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Vol 24 No 7 July/August 2016

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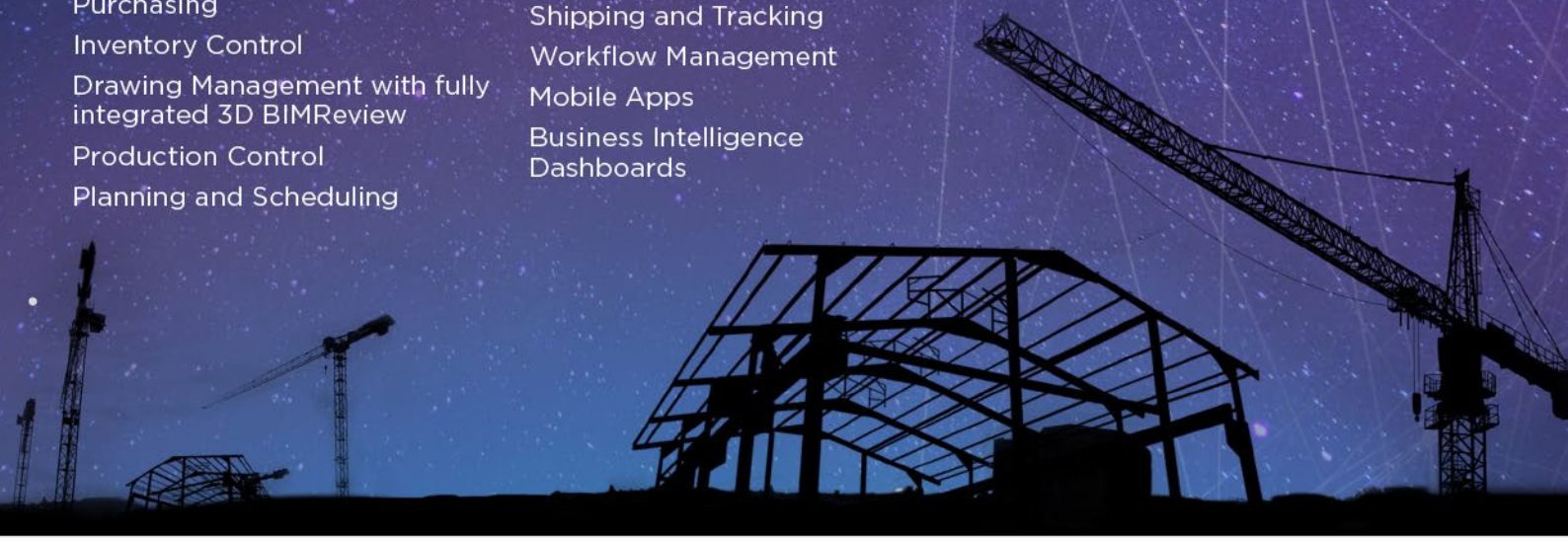

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4 Kingdom Street, Paddington, London
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Main contractor: Wates Construction
Structural engineer: Ramboll
Steelwork contractor: William Hare
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SCI ANNUAL EVENT
SAVE THIS DATE

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Steel Knowledge
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Save this date
Wednesday 9th November 2016

The National Gallery, London

3D Printing – the future of design and manufacture will be the main theme of SCI's 2016 Annual Event to be held on the 9th November, The National Gallery, London. Presentations will include;

- The MX3D bridge project in Amsterdam – Olivier Vassart, ArcelorMittal
- Additive Manufacture – Iain Todd, Sheffield University
- Simulation Driven Additive Manufacturing: New technology from SIMULIA-Abaqus – Auday Alrawe, Intrinsys
- Recent research projects from SCI

More information will be provided over the coming months.

The SCI is committed to helping members meet their design, manufacture, construction and commercial objectives.

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To register your interest to attend this event email or call

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Shortlist justifies optimism for future of steel

Nick Barrett - Editor

The UK is going through what has been widely agreed to be one of the most tumultuous periods in its political history as a result of the referendum vote to leave the EU, and it would be foolhardy to make any predictions about what will happen next, let alone what the final outcome of these events will be. We are living in interesting times.

After an initial shock when the prophets of gloom and doom seemed to have the upper hand, a more optimistic note was struck by commentators and it began to look like things might not be as bad on the economic front as feared. That tide has ebbed and flowed ever since. About all that can be said confidently is that the general political background is uncertain; but in the meantime it's business as usual.

Some investors have said they will push on with plans regardless of the immediately uncertain outlook, others have said they will wait and see. There have been few signs of cancellations of projects so far, and we await revised forecasts for construction output from the key forecasting organisations.

The steel construction sector can confidently tell the market that the outlook for the security of supply of fabricated steelwork remains as assured as it was before the referendum, when the BCSA was forecasting a continuing increase in demand and the most recent news about the prospects for UK manufacturing of steel was positive. The steel sector itself has no reason to fear for the future, whether in the EU or out of it, whatever that might look like.

Reasons for the steel sector's optimism can be seen in the shortlist for this year's Structural Steel Design Awards which has just been published (see News). Judges have visited all 21 on the shortlist, which as you will see is a geographically diverse collection of high quality projects that showcase the reasons why steel is so often the preferred solution for the widest range of types of buildings, bridges and other structures.

The shortlist includes stadia, education buildings, bridges, commercial developments and industrial facilities. It includes iconic structures like the Olympic stadium roof conversion and the Memorial Spire at the International Bomber Command Centre in Lincoln. Footbridges reaching the shortlist have been built as far apart as Chichester in West Sussex, Gwynned in the north west of Wales, and Strabane in Co Tyrone.

One of the most viewed structures on television worldwide this July will be the SSDA shortlisted Land Rover BAR America's Cup HQ Building in Portsmouth, when the America's Cup gets under way on 21 July. The South Bank Tower has had its useful life extended by a refurbishment and the addition of 11 storeys made possible by steel.

When the dust finally settles over the UK's withdrawal from the EU, these structures will remain as a lasting legacy, monuments to what can be achieved by a world-leading steel construction industry. These are interesting times for steel construction, but for all the right reasons.

BCSA says UK steel is still world leader

Structural steel remains the material of choice for construction and looks set for further increases in demand over the coming year following growth of 8% in 2015, British Constructional Steelwork Association President Wendy Coney (pictured) told the Association's National Dinner.

Ms Coney said despite the 'steel in crisis' headlines that at times dominated the media and could have undermined confidence in steel, supply of structural steel was unaffected by problems that beset manufacturers in the face of overproduction of steel in China.

She said: "Steelwork contractor members continued to source their steel from high quality domestic and imported sources, supported by the UK's domestic steel producer and a strong distribution and stockholding sector. This enabled them to meet demand for a full range of projects and clients."

The UK's structural steel industry remained the world's leader and further growth in demand was expected in 2016.

Ms Coney said the steel sector has adapted easily to the introduction of new steel procurement guidelines from the government and has been working with government to ensure that the changes support the domestic supply of rolled steel, while at the same time ensuring the new rules do not have unintended consequences along the supply chain.

Also during the year, the structural steelwork supply chain played a key role in support of the introduction of Building Information Modelling (BIM), which is now mandatory for government construction projects. The sector's long-term familiarity with 3D modelling helped a smooth transition to the new BIM regime, as did the training programmes run by BCSA. The BCSA launched a BIM Charter in April that enables steelwork contractors to demonstrate compliance with the government's BIM requirements.

Highly regarded engineer awarded Fellowship at National Dinner

Roger Pope receives his Fellowship from Wendy Coney

The well-known and highly regarded structural engineer Roger Pope, who has been a specialist technical consultant to the BCSA and Tata Steel for many years, was made a Fellow of the BCSA at the National Dinner.

Dr Pope started his career in 1964 with an industrial scholarship to attend Oxford University from the Steel Company of Wales, later part of British Steel Corporation.

He worked for Redpath Dorman Long and later became managing director of a structural steelwork company before becoming an independent consulting engineer.

He has chaired a number of UK and European standards committees and still convenes the European committee responsible for the "Execution of Steel Structures'. He was instrumental in developing the National Structural Steelwork Specification and the Register of Qualified Steelwork Contractors Scheme for Bridgeworks, and is still active as a bridges assessor for the BCSA.

BCSA President Wendy Coney said: "I think we would all agree that Roger's contribution to the constructional steelwork industry has been significant in moving both the codes and standards and the way the industry works forward. This is why I'm delighted to make Roger a Fellow of BCSA."

Ten-storey Tate Modern extension opens

Known as the Switch House, the new Tate Modern extension, which increases the museum's size by 60%, has opened to the public.

The pyramid-shaped 10-storey structure accommodates a host of new galleries and exhibition space as well as incorporating a panoramic public viewing terrace on its uppermost level.

The structure consists of concrete and steel-framed elements with approximately 1,000t of structural steelwork erected for the project by Severfield.

Beginning at ground floor level, Severfield's steelwork partially fills the project's footprint as it extends upwards to the fifth floor level where it is overlapped and supports the upper parts of the concrete frame.

A jacking system was connected to the steelwork during much of the construction programme to help redistribute the loads from the upper levels of the structure.

The extension is linked to the existing Tate Modern building via two footbridges and an underground route. Clad with distinctive brickwork, the new building fits seamlessly into its surroundings.

Jacques Herzog of project architect Herzog & de Meuron, who also worked on the original conversion of Bankside power station into the Tate Modern museum in 2000, said: "Our aim was to create a building conglomerate which appears as one thing, not as a phase one and a phase two."

SSDA shortlist highlights steel success stories

The British Constructional Steelwork Association and Steel for Life have announced the shortlist for the 48th Structural Steel Design Awards (SSDA).

The 21 projects shortlisted showcase steel's flexibility and versatility in a number of different and varying applications.

The shortlist also reflects the wide geographical spread of steel's appeal for a variety of projects ranging from stadia to education buildings, with entries also received for a variety of bridges, commercial developments and industrial facilities across the UK.

Chairman of the SSDA Judges David Lazenby said: "It is reassuring that the number of submissions for the Award scheme remains high, and that quality and interest of the projects is as strong as ever.

"One impression is that these days there are few easy projects and this means teams must work closely and constructively together."

The winners will be announced at an evening reception in London on 5 October.

The 2016 shortlist is:

- Land Rover BAR America's Cup HQ Building, Portsmouth
- Leeds Station Southern Entrance
- Thames Tower Redevelopment, Reading
- Energy from Waste Plant, Peterborough
- Energy from Waste Facility, Ardley
- Plant-support Structure Ferrybridge Multifuel 1
- New Watford Market
- University of Cambridge Primary School
- The Diamond Engineering Building, Sheffield University
- Sports Hall & Sixth Form Centre, Channing School, London
- London Olympic Roof Conversion
- South Stand Expansion, Etihad Stadium, Manchester
- South Bank Tower, London
- Whyke Horizon Footbridge, Chichester
- Harlech Castle Footbridge, Gwynedd
- Lagan Weir Pedestrian and Cycle Bridge, Belfast
- Strabane Footbridge, Co Tyrone
- Information Age Gallery, The Science Museum, London
- The Memorial Spire, International Bomber Command Centre, Lincoln
- Kiosk and Shelter, Bournemouth Pier Approach
- 6 Bevis Marks Roof Garden, London

Steel-framed BIM store for Asda

Steelwork is nearing completion on Asda's first Level 2 BIM (Building Information Modelling) project in Clacton-on-Sea, Essex.

Working on behalf of main contractor ISG, Walter Watson is erecting the steelwork for the 3,200m² supermarket that is being constructed on the site of a former multi-occupancy retail development.

The steel-framed building will include a customer café, deli counter, an in-store bakery and staff areas with shower and changing facilities. The site also includes an automated petrol filling station and a large car park with four electric vehicle charge points.

The build programme has been fully designed in BIM with all consultants working in collaboration software system Autodesk Revit, resulting in the production of seven fully-annotated 3D models.

ISG's Western Regional Managing Director Rob Martin commented: "The Clacton-on-Sea project represents the culmination of a journey by Asda into advanced collaborative working practices, where ISG has played a key role as a trusted project partner and influencer.

"In a sector where operational costs and asset management are critical, BIM not only creates efficiency benefits during the build phase but also throughout the service life of the store and we are thrilled to be working with Asda on such a milestone project."

Historic gas holders return to Kings Cross

Three Victorian cast iron gas holders have been refurbished and are now being re-erected as part of a residential development at Kings Cross, London.

Bourne Steel has been contracted by main contractor Carillion to erect the gas holders as independently-standing feature structures around three circular residential blocks that will contain 144 apartments.

The erection process is challenging and care has to be taken to not damage the cast iron columns and beams, as they are fragile.

The gas holders also have to be re-built in a certain sequence as they are not tied back to any existing or new structure. In total there are 41 columns, each approximately 14m-tall, to be erected, along with connecting lattice beams and guide rails.

NEWS IN BRIEF

Software specialists **Trimble** and **Autodesk** have entered into an interoperability agreement aimed at saving customers time and reducing project costs typically associated with workflow inefficiency across different suppliers' technologies. The companies said this will benefit architects, engineers and contractors, and importantly, project owners by enabling more freedom to optimise technology workflows.

Severfield has reported increased revenue and profit for the year ending March 2016, and its strongest order book for more than six years. In its annual results, the company posted revenue up 19% to £239M, up from £201M in 2015, while profit before tax was up 59% to £13.2M. Severfield's UK order book, as of 1 June 2016, amounted to £270M, up from £185M in November last year.

After two years of design work, **Sherwin-Williams** said it is now ready to launch a Tekla plug-in tool that allows steelwork contractors to accurately put intumescent coating thicknesses into their 3D models. The company added that it will allow customers to quickly produce fabrication drawings with this important information in print, as before this work had been a laborious manual process.

Voortman Steel Machinery has launched the compact V302 plate-cutting machine, which is said to be equipped with all basic functions of Voortman's existing plate cutting machines, while being compact, fast and user-friendly. It is available with either a plasma cutting torch, an oxy-fuel torch or a plasma/oxy-fuel-combination.

