

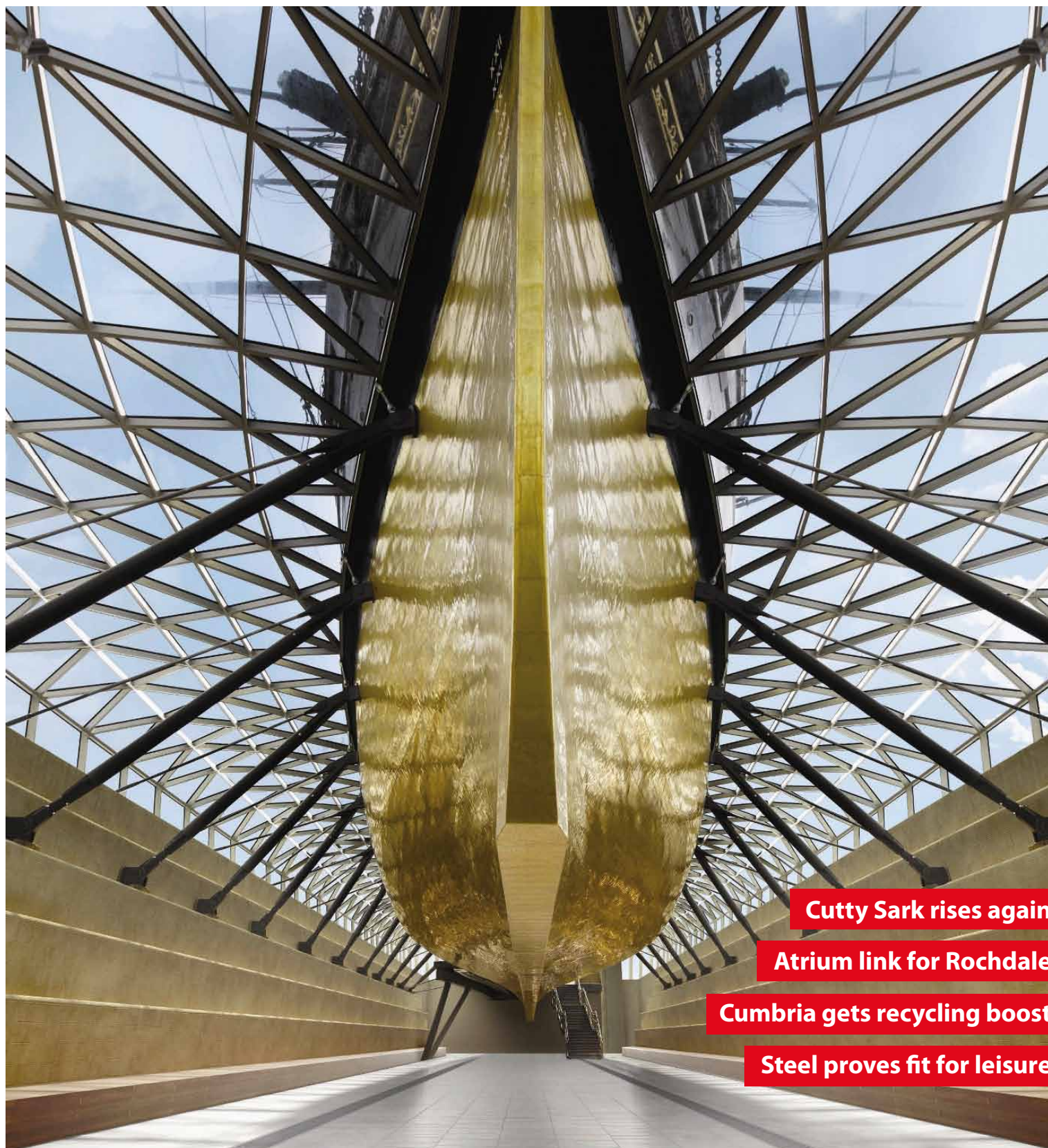
NSC

Steel stars at Pinewood



Vol 20 No.6

June 2012



Cutty Sark rises again

Atrium link for Rochdale

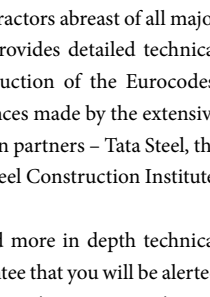
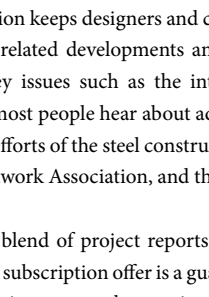
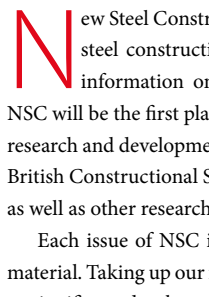
Cumbria gets recycling boost

Steel proves fit for leisure

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New Steel Construction keeps designers and contractors abreast of all major steel construction related developments and provides detailed technical information on key issues such as the introduction of the Eurocodes. NSC will be the first place most people hear about advances made by the extensive research and development efforts of the steel construction partners – Tata Steel, the British Constructional Steelwork Association, and the Steel Construction Institute, as well as other researchers.

Each issue of NSC is a blend of project reports and more in depth technical material. Taking up our free subscription offer is a guarantee that you will be alerted to significant developments in a sector that retains a commitment to continuous development in knowledge and techniques for timely delivery of cost effective, quality projects across all sectors of construction.

Each issue of NSC is typically 44 pages and contains five pages of news, developments related to Eurocodes, cutting edge project reports from site, and the latest technical updates from the Steel Construction Institute in its Advisory Desk Note series. Popular features are 50 Years Ago and 20 Years Ago, looking at key projects of the past by revisiting the pages of 'Building With Steel' and 'Steel Construction'.

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Company

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Postcode

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Email



Cover Image

Cutty Sark, Greenwich, London
 Client: Cutty Sark Enterprises
 Architect: Grimshaw Architects
 Steelwork contractor: S H Structures
 Steel tonnage: 310t


TATA STEEL


June 2012 Vol 20 No 6

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Civic A feature atrium structure is the central element of Rochdale's new council office building, a project which is expected to be a precursor for further developments in the town.

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Entertainment The latest steel-framed stage structure to be erected at the world famous Pinewood Studios has been named after Richard Attenborough.

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Building surety with steel



Nick Barrett - Editor

With this month's issue of NSC you will find a special publication from the BCSA and Tata Steel called *The Surest Way is Steel*. It details some of the ways in which steel construction is delivering great benefits to clients, designers and the ultimate users of buildings and other structures. Case studies highlight the advantages accruing to projects including residential and commercial buildings when steel is chosen as the framing material; the advantages are many and wide ranging, but the main thrust is to demonstrate that especially in uncertain financial times, the surest way of ensuring successful project delivery is to use steel construction.

This issue of NSC also shows something of the diversity of projects that would not be possible in the shape conceived by their designers without flexibility, ease of construction and other steel benefits. Cutty Sark's restoration, our cover story, is one of the highest profile heritage projects in the world, one which would not be possible to put on public view in London in the way it has been without the creative use of steel.

Steel, the most modern of methods of construction, is playing a key role in preserving other parts of our heritage; for example, last year we reported on the creation of a new hull shaped home for Henry VIII's flagship the Mary Rose in Portsmouth (NSC Oct 2011) which opens this year. A 'pearl within an oyster' as architect Chris Wilkinson called it, built with great sensitivity in a dock that is itself a scheduled ancient monument. Hard to imagine it having been done so successfully without steel.

In Worcester a new sports and leisure club is being built for the David Lloyd Group, with steelwork designed and fabricated to meet tight deadlines in just five weeks. Fabrication was under way at the same time as the on-site preparation works, and the steel frame was ready for quick erection as soon as the site was available. This was a challenging timescale but it is the sort of challenge that steelwork designers and contractors routinely rise to.

On other pages you will read about one of the biggest television and film stages in Europe being created at the world famous Pinewood Studios, calling for a flexible construction approach that would intrude as little as possible on a congested site where other programmes and films were being filmed. The steel-framed Richard Attenborough Stage has been built to a fast track programme, on budget and to the highest standard, earning plaudits from a satisfied client grateful for not having had to disrupt any major productions.

Steel is widely acknowledged as having the best sustainability case among construction materials, so it is no surprise to see it feature in this issue as the framing material for a large recycling facility that will revolutionise the handling of much of Cumbria's waste. As well as an efficient facility, Cumbria gets a major industrial building that works on an aesthetic level too. *The Surest Way is Steel* is clearly no idle boast.

NSC

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SCI advises on CE Marking for steel construction

The SCI has issued advice on the impact of CE Marking on the steel construction industry.

SCI said all construction products covered by a harmonised European Standard are required by law to be CE Marked from 1 July 2013. The one exception to this is products covered by BS EN 1090 (typically fabricated steel used in buildings, bridges, towers and masts) where CE

Marking is not mandatory until 1 July 2014.

Harmonised standards are central to the CE marking process. They declare everything that a manufacturer needs to do in order to achieve CE Marking. If a construction product is not covered by a harmonised standard, a European Technical Approval provides an alternative route to CE Marking.

SCI said it has experience of developing

European Technical Approvals to cover unique construction products. A manufacturer can then progress towards CE Marking, supported by a third party Notified Body who undertakes the assessment of factory production control. With a Notified Body, SCI can assist manufacturers in the CE Marking process by developing the necessary European Technical Approval where a harmonized

standard does not exist.

SCI's support for manufacturers wishing to CE Mark their product includes developing a European Technical Approval if necessary, arranging any testing that is required and analysis of test results. Manufacturers will also need the support of a Notified Body (such as SCCS) to undertake assessment of the factory production control.

High level walkway installed at Croke Park



Fitted to the roofs of three stands at Dublin's Croke Park stadium, the Etihad Skyline Walkway, which officially opened on 1 June, is set to be the city's loftiest tourist attraction.

Affording panoramic views of Dublin, the steel-framed Skyline has been installed on top of the Cusack, Hogan and Davin stands and consists of a series of connected trussed walkways spanning between existing roof trusses. There is also an additional connected walkway installed on the corner of the Cusack and Davin stands allowing a view over the stadium's pitch.

More than 100t of galvanized steel was used for the project, which was fabricated, supplied and erected by SIAC Butlers Steel.

The walkway sections, measuring 14m by 1.2m wide were fabricated and fitted with flooring and side wall panelling at SIAC's facility, before being delivered to



site and lifted into place by a 250t capacity mobile crane.

"The walkway frames had to span between trusses, while satisfying the geometric constraints from the available headroom and avoiding any clashes with the existing secondary steelwork to provide

an acceptable structure," explains Pat Egan, SIAC Butlers Steel Director.

"This resulted in a fully welded U-truss, fabricated from hollow sections, being used. This improved the torsional rigidity of the walkway while exceeding the required natural frequency."

Steel erection under way on Walkie Talkie

The construction of London's latest skyscraper, 20 Fenchurch Street, has reached a significant landmark with steelwork erection now under way.

Dubbed the Walkie Talkie, the Rafael Viñoly designed building requires William Hare to install approximately 7,000t of structural steelwork, which equates to more than 10,000 individual pieces.

The Land Securities and Canary Wharf Group development is said to be one of London's most eagerly anticipated projects due to its innovative design. The 160m high building flares outwards from its base so that larger floorplates are to be found at the higher storeys.

When complete in 2014 the building will contain 13,000t of structural and reinforced steel, and approximately 33,000m² of glass - an area equivalent to more than four football pitches.



Steel supplement sets out the surest way for construction

Distributed with this issue of New Steel Construction, *The Surest Way is Steel* is a brochure that fully explains the many advantages associated with the design and construction of structures using steel.

By choosing structural steelwork designers are guaranteed a quick programme, a cost-effective job, safe and assured steel erection, and a host of other notable criteria such as sustainable construction.

The Surest Way is Steel highlights all of steelwork's inherent advantages within a series of succinct articles.

For instance, an article on safety first culture, explains how the steel construction industry, via its continuous focus on improving health and safety, has become one of the safest sectors.

The BCSA and Tata Steel's Target Zero study is analysed, how to choose a steelwork contractor is made clear, while articles on sustainability and two on-site projects - featuring jobs which have gained from using structural steelwork - complete the brochure.



All change for Reading station redevelopment

Work to enlarge and redevelop Reading station, one of the busiest parts of the UK's rail network, is progressing on schedule with steel construction playing a pivotal role.

The scope of works to be carried out includes five new platforms and a new footbridge, a new north entrance building and western gateline building, as well as wider rail bridges for the station's approaches.

Cleveland Bridge is currently on site assembling the new 96m long pedestrian footbridge.

The steel-framed structure will provide access to platforms 7 to 15 and will connect into the station's new north entrance building and western gateline building, on opposite sides of the station.

