

AWARDS SPECIAL

Structural**Awards**2026

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Judging panel



Chair (UK)
Prof. John Orr
Professor of Structural Engineering in the Department of Engineering at the University of Cambridge



UK
Matt Byatt
Co-Founder and Director of Subteno and Past President of the IStructE



UK
Dr Katherine Cashell
Professor in Structural Engineering in the Department of Civil, Environmental & Geomatic Engineering at University College London



UK
Margaret Cooke
Founding Director of Integral Engineering Design



Sweden
Kayin Dawoodi
Design Director at Tyréns



China
Prof. Jiemin Ding
Chief Engineer at Tongji Architectural Design Group



UK
Ian Firth
Leading expert in bridge design and construction and Past President of the IStructE



UK
Thomas Hesslenberg
Associate at Elliott Wood



Australia
Tanya de Hoog
Chief Engineering, Eminence and Innovation Officer at Aurecon and Past President of the IStructE



USA
Edwin T. Huston
President, Structural Engineering Institute



UK
Martin Knight
Founder of Knight Architects



Hong Kong
Eric Kwok
Technical Director at Goldwave Steel



UK
Toby Maclean
Founder of Allt environmental structural engineers



UK
Michelle McDowell
Non-executive director, consultant and mentor



UK
Rosella Nicolin
Head of Sustainability – Europe at Laing O'Rourke



UK
Roger Ridsdill Smith
Head of Structural Engineering team at Foster + Partners



UK
William Rogers-Tizard
Associate Director of Climate and Engineering at RedR



USA
SawTeen See
President of See Robertson Structural Engineers



UK
Andrew Smith
Senior Engineer at Arup



UK
Claire Smith
Partner at Buro Happold (UK)



New Zealand
Katie Symons
Principal Advisor, Ministry of Business, Innovation & Employment



France
Peter Terrell
Founder of Terrell Group

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

Foreword

Purposeful engineering



This year's winners demonstrate the value of responding to the unique set of needs or constraints that every project brief presents, believes John Orr, Chair of the Structural Awards Judging Panel.

For over 50 years, the Structural Awards have celebrated the very best of our profession and global community. What has impressed me about this year's entries and winners is how closely the strongest structural ideas respond to the circumstances of each project. The landscape, the available materials, the needs of a community or the demands of a scientific experiment become the starting point for engineering ingenuity.

We continue to judge projects against our four key attributes of Planet, People, Process and Profession. These allow us to recognise excellence across very different scales and settings, and to consider what each project contributes to society and the wider profession. I am grateful to the judging panel for the care and depth of thought they have brought to these decisions.

At the Danube Valley Bridge (page 33), anchoring suspension cables directly into granite hillsides removes the need for pylons and river supports. The landscape informs an elegant, materially efficient structure. At Drammen City Bridge (page 35), digital modelling and close coordination between two clients, their designers and contractors have produced a coherent crossing that resolves the constraints of river, railway and difficult ground. Techo International Airport (page 37) combines large-span gridshell and truss systems with a thoughtful response to climate and seismic demands. Each demonstrates the value of understanding a place before deciding how to build there.

Timber continues to offer opportunities for innovation. The Hive in Vancouver (page 43) combines a 10-storey mass-timber structure with a self-centring seismic system, supported by full-scale testing that offers lessons for future projects. In Barbados, the National Performing Arts Centre (page 39) uses carefully detailed timber connections to create a hurricane-resistant structure with future reuse planned from the outset. Training local tradespeople gives that achievement a life beyond the building itself. In each case, the engineering advances are matched by an investment in the people who will take them forward.

Retention and reuse remain central to our response to the climate emergency. The transformation of a timber warehouse in Denmark (page 47) retains primary structure and finds new uses for salvaged elements. As a result, its upfront embodied carbon cost (£ per $kgCO_2e$, Modules A1–A5) is remarkably low. Boston Lodge Works (page 45) brings a similarly careful approach to railway heritage, with engineering shaped around the volunteers, apprentices and local contractors who sustain it.

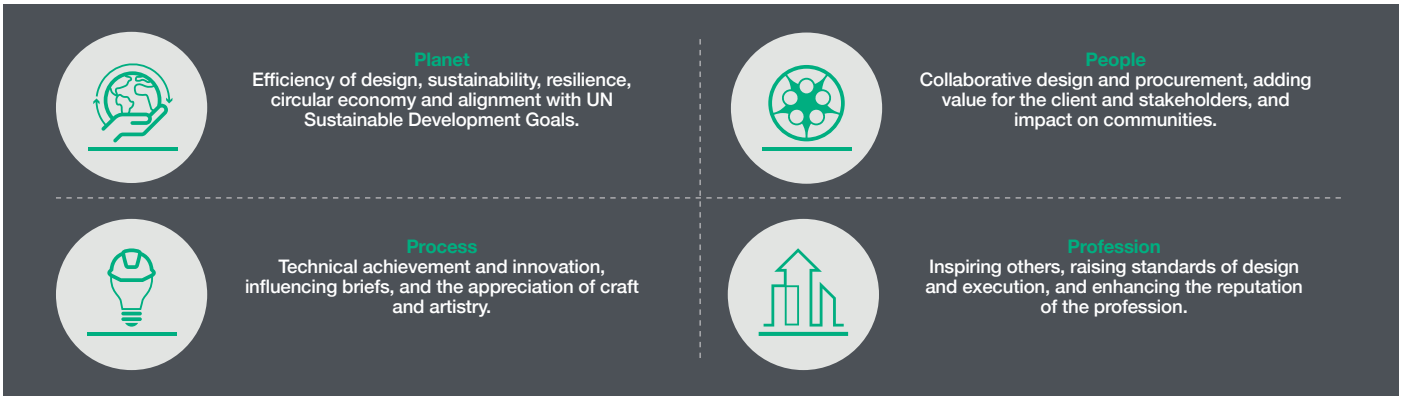
Precision of a different kind is found in the cable-net roof at Xi'an International Football Center (page 41). Its orthogonal cable net accommodates a large central opening, with geometry, force flow and drainage resolved together. Digital form-finding and testing support a design that demands a deep understanding of structural behaviour and construction methodology.