Computer technology company Advanced RISC Machines (ARM) is expanding its Cambridge headquarters at Peterhouse Technology Park, with the construction of a new steel-framed building. Working on behalf of main contractor Kier, **Caunton Engineering** is fabricating, supplying and erecting 1,500t of steel for a BREEAM 'Excellent' building that will increase ARM's onsite office space from 16,500m² to 35,000m².

AROUND THE PRESS

The Structural Engineer
July 2016
Ordsall Chord, Manchester; design of the UK's first network arch bridge
Constructability was a key consideration for all of the options developed. Construction of a network arch structure over the River Irwell was of particular concern and, as such, independent discussions were held with in-house construction experts and Cleveland Bridge UK.

New Civil Engineer
June 2016
Chernobyl structure nears end
The steel shell is being moved into place over the original sarcophagus structure that was erected after the explosion.

Building Magazine
24 June 2016
Steelwork firm sees 2016 profit bounce back
Severfield Chief Executive Ian Lawson said he was delighted that private investor Greybull had rescued Tata's steelworks in Scunthorpe back in the spring. "We buy a considerable amount from there, virtually all of our 70,000 tonnes of section steel."

Construction News
17 June 2016
Galliford Try de-risks perilous rail crossing
[Lincoln High Street Footbridge] – The bridge itself is a single span steel-frame lattice–girder bridge, fabricated off-site and brought to site in seven different sections.

Construction News
27 May 2016
Clocks ticks on Carillion's Anfield revamp
"The truss was moved over the incomplete steel frame for the new stand and left hovering for two hours while weights were added to cranes, allowing them to lower it safely into position. In the end the job went perfectly but only due to months of planning from the team," says Carillion Project Director Chris Ruta.

National Highway Sector Scheme 19A appoints training administrator

The committee responsible for National Highway Sector Scheme (NHSS) 19A has announced the appointment of the Institute of Corrosion as training administrator for the scheme.

National Highway Sector Schemes are quality management schemes that provide a bespoke interpretation of the ISO 9001 quality management system standard for organisations working on UK transportation infrastructure.

Sector scheme 19A addresses the corrosion protection of ferrous materials by industrial coatings. The role of the training administrator will be to review and approve training schemes that enable people to be trained and certificated in coating application and coating inspection.

This will mean that the work associated with the application of protective coatings to steelwork in transportation structures is undertaken and inspected by properly trained and competent personnel.

Under the new arrangements skills cards issued by training schemes approved and registered by the training scheme provider will bear the Institute of Corrosion Crest and the NHSS 19A logo demonstrating that the training meets the sector scheme's requirements.

Existing skills cards issued by registered training schemes will continue to be accepted until the expiry date shown on the card.

Stephen Hankinson, Chair of the committee said: "The introduction of a training administrator is a significant change for the scheme and the committee was delighted to have been able to appoint the Institute of Corrosion to this important role. Moving forward the introduction of additional training providers will be a further change and this can only be of benefit to the scheme and the industry".

Chris Atkins, Chair of the Institute of Corrosion's Professional Development and Training Committee added: "This is a great step for the coating industry, the Institute of Corrosion and asset owners. It provides a clear vision for the future of corrosion protection to steel assets."

Outstanding award for Canary Wharf tower

Canary Wharf Group's newest commercial address, One & Five Bank Street, has joined an elite group after achieving a BREEAM 'Outstanding' rating, making it one of the most sustainable buildings of its type in London.

The steel-framed 27-storey tower is currently in the early stages of construction with groundworks and piling ongoing and completion scheduled for 2019.

The development achieved a design stage score of 87.1%, verified by independent assessors in accordance with BREEAM (Building Research Establishment Environmental Assessment Methodology).

Designed by architects Kohn Pedersen Fox, One & Five Bank Street is a 65,000m^2 commercial scheme, comprising high-quality office space with three levels of state-of-the-art trading floors, a retail unit at ground level and public access to a new promenade along an adjacent dock.

Canary Wharf Contractors Project Executive Bianca Stendtke said: "This BREEAM 2014 design stage score is a special achievement for us. It is our first project to achieve this level, it is an acknowledgement of our project and consultant teams' diligent work, and reflects our commitment to sustainability."

General hospital expansion aided by steel fabrication software

Steelwork design and fabrication for the £4.5M expansion and renovation of Kettering General Hospital is said to have been significantly speeded up with the use of Graitec's Autodesk Advance Steel software.

Steelwork contractor TSI Structures, working in collaboration with structural engineer BWB, chose the software for its steel connection design, detailing and fabrication.

According to TSI Structures Drawing Office Manager Adrian Betts: "The bi-directional link between Advance Steel and Autodesk Revit – used by BWB – made it easier to reuse their design model and work more efficiently with their engineers using a BIM workflow."

TSI says it used the software's built-in steel connection design engine (which fully supports Eurocode 3) to check connections in real time and this ultimately speeded up the design procedure by 20%.

The construction project included two new obstetrics/gynaecology operating rooms and supporting accommodation within a new extension to the front of an existing hospital wing.

Remodelling the hospital's existing operating rooms was also part of the project's remit.

Eurocodes review launched

In response to the recent EU Referendum, BSI has been quick to confirm that it is business as usual in terms of the UK's continued participation in the European Standardization System as a full member of the European Standards making body (CEN). As part of this process, BSI has launched a 'systematic review' of parts of Eurocode 3.

The five parts to be reviewed are:

- EN 1993-1-4: 2006 *Eurocode 3. Design of steel structures. General rules. Supplementary rules for stainless steels*
- EN 1993-1-9: 2005 (AC: 2005 + AC: 2009) *Eurocode 3. Design of steel structures. Fatigue*
- EN 1993-1-10: 2005 (AC: 2005 + AC: 2009) *Eurocode 3. Design of steel structures. Material toughness and through-thickness properties*
- EN 1993-1-11: 2006 (AC: 2009) *Eurocode 3. Design of steel structures. Design of structures with tension components*
- EN 1993-2: 2006 (AC: 2009) Eurocode 3. *Design of steel structures. Steel bridges*

The industry is invited to comment on the above standards and, in particular, to respond to the following questions:

1. Do any clauses require editorial or technical correction?
2. Which clauses would benefit from improvements in clarity?
3. Where should the scope of the EN be extended?
4. Where could the EN be shortened?
5. Are there any clauses whose application leads to uneconomic construction?
6. Are there any clauses whose application necessitates excessive design effort?

This is an opportunity for the UK to influence the future direction of Eurocodes, and both BCSA and SCI are encouraging UK practitioners to participate in the review.

Your comments should be compiled into a template and submitted by 7 October 2016. Contact BSI *Helen.Gray@bsigroup.com* to receive the template.

Steel projects come to the fore at Tekla Awards

Trimble has announced the winners of the UK Tekla Awards 2016, which will now be entered into the Tekla Global BIM Awards.

The awards focus on projects of all shapes and sizes, which have used Trimble's Tekla software as part of the process for designing and modelling structures, or where the use of Tekla software has aided collaboration.

Severfield won the Commercial Projects Award for the South Bank Tower development in London (pictured), while William Hare won the Sports and Recreation Projects category for its work on the Olympic Stadium roof. A Public Vote category was also won by Severfield for the Ordsall Chord bridgeworks.

Trimble Solutions (UK) Managing Director Richard Fletcher said: "It's no surprise that once again our competition has yielded some brilliant projects. In fact, the entries that were submitted to this year's awards were so strong that determining the winners of the seven categories was a tough decision to make.

"The awards are an ideal way for our customers to raise their company profile and attract potential new clients, as well as impress existing clients. They showcase and reward the hard work and innovation that goes into using software to solve engineering challenges, working collaboratively and delivering better outcomes for all involved."

Curved beams raise Mersey bridge pylons

Four hundred tonnes of curved heavy steel sections have been supplied by Barnshaw Section Benders for the construction of the Mersey Gateway Bridge.

The steelwork is being used to form cofferdams that create a safe working environment for the construction of the bridge's three main pylons.

The work to create the cofferdams involved driving steel sheet piles into the riverbed to form an outer circle with a diameter of 40m and a second inner circle with a 20m diameter.

The steel piles needed to have some reinforcement fitted so that they can cope with the pressure. This came in the form of huge steel sections that have to be strong enough to support the piles and curved to match the radius of the inner circle.

The steel sections measure up to 356mm x 406mm, weigh 467kg/m and are formed to a radius of 9.7m so as to fit on the inside of the steel pile structure.

Barnshaws Commercial Director Greg North said: "We often work on large structural steel sections, bending them to add strength to a structure, improve the aesthetic qualities of a project, or, in this case to fit a precise curved profile.

"In all, we have formed nearly 400t of this heavy duty steel section to the exact requirements of the client. They will provide the strength necessary to hold the shape of the cofferdams while the foundations of this new river crossing are constructed."

The cable-stayed bridge will have a total length of 1,000m spanning the river Mersey and the Manchester Ship Canal to provide three lanes in each direction, linking the Central Expressway in Runcorn with the main routes to the M62 and towards Liverpool.

Diary

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

Tuesday 19 July 2016
Portal Frame Design - Part 1
In this three-part series. Part 1 covers initial sizing and frame stability. One hour webinar free to BCSA and SCI Members

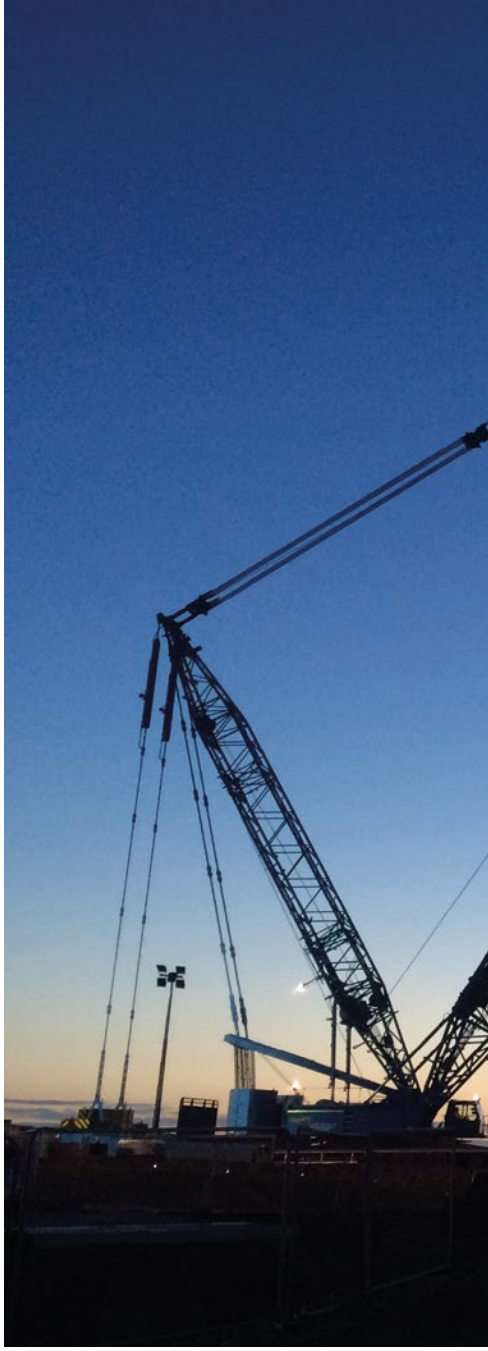
Thursday 15 September 2016
Steel Connection Design
This course is for designers and technicians wanting practical tuition in steel connection design.
Glasgow.

Tuersday 20 September 2016
Portal Frame Design - Part 2
The second presentation in this three-part series covers member verification to BS EN 1993-1-1. One hour webinar free to BCSA and SCI Members

Wednesday-Thursday 5-6 October 2016
Essential Steelwork Design -2 days
This course introduces the concepts and principles of steel building design to EC3.
Leeds.

Wednesday 9 November 2016
SCI Annual Event
3D Printing - the future of design and manufacture.
London.

The company supplied the roof beams for Leicester Tigers' new stand



From niche profiling to specialist fabricator

During the last 20 years Jamestown has developed into one of the UK and Ireland's leading steel specialists.

Since its beginnings more than 20 years ago, Jamestown has developed from a niche profiling company to an independent specialist fabricator. Having successfully weathered several economic cycles, Jamestown is now one of a select number of independent specialists offering design, fabrication and fully-automated welding of plain and cellular plate girders. In addition, Jamestown delivers the manufacture of heavy components across many sectors including highways, rail, construction, marine, port and crane, and machine building.

"Collaboration, partnership and supply chain integration are fundamental to Jamestown's mission statement," says Jamestown Director Fiacre Creegan. "We hold our customers' requirements in very high regard and work closely with them to understand their needs and translate them into the finished product."

Jamestown joined BCSA several years ago, and committed in 2016 to becoming a Headline Sponsor of Steel for Life, demonstrating a keen interest in the promotion and development of the steel industry generally. "The sector operates in a very dynamic way with standards, quality levels and accreditations being critical to progress and success," says Mr Creegan. Jamestown recognised this early on and were early adopters of CE marking, achieving Execution Class 4, NHSS 20, and BS EN 3834 compliance. "This, combined with our strong approach to customer and client liaison, has helped Jamestown achieve a high level of involvement in both the Irish and UK markets," he adds.

Investment and Growth

Investment in people and processes, as well as consistent research and development, have been hallmarks of Jamestown's success over the past 10 years.

Investment has included installing the latest automated welding technology on all three of their automated plate girder lines, which demonstrates a clear commitment to growing the business. This, combined with a move in late 2015 to a large scale 200,000 sq feet production facility with 24, 15 and 20t overhead cranes on a 17 acre site, allows Jamestown to offer a wide-ranging service. "We can now trial erect or trial assemble bridge structures of up to 200t and 150m in length in our new facility" says Mr Creegan.

