The development reused most of the existing building fabric, paired with low-carbon engineered timber extensions, and reused 25t of reclaimed steel, including 9t from other Grosvenor sites.
- The new structure at Holbein Gardens used low-carbon materials, such as cross-laminated timber for the floors and walls and Cemfree concrete.

© BARR GAZETAS

↗ Completed building used 25t of reclaimed steel

↙ Combination of reclaimed steel and cross-laminated timber was used

DESIGNED WITH CIRCULAR ECONOMY AND SUSTAINABILITY THINKING FROM THE START

JUDGES' COMMENTS

The project was designed with circular economy and sustainability thinking from the start, prioritising retention over demolition, reuse, recycling and trialling innovations such as material passports, and procurement and waste management.

The project is a pioneer and exemplar for the direct reuse of structural steel in London. Over 25t of steel was reused in the construction, which has led to further research into reusing pre-1970 steel and has inspired others in the industry to go further.

Find out more

Read more about this project in the March 2023 issue of *The Structural Engineer*: https://doi.org/10.56330/CRPP8446

↑ 93% of existing structure was retained

Location London, UK

ABBA Arena

Awarded for celebrating modular, demountable timber at scale

PROJECT TEAM

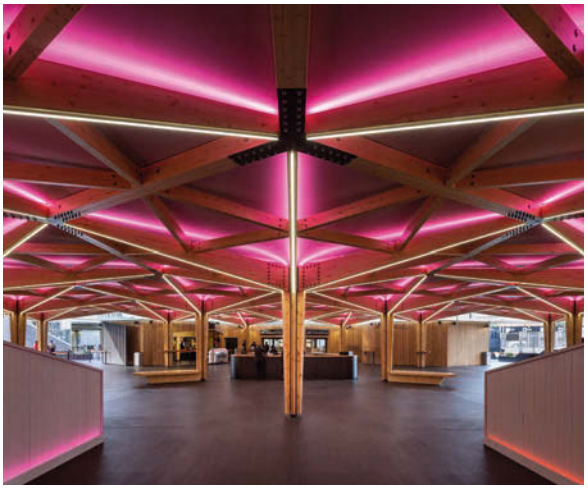
- **Structural engineer:** Atelier One
- **Client:** Pre-stage 4: Stufish; Post-stage 4: ES Global
- **Principal contractor:** ES Global
- **Architect:** Stufish
- **Project manager and quantity surveyor:** Gardiner & Theobald
- **Acoustic consultant:** Charcoalblue
- **Planning consultant:** Quod
- **Transport planning consultant:** i-Transport
- **Landscape consultant:** Jonathan Cook Landscape Architects Ltd
- **Timber specialist contractor:** Xylotek Ltd with Corbett & Tasker
- **Front-of-house contractor:** Stage One

IN BRIEF…

- The ABBA Arena has a 3000 capacity and 70m column-free span. The theatre, as well as its internal and front-of-house structures, will remain on the London site for several years and are fully demountable and transportable to offer full reuse of the building at a new location.
- Timber was considered for the primary structure, but the required member sizes would result in significantly higher transport emissions, so steel was chosen with the added benefits of robustness for repeated assembly and disassembly. Efforts were made to maximise use of timber in the remainder of the development.
- The use of modular construction and prefabricated components on shallow foundations reduced the amount of waste and disruption associated with traditional construction methods. High acoustic performance of the cladding systems ensured minimum disruption to the surrounding neighbourhoods.
- The efforts to utilise timber throughout the project, where the material lends itself to it, were recognised with the project winning a 2022 Wood Award.