The bridge is formed by four lines of 1.4m deep plate girders connected by a series of 1m deep girders. The structure's sides and roof are formed from 500mm x 500mm Jumbo Hollow Section members.

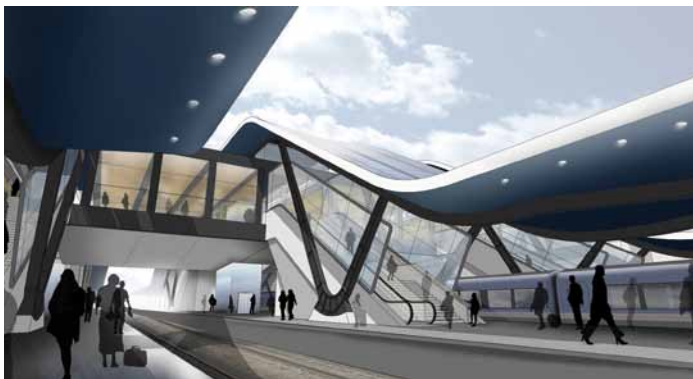
The structure is being built in three stages and assembled on a site adjacent to the railway lines. Stages one and two, measuring 50m long and 24m long

respectively, will be launched out over the rail lines into their final position during two operations scheduled to take place in July and August.

The launch operations will be carried out by Dorman Long Technology, using a number of strand jacks, with the bridge supported on PTFE sliding pads under the outer girders at the pier locations.

Once the first two stages are in place, stage three consists of a final 22m long infill section which will be erected in-situ.

The total weight of the bridge steelwork is 1,070t.



Shared campus rises with steel



A new secondary school development is under construction in Port Glasgow, a shared campus which will bring together the existing Port Glasgow High School and St Stephen's High School.

The project, being undertaken by Graham Construction, features a hybrid design with 250t of steelwork being used for the sports block.

Chosen because of the long clear spans required for the games halls, steel has been erected, supplied and fabricated by Walter Watson.

Local authority Inverclyde Council has made sustainability a key priority in the development of its schools and the project is expected to produce buildings which are better than Buildings Regulation standards for energy efficiency.

The school structures have been designed for low carbon and will follow the design principles set out in the Scottish Government Estate Branch publication 'Optimising the Internal Environment'.

NEWS IN BRIEF

CSC has released a trial version of its Tedds structural calculation software and engineers downloading it get a free sample of automated calculations. "We want engineers to experience how simple and intuitive Tedds' calculations are to use, which is why we've made the sample available," said CSC CEO Mark Roberts. To download the free Tedds trial visit: www.cscworld.com/TryTedds

SCI has published "Fire resistance design of steel-framed buildings (P375)" which provides a general overview of the fire design requirements for steel and composite structures, including guidance on fire design in accordance with the Eurocodes. The book was funded by Tata Steel and the The Department of Trade and Industry. For purchasing details see page 29.

The steel-framed **One World Trade Center** (pictured) which is on the site of the 9/11 attacks, has overtaken the Empire State Building to become New York's tallest building. The recent completion of steelwork for the uppermost 104th floor of the building, means it has reached its final 387m height.



Metsec Site Fixed Framing System (SFS) has been used to provide the infill walling for the extension to Battersea Dogs and Cats Home in London. Sustainability, energy efficiency and ease of maintenance were at the core of the building's design and specification, created by Charles Knowles Architects. Highly insulated curtain-walling, solar thermal and photovoltaic panels, borehole heating and self-cleaning windows as well as the all-steel construction of Metsec SFS, are said to provide outstanding sustainability credentials.

AROUND THE PRESS

Construction News

17 May 2012

Partnership delivers on lean construction

[Kettering Hospital] - The design team settled on a structural steel frame coupled with composite reinforced concrete and steel floor decks. It was the close proximity of the existing building and the busy surrounds to the hospital which proved pivotal in the choice of framing material. "We just weren't happy about the likelihood of hundreds of concrete wagons delivering material to site every day," says Interserve senior project manager Ranjit Lall.

Construction News

3 May 2012

A moment's success

[Regent's Place] - "Since the office block was aimed at attracting multiple corporate tenants, long clear spans were required, so we went for a steel-framed solution with composite floors," says Halcrow Yolles project director Jason Guneratne.

Construction Manager

May 2012

Shelf fulfilment

[Kent History & Library Centre] - With no need for fire rating on a single-storey structure, the exposed steel columns and ceiling soffits did not require an intumescent coating, giving the space an airy and light feel.

Building Magazine

20 April 2012

From London to Rio

UK design companies are negotiating with the team in Rio about selling their temporary (steel-framed) water polo and basketball stadiums.

New Civil Engineer

26 April 2012

Building the plasma cage

[Cadarache nuclear fusion reactor] - This vast 257m long, 49m wide, 17m tall steel-framed building cost £33M to build. That, and the excavation of the Tokamak complex, brought together a workforce of 275 people.

Medals for Olympian engineers

The Institution of Structural Engineers has awarded Gold Medals to Chris Wise, Co Founder of Expedition Engineering and Paul Westbury, CEO of Buro Happold, two engineers that have contributed to the design of venues for the 2012 Olympic Games.

Awarded for exceptional contribution to the structural engineering profession, the Gold Medal is the most prestigious of the Institution's awards, given to an individual to celebrate a lifetime achievement in the field of structural engineering.

Mr Westbury has been selected for the award due to his innovation in the structural form, and design of sports and

entertainment buildings; in particular for his leading contribution to the design and construction of Arsenal's Emirates Stadium in London, the 2006 Olympic Speed Skating Oval in Turin, Dublin's Aviva Stadium and the London 2012 Olympic Stadium (below left).

"I am overwhelmed and delighted to receive the Institution's Gold Medal; to receive such an accolade for doing something I enjoy really is fantastic," said Mr Westbury

Chris Wise of Expedition Engineering and a former Director with Arup, has been chosen for his outstanding contribution to the design of elegant and functional structures covering a wide range of forms.

These include award winning projects such as the Infinity Bridge and the Velodrome for the London Olympics (below right). He has also contributed significantly to design in education, a role that has been complemented by his creation of the Constructionarium.

"To receive the Gold Medal is a significant honour. My career has been about pushing the boundaries of engineering from a human perspective and I'm enormously flattered that this has been recognised by the Institution of Structural Engineers," he said.

A Gold Medal Address will be given by both winners on 3 October, at a venue yet to be announced.



College project performs with steel

A new £2.4m steel-framed media and performing arts building at Winstanley College, Billinge, Wigan, is nearing completion.

Architectural and engineering consultancy Pick Everard is leading the project, procured through the Crescent Purchasing Consortium, to deliver state-of-the-art facilities for students at the college, which is already recognised for its outstanding academic achievement.

The main design and build contractor is ISG Construction, and its subcontractor



Leach Structural Steelwork completed steelwork erection in March. Handover is scheduled for the end of July, ready for the new intake of students in autumn 2012.

The replacement block will house

both media studies and performing arts departments in a single two-storey building, allowing staff and resources to be shared between related departments. With a distinctive partially curved roof, studio spaces and classrooms will provide what is said to be an inspirational environment for film, media, dance, performing arts and music.

The sustainable structure has been designed to use appropriate renewable technologies and is aiming to exceed a BREEAM 'Very Good' rating.

Iconic steel bridge bids for heritage status

The Forth Bridge, the first major structure in the UK to be built with steel, has been chosen to be put forward to Unesco for possible world heritage status.

The railway bridge, which spans the Firth of Forth in the east of Scotland, is represented by the Forth Bridges Forum, and it is now preparing a bid for consideration in 2014, with a final decision expected the following year.

Scottish Culture Secretary Fiona Hyslop said: "The bridge is a Scottish icon that is recognised the world over. If it is successful, it would be a tremendous accolade."

Opened on 4 March 1890, the cantilever bridge has an overall length of 2,528m and



contains more than 64,000t of steel, which was provided by two steelworks in Scotland and one in Wales.

Even today, the structure built by Glasgow based company Sir William Arrol, is regarded as an engineering marvel. The double railway track is elevated 46m above

the water level at high tide. It consists of two main spans of 521.3m, two side spans of 207.3m and 15 approach spans of 51.2m.

Each main span comprises two 207.3m cantilever arms supporting a central 106.7m span truss. More than 6.5 million rivets were used in its construction.

Fabrication contract awarded for giant equine sculptures



The multi-million pound contract to fabricate two 30m high stainless steel plated horses heads, as part of a £41M regeneration project in central Scotland, has been awarded to S H Structures.

Known as The Kelpies and created by world renowned artist Andy Scott, the structures will form the centrepiece of the Helix Project, which will transform land between Falkirk and Grangemouth into a new visitor attraction and park.

One of the giant sculptures will accommodate a visitor centre, while both heads will require more than 6km of structural steel tube for their construction. More than 10,000 fixings will secure the skin cladding to the steelwork.

Tim Burton, Sales and Marketing Manager of S H Structures, said: "Projects of this nature and scale are rare and provide a significant opportunity to be involved in delivering a lasting legacy

that will instil a great sense of pride for everyone involved."

The Clydesdale horse played a hugely influential role in inspiring Mr Scott to create the sculptures and their 3m high models (pictured) which were created as project templates.

"I see The Kelpies as a personification of the lost industries of Scotland as well as a symbol of the modern proud and majestic Scotland," said Mr Scott.

Council offices get a facelift

Merseyside Galvanizing, part of Wedge Group Galvanizing has helped Halton Borough Council give Widnes a dramatic face lift by galvanizing all the steel used to create a decorative exterior for the town's municipal building.

The company worked alongside a St Helen's-based firm that manufactured a large number of steel louvre panels which were then mounted onto the building to enhance its overall look.

Richard Smetham, Sales Manager at Merseyside Galvanizing, said: "We were delighted to work on this project, which involved the production of large steel panels which were used by the council to provide both screening from inside the building as well as for aesthetic impact."



Newspaper storage to move north

The British Library is constructing a storage facility at Boston Spa in West Yorkshire to enable all of its vast collection of newspapers to be moved from its current London location.

The 25m tall steel-framed building was erected by The AA Group (TAAG) working on behalf of main contractor Kier. The company erected 500t of structural steelwork, 30t of secondary steel and a further

30t of cold rolled purlins and cladding rails for the job.

The structure, scheduled for completion in 2013, will be airtight with a low oxygen air system to reduce the risk of fire.

Construction of the warehouse is taking place on a plot adjacent to a similar building - housing the British Library's book collection - which was built a few years ago.

Diary

For SCI events contact Jane Burrell, tel: 01344 636500 email: education@steel-sci.com

19 June 2012
Steel Frame Stability
Birmingham

26 June, 3 July, 12 July 2012
On-line Steel Building Design to EC3 -
Part 1
On-line

12 July 2012
Loading to BS EN 1990
Combined axial load and bending



The roof of the glass structure sits at the waterline and replicates the view one would have if the ship was on water

Raising a maritime treasure

Rejoining the London skyline, the fully restored Cutty Sark has been opened to the public once again. Resting in a steel cradle, the vessel has been raised from the dock floor affording views of its sleek and revolutionary hull. Martin Cooper reports.

FACT FILE

Cutty Sark,
Greenwich, London

Client:

Cutty Sark Enterprises

Architect:

Grimshaw Architects

Construction Manager:

Gardiner & Theobald

Structural engineer:

Buro Happold

Steelwork contractor:

S H Structures

Steel tonnage: 310t

Cutty Sark is possibly Britain's most valued maritime treasure, a ship that evokes the great days of sail and a time when the nation ruled the waves. The world's last remaining tea clipper holds a unique place in many people's hearts, especially the millions that have travelled to Greenwich down the years to visit it.

Since 2006 the ship has been closed to the public and undergoing restoration work. The project was delayed by a fire in 2007, a conflagration that was luckily not as bad as it first appeared. Part of the ongoing conservation work included removing much of the historical contents of the vessel and putting it into storage. Thanks to this and some heroic fire fighting, there was little damage caused to the ship's original fabric.

Although the fire affected the progress of the conservation project the original plans were still viable. Work restarted with

the help of an additional £25M from the Heritage Lottery Fund, and the culmination of six years hard work was rewarded when Her Majesty The Queen officially reopened Cutty Sark in April.

The relaunch marks the start of yet another exciting chapter in the extraordinary life of the three-masted clipper. The project succeeded in rescuing the Cutty Sark and preventing her collapse, while conserving as much of the ship's original fabric from the period of her working life as possible.

The conservation project's centrepiece is a brilliant feat of engineering whereby the ship has been raised, via a steel cradle, 3.1m into the air, relieving the keel of the weight of the ship and preserving her shape.