"It has been our specialist knowledge in welding, welding processes, weld testing and weld design that has helped us to get where we are today," says Niall Fortune, Jamestown's Responsible Welding Coordinator and Beam Production Manager. "We can now produce beams on single or double-shift across one, two or three machines. This gives clients the absolute confidence that Jamestown can comfortably meet the most demanding of project programmes, and can manufacture a quality assured product every time."

Sectors

Jamestown has succeeded in growing into many sectors including rail where it has produced individual components up to 100 tonnes in finished single pieces. "The Foxhall Lane Bridge was a particularly interesting project", said Mr Fortune. "It involved 40m-long, 2m-deep Western Region-type trapezoidal box girders made from weathering steel. Traditionally these box girders had to be painted internally, which is a high risk procedure. Weathering steel was chosen to eliminate this risk by

A new facility allows the company to trial assemble large structures

Jamestown delivers components for infrastructure projects

not requiring anyone to enter the box. The aesthetics of the bridge was maintained by painting the external areas offsite."

With critical elements such as cambers, bearing positions and cross beams with faying surfaces, a full trial erection ensured all elements fitted together before going to site.

In more 'typical' steel construction projects, Jamestown has supplied plate girders to projects like Farringdon Station, the Olympic Stadium, Reading Station redevelopment, Blackburn Bus Station, and St James' Square just to name a few. Mr Fortune says: "With our plate girders there is almost infinite flexibility in design which can help reduce costs and have a broader offering in cell positions and beam depths."

In the port and crane sector, Jamestown applies its high-end welding skills to the manufacture of lightweight crane legs and tapered box girders. "These items demand very specialist knowledge and experience, and are complex due to light gauge plate being used," says Aidan Clear, Jamestown's Production Manager. Correct fit-up is essential on these large items with such tight tolerances so a full trial fit is completed and checked with laser trackers.

Highways is a relatively new sector for Jamestown, having just completed under subcontract a significant bridge scheme involving three separate bridges on the A30 in Cornwall. Our client was delighted," says Richard Wigglesworth, Jamestown's Project Manager, "with bridge lifts fitting perfectly onto bearings and each lift being completed ahead of schedule."

The Future

Jamestown's commitment towards development and growth within the steel sector is clear. "There is plenty of room for those who offer a quality product, and have the resources and capability to go beyond the industry norm," says Mr Creggan. "We feel that although the market is mature, there is still a level of acceptance of existing practices which needs to be challenged.

"Clients can benefit from being given more options than they have perhaps been offered to date. We see that with a broadening of knowledge of design and manufacturing processes, clients can come to understand the options available to them."

Jamestown's move into the area of beam design has been coupled with a greater level of value engineering with client and contractor engineers and managers. 'This has been very successful so far and the benefits of this collaboration have been shown in terms of cost savings across projects in recent years.," says Mr Creggan. "This was evident in the steelwork for the new stand at Leicester Tigers where specific plate thicknesses and lengths were rolled to reduce the overall weight and eliminate waste."

Mr Creegan concludes: "We will continue to grow our presence in the UK market and look forward to growth across all the sectors in which we operate. No doubt there will be challenges, but with the mix of people and the experience within our organisation, Jamestown looks optimistically to the years ahead."

Jamestown Cladding & Profiling Ltd is a headline sponsor of Steel for Life.

Steel protection

Advances in modern surface treatment technology, including coatings and galvanizing, are optimising the protection of constructional steelwork and delivering the required durability at minimum cost. NSC takes a look at the protective systems sector.

Picture courtesy of Sherwin-Williams

Safeguarding structural steelwork with the correct protection will give a steel frame an improved performance as well as extend the life to first maintenance, thereby reducing ongoing maintenance costs

The key is to recognise the environment and what the structure is likely to be exposed to before deciding on the appropriate surface treatment.

If the steelwork is in a dry heated interior environment the risk of corrosion is insignificant and no protective coating is necessary.

However, a steel structure exposed to an aggressive environment needs to be protected with a high performance treatment and may need to be designed with maintenance in mind if extended life is required.

Coatings

Coatings for steel structures have developed considerably in recent times in order to comply with industrial environmental legislation, and in response to customers wanting improved durability and performance.

One of the challenges that the sector has faced is the requirement for high quality paints that dry and cure more rapidly in order to allow for a faster application procedure.

The development of new fast-drying paints delivers reduced drying times and shorter re-coating intervals, which enables steel to be handled and transported offsite at a greater turnaround rate.

The application of an intumescent coating protects a steel-framed building in a fire scenario. Intumescent coatings can be divided into two broad families: thin film and thick film.

Thin film intumescent coating systems are mainly used in buildings where the fire resistance requirements are 30, 60 and 90 minutes. In recent times, a number of products have been developed which can provide 120 minutes fire resistance. All of these coatings can be applied either on site or offsite and can be used to achieve attractive surface finishes.

Thick film intumescent coatings are usually epoxy-based and typically have a much higher dry film thickness than thin film alternatives. These materials are tough and durable and can generally be used to protect against hydrocarbon and cellulosic fires. Aesthetic finishes are possible and they can also be supplied in the form of preformed casings. Thick film intumescent coatings can also be applied offsite.

Galvanizing

The most commonly used method for applying a protective metal coating to constructional steelwork is hot-dip galvanizing.

This process involves immersing steel components in a bath of molten zinc (at about 450°C). The immersed surfaces are uniformly coated with zinc alloy and zinc layers that form a metallurgical bond with the substrate. The resulting coating is durable, tough, abrasion resistant, and provides cathodic (sacrificial) protection to any small damaged areas where the steel substrate is exposed.

Wedge Group Director of Sales & Marketing, David Fitzpatrick says: "Galvanizing provides long-term protection against corrosion and it is undertaken in a factory controlled environment rather than on site. The great thing about galvanized steel is that it can be transported straightaway without the need for drying time.

"The galvanizing sector is able to protect a range of steel products from nuts and bolts to 21m long beams. Longer items up to 29m can be achieved through double dipping if necessary for large construction projects. The nature of the coating also means that life to first maintenance can be in excess of 60 years depending on the environment it is being used in."

STEEL for life

Sponsors Protective Coatings

Gold: Wedge Group Galvanizing
Silver: Jack Tighe Ltd
Bronze: Hempel, Joseph Ash Galvanizing, Sherwin-Williams

Keeping stock

The structural steelwork sector is served by a national network of steel stockholders, one of the best organised distribution networks of any industrial product.

Steel stockholders play a vital part in the steel construction supply chain, ensuring the market is supplied with what it needs when it needs it.

From an extensive national network of depots, steel stockholders serve all parts of the UK and Ireland, and construction is their biggest client. As well as heavy structural sections they supply plate, tubular sections, light sections, cladding materials, flats and angles – all the elements needed to create a steel building.

Stockholders buy in large volumes and stock a wide range of steel so they can respond to the demands of customers for the hundreds of steel sections sizes and grades available.

One of the major benefits to steelwork contractors from the UK's large stockholding sector is their ability to 'break bulk'. This means steelwork contractors don't have to tie up working capital holding stocks of steel on the off chance that it may be demanded soon, or incur the cost of storing the steel itself. Stockholders can do this much more economically as, having a lot of steelwork contractors to supply, they are turning their stock over much more quickly.

Stockholders also provide a just-in-time service to steelwork contractors, many of whom want daily steel deliveries to increase their production efficiency and reduce the handling of steel in their own yard. These regular deliveries also assist when last minute changes are made to a design, or when there are changes to the steel products to be fabricated for that particular project.

They also ensure continuity of supply, whether a particular steel product is needed in large or small quantities, thereby eliminating any supply risk to customers.

Purchasing steel has changed radically in recent times and ParkerSteel says steelwork contractors are looking for online services.

"Our website allows customers to fully manage their account and orders online - in addition to placing orders for any of our product range, they have access to material certification and vehicle tracking of their orders," says ParkerSteel Commercial Director Dylan Alexander.

Stockholders' service does not end with the supply of steel, as the role of the stockholder in processing steel has grown substantially in recent years.

Some have invested in the latest sawing, shotblasting and priming equipment. Some stockholders are also expanding their services by investing in state-of-the-art equipment such as laser cutting machines.

"Stockholders benefit from being able to use their higher demand and rapid turnover to reduce the possession cost of steel. And because they are processing large volumes of steel, the capital cost of the CNC processing equipment used to supply accurately manufactured materials becomes more financially effective," explains AJN Steelstock Sales Executive Phil Cleaver.

Stockholders also need to be reactive and be ready for changes in demand or trends that may affect the sector.

National Tube Stockholders Commercial Director Jonathan Sochart agrees and says," There is a general trend from structural designers and engineers to move towards stronger lighter steels as they push the design envelope and current steel capabilities. In due course this may change the mix of products and grades required by the sector."

"Over 65% of the steel supplied in the UK is via the stockholder route… far higher than any other major EU country. As the UK's GDP at 2.2% is the highest within the G7, the growth opportunities within the UK remain very strong. Our developments into the Scottish and Irish markets in recent years have opened opportunities for us and we are constantly looking to expand either organically or via acquisition," Barrett Steel Group Financial Director Andy Warcup.

STEEL for life

Sponsors Steel Stockholders

Headline: Barrett Steel Limited
Gold: AJN Steelstock Ltd, National Tube Stockholders and Cleveland Steel & Tubes, ParkerSteel

Picture courtesy of Barrett Steel Group

Retail arrives at Sussex station

The construction of a Waitrose superstore and accompanying car park represents the largest element of the £35M Haywards Heath station upgrade.

Sitting atop the store are the saw-toothed roofs of the back-of-house facilities

FACT FILE
Haywards Heath Station Quarter Waitrose store
Main client: Solum Regeneration
Architect: Pozzoni Architecture
Main contractor: BAM Construction
Structural engineer: BAM Design
Steelwork contractor: Elland Steel Structures
Steel tonnage: 475t

Big changes are afoot in and around Haywards Heath railway station, as the East Sussex town seeks to regenerate its transportation hub.

Solum Regeneration, a partnership between Network Rail and Kier, working closely with Southern Rail, and Waitrose, have all combined on this £35M scheme.

Ultimately, the overall Station Quarter development will deliver an integrated transport hub; a four-level multi-storey car park (see box); an enclosed footbridge linking the car park and the station platforms; an enhanced public realm around the station, and a Waitrose superstore with its own dedicated parking.

BAM Construction is the main contractor for the steel-framed Waitrose part of the development and it started on site during April last year. The plot of land adjacent to Haywards Heath station was formerly occupied by a bus transfer station and a large surface car park for rail passengers.

"We had to liaise with the team constructing the multi-storey car park, because until it was open we had to keep a portion of the existing car park open and consequently couldn't take possession of the entire site," explains BAM Construction Project Manager Alan Newland.

BAM started by levelling part of the sloping site in preparation for the steel frame of the Waitrose store and car park to be erected. This involved the removal of some 19,000m^3 of overburden, which required a total of 2,500 truck movements.

The steel-framed Waitrose store consists of a lower level 2,300m^2 store and café that is dug into the previous slope and is partially subterranean along one elevation. An upper level accommodates back-of-house and storage facilities, and car parking for 60 vehicles.

Taking in the sloping topography, the upper level car parking area of the steel frame then joins a ground level surface parking lot.

The upper car park deck comprises a 165mm deep composite slab, primarily supported on a series of cellular beams. These beams are up to a maximum depth of 761mm, and are supported by a series of 914mm deep UB sections.

The lower level of the steel structure accommodates the Waitrose sales area and column intrusions had to be kept to a minimum in this area, according to BAM Design structural engineering team member Kangaichelian Sirijeyanantham.

"As well as the required long span qualities a steel frame gave us, the other reasons the design team went with this form of framing solution is that it is more economical and faster."

Other advantages the project team has gained from the design are that cellular beams throughout the steel frame have allowed building services to be accommodated within the beam depth, while at ground floor, in addition to carrying the vertical loads, the floor system also acts as a diaphragm to transfer lateral forces from the perimeter retaining walls.

Also sitting on the upper level and atop one of the main store elevations is a back-of-house area that includes a loading bay, storage facilities and offices.

The superstructure of this area comprises a two-storey steel frame topped by a saw tooth profile roof formed by a series of high-level trusses.

Also on the upper level the steel frame includes a lobby structure housing a travellator and passenger lifts that connects the car park with the sales floor below.

This small structure is stabilised by a moment frame together with the concrete core walls that form the adjacent lift shafts. Meanwhile the majority of the steel structure gets its stability from vertical and horizontal cross bracings.

According to steelwork contractor Elland Steel Structures, steel erection was a challenge because of the site constraints.

Using a single 70t-capacity mobile crane for its entire steel programme, that also included the installation of metal decking,

Elland Steel Structures erected the majority of the frame from outside of the structure's footprint.

"As we had to erect the sales area first, which is below ground level in parts, it was easier to stand the crane just outside of the footprint," explains Elland Steel Structures Commercial Director Jeremy Shorrocks.

"The only exception to this was the initial part of the erection process which involved installing the steelwork furthest from our preferred crane position."

For this part of the work, a temporary ramp was installed to allow the crane access to the sales area.

Elland completed the steel programme in May and the Waitrose store is due to be completed in October.

Multi-storey car park

Built by Bourne Parking [part of Bourne Construction Engineering] acting as both main contractor and steelwork contractor, the station's new multi-storey car park opened earlier this year. It is operated by Indigo Park Solutions on behalf of Southern Railway.

The structure acted as a catalyst for the Waitrose part of the development as once it was open the adjoining surface car park could be closed and the construction of the superstore begin.

The car park has four levels, consisting of a ground level and three suspended floors accommodating 1,056 car spaces.

Built around a 16m x 7.2m grid, the structure required 960t of steelwork. The braced frame was erected around three concrete cores and it supports pre-cast concrete flooring planks.

"Logistics was the biggest challenge on this project as we had to work adjacent to an existing car park and busy railway lines," says Bourne Parking Project Manager Kevin Clarke.

"We had to ensure our cranes didn't overslew the adjacent car park and railway and we had to erect the steel frame in a sequence which ensured, in the event of an accident, it couldn't fall on to the rail tracks.