DIRK LINDNER COURTESY OF STUFISH

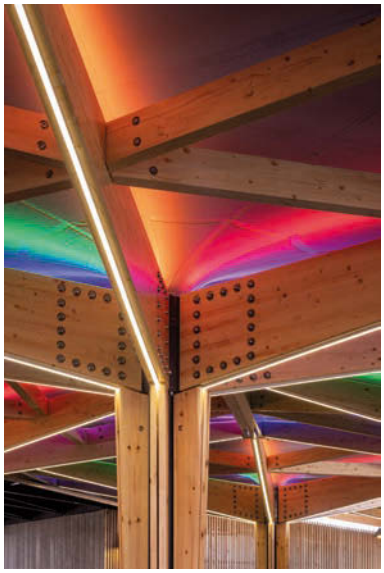
← ABBA Arena became landmark for previously remote and isolated Pudding Mill Lane in London



DIRK LINDNER COURTESY OF STUFISH

↑ Idea of large-scale reuse is at heart of ABBA Arena

↓ Demountable cross-laminated timber detailing



DIRK LINDNER COURTESY OF STUFISH

JUDGES' COMMENTS

ABBA Arena is a new type of building responding to the need to address the issue of sustainability within the entertainment industry. The idea of redeployable structures at this scale is new and offers huge potential in terms of the future reuse of buildings.

Every aspect of low carbon was considered and optimised for the structure, and timber is used extensively in the development for a lower embodied carbon when compared with similar projects. The access deck and show grid was utilised as a tie resisting the horizontal thrust of a light steel dome which was chosen for the roof, with the added benefits of robustness for repeated assembly and disassembly. The perimeter structure was designed to keep the number of elements required to a minimum, utilising the rainscreen support structure for stiffness under out-of-plane loads.

An exemplar for reusable design and whole-life low-carbon considerations. It is rare to see a project that marries so many good ideas together.

Location Wellington, New Zealand

8 Willis Street

Awarded for **innovation in seismic retrofit for improved resilience**

PROJECT TEAM

- ➜ **Structural engineer:** Beca
- ➜ **Client:** Argosy Property
- ➜ **Principal contractor:** McKee Fehl
- ➜ **Architect:** Architecture+
- ➜ **Mechanical engineer:** CORA
- ➜ **Electrical engineer:** BlackYARD
- ➜ **Hydraulics:** Stretton Michael
- ➜ **Fire engineering:** Cognition

IN BRIEF…

- →| 8 Willis Street's structure is typical of New Zealand buildings from the 1980s and 1990s, with a ductile reinforced concrete frame with shear walls, precast concrete floors and shallow pad foundations.
- →| Assessment found the building's seismic rating was around 40%NBS – marginally above the threshold for triggering an 'earthquake-prone building' notice, and well below the acceptable standard for commercial tenants.
- →| The team's revolutionary structural design process strengthened the building to 130%NBS with a highly efficient retrofit that added a dozen 4000kN fluid viscous dampers to the reinforced concrete frame – reducing inter-storey drift without creating additional foundation loads.
- →| The existing building's size was increased by five storeys and its footprint expanded – transforming the project's commercial viability for our client.

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↑ Building front was extended to Willis Street boundary

➔ Twelve 4000kN fluid viscous dampers were used

↓ Design allowed for full-height atrium through existing floors to create feature staircase

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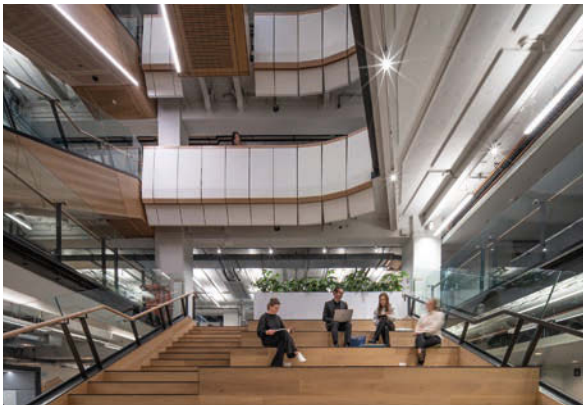

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JUDGES' COMMENTS

A well-considered project highlighting the value that the structural engineer brought to the project. Fluid viscous dampers have been used in a technical and elegant way to significantly improve earthquake resistance to the building. The thoughtful placement of the dampers has maintained open spaces, uninhibited by the structure, unlike other highly resilient seismic retrofits and new builds, where primary structural components tend to dominate the interior.