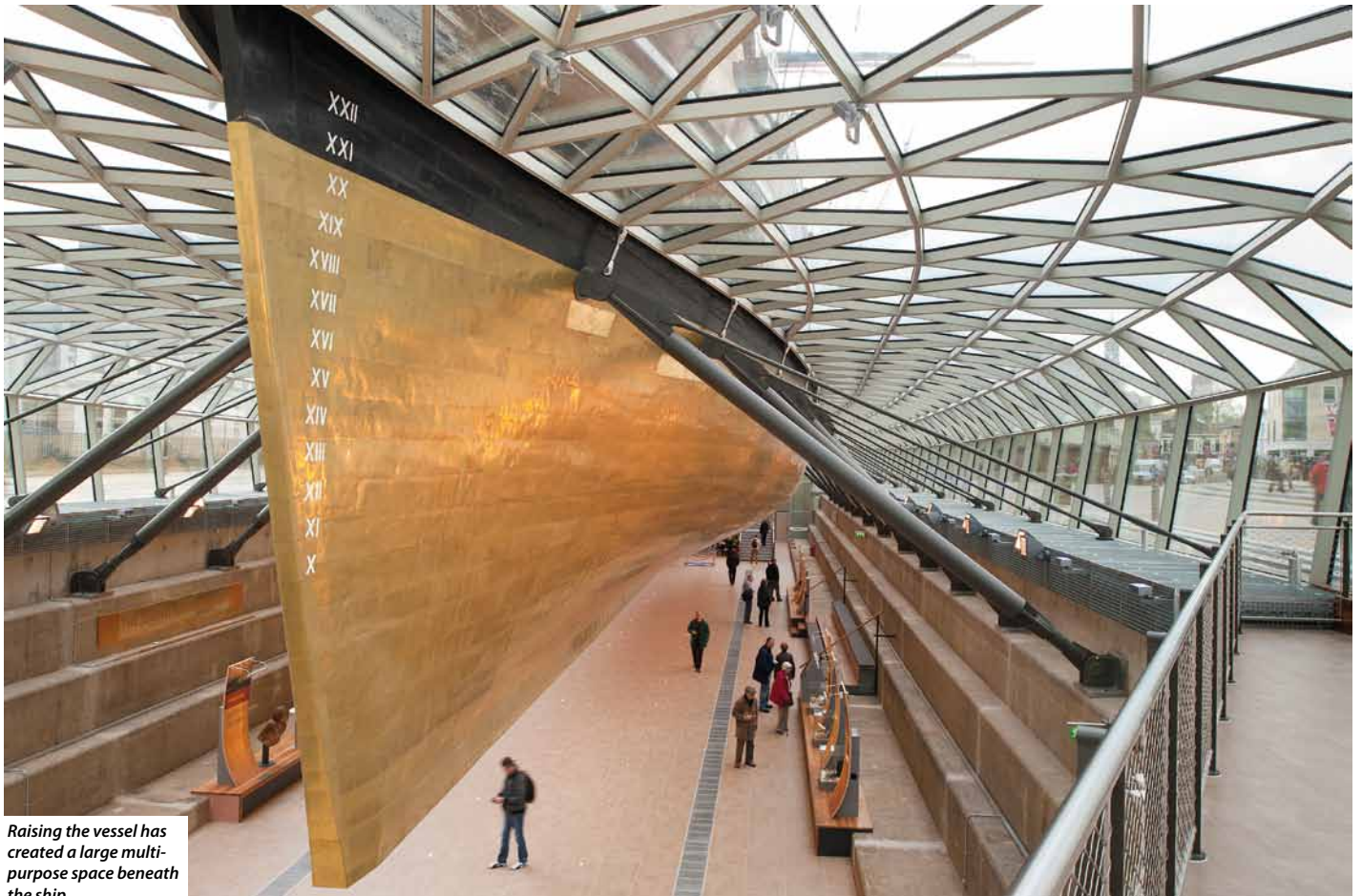
Chris Nash, Grimshaw Project Architect, says: "The vessel had been sitting on wooden props and a concrete plinth on the bottom of the dry dock for 50 years. This wasn't good

for the hull which was bulging and would not have lasted much longer."

The design plan was to replicate the vessel sitting in water and to restore the sleek and unique shape of the hull. This has been achieved by strengthening the original ironwork and installing a steel cradle, a structure that also has the added benefit of allowing visitors to walk beneath the ship and view the elegant lines of her hull.

Launched in 1869 from Dumbarton, Scotland, Cutty Sark visited most major ports around the world. She carried cargo ranging from the finest teas to gunpowder, and from whisky to buffalo horns. Speed was what made her famous and she was the fastest ship of the era. The revolutionary and sleek hull design - now on view - was the secret of her success, enabling it to glide through the water.

The building of the support cradle has relied on steel construction as this



Raising the vessel has created a large multi-purpose space beneath the ship



Day and night the restored vessel is once again a London landmark



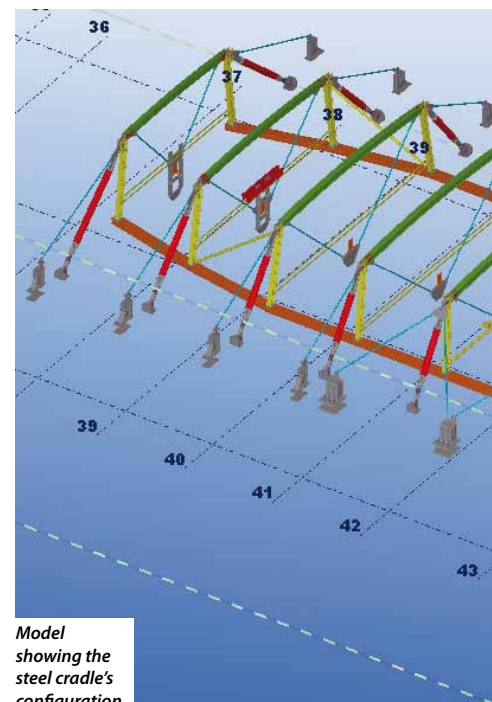
CHS struts and Macalloy ties connect the steel frames to the dry dock wall

was the only viable material for the job. S H Structures fabricated, supplied and erected around 200t of steelwork for the cradle which consists of 13 hanger frames.

The steel frames vary in shape and follow the geometry of the vessel. They consist of an internal beam that goes through the ship's hull at the waterline and is then connected to the dry dock wall on either side by a CHS strut and a stabilising Macalloy bar.

Internally each of the frames is connected, via 64mm diameter Macalloy ties, to new keel strengthening plates. Running the length of the keel, these plates are 550mm deep and between 45mm and 35mm thick, depending on their location, and are placed either side of the original timber keel.

The hull has been strengthened with two 50mm thick \times 500mm deep steel



Model showing the steel cradle's configuration



strake plates that run along both sides of the ship. The hanger frames sit above this and are connected across the ship by 12 compression beams.

The majority of the ship's internal steelwork had to be completed prior to the lifting process. Raising a vessel, one which has not moved in half a century, 3.1m into the air, was obviously a very challenging part of the project and a major undertaking for S H Structures.

"Using a total of twenty-four 100t capacity climbing jacks, the ship was raised in 100mm bursts and lifted to its final height in three days," explains Tim Kelly, Buro Happold Associate. "The initial lift was a little tense as the ship tore away quite a large chunk of the concrete plinth, but from then on, apart from some creaking, the lifting proceeded smoothly."

Ship shape

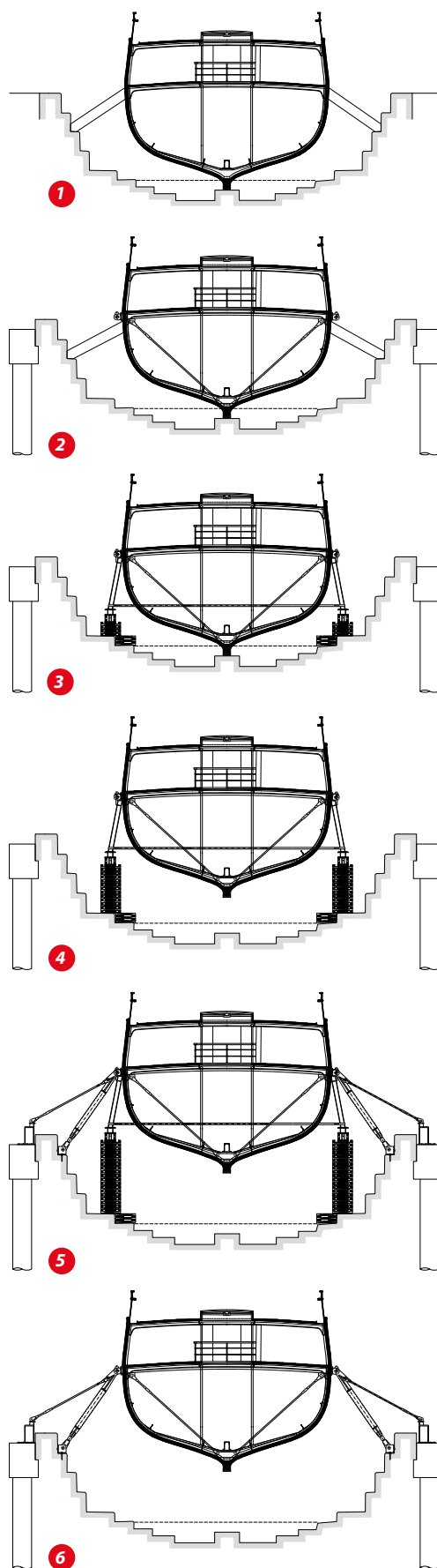
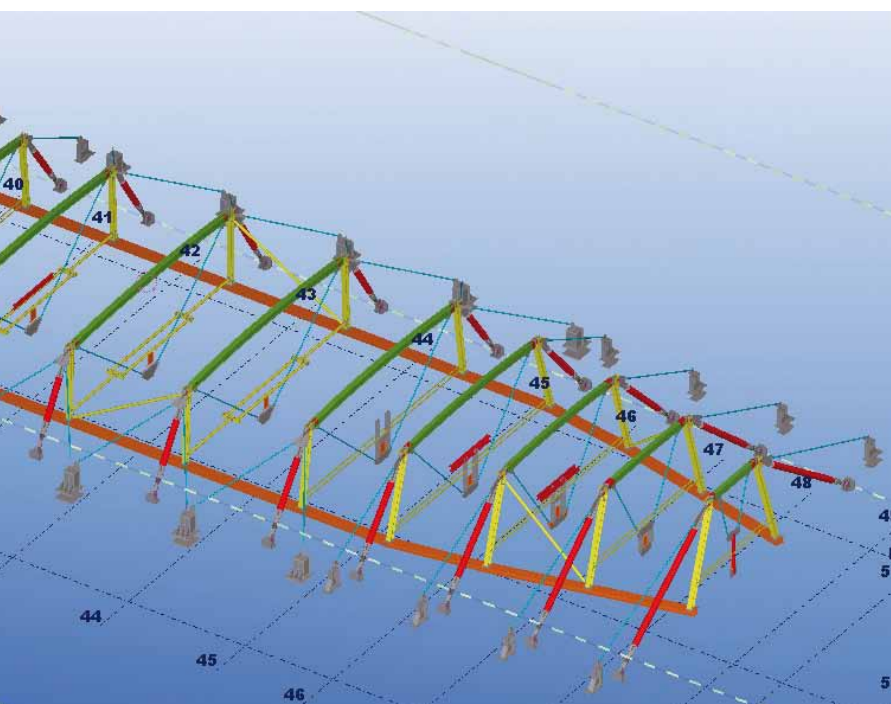
The conservation work was a truly unique initiative and was complicated by the variety of materials. Steelwork was used to create walkways into the ship and also to replace the main deck.

Around the outside of the ship the hull planks were in need of varying degrees of repair and were removed to undergo carefully managed stages of detailed work. The planks vary in size and are curved to follow the ship's shape. Once repaired they were refixed to the hull, using bolts recessed into the original holes of the planks.

S H Structures had to design and build a temporary cradle for the lifting procedure. This consisted of a cranked beam on either side of the ship which was connected to the vessel at the same points as the external struts and ties which would eventually connect the ship back to the dry dock.

"After we'd lifted the ship the first 100mm we were able to weld a steel sole plate under the keel," explains Mark Randerson, S H Structures Technical Director. "This completed the keel strengthening by connecting the two plates which had previously been positioned either side of the original woodwork."

Once the Cutty Sark was 3.1m high, and with the cradle in place, the external steelwork was erected. On completion - with the new steelwork taking the ship's loads - the temporary members were then lowered



- 1 & 2:** Internal steelwork is completed and a temporary cradle is put in place
- 3 & 4:** The vessel is jacked upwards incrementally in 100mm intervals
- 5:** Once at its final height of 3.1m, the permanent cradle is installed connecting the ship to the dock
- 6:** The temporary steelwork is removed and the job is complete



The steel and glass roof is structurally independent from the new steelwork

back down by jacks and dismantled.