The Supreme Award winner, the Jiangmen Underground Neutrino Observatory central detector (page 49), takes such an understanding into an extraordinary setting, 700m underground. Its acrylic sphere and stainless steel lattice support must manage buoyancy, seismic effects and the changing loads imposed during filling and operation, while satisfying demanding scientific requirements. Close collaboration between engineers and scientists has made a highly complex international research facility possible. I find it particularly exciting to see structural engineering enabling discoveries in another discipline, and this project is a remarkable demonstration of that contribution.

As you look through this special issue, I hope you are reminded that sharing what we learn is part of our collective responsibility to each other as structural engineers.

Every team whose project made our shortlist should be proud of the quality and ingenuity of their work. Many of the projects in our shortlist display excellence across several of the key attributes, a testament to the holistic nature of design that improves the world we live in. Special recognition goes to this year's winners – those projects that truly set themselves apart in their demonstration of excellence against the key attributes. On behalf of the judging panel, I offer our warmest congratulations to them all.

© COVER IMAGE: DRAMMEN CITY BRIDGE © NIKLAS HART

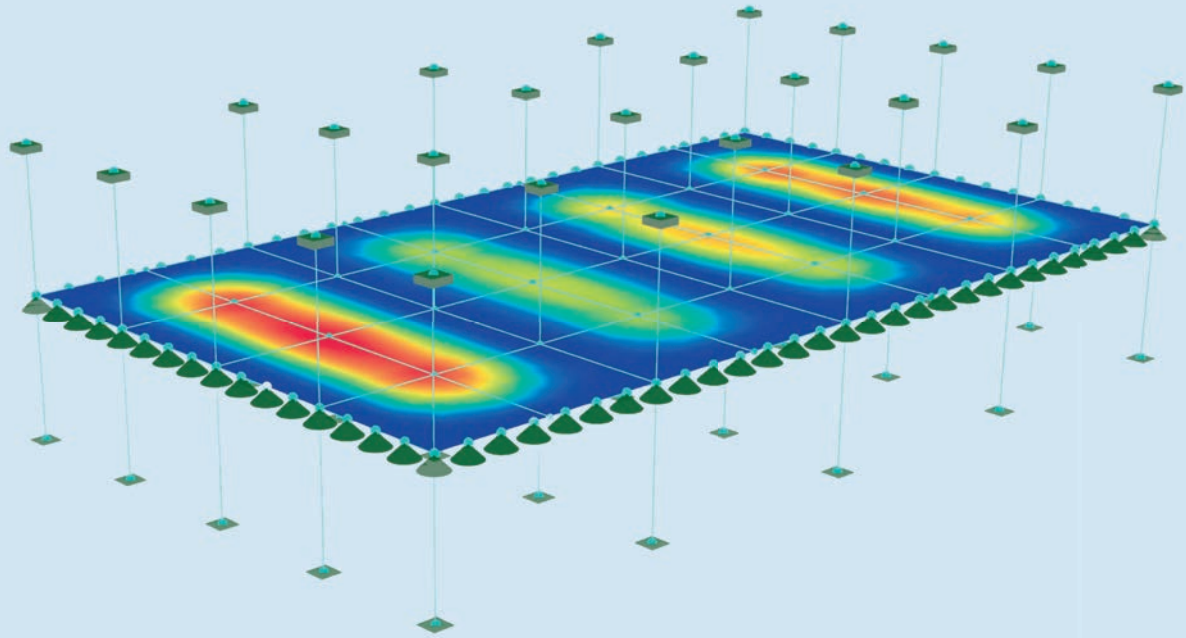


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Location Linz, Austria

Danube Valley Bridge

Awarded for minimising environmental impact while overcoming a highly complex engineering challenge.

PROJECT TEAM

- **Structural designer:** schlaich bergermann partner (sbp)
- **Client:** ASFINAG
- **Principal contractor:** f-pile
- **Architects:** schlaich bergermann partner (sbp) gmp von Gerkan, Marg and Partners Architects
- **Key contractors:** Baumann + Obholzer ZT ICM SpA Maeg Costruzioni SpA Schréder

IN BRIEF…

- The 305m suspension bridge spans the Danube Valley without the need for pylons, using the surrounding granite cliffs to anchor its main cables directly into the landscape. A key structural challenge was developing an efficient load path while minimising the bridge's visual and environmental impact within a sensitive river corridor.
- By integrating the primary loadbearing elements into the natural geology, the bridge achieves a level of transparency and landscape integration unprecedented for a motorway crossing of this scale. The curvature of the suspension cables follows the natural lines of the valley, while the absence of towering structures preserves the historic silhouette of the Danube gorge.
- This approach resulted in a drastic reduction of embodied carbon, as thousands of cubic metres of concrete and hundreds of tonnes of reinforcement steel were saved compared with a conventional pylon-based design.
- The process began with an exhaustive 3D laser scan of the granite cliffs, which provided the basis for a high-fidelity digital twin of the topography. This was essential for the precision-drilled rock anchors, which had to be positioned with millimetric accuracy to receive the force of the main cables.

JUDGES' COMMENTS

An elegant response to a highly complex engineering challenge. By anchoring suspension cables directly into the surrounding granite cliffs, the need for pylons and river supports was eliminated. The judges praised the way the design worked with the natural landscape to reduce material consumption, minimise environmental impact and maintain river navigation during construction. The project combines technical innovation, precise construction methods and high-quality detailing to deliver a lightweight structure that demonstrates the value of context-led design.



© ASFINAG

↗ The cables were installed one by one using a cable car running on two auxiliary cables



© ASFINAG

↗ Segments of the bridge were moved into position using a heavy-duty strand-jacking system and a temporary stay-cable arrangement



↘ The decision to span the valley from cliff to cliff meant that the entire Danube riverbed remained untouched

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Location Drammen, Norway

Drammen City Bridge

Awarded for combining collaboration and digital innovation to deliver transformative urban connectivity.



