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NSC

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17

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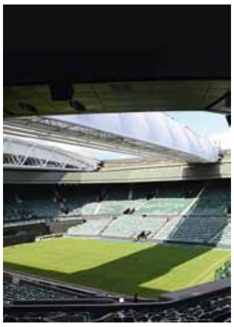
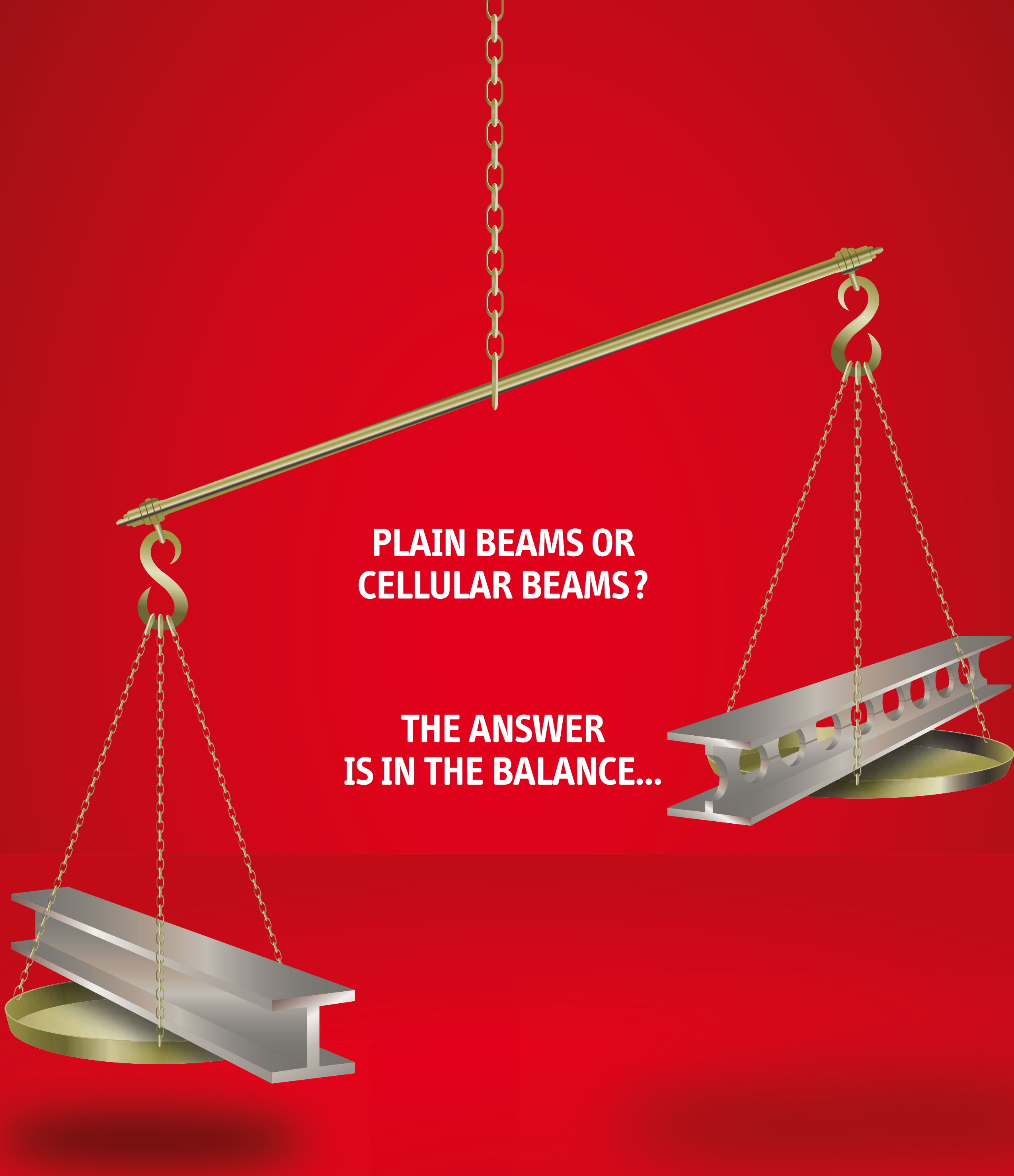
Cover Image
Wimbledon Centre Court Redevelopment
Client: All England Lawn Tennis Club
Lead Concept Designer: Bianchi Morley
Steelwork contractor: Watson Steel Structures





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SCI

Time for construction to speak up

The steel construction sector can feel justifiably proud of itself having just staged a Structural Steel Design Awards event that was a first class showcase for the best that it can achieve. The judges admitted that the quality of those gaining Awards was excellent, and that not a lot separated those on the 22 strong shortlist from those that gained the ultimate accolade.

What was particularly impressive to the judges – a group of architects and engineers with first hand experience at the front line of delivering prestige projects like the SSDA entries – was the variety of project as well as their obvious quality. Wimbledon's Centre Court Redevelopment has captured most of the headline interest with its already famous closing roof, and it could hardly be more different from its fellow Award winner the Xstrata Aerial Walkway at Kew. Commercial, education, and infrastructure projects gained the other Awards. Projects from sectors as diverse as transportation, corporate headquarters, factories, museums, bridges and energy plants also featured in this year's awards.

With the construction sector reeling under dramatic falls in workloads the question inevitably arises in some people's minds what the impact will be on award scheme entries for the next few years. The recession seems to be bottoming out, but there are few confident predictions being made that this means things will get much better for construction anytime soon.

All that might change of course with the next quarter's economic statistics, and the gloom merchants will be forced to beat retreat. But rather than wait for recovery the construction industry can do some things to help create its own recovery. The obvious things are a greater than ever focus on efficiency, which will be to the benefit of steel with its consistently better value product and increased construction programme certainty, as well as all the other benefits like sustainability.

Speaking at the Awards ceremony (see News) Corus Chief Executive Officer Kirby Adams suggested another tactic, urging the industry to up the pressure on government to bring forward investments that will help lift construction out of the mire and place the UK on a sounder footing to benefit when recovery comes. Corus has a voice that government hears, he said, but so do all the other companies in the industry as well as all the individuals who work in it. It's clearly time for government to stop talking and start acting, but maybe we should all think about making our voice heard.

Nick Barrett - Editor

STRUCTURAL STEEL DESIGN AWARDS 2009

Award winners delight their users

The Structural Steel Design Awards has entered its fifth decade with a quality of entries the match of anything seen in the scheme's 41-year history, said Chairman of the Judges David Lazenby at the 2009 awards ceremony.

Awards were presented by Corus Chief Executive Officer Kirby Adams during a well attended ceremony hosted by television presenter Gabby Logan at London's Science Museum, on 9 July. Mr Lazenby praised the standard of all 22 shortlisted entries, all of which were visited by judges, including those that did not achieve the accolade of one of the awards.

The five Award winners were Cabot Circus Roof, Bristol; Oxford University Biochemistry Building; Xstrata Aerial Walkway, Kew; Castleford Footbridge, Yorkshire; and Wimbledon Centre Court Redevelopment.

"It is never easy to reach the necessary judgements," Mr Lazenby said, "but this year we have selected five Award winners, six Commendations and four Merits for particular aspects of those projects. They are all praiseworthy – they demonstrate that steel is the structural material of choice, and they all have the characteristics of serving the client well, and delighting the users and the public."

Praising the short list for the variety of projects, which included entries from city centres and one on the top of a mountain, Mr Lazenby added:"We have blockbusters and little gems, ranging from the heroic to the delicate. We continue to see good results of traditional methods of project procurement, but we have also recognised some fine examples of design and build."

Mr Lazenby congratulated all the project teams, including the clients whose satisfaction is essential as we face such challenging times. More than ever, we see real constructive teamwork contributing to the successes."

The judging panel also came in for praise for their hard work and for making tough choices. Mr Lazenby concluded by hoping the winning projects would inspire the industry, generate continuing success in these very tough times, and encourage future submissions to the Award scheme.

BCSA President Jack Sanderson concluded the ceremony, praising all of the entrants for the achievenments represented by their projects. 'They reflect a steel construction sector that is vibrant and innovative," he concluded.

Mr Sanderson presented BCSA Deputy Director General Gillian Mitchell with a bouquet of flowers to mark the association's appreciation of her 25 years service, during which she was made Member of the Order of the British Empire in recognition of her services to the industry.

Chairman of the Judges, David Lazenby

Host, Gabby Logan

Gillian Mitchell receives a bouquet of flowers from BCSA President, Jack Sanderson

Awards

- Cabot Circus Roof, Broadmead, Bristol
- Oxford University Biochemistry Building
- Xstrata Aerial Walkway, Kew
- Castleford Footbridge
- Wimbledon Centre Court Redevelopment

Commendations

- Ryanair Hangar, Stansted
- No 2 Spinningfields Square, Manchester
- New Academic Building, London School of Economics
- 201 Bishopsgate and the Broadgate Tower, London
- Cabot Circus Footbridge, Broadmead, Bristol
- A2/A282 Dartford Improvement Scheme

Certificates of Merit

- The Weather Room, Monken Hadley
- Hafod Eryri, Snowdonia National Park
- Unilever House, Leatherhead
- Lakeside Energy from Waste Plant, Colnbrook

All photos on this spread: © Joanna Plumbe Photography

The award winning teams

Cabot Circus Roof. Broadmead, Bristol

Oxford University Biochemistry Building

Xstrata Aerial Walkway. Kew

Castleford Footbridge

Wimbledon Centre Court Redevelopment

Students show design innovation

The Corus Student Design Awards once again revealed the depth of architectural and engineering talent that is coming through UK universities and colleges, said Corus Chief Executive Officer Kirby Adams who presented the prizes. "The future of steel construction design looks secure, judging by the standard of this year's entries," said Mr Adams. "The winning teams showed a high level of innovation and design skill, with a developed appreciation of what steel can achieve. My congratulations go to them all."

Prizes were presented at an awards ceremony held at London's Science Museum to undergraduates from the University of Southampton, Cardiff University and Manchester School of Architecture. The awards, organised by Corus, supported by the Steel Construction Institute, the British Constructional Steelwork Association and others, were created by Corus to acknowledge excellence in steel design.

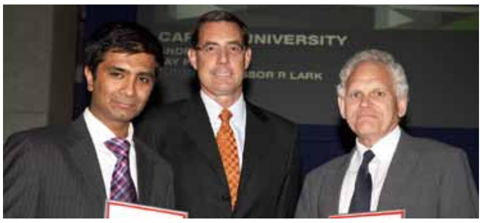
The Structures prize went to the University of Southampton whose entry comprised a series of trussed arches that the judges panel, chaired by Alan Jones of SKM anthony hunts, said has real architectural presence. Cardiff University was awarded the Bridges prize, with the judges chaired by Barry Mawson of Capita Symonds commenting particularly on the good conceptual design of the approach spans, and good clear drawings. Manchester School of Architecture's entry was described by the judges panel, chaired by David Bonnett of David Bonnett Associates, as terrific and very elegant, and was an idea that had not been seen before.

The brief for the Bridge entries was to design a structure to carry a dual carriageway over a grade separated interchange with a motorway. An elegant structural solution had to be produced, demonstrating sound engineering and structural design skills.

For the Structures award students had to produce an outline design for a structure to enclose a winter sports facility, including an artificial ski slope, an ice skating rink and a climbing wall. Individuality and flair were among the qualities looked for.

The design brief for the Architecture award was to produced a design for Community One, a 'vertical community' where people would live, work and use leisure facilities under one roof instead of increasing pollution through travelling.

Winners – Structures University of Southampton. L-R: Rohan Mehpa, Mark Eaden, Paolo Faccioli, Laura Lee, Dr Mike Byfield and Kirby Adams



Winners – Bridges Cardiff University. L-R: Jay Patel, Kirby Adams and Professor R Lark

Winners – Architecture Manchester School of Architecture; Romulus Sim (centre right), with his tutors Harriet Harris (centre left) and Siobhan Barry (right). Kirby Adams is to their left.

AROUND THE PRESS

Building
29 May 2009
Supersize me
The (Dallas Cowboys) stadium has the longest single span roof structure in the world, with two monumental arches, each a quarter of a mile long, measuring 35ft deep by 17ft wide and weighing 3,225 tonnes.

The Structural Engineer
2 June 2009
Library wins award
The New Wymondham Library takes the form of a three segment fan constructed using a hybrid glue laminated timber and steel frame that radiates from the cylindrical rotunda.

Building
19 June 2009
Made in Taiwan
(Kaohsiung Stadium) As well as winning points for sustainability, it is also a beautiful feat of sports architecture. The roof is made of helical-shaped steel pipes, supported on 159 structural trusses, curving round a rough semi-circle and resembling a sinuous snake.

The Structural Engineer
16 June 2009
Victoria Square, Belfast
A series of two-storey deep hybrid Vierendeel trusses, which span up to 28m, provide column-free access for up to 18 delivery vehicles within the service yards at ground floor level.

Contract Journal
24 June 2009
London 2012 Olympic Stadium
Steel is being used sparingly - 10,000t compared to the 47,000t required for Beijing - which is in keeping with the recyclable quality of the venue.

Time for action on investment

Corus Chief Executive Officer Kirby Adams has called on government to support construction by increasing infrastructure investment and bringing projects forward. Speaking at the Structural Steel Design Awards ceremony where he presented the awards Mr Adams said the time for government to act to help reverse the recent fall in demand for the industry's products was now.

Mr Adams called on the audience to increase pressure on government to help reverse the decline. He said: "Corus has a voice in government as one of the construction industry's biggest employers and so do you.

"We desperately need investment in infrastructure to be increased and brought forward. As in many developed countries, much of the UK's infrastructure needs upgrading or replacing. Our towns and cities would benefit from greater spending on steel-intensive, environmentally beneficial initiatives such as urban transport. And we need a government strategy to enable this world-beating British steel fabrication industry to benefit as soon as possible from the expected investment explosion in renewable energy projects."

Mr Adams said the advent of the Eurocodes opens up tremendous possibilities for the UK to export its steel design competence and increase the use of steel on the continent to levels similar to the UK, where the market share of steel in construction is the highest in the world, with over 70% of multi storey buildings for example framed in steel.

He said that one of the first things that struck him about construction when he took over as CEO earlier this year is the closely-knit steelwork supply chain, and this partnership was a key reason behind the UK having the most steel-intensive construction industry in the world.

BCSA ready to respond

New BCSA President, Jack Sanderson, (left) and Deputy President, Ivor Roberts (right)

New BCSA President Jack Sanderson cut through the economic gloom surrounding construction with a prediction that association members will be well placed to respond quickly when recovery comes.

Speaking at BCSA's Annual Lunch Mr Sanderson also announced a raft of new publications and technical and marketing initiatives being undertaken by the association alone and in partnership with Corus. He said: "The underlying demand for steel construction remains strong and members are well placed to respond quickly to the recovery.

"I am pleased to report that BCSA is in good shape and, despite the difficult year ahead, I look forward to the future with confidence." Health, education, power and infrastructure sectors were holding up, he said.

Mr Sanderson outlined a busy programme of work by BCSA to support regulatory as well as market changes. He announced publication of a new guide to the reasons for specifying a BCSA member or associate member. A new Guide in the Health & Safety series, for the Management of Site Lifting Operations, was announced.

BCSA's website - *www.SteelConstruction.org* - has been redesigned and the new site was launched on the day of the Annual Lunch. A new Guide to the Routes to CE Marking was launched and a CE Marking edition of the NSSS is currently in preparation, with a series of seminars introducing this publication planned for later this year.

Mr Sanderson said the first major zero carbon outputs from a joint market development project with Corus, Target Zero, will be published in September.

BCSA lobbies for improved Construction Act

After a number of years of lobbying and campaigning, the changes to the Construction Act contained in Part 8 of the Local Democracy, Economic Development and Construction Bill are reaching their completion in the House of Commons. The Bill completed Committee stage on 18 June and at the time of going to press, is waiting for Report stage.

At every stage, BCSA members and its SEC Group colleagues have sought support from politicians and senior civil servants to amendments to Part 8 to improve the bill.

Marion Rich, BCSA Director of Legal and Contractual Affairs, said: "BCSA members have been very active in lobbying their MPs and other representatives. The positive response to this has allowed SEC Group to send briefing material to over 200 MPs."

BCSA and SEC Group continue to ensure that amendments are laid at every stage of the process with a view to improving the bill.

School timetable dictates construction programme

New buildings for Catford High School in south London have been completed, with all building work having been coordinated around the school's timetable in order to minimise disruption.

"The site was adjacent to the existing school in the middle of a residential area and so security and delivery times had to be programmed to create minimal upheaval to students and residents," said Charlie Rowell, Bourne Steel Divisional Operations Director.

All steelwork was delivered to site 'piece small' and timed to arrive either before or after the busy school opening and closing times.

The build sequence also had to be sequenced around the demolition of the existing old school buildings.

"Part of the new school was initially constructed and handed over," explained Mr Rowell. "Once the school had vacated the redundant buildings, they were demolished clearing the ground for the construction of the rest of the new build."

Working on behalf of main contractor Costain, Bourne Steel erected approximately 300t of structural steelwork for the job. The works consisted of a series of blocks, including a sports hall, dining hall and drama hall, all linked by a covered street.

Cultural centre for west London

Located adjacent to the Grand Union Canal and the A40 Westway flyover, a new cultural hub in west London known as Great Western Studios is set to be fully occupied this August.

The scheme involves refurbishing an old canalside warehouse into studio and exhibition spaces for more than 100 artists, designers and craftspeople. Spread over three floors the building will contain 91 studios, a cafe and an exhibition gallery area.