Steelwork has also played an important role in other aspects of the ship's preservation, with new base plates for the restored masts, and 150 new steel frames inserted to strengthen the corroded iron ribs.

By suspending the vessel the project has created a large open space beneath the ship, a space that has a glazed diagrid roof positioned just above the framework struts and ties, and consequently just above the waterline. The steel-framed diagrid roof is a separate steel structure and is connected to the dry dock and the vessel independently from the struts and Macalloy ties.

Lifting up the Cutty Sark has created a large open space under the ship at the bottom of the dock. This space now houses toilets, gift shops and permanent exhibitions, de-cluttering the ship as all

Cutty Sark timeline: 1869 - 2012

1869 Built and launched at Dumbarton.

1870 Undertakes first tea voyage to China.

1877 Last consignment of tea taken from China to London.

1878-82 Takes various cargoes to and from London, India, Japan, Singapore and the Philippines.

1885 Sets record passage time of 73 days from Sydney to London.

1895 Sold to Portuguese firm J. Ferreira and renamed.

1922 Bought by Wilfred Dowman and renamed Cutty Sark. She is restored and moored at Falmouth.

1938 Donated to Thames Nautical Training College and moored at Greenhithe, Kent.



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of this was previously on board. This has improved the visitor experience by restoring views along the length of the ship.

The new glazed space has also created a revenue stream for the Cutty Sark Trust, as it can be rented out as a unique corporate venue.

“The client always realised that conservation was going to be an expensive job and we were initially approached to design something that would ultimately help pay for the work,” sums up Mr Nash.

By raising the Cutty Sark and creating the large open space for visitors and exhibitions, the project team have done just that. The venue will help the vessel with a sustainable future, generating funds to cover maintenance needs. And, importantly, they have also opened up the ship and allowed visitors new and exciting views of its keel.



The space beneath the Cutty Sark is available for hire, generating revenue which will go toward the cost of the restoration project

1951 Exhibited at Deptford as part of the Festival of Britain.

1954 Floated into her dry dock at Greenwich and restored.

1957 Opened to the public by HM The Queen.

2012 HM The Queen reopens the Cutty Sark upon completion of the conservation project.

2007 Major fire on board the ship delays the project.

2006 Closes to the public for restoration.

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The atrium steelwork sits on top of the concrete structures

Trusses span feature atrium

Structural steelwork has played a central role in the construction of Rochdale's new council building, a project expected to kickstart a large scale town centre renaissance.

FACT FILE

Rochdale council offices

Main client:

Rochdale Metropolitan Borough Council

Architect:

FaulknerBrowns Architects

Main contractor:

Sir Robert McAlpine

Structural engineer:

Curtins Consulting

Steelwork contractor:

Cauntan Engineering

Steel tonnage: 129t

There is little doubt that the economic downturn is affecting the health and viability of town centres across the country, but a large scale redevelopment currently taking place in Rochdale aims to buck this trend.

The local authority is spearheading an ambitious £250M programme to create a vibrant town centre with new leisure, shopping, cultural and learning opportunities for residents, visitors and businesses.

Work is currently under way to bring the Metrolink - Greater Manchester's light rail system - to the town, and a new leisure centre is taking shape, but currently dominating the town centre is the construction of the new library, customer information point and council offices building.

Due to be completed by the end of the year, the new facility will bring together

around 2,000 council staff from more than 30 buildings. The council says this will save it more than £28M in maintenance costs.

To be known as Number One Riverside, the 1,532m² building will meet high energy saving standards with features such as solar thermal panels, which use the sun's rays to generate hot water, and photovoltaic panels creating renewable electricity. Other installed features will include a biomass boiler to generate sustainable heat, while rainwater will be harvested and recycled.

The building is essentially a five-storey concrete framed structure with two S-shaped wings separated by an atrium. Spanning the atrium at roof level and supporting glazing and high level rooflights is a steel-framed structure. Topping the building, steelwork forms the project's feature element, chosen for this part of the job for a number of reasons.

"We used steelwork because it's

lightweight, flexible and gave us the required spans without being too bulky," explains David Sandbrook, Curtins Project Engineer. "The frames which form the atrium roof, as well as internal steel footbridges, were all prefabricated off-site and this speeded up construction and cut down on the amount of working at height."

The atrium roof follows the S-shape of the building and is approximately 100m long. A series of steel moment frames, arranged in goal post configuration, were installed to construct the roof. The trusses (frames) are made of box sections and are between 8m and 11m wide, and 1.2m high, supporting a glazed facade on the sides and louvre panels and rooflights along the top.

The roof steelwork trusses sit on the top of the concrete structure on either side of the atrium. Holding bolts, supplied by Cauntan Engineering, were cast into the concrete prior to the trusses being erected - an example of the integral coordination between trades needed on this project.

On the northern elevation of the building the atrium forms the structure's main entrance and here two lattice trusses positioned on either side of the void support the glazed facade. The trusses are 25m high - the full height of the building - and 1.5m wide.

"They were brought to site as complete pieces and erected directly from the truck by the on site tower crane," says Tony Goodman, Cauntan Engineering Project Manager. "Temporary stability was provided



The steel atrium forms a feature element for the building by linking the two wings

to these trusses with members tied back to the concrete frame, and this will only be removed once the glazing is completed.”

Using only the project’s tower crane, the steelwork erection programme for the atrium commenced with the north entrance and progressed ‘frame by frame’ along the roof towards the southern elevation, a method that ensured overall stability was maintained.

Each of the wing’s floorplates differ, with some spanning the atrium in places, and others not. Eleven steel footbridges, varying in length up to 17m long, are located on the first, second, third and fourth floors and also span the atrium linking the two wings.

Steelwork contractor Cauntion Engineering fabricated, supplied and also erected the ten footbridges as complete units, with two of them erected in conjunction with a vertical concrete column passing through the middle. Each of these bridges arrived on site with metal decking in place and handrails fixed, allowing them to be erected directly from the delivery truck.

An eleventh footbridge, the longest, had to be erected ‘piece small’ as its weight exceeded the tower crane’s capacity.

Coordination between trades was a key issue for this job, not just for the positioning of the atrium roof’s holding bolts, but also the erection of the eleven atrium footbridges. These steel structures, all fabricated, supplied and erected by Cauntion, vary in length from 7m up to a maximum of 18m.

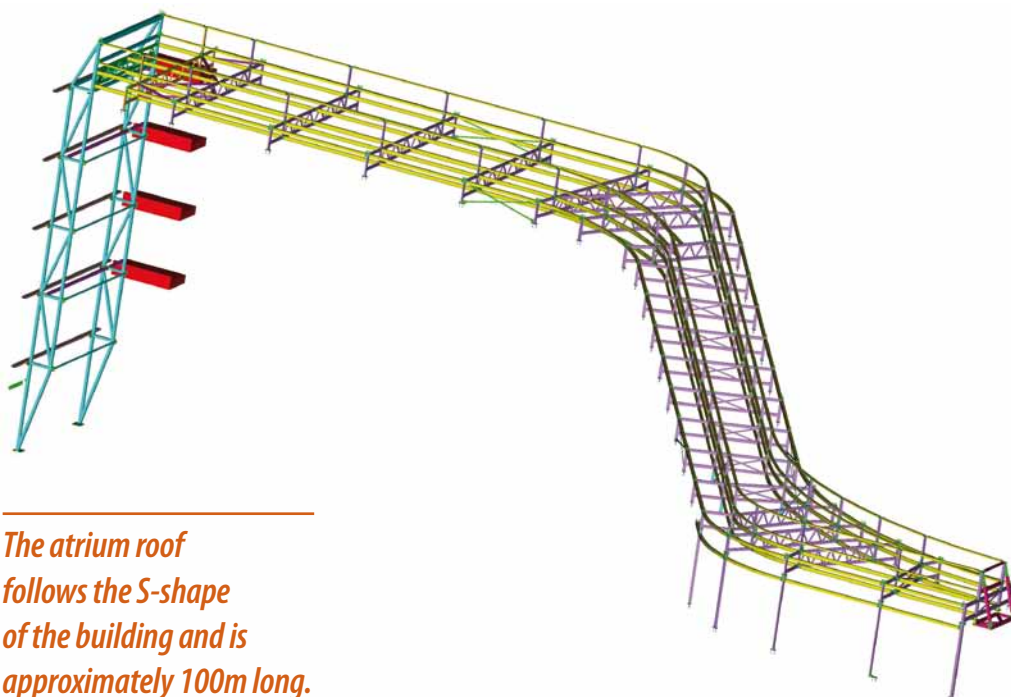
The bridges are positioned at various

locations along the atrium’s length, with three on the first floor, three on the second floor, three on the third floor and two on the fourth level. In order to aid a quick and efficient construction programme the bridges had to be erected along with the concrete superstructure.

As each floor was constructed, the bridges for that level were ready and lifted into position. Thanks to off-site fabrication, the erection process was quick and performed by one solitary mobile crane.

“It was imperative to get the bridges into position as each floor was built,” says Mr Sandbrook. “It would have been very tricky to get them into place once the building was topped out.”

Commenting on the town’s redevelopment, Council Leader Councillor Colin Lambert says: “2012 is going to be a big year for us as well as the nation, and a milestone for the borough will be the completion of these major infrastructure projects.”



The atrium roof follows the S-shape of the building and is approximately 100m long.

Steel supports a sporting life

Long clear spans cover the two upper level tennis courts

FACT FILE

David Lloyd Leisure Club, Worcester

Main client:

David Lloyd Leisure Group

Architect: JJA Ryder

Main contractor:

Pellikaan Construction

Structural engineer:

Dewar Associates

Steelwork contractor:

James Killelea

Steel tonnage: 205t

A new leisure club in Worcester is taking advantage of steelwork's flexibility and long span qualities.

The sport and leisure sector has consistently been one of the better performing areas of construction over the last few years. Whether it has been investment in new facilities by cash rich professional sports clubs or councils building municipal leisure centres, there has been a healthy level of projects.

A company in the leisure sector which has invested in numerous new sports, health and leisure clubs in recent times is the David Lloyd Group. It currently operates 80 clubs in the UK, most of which are steel-framed buildings.

There are further expansion plans ahead and David Lloyd Leisure is currently constructing a new facility in Worcester. The 5,600m² development is located adjacent to Sixways Stadium, home of Worcester Warriors Rugby Union Club, and will include an array of indoor and outdoor

sporting facilities.

Main contractor Pellikaan and steelwork contractor James Killelea have all worked on a number of David Lloyd projects before, and agree that steel is the most cost-effective construction method for these jobs.

Mike Dewar of Dewar Associates agrees, and says: "Over time the team has devised the most economical way to design and construct leisure centres for David Lloyd. Steel construction lends itself to the necessary speed of construction and the long spans required for indoor sports halls."

For the Worcester centre the design consists of a two-storey structure with an asymmetric curved roof which allows sufficient space for three internal tennis courts - two of which are on the upper level along with a 900m² fitness suite. The ground floor accommodates a 25m swimming pool, entrance bar and restaurant, a children's

pool, a sauna and changing rooms.

The structure has a 56m × 52m rectangular shape with a smaller 17m × 8m section added to one elevation. Using structural steelwork for the building's frame, long span rafters create the roof which continues its shape when spanning this annexed section of the centre.

The upper floor is constructed of a 150mm thick concrete slab supported from steel beams spanning on to columns generally on a 7.2m × 5.3m grid pattern. There are some exceptions to this pattern; the adult swimming pool requires a clear span of 16.6m, while the sauna and children's pool area also needed longer spans.

"A steel deck slab is utilised for the upper floor which has allowed the steel beams to be designed compositely," explains Mike Dewar of Dewar Associates.

Speed of construction - one of the main reasons for choosing steel - is an important criteria on this project as the centre is scheduled to open in December. Steel erection was completed in just five weeks and contractor James Killelea's



Curved rafters form the distinctive roofline

The annexed single storey area will contain one tennis court, and the bar and restaurant



"A steel deck slab is utilised for the upper floor which has allowed the steel beams to be designed compositely."

Project Manager Bob Allan says the overall timescale was a challenge: "We only had five weeks to design and fabricate the steel. However we've done similar David Lloyd projects and this helped us."

As time was of the essence the fabrication of the steelwork was being done while the early preparatory works were being carried out on site. The project is located on a former car park which needed to be cleared before a culvert was diverted and pad foundations installed in readiness for the steel erection.

"Once steel was on site the main frame went up quickly and on schedule, which meant we could then get the roof on and let all the follow-on trades get started," comments Mark Allen, Pellikaan Project Manager.

James Killelea sequenced the steel programme and erected the annexed part of the structure first. Once this portion was completed, it was self supporting and allowed the company to begin work on the two level part of the project.