Located in the centre of the city, the project replaced an ageing crossing with an elegant new structure

© JOSTEIN THORVALDSEN

PROJECT TEAM

- **Structural designers:**
  - Degree of Freedom
  - Norconsult
- **Clients:**
  - Drammen kommune (over river)
  - Bane NOR (over railway)
- **Principal contractors:**
  - PNC Norge (PORR)
  - NCC
- **Architects:**
  - SAAHA
  - Knight Architects
- **Key contractors:**
  - Asplan Viak
  - Light Bureau

IN BRIEF...

- This multimodal crossing in Drammen, Norway, brought together two clients, two designers and two contractors to deliver a steel-concrete composite structure spanning the river and railway. The design responds to complex constraints, including poor ground conditions, ice loads and tight geometry, through deep piled foundations, design coordination and advanced parametric modelling.
- Over the railway, the bridge is formed by a reinforced concrete deck across a series of short spans. Over the river, it transitions into a long-span steel-concrete composite structure, with three main spans of 46m, 86m and 42m.



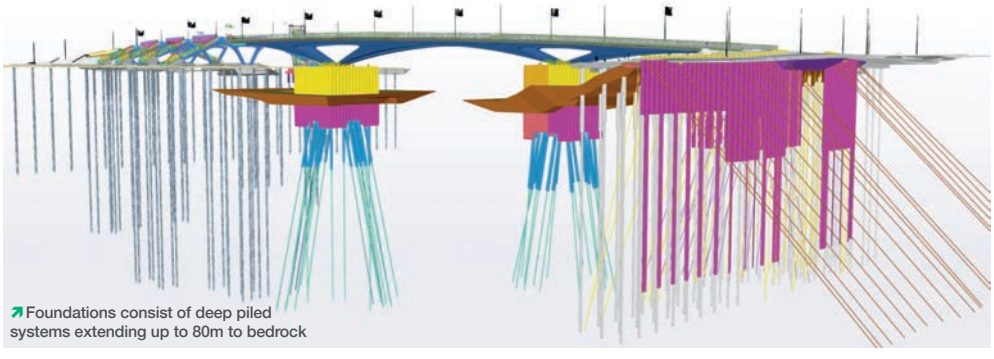
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The 19.4m-wide deck was designed exclusively for public transport, cyclists and pedestrians

- The foundation design further exemplifies technical ingenuity. Faced with deep soft soils and complex loading conditions, an optimised piled solution was developed through an iterative process linking superstructure response and ground behaviour. This integration ensured both structural efficiency and long-term performance.
- The bridge was delivered in a uniquely complex stakeholder environment, involving multiple clients, designers and contractors operating under different frameworks. Achieving a single continuous structure required a high level of collaboration, trust and shared ownership across all parties.

JUDGES' COMMENTS

This elegant bridge demonstrates the value of collaboration, parametric design and construction integration. The judges were particularly impressed by the way digital modelling informed both the design and delivery processes, improving efficiency and buildability. The structure successfully connects communities while accommodating complex site constraints, including rail infrastructure, poor ground conditions and river crossings. Careful coordination between multiple stakeholders resulted in a seamless and well-resolved solution that combines technical excellence with significant public benefit



Foundations consist of deep piled systems extending up to 80m to bedrock

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Location Phnom Penh, Cambodia

Techo International Airport

Awarded for elegantly integrating bamboo, timber, steel and glass within a major transport hub.

PROJECT TEAM

- **Structural designer:** Foster + Partners
- **Client:** Cambodia Airport Investment Co., Ltd
- **Principal contractor:** China Construction Third Engineering Bureau Co., Ltd
- **Architect:** Foster + Partners
- **Key contractors:**
  - BNP Associates
  - Buro Happold
  - Front
  - Origin Projects
  - RLB
  - Sandy Brown
  - Warringtonfire

IN BRIEF…

- Located 20km south of Phnom Penh city centre, the international airport forms the centrepiece of a wider masterplan for a new airport city. The design draws inspiration from traditional Cambodian architecture while responding to the tropical climate, creating a terminal that reflects its setting.
- The headhouse roof was designed to minimise steel tonnage through structural efficiency. It comprises four-chorded steel trussed columns arranged on a 36m × 36m grid, which support 3D four-chorded roof trusses spanning in two orthogonal directions. The steel trusses springing from the columns transition into the roof shell through a smooth curve, forming a visually seamless integration of roof and column elements.
- The north pier measures approx. 875m × 45m, with a height of up to 26m at the roof apex. It comprises a two-storey reinforced concrete superstructure topped by a doubly curved steel roof. Due to its length, the building is divided into five independent structures by four expansion joints.
- The airport is an example of efficient architecture designed and built on an extremely tight budget. In the absence of national building codes, the design team used international best practice and conceived a structure that could be delivered in a country with a less developed construction industry.

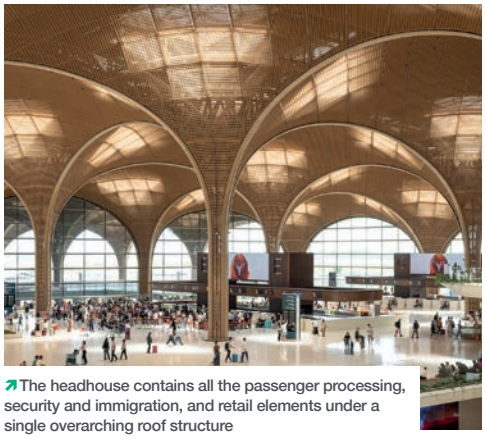


The cantilevering roof structure provides environmental protection to the terminal

FOSTER + PARTNERS

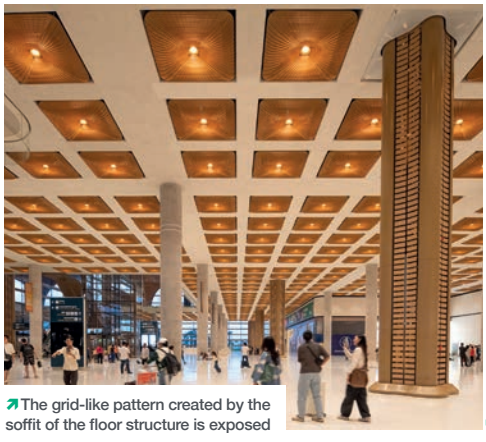
JUDGES' COMMENTS

A well-executed airport structure that successfully integrates bamboo, steel and glass into a single structural system. The judges were impressed by the gridshell and truss systems, which achieve large spans while supporting architectural, climatic and seismic requirements. The decoupling of structural systems enhances resilience and efficiency, while the extensive use of locally relevant materials strengthens the project's connection to place. A refined and accessible expression of structural engineering that demonstrates how technical performance, sustainability and architectural quality can be successfully combined.