Working on behalf of main contractor Readie Construction, Atlas Ward Structures has fabricated and erected nearly 200t of structural steelwork for the project.

NEWS IN BRIEF

Cairnhill Structures has taken delivery of a **FICEP** Close Coupled CNC Sawing and Drilling line, a system which includes high speed carbide drilling. The line utilises scribing technology which complements the company's existing FICEP CNC punch. The scribing attachment is extremely versatile and automatically marks all reference points, including fit up lines and reference point indication for all fittings.

AceCad Software has launched StruM.I.S .NET V7.3 its latest version of the management information system for steelwork fabricators. A new feature is Transaction Interfaces which allows users to integrate purchase and sales invoices together with internal organisational costs and expenses into a number of third party software accounting systems. The new software contains a number of other new features and over 150 enhancements. For more information visit *www.acecadsoftware.com* email *sales@acecadsoftware.com* or Tel: 01332 545800.

Metsec is supplying lattice trusses and purlins for roofing, and its site fixed Steel Framing System (SFS) for infill walling, for an environmentally friendly fire station project in Rayleigh, Essex. The innovative architectural scheme incorporates a single storey four bay garage, a training tower, and a two storey administration and accommodation block.

Tool manufacturer **Hilti** is offering trade-ins via a new 'Hilti Scrappage Scheme,' which runs for one month commencing 1 July 2009. The scheme allows customers to exchange competitor tools, whether they are in good working order or broken. For more information Tel: 0800 886 100 or visit *www.hilti.co.uk*

Olympic size order for metal flooring

Composite Metal Flooring (CMF) is manufacturing and installing the specialist flooring for the £1.45bn Westfield Stratford City development which is adjacent to the Olympic Park in east London.

The company will eventually supply 350,000m² of composite metal flooring for the new shopping centre which is due to open in 2011. The project will be the retail heart of one of the largest urban regeneration projects ever undertaken in the UK.

CMF Operations Director Stephen Haines (pictured) said the contract is the largest and most prestigious to date and he is pleased to report it is on target, on time, on budget and due to be complete in November 2009.

Last year CMF opened its own manufacturing plant near Pontypool on land bought from the Welsh Assembly Government. This was part of a development agreement that ensured the building was constructed to BREEAM sustainable standards which is an important consideration for companies supplying Stratford City.

Bridge opens up redevelopment for Gloucester

The new £10M High Orchard lift bridge, which forms an important route into the massive Gloucester Quays redevelopment scheme has recently opened. Completed by a joint venture involving English Partnerships, British Waterways and developer Peel Holdings, the single span bridge, with an electro-hydraulic movable deck, has created a spectacular landmark on Gloucester's skyline.

The steel bridge deck was supplied and erected by Rowecord Engineering and measures 28m long x 16m wide. It weighs around 200t, with an additional concrete and steel 100t counterweight in the tail section of the bridge.

Davy Markham was contracted by civil engineering contractors Alun Griffiths to design and manufacture the mechanical, hydraulic and electrical elements of the bridge, notably the main pivot bearings, deck operating system and tail locking assemblies.

The bridge deck rotates 69 degrees around a horizontal axis, to allow entry to a 12.5m wide navigation channel.

Steelwork provides a new home for rare breeds

Phase one of the construction of a new visitor centre and attached animal enclosures at Twycross Zoo in Warwickshire has been completed by a project team including Adey Steel and Kier Marriott.

The initial works included the erection of a steel-framed single storey Visitor Welcome Centre to be known as Himalaya. This predominantly beam and column structure measures 72m by 42m and required approximately 200t of structural steelwork.

The building will include a 300 seat restaurant looking out onto a Himalayan mountain scene with resident snow leopards.

"The leopard enclosure forms part of our second phase of works," explained Eric Gaunt, Contract Manager for Adey Steel. "The tension structure will be formed by tubular columns and restraint guys with stainless steel netting draped over it."

On the opposite elevation another enclosure, housing a wetland aviary with wading birds, will be constructed in a similar manner.

The use of local, sustainable materials, ground source heating and landscaping to attract native biodiversity are fundamental to the job. The visitor centre will feature a pitched roof topped with sedum helping blend into its green environment.

Zoo Director Suzanne Boardman said: "We are really excited about the new centre. This is a major development and is one of a number of improvements to be completed to attract more visitors and support our bid to make Twycross Zoo the best zoological society in the world."

Diary

For all Corus events visit www.corusevents.com tel: 01724 405060 email events@corusgroup.com

5 August 2009
Steel: the Show 2009
The Belfry, Birmingham
Numbers limited. Free

6 August 2009
Steel: the Show 2009
Eastwood Hall, Nottingham
Numbers limited. Free

201 BISHOPSGATE AND THE BROADGATE TOWER, LONDON

Structural Steel DESIGN AWARDS 2009

Every year the Structural Steel Design Awards demonstrate that steelwork is the structural material of choice for so much of our built environment.

This year the entries again show how project teams successfully exploit the aesthetic, technical and economic benefits of steel. The judges have been impressed by the range of types and sizes of projects submitted, and the intelligent team collaborations which have proved successful on them, both public and private. Whether in buildings or bridges, large or small, the quality of the short-list and particularly the winners is outstanding. Also, in a world which is increasingly concerned with the demands of sustainability, steel is seen to have strong green credentials.

The Awards celebrate excellence in concept, design and execution of a wide range of projects. They are beacons of success in a challenging world.

D W Lazenby CBE DIC FCGI FICE FIStructE
Chairman of the judging panel.

AWARDS

THE JUDGES

Chairman of the Structural Steel Design Awards judges **David Lazenby** CBE had a distinguished career as a consulting engineer before taking a new turn in the late 1990s to give British Standards new focus and direction. He also led the huge pan-European exercise to develop the Eurocodes, as Chairman of the lead European committee.

David Lazenby's career began with Balfour Beatty in 1959. In 1964 he moved to consultant Andrews Kent & Stone, where he stayed for 30 years and became managing partner and subsequently a director. In 1990–91 he was one of the youngest ever Presidents of the Institution of Structural Engineers.

In parallel he had become involved in developing codes and standards, advancing from technical committees and sector boards to become a non-executive director of BSI Group. In 1997 he became the Director of British Standards, one of three executive directors responsible for over 5000 staff in 100+ countries, and a budget of £300+M.

His experience both as a user of standards and as a committee and board member helped him to bring a new focus on market relevance and he is credited with bringing global success to the organization. Establishing it as a world leader in its field, as well as making it profitable, has been almost unique among national standards bodies.

Since 2003 he has operated his own consultancies, Eurocode Consultants Ltd. and DWL Consultants Ltd. He is currently advising on a major project in Abu Dhabi.

Martin Manning is an Arup Fellow and a Director of Arup. He joined the firm directly from university and during the last 40 years has worked in Arup offices, and on projects, around the world. More recently he has worked on airport terminal buildings and railway stations. He is currently engaged on a large mixed-use development in central London. He is the current Chairman of the SCI, a Member of The Institution of Structural Engineers and a Fellow of the Royal Academy of Engineering.

Gerry Hayter has spent his career in transport, mainly in London. He joined London Underground as a civil engineering graduate in 1975, working on the design of railway bridges, lifts and stations. After 10 years he joined the Bridges Engineering Division of the Department of Transport where he developed new standards for the design, assessment of highway bridges and structures for 40 tonne lorries. In 1994 he joined the London Network Management Division of the Highways Agency, responsible for the maintenance of highway structures in West London. A number of senior technical posts at the agency followed, culminating in his present position as Group Manager of the Research and Standards Management Group, with responsibility for the development of the Agency's £12m research programme.

Christopher Nash is Managing Partner of Grimshaw Architects. He graduated in 1978 from Bristol University School of Architecture, and joined Grimshaw in 1982. As an architect he was responsible for many of the practice's high profile buildings. These include - from his early years - the Financial Times Printing Works in London's Docklands and the British Pavilion for the Seville Expo 92, The Western Morning News headquarters in Plymouth, the RAC Regional Headquarters in Bristol and many other projects. Having spent ten years as Managing Partner, Chris has recently returned to leading projects. Following the success of the Zurich Airport fifth expansion project, he is currently Partner in charge of the team designing the five projects comprising the Gatwick Airport South Terminal modernisation.

Joe Locke retired in 2004 from his position at William Hare, where he was responsible for the engineering aspects of the company's activities and also Executive Director of subsidiary Westbury Tubular Structures; having previously retired in 1998 as Chief Executive Officer of Watson Steel. Joe was an apprentice with Watson and sat his associate membership of the Institution of Structural Engineers at only 23. Joe worked at home and overseas on a considerable number of high prestige contracts, including Sellafield nuclear power station's massive thermal oxide reprocessing plant and the terminal building of Kansai airport, Japan. Joe Locke was awarded an MBE in 1990 for his contribution to the structural steelwork industry.

Oliver Tyler joined Wilkinson Eyre Architects (WEA) in 1991; he became an Associate in 1997 and then a Director in 1999. He has over 23 years experience in architectural practice and extensive experience in leading and coordinating the design and construction of buildings.

Oliver has led a number of prestigious projects at WEA including Stratford Market Depot and Stratford Regional Station in London for the Jubilee Line Extension; the Dyson Headquarters in Wiltshire and the Arena and Convention Centre in Liverpool – the centrepiece for the city's 2008 Capital of Culture celebrations.

He is currently Director in charge of the Crossrail Liverpool Street Station Project, the new Regional Headquarters for Audi UK in London and a number of other major commercial developments.

Bristol's new £500M mixed-use development incorporates a unique collection of slender gridshell and barrel vaulted glass roofs.

Fact file

Architects: *Chapman Taylor; Benoy*
Artist for the Roof Forms: *Nayan Kulkarni*
Structural engineer: *SKM anthony hunts*
Steelwork contractor: *SH Structures Ltd*
Main contractor: *Sir Robert McAlpine Ltd*
Client: *The Bristol Alliance*

The Cabot Circus retail development incorporates free-form vaulted and shell shaped glass and steel roofs with a combined area of 5,850m^2. These stunning and eye-catching elements have been designed as a series of ten interlocking glazed undulating panels, spanning up to 55m in places.

Early in the design process the proposed roofs became divorced from the intended building elevations. This called for a complex geometry study and involved realigning of the roof geometry without compromising the artistic intent and achieving support from adjacent structures.

"Once we became involved in the project our brief was to turn the architect's vision into something buildable, while maintaining a free-form fluid design for the roofs," says Tim Roe, Technical Director at SKM anthony hunts.

There are ten roofs in total, the largest being the atrium which has a maximum span of 55m and an average span of 40m.

"The atrium roof is formed with a toroidal grid which has a high degree of repetition that provided significant fabrication benefits, particularly in controlling fabrication and erection tolerances," says Mr Roe.

The grid was also chosen as it provides an aesthetic, practical and structurally economic solution. The other nine roofs in the development are all free form barrel vaulted structures.

A primary consideration in the roof design was the support performance provided by the buildings. Since each roof was supported by more than one independent building structure, the designs needed to accommodate differential building movements. This involved detailed consideration of the stiffness of the boundary condition, and the movements imposed by it, to evaluate the safe capacity of the arches and shells. Elastic supports were determined and then used in the calculation of all subsequent design forces, global capacities and support reactions.

The atrium roof was fabricated by cutting the tubular steel with square ends and then welding to precision machined solid nodes. The roofs were divided into transportable 'ladder' frames that were two bays wide and approximately ten bays long. The frames were made as large as possible to limit the amount of site welding and to reduce the number of deliveries.

These fabricated frames were craned onto a full birdcage scaffold covering the entire 2,000m^2 of the atrium. On completion of the internal grid, the 355mm diameter circular edge frame incorporating a 450mm wide walk-in gutter profile was positioned and securely supported on the scaffold.

The perimeter members were cut to length on site and welded between the internal grid and the boundary elements, giving tolerance provision. A number of surveys were carried out throughout the assembly of the roofs to ensure the roof nodes were kept within specified +/- 20mm tolerance for any node position.

Each roof was modelled using cutting edge 3D software and the lotting and nesting of the materials was carried out using this 3D model which significantly reduced waste material in fabrication. Waste was recycled to make jigs for future projects or used to manufacture any new sections of the structure.

In summary the judges say the design and execution is of a very high quality.

An iconic building housing a state-of-the art facility, the Oxford University Biochemistry Building provides a functional laboratory space alongside a high quality working environment.

The new Biochemistry building for Oxford University is a striking example of contemporary design co-existing with a host of historic buildings.

The design of the building incorporates a large central atrium which includes secluded study alcoves, footbridges and communal areas ensuring an interactive functional yet personal atmosphere.

Oxford University insists on a highly sustainable approach to its developments and the Biochemistry building's atrium helps draw in cool air at basement level and venting warm air at roof level, aided when necessary by waste heat recovered from laboratory ventilation. It also provides large quantities of natural daylight, right down to lower basement level, while photovoltaic panels on the atrium roof feed into the energy requirements of the structure.

A number of constraints had to be considered including a congested site in a city centre, surrounded by operational buildings and basement excavation adjacent to Grade I listed buildings.

"Reduced transport of materials and the ability to achieve anytime deliveries tipped the balance towards a steel structure," says Fergal Kelly, Project Engineer for Peter Brett Associates. "The use of top-down construction for the basement with the steel frame connected at basement slab level provided high speed installation of the permanent steel structure propping the secant walling."

Top down construction of the project's two level steel-framed basement placed severe constraints on the installation of steel columns within plunge piles. "However, the piling and steelwork contractors rose to the challenge and produced 18m long plunge columns with a typical plan tolerance at the top of the cantilever of +/-10mm," says Dr Kelly.

Temporary propping of the secant piled retaining wall was achieved with permanent steel beams prior to the slab pour.

Importantly, CO_2 audits of various framing solutions showed that a steel composite frame produced the least CO_2 emissions as well as the lowest haulage emissions. This helped the client and team decide that steel framing was beneficial on a number of levels.

Ventilation requirements and a high density of ancillary services required a structure that facilitated services to an unusual degree. A hybrid parallel beam configuration was used where steel framing was split into two orthogonal levels.

"This system provided the shallowest and most economical floor zone while ensuring that future refit of services is made easier by the continuous dedicated service zones in two directions," says Dr Kelly.

The service void system also included a grillage of continuous beams which enhanced structural efficiency, provided a natural ability to form the required cantilevers and aided a faster and safer erection process.

In summary the judges say this is a surprisingly airy building and a very effective steel solution to a complex and adaptable structure.

Fact file

Architect: *Hawkins Brown*
Structural engineer: *Peter Brett Associates*
Steelwork contractor: *William Hare Ltd*
Main contractor: *Laing O'Rourke*
Client: *Oxford University Estates Directorate*

Since opening in May 2008 Kew Gardens' aerial walkway has been a complete success delighting thousands of visitors with its treetop views.

Fact file

Architect: *Marks Barfield Architects*
Structural engineer: *Jane Wernick Associates Ltd*
Steelwork contractor: *W.S Britland & Co Ltd*
Main contractor: *W.S Britland & Co Ltd*
Client: *Royal Botanic Gardens, Kew*

Brilliantly harmonising with its arboreal setting and providing a dramatic elevated view is how the judges descibe the Xstrata Aerial Walkway.

The initial idea for the project came about when Tony Kirkham, Head of Kew's Arboretum decided the Gardens needed a permanent walkway to enable visitors of all ages and physical abilities to experience the tree canopy. It replaces a popular temporary scaffold walkway which was erected during 2003.

Chris Smiles, Associate at Marks Barfield and Project Architect, says the walkway gives an up close experience of bio-diversity as well as blending into its arboreal surroundings.

"We looked at many materials," he says. "But weathering steel was chosen for its strength, appearance and low maintenance, which are all important criteria as this is an environmentally sensitive area."

Weathering steel was also chosen as its colour blends well with nature, yet looks man-made, and needs no future painting.

Overall the walkway consists of a 200m-long looped arrangement of modular trusses, connected by circular node platforms, which in turn are supported by triangular pylons, all of which are fabricated from weathering steel.

The natural environment played a key role in the design of the walkway's 12 trusses. These steel framed 12m long units are designed using the Fibonacci numerical sequence that lies at the heart of many plant structures.

This design has created a seemingly random appearance of truss members, but has an integral strength based on a natural growth pattern.

"Since weathering steel can only be supplied in sheets we chose to fabricate triangular tapered sections that are strongest at the base and branch out to support the walkway," says Jane Wernick, Director of Jane Wernick Associates.

Offsite construction also played an important role in the construction process. The trusses were entirely fabricated offsite and brought to Kew as completed units with all fittings such as timber handrails, expanded metal decking and balustrades attached.

This ensured minimal impact on the surroundings, while pin connections also minimised the need for on-site welding.

Fabricating the complete truss and node sections offsite meant contractor Britland had only to lift them individually into place during the erection programme.

Erecting steelwork among the valuable trees called for the upmost care and accuracy and Britland worked closely with Kew's team, who pulled branches out of the way, and did minimal trimming where necessary.

Summing up the judges say the weathering steel plated structure is precisely located to avoid the trees and their roots, enabling close proximity without damage.

Spanning the River Aire, Castleford's new footbridge unites the town and forms the first phase of a proposed riverscape masterplan.

Wakefield Council funded the £4.8M Castleford Footbridge along with Yorkshire Forward and English Partnerships with the view of creating a safe new pedestrian route between the town's two riverside communities.