The entire structure derives its stability

from bracing located on both floor levels in an east west direction combined with a sway frame in the north south direction.

The building is braced against lateral loads by utilising the first floor slab as a diaphragm transferring the loads back to the braced bays on the structure's perimeter. The upper storey is portalised in the long span direction with continuous columns at first floor level to ease the erection logistics.

James Killelea used one 50t mobile crane to complete the steelwork programme. The largest lifts were the main long span rafters

and these were brought to site in two parts before being spliced together and lifted into position as one complete member.

The building has a maximum height of 13.6m so columns were able to be brought to site as complete pieces, which helped with the quick erection programme as less on site bolting was needed.

Summing up the project Jason Andrews, David Lloyd Leisure Regional Director, says: "We are very excited about coming to Worcester and providing the community with what will be a fantastic club."



There are plans for further developments in the area; a hotel next to the centre has been mooted



A tight and confined site did not interfere with the steel erection programme

Stage set by steel

Built in a fast-track 32 week programme, the latest film and TV stage at Pinewood Studios has been dedicated to one of the British film industry's most respected figures.

The building was in use immediately after handover



Designed and built for both film and television production, the recently completed Richard Attenborough Stage is one of the largest facilities ever built at the world renowned Pinewood Studios.

Requiring more than 420t of structural steelwork, the building covers an area of 3,000m², more than equal to two Olympic swimming pools, and reaches a maximum height of 18m. It is believed to be the tallest TV and film stage in Europe.

The building, which is 61.87m long and 45m wide, was completed in a 32 week fast track programme, within budget and on schedule. Pinewood wanted the Stage up and running as quickly as possible, and immediately following project handover it was being used as the film production of *Les Misérables* moved in to start building sets.

Roy Foster, a partner of Foster Willis Architects, says: "This was a very high speed project which had to meet exacting cost and performance standards. It was an outstanding achievement in such a congested, demanding environment."

Pinewood Studios Group Chief Executive Ivan Dunleavy agrees and comments: "Recognising that we had various activities operating around the site, the project team's flexibility enabled us to manage our ongoing business throughout a heavy duty construction project, which was very helpful indeed."

Using steelwork helped the project team negotiate the confined and busy site conditions and meet its tight deadlines. Steelwork's speed of construction is one of its main attributes and guaranteed the job was completed on schedule, while bringing much



of the steel to site in small pieces limited large truck movements in and around Pinewood Studios' narrow road network.

The Attenborough Stage is constructed on mass concrete foundations and trench footings which support the main braced steel frame. The perimeter of the structure's frame is formed with a series of 18m high columns, spaced at 7m intervals. Most of the bays feature diagonal bracing, positioned within the extra thick wall cavities which also accommodate acoustic insulation.

"We needed to stiffen the structure up and prevent any potential 'frame creaking' so we opted for a braced frame as opposed to a sway frame," says Alan Pemberton, MLM Operations Director.

Any frame movement or creaking (noise) would be unhelpful in a TV and film environment where sound recordings are taking place. The client said it had encountered this problem in the past with other types of studio buildings, so this structure has plenty of bracing to limit or negate any potential movement.

Spanning the width of the building and creating the clear open column free space are eight tapering roof trusses, which vary in depth from 2.7m to a maximum of 4.2m at the structure's apex. The trusses are 45m long and were brought to site in small pieces and assembled into three sections. Once the three sections had been bolted together the trusses were then lifted into place as one large element by two mobile cranes.

"The trusses are deep because they are working overtime, supporting an array of essential studio equipment like cabling, high level walkways and runway beams for a crane," says Bill Armstrong, Atlas Ward

Structures Senior Project Manager.

High level walkways crisscross the roof, supported on the bottom cord of trusses, forming a working platform for maintenance, gantries and scenery hoists. There are five walkways spanning the length of the structure and eight spanning the width.

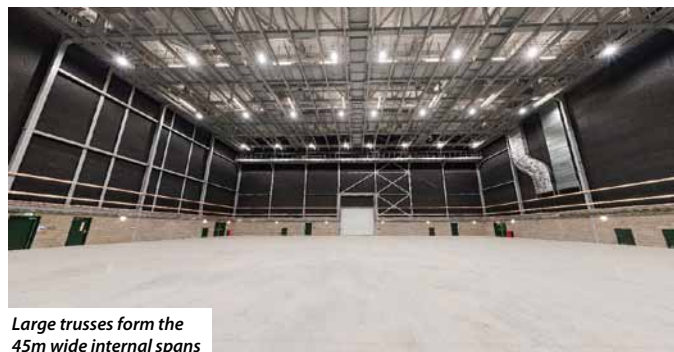
In a similar procedure to the trusses, walkways were brought to site in small sections to be assembled on the ground and then lifted into place as complete structures.

Underslung from the trusses are a series of runway beams for the studio's overhead crane. All of this equipment and ancillary steelwork means the trusses are supporting an enormous amount and so they were designed to withstand an imposed loading of 3kN/m² over the whole roof area.

Atlas Ward completed the majority of its steel erection programme in eight weeks, with the main challenge being the confined nature of the site. "As we started erecting the perimeter columns and trusses we were gradually eating up the available space," says Mr Armstrong. "Fortunately the trusses start 7m (one bay) in from each gable end, which meant there was room for our equipment when the last truss was erected."

Each gable end of the structure is formed with lightweight steel which connects back to the trusses.

Summing up the project, LIFE Build Solutions Director Ken Adams says: "The Richard Attenborough Stage is the eighth project we have successfully undertaken for the Pinewood Studios Group, with the landmark Gatehouse complex opened by the Queen in 2007. We look forward to supporting our client for many years to come."



Large trusses form the 45m wide internal spans

The building covers an area of 3,000m², more than equal to two Olympic swimming pools and reaches a maximum height of 18m. It is believed to be the tallest TV and film stage in Europe.

FACT FILE

The Richard Attenborough Stage, Pinewood Studios, Buckinghamshire

Main client: Pinewood Studios

Architect: Foster Willis Architects

Main contractor:

LIFE Build Solutions

Structural engineer: MLM

Steelwork contractor:

Atlas Ward Structures

Steel tonnage: 420t

Project value: £4.5M



Lord David Puttnam (left) and Lord Michael Grade salute the new stage with members of the project team

Shedding waste

A large steel braced structure housing three long span halls will accommodate a new recycling facility to process a large proportion of Cumbria's waste.

FACT FILE

**Sowerbywood Refuse
Derived Fuel facility,
Barrow-in-Furness**

Client: Shanks

Architect: WYG

Engineering

Main contractor:

Hanson Contracting

Structural engineer:

WYG Engineering

Steelwork

contractor: Border

Steelwork Structures

Steel tonnage: 750t

Simply sending household and commercial waste straight to landfill is no longer an acceptable option for UK municipalities. The diminishing capacity of the nation's landfill has resulted in more environmentally friendly options, involving recycling, as the preferred methods for today's greener society.

It has been estimated that more than 100 million tonnes of municipal solid waste is produced in the UK every year and much of this can be economically diverted from landfill and turned into a fuel known as refuse solid recovered fuel (SRF).

SRF is manufactured as part of a waste treatment process called mechanical biological treatment (MBT). The MBT process shreds and dries waste before sorting it to recover recyclates including metals and aggregates. The residual waste is then used to manufacture SRF which in turn is used in energy generation to offset dependency on traditional fossil fuels.

As part of its 25 year agreement with Cumbria County Council, waste management specialist Shanks is currently developing its latest MBT facility in Barrow-in-Furness. Once operational much of the county's waste will be sent to the plant,

as well as another at Hespin Wood near Carlisle which was recently commissioned.

Both of the plants share the same project team and a similar steel construction design. The Barrow facility is due to be commissioned in November and consists of a large L-shaped structure approximately 150m long by a maximum of 70m wide and 15m high to the eaves.

The building includes three large halls; a bio drying hall, a refinement hall, and fines stabilisation zone (baling hall), as well as a shredder pit, a reception pit and an attached three-storey office block with control room, canteen and welfare facilities.

There are some long column free spans required in the halls, and consequently steel was the obvious choice for the framing material.

The longest spans are 28m long in the refinement hall. Steelwork contractor Border Steelwork Structures brought these roof beams to site in three pieces, bolted them together on the ground and then lifted them into place as complete members. Roof beams with a 22m length were required for the adjacent bio drying hall and these were brought to site as complete sections.

Supporting the beams in both of these halls are a series of 13.9m high

914 × 305 × 289 columns.

"There were tight deflection and settlement criteria set by the process supplier Ecodeco for the operation of the overhead cranes in the bio drying hall," says Giles Smith, WYG Engineering Associate. "So these large columns sit on piled foundations, installed to absorb the extra loadings from the crane movements, while the remainder of the steelwork is supported on pad foundations."

The building is located to the north of Barrow and on the coast, which means it is exposed to some strong south westerly winds. The structure also features a number of large openings for deliveries and therefore the wind loading on the building is significant.

To control the relative lateral deflections of adjacent frames, the steel structure is braced. However the long span rafters are continuous with beam stanchions for efficient design, which has resulted in a hybrid braced/continuous frame resisting the lateral loads.

The nature of the processes which will be undertaken within the facility will generate significant heat, and this, together with the project's exposed location, has required all of the steelwork to be galvanized.

Steelwork provided the necessary large open halls for the facility



Hanson Contracting started the Barrow project in October 2010 and initially had to level the greenfield site by undertaking a cut and fill programme. Much of the building's footprint was then stabilised and piles were installed. Prior to the steelwork erection beginning Hanson also constructed the concrete reception pit.

"Steelwork was delivered to site in 25t loads and erected using a 50t mobile crane," says Stuart Airey, Border Steelwork Senior Contracts Manager. "We divided the job into phases, sequenced to form braced boxes, with the cladding team following close behind the steel erectors."

Border Steelwork was also responsible for all of the project's cladding, and consequently the company was on site for nearly six months.

After the steel frame was up and the roof cladding installed, the wall cladding, which consists of precast walls and composite steel panels was completed.

"We wanted an industrial building that looks tidy," explains Derrick O'Donnell, Hanson Contracting Project Manager. "Using steelwork has given us the desired structure."

MBT is a sustainable and progressive waste technology which means the amount of rubbish sent to landfill will fall dramatically. This will lead to a major reduction in the amount of methane the county produces and will save Cumbria paying out millions of pounds in landfill costs.

Councillor Jim Buchanan, Leader of Cumbria County Council, said: "Our contract with Shanks really will revolutionise the way we deal with waste and ensure we have a greener, more cost-effective system."



Steelwork was erected by mobile crane, with the cladding installed subsequently by a self erecting tower crane



One of the facility's refuse pits

"We wanted an industrial building that looks tidy. Using steelwork has given us the desired structure."



Large delivery openings mean there are extra wind loadings on the structure

Simplified assessment methods for LTB

David Brown of the SCI considers the simplified assessment method for lateral-torsional buckling given in EC3, and finds a useful application in elastic portal frames.

The advantage of using intermediate restraints to the tension flange of a steel member was discussed in the July 2011 edition of New Steel Construction. Provided the intermediate restraints are spaced sufficiently closely, the flexural buckling resistance and the lateral torsional buckling resistance can be increased, compared to a member without intermediate restraints. This approach might be considered to be at one end of a scale of complexity.

An altogether simpler approach is described in BS EN 1993-1-1, which whilst not being attractive for orthodox situations (the results are too conservative), can have useful application in situations not explicitly covered by the Standard, or where the alternatives are complex and time-consuming to apply.

The so-called 'simplified assessment method' is described in clause 6.3.2.4 of BS EN 1993-1-1, and proposes that the compression zone of a member be treated as a Tee-shaped simple strut between points of restraint. The clause proposes that the Tee be taken as the compression flange, plus 1/3 of the compressed part of the web area. The concept is illustrated in Figure 1 and will be familiar to many bridge designers.

This simplified approach has the disadvantage that the contribution from the tension zone is ignored. The tension zone normally contributes to reduce the tendency to buckle. BS EN 1993-1-1 clause 6.3.2.4 states that the member is not susceptible to lateral-torsional buckling if the length L_c of the equivalent compression flange between restraints satisfies the expression:

$$\text{where: } \frac{k_c L_c}{i_{tz} \lambda_1} \leq \bar{\lambda}_{c0} \frac{M_{c,Rd}}{M_{y,Ed}}$$

$M_{y,Ed}$ is the maximum design value of the bending moment within the restraint spacing

$M_{c,Rd} = W_y \frac{f_y}{\gamma_{M1}}$ This is the bending resistance of the cross-section, but calculated with γ_{M1} rather than γ_{M0} , which would normally be used for cross-sectional

resistance. In the UK, the difference is irrelevant because, according to the UK NA, γ_{M1} and $\gamma_{M0} = 1.0$ is a slenderness correction factor. The UK NA relates this to the C_1 factor that accounts for the shape of the bending moment diagram. The value is given by

$$k_c = \frac{1}{\sqrt{C_1}}$$

i_{tz} is the radius of gyration of the Tee-shaped equivalent compression flange about the minor axis of the section

$\bar{\lambda}_{c0}$ is a slenderness limit, defined in the UK NA as 0.4 for rolled sections.

$$\lambda_1 = \pi \sqrt{\frac{E}{f_y}} = 93.9 \epsilon$$

Practical application

Consider a $457 \times 191 \times 67$ UKB in S355 steel, with restraints to the compression flange at 5m. The dimensions of the equivalent compression flange, taking 1/6 of the distance between flanges, and ignoring the root radius, are shown in Figure 2.