Location Chengdu, China

Chengdu Phoenix Mountain Football Stadium

Awarded for innovation in the design and testing of cable-dome structures

PROJECT TEAM

- ➜ **Structural engineer:** China Southwest Architectural Design and Research Institute Co. Ltd
- ➜ **Client:** Chengdu Urban Investment Co. Ltd
- ➜ **Principal contractor:** China Construction Eighth Engineering Bureau Co. Ltd
- ➜ **Architect:** China Southwest Architectural Design and Research Institute Co. Ltd
- ➜ **Manufacturers:** Guizhou Steel Wire Rope Co. Ltd Sanxin Membrane Structure Company
- ➜ **Consultant:** HKS Architects (China)

IN BRIEF…

- →| Chengdu Phoenix Mountain Sports Center consists of a professional football stadium with a capacity of 60 000 spectators, a sports arena with a capacity of 18 000 spectators, and a club connecting the two. The stadium has a one-storey basement and six floors, with a roof height of approx. 64m.
- →| The Phoenix Mountain Sports Center separates the stadium, club and sports arena into three independent structural units with structural anti-seismic joints.
- →| The size of the structural unit of the football stadium is 322m × 285m, and it adopts a reinforced concrete frame-shear wall structure as the main structure.
- →| The inner transparent part of the roof canopy, covered by an ETFE membrane, forms a cable-dome structure with a large opening. Two loops of ring cables are arranged in the circumferential direction of the cable-dome, and 80 sunflower-shaped diagonal cables are arranged in the radial direction.

JUDGES' COMMENTS

This project demonstrates developments in design and construction methods for large cable-supported domes with central openings. The design team carefully considered the flow of forces around the asymmetric roof, using an inner ring steel truss and prestressed sunflower configuration cable layout to create an efficient structural form.

This is innovative engineering design, and the judges admired how the team used scale model testing and ETFE testing to verify their findings and prove it worked in order to achieve the successful completion of the project.

↘ Stadium is venue for World University Games in 2023

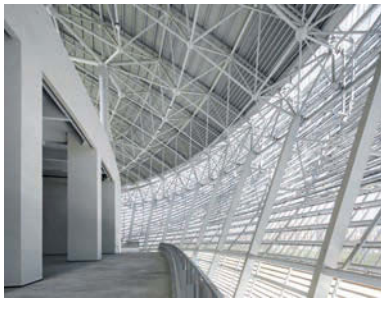
TIAN QIU

TIAN QIU

↑ Transparent and lightweight roof is conducive to sunlight exposure

➜ Outer facade of stadium uses steel-framed structure

> **THE DESIGN TEAM CAREFULLY CONSIDERED THE FLOW OF FORCES AROUND THE ASYMMETRIC ROOF**



TIAN QIU

Location Niamey, Niger

Collège Hampaté Bâ

Awarded for using sustainable local materials and enabling positive social impact

PROJECT TEAM

- **Structural engineer:** MHA Structural Design
- **Client:** Article 25 on behalf of Collège Amadou Hampaté Bâ
- **Principal contractor:** Afrique Univers Niger
- **Architect:** Article 25
- **Mechanical, electrical and plumbing engineer:** Max Fordham

IN BRIEF…

- The college provides subsidised education for children from low-income families. The project involved the refurbishment of existing classrooms and provision of new classrooms, administrative facilities and bathrooms along with upgrades to water and electrical supplies.
- Research into local materials and skills led to the adoption of laterite as the primary material for loadbearing walls and barrel-vaulted roofs. Laterite is a cheap and, significantly, sustainable building material quarried locally.
- The soil for cement-stabilised earth blocks (CSEBs) was sourced directly from site excavations and mixed with 6–8% of cement to improve resistance and durability. The local masons set up an open-air workshop on site for mixing the components, pressing it into the mould, and curing the adobes.
- The double-roof system provides shading and forms an air curtain to reduce the temperature of the ceiling. Mono-pitch steel trusses are oriented so that the prevailing winds enhance cooling effects.