This was done by erecting the sections of the car park furthest from the rail lines first, and once we had a stable structure the last bays along the Network Rail boundary were bolted onto this braced frame."

The Waitrose store is the largest part of the station upgrade scheme

Bridging the A1 gap

Eight steel composite bridges are being installed as part of the A1 upgrade in North Yorkshire.

FACT FILE
Bridges on A1 Leeming to Barton upgrade
Main client: Highways England
Main contractor: Carillion/Morgan Sindall JV
Structural engineer: Aecom
Steelwork contractor: Cleveland Bridge
Steel tonnage: 1,431t

As the only section of non-motorway on the strategic M1/A1(M) route between London and Newcastle the busy 12-mile section between Leeming and Barton in North Yorkshire is being upgraded from a dual carriageway into a three-lane motorway.

Once completed the scheme will unlock growth and boost the economy by creating a continuous motorway-standard route that will also improve journey times and increase safety.

This stretch of road carries approximately 69,000 vehicles every day and, according to Highways England, it is not entirely fit for purpose for today's traffic volume.

It suffers from poor alignment with numerous side roads and minor lanes entering and exiting, which has contributed to the accident severity ratio being significantly higher than for other similar roads.

A major part of this project is the construction of new bridges that either span the widened road or carry the new highway over streets and rivers.

Eight of these new bridges are steel composite structures and they are being fabricated, supplied and erected by Cleveland Bridge for the Carillion/Morgan Sindall JV.

The project's structural engineer is Aecom, and its Principal Engineer Peter Robinson explains the choice of materials for the bridge's design.

"We had to look at a number of criteria when choosing which materials to use for each bridge. Steel was used for the longer span structures because it is lighter than other materials and so more cost-effective, while another important factor was installation and getting materials to site. Steel beams and components are generally fabricated offsite and then quickly assembled and erected on site, which causes minimal disruption."

All of the steel bridges were modelled in 3D using the Autodesk Revit programme. This was then inserted into a BIM model, which proved to be critical for providing toolbox talks on site and to help the various trades carry out clash detections.

The longest steel bridge on the scheme at 86.5m and the one with the biggest steel tonnage at 398t is the Kneeton Lane Overbridge, which is located just north of Scotch Corner.

This structure consists of two spans supported on reinforced earth abutments that have been squared up to allow for a semi-integral form of construction.

The central pier however is skewed to follow the alignment of the A1(M) below; this results in asymmetrical spans.

"The bridge was checked for lateral torsional buckling in the temporary condition using the analysis package Lusas. Because of the skewed pier, significant twisting occurred in the model which led

Left and below: Kneeton Lane Overbridge being installed

Kneeton Lane Overbridge

to the use of plan bracing to provide the required stability," says Mr Robinson.

To install this structure Cleveland Bridge delivered six braced pairs of girders, each measuring 2.5m deep, to site and assembled them into units, each measuring 15m wide by 23.75m long. This assembly work was carried out using 500t-capacity mobile cranes and done on the temporarily closed northbound carriageway of the A1.

"We then painted the bolted connections and the main contractor was given access to fit the permanent formwork to the assembled girders. This reduced the need for additional road closures to install the formwork when the girders were in position," says Cleveland Bridge Construction Manager Ian Brierley.

The 500t crane was then replaced with a 1,000t-capacity crane, which lifted the four sections into place during two consecutive overnight road closures, with the heaviest lift weighing 170t.

A similar procedure for a near identical bridge was carried out at the southern end of the scheme near the village of Leeming. Known as the Low Street Overbridge, this structure over the A1 is slightly lighter requiring 378t of structural steelwork.

A slightly different approach was needed for the Agricola Underbridge that carries the A1 across the River Swale, just south of Brompton.

Agricola is an existing three-span steel composite semi-integral structure, which has been widened to accommodate the new three-lane highway plus its hard shoulder.

After the abutments and centrally-positioned pier had been extended on either side, the southbound and northbound elements of the bridge each required 87t of steel that equated to four new 1m-deep girders each with an overall length of 57m.

Each side of the Agricola Underbridge was installed in a single visit using a 200t-capacity mobile crane positioned on the existing and temporarily closed A1 bridge over the River Swale.

As *New Steel Construction* went to press (early July) Cleveland Bridge still had one more bridge to install. This is Fort Overbridge, a two span continuous steel composite bridge supported on conventional abutments with inspection galleries.

The structure replaces the existing Fort Overbridge, which had insufficient spans for the widened road. As the structure is near the Roman site of Cataractonium some archaeological works were undertaken prior to the work starting on the new bridge.

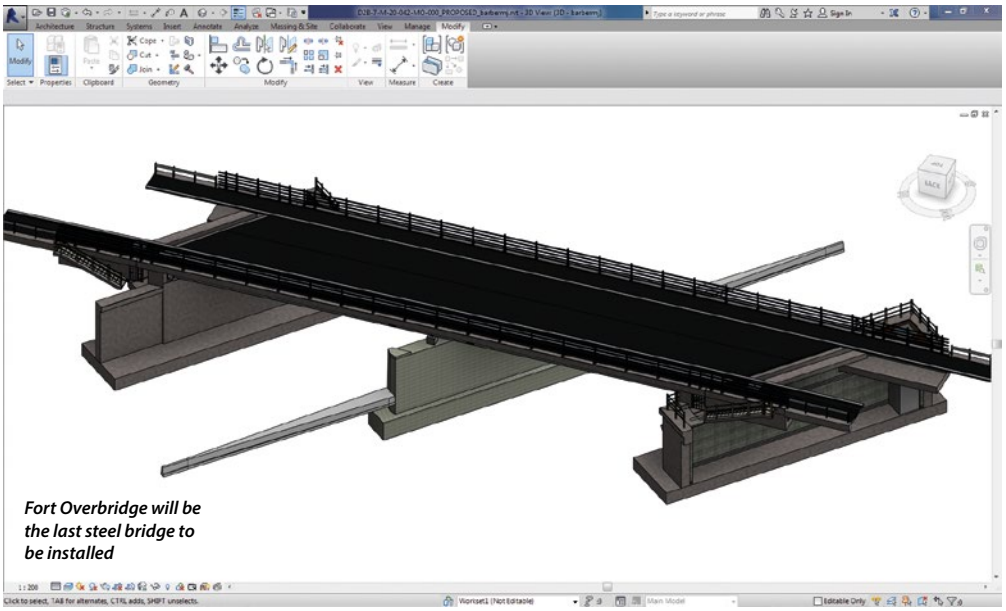
According to Aecom the requirement to include a number of large services proved to be a challenge during the design of this bridge.

"Working closely with Cleveland Bridge and the various utility companies a solution was found to locate the services within steel ducts beneath the deck slab supported on the cross bracing. The bridge steelwork will be installed with the ducts already in place reducing the number of lifting operations on site," explains Mr Robinson.

Summing up the steel bridgeworks, Mr Brierley says: "All of our bridge beam installations have been required to take place during a temporary closure of the A1 or its service roads. This required careful planning of the works to allow the programme to be achieved and avoid delaying the reopening of the A1 and the associated disruption to national traffic."

The other four bridges are Brompton North Underbridge, Brompton South Underbridge, Sowber Hill Accommodation Overbridge and Kneeton Hall Accommodation Overbridge (see map).

Agricola Underbridge is widened with new steel girders



Fort Overbridge will be the last steel bridge to be installed

The winds of change

One of the large roof trusses is lifted into place

Part of the wider Green Port Hull vision, Siemens is building a large steel-framed blade manufacturing facility on the River Humber. Martin Cooper reports.

FACT FILE
Siemens wind turbine blade manufacturing facility, Hull
Main client: Siemens
Architect: Pringle Brandon Perkins + Will
Main contractor: VolkerFitzpatrick
Structural engineer: Waterman Structures
Steelwork contractor: Caunton Engineering
Steel tonnage: 2,500t

Forming the centrepiece of the Green Port Hull vision, which seeks to establish the city and the East Riding of Yorkshire as a world-class centre for renewable energy, the Siemens wind turbine blade manufacturing facility will create 1,000 jobs and is said to be the biggest influence of the local economy for generations.

Located at Hull's Alexandra Dock, the 40,000m² facility will mould 75m-long wind turbine blades, [the world's longest blades], paint them, drill them and then store them on a specially prepared dockside lot ready to be delivered offshore for final assembly.

All of the parts that make a wind turbine, including nacelles - the fuselage that connects to the blades and contains the generating components - along with the masts will also be stored on the site.

This will allow Siemens to dispatch all of the constituent parts that make up a wind turbine from one location, once blade production begins later this year.

The blade manufacturing process will be housed in a large steel-framed multi-span braced structure measuring approximately 300m long × 116m wide.

In order to get planning permission the site had been previously raised 200mm above the flood plain with a 1m-deep stone plateau as part of the preliminary works.

VolkerFitzpatrick, which is managing the build of the facility, started on site last August, just as the installation of 4,000 driven piles was coming to an end.

"The building is essentially divided into two main parts - a four span manufacturing and painting area, and a three span finishing area," says VolkerFitzpatrick Operations Manager Ian Simmons.

The former area has two manufacturing/moulding lines contained within 36m-wide spans. In between there is a 22m-wide painting span while, attached along the eastern side of the building, another 22m-wide span will accommodate storage and warehousing.

All of these spans are formed by a series of twin braced lattice columns supporting a series of roof trusses that measure up to 2.1m deep.

All of these spans will accommodate cranes with the two widest spans featuring 40t-capacity overhead cranes running on crane rails that are connected to the main lattice columns. All of the spans have smaller console cranes that run on separate rails that are also connected to the steel main frame.

"As with many industrial buildings this is a bespoke steel frame designed and tailored around the manufacturing process and the way the cranes will be operated," explains Waterman Structures Regional Director Mark Billington.

"Before designing the steel frame we had to gather information on whether the cranes would operate separately or in tandem in order to determine the loadings and fatigue on the steelwork."

Twin lattice braced columns were

Clear open spans of up to 36m are vital for the manufacturing process

Crane beams are supported on twin lattice columns

chosen for their stiffness and ability to carry heavy loadings, the inner part of the twin columns, where necessary, supports the high-level crane rails, while an outer part extends up to the roof, connecting with the roof trusses.

Because of the need to incorporate cranes, the northern or manufacturing part of the facility has a height to eaves of 15m. The southern part of building, or finishing zone, has no overhead cranes and consequently the roof level for this zone drops down to 10m.

This part of the building has the same width as the northern zone but is formed with just three spans, two at 47m and a third measuring 22m wide. As this area does not have to support any cranes, the truss supporting columns are not twin lattice sections but 610 UBs.

"The longest trusses were brought to site in three sections, while the 22m-long trusses were fabricated in two pieces," explains Caunton Engineering Contract Manager Michael Firth. "Once on site they were bolted and assembled into complete trusses and then lifted into place by a single mobile crane."

▶20

Alexandra Dock – the whole story

Associated British Ports, which owns the site, has appointed Graham Lagan Construction Group JV to develop the overall Alexandra Dock for the Siemens facilities.

The blade manufacturing facility ❶ is being built under a separate contract and so all around this site other important works are on going. The JV is responsible for the partial reclamation and infill of the existing dock, the construction of three new berths and a roll-on roll-off ramp.

On the opposite side of the dock to the blade facility, a separate steel-framed structure for the servicing and refurbishment of blades is being erected ❷.

A lattice column being fabricated at Caunton's facility

The four-span manufacturing area was the first part to be erected

▶19

Caunton Engineering had up to five mobile cranes working on its steel programme, with multiple spans of the building being erected at any one time.

The facility also features an attached two-storey office block that is structurally independent and gains its stability not from bracing but from a series of moment frames.

It features a steel frame supporting precast planks on the beams' bottom flange - a construction method chosen as the client wanted exposed soffits.

The first wind farm to receive turbines from the Hull facility later this year is expected to be Dudgeon, which is located off the Norfolk coast.

The lateral stability of large industrial buildings

Richard Henderson discusses the lateral stability of large industrial buildings such as the Siemens Turbine Blade Factory

The (northern) manufacturing area of the Siemens factory has four bays with two 40t electric overhead travelling (EOT) cranes travelling on runway beams supported by double lattice columns. This arrangement conveniently allows the runway beam vertical reaction to be transferred to the ground directly through one leg of the double column. The estuary-side site requires piled foundations and this allows overall building stability in the direction perpendicular to the runway beams to be provided by fixed base columns. The double lattice columns are laterally stiff by virtue of acting as the tension and compression booms of a vertical cantilever truss. The push-pull in the columns is transferred via pile caps into the piles. The column leg not supporting the crane runway beams continues upward to support the roof trusses which are simply supported between columns. In the orthogonal direction, K bracing is provided to stabilize the building.

The lower (southern) finishing area of the building is separated from the manufacturing area by a movement joint. No EOT cranes are required so double columns are not provided. UB columns are adopted and lateral stability is provided by vertical bracing in the three perimeter walls. Bracing is also provided where the finishing area abuts the manufacturing area. The roof is braced in plane so the building forms a braced box.

For a structure on a site where piles are not necessary, fixed-foot columns are more difficult to achieve because of the flexibility of pad foundations. In these circumstances it may be appropriate to design the columns to have pinned feet and frame into the roof trusses such that the columns and roof trusses form portal frames with a stiff truss rafter. The column stiffness therefore controls the sway deflection. A space free from bracing can be achieved if there is a regular array of columns in each direction and the lateral stiffness is similar in each of the orthogonal directions.

A conventional portal frame structure is similarly designed as continuous in the plane of the frame and achieves stability through the moment connections between columns and rafters. The portal frame rafters are more flexible than the truss rafters and therefore contribute to the flexibility of the frame. In the orthogonal direction, the portal frames are often braced or portalised bays can be introduced if internal bracing interferes with the building function.

These examples show how the choice of stability system of the building is driven by the type of foundation, the use of the enclosed space and the opportunity for the use of bracing.