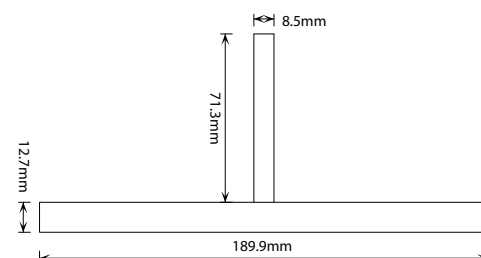


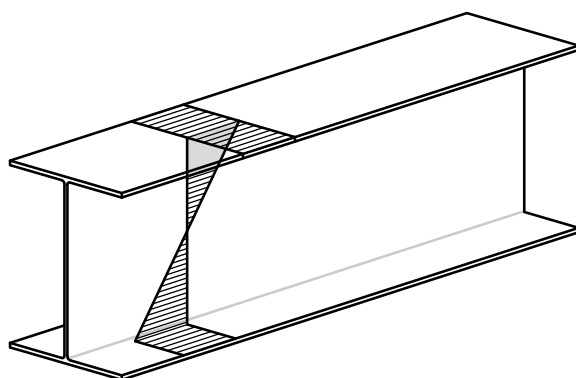
Figure 2: Equivalent compression flange

The calculated properties for the Tee-shaped equivalent compression flange shown in Figure 2 are:

$$A = 3018 \text{ mm}^2$$

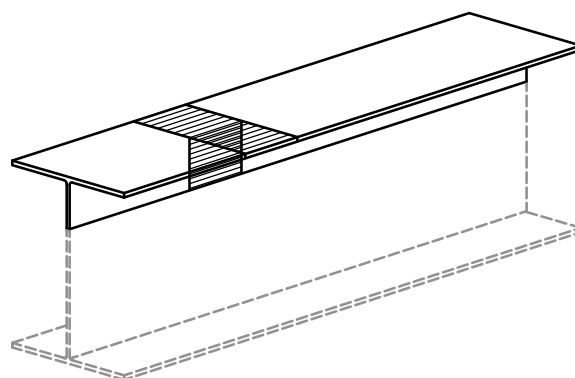
$$I_z = 7.25 \times 10^6 \text{ mm}^4$$

$$i_{tz} = 49 \text{ mm}$$



Original Beam

Figure 1: Principle of simplified assessment method



Equivalent compression flange

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From the Blue Book, for a $457 \times 191 \times 67$ UKB in S355 steel,
 $M_{c,Rd} = 552 \text{ kNm}$
 Assuming a uniform bending moment, then C_1 and $k_1 = 1$

$$\lambda_1 = 93.9 \times \sqrt{\frac{235}{355}} = 76.4$$

The expression given above can then be used to calculate the maximum design moment, $M_{y,Ed}$:

$$\frac{k_c L_c}{i_{t,z} \bar{e}_1} \leq \bar{\lambda}_{c0} \frac{M_{c,Rd}}{M_{y,Ed}} = \frac{1.0 \times 5000}{49 \times 76.4} \leq 0.4 \frac{552}{M_{y,Ed}}$$

which gives $M_{y,Ed} = 165 \text{ kNm}$

The buckling resistance moment, $M_{b,Rd}$ given in the Blue Book for the $457 \times 191 \times 67$ UKB in S355 steel is 257 kNm , which illustrates the conservatism of this simplified method in orthodox situations.

Extending the application of the simplified assessment method

The concept of using a simple strut to assess susceptibility to lateral-torsional buckling may be applied to other situations. The common situation of a haunched beam is not specifically addressed in BS EN 1993-1-1, which is unfortunate, as this is a very

common situation in portal frames. BS EN 1993-1-1 does contain checks for a haunched length containing a plastic hinge, which could be used, on the basis that an elastic length must be more stable than one containing a hinge. The checks are, however, laborious to apply, which means the simple strut approach may be attractive.

The development from the haunched member, with a restraint at each end, to a simple Tee-shaped strut, is shown in Figure 3. The middle flange is ignored, and conservatively, it is assumed that the stress at the extreme fibre of the compound section is uniform throughout the Tee. The depth of the tee section depends on the longitudinal location selected. Choosing the deepest section will be the most conservative, so an appropriate rule of thumb is to calculate the cross-sectional properties of the equivalent Tee section at a third of the length from the deepest cross-section.

The interest in the simplified assessment method has arisen from the particular issue described above – how to assess the susceptibility of a haunched length in a portal frame to lateral-torsional buckling. The forthcoming publication on the elastic design of portal frames will include a numerical example of both the simplified assessment method and the use of the rather more involved 'plastic' verification.

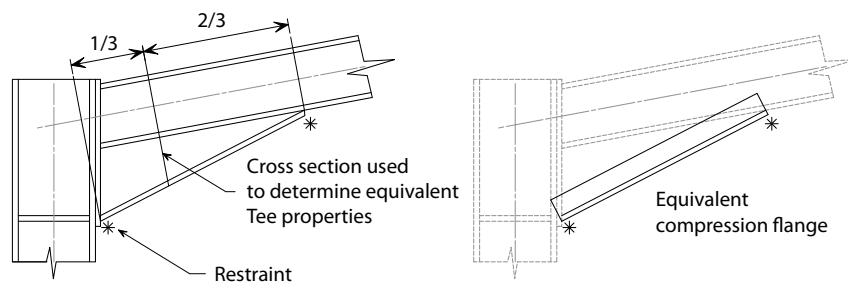


Figure 3: Haunched section and equivalent Tee

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AD 368

Shear resistance of I-sections in P363

This Advisory Desk Note provides clarification and further guidance on the design shear resistance values given in SCI P363 *Steel building design: Design data* (Euro Blue Book) for I-Sections, under the tables for web bearing and buckling.

In P363, Section 9.1(a) of the Explanatory notes states that the design shear resistance of the cross section $V_{c,Rd}$ is calculated in accordance with BS EN 1993-1-1, Clause 6.2.6 using:

$$V_{c,Rd} = V_{pl,Rd} = \frac{A_v (f_y / \sqrt{3})}{\gamma_{M0}}$$

where:

A_v is the shear area ($A_v = A - 2bt_f + (t_w + 2r) t_f$ but not less than $\eta h_w t_w$ for rolled I sections)

f_y is the yield strength

γ_{M0} is the partial factor for resistance of cross sections ($\gamma_{M0} = 1.0$, according to the UK in the National Annex).

However, in addition, BS EN 1993-1-1, Clause 6.2.6(6) requires the shear buckling resistance to be verified in accordance with BS EN 1993-1-5 if the web slenderness is such that:

$$\frac{h_w}{t_w} > 72 \frac{\varepsilon}{\eta}$$

where:

h_w is the clear web depth between the flanges ($= h - 2t_f$ for rolled I-sections, see BS EN 1993-1-1, Clause 1.4). Note that this is not the same as c , as defined in Table 5.2 of BS EN 1993-1-1.

t_w is the web thickness

t_f is the flange thickness

$$\varepsilon = \sqrt{\frac{235}{f_y}} \quad (f_y \text{ in N/mm}^2)$$

η is given in NA.2.4 of UK NA to BS EN 1993-1-5 as $\eta = 1$ (and BS EN 1993-1-1 permits η to be conservatively taken as equal to 1.0)

There is no need to verify the shear buckling resistance for any UKB sections made of steel grade S275 because h_w/t_w is within the above limit. For grade S355, only two UKB sections ($406 \times 140 \times 39$ UKB, with $h_w/t_w = 59.5$ and $762 \times 267 \times 134$ UKB, with $h_w/t_w = 59.9$) require shear buckling resistance verification because the ratios exceed the limit of $72\varepsilon/\eta = 72 \times 0.81 = 58.3$.

Clause 5.1(2) of BS EN 1993-1-5 states that plates with h_w/t_w greater than $72\varepsilon/\eta$ should be checked for resistance to shear buckling and should be provided with transverse stiffeners at the supports.

Example

Consider the shear resistance of a $406 \times 140 \times 39$ UKB grade S355.

$$h_w/t_w = (398.0 - 2 \times 8.6)/6.4 = 59.5 > 58.3$$

Therefore, shear buckling resistance is to be determined

For transverse stiffeners at supports only, Expression 5.5 of BS EN 1993-1-5 gives

$$\bar{\lambda}_w = \frac{h_w}{86.4 t_w \varepsilon} = \frac{380.8}{86.4 \times 6.4 \times 0.81} = 0.85$$

For a non-rigid end post, Table 5.1 of BS EN 1993-1-5 gives

$$\chi_w = \frac{0.83}{\bar{\lambda}_w} = \frac{0.83}{0.85} = 0.976$$

Expression (5.2) of BS EN 1993-1-5 gives

$$\chi_w = \frac{0.83}{\bar{\lambda}_w} = \frac{0.83}{0.85} = 0.976$$

Expression (5.1) of BS EN 1993-1-5 gives

$$V_{b,Rd} = \frac{\chi_w f_{yw} h_w t_w}{\sqrt{3} \gamma_{M1}} = \frac{0.976 \times 355 \times 380.8 \times 6.4}{\sqrt{3} \times 1.0} = 488 \text{ kN}$$

Ignoring the contribution from the flange to the shear buckling resistance

$$V_{b,Rd} = V_{b,Rd} \leq \frac{f_{yw} h_w t_w}{\sqrt{3} \gamma_{M1}} = \frac{355 \times 380.8 \times 6.4}{\sqrt{3} \times 1.0} = 500 \text{ kN}$$

Therefore $V_{b,Rd} = 488 \text{ kN}$

The Blue Book gives $V_{c,Rd} = 566 \text{ kN}$ for this section.

Similarly, for a $762 \times 267 \times 134$ UKB grade S355, $V_{b,Rd} = 1768 \text{ kN}$ and $V_{c,Rd} = 1970 \text{ kN}$

For these two sections, the shear resistances given in the Blue Book are greater than given by the full application of the rules in the Eurocodes. The lesser values should always be used in design. Although the difference between the shear buckling resistance and the cross-section shear resistance appear large (14% and 10% respectively), in practical cases this will not be critical for member sizing.

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New Ascot Grandstand

FROM
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MAY 1962

Right: Work in progress on the Ascot Grandstand, showing terrace rakers, box balcony cantilevers and roof construction of galvanized trusses and plated girders – the latter with manholes for maintenance access

Steelwork was used for the frame of the new Queen Elizabeth II Stand at Ascot, which was opened last June after a construction period of only ten months, because such a tight building programme demanded as much prefabrication of materials as possible before work commenced on site.

The stand consists of two main portions. The main section facing the course is 560 ft. long, 80 ft. deep and an average height of 74 ft.; there is a circulation area centrally at the rear one-third as long. Two complete joints either side of the circulation block divide the stand into three; 1,200 tons of steel were used.

The main section of the stand was designed on a fully rigid basis, all the intersecting connexions between columns were shop-welded, and side joints where they were required, were bolted and positioned at points of minimum moment, i.e. mid points of column and third points of beams. In order to reduce the number of site joints complete sections comprising columns of two bays for two storey heights together with connecting beams and cantilevers were fabricated in the shop: these sections were fabricated in the shop up to the maximum size possible for handling and transport.

Universal Beam and Column sections to B.S.15 were employed almost exclusively for the job and where some full strength joints required bolts, high-strength friction grip bolts were used.

The steelwork was unpainted and protected by concrete cladding 2 in. over the sections. The 40-ft cantilever roof structure was hot dip galvanized to save weight. The cantilevers were generally of lattice construction except where they supported the Tic-Tac platform, and plate girders of the same outline were used.

The design loading for the structure was 100 lb./sq. ft. except in the upper private dining-rooms and boxes where it was 80 lb./sq. ft. The steelwork supports precast concrete floors and terraces on a 20-ft. frame spacing with front rakers at 10-ft. centres. Where possible all pre-cast work was of hollow construction to reduce dead load.