JUDGES' COMMENTS

The design team overcame challenges of the extreme Sahelian climate and limited construction skills and materials to create a functional yet inspiring space for learning, with the exposed structure celebrated as a learning tool. The structure utilises locally sourced materials to reduce the building's carbon footprint and promote the use of sustainable building practices.

The project had a major impact on the local community and the students that it serves. An important target was to keep female students in the education system. During construction, female students attended courses on construction skills and were exposed to postulates of architecture, engineering and construction. The students were encouraged to consider continued education and careers in the construction industry.

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↑ Roofs overhang walls to shade and protect from heavy rains

← During construction, female students attended courses on construction skills

↓ Low-carbon CSEBs were built on site by expert local mason

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Location London, UK

Cody Dock Rolling Bridge

Awarded for the bold design of a transformative structure

PROJECT TEAM

- **Structural engineer:** Price & Myers
- **Client:** Gasworks Dock Partnership
- **Principal contractor:** Gasworks Dock Partnership & Cake Industries
- **Architect:** Thomas Randall-Page

IN BRIEF…

- Cody Dock has been brought back into use following years of dereliction. This new steel bridge spans over the dock mouth, allowing the passage of vessels into the dock by rolling along a track such that the deck turns upside down.
- The bridge is carefully counterweighted so that the centre of gravity is level, allowing the 13t bridge to roll using only a hand-cranked winch.
- The footbridge is a simply supported structure with a monocoque steel deck spanning 7m over the dock mouth and tapering in depth from 400mm to 550mm at mid-span.
- The bridge aims to be understated when resting but playful in its movement, creating a spectacle when operated. Part of the ambitious footpath and cycleway project along the length of the Lea River, the hope is that this rolling bridge will become an important landmark and a symbol for the dynamic community growing here.

JUDGES' COMMENTS

This technically innovative and intriguing bridge showcases the application of advanced mathematics to develop an elegant and stable geometric design that is understated when stationery but playful in its movement, creating a spectacle when operated. The engineers have implemented a clever mechanical engineering solution by adding a counterweight to raise the centre of gravity to the midpoint of the frame, to facilitate its hand-operated movement.

The unique design necessitated a passionately collaborative team.

JIM STEPHENSON

↑ Bridge is rolled using pair of manual winches

→ Undulating concrete abutments are cast into existing masonry walls

> "UNDERSTATED WHEN STATIONERY BUT PLAYFUL IN ITS MOVEMENT

Each role extended past typical scope boundaries, with everyone having to adopt a holistic understanding of the structure, mechanics, geometry, architecture and fabrication.

The project signifies collaboration between, not only the design team, but the local community as a contemporary piece of industrial architecture/functional sculpture that will endure for generations to come.

JIM STEPHENSON

↙ Bridge will allow boats through for first time in over 50 years

JIM STEPHENSON

Location Banff, Alberta, Canada

Nancy Pauw Bridge

Supreme Award for Structural Engineering Excellence

PROJECT TEAM

- **Structural engineer:** StructureCraft
- **Client:** Town of Banff
- **Principal contractor:** StructureCraft
- **Geotechnical engineer:** Thurber Engineering
- **Landscape architect and lighting designer:** Ground Cubed
- **Environmental consultants:** Avens, Ram Consulting