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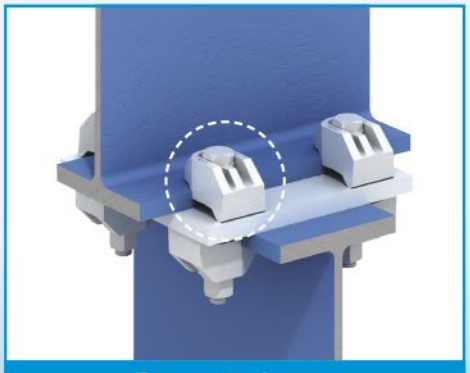
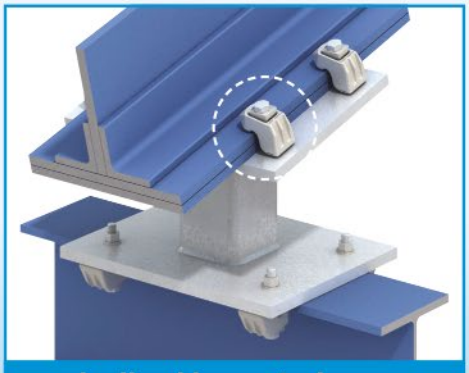


Beam-to-beam
(tensile loading)

Beam-to-column
(slip resistance)



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(combined loading)

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Kingdom of steel

One of the final structures within the 11-acre Paddington Central mixed-use campus is currently under construction with steelwork playing a crucial role. Martin Cooper reports.

FACT FILE
4 Kingdom Street, Paddington, London
Main Client: British Land
Architect: Allies & Morrison
Main contractor: Wates Construction
Structural engineer: Ramboll
Steelwork contractor: William Hare
Steel tonnage: 2,400t

Meeting room pods are attached to each floor

Paddington Central campus is a mixed-use development situated alongside the Grand Union Canal and adjacent to Paddington Station. Part of a wider redevelopment of a once industrial area of central London, the campus benefits from both good transportation connections, which will be further boosted once Crossrail opens in 2018, and a tranquil canal-side city centre setting.

4 Kingdom Street is a 13,500m² nine-storey steel-framed office building being built on the second to last vacant plot within the campus.

Following its acquisition of the Paddington Central campus in July 2013, British Land appointed architects Allies and Morrison to review and update the design of 4 Kingdom Street, which had originally been granted planning consent in 2010.

In 2014, Westminster City Council approved changes to the scheme, which retained the consented bulk and massing, while providing increased flexibility to the office floorplates along with improved amenities for occupiers.

The re-designed building now has typical floorplates of 1,405m².

The core of the building has been relocated to maximise space and efficiency, creating more flexible floorplates and greater optionality for occupiers. The building also includes a communal roof terrace, which provides outside space for breakout, entertaining and sporting facilities.

With the redesign taken on board, main contractor Wates Construction started on site in June last year.

The building sits atop a steel-framed podium deck that dates back to 2004 [see box]. Utilising this existing structure meant preliminary works were minimal and the superstructure began to be erected early in the construction programme.

Using the same 12m × 12m grid pattern as the podium has created clear column-free internal spans. Fabsec cellular beams, up to 600mm deep, have been used throughout the building to accommodate services.

Structural stability for the building's steel frame is provided by the large slip-formed core, along with the diaphragm action of the composite flooring, which consists of metal decking and a concrete topping.

"The building features quite a lot of exposed steelwork in the offices and public spaces, which is an architectural nod towards the nearby historical Brunel structures," says Allies & Morrison Associate Director Hayden French.

Each floor has a large corner terrace and a glass pod designed as a creative meeting space. Both of these standout features incorporate exposed steel and detailing, with the corner terraces also presenting the team with an installation challenge.

A service road separates the building from the busy Westway

Exposed steelwork will be a nod to the area's historic buildings

The project benefits from Paddington's extensive transport network

As they sit outside of the building's cladding the corner terraces, which measure 12m × 4.5m, will be installed after the main frame is completed. They will be brought to site in two completed sections that will be welded together on the ground before being lifted into place.

The steel-framed pods are a separate nine-storey structure that is bolted to the western elevation. Initially designed as a fire escape, it was redesigned as a flexible space, offering each floor a meeting room or separate breakout office space.

"Their flexibility is further enhanced by the fact that a connecting staircase can be added between pods if a client takes two floors, thereby gaining a private internal stair," adds Mr French.

The pod structure is formed by a series of ring beams connecting to circular columns creating the complex steel space.

Working on behalf of main contractor Wates Construction, steelwork contractor William Hare completed its entire steel erection package, that also included the installation of metal decking, at the end of May.

"We erected the majority of the steelwork using the on site tower crane," says William Hare Senior Site Supervisor Kris Garnett. "However there are a couple of large trusses on the podium deck level that required us to bring a large 360t-capacity mobile crane to site,"

"The area around the site is very constrained by the nearby railway lines and the elevated section of the A4. We had to position the mobile crane in the service road as it was the only place," adds Mr Garnett.

The trusses in question measure 15m long × 4m deep and both weigh 30t. They support a 4.5m-deep cantilever along the building's northern elevation that partially spans a service road. As columns in this area do not align, the trusses bring the loads back into the main steel frame.

Summing up the project, Wates Construction Project Manager Duane McCreadie says: "Logistics are the main challenge on this job, especially with the proximity of the ongoing Crossrail works and the busy Paddington Station adjacent to our site."

"Having a steel designed building has enabled us to minimise deliveries and the amount of on site craneage,"

4 Kingdom Street is scheduled for completion by Spring 2017.

Podium deck

Designed in 2003 when the Paddington Central campus was established, the Kingdom Street podium deck was constructed through 2004 and completed the following year.

Supporting four buildings, including 4 Kingdom Street, the podium was designed to allow the Crossrail project to proceed under the podium while construction of the campus could continue simultaneously above.

The steel-framed podium is formed with steel columns spaced around a 12m grid pattern. This supports a 400mm deep slab, which has encased steel beams within its depth for extra strength.

"The grid pattern would allow train lines and sidings to pass within its spans," explains Ramboll Project Engineer Mark Drew. "Crossrail had originally planned to take muck away from their Paddington tunneling works via trains located beneath the podium. However, this work was then relocated and they've subsequently used the space beneath the podium for storage and temporary offices."

Because of its anticipated use, the podium has a sturdy design with plenty of impact resistance, such as concrete encased steel columns.

"It was designed to accommodate a building at 4 Kingdom Street's location with a notional height of nine storeys," sums up Mr Drew.

A lesson in offsite fabrication

The construction of a North Wales school has reaped the benefits of using offsite fabrication as weeks have been shaved off of the construction programme. Martin Cooper reports.

FACT FILE
Ysgol Glan Clwyd, St Asaph, Denbighshire
Main client: Denbighshire County Council
Architect: Bond Bryan Architects
Main contractor: Willmott Dixon
Structural engineer: Caulmert
Steelwork contractor: EvadX
Steel tonnage: 365t

One of the leading Welsh languages schools, Ysgol Glan Clwyd in St Asaph, North Wales, is undergoing a £14.5M development that will extend and improve the school site to accommodate an increase in demand for spaces, as well as providing new, modern facilities.

Denbighshire County Council and the Welsh Government, through the 21st Century Schools programme, are funding the project.

A new steel-framed teaching block, where a number of time-saving offsite manufacturing procedures have been utilised, is the cornerstone of the entire development.

Once this building is completed and open later this year, with students and staff fully decamped in it, phase two of the scheme will begin which includes refurbishing the existing school structures.

Construction work began in November last year with main contractor Willmott Dixon relocating approximately 20,000m^3 of earth in order level the former playing field site in readiness for the build programme.

"No material left site as it was all moved to another area of our plot to be used later in creating new playing pitches for the school," explains Willmott Dixon Construction Manager Brian Hanlon.

As with many construction projects time is of the essence and the choice of steel as the framing solution for this job has paid off.

Due to a few inclement weather stoppages and a period of downtime to relocate some great crested newts from the site, the project may well have found itself behind schedule. However, due to the steel package being completed in eight weeks, instead of the projected 13, the job is actually ahead.

"We pre-assembled all of the steel window frames at our facility, which then speeded up our programme on site considerably," says EvadX Managing Director Simon Adams.

"The cold rolled framing system was then fixed to the window frames on site onto previously shop-welded connections, which allowed the remaining cold rolled elements to be installed quickly."

Another time saving procedure EvadX used for their steel package was to supply and manufacture balustrades for the areas of the first and second floors that overlook the central atrium. Again these were fixed to beams on site with the beams having shop-welded connections to receive the balustrades that made installation quicker.

The balustrades have also doubled up as edge protection during the construction programme.

"Basically once an area of the main steel frame was erected we had another gang following on behind immediately installing the cold rolled elements," adds Mr Adams. "This meant the building was watertight much quicker."

Overall the new three-floor steel teaching block is a rectangular building measuring 60m x 40m that will be connected to the existing school via a first floor enclosed 11.5m-long link bridge.

"The structure is a steel-frame for a number of reasons," says Caulmert Director Paul Savile. "Contractor preference, the building lends itself to a steel design, while resource availability in North Wales favours steel."

Erected around a regular 7.4m grid pattern, the steel frame supports metal

The new three-storey teaching block

decking flooring and gains its stability from discreetly placed K-bracing, mostly positioned in partition walls.

The K-bracing consists of hollow sections that also support the building's cladding, thereby creating a reduced wall thickness and flush internal walls. This has also created a cost saving as the building has a reduced footprint that in turn equals less materials.

The building's internal make-up consists of classrooms arranged around the upper two floors, with each floor containing a circulation route that wraps around an internal atrium. A link bridge crosses the atrium at the top level, adding architecturally to the design and providing extra circulation.

"This link bridge, as well as the one spanning between the new build and the existing school, would have been too heavy if we hadn't gone for a steel design," adds Mr Savile.

The ground floor of the new building will also house some teaching space, along with a dinner/canteen area and a performance space with terraced seating occupying the open column-free space within the atrium.

Three roof lights positioned in the atrium's ceiling will allow plenty of natural daylight to flood into the ground floor and the inner parts of the school.

The new extension will be fully occupied at the beginning of the New Year and Willmott Dixon will then start refurbishing the existing school buildings and creating new playing fields, with the entire project due for completion in September 2017.

Student visit

Prior to the steel erection programme getting under way, students from Ysgol Glan Clwyd were given a unique first-hand experience when they visited the EvadX facility near Rhyl. They saw the production of the steel frame that has formed the structure of the school's brand new teaching accommodation.

A total of 21 pupils were able to see the fabrication process, from the detailed design and creation of the 3D model within Evadx's drawing office, to the CNC machinery in the factory, to the planning for the delivery and erection of the steel frame.

EvadX also gave pupils an insight and view of the industry, informing students of the apprenticeship opportunities in the industry and specifically in relation to EvadX.

The visit was extremely fruitful for one student. Morgan Davies was so impressed by what he saw he immediately applied to be taken on as an apprentice in the EvadX drawing office.

He starts his new career at EvadX later this year and the company has also enrolled him in a specialist training course at Stafford College.

EvadX Managing Director Simon Adams said: "It was great to have the pupils visit the EvadX factory. It has allowed them to appreciate the processes involved in the production of the steel frame."

Assistant Head teacher of Ysgol Glan Clwyd John Evans added: "It was a fantastic opportunity for our pupils to experience the production of the steel frame.

"It is important for pupils to have an understanding of what is involved and visits such as this puts into perspective the work they do in lessons."

Interestingly, Morgan will not be the first pupil from Ysgol Glan Clwyd to work at EvadX, the company's Quality Manager Robert Evans, previously went to the school.

A performance space with terraced seating will occupy part of the atrium

Exterior and interior visualisations of the new school

Responsibilities in steel frame design

The Structural Engineer of April 2016[1] posed a number of questions about the responsibilities of the structure designer and the connection designer – presuming the connections are to be designed by the steelwork contractor. David Brown of the SCI offers a detailed response.

In the April 2016 edition of *The Structural Engineer*, the 'Verulam' section presented a series of 6 scenarios presenting 'grey areas' where the correspondent suggested that responsibility was unclear. This article summarises the key elements of the question and provides a response.

1. Connections with high tying forces.

The scenario presented is that high tying forces demand 'strong' connections, which are likely to be stiffer than ideal – no longer nominally pinned - and transfer significant moments into the columns. The question related to the responsibility for verifying that the columns are still satisfactory.

The short answer is that the original structural designer must have an appreciation of the likely connection. The designer of the structure must anticipate that if the forces are so large that a nominally pinned connection is not physically possible, the design rules for "columns in simple construction" are no longer appropriate and the columns should be designed to accommodate the larger moments. The Green Books on Simple Connections[2,3], give tabulated resistances in shear and in tying for nominally pinned connections, so developing this necessary appreciation of the likely connection is not onerous.

In fact, a more realistic scenario is when a designer specifies axial tensions in the beams that are not tying forces – for some reason they are 'real' forces. Immediately, this is at variance with the concept of "simple" or nominally pinned connections, which are "shear only". Although nominally pinned connections can be verified for shear and, as an entirely separate check, a tying force, the Green Books do not contain any design rules for the combination of shear and axial forces.

Figure 1: One of the Eurocode 'Green Books'

In the original question, it was suggested that BS 5950 was "a little hazy" about requiring the connection flexibilities to be checked to ensure that they comply with the frame design concepts. Not so – clause 2.1.2.1 requires that "in each case the details of the joints should be such as to fulfil the assumptions made in the relevant design method" although it might be argued that BS 5950 does not specify how stiffness is to be calculated. It might also be said that BS 5950 puts the onus on the connection designer to meet the structure designer's assumptions, but this cannot be reasonable or sensible if those assumptions are unrealistic.