The columns were designed as pin based and two bolts used at each foundation. Because of the complexity of the rigid design under wind action, there being columns of 4-storey height at the front and six at the rear, an electronic computer

was used for this analysis. These calculations showed that usual assumptions of shear distribution were inadequate for such a shape.

The lightning-protection system of the structure used the main frame as the conductor from roof to ground level. The copper tapes were connected to several stanchions in parallel at eaves level; care was taken to insulate the tapes from the zinc galvanized roof-work. At foundations level tapes were connected to the stanchions just above the base plates and connected to one another as a ring main.



View of the completed stand



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Applied QA in furnace reconstruction project

Taken from STEEL CONSTRUCTION April 1992



Introduction

A major new blast furnace re-construction project is currently under way at British Steel's Port Talbot works. The new furnace will substantially improve steel making capacity at the plant. The £71 million project is being co-ordinated by British Steel with shutdown of the existing facilities scheduled for April 1992.

Demolition and reconstruction will then take place over a 153 day period culminating in the commissioning of the new furnace and associated structures and process plant in August 1992.

Rowecord Engineering Limited were awarded the contract to assemble and weld the new furnace shell plates into three separate modules in July 1991.

This article focuses on several key quality assurance aspects of the project and acknowledgement is due to all who contributed valuable time and information.

Project Description

The furnace shell was divided into 14 tiers. Each tier was made up of either six or seven rolled plate segments.

Hot rolled structural steel plate materials to BS EN10025: 1990, mainly grade Fe 510 D1 were supplied cut to size and pre-rolled by British Steel. Plate thicknesses ranged from 25mm to 90mm. Each tier assembly was approximately 3 metres high and weighed from 25 tonnes to 80 tonnes.

Contract Review: Planning and Preparation

Effective lines of communication were established

between the Rowecord and British Steel engineering teams. The "fast track" nature of the project and the special site conditions necessitated rapid exchange of information and a fast response to any points of clarification.

Pre-tender planning had obviously defined the project requirements in terms of resources and programme, however it became necessary to prepare more detailed schemes to co-ordinate the activities of British Steel and other contractors involved in the project.

Method statements detailing construction operations and safety procedures were prepared, along with Quality Plans defining the specified requirements in terms of tolerances and weld acceptance levels.

Resources in terms of labour and equipment were reviewed and defined to align with the assembly sequence and with the overall construction programme. Power generation and welding equipment was confirmed and installed. Craneage was ordered and positioned.

Process Control:

Development of Welding Procedures

Development of practical welding procedures became the top priority, the overall success of the project was dependent upon being able to maximise the weld deposition rates and minimise their repair rate, thus maintaining productivity and programme.

Approval testing of welding procedures was carried out in accordance with BS 4870: Part 1 with full ultrasonic testing for volumetric examination and magnetic particle inspection for surface examination. Mechanical tests included tensiles, bends and Charpy impact specimens. British Steel undertook metallographic examination of tested Charpy impact specimens to ascertain notch locations and to assess weld metal and heat affected zone microstructures. Procedure qualification records were prepared and submitted to British Steel for approval.

Process Control:

Application of Welding Procedures

Different solutions were arrived at to weld the horizontal seams and the vertical butts. For the verticals an all positional flux cored wire electrode was chosen.

All vertical weld preparations were of double-vee configuration and required welding on both sides.

Carriages mounted on rigid track, fixed with magnets, parallel to the joint, provided control of travel speed. An oscillating device, mounted on the carriage, held the welding gun in the joint and introduced the option to weave the arc across the weld pool thus ensuring sidewall fusion.

Horizontal seams were welded using a metal-cored wire electrode. Oscillation was unnecessary for welding in the horizontal position thus simplifying the equipment and welding procedure. The carriages were mounted on a flexible track to follow the circumferential joint.

The use of low hydrogen type electrodes and high



welding heat inputs reduced the preheat requirements to a minimum. Electrical heating pads were used where preheat was specified. Temperature recorders monitored preheat levels throughout welding operations.

Training

Welding operators were selected from the labour force and allocated to the project. There followed a week's intensive training and practice supervised by engineers from Rowecord and the equipment suppliers.

Time was also spent in teaching basic maintenance of the equipment. Simple breakdowns and repairs could then be attended to without the need for off-site expertise.

Inspection and Testing: Dimensional Control

The specification laid down stringent dimensional tolerances on circumference, diameter, concentricity and height, therefore comprehensive surveys were undertaken at all stages of manufacture and construction.

After delivery the assembled tiers were re-surveyed. Allowances for welding shrinkage and corrections for tier to tier variations were made as the project progressed. Regular in-process checks were made to monitor welding distortion and to recommend changes to welding sequences to compensate.

Record of the dimensional accuracy of each module was compiled as the project progressed.

Inspection and Testing: Welding Inspection

All completed welds were 100% visually examined prior to final inspection. Final non-destructive testing involved percentage checking with particular emphasis being placed on critical areas such as adjacent to cut-outs and cooler slots in the shell wall, and the junctions of vertical and horizontal welds. Ultrasonic testing was carried out for surface examination. Testing rates were varied according to the level and type of defects discovered. Repair rates were extremely low and were generally associated with areas completed with manual welding. N.D.T. reports were compiled into full documentary records to complete a welding history of the major joints on the project.

Conclusion

The overall success of the project was achieved by application of quality assurance in activities such as forward planning, developing and control of the welding process, training and quality control operations such as dimensional surveying and non-destructive testing.

In parallel with the furnace shell assembly and welding project Rowecord Engineering Limited have been awarded several other module construction contracts involving fabrication and erection of foundation brackets, underneath cooling structures, tower structures, bustle main pipework and hot blast systems.

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Fire resistance design of steel-framed buildings (P375)



Design for fire resistance is a key requirement for most steel-framed buildings. Beams and slabs are required to provide a certain level of load bearing resistance in defined fire situations, slabs are also required to provide insulation and integrity in order to limit the spread of fire.

This new publication provides a general overview of the fire design requirements for steel and composite structures and provides;

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- an explanation on how to determine the heat flux transferred to the members and how to determine their resistance at elevated temperatures.

This publication also notes that the Eurocodes cover both simple and advanced calculation models and gives in-depth guidance on the use of the simple model.

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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	SCM	Contract Value (1)
A C Bacon Engineering Ltd	01953 850611			●	●		●											Up to £2,000,000
ACL Structures Ltd	01258 456051			●	●	●	●				●				●		●	Up to £2,000,000
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Adstone Construction Ltd	01905 794561			●	●	●										✓		Up to £1,400,000
Advanced Fabrications Poyle Ltd	01753 531116				●		●	●	●	●	●				●			Up to £800,000
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Arramax Structures Ltd	01623 747466	●		●	●	●	●	●	●	●	●	●						Up to £800,000
ASA Steel Structures Ltd	01782 566366			●	●	●	●			●	●			●	●			Up to £800,000*
ASD Westok Ltd	0113 205 5270												●			✓		Up to £6,000,000
ASME Engineering Ltd	020 8966 7150				●					●	●			●	●	✓		Up to £800,000*
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Atlasco Constructional Engineers Ltd	01782 564711			●	●	●	●							●				Up to £2,000,000
Austin-Divall Fabrications Ltd	01903 721950			●	●		●	●		●	●			●	●			Up to £200,000
B&B Group Ltd	01942 676770			●	●	●	●	●		●	●	●		●		✓		Up to £1,400,000
B D Structures Ltd	01942 817770			●	●	●	●				●	●		●				Up to £400,000
Ballykine Structural Engineers Ltd	028 9756 2560			●	●	●	●	●				●				✓		Up to £1,400,000
Barnshaw Section Benders Ltd	01902 880848												●			✓		Up to £800,000
BHC Ltd	01555 840006	●	●	●	●	●	●							●				Above £6,000,000
Billington Structures Ltd	01226 340666		●	●	●	●	●	●	●	●	●	●		●		✓	●	Above £6,000,000
Border Steelwork Structures Ltd	01228 548744			●	●	●	●			●	●				●			Up to £3,000,000
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D H Structures Ltd	01785 246269				●		●				●			●				Up to £40,000
Discairn Project Services Ltd	01604 787276				●					●	●				●	✓		Up to £800,000
Duggan Steel Ltd	00 353 29 70072		●	●	●	●	●	●			●					✓		Up to £6,000,000
ECS Engineering Services Ltd	01773 860001	●		●	●	●	●	●	●	●	●			●	●	✓		Up to £2,000,000
Elland Steel Structures Ltd	01422 380262		●	●	●	●	●	●	●	●	●	●		●		✓	●	Up to £6,000,000
EvadX Ltd	01745 336413			●	●	●	●	●	●	●	●					✓	●	Up to £3,000,000
Fisher Engineering Ltd	028 6638 8521		●	●	●	●	●	●	●	●	●	●				✓	●	Above £6,000,000
Fox Bros Engineering Ltd	00 353 53 942 1677			●	●	●	●	●			●							Up to £3,000,000
Gorge Fabrications Ltd	0121 522 5770				●	●	●	●		●					●			Up to £800,000
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 £3,000,000
H Young Structures Ltd	01953 601881			●	●	●	●	●						●			●	Up to £2,000,000
Had Fab Ltd	01875 611711				●				●	●	●				●	✓		Up to £2,000,000
Hambleton Steel Ltd	01748 810598		●	●	●	●	●	●				●		●		✓	●	Up to £2,000,000
Harry Marsh (Engineers) Ltd	0191 510 9797			●	●	●	●				●	●				✓		Up to £2,000,000
Henry Smith (Constructional Engineers) Ltd	01606 592121			●	●	●	●	●										Up to £3,000,000
Hescott Engineering Company Ltd	01324 556610			●	●	●	●			●				●	●			Up to £3,000,000
Hillcrest Fabrications Ltd	01283 212720				●			●							●			Up to £400,000
Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	SCM	Contract Value (1)

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	SCM	Contract Value (1)
Hills of Shoburyness Ltd	01702 296321									●	●				●			Up to £1,400,000
J Robertson & Co Ltd	01255 672855									●	●				●			Up to £200,000
James Killelea & Co Ltd	01706 229411		●	●	●	●	●					●		●				Up to £6,000,000*
Kiernan Structural Steel Ltd	00 353 43 334 1445			●	●	●	●	●	●	●	●	●		●	●	✓	●	Up to £4,000,000
Leach Structural Steelwork Ltd	01995 640133			●	●	●	●	●			●						●	Up to £2,000,000
M Hasson & Sons Ltd	028 2957 1281			●	●	●	●	●	●	●	●				●	✓		Up to £3,000,000
M&S Engineering Ltd	01461 40111				●				●	●	●			●	●			Up to £1,400,000
Mabey Bridge Ltd	01291 623801	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✓	●	Above £6,000,000
Mackay Steelwork & Cladding Ltd	01862 843910			●	●		●			●	●			●	●			Up to £800,000
Maldon Marine Ltd	01621 859000				●			●	●	●					●			Up to £1,400,000
Mifflin Construction Ltd	01568 613311		●	●	●	●	●				●							Up to £3,000,000
Newbridge Engineering Ltd	01429 866722			●	●	●	●								●	✓		Up to £1,400,000
Nusteel Structures Ltd	01303 268112						●	●	●	●						✓		Up to £4,000,000
On Site Services (Gravesend) Ltd	01474 321552				●		●	●		●	●				●			Up to £200,000
Overdale Construction Services Ltd	01656 729229			●	●		●	●			●				●			Up to £400,000
Paddy Wall & Sons	00 353 51 420 515			●	●	●	●	●	●	●	●							Up to £6,000,000
Painter Brothers Ltd	01432 374400								●		●				●	✓	●	Up to £6,000,000
Pencro Structural Engineering Ltd	028 9335 2886			●	●	●	●	●	●	●	●			●	●	✓		Up to £2,000,000
Peter Marshall (Steel Stairs) Ltd	0113 307 6730									●					●			Up to £800,000
PMS Fabrications Ltd	01228 599090			●	●	●	●			●	●	●		●	●			Up to £1,400,000
REIDsteel	01202 483333		●	●	●	●	●	●	●	●	●	●		●				Up to £6,000,000
Rippin Ltd	01383 518610			●	●	●	●	●										Up to £1,400,000
Rowecord Engineering Ltd	01633 250511	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✓	●	Above £6,000,000
Rowen Structures Ltd	01773 860086		●	●	●	●	●	●	●	●	●	●		●				Above £6,000,000*
S H Structures Ltd	01977 681931						●	●	●	●						✓	●	Up to £3,000,000
Severfield-Rowen Structures Ltd	01845 577896	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✓	●	Above £6,000,000
Shipley Fabrications Ltd	01400 251480			●	●	●	●			●	●	●		●	●			Up to £1,400,000
SIAC Butlers Steel Ltd	00 353 57 862 3305		●	●	●	●	●	●	●		●	●				✓	●	Above £6,000,000
SIAC Tetbury Steel Ltd	01666 502792			●	●	●	●		●		●	●		●	✓	●	●	Up to £2,000,000
Snashall Steel Fabrications Co Ltd	01300 345588			●	●	●	●								●			Up to £1,400,000
South Durham Structures Ltd	01388 777350			●	●	●				●	●	●			●			Up to £800,000
Temple Mill Fabrications Ltd	01623 741720			●	●	●	●				●	●			●			Up to £200,000
The AA Group Ltd	01695 50123			●	●	●	●			●	●	●		●	●		●	Up to £4,000,000*
Traditional Structures Ltd	01922 414172		●	●	●	●	●	●	●		●	●		●		✓	●	Up to £2,000,000
Tubecon AESS	01226 345261						●	●	●	●				●	●	✓	●	Above £6,000,000*
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 £200,000
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	SCM	Contract Value (1)