The headhouse contains all the passenger processing, security and immigration, and retail elements under a single overarching roof structure

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The grid-like pattern created by the soffit of the floor structure is exposed

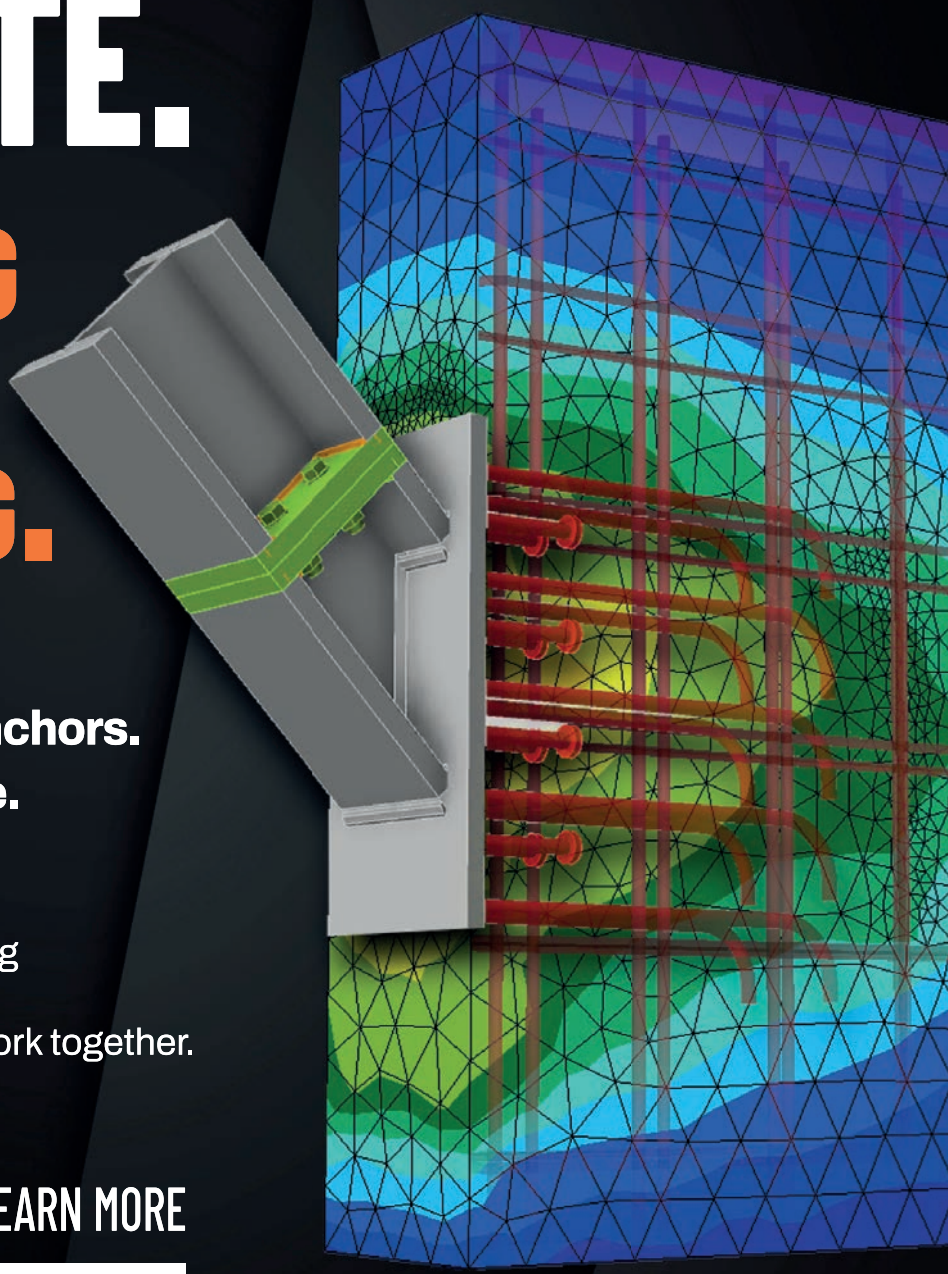
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Location Newton, Barbados

Barbados National Performing Arts Centre, phase 1

Awarded for ingenious timber engineering that combined local skills, innovation and adaptability.

PROJECT TEAM

- **Structural designer:** StructureCraft
- **Client:** Barbados Tourism Investment
- **Principal contractor:** Empire
- **Architect:** Adjaye Associates

IN BRIEF…

- This timber performing arts pavilion, created for the Caribbean Festival of Arts, demonstrates the structural potential of mass timber at a significant scale. A key challenge was achieving the large, open performance space while minimising reliance on steel connections. The solution centres on a 24m span timber truss, configured to maximise compression forces and enable the use of traditional timber joinery throughout the primary structure.
- The brief for phase 1 was ambitious: build a 35,000sq.ft performing arts pavilion in four months directly on the permanent foundations of a future 85,000sq.ft complex so that every timber element could be reused in phase 2.
- The initial concept was a two-level structure matching the phase 2 floor plan. Three weeks into design, shipping logistics for this scheme proved unworkable within the timeline. During a team design charette, an alternative emerged: a single-level pavilion using sloped perimeter canopy roofs as both an enclosure and lateral system, which could be rotated to become the permanent roof in phase 2.

JUDGES' COMMENTS

Delivered under demanding programme, material and logistical constraints, this project demonstrates exceptional engineering ingenuity. A predominantly timber structure was developed using innovative all-timber connections and traditional joinery techniques at an unprecedented scale, reducing reliance on imported materials. Judges valued the adaptability of the design, including provision for future reuse and reconfiguration. Training local tradespeople and building confidence in timber construction created lasting community benefits, while the precise execution of the hurricane-resistant structure highlights the strength of collaboration between designers, craftspeople and the local workforce.