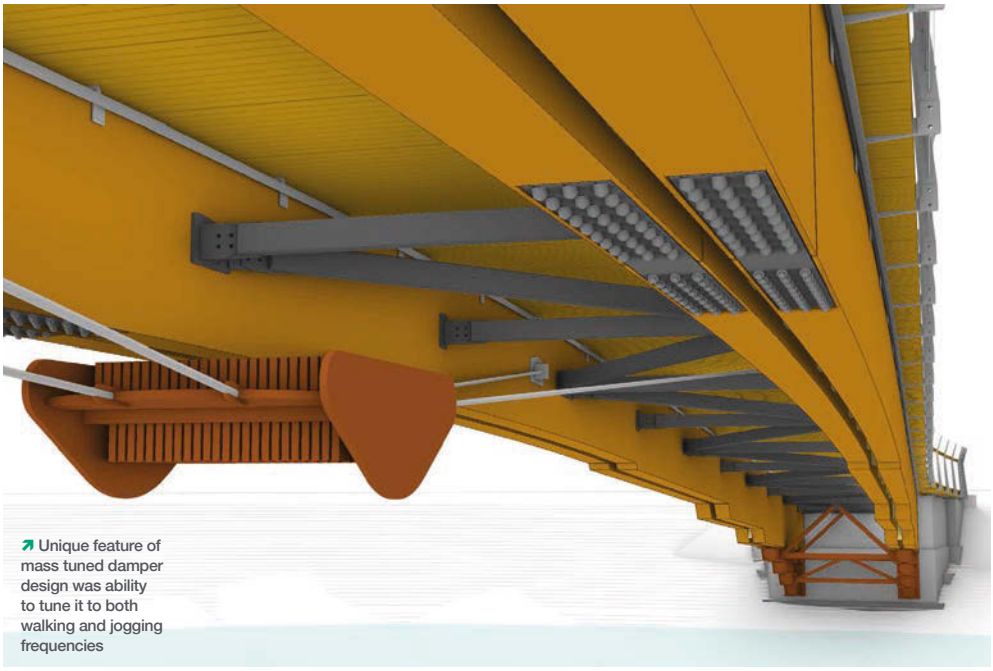
IN BRIEF…

- Nancy Pauw Bridge over the Bow River in Banff was designed to be graceful, unobtrusive and natural, fitting in with both the beautiful surroundings and the Rocky Mountains.
- The timber arch bridge needed to be a low-profile design with a maximum slope of 5% and give clearance for flood conditions but not alter the paths of ever-present elk passing across the river.
- The team analysed and designed a special tuned mass damper, involving a simple carriage with weathering steel plates suspended by splayed cables from the bridge.
- StructureCraft engaged both a wildlife ecologist and an environmental engineer to create a site-specific environmental protection plan. The decision was made to not only clear span, but slightly over-span, to reduce the impact footprint to negligible.

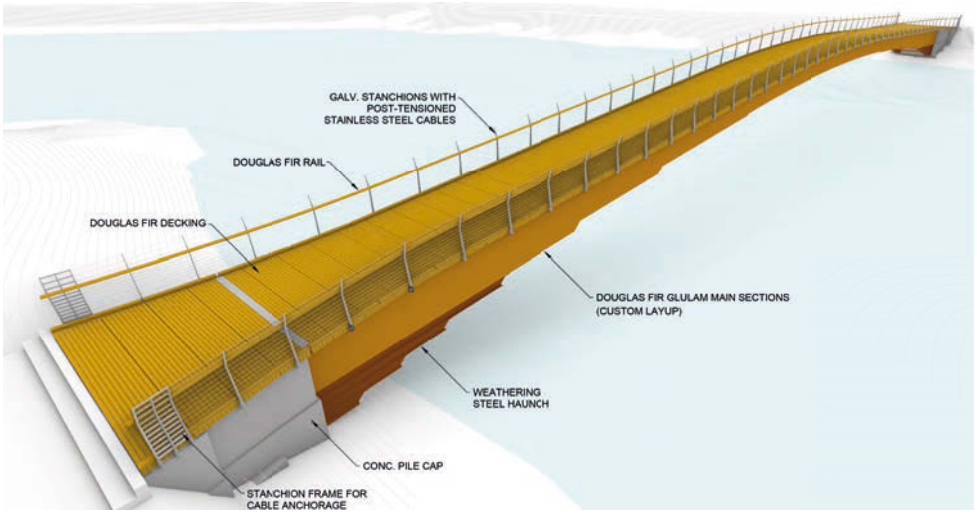
JUDGES' COMMENTS

A massive congratulations to the StructureCraft team. Their work on the Nancy Pauw Bridge, an exceptionally low-profile timber bridge in Banff, not only demonstrates the innovation and technical excellence that contribute to design elegance, but it showcases their unique problem-solving skills and ability to deliver structures which impact positively on social and environmental issues.