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	Company name	Tel
Balfour Beatty Utility Solutions Ltd	01332 661491	Roger Pope Associates	01752 263636
Griffiths & Armour	0151 236 5656	Sandberg LLP	020 7565 7000
Highways Agency	08457 504030	SUM Ltd	0113 242 7390
Kier Construction Ltd	01767 640111		



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	4 Steel producers	7 Safety systems	SCM Steel Construction Sustainability Charter
2 Computer software	5 Manufacturing equipment	8 Steel stockholders	● = Gold, ● = Silver, ● = Member
3 Design services	6 Protective systems	9 Structural fasteners	

Company name	Tel	1	2	3	4	5	6	7	8	9	SCM
AceCad Software Ltd	01332 545800	●									
Albion Sections Ltd	0121 553 1877	●									
Andrews Fasteners Ltd	0113 246 9992									●	
ArcelorMittal Distribution – Birkenhead	0151 647 4221								●		
ArcelorMittal Distribution – Bristol	01454 311442								●		
ArcelorMittal Distribution – South Wales	01633 627890								●		
ArcelorMittal Distribution – Scunthorpe	01724 810810								●		
ASD metal services	0113 254 0711									●	
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 Ltd	01274 682281								●		
BW Industries Ltd	01262 400088	●									

Company name	Tel	1	2	3	4	5	6	7	8	9	SCM
Cellbeam Ltd	01937 840600	●									
Cellshield Ltd	01937 840600								●		
CMC (UK) Ltd	029 2089 5260								●		
Composite Profiles UK Ltd	01202 659237	●									
Computer Services Consultants (UK) Ltd	0113 239 3000	●									
Cooper & Turner Ltd	0114 256 0057									●	
Cutmaster Machines UK Ltd	01226 707865					●					
Daver Steels Ltd	0114 261 1999	●									
Development Design Detailing Services Ltd	01204 396606			●							
Easi-edge Ltd	01777 870901								●		●
Fabsec Ltd	0845 094 2530	●									
FabTrol Systems UK Ltd	01274 590865	●									
Ficep (UK) Ltd	01924 223530					●					
FLI Structures	01452 722200	●									●



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	MB Moving bridges
PG Bridges made principally from plate girders	RF Bridge refurbishment
TW Bridges made principally from trusswork	AS Ancillary structures in steel associated with bridges, footbridges or sign gantries (eg grillages, purpose-made temporary works)
BA Bridges with stiffened complex platework (eg in decks, box girders or arch boxes)	QM Quality management certification to ISO 9001
CM Cable-supported bridges (eg cable-stayed or suspension) and other major structures (eg 100 metre span)	SCM Steel Construction Sustainability Charter (● = Gold, ● = Silver, ● = Member)

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.

BCSA steelwork contractor member	Tel	FG	PG	TW	BA	CM	MB	RF	AS	QM	NHSS 19A 20	SCM	Contract Value ⁽¹⁾
B&B Bridges Ltd	01942 676770	●	●	●	●	●	●	●	●	✓			Up to £1,400,000
Briton Fabricators Ltd	0115 963 2901	●	●	●	●	●	●	●	●	✓	✓		Up to £3,000,000
Cairnhill Structures Ltd	01236 449393	●	●	●	●	●	●	●	●	✓		●	Up to £2,000,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	✓	✓	●	Above £6,000,000
Four-Tees Engineers Ltd	01489 885899	●	●	●	●	●	●	●	●	✓	✓	●	Up to £2,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445	●	●	●	●	●	●	●	●	✓		●	Up to £800,000
Mabey Bridge Ltd	01291 623801	●	●	●	●	●	●	●	●	✓	✓	●	Above £6,000,000
Nusteel Structures Ltd	01303 268112	●	●	●	●	●	●	●	●	✓	✓	✓	Up to £4,000,000
Painter Brothers Ltd	01432 374400	●	●	●	●	●	●	●	●	✓		●	Up to £6,000,000
Rowcord Engineering Ltd	01633 250511	●	●	●	●	●	●	●	●	✓	✓	●	Above £6,000,000
S H Structures Ltd	01977 681931	●	●	●	●	●	●	●	●	✓	✓	●	Up to £3,000,000
SIAC Butlers Steel Ltd	00 353 57 862 3305	●	●	●	●	●	●	●	●	✓		●	Above £6,000,000
TEMA Engineering Ltd	029 2034 4556	●	●	●	●	●	●	●	●	✓			Up to £1,400,000*
Varley & Gulliver Ltd	0121 773 2441	●	●	●	●	●	●	●	●	✓	✓		Up to £4,000,000
Watson Steel Structures Ltd	01204 699999	●	●	●	●	●	●	●	●	✓	✓	●	Above £6,000,000
Non-BCSA member													
ABC Bridges Ltd	0845 0603222	●								✓			Up to £100,000
A G Brown Ltd	01592 630003	●						●	●	✓			Up to £400,000
Allerton Steel Ltd	01609 774471	●	●	●	●	●	●	●	●	✓			Up to £1,400,000
Cimolai Spa	01223 350876	●	●	●	●	●	●			✓			Above £6,000,000
Concrete & Timber Services Ltd	01484 606416	●	●	●		●	●		●	✓		●	Up to £800,000
Donyal Engineering Ltd	01207 270909	●						●	●	✓	✓	✓	Up to £1,400,000
Francis & Lewis International Ltd	01452 722200							●	●	✓		●	Up to £2,000,000
Harland & Wolff Heavy Industries Ltd	028 9045 8456	●	●	●	●	●		●	●	✓			Up to £2,000,000
Hollandia BV	00 31 180 540540	●	●	●	●	●	●	●	●	✓			Above £6,000,000
Interserve Construction Ltd	0121 344 4888							●	●	✓			Above £6,000,000*
Interserve Construction Ltd	020 8311 5500	●	●	●	●		●	●	●	✓			Above £6,000,000*
Millar Callaghan Engineering Services Ltd	01294 217711	●						●	●	✓			Up to £800,000
P C Richardson & Co (Middlesbrough) Ltd	01642 714791	●						●	●	✓			Up to £3,000,000
The Lanarkshire Welding Company Ltd	01698 264271	●	●	●	●	●	●	●	●	✓		●	Up to £2,000,000

Company name	Tel	1	2	3	4	5	6	7	8	9	SCM
Forward Protective Coatings Ltd	01623 748323						●				
Graitec UK Ltd	0844 543 888		●								
Hadley Rolled Products Ltd	0121 555 1342	●									●
Hempel UK Ltd	01633 874024						●				
Hi-Span Ltd	01953 603081	●									●
Highland Metals Ltd	01343 548855						●				
Hilti (GB) Ltd	0800 886100								●		
International Paint Ltd	0191 469 6111						●				●
Jack Tighe Ltd	01302 880360						●				
Jamestown Cladding and Profiling	00 353 45 434288	●									
Jotun Paints (Europe) Ltd	01724 400000						●				
Kaltenbach Ltd	01234 213201					●					
Kingspan Structural Products	01944 712000	●									●
Leighs Paints	01204 521771						●				●
Lindapter International	01274 521444								●		
Metsec plc	0121 601 6000	●									●
MSW	0115 946 2316	●									
National Tube Stockholders Ltd	01845 577440								●		
Northern Steel Decking Ltd	01909 550054	●									

Company name	Tel	1	2	3	4	5	6	7	8	9	SCM
John Parker & Sons Ltd	01227 783200								●	●	
Peddinghaus Corporation UK Ltd	01952 200377					●					
Peddinghaus Corporation UK Ltd	00 353 87 2577 884					●					
PPG Performance Coatings UK Ltd	01773 814520						●				
Prodeck-Fixing Ltd	01278 780586	●									
Rainham Steel Co Ltd	01708 522311								●		
Richard Lees Steel Decking Ltd	01335 300999	●									●
Structural Metal Decks Ltd	01202 718898	●									●
Studwelders Composite Floor Decks Ltd	01291 626048	●									
Tata Steel	01724 404040				●						
Tata Steel Distribution (UK & Ireland)	01902 484100								●		
Tata Steel Service Centres Ireland	028 9266 0747								●		
Tata Steel Service Centre Dublin	00 353 1 405 0300								●		
Tata Steel Tubes	01536 402121				●						
Tata Steel UK Panels & Profiles	0845 308 8330	●									
Tekla (UK) Ltd	0113 307 1200		●								
Tension Control Bolts Ltd	01948 667700						●			●	
Wedge Group Galvanizing Ltd	01909 486384						●				

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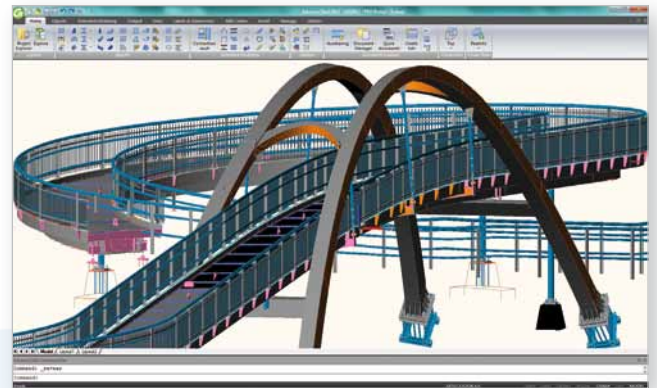
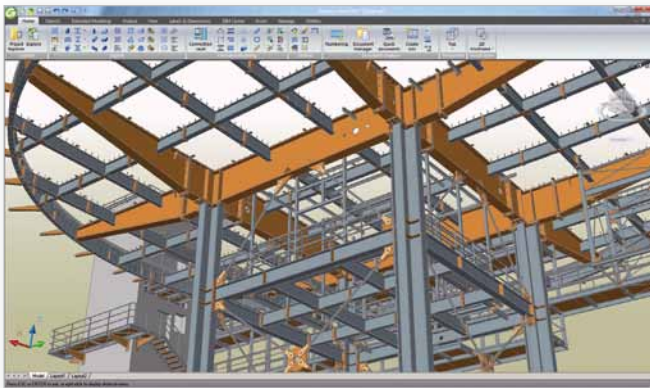




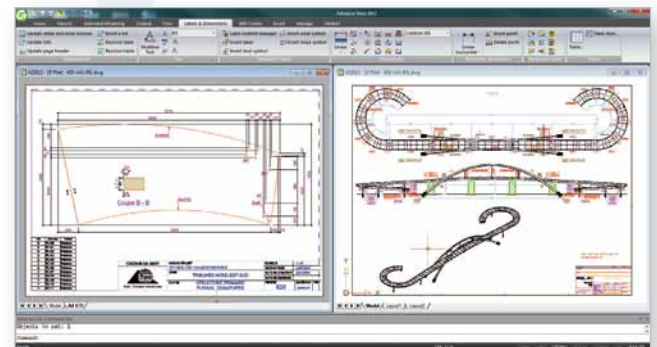
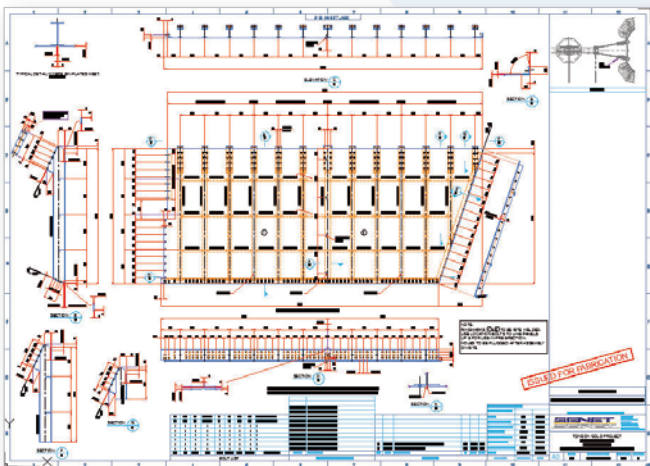
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