PETER MAIER

The same carpenters who produced the BIM drawings and hand-fabricated the joinery travelled to Barbados to assemble the structure



PETER MAIER

For CARIFESTA XV speakers were hung from the truss, lighting rigged to the roof, and the timber structure itself served as the only backdrop



PETER MAIER

The National Performing Arts Centre in Newton was commissioned as part of the Barbados Heritage District masterplan

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Location Xi'an, China

Xi'an International Football Center

Awarded for a world-first cable-net roof that advances long-span stadium engineering.

PROJECT TEAM

- **Structural designers:** Shanghai Institute of Architectural Design & Research Co., Ltd schlaich bergermann partner (sbp)
- **Client:** Xi'an International Football Center Operations Management Co., Ltd
- **Principal contractor:** Shaanxi Construction Engineering Group Co., Ltd
- **Architect:** Zaha Hadid Architects
- **Key contractors:** Arcplus Institute of Shanghai Architectural Design & Research Co., Ltd
  Beijing University of Technology
  Chongqing University
  Nanjing Southeast Modern Prestressing Engineering Co., Ltd
  Shaanxi Construction Machinery Construction Group Co., Ltd
  Southeast University
  Tongji University

IN BRIEF...

- The stadium provides seating for around 60,000 spectators and was designed to host major national and international sporting events. A key structural challenge was creating the large-span roof over the seating bowl, while maintaining an efficient and lightweight structural system. The solution combines an orthogonal cable net, with a spoke-type single-layer cable net to form an innovative long-span roof structure.
- It features a reinforced concrete frame with buckling-restrained braces and a long-span spatial steel roof. The roof plan – rectangular with rounded corners, 295.6m × 250.6m – adopts a hybrid system of an outer rigid reticulated shell and an inner flexible cable net.
- The initial equilibrium form-finding method and control parameters of the large-opening orthogonal cable-net system were studied to understand interactions between cable forces, outer ring internal forces, and deformation compatibility. This identified the optimum cable-force distribution and initial state – minimising bending moments in the outer compression ring while achieving uniform ring-cable forces.

ALL PICTURES: SHANGHAI INSTITUTE OF ARCHITECTURAL DESIGN & RESEARCH CO., LTD AND SBP



The tendons are solid bars of high-strength stainless steel, coated in PTFE to prevent bimetallic corrosion



The stadium's terracotta facade was directly inspired by the Qin Dynasty's Terracotta Army



PTFE membrane tensioned between upper and lower cables forms V-shaped cable-membrane trusses

> "THE RESULT IS AN ELEGANT AND TECHNICALLY SOPHISTICATED ROOF

JUDGES' COMMENTS

A highly accomplished roof design. The world-first orthogonal cable-net system with a large central opening combines radial and orthogonal elements to create an efficient long-span structure that integrates drainage, geometry and force flow within a single solution. Extensive testing, digital form-finding and advanced construction techniques underpinned its delivery. The result is an elegant and technically sophisticated roof that pushes the boundaries of stadium engineering, while providing a benchmark for future large-span sports venues.

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Base Line

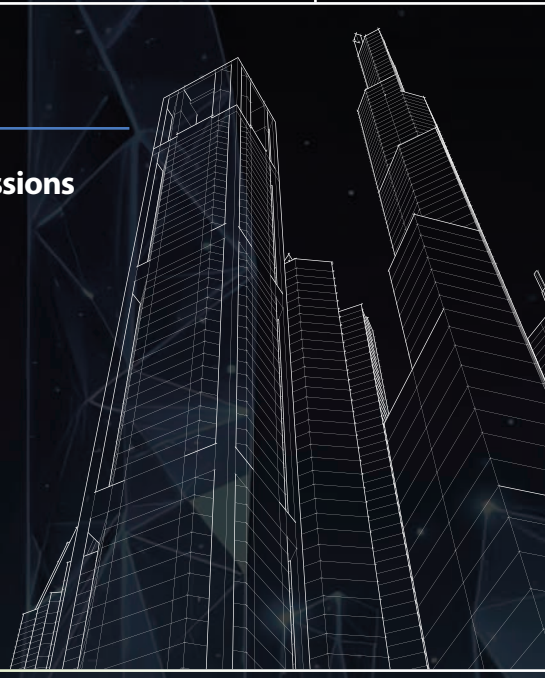
Carbon Factors & CO_2 emissions

ComFlor® 51+ 0.9 mm
36.3 kg CO_2/m^2

ComFlor® 51+ 1.0 mm
40.7 CO_2/m^2

ComFlor® 51+ 1.2 mm
48.0 kg CO_2/m^2

Total CO_2 emissions:
1,258 tonnes CO_2



Optemis® Evolve

Carbon Factors & CO_2 emissions

ComFlor® 51+ 0.9 mm
20.0 kg CO_2/m^2

ComFlor® 51+ 1.0 mm
22.0 CO_2/m^2

ComFlor® 51+ 1.2 mm
26.1 kg CO_2/m^2

Total CO_2 emissions:
691 tonnes CO_2

45% reduction in embodied carbon

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Location Vancouver, Canada

The Hive

Awarded for advancing resilient, low-carbon tall timber construction in a seismic region.

PROJECT TEAM

- **Structural designer:** Fast + Epp
- **Client:** Ventana Construction Corporation
- **Architect:** DIALOG
- **Key contractors:**
  - AES Engineering
  - AME Group
  - BentallGreenOak (BGO)
  - EXP
  - George Third & Son
  - GHL Consultants
  - Kalesnikoff
  - Supreme Steel

IN BRIEF...

- This 10-storey mass timber office building is North America's tallest timber braced frame and cross-laminated timber (CLT) shear wall structure. Its innovative seismic system enhances structural resilience while reducing carbon, creating a high-performance workplace.
- Located on a sloped urban site, four levels of below-grade concrete parking and a concrete podium support the timber superstructure above. The building uses CLT panels supported by dropped perimeter glulam beams and interior flush steel beams.
- The incorporation of resilient slip friction joints enabled a self-centring seismic system that minimises damage during major seismic events. This approach reduces the need for repair, replacement and associated material consumption following an earthquake, extending the building's lifespan and supporting long-term climate resilience in a high seismic region.
- The project has contributed to industry knowledge through rigorous testing and analysis, including full-scale connection testing and detailed seismic modelling. Its open-source findings offer valuable insights for future projects, supporting the continued evolution of timber engineering while advancing industry knowledge and strengthening the reputation of structural engineering.