They were joined by a host of other impressive winners, recognised for their intelligent use of materials, circular approaches to design, and sustainable construction. Now in its second year, the new attribute-based judging framework is helping to paint a better picture of how structural engineers are supporting a safer and more sustainable built environment.



↗ Unique feature of mass tuned damper design was ability to tune it to both walking and jogging frequencies



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↑ Extensive non-linear soil-structure analysis was conducted to ensure such a shallow structure was achievable

> "SHOWCASES THEIR UNIQUE PROBLEM-SOLVING SKILLS

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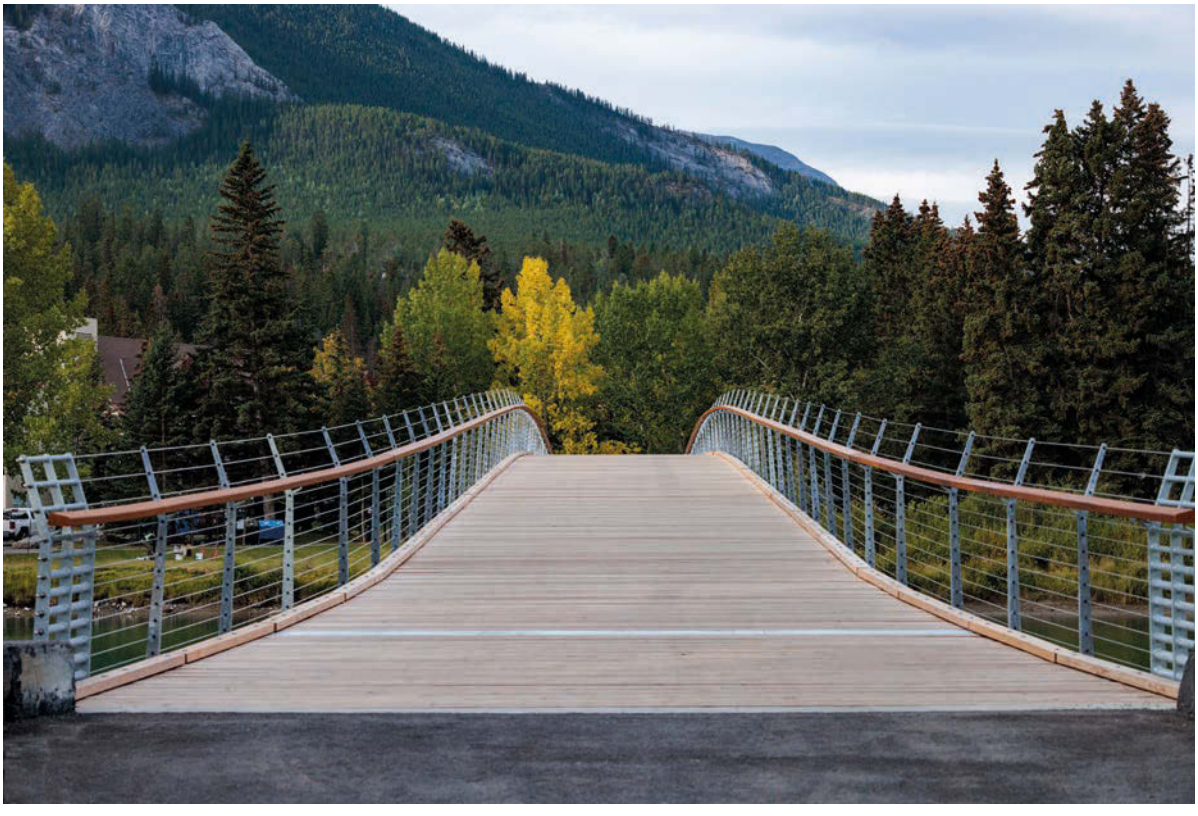

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↑ Unimpeded views for users while crossing were design essential

← Bridge decking consists of spaced uncoated Douglas fir 4×6 timbers prestressed into 1m-wide removable panels