Wakefield Council appointed architects McDowell + Benedetti to design the bridge and as it had a fixed vision and the council had a fixed budget, the project was put out to tender as a designed bridge. Costain came on board as the main civils contractor and it in turn brought along engineer Tony Gee & Partners and Roewcord Engineering as structural steelwork contractor.

The erection process of the bridge was quite a challenge explains Graham Pugh, Rowecord's Project Manager. "Access on both river banks for our cranes and for delivery of the bridge deck units was highly restricted.

For maximum safety we wanted to limit the amount of work carried out over water, which meant delivering the deck sections to site in the biggest pieces possible, which in turn meant using some very big cranes to lift them into place. Shoe-horning the cranes and lorries into place between people's homes with inches to spare was, shall we say, interesting."

The bridge is S-shaped in plan, 4m wide and stretches for 130m over three V-shaped piers. A twin steel box girder forms the spine of the structure and it varies in depth around the outer curve in order to counter the span differential.

Circular hollow sections, each topped by a tapering section that terminates in a solid steel machined fork-head, support the box girder deck.

The curved nature of the bridge presented a complex articulation to overcome as the support legs are inclined in two planes and the line of the deck varies over the connection. This challenge was overcome by utilising a complex arrangement of spherical bearings and bimetallic isolation.

The risk of bimetallic corrosion had to be considered in many connections. The bridge is a combination of S355 J2 steel and grade 1.4401 stainless steel, the latter being used for the majority of the architectural features. Isolation was achieved in most locations with nylon pads and top hat washers.

However, the pin arrangement required a harder wearing compound to carry the 100t design load and isolate the Duplex stainless steel pin from the mild steel machined head. This was achieved by inserting a fibre-wound bushing into the connection.

The bridge's main beam was originally a multicell box girder spanning between piers. However, one cell gradually increased in depth and rose out of the decking to form seats between the piers. This provided the extra depth at mid-span to satisfy the maximum bending moment in the structure.

"We needed the extra depth for the longer spans," says Architect Renato Benedetti. "The idea was to create public space in the middle of the river to which the benches were integral. We liked the synergy of needing the depth and turning it into a place to sit."

The judges say the bridge is a triumphal demonstration of infrastructure improving the quality of life.

Fact file

Architect: *McDowell + Benedetti*
Structural engineer: *Tony Gee & Partners LLP*
Steelwork contractor: *Rowecord Engineering Ltd*
Main contractor: *Costain Ltd*
Client: *Wakefield Metropolitan Borough Council*

Image courtesy of the Photo Image Unit

Constructed over a three-year period the steelwork element of the Centre Court redevelopment included the demolition and rebuilding of the East Stand and fixed roof, followed by the construction of a retractable roof to provide full rain cover.

Fact file

Architect: *Populous*
Lead concept designer: *Bianchi Morley Ltd*
Structural designer: *Capita Symonds*
Detail structural coordinator: *Edge Structures*
Steelwork contractor: *Watson Steel Structures Ltd*
Main contractor: *Galliford Try*
Client: *All England Lawn Tennis Club (AELTC)*

The main objectives of the Wimbledon redevelopment project were to provide a roof for the centre court, to condition the space to eliminate condensation and provide a comfortable spectator environment, extend the terraces to provide the maximum possible seating within the existing structure and construct a new East Stand and roof.

Working on this iconic structure over a four year period without causing any impact on the world famous tennis championships was a major design and logistical challenge which was successfully achieved.

"As well as enlarging Centre Court we've also improved the amount of sunlight to areas of the court," says Dale Jennins, Project Architect for Populous.

The main focus of the design was driven by the sequencing around Championships and the requirement for maximising pre-fabrication and pre-assembly of the main steel elements. The main trusses for the East Stand's roof were pre-assembled in an area across the road from the main site. The moving trusses for the retractable roof were designed to be as lightweight as possible by forming a deep lattice truss using tubular sections.

The third year of works presented the largest risk with no default position for major elements. The work completed in years one and two was all about securing delivery in the third year. By year four the project team was in a position to complete the retractable roof with erection commencing immediately after the 2008 Championships. This allowed ample time not only for the construction of the centrepiece moving roof, but also allowed adequate commissioning and testing periods for the structure and its services.

Importantly throughout the project a research and development programme to build a full size mock retractable roof was undertaken in Sheffield. "This enabled us to design, fit, test and underwrite every element of the roof," says Paul Hulme, Watson's Project Manager. "This eliminated a high level of risk from this operation and turned the roof build into an installation operation."

The retractable roof weighs 1,100t and the air conditioning plant adds a further 400t. This means the four main trusses spanning 77m between the columns had to be very substantial, not only in terms of strength but also in terms of stiffness.

"Traditionally moving roofs at stadiums are solid plates that slide, but that would not have worked at Wimbledon because we couldn't have any overhang interfering with adjacent courts," says Mr Jennins.

The roof is divided into two sections with four bays in one and five in the other. When the roof is deployed each section is extended over the court and they join in a overlapping concertina seam over the centre of the court. At the same time fabric is unfolded by hinged arms in four lines on top of each truss. Operated by electro mechanical actuators, they help to push and keep the trusses apart.

Deploying the roof over the court will take 10 minutes, keeping disruption to the Centre Court action to a minimum.

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Providing high quality office, restaurant and retail space over six floors, the project is a landmark structure at the entrance to a city centre business development.

Fact file

Architect: *Sheppard Robson*
Structural engineer: *Capita Symonds Structures*
Steelwork contractor: *William Hare Ltd*
Main contractor: *Bovis Lend Lease*
Client: *Allied London Properties*

Local planning conditions stipulated that the Spinningfields development should maintain the existing views of the historic Grade I listed John Rylands Library and that it should also reinstate the processional route between Manchester Town Hall and the Crown Courts.

No 2 Spinningfields responds to these constraints by taking the form of two parallelograms on plan, oppositely positioned one above the other, creating a level two roof terrace to the west elevation and a 23m long cantilever to the east elevation. All of which has created what the judges describe as a building of obvious quality in many respects.

Another key planning constraint was a limit to the overall building height which meant a structural solution had to be found that kept the floor zones as small as possible.

The adaptability of the floor plate was another key client concern. The office floors have been designed so that they can be fitted out on either an open plan or cellular basis, and the servicing has been provided so that each floor can be sub-divided into two separate tenancies.

The floors also have built-in loading allowances for future storage capability and soft spots for tenant plant requirements. A high loading capacity for the retail floors was included to ensure flexibility for tenant fit out.

"The use of steel was the only way such a demanding structure could be delivered economically," says Jon Smith, Capita Symonds Structures' Associate Director. "The project's cantilever was a significant driver in the scheme and couldn't have been done in any other material."

The integrated services solution meant that floor zones were minimised, the reduced self weight of the structure meant the loads to be resolved by the cantilever and the foundations were kept as small as possible. The high load capacity of the steel meant the cantilever elements were kept as compact as possible.

The floor construction comprises a 150mm thick concrete slab on composite metal decking on a grid of secondary and primary Fabsec beams. 400mm diameter openings in the 550mm deep beams allowed for integration of the services within the structural zone.

The 23m cantilever was resolved by making the perimeter steelwork into a three storey deep truss, achieving the most economical frame solution.

The structure was also engineered to suit the cladding deflection requirements, with a deflection matrix being developed to determine differential deflections of cladding modules and stiffening employed to ensure compatibility between the frame and the facade system.

"The project has successfully created the largest office cantilever in the UK, that we are aware of, forming a truly landmark building," says Mr Smith.

The judges say this is a building of obvious quality in many respects.

A range of innovative strategies were employed for this extensive remodelling of an Edwardian government office block.

This project skillfully combined steel and glass to transform an Edwardian office block into light and airy accommodation, say the judges.

Originally built in 1912 and situated between London's Kingsway and Lincoln's Inn Fields, this Portland stone clad steel-framed structure has nine-storeys plus basement and is U-shaped in plan.

As well as retaining the building's facade, the construction plans also incorporated a larger floorplan, an atrium taking up some of the open area of the U-shape, a roof pavilion and a revamped forecourt area.

The scheme provides the London School of Economics (LSE) with four new lecture theatres, 18 classrooms, research facilities and academic offices on the upper floors.

Demolition work essentially removed all the existing floors, including the structure's two basement levels, while retaining the facade and the external bay of floor structure around the perimeter of the building.

Retaining some of the existing floor space helped stabilise the facade during the works, but this also meant steelwork contractor Bourne Steel was needed on site from an early stage.

Charlie Rowell, Bourne Steel Divisional Operations Director, says his company was involved during the demolition process by installing early steelwork to support the retained 7.5m x 3.3m grid bay.

"As each floor was demolished we had to erect new permanent steelwork and we were basically in and out at this stage," says Mr Rowell. "Once demolition was over, however, our presence on site increased significantly as we then began erecting the new build elements of the job."

During the demolition process two new lift cores using Corus Bi-Steel's Corefast system were installed. These were completed twice as quickly as an equivalent concrete jump-formed version, providing major programme benefits.

One of the main objectives of the scheme was to create more open plan floor plates for the building. This was achieved by retaining the majority of columns from the existing bay and then hanging the majority of new floor plates from a 15t 17.5m long roof level transfer truss. This innovative solution also minimised the number of required new columns.

Robert Westcott, Director at Alan Baxter & Associates says the roof truss arrangement allows for flexible floor plates as well as minimal internal columns.

"All of the floors from the eighth to the third level are hung from the bottom cord of the truss by two steel hangers which are each made up of two 100mm x 50mm solid steel bars," adds Mr Westcott. Further down the structure, separate SHS hangers connect to the second and first floor levels.

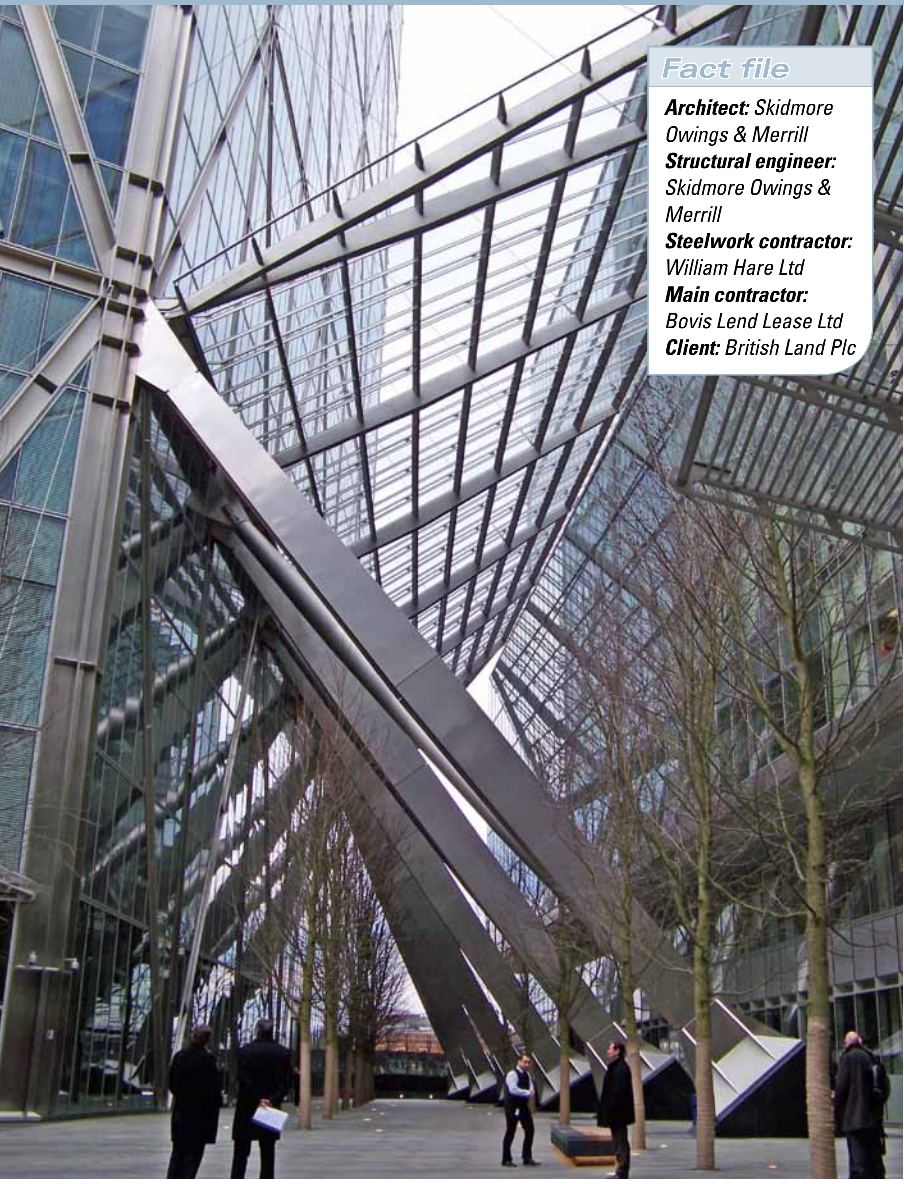
Another 6t steel truss has also been installed at ground level and this supports eight 19m long pre-cast concrete ribs which form part of the roof structure to the basement level lecture theatre.

Fact file

Architect: Grimshaw
Structural engineer: Alan Baxter & Associates
Steelwork contractor: Bourne Steel Ltd
Main contractor: Osborne
Client: London School of Economics & Political Science

The Judges visiting the academic building. All projects on the shortist are visited by the Judges.

COMMENDATION • 201 BISHOPSGATE AND THE BROADGATE TOWER, LONDON



Fact file

Architect: *Skidmore Owings & Merrill*
Structural engineer: *Skidmore Owings & Merrill*
Steelwork contractor: *William Hare Ltd*
Main contractor: *Bovis Lend Lease Ltd*
Client: *British Land Plc*

Two landmark office buildings, partially situated above busy railway lines, called for an innovative design approach and sophisticated steelwork.

This City of London development consists of the 12-storey Bishopsgate building and the 35-storey Broadgate Tower, which together required more than 12,000t of structural steelwork.

The project is located directly above busy railway lines and was only structurally possible after significant enabling works were completed to create a raft structure over these lines. The project team made use of and modified a raft which was originally constructed for an earlier job which was shelved in the 1990s.

In order to limit deflections and settlement it was necessary to distribute the resulting vertical forces from the two buildings evenly across the raft support. A series of raking A-frame legs effectively prop the structures at level 5 and transfer the loads to strategically located transfer beams and columns within the raft.

"The five-storey rakers provided a major challenge during the construction of the steelwork frame and an extensive arrangement of temporary props and trestles were required," says Nick Day, William Hare's London Director. "The operation included a sophisticated load transfer operation using a jacking system to transfer the loads from the temporary supports onto the main raking columns."

The Broadgate Tower is an elongated rhombus in shape and its lateral stability is provided by a perimeter diagrid bracing system. The diagrid nodes occur at six storey increments, with plan bracing and RC diaphragm floor plates distributing the horizontal loadings into the external bracing lines.

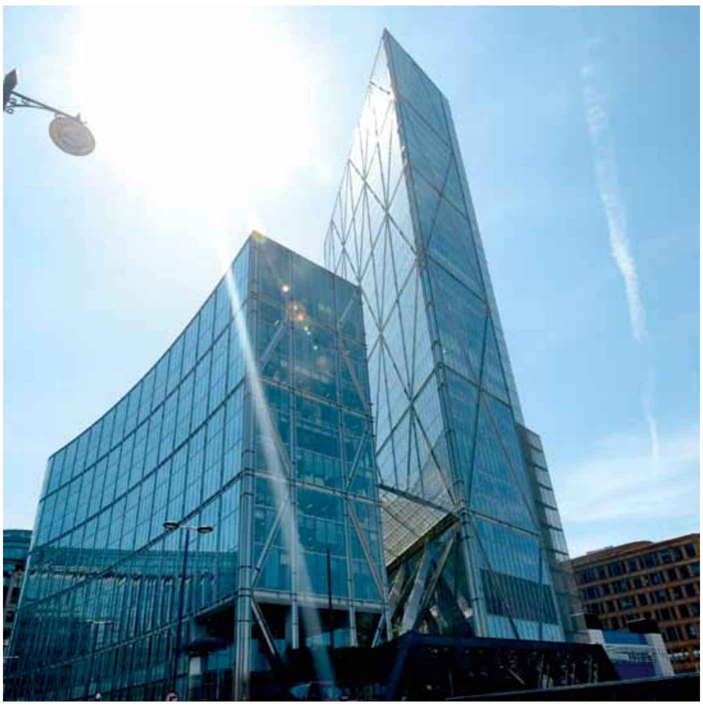
Wherever possible the main diagrid column and bracing connections were designed as a bolted joint, but in certain locations, it was necessary to site weld the joints. This detail required a robust temporary connection to be installed during erection in order that construction could continue above the splice location.

The 201 Bishopsgate structure is constructed with steel framed stability cores and long span cellular beams with nominal moment frames provided around the outside framing for enhanced stiffness.