↙ The timber braced frame is expressed through a distinctive honeycomb facade

© MICHAEL ELKAN



© SALINA KASSAM

↗ Seismic resistance is provided by a two-part timber lateral system, consisting of perimeter timber braced frames with resilient slip friction joints (pictured) and interior balloon-framed CLT shear walls

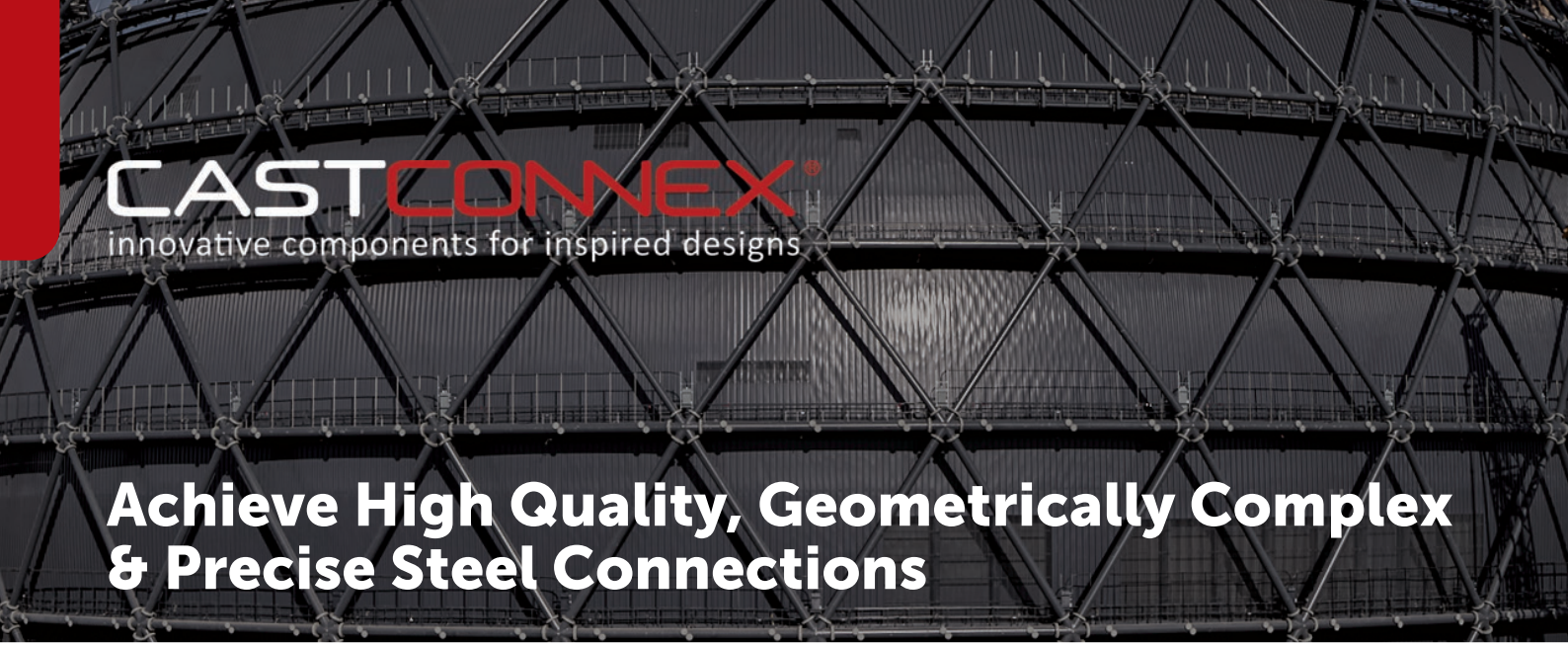


© FAST + EPP

↗ The building provides approx. 164,000sq.ft of high-performance office space with exposed mass timber creating a warm, natural interior environment

JUDGES' COMMENTS

Through the use of timber shear walls and a self-centring seismic system, the project demonstrates how high-performance timber structures can be delivered in challenging environments. What stood out was the way advances in engineering practice and technology have been translated into a building that clearly expresses how it works, making structural principles visible and accessible to a wider audience. As both a technical achievement and a powerful demonstration of engineering in action, the project provides valuable insights for the future of timber construction.



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Improved constructability

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Cast steel components provide precision and accuracy at a level that is unachievable via conventional fabrication, improve site fit-up, and reduce rework costs and the associated delays. Castings can be designed to eliminate the need for field welding.

Improved fatigue life

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Aesthetics

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Location Gwynedd, UK

Boston Lodge Works

Awarded for using structural engineering to strengthen communities, skills and heritage conservation.

PROJECT TEAM

- ➜ **Structural designer:** Integral Engineering Design
- ➜ **Client:** Ffestiniog & Welsh Highland Railways
- ➜ **Principal contractor:** OBR Construction
- ➜ **Architect:** Thread
- ➜ **Key contractors:** C2 Safety, E3 Consulting Engineers, Greenwood Projects

IN BRIEF…

- The Ffestiniog Railway is the world's oldest narrow-gauge railway and holds international heritage significance as a pioneer of steam power, recognised as part of the UNESCO Slate Landscape of Northwest Wales. Boston Lodge Works is the heart of the organisation, with hundreds of volunteers working alongside professional craftspeople to maintain the historic steam engines and carriages, bring derelict engines back into use, and even build new carriages.
- The project refurbished, repaired, adapted and extended existing buildings to provide improved facilities for staff and volunteers. It has allowed the site to be opened to visitors for the first time, showcasing the history of the site and railway, offering deeper insights into its pivotal role in Welsh railway and slate heritage through guided tours, talks and hands-on skills training.
- Working carefully with the architect and client, the structural engineers reduced the proposed carbon footprint by 25% (13tCO_2e) by making more efficient use of existing buildings and reducing the amount of new-build required.
- Construction was tendered at national level but the client chose a local contractor, based just 36 miles from the site, to carry out the work. The contractor had less conservation experience than others, which increased the need for the consultants to ensure conservation standards were maintained.