The Eurocodes place the responsibility squarely with the original designer. To paraphrase BS EN 1993-1-1 clause 5.1.2, the effects of the behaviour of the joints… must be taken into account when they are significant. In clause 5.5.1(2), "the calculation model and basic assumptions should reflect…. the anticipated type of behaviour of the cross sections, members, joints and bearings". This leads on to BS EN 1993-1-8, where rules are presented to calculate joint stiffness and compare this with limits on nominally pinned, semi-rigid and rigid behaviour. Rather than follow the calculation procedure, the Eurocode points out that a joint may be classified on the basis of "experience of previous satisfactory performance in similar cases", which seems a more attractive option if that experience exists. In the UK, designers have the advantage that the National Annex notes that connections designed in accordance with the principles in the Green Book on Simple Connections[3] (Figure 1) are nominally pinned, without justification by calculation of stiffness.

2. Flange to web welds in a plate girder.

This question has reached SCI on a number of occasions. The responsibility lies with the designer of the member, not the connection designer.

3. Joint resistances in hollow section trusses.

The situation described was when checked by the connection designer, the joints required expensive stiffening (although it was really strengthening that was required). When the truss designer has selected members, the joint resistance has also been set. Joints should be checked as part of the design process, as judicious choice of members and geometry can lead to nodes which do not need strengthening. As the question in Verulam noted, there is published guidance on this specific subject in *Steel Industry Guidance Note SN48*[4]. All these guidance notes are available on Steelbiz. Although checking joint resistance can appear daunting (see Figure 2 over the page showing part of BS EN 1993-1-8), software is available. Free software can be obtained from Tata Steel Tubes, in Corby – the contact number is listed on SN48.

4. Holding Down Bolts and foundation design.

The question focused on the design responsibility when holding down bolts are in tension. As the original contributor noted, this is covered in *Steel Industry Guidance Note SN51*[5]. Once the loads in the anchors have been calculated by the steelwork contractor, it is for the consulting engineer to design and specify the anchorage arrangement and the base reinforcement.

▶ Continued on p28

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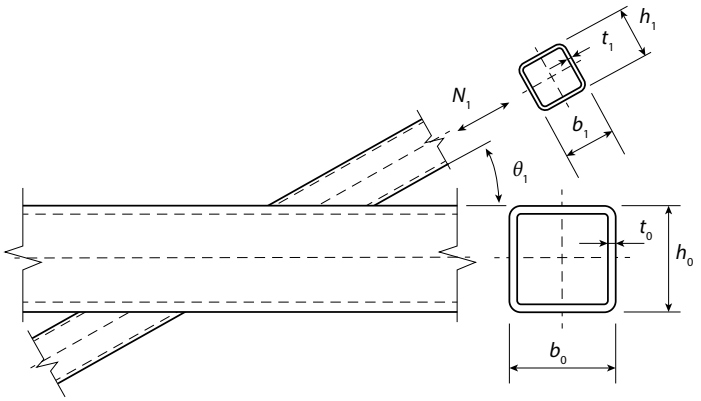
Type of joint	Design resistance
	Chord face failure $\beta \le 0{,}85$
	$N_{1,Rd} = \frac{k_n f_{y0} t_0^2}{(1-\beta)\sin\theta_1}\left(\frac{2\eta}{\sin\theta_1} + 4\sqrt{1-\beta}\right)/\gamma_{m5}$
	Chord side wall buckling [1] $\beta = 1.0$ [2]
	$N_{1,Rd} = \frac{k_n f_b t_0}{\sin\theta_1}\left(\frac{2h_1}{\sin\theta_1} + 10t_0\right)/\gamma_{m5}$
	Brace failure $\beta \ge 0{,}85$
	$N_{1,Rd} = f_{yi} t_1 (2h_1 - 4t_1 + 2b_{eff})/\gamma_{M5}$
	Punching shear $0{,}85 \le \beta \le (1-1/\gamma)$
	$N_{1,Rd} = \frac{f_{y0} t_0}{\sqrt{3}\sin\theta_1}\left(\frac{2h_1}{\sin\theta_1} + 2b_{e,p}\right)/\gamma_{m5}$

Figure 2: Typical joint checks from BS EN 1993-1-8

▶26 Managing significant base shear deserves careful thought, especially as the UK appears to have an almost unique approach to detailing this interface. Other countries tend to use anchors solidly cast in (so therefore cast with rather more precision than is typical in the UK) and have a mere smear of grout. In the UK, we use bolts cast in conical or cylindrical formers to allow for significant movement, and generally a significant thickness of grout, as shown in Figure 3 – which may be deeper in practice due to the variability of the concrete levels. The baseplate tends to have 6 mm oversize holes – so it is unlikely that all the bolts are in bearing on the plate. Friction may transfer shear, as may the bolts, but for significant base shear additional measures may be justified. This may be to consider the grouting operation as special, rather than mundane, and ensure the final result is as specified. More elaborate measures might involve locating

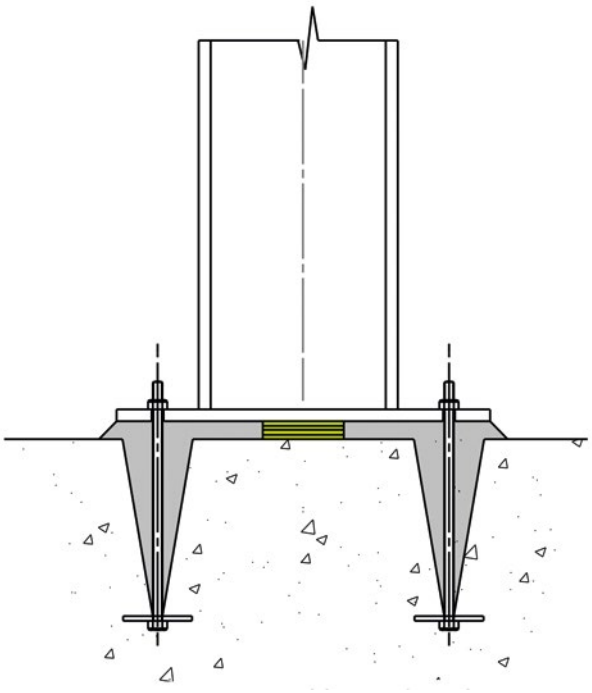


Figure 3: Typical base detail

the whole base in a pocket, or welding a shear nib on the underside (to be located in a pocket in the foundation).

5. Nominally pinned connections invalidate the original assumption of full fixity to the column.

In this situation, the designer had assumed an effective length of 0.7L for the column, yet the permitted connections are nominally pinned, with only shear loads provided. The scenario seems unlikely – the choice of 0.7L must have been based on full fixity at both ends – both ends held in position and restrained in direction according to Table 22 of BS 5950. But nominally pinned connections do not provide full restraint in direction, so a longer effective length would be the correct choice. In the scenario described, it seems the original designer has made an error in choosing the effective length. Practice probably varies amongst designers, but an effective length equal to the system length or an effective length factor of 0.85 are common choices when nominally pinned connections are anticipated.

6. High shear and bending.

The last situation presented in Verulam was a member with high shear – sufficiently high to reduce the moment capacity. In the (hopefully hypothetical) scenario, the necessary strengthening was considered to be part of the connection design. Clearly, the connection plays no part in the combination of member design forces and the responsibility for selecting a member with sufficient strength lies squarely with the structure designer.

A relatively common (real) situation is when a floor plan is prepared, possibly indicating certain shear loads for major beams, but also with a general note stating that if no force is given, the connection must be designed for a certain minimum shear. This note can easily become too general, with the connections for small beams supposed to be designed for a shear force that exceeds the resistance of the beam itself. In general, the critical check for a beam is likely to be the bending resistance or deflection, with the shear force no more than about 60% of the beam's shear resistance. High shears at the end of a beam are generally only produced if there is a concentrated load near the end of the beam.

You can lead a horse to water …

The proverb continues … but you can't make them drink. There are very many resources available covering the sorts of topics raised in Verulam, if only designers knew of them and read them. A good place to start is the Steel Industry Guidance Notes (SIGNS), which cover a wide variety of topics. Searching for "SIGNS" on Steelbiz will produce a complete list, which could form the background to a succinct library of "good practice" guidance. You can also go to *www.newsteelconstruction.com* and search the Advisory Desk articles.

1 Volume 94, Issue 4. The Institution of Structural Engineers, April 2016
2 Joints in steel construction: Simple Connections, SCI and BCSA, 2009
3 Joints in steel construction: Simple joints to Eurocode 3, SCI and BCSA, 2014
4 SN48 Design of welded joints using structural hollow sections. Available on Steelbiz
5 SN51 Design responsibility – simple connections. Available on Steelbiz

AD 399:
Design of partial penetration butt welds in accordance with BS EN 1993-1-8

Partial penetration butt welds are covered by Clause 4.7.2, which directs the designer to 'use the method for a deep penetration fillet weld" given in clause 4.5.2(3).

Clause 4.5.2(3) really concerns only the definition of the throat, and leaves the designer unsure of how the design resistance is to be calculated.

Partial penetration welds are considered to be less ductile than full penetration welds and therefore many design Standards require that they are to be treated in the same way as fillet welds. This is the principle behind the advice in clause 4.7.2. Unless rotation is suitably restrained, eccentricity must be taken into account when calculating the stress in the weld. Examples of details where eccentricity is introduced in partial penetration butt welds are shown in Figure 4.9 of BS EN 1993-1-8.

Eccentricity need not be considered if the weld is used as part of a weld group around the perimeter of a structural hollow section (clause 4.12(3)). It is reasonable to assume that there is no eccenticity if the welded element is part of a member which itself cannot rotate at the joint – for example if a partial penetration weld is used to connect the flange of a beam to an end plate.

In the numerical example which follows, it is assumed that rotation cannot take place.

Throat

The throat of a partial penetration butt weld is the distance from the root to the external face of the weld, as described in clause 4.5.2(1). Examples are shown in figure 1.

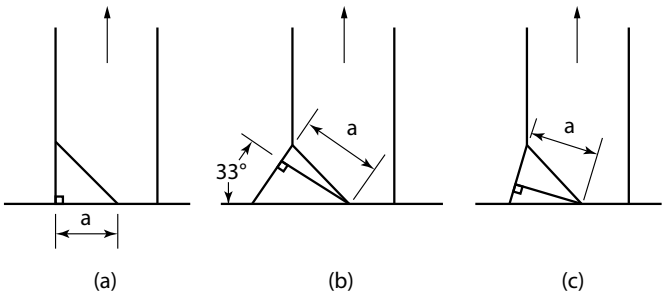


Figure 1: Throat (a) of partial penetration welds

Common practice is to either (a) assume the penetration (and hence the design throat) is less than the preparation, or (b) to conduct weld procedure trials to demonstrate what penetration can consistently be achieved. The first approach was encouraged by the 1990 version of BS 5950, where clause 6.6.6.2 specified a reduction of 3 mm for V and bevel welds. Clause 6.9.2 of the 2000 version of BS 5950 specifies no reduction but refers to the depth of penetration, which may be more or less than the preparation.

Design resistance

It is recommended the the directional method of clause 4.5.3.2(6) is used when calculating the resistance of a partial penetration butt weld. Assuming there is no longitudinal stress, the direct stress must be resolved into a perpendicular stress on the throat, $\sigma\perp$ and a shear stress on the throat, $\tau\perp$. Expression 4.1 of BS EN 1993-1-8 requires that the combination of perpendicular stresses are verified and also limits the perpendicular stress. With no longitudinal stress on the weld throat, the verifications become:

$$(\sigma\perp^2 + 3\tau\perp^2)^{0.5} \le \frac{f_u}{\beta_w \gamma_{M2}} \quad \text{and} \quad \sigma\perp \le \frac{0.9 f_u}{\gamma_{M2}}$$

In case (b) of figure 1, assuming the applied force is 2000 N/mm, and the throat is 9 mm, the components of force become:

$\sigma\perp = 2000\ \text{Cos}(33)/9 = 186\ \text{N/mm}^2$ and $\tau\perp = 2000\ \text{Sin}(33)/9 = 121\ \text{N/mm}^2$

The combined check of shear and perpendicular stress, with $\beta_w = 0.9$ for S355 (taken from Table 4.1) becomes:

$(186^2 + 3(121)^2)^{0.5} = 280\ \text{N/mm}^2$. The limit is $\dfrac{470}{0.9 \times 1.25} = 418\ \text{N/mm}^2$

The perpendicular stress $\sigma\perp$ is $186\ \text{N/mm}^2$; the limit is $\dfrac{0.9 \times 470}{1.25} = 338\ \text{N/mm}^2$

Of course, if a standard fillet weld is verified by the same process, using an angle to the throat of 45°, it can be demonstrated that the resistances are those quoted in the Blue Book[1] for a transverse weld.

Reference

1 Steel building design: Design data. In accordance with Eurocodes and UK National Annexes (P363). SCI, Reprinted 2015.

Contact: **Abdul Malik**
Tel: **01344636525**
Email: **advisory@steel-sci.com**

New and revised codes & standards

From BSI Updates June 2016

BRITISH STANDARDS

BS 5427:2016
Code of practice for the use of profiled sheet for roof and wall cladding on buildings
Supersedes BS 5427-1:1996

BS EN PUBLICATIONS

BS EN ISO 12707:2016
Non-destructive testing. Magnetic particle testing. Vocabulary
Supersedes BS EN 1330-7:2005

BRITISH STANDARDS WITHDRAWN

BS 5427-1:1996
Code of practice for the use of profiled sheet for roof and wall cladding on buildings. Design
Superseded by BS 5427:2016

BS EN 1330-7:2005
Non-destructive testing. Terminology. Terms used in magnetic particle testing
Superseded by BS EN ISO 12707:2016

NEW WORK STARTED

EN ISO 14713-2
Zinc coatings. Guidelines and recommendations for the protection against corrosion of iron and steel in structures. Hot dip galvanizing
Will supersede BS EN ISO 14713-2:2009

ISO 5173
Destructive tests on welds in metallic materials. Bend tests
Will supersede BS EN ISO 5173:2010+A1:2011

ISO 11666
Non-destructive testing of welds. Ultrasonic testing. Acceptance levels
Will supersede BS EN ISO 11666:2010

BUILDINGWITHSTEEL Reprinted from Volume 4 No. 3 August 1966

Chilbolton radio-telescope aerial

The 82-ft diameter steerable aerial at Chilbolton, Hampshire, for the radio Research Station of the Science Research Council has now reached the final stages of erection and comissioning.