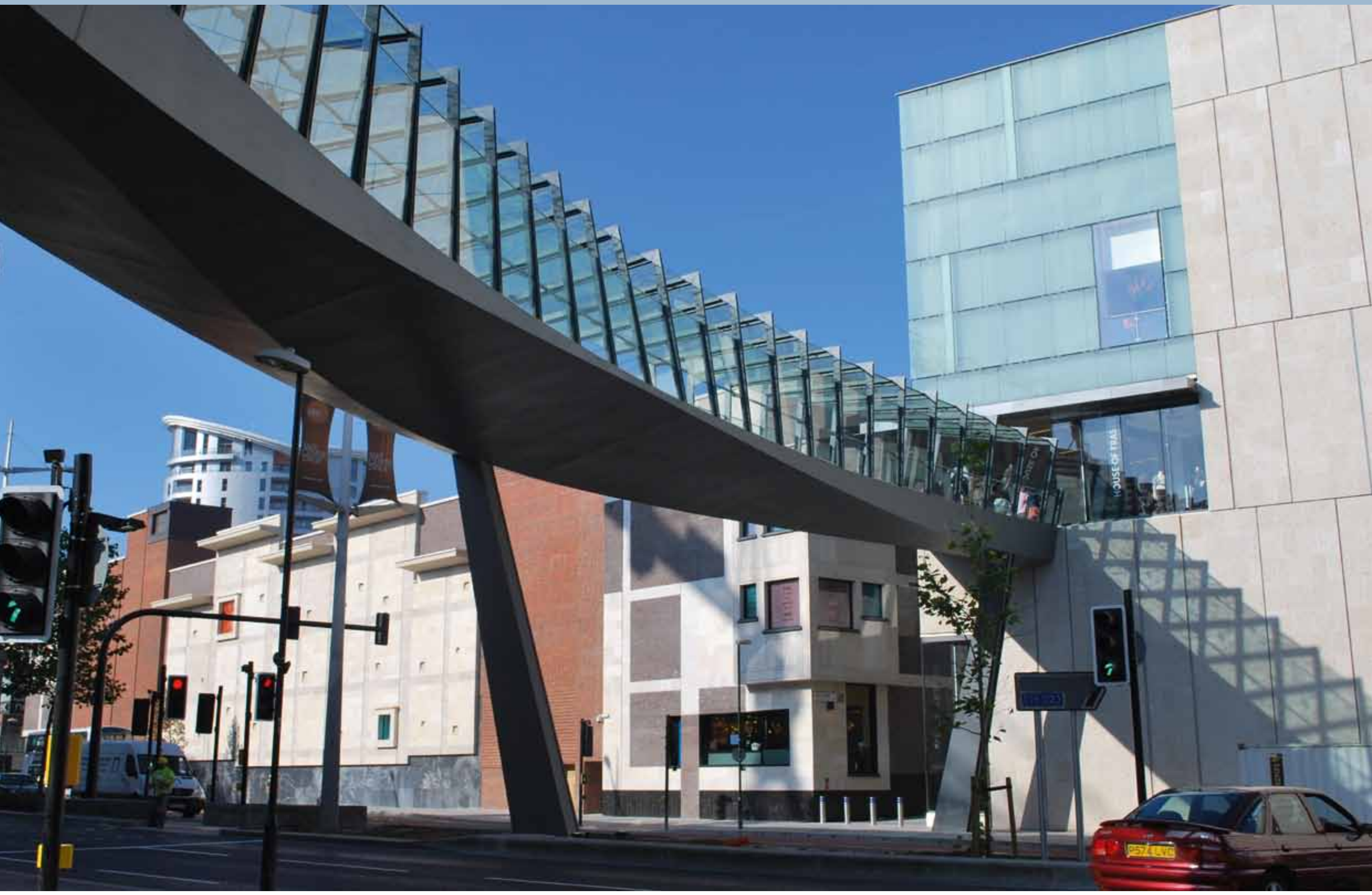
"Both structures are technically sophisticated and include a number of innovations," says Mr Day. "They have double-decker lifts and an efficient heating and cooling plant, which is expected to produce a lower level of emissions than required by current building regulations."

The structural fire protection is provided by a combination of off-site applied intumescent paint and on-site installed fire boarding. At the tower roof level it was necessary to treat some external components with an epoxy-based intumescent to provide the necessary two hours rating, while others were concrete encased.

These landmark offices are prominent and prestigious, say the judges. A heroic solution, creating interesting space.



CABOT CIRCUS FOOTBRIDGE, BROADMEAD, BRISTOL • COMMENDATION



The sweeping high level glazed footbridge connects the new Cabot Circus retail development with its multi-storey car park by spanning the Bond Street South dual carriageway.

The Cabot Circus footbridge was initially planned as a continuation of a long sweeping pedestrian boulevard that cuts through the new 2,500 space car park. The use of steel, as a lightweight and malleable material aided the architectural vision and allowed the creation of an organic form, which provides a dynamic counterpoint to the flanking buildings.

Externally the 90m long bridge is viewed almost exclusively from the street below, and generally from the confines of passing vehicles. With this in mind, the bridge design incorporates a wide bridge soffit that defines the visual signature, while the careful use of concealed deck splices provides the required continuity on plan.

The bridge's deck structure comprises a closed steel torsional box, which is triangular in section and provides a smooth soffit plane. The section varies along the bridge length so that the soffit seam meanders from side to side providing a fluid three dimensional form.

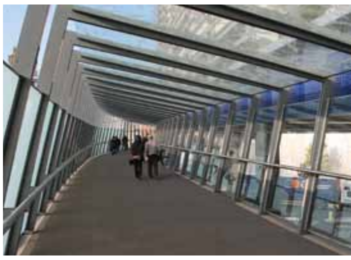
The deck is supported at mid span and at each end on tapered cantilevering raking steel columns orientated in alternating directions. This creates a transitional shape from a structurally effective form and simply definable geometric parameters.

Internally, the changing deck geometry exerts an influence on the enclosure, defining the internal space of the bridge. The side plates of the deck are variable in inclination, and this variance is translated through to the steel portals, which incrementally rotate relative to each other along the length of the bridge.

Services have been subtly integrated with lighting strips set flush into the portals and placed at varying heights to further accentuate the warping geometry. The glazing framework at deck level provides the weather protection for pedestrians. There is no guttering system and rainwater run-off falls via the wall planes into longitudinal grills between the portals, which act as edge demarcation of the deck.

The steel frames are portalised laterally to provide the principal axis of stability, while out of plane, the frames work compositely to cantilever from the main deck. This stability system can accommodate the vertical and lateral deflections of the bridge, while maintaining stability of the glass panes.

"Without 3D modelling this design wouldn't have been possible," sums up Alan Gilbertson, Project Engineer for David Dexter Associates. "The bridge incorporates challenging geometry, everything is on a curve and tilting, and so needed careful detailing. We also had to ensure buildability and liaised closely with SH Structures."



Fact file

Architect:
Wilkinson Eyre
Structural engineer:
David Dexter Associates
Concept designer:
Waterman Civils
Steelwork contractor:
SH Structures Ltd
Main contractor:
Sir Robert McAlpine Ltd
Client: *The Bristol Alliance*

More than 4,000t of weathering steel was used for the construction of four new bridges on the busy A2/A282 junction in north Kent.

Approximately 200,000 vehicles use the A2/A282 intersection in Kent every day, creating considerable congestion, particularly during peak hours. In order to improve the severe traffic flow problems the Highways Agency implemented a number of changes.

One of the main drivers of the project was to divert traffic away from a roundabout that sits below the interchange. This was achieved by constructing new free flow links, one carrying traffic from the A2 westbound onto the A282 northbound, another from the A282 southbound to the A2 eastbound and a third dedicated lane for A2 westbound to A282 southbound movement.

These link roads required four new bridges to carry traffic over the existing highways and all of these structures were constructed with weathering steel.

"Repainting these structures at a later date for maintenance would have been logistically difficult," explains Simon Reavell, Project Manager for Fairfield-Mabey. "That's why weathering steel was chosen, it doesn't need to be repainted and this meant safety, environmental and cost benefits for the client."

The four bridges consist of a main east to north link flyover, which is a 420m long, nine span viaduct; two parallel five span bridges both 250m long, and smaller slip road bridge feeding traffic onto the A282 from the A2.

Work on the main 420m long flyover began in January 2007 and four weeks were needed to assemble some steel sections on site. Steel erection started in February 2007 with the majority of the steel lifted into place by a 1,000t telescopic crane.

The middle section of this structure was erected first, followed by the remaining spans toward the south abutment, completing six of the nine spans in one sequence. The remaining spans toward the north abutment were then erected.

Steelwork for the bridge deck consists of two braced pairs of girders for each span which were paired on site and lifted before being lifted into place. Each pair of girders consists of four steel sections which were bolted together on site and prepared for erection. The decision was taken at the design stage to fit the GRP formwork onto the pre-assembled steelwork at ground level.

"This cut down on crane usage," says Robert Phillips, Costain Project Manager. "Otherwise we would have had to come along again and lift the formwork into place."

Summing up Mr Reavell says by using modern fabrication facilities and forging a team comprising designers, principal contractor and steelwork contractor, the project was completed in December 2007, five months earlier than expected. The completed project now alleviates existing and anticipated congestion, improves safety and contributes towards an integrated transport strategy for the area.

The judges agree and say the innovative use of weathering steel on this scale is practical and appropriate.

Fact file

Structural engineer: *Jacobs*
Steelwork contractor: *Fairfield-Mabey Ltd*
Main contractor: *Costain*
Client: *Highways Agency*

With a clear span of 125m Ryanair's new cavernous hangar can accommodate up to five Boeing 737s.

Fact file

Architect: *Capita Architecture*
Structural engineer: *Barrett Steel Buildings Ltd*
Steelwork contractor: *Barrett Steel Buildings Ltd*
Main contractor: *Kier Eastern*
Client: *East Midlands Training (Ryanair)*

Not far from Stansted's main runway and within sight of the passenger terminal a new hangar capable of accommodating five 737s is up and running. This huge structure has a large clear span of 125m, an apex height of 25m and an overall building depth of 60m.

Working on a design and build contract Barrett Steel Buildings had to overcome a series of engineering and logistical challenges to lift the hangar's three 125m-long steel trusses.

Design solution initially involved erecting the hangar's framework, including large 25m high columns to support the trusses. Once this was complete a multi crane lifting operation, to erect the roof trusses, was able to begin.

The first truss was formed by two separate 62.5m long x 7.2m deep sections, bolted together and lifted as one 100t box girder by two 300t capacity mobile cranes during a full day operation.

"We wanted a rigid box which would then enable the following two trusses to be braced back to it securely," says Chris Heptonstall, Associate Design Director at Barrett Steel Buildings.

Two more lifting operations then took place to install the second and third trusses. These large sections were also assembled at ground level, but in three equal lengths. They were then lifted individually, by one 100t capacity mobile cranes, and spliced together while suspended in the air.

While the three sections of the truss were being spliced together another 25t capacity mobile crane was used to install the bracing which connects trusses back to the rigid box which was initially erected.

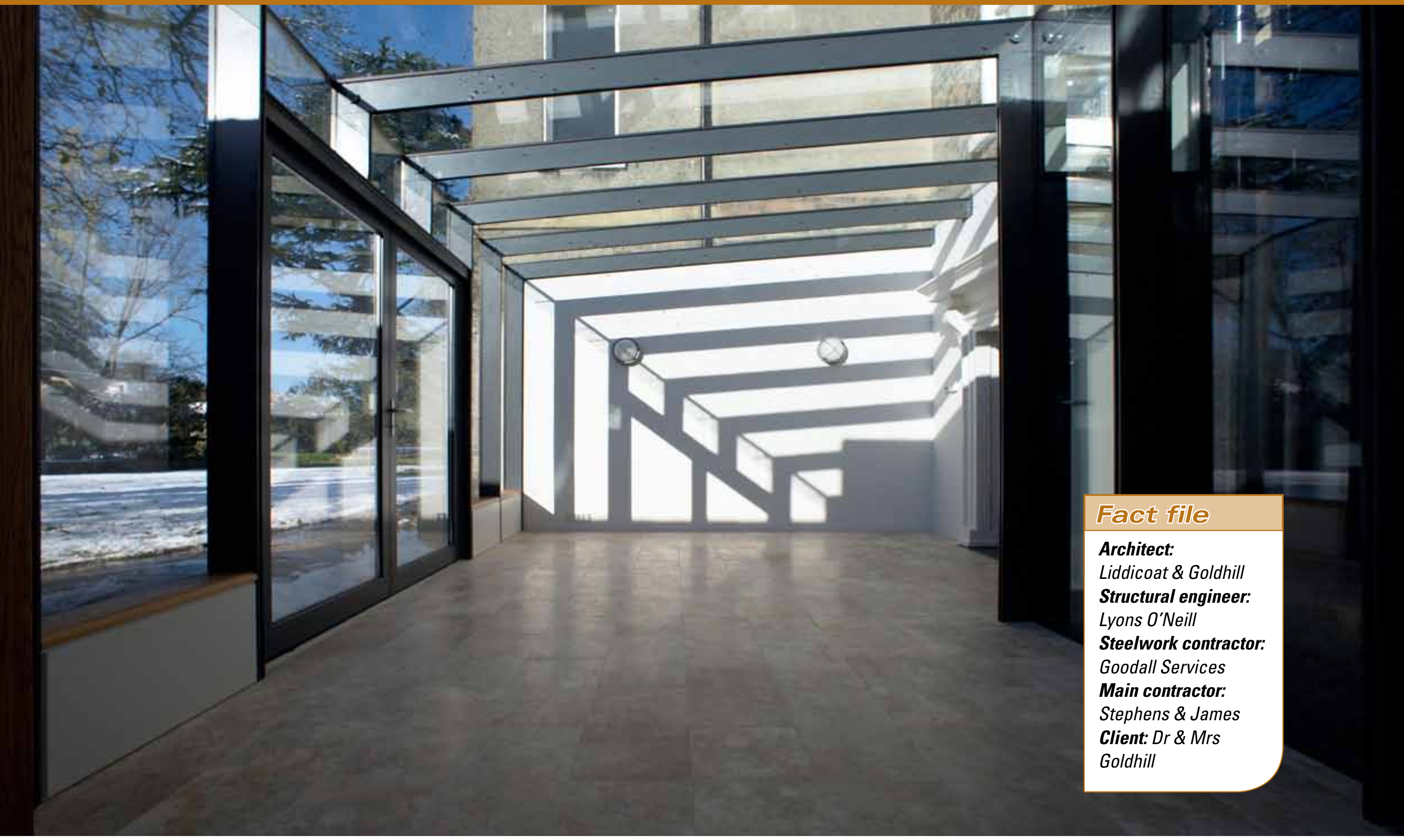
The roof trusses are all pre-cambered to take out the dead deflection and all connections are friction grip using TCB bolts. "We chose TCB's for their speed of fixing and the surety that the full slip potential was guaranteed," adds Mr Heptonstall.

All of the trusses were fabricated 50mm short of the supporting columns, and specially designed packs were installed to make up the difference during installation.

The three day lifting operations were the highlight of the steelwork erection, but before this Barrett Steel Buildings had already constructed the entire braced frame of the hangar and an office area, while main contractor Kier Eastern had undertaken a month-long earthmoving operation.

Nick Bache, Director, Kier Eastern, says: "During the selection process of the contractor Barrett Steel Buildings became the obvious choice as they were not only technically very able but also passionate about providing a service. They were an integral part of this very successful project for Ryanair."

To conclude, the judges says the project is a fine example of an optimised long span structure, at minimum cost with fast erection.



Fact file

Architect: *Liddicoat & Goldhill*
Structural engineer: *Lyons O'Neill*
Steelwork contractor: *Goodall Services*
Main contractor: *Stephens & James*
Client: *Dr & Mrs Goldhill*

A steel framed addition to connect parts of a listed building has created a sensitive addition to an historic setting.

White Lodge is a Grade II listed house in Hertfordshire. The oldest parts date back to the 17th Century, and a number of additions and alterations have taken place over years.

"The Weather Room is our practice's first complete work, and the latest layer added to this historic building," says Sophie Goldhill, Partner at Liddicoat & Goldhill. "Our brief was to reunite disconnected wings of the house and open the building to its extensive gardens."

The form of the new space was dictated by the strictures of working on a listed building in a very tightly controlled Conversation Area. "The detail of the construction became our focus and a close working relationship developed between ourselves and the other project team members," says Ms Goldhill.

The architect and the project's engineer spent a lot of time at steelwork contractor Goodall Services' workshop, where each component and connection was drawn, prototyped and refined.

"We pre-erected part of the structure off site to ensure all details worked and the erection sequence was ideal. This also allowed us to minimise the time on site and ensure a structure erected to tolerances suitable for the glass installation," says Damian O'Neill, Director at Lyons O'Neill.

The Weather Room's structure is formed by powder-coated steel glazing bars in a portal frame which supports the structural double-glazing. Steel was chosen to allow very fine 45mm sightlines through to the garden, while still being capable of bearing people and scaffolding on the roof to allow maintenance.

All glazing bars were hand-made by welding a 'sandwich' of bright steel flats together. A narrow rebate was created to the inside of the bars, allowing installation of an adhesive LED light tape.

"This highly-efficient, low energy lighting system solved the conundrum of providing even, atmospheric light in a space with a glazed ceiling without obtrusive luminaries," adds Ms Goldhill. "The resultant effect is of warm ribbons of light glowing from the sharp edge of the steel."

The interior of the Weather Room is tempered by the external condition; the structure plays a crucial role in this relationship. By day, it animates the space through the play of light and shadow from the glass and steel flats. As night falls, concealed blades of light within the steel succeed the sun and the space develops an entirely different character.

"Our ambition was to provide a discreet and integrated structure which sat well with the modern intervention of the conservatory. Working with the architect we developed a lighting scheme which was incorporated within the structure allowing the pure lines of the fins to be uninterrupted by fittings and cabling," explains up Mr O'Neill.

A host of unusual challenges were overcome to complete a visitor centre on the summit of Mount Snowdon.