© FFESTINIOG & WELSH HIGHLAND RAILWAYS

Wherever possible locally sourced timber and slate (for both walling and roofing) were used

> "THE PROJECT HAS CREATED OPPORTUNITIES THAT EXTEND WELL BEYOND THE CONSTRUCTION PHASE

JUDGES' COMMENTS

This heritage refurbishment demonstrates how structural engineering can generate meaningful social value alongside conservation outcomes. Through extensive involvement of volunteers, apprentices and local contractors, the engineering solutions were shaped to support both the conservation of an important heritage asset and the people who will continue to care for it. By prioritising local skills, materials and supply chains, the project has created opportunities that extend well beyond the construction phase. The project shows how engineering can make a positive community impact and preserve important heritage.



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The project touched nine buildings across the site



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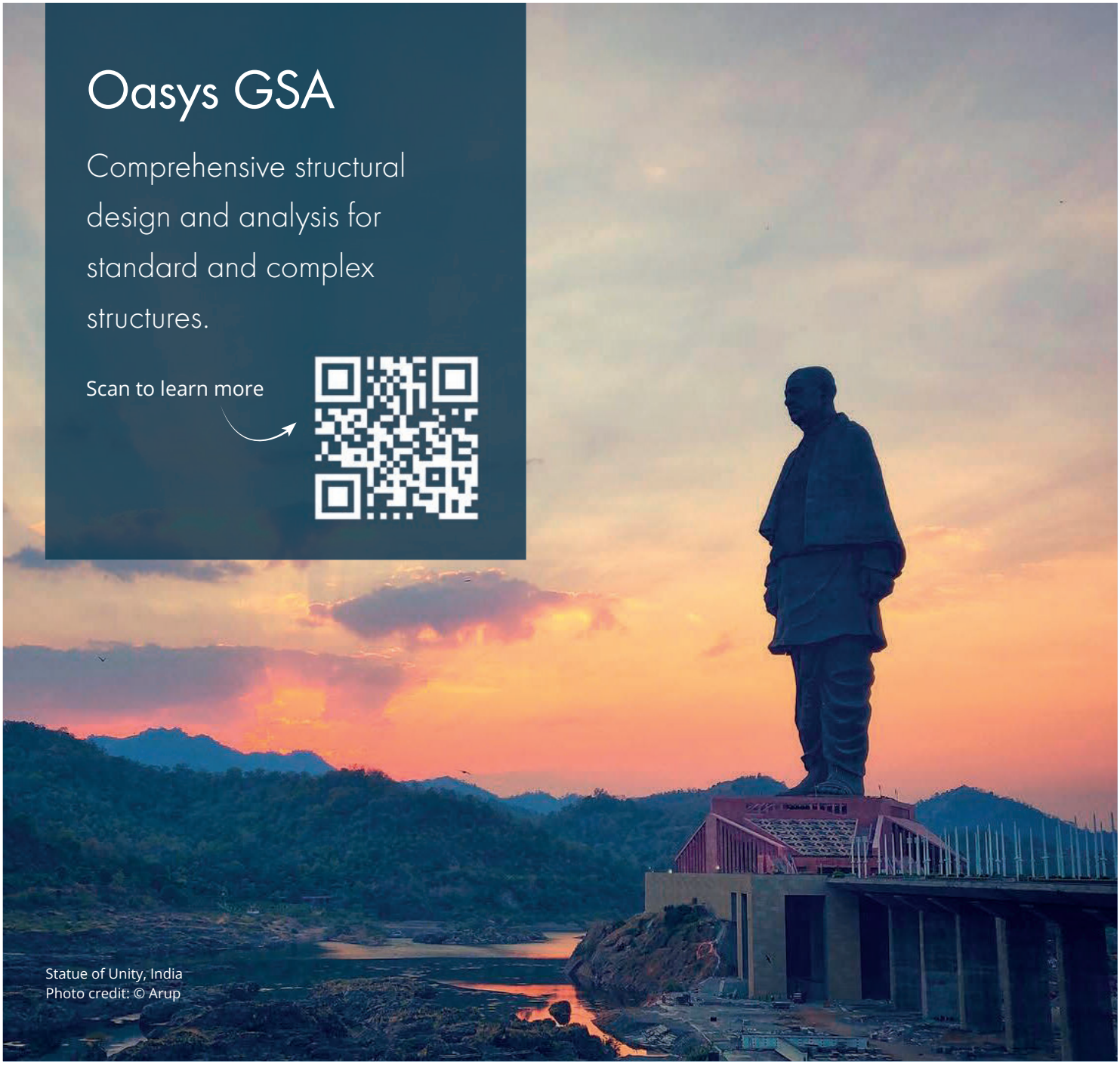
Much of the work undertaken, including repairs and adaptions to suit changing needs, was undertaken by the volunteers and staff

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Location Østbirk, Denmark

Timber warehouse transformation

Awarded for demonstrating circular economy principles through exceptional retention, reuse and adaptation.

PROJECT TEAM

- **Structural designer:** Søren Jensen Consulting Engineers
- **Client:** VELUX
- **Principal contractor:** KG Hansen
- **Architect:** Praksis Architects
- **Key contractors:** BRIQ, ETBLÅ

IN BRIEF...

- The transformation of a former timber warehouse into an innovation hub places sustainability, innovation and user wellbeing at its centre. Based on adaptive reuse, the project preserves the primary timber structure while integrating daylight and fresh air to create a healthy indoor climate. It demonstrates how future construction can be found within existing buildings, uniting materials, structure and architecture in an integrated solution with reduced environmental impact.
- The existing building consists of a distinctive structural system composed of glulam frames, solid glulam beams and lattice girders, all of which have been retained and reverified in accordance with current standards. The entire loadbearing timber structure has been re-analysed and documented in relation to the revised load conditions and new building use.
- Internally, a new independent and self-stabilising three-storey glulam structure has been incorporated, consisting of a column-and-beam system supporting simply supported timber deck elements. This new structure is structurally independent yet coordinated with the existing building, enabling large, flexible spatial layouts without imposing unnecessary loads on the original structure.