It is to be used for investigations into the propagation of radio waves, radiation from radio stars, for the tracking of artifical satellites and space probes, and will transmit and receive signals in the frequency range 100 to 10,000 M/cs. It incorporates the latest advances in constructional methods to obtain a stable parabolic surface accurate to within about 0.1 in. A digital control computer will provide the tracking information for the electrical power servo-mechanisms controlling the azimuth and elevation motions of the aerial. This fully steerable aerial is the only large aerial in the United Kingdom specifically designed for satellite tracking apart from the GPO satellite communications terminal station at Goonhilly.

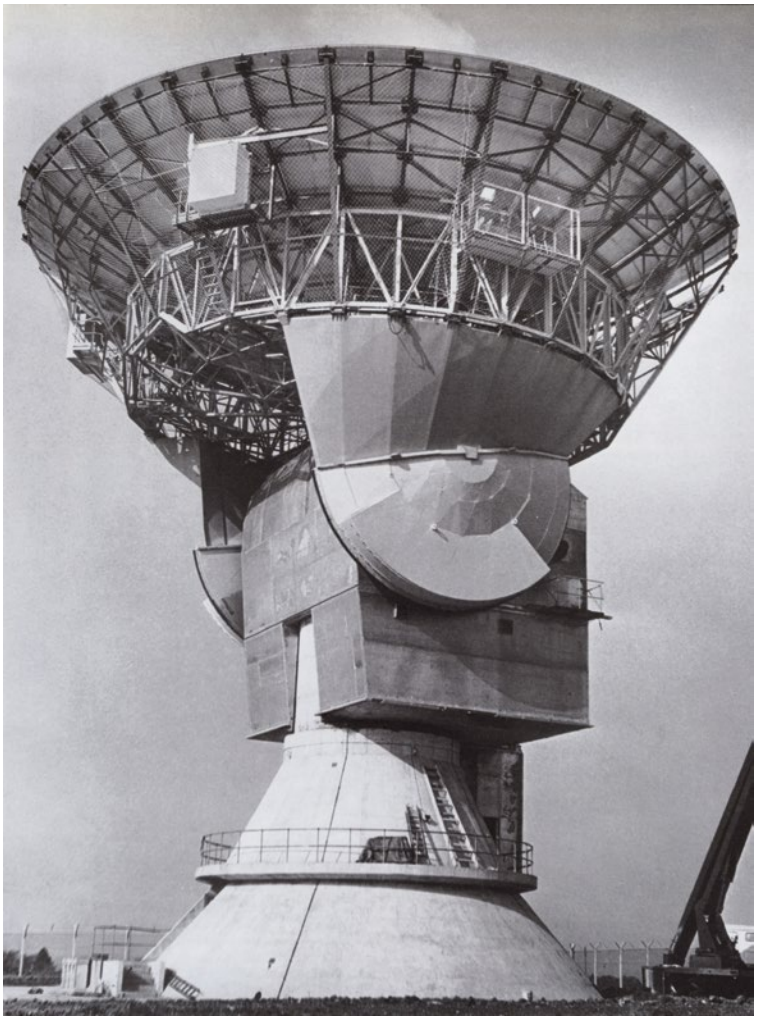
The complete aerial incorporates a steelwork structure weighing 52 tons and is designed to withstand winds of up to 100 mph and for a life of 20 years. It is supported on a 51-ft high concrete tower with a 60-ft diameter base.

The reflector surface comprises aluminium honeycomb sandwich 'petals' fitted to a steelwork support structure by expansion joints. This circular structure is an open framework constructed from all-welded sub-frames bolted and dowelled together on site. It is 82 ft in diameter and 5 ft deep at the centre and designed to follow the contour of the reflector and provide the surface with the required lateral and torsional stability.

The primary structural member is a ring girder measuring 56 ft in diameter by 10 ft deep, supported over two quarter arcs: for ease of transportation and erection it was constructed and delivered to site in four all-welded quarter sections. Sixteen frame girders converge from the ring girder to a central hub, and radiate outward to the periphery. A secondary 73-ft diameter ring girder gives additional support to the outer radial frames and, in conjunction with the 16 intermediate outer radial rakers, provides adequate support for the outer area of the reflecting surface. The frames and rakers are braced together on the front and rear faces, the circumferential ties forming continuous hoops. The centre hub houses electronic equipment and is constructed of steel plate suitably gusseted.

A trial erection was followed by load testing of the structure to check the stiffness and natural frequency. Site erection of the 56-ft ring girder unit was carried out at ground level and the sub-assembly then lifted to its final position, the structure at this stage weighing 37½ tons.

All the civil, mechanical and electical engineering work is being carried out under the co-ordination of the Ministry of Public Buildings and Works. The main contractor was responsible for the design of the aerial.



Top Right: Hoisting the 37½-ton ring girder unit into position.
Right: The radio-telescope virtually completed.

Steelwork contractors for buildings

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

Gillian Mitchell MBE, Deputy Director General, BCSA, 4 Whitehall Court, London SW1A 2ES
Tel: 020 7747 8121 Email: *gillian.mitchell@steelconstruction.org*

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

- **C** Heavy industrial platework for plant structures, bunkers, hoppers, silos etc
- **D** High rise buildings (offices etc over 15 storeys)
- **E** Large span portals (over 30m)
- **F** Medium/small span portals (up to 30m) and low rise buildings (up to 4 storeys)
- **G** Medium rise buildings (from 5 to 15 storeys)
- **H** Large span trusswork (over 20m)
- **J** Tubular steelwork where tubular construction forms a major part of the structure
- **K** Towers and masts
- **L** Architectural steelwork for staircases, balconies, canopies etc
- **M** Frames for machinery, supports for plant and conveyors
- **N** Large grandstands and stadia (over 5000 persons)
- **Q** Specialist fabrication services (eg bending, cellular/castellated beams, plate girders)
- **R** Refurbishment
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FPC Factory Production Control certification to BS EN 1090-1
1 – Execution Class 1 **2** – Execution Class 2
3 – Execution Class 3 **4** – Execution Class 4

BIM BIM Level 2 assessed
QM Quality management certification to ISO 9001
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.

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	BIM	SCM	Guide Contract Value (1)
A & J Stead Ltd	01653 693742			●	●					●	●			●	●		2			Up to £200,000
A C Bacon Engineering Ltd	01953 850611			●	●	●	●				●			●			2			Up to £3,000,000
A&J Fabtech Ltd	01924 439614	●					●		●	●	●		●	●		✔	3			Up to £400,000
Access Design & Engineering	01642 245151					●				●	●			●	●	✔	2			Up to £4,000,000
Adey Steel Ltd	01509 556677				●	●	●	●		●	●			●	●	✔	3		●	Up to £2,000,000
Adstone Construction Ltd	01905 794561			●	●	●	●									✔	2		●	Up to £3,000,000
Advanced Fabrications Poyle Ltd	01753 653617				●	●	●	●		●	●			●	●	✔	2			Up to £800,000
AIC Steel Ltd	01633 528400	●			●	●		●			●	●	●			✔	4			Up to £800,000*
AJ Engineering & Construction Services Ltd	01309 671919			●	●					●	●			●	●	✔	4			Up to £2,000,000
AKD Contracts Ltd	01322 312203				●					●	●			●	●		2			Up to £100,000
Angle Ring Company Ltd	0121 557 7241												●			✔	4			Up to £1,400,000
Apex Steel Structures Ltd	01268 660828			●	●	●	●			●	●			●			2			Up to £1,400,000
Arminhall Engineering Ltd	01799 524510	●			●	●		●		●	●			●	●	✔	2			Up to £400,000
Arromax Structures Ltd	01623 747466	●		●	●	●	●	●		●	●	●		●	●		2			Up to £800,000
ASA Steel Structures Ltd	01782 566366			●	●	●	●			●	●			●	●	✔	4			Up to £800,000
ASME Engineering Ltd	020 8966 7150				●	●				●	●			●	●	✔	3		●	Up to £2,000,000
Atlasco Constructional Engineers Ltd	01782 564711			●	●	●	●				●			●	●	✔	2			Up to £1,400,000
Austin-Divall Fabrications Ltd	01903 721950			●	●		●	●		●	●			●	●	✔	2			Up to £800,000
B D Structures Ltd	01942 817770			●	●	●	●				●	●		●		✔	2			Up to £800,000
Ballykine Structural Engineers Ltd	028 9756 2560			●	●	●	●	●				●				✔	4			Up to £1,400,000
Barnshaw Section Benders Ltd	0121 557 8261												●			✔	4			Up to £2,000,000
BHC Ltd	01555 840006	●	●	●	●	●	●	●			●	●		●	●	✔	4		●	Above £6,000,000
Billington Structures Ltd	01226 340666		●	●	●	●	●	●	●	●	●	●		●	●	✔	4		●	Above £6,000,000
Border Steelwork Structures Ltd	01228 548744			●	●	●	●			●	●				●		4			Up to £3,000,000
Bourne Construction Engineering Ltd	01202 746666		●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	●	Above £6,000,000
Briton Fabricators Ltd	0115 963 2901	●		●	●	●	●	●	●	●	●			●	●	✔	4			Up to £4,000,000
Builders Beams Ltd	01227 863770			●	●	●	●	●		●				●	●	✔	2	✔		Up to £1,400,000
Cairnhill Structures Ltd	01236 449393	●			●	●	●	●	●	●				●	●	✔	4		●	Up to £3,000,000
Caunton Engineering Ltd	01773 531111	●	●	●	●	●	●	●		●	●	●		●	●	✔	4		●	Up to £6,000,000
Cementation Fabrications	0300 105 0135	●			●			●			●		●		●	✔	3		●	Up to £6,000,000*
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	●	●	●		●		✔	4		●	Above £6,000,000*
CMF Ltd	020 8844 0940				●		●	●		●	●			●	●	✔	4			Up to £6,000,000
Cook Fabrications Ltd	01303 893011				●					●	●			●	●		2			Up to £1,400,000
Coventry Construction Ltd	024 7646 4484			●	●	●	●		●	●	●			●	●	✔	4			Up to £800,000
D H Structures Ltd	01785 246269			●	●		●				●						2			Up to £100,000
D Hughes Welding & Fabrication Ltd	01248 421104				●	●	●	●		●	●		●	●	●	✔	4			Up to £400,000
Duggan Steel Ltd	00 353 29 70072		●	●	●	●	●	●	●		●	●			●	✔	4			Up to £4,000,000
ECS Engineering Services Ltd	01773 860001	●		●	●	●	●	●	●	●	●			●	●	✔	3			Up to £3,000,000
Elland Steel Structures Ltd	01422 380262		●	●	●	●	●	●	●	●	●	●		●		✔	4		●	Up to £6,000,000
EvadX Ltd	01745 336413			●	●	●	●	●	●	●	●	●				✔	3		●	Up to £3,000,000
Four Bay Structures Ltd	01603 758141			●	●					●	●			●	●		2			Up to £1,400,000
Four-Tees Engineers Ltd	01489 885899												●		●	✔	3		●	Up to £2,000,000
Fox Bros Engineering Ltd	00 353 53 942 1677			●	●	●	●	●			●				●		2			Up to £2,000,000
Gorge Fabrications Ltd	0121 522 5770				●	●	●	●		●				●	●	✔	2			Up to £1,400,000
Company name	**Tel**	**C**	**D**	**E**	**F**	**G**	**H**	**J**	**K**	**L**	**M**	**N**	**Q**	**R**	**S**	**QM**	**FPC**	**BIM**	**SCM**	**Guide Contract Value (1)**