"Working on the highest point in England and Wales was an immense challenge," says Andrew Roberts, EvadX Project Manager. "Getting all of the materials, plant and personnel to the summit was a unique challenge."

Conveniently Snowdon has a mountain railway and this provided the contractors with a viable transport route to the top. All of the steelwork was bundled into 11m-long packages so it would fit onto the train's flat bed carriage.

Once materials were on-site the construction team were very much at the mercy of the elements. "It can be a bright sunny day at the bottom, but windy and raining at the summit," says Mr Roberts. "The weather is extremely changeable, even in the middle of Summer."

Work on the project effectively began with the demolition of an existing Snowdon visitor centre and this took place in 2006. Once the ground was cleared the concrete foundations were installed to allow EvadX to begin its steel erection programme in May 2007.

The finished visitor centre consists of a large cafe with washrooms and information area, medical facilities and an emergency overnight shelter. Attached to the centre there is a 60m-long steel framed lean-to structure which houses a new platform for the railway, plant rooms and staff accommodation.

In order to make sure the fabricated structure fitted together correctly EvadX did a complete trial erection of the building at Corus' Deeside facility at Shotton. "We marked up all of the individual members which then helped with the second erection on the summit and also ensured the steel was taken up the mountain in the correct order," explains Mr Roberts.

There is little room on the summit to store materials and as the building was erected available space decreased. The erection programme was divided into three main phases and all steel taken to the summit was usually erected that day to minimise disruption to other trades.

According to the design team the main structure, which measures 30m-long x 13.5m wide, was a challenge to fabricate and design because of its unusual sloping shape. The slope of the structure is intended to fit into the mountain's summit environment without impairing the spectacular view.

Geraint Bowen, Arup Project Manager, says in order to achieve the pitched roof and the curved ends of the structure some complex geometry had to be undertaken. "We also had to design the building using some heavy sections as wind loadings, incorporating speeds of up to 150mph, had to be accounted for."

Consequently the columns are predominantly 254 x 254 x 73 UC sections at 3m centres along the perimeter, while at the corners, where the columns change sloping directions, there are double 250 x 250 SHS sections.

Summing up the judges say rarely can a site and logistics be more challenging than this.

Fact file

Architect: *Ray Hole Architects*
Structural engineer: *Arup*
Steelwork contractor: *EvadX Ltd*
Main contractor: *Carillion*
Client: *Snowdonia National Park Authority*

Feature steelwork came to the fore in this speculative office development built within an existing business park.

Unilever's new Leatherhead headquarters houses many of the company's separate UK business units in a single location. The structure is a three storey office block springing from a podium deck, with both the deck and main frame completed with steel. The site's naturally sloping topography provided the opportunity for undercroft parking, while a feature pavilion perched on the edge of the deck, affords views of the surrounding countryside.

The architectural brief for the building required clean internal lines and so CHS columns have been used throughout the structure above podium level. "We did have to specify heavier sections where needed, such as UC's in the undercroft parking area," says Lee Geddes, Project Engineer for Mott MacDonald.

The office accommodation is arranged in a number of linear wings which are wrapped around a central full height entrance atrium and an external courtyard, which opens up towards an adjacent brook and the greenbelt countryside beyond.

A series of secondary atria spaces on either side of the courtyard ensure clear circulation patterns and accommodate lift cores and steel feature stairs.

The central atrium, intended to form the heart of the building, acts not only as a first impression on visitors, but also as a space to showcase and launch new products as well as improving communication across the different departments that were relocated in the building.

The three storey space is top-lit by a northlight roof comprising a series of steel stressed skin prismatic arch trusses. These span across the 18m width and support glass infill panels.

To create the trusses, standard profiled steel decking sheets were used. They fall into the three dimensional hypar form with ease and in turn form a shear diaphragm, unifying steel corner angle sections to make a stiff 'Toblerone' box-like truss.

"By using profiled metal decking in this way we've raised its status on this project, allowing it to be visually exposed, where typically it would be concealed behind finishes," says Steve Webb, Director at Webb Yates Engineers.

Each atrium is fitted with a helical feature stair and these were fabricated with an internal stringer extended in height to double up as the balustrade. This steel needed to be relatively thick and shaped into a tight radius helix which would be extremely difficult to roll. A novel alternative solution was found when the subcontractor proposed to cut the stringer from a large diameter tubular section. The stair was constructed around this and the stringer/balustrade profile cut afterwards.

Cellform beams allow for service runs within the depth of the steelwork and therefore ensured generous ceiling heights could be maintained while keeping the overall storey height. This relatively light solution also proved effective with regard to keeping the foundations minimal.

The adaptability of the steel frame means a potential second phase could be implemented for future expansion. By bolting on additional wings in the northwest car park, an extra 1,347m² of net floor space could be generated.

Fact file

Architect: *dn-a*
Structural engineer (main frame): *Mott MacDonald*
Structural engineer (feature steelwork): *Webb Yates Engineers Ltd*
Steelwork contractor (main frame): *Caunton Engineering Ltd*
Steelwork contractor (feature steelwork): *AlloyFabweld Ltd*
Main contractor: *Bowmer & Kirkland Ltd*
Client: *Landid and RREEF*

A large multi facetted waste plant was erected prominently, economically and effectively close to Heathrow Airport.

The Lakeside plant is a state of the art facility which converts household waste into electrical energy. Located adjacent to Heathrow Airport, it is clearly visible from the M25 and the new T5 building, and this highly architectural structure has become a local landmark.

The design for the building takes the large, sweeping, aeronautical form of the roof as its main starting point and key statement. This unifies the disparate elements below, such as the tipping hall and ramp, offices, boiler hall and flue scrubbers to create a single, identifiable motif for the building.

The external frame is completely independent of all the internal process support structure, making it possible to adapt the internal structure in the future without adversely affecting the shell.

Adopting a steel solution enabled a building of over 40m high to be constructed while maximising the internal space. This was achieved by using a series of long span beams and trusses for the roof and three unrestrained central columns up to 40m in length.

"The 40m cruciform columns were spliced on site and dropped down into position between the installed processing equipment," says Frances Walker, Watson Steel Contracts Manager.

Because of the weight and the complex nature of this processing equipment, the building's main frame was erected around and over it. All of the erectors and their cranes could only gain access from outside of the building's frame.

"The process equipment installation was critical to the entire project and because it is also extremely large it needed to be installed prior to the erection of the superstructure steelwork. This requirement led to a phased erection of the main frame. At any one time we had process equipment installers working at one end of the building while Watson's were erecting steel at the other end," says Mark Palmer, Project Engineer for Royal Haskoning.

The structure presented a considerable challenge in respect of workmanship. The sides are curved on plan, translating an ovoid shape on the ground, and the roof is a curve which changes in pitch, steepening towards the chimney.

The combination of these factors resulted in eaves that transcribe a spiral along the building, which made accuracy of fabrication and erection paramount. The geometry of the building's Y-shaped columns is different at each location and these had to be welded in-situ.

In order to minimise the visual impact of the external plant on the roof, two large down-stand recesses were framed into the overall roof profile. The chimney flues extend vertically by 75m and are therefore the most visual part of the building.

This innovative building, which contains 2,500t of structural steelwork, combines the functional requirements of an industrial process with excellent architecture and demonstrates that industrial buildings can be both attractive and efficient say the judges.

Fact file

Structural engineer: *Royal Haskoning*
Steelwork contractor: *Watson Steel Structures Ltd*
Main contractor: *BAM Nuttall Limited*
Client: *Lakeside Energy from Waste Ltd*

30 CROWN PLACE, LONDON EC2

30 Crown Place image courtesy of Ramboll

The project at 30 Crown Place is a £60M 18 storey high commercial office development offering 17,500m² of grade A office space in the City of London.

By adopting a lightweight composite steel superstructure and steel substructure, the project team was able to reduce the foundations and reuse piles where possible. The floors act as a diaphragm between the two cores, formed from composite beams. The structural system incorporates the building services within the same depth increasing the efficiency of the system.

The larger lower floor plate rises to ten floors, above this point a smaller floor plate continues to high level. The change between the two is facilitated by a high level steel transfer truss which is used to suspend the column hangers to the southern facade, minimising the number of columns required at the lower levels of the building.

Alan Bunting, Ramboll Project Engineer, says: "The column transfer was integral to the scheme and provides an open plan reduced column office space."

Constructing a frame with this roof truss created a challenge. The hangers needed the truss and the truss needed the floors to be in place, which in turn, relied on the hangers. The solution was to build a temporary truss, between the 8th and 9th floors, from which the hangers could be constructed and supported until such time as the permanent truss was ready to receive their load.

The building loads where transferred from the temporary truss to the roof truss by pushing the column hangers and all nine floors, up to meet their connections. Large hydraulic jacks were used to push against the lower truss, while monitoring stations on three floors reported its movement.

"Without the inherent capabilities of steel the project could not have been achieved," says Mr Bunting. "Steel was the only cost effective material to allow the integration of the structure and services within the floor zone, while providing minimal columns."

Fact file

Architect:
RHWL Architects
Structural engineer:
Ramboll
Steelwork contractor:
Rowen Structures Ltd
Main contractor:
Skanska
Cost consultan:
Davis Langdon LLP
Development manager:
City Offices Real Estate
Client: *Greycoat Crown Place Limited Partnership*

40 PORTMAN SQUARE, LONDON W1

One of the main client objectives for 40 Portman Square included delivering a first class office development to attract financial tenants to a traditionally unfashionable London location.

Steve Peet, Arup Project Engineer, says this has been achieved in style with a building providing almost 9,300m² of office space over seven floors and two storeys of residential accommodation above.

"A total building cost of £36.5M and all offices pre-let six months before completion at average rents of more than £100 per square foot demonstrates the market's reaction to the development and its cost effectiveness," says Mr Peet.

The quality of the office accommodation has been described as exceptional. The building contains some of the largest floor plates in the West End, providing column free space with abundant natural daylight in all sides.

The structure is a steel frame of long span fabricated beams and composite floors about a central braced steel core. The central core and long span floors allow for all office levels to be free of internal columns. A novel suspension system within the dry lined walls of the residential floors permits the 42m wide northern elevation of the sixth floor office to be entirely unobstructed by columns.

Steel was the only realistic choice for the long span floor beams in order to integrate the services, while the weight saving determined that single piles for each column were feasible with the consequential saving to cost and programme.

Fact file

Architect:
Squire and Partners
Structural engineer:
Arup
Steelwork contractor:
Graham Wood Structural Ltd
Main contractor:
BAM Construction Ltd London
Clients: *Delancey, Standard Life Investment Funds*

THE TANK MUSEUM, BOVINGTON

The Tank Museum has the world's largest collection of tanks. More than 250 military vehicles, some dating back to before WW1, can be seen at the museum and more than 100,000 visitors per year flock to the site.

A new display area has been constructed adjacent to the existing museum which also includes an administration block, cafeteria, main entrance hall and a 20m-high viewing tower.

The display area was formed by a series of trusses, eight in total, which span 36m and fan-out from the central entrance hall area to form a large column-free area.

A feature saw tooth roof of the main display area is also formed by the trusses. These large sections radiate out from 4.2m centres, at the entrance hall, to a maximum 10.4m centre arrangement near the building's perimeter. Connecting the trusses, to form the roof structure, are an arrangement of diagonally placed hot rolled rafters and more then 30t of Metsec supplied secondary steelwork.

"The saw tooth roof was designed to allow natural daylight to easily penetrate the display area below," explains Ivor Robinson, Contracts Manager for Bourne Special Projects." However, this arrangement means the roof slopes in a number directions and we had to design some time-consuming connections."

Because the majority of the display area needed to be column-free which will aid the movement of exhibits in, out and around the hall, bracing was ruled out in most areas.

"We were able to put some feature bracing in one bay near to the perimeter wall," explains Ken Richards, AKS Ward Project Engineer. "But elsewhere the roof rafters act as the bracing."

Fact file

Architect:
Kennedy O'Callaghan
Structural engineer:
AKS Ward
Steelwork contractor:
Bourne Special Projects Ltd
Main contractor:
Norwest Holst Ltd
Client: *The Tank Museum*

THE CURVE, LEICESTER

Fact file

Architect: *Rafael Viñoly Architects*
Structural engineer:
Adams Kara Taylor
Steelwork contractor:
William Hare Ltd
Main contractor:
Bovis Lend Lease
Client: *Leicester City Council*

The Curve, otherwise known as the Leicester Performing Arts Centre forms one of the main elements of a new Cultural Quarter rapidly taking shape in Leicester's St George's district.

Inside the four level 13,000m^2 building there is a main foyer and two auditoriums. The main 750-seat theatre and the smaller 350-seat venue are conceived as islands containing balconies arranged in an intimate manner that helps control acoustics.

Jim Dunn, Project Director for Adams Kara Taylor, says: "We had to deal with a very tight and confined inner city site, which ultimately dictated the shape of the building."

In order to maintain the transparent vision for the structure it was decided to have as few view-blocking columns along the facade as possible. To achieve this, there are in fact no structural columns and everything is suspended from the roof. This includes the facade and walkway, a 125m^2 conference room and all heavy plant.

Steelwork contractor, William Hare erected more than 3,000t of steel for the roof structure, with the remainder of its final 5,200 tonnage being accounted for by two steel-framed shoulder blocks which house administration offices, workshops and changing rooms.

The steel roof is made up of a number of 6m deep trusses which have varying spans from 25m to 30m. The roof is also functional, explains Mr Dunn. "The plant room hangs from the bottom cord of the trusses and acts as ballast."

5 ALDERMANBURY SQUARE, LONDON

Replacing a 1960s 18 storey high London office block with a modern flexible structure with one extra floor was the main challenge associated with this project.

"We squeezed in an extra floor by compressing the structure around the horizontal service voids, while the selection of core-ten composite box columns allowed us to place perimeter columns in the cladding zone, and gave us uninterrupted column free interior walls," says Simon Groves, Ramboll Project Engineer.

These innovations with the project's steel frame increased the revenue for the building and also created flush perimeter walls which give extra flexibility.

The adaptability of the steel frame came to the fore on the ground floor where new hanging retail mezzanines were added. On the 13th to 16th floors, which had been let to a single tenant, a dedicated communicating staircase was provided by creating openings in the secondary beams.

"Many of the perimeter columns are inclined in two directions and they required precise engineering and milling," says Richard Tarren, Severfield's Project Manager. "The members are also box columns which were later infilled with concrete, so during fabrication we had to install reinforcement."

The building features curving elevations on the east and west facades to reduce the visual impact of its volume.

Fact file

Architect:
Eric Parry Architects
Structural engineer:
Ramboll
Steelwork contractor:
Severfield-Reeve Structures Ltd
Main contractor:
Bovis Lend Lease
Development manager:
Hanover Cube
Client: *Scottish Widows*

THE BRIDGE ACADEMY, HACKNEY

Bridge Academy is part of a national government initiative to build state of the art schools in the country's worst performing areas.

The brief was to design a city academy on a tight site alongside the Grand Union Canal and maximise space. The resulting £33M, seven storey building provides an internal area of 10,250m² with 5,500m² of external space on the 6,000m² site.

Steel was chosen as the structural material to meet the demands for long spans with integrated services, heavily loaded terrace area as well as truss elements and tension members.

The main building consists of a horseshoe of accommodation that terraces down to the open side with circulation galleries provided on the inner perimeter. In the centre of the horseshoe and suspended from the inner perimeter is a two storey structure that houses the learning resource centre and 'village square'.

The suspended structure enables the 'village square' to be a completely column free and flexible space.

The inclined inner perimeter is formed from 12 CHS sections arranged as an inclined truss and clad in lightweight ETFE.

All teaching spaces are naturally ventilated with air introduced at the outer perimeter and extracted via the circulation galleries where excess heat is recovered and re-used. The underside of the project's profiled metal decks are coated with a high emissivity paint developed by NASA that improves the heat transfer between the air and the concrete via the steel surface.

Image courtesy of Samma Fisher Payne/BDP

Fact file

Architect: *BDP*
Structural engineer: *BDP*
Steelwork contractor: *Watson Steel Structures Ltd*
Main contractor: *Mace Plus*
Clients: *Department for Children, Schools & Families; UBS AG*

THE UNIVERSITY OF SHEFFIELD ADVANCED MANUFACTURING RESEARCH CENTRE WITH BOEING, ROLLS-ROYCE FACTORY OF THE FUTURE

The £15M University of Sheffield's 'Factory of the Future' was designed as an exemplar facility embracing renewable technologies and it is one of the UK's first carbon neutral buildings.

"The inclusion of 20 sustainable and specified environmental features, plus the tight programme meant steel was the only option," says Jason Hensman, Conder's Managing Director.

The building has achieved an 'Excellent' BREEAM rating and Geoff Halliwell, Director at Bond Bryan Architects says: "The structure has low environmental impact and has achieved the highest BREEAM rating for any building of its kind."