JUDGES' COMMENTS

This adaptive reuse project places circular economy principles at the heart of the design process. Judges praised the extensive retention of the existing structure, the reuse and recertification of materials, and the thoughtful incorporation of salvaged elements into new applications. Existing structural logic was respected and enhanced rather than replaced. Through careful engineering and a clear sustainability strategy, the project demonstrates how refurbishment can dramatically reduce embodied carbon while creating a high-quality contemporary workspace.

ADAM MØRK



The existing 9,000m² timber warehouse has been converted into a 14,000m² space with office facilities, meeting rooms, laboratories and more

Adam Mørk



The numerous rooflights and their varied placement are integrated into the roof structure, creating differentiated daylight conditions that change with the weather and seasons

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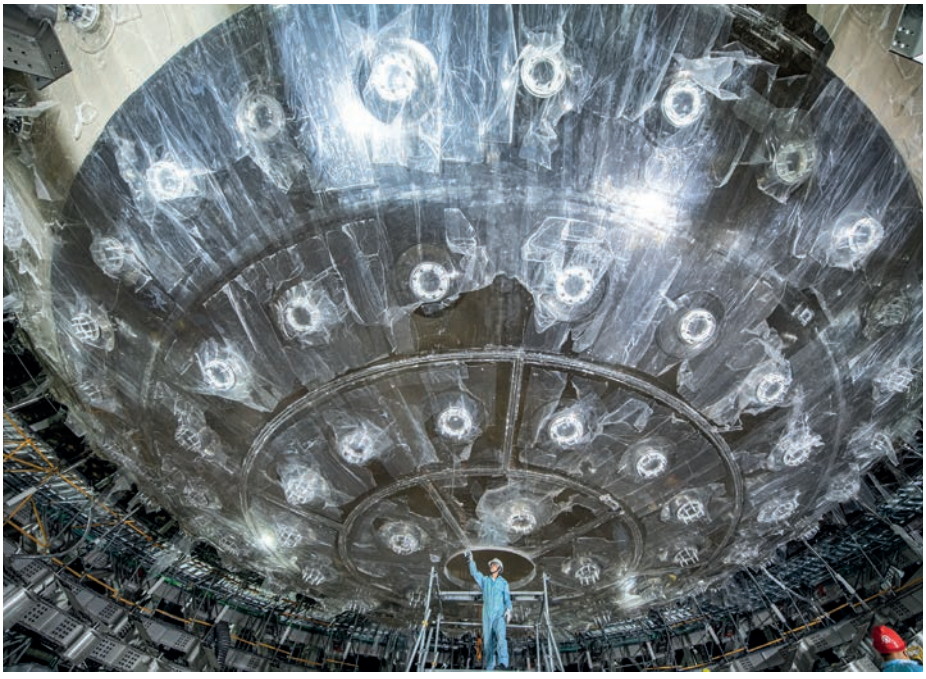
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Location Guangdong, China

Jiangmen Underground Neutrino Observatory central detector

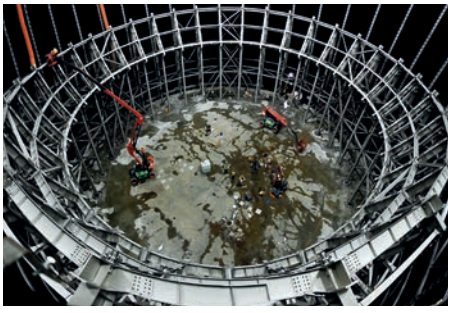
Awarded for enabling world-leading scientific research through exceptional structural engineering innovation.



The JUNO detector is housed in an acrylic sphere suported by a stainless steel lattice structure



The facility is fitted with 45,000 photomultiplier tubes for neutrino signal detection



The shell is supported by lattice columns at the equator

ALL PICTURES: INSTITUTE OF HIGH ENERGY PHYSICS, CHINESE ACADEMY OF SCIENCES

PROJECT TEAM

➜ Structural designer:
Beijing Institute of Architectural Design (BIAD)

➜ Clients:
Institute of High Energy Physics Chinese Academy of Sciences

➜ Principal contractors:
Donchamp (Jiangsu) Materials Technology Co., Ltd
Zhejiang Southeast Space Frame Co., Ltd

➜ Key contractors:
China Academy of Building Research
Dongguan University of Technology
Fujian Longxi Bearing (Group) Co., Ltd
Jiangsu Tianmu Construction Group Co., Ltd
Sun Yat-sen University
The Fourth Research and Design Engineering Corporation of CNNC
Tsinghua University
Zhejiang University

IN BRIEF…

→| Designed to determine the neutrino mass hierarchy and conduct frontier scientific research, the Jiangmen Underground Neutrino Observatory (JUNO) houses a central detector in a water pool 700m underground – the world's largest liquid scintillator detector. JUNO is the world's first operational next-generation ultra-large-scale, high-precision neutrino experimental facility.

→| Material selection prioritised durability and ultra-low radioactivity. The acrylic sphere has a 120mm wall thickness and weighs approx. 600t. The lattice shell, lattice columns and struts are fabricated from S30408 austenitic stainless steel (total 900t), delivering excellent corrosion resistance to meet the 30-year design service life requirement in the ultrapure water environment.

→| During installation, spherical plain bearings at strut ends enabled hinged connections for easy alignment. After installation, bolts were tightened to lock and convert joints to rigid connections, enhancing structural stability. Nonlinear stability analysis considering various installation imperfections indicated a structural stability factor of 3.45, satisfying design requirements.

→| The world's first large-scale composite structure combining an acrylic sphere with a stainless steel lattice shell provides a new design paradigm for large scientific detectors, deep-sea equipment and special storage vessels.

JUDGES' COMMENTS

This extraordinary facility demonstrates the vital role of structural engineering in enabling world-leading scientific research. Located 700m underground, the project required the design of a highly complex acrylic and stainless steel composite sphere subject to demanding operational, seismic and construction requirements. By solving unprecedented technical challenges in a high-consequence environment and demonstrating exceptional collaboration between engineers, scientists and international partners the project advances both scientific knowledge and structural engineering practice.