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	BIM	SCM	Guide Contract Value (1)
Gregg & Patterson (Engineers) Ltd	028 9061 8131			●	●	●	●	●				●		●		✔	3			Up to £3,000,000
H Young Structures Ltd	01953 601881			●	●	●	●	●		●	●			●	●	✔	2		🟢	Up to £2,000,000
Had Fab Ltd	01875 611711				●				●	●	●				●	✔	4			Up to £3,000,000
Hambleton Steel Ltd	01748 810598		●	●	●	●	●	●				●		●		✔	4		⚪	Up to £6,000,000
Harry Marsh (Engineers) Ltd	0191 510 9797			●	●	●	●				●	●			●	✔	2			Up to £1,400,000
Hescott Engineering Company Ltd	01324 556610			●	●	●	●			●				●	●	✔	2			Up to £3,000,000
Intersteels Ltd	01322 337766				●	●	●	●					●			✔	3			Up to £2,000,000
J & A Plant Ltd	01942 713511				●	●									●		2			Up to £40,000
James Killelea & Co Ltd	01706 229411		●	●	●	●	●				●	●		●			4			Up to £6,000,000*
John Reid & Sons (Strucsteel) Ltd	01202 483333		●	●	●	●	●	●	●	●	●	●		●	●	✔	4			Up to £6,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445			●	●	●	●	●	●	●	●	●		●	●	✔	4		🟠	Up to £3,000,000
Kloeckner Metals UK Westok	0113 205 5270												●			✔	4			Up to £6,000,000
Leach Structural Steelwork Ltd	01995 640133			●	●	●	●	●			●					✔	2		⚪	Up to £6,000,000
Legge Steel (Fabrications) Ltd	01592 205320			●	●		●		●	●	●			●	●		3			Up to £800,000
Luxtrade Ltd	01902 353182									●	●				●	✔	2			Up to £800,000
M Hasson & Sons Ltd	028 2957 1281			●	●	●	●	●	●	●	●				●	✔	4			Up to £2,000,000
M J Patch Structures Ltd	01275 333431				●	●				●	●				●	✔	2			Up to £800,000
M&S Engineering Ltd	01461 40111				●				●	●	●			●	●		3			Up to £1,400,000
Mackay Steelwork & Cladding Ltd	01862 843910			●	●		●			●	●			●	●	✔	4			Up to £1,400,000
Maldon Marine Ltd	01621 859000				●	●		●	●	●	●			●	●	✔	3			Up to £1,400,000
Mifflin Construction Ltd	01568 613311			●	●	●	●				●						2			Up to £3,000,000
Murphy International Ltd	00 353 45 431384	●			●		●	●	●		●				●	✔	4			Up to £1,400,000
Newbridge Engineering Ltd	01429 866722	●		●	●	●	●				●				●	✔	4			Up to £1,400,000
Nusteel Structures Ltd	01303 268112						●	●	●	●						✔	4			Up to £4,000,000
Overdale Construction Services Ltd	01656 729229			●	●		●	●			●				●		2			Up to £400,000
Painter Brothers Ltd	01432 374400								●		●			●	●	✔	2		🟠	Up to £6,000,000
Pencro Structural Engineering Ltd	028 9335 2886			●	●	●	●	●	●		●			●	●	✔	2			Up to £2,000,000
Peter Marshall (Steel Stairs) Ltd	0113 307 6730									●					●	✔	2			Up to £800,000*
PMS Fabrications Ltd	01228 599090			●	●	●	●		●	●	●			●	●		2			Up to £1,400,000
Rippin Ltd	01383 518610			●	●	●	●	●						●	●		2			Up to £1,400,000
S H Structures Ltd	01977 681931	●			●		●	●	●	●	●	●				✔	4		⚪	Up to £2,000,000
SDM Fabrication Ltd	01354 660895	●	●	●	●	●	●				●			●	●	✔	4			Up to £1,400,000
Sean Brady Construction Engineering Ltd	00 353 49 436 4144			●	●	●	●			●	●			●	●		2			Up to £800,000
Severfield plc	01845 577896	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4		🟠	Above £6,000,000
SGC Steel Fabrication	01704 531286				●					●				●	●	✔	2			Up to £800,000
Shaun Hodgson Engineering Ltd	01553 766499	●		●	●		●			●	●			●	●	✔	3			Up to £800,000
Shipley Structures Ltd	01400 251480			●	●	●	●		●	●	●			●	●		2			Up to £1,400,000
Snashall Steel Fabrications Co Ltd	01300 345588			●	●	●	●	●			●				●		2	✔		Up to £1,400,000
South Durham Structures Ltd	01388 777350			●	●	●				●	●	●			●		2			Up to £800,000
Southern Fabrications (Sussex) Ltd	01243 649000				●	●				●	●			●	●	✔	2			Up to £800,000
Taziker Industrial Ltd	01204 468080									●				●	●	✔	3			Above £6,000,000
Temple Mill Fabrications Ltd	01623 741720			●	●	●	●				●			●	●	✔	2			Up to £400,000
Traditional Structures Ltd	01922 414172			●	●	●	●	●	●		●			●	●	✔	2		⚪	Up to £2,000,000
TSI Structures Ltd	01603 720031			●	●	●	●	●			●			●		✔	2	✔		Up to £1,400,000
Tubecon	01226 345261						●	●	●	●				●	●	✔	4		🟠	Above £6,000,000*
Underhill Engineering & Building Services Ltd	01752 752483				●		●	●	●	●	●			●	●	✔	4			Up to £3,000,000
W & H Steel & Roofing Systems Ltd	00 353 56 444 1855			●	●	●	●	●						●	●		4			Up to £2,000,000
W I G Engineering Ltd	01869 320515				●					●					●	✔	2			Up to £200,000
Walter Watson Ltd	028 4377 8711			●	●	●	●	●				●				✔	4			Up to £6,000,000
Westbury Park Engineering Ltd	01373 825500	●		●	●		●	●	●	●	●				●	✔	4			Up to £800,000
William Haley Engineering Ltd	01278 760591			●	●	●			●	●	●			●		✔	4		🟠	Up to £4,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	🟠	Above £6,000,000
Company name	**Tel**	**C**	**D**	**E**	**F**	**G**	**H**	**J**	**K**	**L**	**M**	**N**	**Q**	**R**	**S**	**QM**	**FPC**	**BIM**	**SCM**	**Guide 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
A Lamb Associates Ltd	01772 316278
Balfour Beatty Utility Solutions Ltd	01332 661491
Bluefin Group	020 3040 6723
Griffiths & Armour	0151 236 5656
Highways England Company Ltd	08457 504030
Kier Construction Ltd	01767 640111

Company name	Tel
PTS (TQM) Ltd	01785 250706
Sandberg LLP	020 7565 7000
Structural & Weld Testing Services Ltd	01795 420264
SUM Ltd	0113 242 7390
Welding Quality Management Services Ltd	00 353 87 295 5335

Steelwork contractors for bridgeworks

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

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

- **FG** Footbridge and sign gantries
- **PG** Bridges made principally from plate girders
- **TW** Bridges made principally from trusswork
- **BA** Bridges with stiffened complex platework (eg in decks, box girders or arch boxes)
- **CM** Cable-supported bridges (eg cable-stayed or suspension) and other major structures (eg 100 metre span)
- **MB** Moving bridges
- **RF** Bridge refurbishment
- **AS** Ancilliary structures in steel associated with bridges, footbridges or sign gantries (eg grillages, purpose-made temporary works)
- **QM** Quality management certification to ISO 9001
- **FPC** Factory Production Control certification to BS EN 1090-1
  1 – Execution Class 1 2 – Execution Class 2
  3 – Execution Class 3 4 – Execution Class 4
- **BIM** BIM Level 2 compliant
- **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	FPC	BIM	NHSS 19A	NHSS 20	SCM	Guide Contract Value (1)
A&J Fabtech Ltd	01924 439614	●	●	●	●				●	✓	3					Up to £400,000
AIC Steel Ltd	01633 528400	●	●	●					●	✓	4		✓	✓		Up to £800,000*
Bourne Construction Engineering Ltd	01202 746666	●	●	●				●	●	✓	4	✓		✓	●	Above £6,000,000
Briton Fabricators Ltd	0115 963 2901	●	●	●	●	●	●	●	●	✓	4			✓		Up to £4,000,000
Cairnhill Structures Ltd	01236 449393	●	●	●	●			●	●	✓	4			✓	●	Up to £3,000,000
Cementation Fabrications	0300 105 0135	●	●						●	✓	3				●	Up to £6,000,000*
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	✓	4		✓	✓	●	Above £6,000,000*
D Hughes Welding & Fabrication Ltd	01248 421104	●		●			●	●	●	✓	4					Up to £400,000
Donyal Engineering Ltd	01207 270909	●						●	●	✓	3			✓	●	Up to £1,400,000
ECS Engineering Ltd	01773 860001	●	●	●	●		●		●	✓	3					Up to £3,000,000
Four-Tees Engineers Ltd	01489 885899	●	●	●	●		●	●	●	✓	3			✓	●	Up to £2,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445	●		●				●	●	✓	4			✓	●	Up to £3,000,000
Millar Callaghan Engineering Services Ltd	01294 217711	●						●	●	✓	4					Up to £800,000
Murphy International Ltd	00 353 45 431384	●	●	●	●				●	✓	4					Up to £1,400,000
Nusteel Structures Ltd	01303 268112	●	●	●	●	●		●	●	✓	4		✓	✓		Up to £4,000,000
S H Structures Ltd	01977 681931	●		●	●	●	●		●	✓	4			✓	●	Up to £2,000,000
Severfield (UK) Ltd	01204 699999	●	●	●	●	●	●	●	●	✓	4			✓	●	Above £6,000,000
Taziker Industrial Ltd	01204 468080	●	●	●	●			●	●	✓	3		✓	✓		Above £6,000,000
Underhill Building & Engineering Services Ltd	01752 752483	●	●	●	●			●	●	✓	4					Up to £3,000,000
Non-BCSA member																
Allerton Steel Ltd	01609 774471	●	●	●	●				●	✓	4			✓		Up to £4,000,000
Centregreat Engineering Ltd	029 2046 5683	●	●	●	●		●	●	●	✓	4					Up to £800,000
Cimolai SpA	01223 836299	●	●	●	●	●	●	●	●	✓	4					Above £6,000,000
CTS Bridges Ltd	01484 606416	●	●	●	●	●	●		●	✓	4				●	Up to £800,000
Francis & Lewis International Ltd	01452 722200							●	●	✓	4			✓	●	Up to £2,000,000
Harland & Wolff Heavy Industries Ltd	028 9045 8456	●	●	●	●	●		●	●	✓	3					Up to £2,000,000
HS Carlsteel Engineering Ltd	020 8312 1879	●	●					●	●	✓	3			✓		Up to £400,000
IHC Engineering (UK) Ltd	01773 861734	●							●	✓	3			✓		Up to £400,000
Interserve Construction Ltd	020 8311 5500							●	●	✓	N/A					Above £6,000,000*
Lanarkshire Welding Company Ltd	01698 264271	●	●	●	●	●	●	●	●	✓	4		✓		●	Up to £2,000,000
P C Richardson & Co (Middlesbrough) Ltd	01642 714791	●						●	●	✓	N/A					Up to £3,000,000
Total Steelwork & Fabrication Ltd	01925 234320	●						●	●	✓	3			✓		Up to £3,000,000
Victor Buyck Steel Construction	00 32 9 376 2211	●	●	●	●	●	●	●	●	✓	4				●	Above £6,000,000

Industry Members

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

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

CE
CE Marking compliant, where relevant:
M manufacturer (products CE Marked)
D/I distributor/importer (systems comply with the CPR)
N/A CPR not applicable

SCM
Steel Construction Sustainability Charter
Gold,
Silver,
Member

Company name	Tel	1	2	3	4	5	6	7	8	9	CE	SCM
AJN Steelstock Ltd	01638 555500								●		M	
Albion Sections Ltd	0121 553 1877	●									M	
Arcelor Mittal Distribution - Scunthorpe	01724 810810								●		D/I	
Autodesk Ltd	01252 456893		●									
AVEVA Solutions Ltd	01223 556655		●								N/A	
Ayrshire Metals Ltd	01327 300990	●									M	
BAPP Group Ltd	01226 383824									●	M	
Barrett Steel Services Limited	01274 682281								●		M	
Behringer Ltd	01296 668259					●					N/A	
British Steel	01724 404040				●						M	
BW Industries Ltd	01262 400088	●									M	
Cellbeam Ltd	01937 840600	●									M	
Cellshield Ltd	01937 840600							●			N/A	
Cleveland Steel & Tubes Ltd	01845 577789								●		M	
CMC (UK) Ltd	029 2089 5260								●		D/I	
Composite Profiles UK Ltd	01202 659237	●									D/I	
Cooper & Turner Ltd	0114 256 0057									●	M	
Cutmaster Machines (UK) Ltd	01226 707865					●					N/A	
Daver Steels Ltd	0114 261 1999	●									M	
Dent Steel Services (Yorkshire) Ltd	01274 607070								●		M	
Duggan Profiles & Steel Service Centre Ltd	00 353 56 7722485	●							●		M	
easi-edge Ltd	01777 870901							●			N/A	
Fabsec Ltd	01937 840641	●									N/A	
Ficep (UK) Ltd	01924 223530					●					N/A	
FLI Structures	01452 722200	●									M	
Forward Protective Coatings Ltd	01623 748323						●				N/A	
Goodwin Steel Castings Ltd	01782 220000	●									N/A	
Graitec UK Ltd	0844 543 8888		●								N/A	
Hadley Group Ltd	0121 555 1342	●									M	
Hempel UK Ltd	01633 874024						●				N/A	
Highland Metals Ltd	01343 548855						●				N/A	
Hilti (GB) Ltd	0800 886100									●	M	
Hi-Span Ltd	01953 603081	●									M	

Company name	Tel	1	2	3	4	5	6	7	8	9	CE	SCM
International Paint Ltd	0191 469 6111						●				N/A	
Jack Tighe Ltd	01302 880360						●				N/A	
Jamestown Cladding & Profiling Ltd	00 353 45 434288	●									M	
John Parker & Sons Ltd	01227 783200								●	●	D/I	
Joseph Ash Galvanizing	01246 854650						●				N/A	
Jotun Paints (Europe) Ltd	01724 400000						●				N/A	
Kaltenbach Ltd	01234 213201					●					N/A	
Kingspan Structural Products	01944 712000	●									M	
Kloeckner Metals UK	0113 254 0711								●		D/I	
Lindapter International	01274 521444									●	M	
MSW UK Ltd	0115 946 2316	●									D/I	
Murray Plate Group Ltd	0161 866 0266								●		D/I	
National Tube Stockholders Ltd	01845 577440								●		D/I	
Peddinghaus Corporation UK Ltd	01952 200377					●					N/A	
PPG Performance Coatings UK Ltd	01773 814520						●				N/A	
Prodeck-Fixing Ltd	01278 780586	●									D/I	
Rainham Steel Co Ltd	01708 522311								●		D/I	
Sherwin-Williams Protective & Marine Coatings	01204 521771						●				M	
Sika Ltd	01707 384444						●				M	
Simpson Strong-Tie	01827 255600									●	M	
Structural Metal Decks Ltd	01202 718898	●									M	
StruMIS Ltd	01332 545800		●								N/A	
Tata Steel Distribution UK & Ireland	01902 484000								●		D/I	
Tata Steel Ireland Service Centre	028 9266 0747								●		D/I	
Tata Steel Service Centre Dublin	00 353 1 405 0300								●		D/I	
Tata Steel Tubes	01536 402121				●						M	
Tata Steel UK Panels & Profiles	0845 3088330	●									M	
Tension Control Bolts Ltd	01948 667700						●			●	M	
Trimble Solutions (UK) Ltd	0113 887 9790		●								N/A	
voestalpine Metsec plc	0121 601 6000	●									M	
Wedge Group Galvanizing Ltd	01909 486384						●				N/A	
Yamazaki Mazak UK Ltd	01905 755755					●					N/A	

Complicated is Over.

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