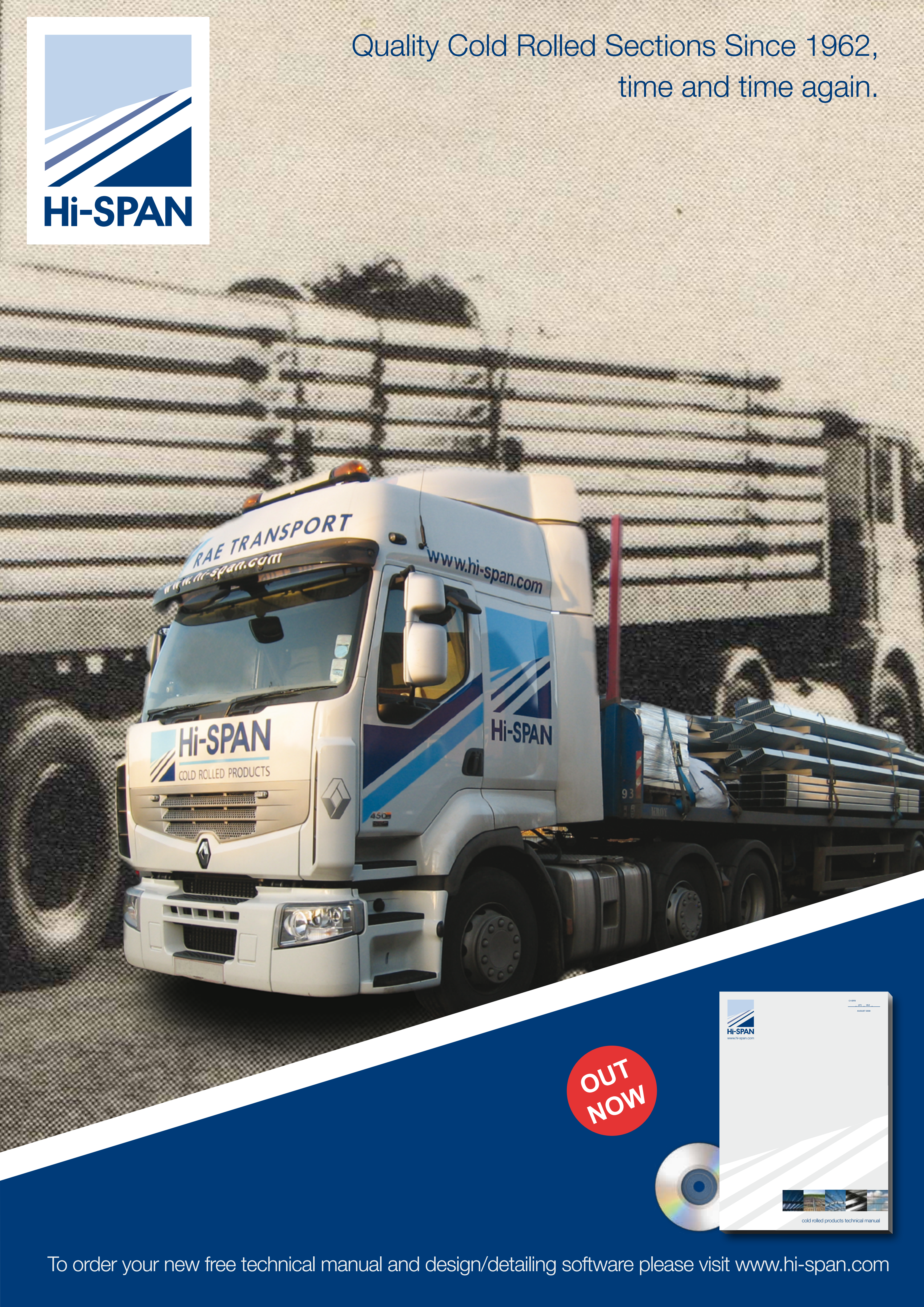
The building's steel frame consists of universal beam and columns, with cellular beams for office floors. The structure extends above single storey height along two sides with the front zone connected to the rear areas via three architectural bridges.

The roof structure was formed from steel tubing and Macalloy bars, while two trusses in each skylight add to the overall appearance and allow light to penetrate the building.

Buro Happold's Project Leader, Jason Gardner, sums up: "The carbon neutral target was achieved through a combination of good structural and building design."

Fact file

Architect: *Bond Bryan Ltd*
Structural engineer: *Buro Happold*
Steelwork contractor: *Conder Structures Ltd*
Main contractor: *The Bowmer & Kirkland Group*
Client: *University of Sheffield*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Reduced thermal bridging for steel construction

Energy efficiency is an increasingly important parameter in the design of modern buildings as are thermal bridges that lead to local heat losses and reduce the building's energy efficiency. Andrew Way of SCI explains the issues of thermal bridges and how these can be reduced in steel construction.

Thermal bridges, also known as cold bridges, occur where the insulation of a building envelope is penetrated by a material with a relatively high thermal conductivity and at interfaces between building elements where there is a discontinuity in the insulation. There are two main consequences of thermal bridges, firstly local heat losses occur which mean more energy is required to maintain the internal temperature of the building and secondly there are lower internal surface temperatures around the thermal bridge which can cause condensation leading to the possibility of mould growth.

The thermal efficiency of a building envelope is a function of the thermal performance of the planar elements (e.g. wall, roofs and windows) and the thermal bridges. The thermal image in Figure 1 shows local heat losses around the door, window and floor slab. The parameter used to express the thermal performance of a planar element is its U value. Lower U values equate to higher levels of thermal insulation. U values are expressed in units of Watts per square metre Kelvin (W/m²K). Revisions to Building Regulations and the introduction of new standards such as The Code for Sustainable Homes have increased the requirements for thermal performance of building envelopes. This has lead to a decrease in U values for modern buildings. However, local heat losses caused by thermal bridges become relatively more important, as the thermal performance of the planar elements of the building envelope are improved.

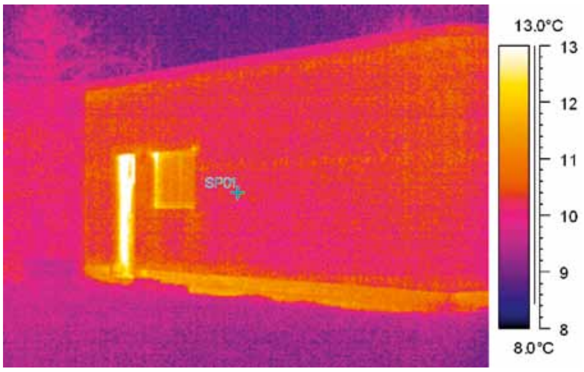

Figure 1: Thermal image of a small industrial building showing local heat losses

Causes and Solutions

Thermal bridges in building envelopes may be caused by:

- Geometry (e.g. at corners which provide additional heat flow paths)
- Building envelope interfaces (e.g. window sills, jambs and headers)
- Structural interfaces (e.g. floor to wall junctions, eaves)
- Penetration of the building envelope (e.g. balcony supports, fixings and structural elements)
- Structural considerations (e.g. lintels, cladding supports,)
- Poor construction practice (e.g. gaps in insulation, debris in wall cavity).

Steel has a high thermal conductivity (λ) compared with many other construction materials (see Table 1). The high thermal conductivity means that steel construction systems, both the structural frame and cladding, must be carefully designed to minimise unwanted heat flows. For example, built up cladding and composite (sandwich) cladding panels with steel skins are designed to keep thermal bridging to a minimum by ensuring that steel elements are not continuous through the cladding e.g. for a built up cladding system a thermal break is provided beneath the bracket.

Material	Thermal conductivity, λ (W/mK)
Steel	45 to 50
Stainless steel	15 to 17
In situ normal weight concrete	1.7 to 2.2
Brickwork	0.6 to 0.8
Gypsum based board	0.16 to 0.22
Plywood	0.12 to 0.15
Mineral wool insulation	0.03 to 0.04
Closed cell insulation	0.02 to 0.03

Table 1: Thermal conductivity of common construction materials

Sometimes structural steel elements are required to penetrate the insulated envelope (e.g. canopies and roof members) or be fixed to other steel components, such as balcony brackets and brick support units. These areas require careful consideration.

There are three fundamental ways of reducing thermal bridging in steel construction:

- Eliminate the thermal bridge by keeping the steelwork within the insulated envelope
- Locally insulate any steelwork that penetrates the envelope
- Reduce the thermal transmittance of the thermal bridge by using thermal breaks, changing the detailing or by including alternative materials.

These methods are considered in detail in SCI publication P380.

For example, balconies may be supported from the structural frame of the building or independently supported from the ground (as shown in Figure 2). Independently supported balconies require considerably less connection to the building and the thermal bridging is significantly reduced.

Figure 2: Independently supported balconies to minimise thermal bridging


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Total heat loss

Building Regulations generally give requirements for total energy performance of a building and do not give specific limits for the amount of thermal bridging that is acceptable. However, the energy performance of a building is dependent on the total heat loss through the building envelope which includes the heat losses due to thermal bridges.

The heat loss through a linear thermal bridge, such as a brickwork support angle detail, is defined by its linear thermal transmittance (termed Ψ value or psi value). Linear thermal transmittance is the rate of heat flow per degree temperature difference per unit length of the thermal bridge. The units for Ψ values are Watts per metre Kelvin (W/mK). Repeating thermal bridges, such as wall studs or brick ties, are normally included in the U value but non repeating thermal bridges, such as floor junctions, window sills and ridges, form additional heat transfer paths that are not included in the U value. These can be accounted for by the linear thermal transmittance (Ψ value) for each thermal bridge.

The total fabric conduction heat loss (per Kelvin) is then given by:

$$\Sigma\,(\Psi.L) + \Sigma\,(U.A)$$

where:

- Ψ is the linear thermal transmittance (W/mK)
- L is the length of the thermal bridge (m)
- U is the U value of the planar element (W/m^2K)
- A is the area of the planar element (m^2).

Computer thermal modelling can be used to obtain Ψ values for thermal bridge construction details. In some cases generic thermal bridge performance data is available (e.g. from MCRMA, Accredited Construction Details and BRE Information Paper 1/06). Data may also be available from product manufacturers or system suppliers.

Information from system suppliers

Some steel framing system suppliers are carrying out thermal modelling to determine the Ψ values and temperature factors for the interface details specific to their system. One such system supplier is Fusion Building Systems; their thermal modelling has shown that the linear thermal transmittance values for the Fusion system are significantly lower than those published for generic light steel construction (e.g. Accredited Construction Details). The thermal modelling work carried out by Fusion has been assessed and verified through the SCI Assessed scheme. Hence, the thermal modelling and its verification has been extremely beneficial to Fusion as building energy performance models can use accurate and improved Ψ values. Thereby, producing better results when buildings are assessed for; The Code for Sustainable Homes, Building Energy Performance Certificates and Building Energy Ratings.

Control of condensation

As far as building occupiers are concerned condensation and potential mould growth are likely to be more serious than local heat loss. Low surface temperatures in the region of thermal bridges can lead to surface condensation if they are below the dew point of the air. For non absorbent surfaces, condensation can cause unsightly collection of moisture and dripping or pooling on surfaces beneath. For absorbent materials such as insulation products or plasterboard, interstitial condensation can occur, leading to loss of thermal performance, structural integrity and mould growth.

BS 5250 'Code of practice for control of condensation in buildings' describes the causes and effects of surface and interstitial condensation in buildings and gives recommendations for their control. Further information on condensation due to thermal bridges is provided in BRE Information Paper 1/06. An indicator of condensation risk is provided by the temperature factor f_{Rsi}. This factor is given by the following equation:

$$f_{Rsi} = (t_{si} - t_{ao}) / (t_{ai} - t_{ao})$$

where:

- t_{si} is internal surface temperature
- t_{ao} is external air temperature
- t_{ai} is internal air temperature.

Computer thermal modelling can be used to obtain internal surface temperature for a specific construction detail.

Minimum recommended values of f_{Rsi}, termed critical temperature factors f_{CRsi}, are given in Table 2. The critical temperature factors depend upon the building use and the consequent internal relative humidity of the building. The higher the likely internal humidity, the higher the critical temperature factor will be to eliminate the likelihood of condensation.

Type of building	Critical temperature factors fCRsi
Storage buildings	0.30
Offices, retail premises	0.50
Dwellings; residential buildings; schools	0.75
Sports halls, kitchens, canteens	0.80
Swimming pools, laundries, breweries	0.90

Table 2: Recommended critical temperature factors

Thermal breaks

Thermal breaks between structural steel members may be provided by creating a connection which incorporates a material with a low thermal conductivity such as PTFE, polyethylene and synthetic resin bonded fabric. Where structural forces are required to be transferred through the thermal break it is vital to ensure that the structural performance remains acceptable. Materials used for thermal breaks will generally be more compressible than steel. Therefore, deflections, as well as strength, should be checked when thermal breaks are used. Proprietary products are available to provide structural thermal breaks (as shown in Figure 3) and these generally provide a better solution in terms of thermal insulation and structural capability.

The benefits of proprietary products, such as Isokorb, are demonstrated by the thermal modelling results shown in Table 3 and Figure 4. The modelling was carried out with an internal air temperature of 20°C and an external temperature of -5°C.

Further information on reducing thermal bridging in steel construction is provided in SCI publication P380.

Figure 3: Isokorb thermal break units attached to steel frame

Description of model	Thermal bridge heat loss	Min. internal surface temperature	Temperature factor, fRsi
Beam with Isokorb KST 22	0.43 W/K	15.2 °C	0.81
Beam without thermal break	1.0 W/K	7.5 °C	0.50

Table 3: Results from thermal modelling

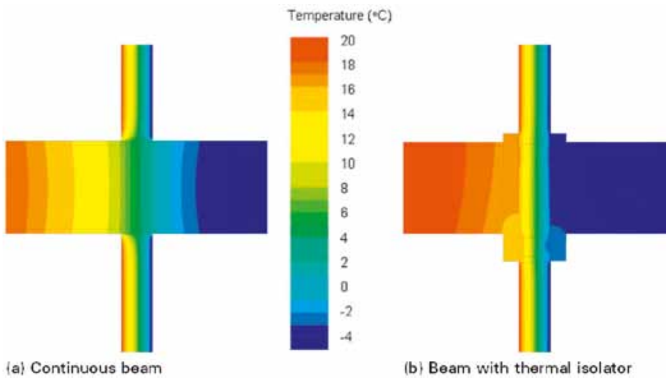


Figure 4: Temperature distribution results from thermal modelling

British steel in Bahrain

by **D. K. Doran,** BSc(Eng), DIC, MICE,
Manager, Structural Design Department, George Wimpey & Co. Ltd

The foundation stone for Isa new town was laid in December 1963 by the Ruler of Bahrain and its Dependencies, His Highness Sheikh Isa bin Shulman Al-Khalifa. The town, named after the Ruler, will eventually accommodate 15,000 people in territory won from the desert.

The plan for Isa Town includes as one of its essential amenities a comprehensive sports complex with a stadium in which there is accommodation for 11,000 spectators including 5,000 seated under cover in a modern grandstand recently completed.

The roof structure 416ft 8in × 57ft 6in was designed in B.S.15 mild steel and checked using an IBM 360 computer. The structure was fabricated in the UK and shipped piece small to Bahrain. All site connections were simple bolted joints and erection of the 145 tons of steelwork was achieved with unskilled local labour and one specialist supervisor. The steelwork was assembled into girders, etc on the ground and then lifted into position using a LIMA machine with a 100ft jib. Good alignment of the canopy fascia was obtained by adjustment to turnbuckles in the 4in diameter ties at the rear of the stand.

The roof framing is essentially a 45ft cantilever supported on tapered box stanchions formed of $\frac{3}{8}$in thick welded plates and an anchor span of 12ft 6in. To combat corrosion all work was hot dip galvanised (to B.S.729) using a 2oz per sq ft coating. Protection of the steelwork was completed, after using a degreasing agent, by the application of calcium plumbate, followed by two undercoats and a gloss finish paint. The terracing is constructed of precast concrete units which are supported on in situ concrete crosswalls at 16ft 8in centres.

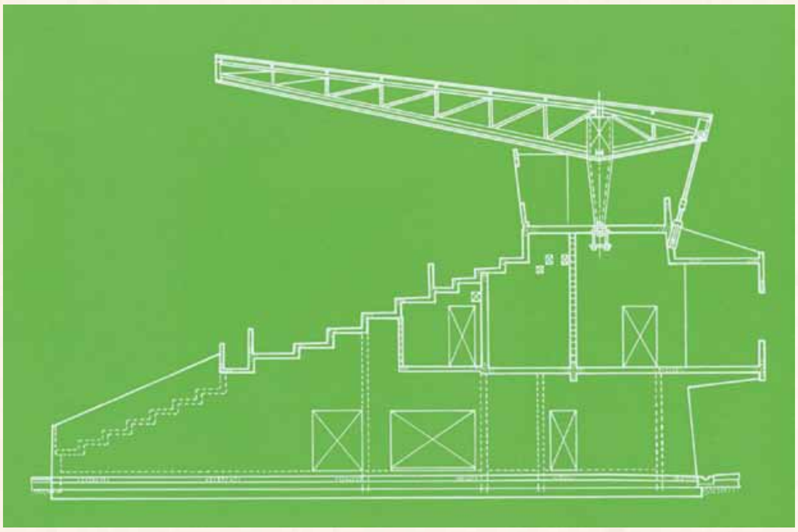
Alternate crosswalls support the box stanchions.

Design wind pressures for the open backed stand were derived from the Swiss Code of Practice and confirmed by wind tunnel tests.

The roof covering and blue covered under lining were in plastic coated steel sheet fixed to the purlins by self tapping stainless steel screws.

The architect for this project was E. V. Collins, ARIBA, and the author was the engineer.

Above: View of completed grandstand



Below left: Erection of longitudinal guides between columns.

Below right: Cross section of stand.

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Catalogue Reference: P387
Edited by M E Brettle and D G Brown
ISBN 978-1-85942-191-8
106 pp, A4, paperback;
July 2009

Steel Building Design: Worked Examples for Students

A concise overview of steel design to the Eurocodes

This easy-to-read publication provides a concise overview of steel design to the Eurocodes. Although prepared with students in mind, the guide should be a very valuable reference for practicing engineers, as it covers common design cases and includes the influence of the UK National Annex. The publication gives:

- An introduction to Eurocode terminology and the structure of the Eurocode system.
- Twelve worked examples, including values of parameters and design options given in UK National Annexes.
- Templates for practical design including frame stability, typical members and connections, chosen to represent realistic design situations.
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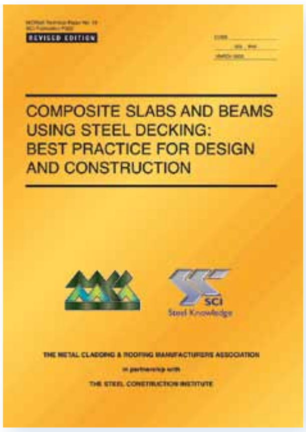

Catalogue Reference: P300
Author: J W Rackham, G H Couchman, S J Hicks
ISBN 978-1-85942-184-0;
116 pp, A4, paperback;
May 2009

Composite slabs and beams using steel decking: Best practice for design and construction

This long awaited Revised Edition covers the design and construction of composite floors, paying particular attention to the good practice aspects. The major revision is the addition of design guidance to the Eurocodes. The use of fibre reinforced concrete is also covered in the revised guide.

The Revised Edition covers the design and construction of composite floors, paying particular attention to the good practice aspects. Following a description of the benefits of composite construction and its common applications, the roles and responsibilities of the parties involved in the design and construction process are identified. The requirements for the transfer of information throughout the design and construction process are described.

The design of composite slabs and beams is discussed in detail in relation to the Eurocodes and BS 5950. In addition to general ultimate and serviceability limit state design issues, practical design considerations such as the formation of holes in the slab, support details, fire protection, and attachments to the slab are discussed. Guidance is also given on the acoustic performance of typical composite slabs. The obligations of designers according to the CDM Regulations are identified and discussed.

The practical application of *Slimdek* construction, which normally utilises deep decking and special support beams, is also covered. Typical construction details are illustrated, and guidance is given on the formation of openings in the beams and the slab.

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AD 336
Execution class for bridge steelwork

This Advisory Desk Note provides background to the choice of 'default' execution class in the Model Project Specification (MPS) for the execution of steelwork in bridges (SCI publication P382).

The execution standard for steel structures, EN 1090-2 (*Execution of steel structures and aluminium structures - Technical requirements for steel structures*), provides for four execution classes for steel structures, EXC1 being the lowest class and EXC4 the highest class. The requirements for quality, testing and acceptance criteria are greater the higher the class. It is left to the project specification to choose the appropriate class for the structure, either by the choice of a single class or by specifying different classes for different elements, depending on the reliability required for the individual element. Clause 4.1.2 states that if no class is specified, EXC2 shall apply.

For bridge steelwork, the quality that has traditionally been specified in the UK (using BS 5400-6 and the Model Appendix 18/1, P170) corresponds generally to class EXC3. For elements that are particularly susceptible to fatigue loading, more stringent requirements have been applied and for lightly loaded bridges requirements have sometimes been relaxed. In drawing up the MPS, the Steel Bridge Group took the view that EXC3 should be specified as a default and that comment would be made about increasing or, occasionally, decreasing the execution class. It was felt that it was preferable to specify EXC3 as a default, with few exceptions, rather than advise the designer to consider the most appropriate class for each part of the bridge and then to expect the steelwork contractor to work to different quality levels for different details. It was also recognised that in some cases the requirements corresponding to EXC4 are impractical in an ordinary workshop and that, where requirements better than EXC3 are needed, they should be addressed in detail rather than simply classing the element as EXC4.

The Steel Bridge Group has also reviewed a new draft Annex for EN 1993-1-1 (*Design of steel structures - General rules and rules for buildings*) that would give the (normative) provisions for selection of the execution class, taking account of the requirements in EN 1990 (*Eurocode - Basis of structural design*) for achieving the required reliability. In that draft Annex, which is derived from informative Annex B of EN 1090-2, two new classifications are defined - service category (SC) and production category (PC); these are in addition to the definition of consequence class (CC) already given in EN 1990. Two service categories are defined, SC1 and SC2, the latter being the category for structures subject to fatigue. Two production categories are defined, PC1 and PC2, the latter being the category most likely to be appropriate to road and rail bridges (footbridges might in some cases be PC1).

Bridge structures are generally in consequence class CC2 or CC3 according to EN 1990 and thus the draft Annex recommends the use of EXC3 or possibly EXC4 (particularly for CC3+SC2+PC2). The choice of EXC3 in the MPS is thus consistent with the recommendations in the draft Annex.

The new draft Annex to EN 1993-1-1 is to be formally considered by TC250/SC3 in October 2009 and publication (and thus implementation) is therefore not likely until late 2010.

Contact: David Iles
Tel: 01344 636525
Email: advisory@steel-sci.com

Specifying bridge steelwork to BS EN 1090-2

David Iles explains how the Steel Bridge Group is helping bridge designers to use the new Execution Standard.

Bridge designers in the UK are familiar with the modestly sized (38 pages) BS 5400 Part 6, which has been used for nearly 30 years. It was a document that deliberately left some technical matters to be specified for the individual bridge project and since 1996 the Model Appendix 18/1, produced by the Steel Bridge Group has provided model additional clauses, each complete with a commentary explaining their intent or use, that have been widely adopted in contract specifications. The clauses are usually implemented through the Specification for Highway Works, which calls for the production of an "Appendix 18/1" in its 1800 series of specification clauses.

In conjunction with the switch to the Structural Eurocodes, specification of structural steelwork will in future be in accordance with BS EN 1090-2. That standard covers all types of steel structure (buildings, bridges, towers and masts etc.) and a range of steel products (structural steels stainless steels, cold formed steels, etc) and it is 203 pages long. The standard includes over 150 instances where additional requirements can be given or options selected, to suit the particular structure or project. Bridge designers and specifiers will therefore find it differs greatly from what they are familiar with and will need guidance in producing a project specification that ensures the quality of workmanship appropriate to highway and railway bridges.

The Steel Bridge Group identified this need and formed a small working group to examine all the alternatives and options in BS EN 1090-2 and to produce a new document of model clauses, with commentaries, that would be suitable for most bridge projects in the UK. The document would ensure the same quality of fabrication and erection (now collectively called execution) that we have been used to in the UK. The result is a new SCI publication, Steel Bridge Group: Model Project Specification for the Execution of Steelwork in Bridge Structures - MPS for short.

The new publication (SCI reference P382) is not being produced in paper form but as a document that is available on Steelbiz. P382 is available in two forms - the full document, with commentaries, as a pdf document, and the model clauses alone in a Word file, suitable for incorporation in contact documents. This dual document format was successfully used for the Model Appendix 18/1 publication. Full access to both documents is available to SCI members. Paper copies can be provided on demand, at a small cost (telephone 01344 636513 or email *publications@steel-sci.com*).

Because the document has been produced by the Steel Bridge Group, calling upon the experience of its members, the MPS provides an authoritative complement to BS EN 1090-2 for bridge steelwork and is likely to be widely adopted. It is expected that the Highways Agency will reference the MPS when it updates Series 1800 of the Specification for Highway Works.

New and Revised Codes & Standards

(from BSI Updates June & July 2009)

BS EN PUBLICATIONS

The following are British Standard implementations of the English language versions of European Standards (ENs). BSI has an obligation to publish all ENs and to withdraw any conflicting British Standards or parts of British Standard. This has led to a series of standards, BS ENs using the EN number.

Note: The date referenced in the identifier is the date of the European standard.

BS EN ISO 898:-
Mechanical properties of fasteners made of carbon steel and alloy steel
BS EN ISO 898-1:2009
Bolts, screws and studs with specified property classes. Coarse thread and fine pitch thread
Supersedes BS EN ISO 898-1:1999

BS EN 10088:-
Stainless steels
BS EN 10088-4:2009
Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for construction purposes
No current standard is superseded
BS EN 10088-5:2009
Technical delivery conditions for bars, rods, wire, sections and bright products of corrosion resisting steels for construction purposes
No current standard is superseded

BS EN 10343:2009
Steels for quenching and tempering for construction purposes. Technical delivery conditions
No current standard is superseded

AMENDMENTS TO BRITISH STANDARDS

BS 6779:-
Highway parapets for bridges and other structures
BS 6779-3:1994
Specification for vehicle containment parapets of combined metal and concrete construction
CORRIGENDUM 1

CORRIGENDA TO BRITISH STANDARDS

BS 5395:-
Stairs. ladders and walkways
BS 5395-2:1984
Code of practice for the design of helical and spiral stairs
CORRIGENDUM 3. Also incorporates Corrigenda 1 & 2 and Amendment 1.

BS EN 1991:-
Eurocode 1. Actions on structures
BS EN 1991-1:-
General actions
BS EN 1991-1-2:2002
Actions on structures exposed to fire
CORRIGENDUM 1
BS EN 1991-1-3:2003
Snow loads
CORRIGENDUM 2. Also incorporates Corrigendum 1.

BS EN 10083:-
Steels for quenching and tempering
BS EN 10083-3:2006
Technical delivery conditions for alloy steels
CORRIGENDUM 1

BRITISH STANDARDS UNDER REVIEW

BS 6954:-
Tolerances for building
BS 6954-1:1988
(ISO 3443-1:1979)
Recommendations for basic principles for evaluation and specification

BS EN ISO 4014:2001
Hexagon head bolts. Product grades A and B

BS EN ISO 4016:2001
Hexagon head bolts. Product grade C

BS EN ISO 4017:2001
Hexagon head screws. Product grades A and B

BS EN ISO 4018:2001
Hexagon head screws. Product grade C

BS EN ISO 8676:2001
Hexagon head screws with metric fine pitch thread. Product grades A and B

BS EN ISO 8765:2001
Hexagon head bolts with metric fine pitch thread. Product grades A and B

DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT – ADOPTIONS

09/30156692 DC
BS EN 10029 Hot-rolled steel plates 3 mm thick or above. Tolerances on dimensions and shape

09/30167117 DC
BS EN ISO 17633 Welding consumables. Tubular cored electrodes and rods for gas shielded and non-gas shielded metal arc welding of stainless and heat-resisting steels. Classification

CEN EUROPEAN STANDARDS

EN 1993:-
Eurocode 3. Design of steel structures
EN 1993-1-1:-
General rules and rules for buildings
CORRIGENDUM 2: April 2009 to EN 1993-1-1:2005
EN 1993-1-6:-
Strength and stability of shell structures
CORRIGENDUM 1: April 2009 to EN 1993-1-6:2007
EN 1993-1-7:-
Plated structures subject to out of plane loading
CORRIGENDUM 1: April 2009 to EN 1993-1-7:2007
EN 1993-1-11:-
Design of structures with tension components
CORRIGENDUM 1: April 2009 to EN 1993-1-11:2006
EN 1993-1-12:-
Additional rules for the extension of EN 1993 up to steel grades S 700
CORRIGENDUM 1: April 2009 to EN 1993-1-12:2007
EN 1993-4-1:-
Silos
CORRIGENDUM 1: April 2009 to EN 1993-4-1:2007

EN 1994:-
Eurocode 4. Design of composite steel and concrete structures
EN 1994-1-1:-
General rules and rules for buildings
CORRIGENDUM 1: April 2009 to EN 1994-1-1:2004

Steelwork contractors for buildings

BCSA is the national organisation for the steel construction industry.
Membership of BCSA is open to any Steelwork Contractor who has a fabrication facility within the United Kingdom or Republic of Ireland.
Details of BCSA membership and services can be obtained from

Gillian Mitchell MBE, Deputy Director General, BCSA, 4 Whitehall Court, London SW1A 2ES
Tel: 020 7839 8566 Email: gillian.mitchell@steelconstruction.org

Applicants may be registered in one or more Buildings category to undertake the fabrication and the responsibility for any design and erection of:

- **C** Heavy industrial platework for plant structures, bunkers, hoppers, silos etc
- **D** High rise buildings (offices etc over 15 storeys)
- **E** Large span portals (over 30m)
- **F** Medium/small span portals (up to 30m) and low rise buildings (up to 4 storeys)
- **G** Medium rise buildings (from 5 to 15 storeys)
- **H** Large span trusswork (over 20m)
- **J** Tubular steelwork where tubular construction forms a major part of the structure
- **K** Towers and masts
- **L** Architectural steelwork for staircases, balconies, canopies etc
- **M** Frames for machinery, supports for plant and conveyors
- **N** Large grandstands and stadia (over 5000 persons)
- **Q** Specialist fabrication services (eg bending, cellular/castellated beams, plate girders)
- **R** Refurbishment
- **S** Lighter fabrications including fire escapes, ladders and catwalks
- **QM** Quality management certification to ISO 9001

Notes

(1) Contracts which are primarily steelwork but which may include associated works. The steelwork contract value for which a company is pre-qualified under the Scheme is intended to give guidance on the size of steelwork contract that can be undertaken; where a project lasts longer than a year, the value is the proportion of the steelwork contract to be undertaken within a 12 month period.

Where an asterisk (*) appears against any company's classification number, this indicates that the assets required for this classification level are those of the parent company.

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	Contract Value (1)
A C Bacon Engineering Ltd	01953 850611			●	●		●										Up to £1,400,000
ACL Structures Ltd	01258 456051			●	●		●				●						Up to £3,000,000
Adey Steel Ltd	01509 556677				●	●	●	●		●	●			●	●		Up to £3,000,000
Adstone Construction Ltd	01905 794561			●	●	●											Up to £4,000,000
Advanced Fabrications Poyle Ltd	01753 531116				●		●	●	●	●	●				●	✓	Up to £800,000
Andrew Mannion Structural Engineers Ltd	00 353 90 644 8300		●	●	●	●	●	●			●	●		●		✓	Up to £6,000,000
Angle Ring Company Ltd	0121 557 7241												●				Up to £800,000
Apex Steel Structures Ltd	01268 660828				●		●			●	●						Up to £800,000
Arromax Structures Ltd	01623 747466	●		●	●	●	●	●	●		●	●					Up to £800,000
ASA Steel Structures Ltd	01782 566366			●	●		●			●	●			●	●		Up to £800,000*
ASD Westok Ltd	01924 264121												●				Up to £6,000,000
ASME Engineering Ltd	020 8954 0028				●					●	●			●	●	✓	Up to £1,400,000*
Atlas Ward Structures Ltd	01944 710421		●	●	●	●	●	●	●	●	●	●		●	●	✓	Above £6,000,000
Atlasco Constructional Engineers Ltd	01782 564711			●	●		●							●			Up to £2,000,000
AWF Steel Ltd	01236 457960				●					●				●	●		Up to £100,000
B D Structures Ltd	01942 817770			●	●	●	●				●			●			Up to £1,400,000
Ballykine Structural Engineers Ltd	028 9756 2560			●	●	●	●	●				●				✓	Up to £2,000,000
Barnshaw Section Benders Ltd	01902 880848												●			✓	Up to £800,000
Barrett Steel Buildings Ltd	01274 266800			●	●	●	●									✓	Up to £6,000,000
Barretts of Aspley Ltd	01525 280136				●					●	●						Up to £3,000,000
BHC Ltd	01555 840006	●	●	●	●	●	●							●			Above £6,000,000
Billington Structures Ltd	01226 340666		●	●	●	●	●	●	●	●	●	●		●		✓	Above £6,000,000
Bone Steel Ltd	01698 375000	●	●	●	●	●	●			●	●	●		●			Up to £6,000,000*
Border Steelwork Structures Ltd	01228 548744			●	●	●	●			●	●				●		Up to £3,000,000
Bourne Construction Engineering Ltd	01202 746666		●	●	●	●	●	●	●	●	●	●	●	●		✓	Above £6,000,000
Browne Structures Ltd	01283 212720				●			●							●		Up to £400,000
BSB Structural Ltd	01506 840937			●	●	●									●		Up to £800,000
Cairnhill Structures Ltd	01236 449393				●	●	●	●		●	●			●	●	✓	Up to £1,400,000
Caunton Engineering Ltd	01773 531111	●	●	●	●	●	●	●			●	●		●		✓	Up to £6,000,000
Chieftain Contracts Ltd	01324 812911			●	●										●		Up to £400,000
Cleveland Bridge UK Ltd	01325 502277	●	●	●	●	●	●	●	●	●	●	●		●		✓	Above £6,000,000*
CMF Ltd	020 8844 0940				●		●	●		●	●				●		Up to £6,000,000
Compass Engineering Ltd	01226 298388			●	●		●		●								Up to £2,000,000
Conder Structures Ltd	01283 545377		●	●	●	●	●				●	●		●	●	✓	Up to £6,000,000
Cordell Group Ltd	01642 452406	●			●	●	●	●	●	●	●					✓	Up to £3,000,000
Coventry Construction Ltd	024 7646 4484			●	●	●	●		●	●	●			●	●		Up to £1,400,000
Cronin Buckley Fabrication & Construction Ltd	00 353 21 487 0017			●	●	●	●				●						Up to £6,000,000
Crown Structural Engineering Ltd	01623 490555			●	●	●	●		●		●			●	●	✓	Up to £1,400,000
D A Green & Sons Ltd	01406 370585		●	●	●	●	●	●	●	●	●	●		●	●	✓	Up to £6,000,000
D H Structures Ltd	01785 246269				●						●						Up to £200,000
Deconsys Technology Ltd	01274 521700				●					●				●	●		Up to £200,000
Discain Project Services Ltd	01604 787276				●					●	●				●	✓	Up to £1,400,000
Duggan Steel Ltd	00 353 29 70072		●	●	●	●	●	●			●						Up to £6,000,000
Elland Steel Structures Ltd	01422 380262		●	●	●	●	●	●	●	●	●	●		●		✓	Up to £6,000,000
Emmett Fabrications Ltd	01274 597484			●	●	●	●							●			Up to £1,400,000
EvadX Ltd	01745 336413			●	●	●	●	●	●	●	●	●				✓	Up to £3,000,000
F J Booth & Partners Ltd	01642 241581			●	●		●				●				●	✓	Up to £4,000,000
Fairfield-Mabey Ltd	01291 623801	●	●	●	●	●	●	●	●	●	●	●		●		✓	Above £6,000,000
Company name	**Tel**	**C**	**D**	**E**	**F**	**G**	**H**	**J**	**K**	**L**	**M**	**N**	**Q**	**R**	**S**	**QM**	**Contract Value (1)**

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	Contract Value (1)
Fisher Engineering Ltd	028 6638 8521			●	●	●	●	●	●	●	●	●				✓	Above £6,000,000
Fox Bros Engineering Ltd	00 353 53 942 1677			●	●	●	●	●			●						Up to £3,000,000
Frank H Dale Ltd	01568 612212		●	●	●	●										✓	Up to £6,000,000
Gibbs Engineering Ltd	01278 455253				●		●	●		●	●				●	✓	Up to £200,000
GME Structures Ltd	01939 233023			●	●		●	●		●	●			●	●		Up to £800,000
Gorge Fabrications Ltd	0121 522 5770				●	●	●	●		●				●			Up to £1,400,000
Graham Wood Structural Ltd	01903 755991		●	●	●	●	●	●	●	●	●	●		●			Up to £6,000,000
Grays Engineering (Contracts) Ltd	01375 372411				●			●		●	●				●		Up to £100,000
Gregg & Patterson (Engineers) Ltd	028 9061 8131			●	●	●	●	●				●				✓	Up to £4,000,000
H Young Structures Ltd	01953 601881			●	●	●	●	●			●						Up to £2,000,000
Had Fab Ltd	01875 611711								●		●				●	✓	Up to £1,400,000
Hambleton Steel Ltd	01748 810598		●	●	●	●	●	●				●		●		✓	Up to £6,000,000
Harry Marsh (Engineers) Ltd	0191 510 9797			●	●	●	●				●	●					Up to £2,000,000
Harry Peers Steelwork Ltd	01204 558500			●	●	●	●	●	●	●	●			●		✓	Up to £4,000,000
Henry Smith (Constructional Engineers) Ltd	01606 592121			●	●	●	●	●									Up to £6,000,000
Hescott Engineering Company Ltd	01324 556610			●	●	●	●			●				●	●		Up to £3,000,000
Hills of Shoeburyness Ltd	01702 296321									●	●				●		Up to £800,000
J Robertson & Co Ltd	01255 672855									●	●				●		Up to £200,000
James Bros (Hamworthy) Ltd	01202 673815			●	●		●			●	●	●			●	✓	Up to £2,000,000
James Killelea & Co Ltd	01706 229411		●	●	●	●	●					●		●			Up to £6,000,000*
John Reid & Sons (Strucsteel) Ltd	01202 483333		●	●	●	●	●	●	●	●	●	●		●			Up to £6,000,000
Leach Structural Steelwork Ltd	01995 640133			●	●	●	●	●			●						Up to £1,400,000
Leonard Cooper Ltd	0113 270 5441				●		●		●		●			●			Up to £1,400,000
Leonard Engineering (Ballybay) Ltd	00 353 42 974 1099			●	●	●	●				●						Up to £3,000,000
Lowe Engineering (Midland) Ltd	01889 563244									●					●	✓	Up to £800,000
M Hasson & Sons Ltd	028 2957 1281			●	●	●	●	●	●	●	●				●	✓	Up to £3,000,000
M&S Engineering Ltd	01461 40111				●				●	●	●			●	●		Up to £1,400,000
Maldon Marine Ltd	01621 859000				●			●	●	●					●		Up to £800,000
Midland Steel Structures Ltd	024 7644 5584			●	●	●	●										Up to £2,000,000
Mifflin Construction Ltd	01568 613311		●	●	●	●	●				●						Up to £4,000,000
Milltown Engineering Ltd	00 353 59 972 7119			●	●	●	●	●									Up to £6,000,000
Newbridge Engineering Ltd	01429 866722			●	●	●	●									✓	Up to £1,400,000
Newton Fabrications Ltd	01292 269135			●	●	●				●	●	●			●	✓	Up to £4,000,000
On Site Services (Gravesend) Ltd	01474 321552				●		●	●		●	●				●		Up to £400,000
Overdale Construction Services Ltd	01656 729229			●	●		●	●			●				●		Up to £800,000
Paddy Wall & Sons	00 353 51 420 515			●	●	●	●	●	●	●	●					✓	Up to £6,000,000
Pencro Structural Engineering Ltd	028 9335 2886			●	●		●	●			●					✓	Up to £2,000,000
Peter Marshall (Fire Escapes) Ltd	0113 307 6730									●					●		Up to £1,400,000
PMS Fabrications Ltd	01228 599090			●	●	●	●		●	●	●			●	●		Up to £1,400,000
Remnant Engineering Ltd	01564 841160				●		●	●		●					●	✓	Up to £400,000*
Rippin Ltd	01383 518610			●	●	●	●	●									Up to £2,000,000
Roberts Engineering	01482 838240				●					●				●	●		Up to £100,000
Robinson Construction	01332 574711		●	●	●	●	●		●	●	●	●		●	●	✓	Above £6,000,000
Rowecord Engineering Ltd	01633 250511	●	●	●	●	●	●	●	●	●	●	●	●	●		✓	Above £6,000,000
Rowen Structures Ltd	01773 860086		●	●	●	●	●	●	●	●	●	●		●			Above £6,000,000*
RSL (South West) Ltd	01460 67373			●	●		●				●						Up to £1,400,000
S H Structures Ltd	01977 681931						●	●	●	●							Up to £3,000,000
Selwyn Construction Engineering Ltd	0151 678 0236									●	●				●	✓	Up to £200,000
Severfield-Reeve Structures Ltd	01845 577896	●	●	●	●	●	●	●	●	●	●	●	●	●		✓	Above £6,000,000
Shipley Fabrications Ltd	01400 231115			●	●	●	●		●	●	●				●		Up to £200,000
SIAC Butlers Steel Ltd	00 353 57 862 3305		●	●	●	●	●	●			●	●				✓	Above £6,000,000
SIAC Tetbury Steel Ltd	01666 502792			●	●	●	●				●	●				✓	Up to £3,000,000
Snashall Steel Fabrications Co Ltd	01300 345588			●	●		●								●		Up to £2,000,000
South Durham Structures Ltd	01388 777350			●	●	●				●	●	●			●		Up to £800,000
Temple Mill Fabrications Ltd	01623 741720			●	●	●	●				●	●			●		Up to £400,000
Terence McCormack Ltd	028 3026 2261			●	●		●	●								✓	Up to £800,000
The AA Group Ltd	01695 50123			●	●	●	●			●	●				●		Up to £4,000,000
The Steel People Ltd	01622 715900				●					●					●		Up to £100,000
Traditional Structures Ltd	01922 414172			●	●	●	●	●	●		●	●		●		✓	Up to £3,000,000*
W & H Steel & Roofing Systems Ltd	00 353 56 444 1855			●	●	●	●	●						●	●		Up to £4,000,000
W I G Engineering Ltd	01869 320515				●					●					●		Up to £400,000
W S Britland & Company Ltd	01304 831583				●		●	●	●		●				●	✓	*Accounts outstanding*
Walter Watson Ltd	028 4377 8711			●	●	●	●	●				●				✓	Up to £6,000,000
Watson Steel Structures Ltd	01204 699999	●	●	●	●	●	●	●	●	●	●	●		●		✓	Above £6,000,000
Westbury Park Engineering Ltd	01373 825500	●			●			●	●	●	●				●	✓	Up to £800,000
William Haley Engineering Ltd	01278 760591			●	●	●			●	●	●					✓	Up to £2,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	●		●		✓	Above £6,000,000
Company name	**Tel**	**C**	**D**	**E**	**F**	**G**	**H**	**J**	**K**	**L**	**M**	**N**	**Q**	**R**	**S**	**QM**	**Contract Value (1)**

Associate Members

Associate Members are those principal companies involved in the direct supply to all or some Members of components, materials or products. Associate member companies must have a registered office within the United Kingdom or Republic of Ireland.

1 Structural components **2** Computer software **3** Design services **4** Steel producers **5** Manufacturing equipment **6** Protective systems **7** Safety systems **8** Steel stockholders **9** Structural fasteners

Company name	Tel	1	2	3	4	5	6	7	8	9
AceCad Software Ltd	01332 545800		●							
Advanced Steel Services Ltd	01772 259822								●	
Albion Sections Ltd	0121 553 1877	●								
Alternative Steel Co Ltd	01942 610601								●	
Andrews Fasteners Ltd	0113 246 9992									●
Arcelor Mittal Distribution Solutions UK	01454 311442								●	
Arcelor Mittal Distribution Solutions UK	01443 812181								●	
Arcelor Mittal Distribution Solutions UK	01925 817000								●	
Arcelor Mittal Distribution Solutions UK	01724 810810								●	
Arro-Cad Ltd	01283 558206			●						
ASD metal services - Biddulph	01782 515152								●	
ASD metal services – Bodmin	01208 77066								●	
ASD metal services - Cardiff	029 2046 0622								●	
ASD metal services - Carlisle	01228 674766								●	
ASD metal services - Daventry	01327 876021								●	
ASD metal services - Durham	0191 492 2322								●	
ASD metal services - Edinburgh	0131 459 3200								●	
ASD metal services - Exeter	01395 233366								●	
ASD metal services - Grimsby	01472 353851								●	
ASD metal services - Hull	01482 633360								●	
ASD metal services – London	020 7476 0444								●	
ASD metal services - Norfolk	01553 761431								●	
ASD metal services - Stalbridge	01963 362646								●	
ASD metal services - Tividale	0121 520 1231								●	
Austin Trumanns Steel Ltd	0161 866 0266								●	
Ayrshire Metal Products (Daventry) Ltd	01327 300990	●								
BAPP Group Ltd	01226 383824									●
Barnshaw Plate Bending Centre Ltd	0161 320 9696	●								
Barrett Steel Services Ltd	01274 682281								●	
Bentley Systems (UK) Ltd	0141 353 5168		●							
Cellbeam Ltd	01937 840600	●								
Cellshield Ltd	01937 840600							●		
Combisafe International Ltd	01604 660600							●		
Composite Metal Flooring Ltd	01495 761080	●								
Composite Profiles UK Ltd	01202 659237	●								
Computer Services Consultants (UK) Ltd	0113 239 3000		●							
Cooper & Turner Ltd	0114 256 0057									●
Corus	01724 404040				●					
Corus Bristol	01454 315314								●	
Corus Dartford	01322 227272								●	
Corus Ireland Service Centre	028 9266 0747								●	
Corus Newcastle	0191 414 2121								●	
Corus Panels & Profiles	01684 856600	●								
Corus Service Centre Dublin	00 353 1 405 0300								●	
Corus Tubes	01536 402121				●					
Corus Wednesfield	01902 484100								●	
Daver Steels Ltd	0114 261 1999	●								
Development Design Detailing Services Ltd	01204 396606			●						
Company name	**Tel**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**

Company name	Tel	1	2	3	4	5	6	7	8	9
Easi-edge Ltd	01777 870901							●		
Fabsec Ltd	0845 094 2530	●								
Ficep (UK) Ltd	0113 265 3921					●				
FLI Structures	01452 722260	●								
Forward Protective Coatings Ltd	01623 748323						●			
GWS Engineering & Industrial Supplies Ltd	00 353 21 4875 878									●
Hempel UK Ltd	01633 874024						●			
Hi-Span Ltd	01953 603081	●								
Industrial Shotblast & Spraying Ltd	0845 130 6715						●			
International Paint Ltd	0191 469 6111						●			
Interpipe UK Ltd	0845 226 7007								●	
Jack Tighe Ltd	01302 880360						●			
Kaltenbach Ltd	01234 213201					●				
Kingspan Structural Products	01944 712000	●								
LaserTUBE Cutting	0121 601 5000								●	
Leighs Paints	01204 521771						●			
Lindapter International	01274 521444									●
Metsec plc	0121 601 6000	●								
MSW (UK) Ltd	01355 232266	●								
MSW Structural Floor Systems	0115 946 2316	●								
National Tube Stockholders Ltd	01845 577440								●	
Northern Steel Decking Ltd	01909 550054	●								
Northern Steel Decking Scotland Ltd	01505 328830	●								
John Parker & Sons Ltd	01227 783200								●	●
Peddinghaus Corporation UK Ltd	01952 200377					●				
Peddinghaus Corporation UK Ltd	00 353 87 2577 884					●				
PMR Fixers	01335 347629	●								
PP Protube Ltd	01744 818992	●								
PPG Performance Coatings UK Ltd	01773 837300						●			
Profast (Group) Ltd	00 353 1 456 6666									●
Rainham Steel Co Ltd	01708 522311								●	
Richard Lees Steel Decking Ltd	01335 300999	●								
Rösler UK	0151 482 0444					●				
Schöck Ltd	0845 241 3390	●								
Site Coat Services Ltd	01476 577473						●			
Steel Projects UK Ltd	0113 253 2171		●							
Steelstock (Burton-on-Trent) Ltd	01283 226161								●	
Structural Metal Decks Ltd	01202 718898	●								
Structural Sections Ltd	0121 555 1342	●								
Struthers & Carter Ltd	01482 795171								●	
Studwelders Ltd	01291 626048	●								
Tekla (UK) Ltd	0113 307 1200		●							
Tension Control Bolts Ltd	01948 667700									●
Trailerpal Ltd	01743 446666							●		
Voortman UK Ltd	01827 63300					●				
Wedge Group Galvanizing Ltd	01909 486384						●			
Wells Protective Coatings Ltd	01302 733611						●			
Company name	**Tel**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**

Corporate Members

Corporate Members are clients, professional offices, educational establishments etc which support the development of national specifications, quality, fabrication and erection techniques, overall industry efficiency and good practice.

Company name	Tel
Balfour Beatty Utility Solutions Ltd	01332 661491
Griffiths & Armour	0151 236 5656
Roger Pope Associates	01752 263636
Highways Agency	08457 504030

Steelwork contractors for bridgework

The Register of Qualified Steelwork Contractors Scheme for Bridgeworks (RQSC) is open to any Steelwork Contractor who has a fabrication facility within the European Union.

Applicants may be registered in one or more category to undertake the fabrication and the responsibility for any design and erection of:

- **FG** Footbridge and sign gantries
- **PG** Bridges made principally from plate girders
- **TW** Bridges made principally from trusswork
- **BA** Bridges with stiffened complex platework (eg in decks, box girders or arch boxes)
- **CM** Cable-supported bridges (eg cable-stayed or suspension) and other major structures (eg 100 metre span)
- **MB** Moving bridges
- **RF** Bridge refurbishment
- **QM** Quality management certification to ISO 9001

Notes

(1) Contracts which are primarily steelwork but which may include associated works. The steelwork contract value for which a company is pre-qualified under the Scheme is intended to give guidance on the size of steelwork contract that can be undertaken; where a project lasts longer than a year, the value is the proportion of the steelwork contract to be undertaken within a 12 month period.

Where an asterisk (*) appears against any company's classification number, this indicates that the assets required for this classification level are those of the parent company.

Company name	Tel	FG	PG	TW	BA	CM	MB	RF	QM	Contract Value (1)
'N' Class Fabrication Ltd	01733 558989	●	●	●	●		●	●	✓	Up to £800,000 *Operating under CVA*
Briton Fabricators Ltd*	0115 963 2901	●	●	●	●	●		●	✓	Up to £2,000,000
Cimolai Spa	01223 350876	●	●	●	●	●	●		✓	Above £6,000,000
Cleveland Bridge UK Ltd*	01325 502277	●	●	●	●	●	●	●	✓	Above £6,000,000*
Concrete & Timber Services Ltd	01484 606416	●	●	●		●	●		✓	Up to £800,000
Fairfield-Mabey Ltd*	01291 623801	●	●	●	●	●	●	●	✓	Above £6,000,000
Harland & Wolff Heavy Industries Ltd	028 9045 8456	●	●	●	●	●		●	✓	Up to £6,000,000
Interserve Project Services Ltd	0121 344 4888							●	✓	Above £6,000,000
Interserve Project Services Ltd	020 8311 5500	●	●	●	●		●	●	✓	Up to £400,000*
Nusteel Structures Ltd*	01303 268112	●	●	●	●	●		●	✓	Up to £4,000,000*
P C Richardson & Co (Middlesbrough) Ltd	01642 714791	●						●	✓	Up to £3,000,000*
Remnant Engineering Ltd*	01564 841160	●							✓	Up to £400,000*
Rowecord Engineering Ltd*	01633 250511	●	●	●	●	●	●	●	✓	Above £6,000,000
TEMA Engineering Ltd	029 2034 4556	●	●	●	●	●	●	●	✓	Up to £1,400,000*
W S Britland & Co Ltd*	01304 831583	●							✓	*Accounts outstanding*
Watson Steel Structures Ltd*	01204 699999	●	●	●	●	●	●	●	✓	Above £6,000,000

* Denotes membership of the BCSA