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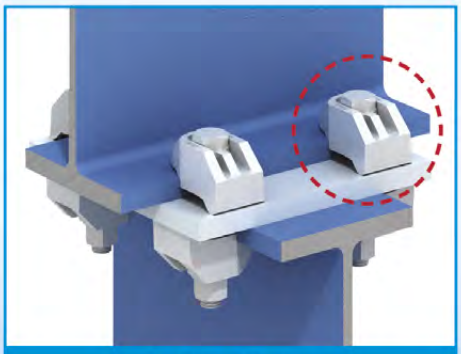

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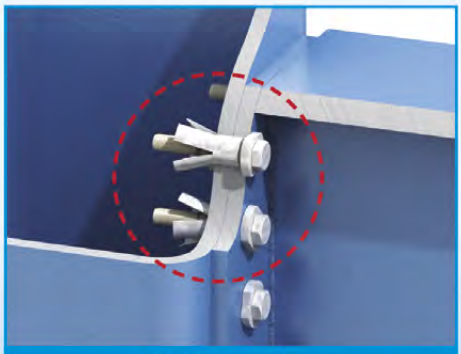

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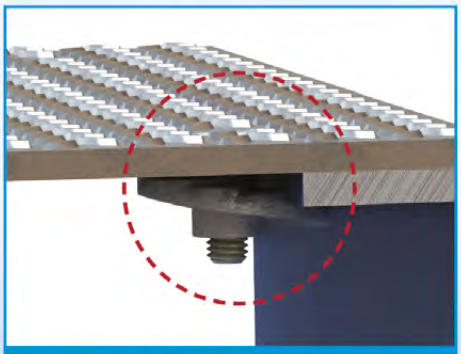

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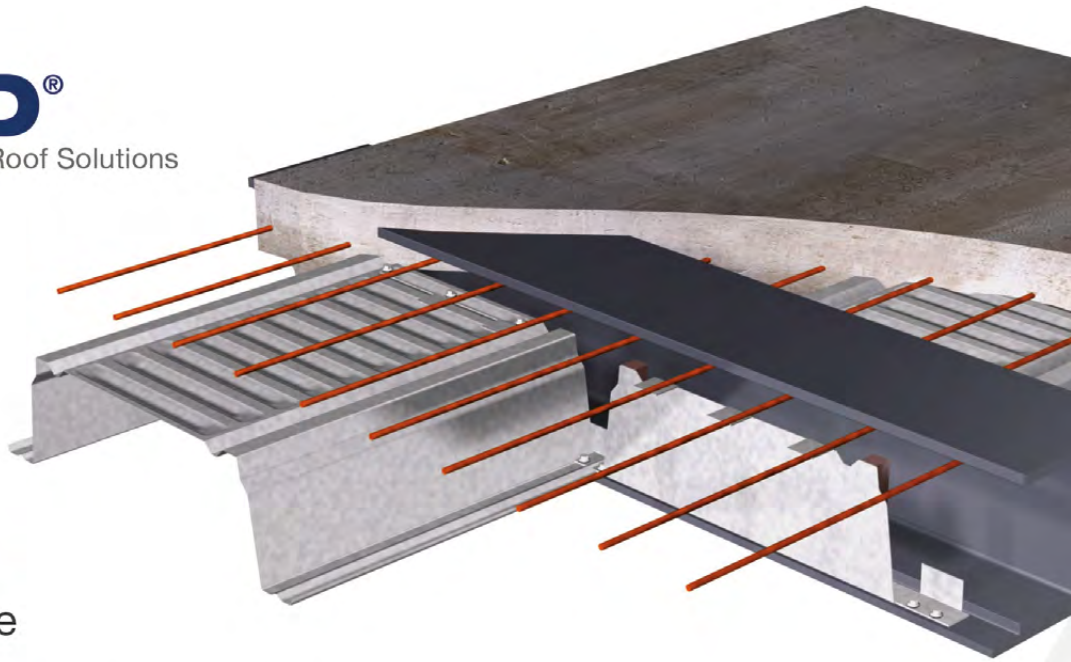

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Happy Birthday, SSDA

Nick Barrett - Editor

The Structural Steel Design Awards (SSDA) is 50 years old this year and in this issue of NSC we start a new series to mark that achievement with a look at some of the project highlights of the Award's first ten years. Articles on the following decades will be carried over our next four issues.

A look at the first ten years of winners quickly reveals that the ambition to make the SSDA among the most prestigious in construction was there from the beginning.

Engineering excellence, innovation, speed of construction and economy are among the features common to all of the projects, which are still efficiently providing infrastructure and accommodation services 50 years on, such as the 25-storey Winterton House in Tower Hamlets, London, an iconic structure locally and one of the tallest buildings in the Borough. Heathrow's Terminal 1 was an inaugural year winner, and all major UK airport terminal buildings since then, as well as other key airport structures like Gatwick's Air Bridge, have featured steel.

Four of the inaugural year's eight awards went to bridges, such as the Tinsley Viaduct over the M1, and a pedestrian bridge in a shopping centre. Bridges have featured strongly in the Awards ever since, often becoming tourist attractions in their own right. The St Katherine-by-the-Tower Inner Lifting Bridge became a tourist draw from its inception in 1974. We can hopefully look forward to seeing steel bridges perform strongly in construction of HS2 in years to come.

From those early days of the Awards we have seen inspiring examples of leading engineering and architectural design excellence, as well as the world-class contribution from steelwork contractors. In many cases we could point to examples of innovation that the construction industry generally is still catching up on. Offsite construction for example is now attracting champions from all quarters, but it has always been a feature of steel construction, and a great example can be seen in the Sainsbury Centre for Visual Arts, which hugely impressed the judges who said it was an extreme example of a flexible shed.

This 133m-long structure - architect Norman Foster's first public building - incorporated exhibition and teaching spaces, restaurants and offices, fabricated to a tight programme and tight tolerances, and erected over only 18 weeks. The Centre has its own celebrations this year to mark 40 years of operation and is holding a major exhibition called Superstructures that highlights the use of new technology, lightweight structures and innovative engineering techniques and solutions. Construction of this SSDA award winner itself will, fittingly, feature in the exhibition, as will much of the quality in construction that has become familiar to SSDA judges over the years.

A full list and description of all SSDA winners can be found at: *https://www.steelconstruction.info/SSDA_2018_–_50th_Anniversary_Year*

International steel conference comes to London

The Worldsteel Association will be holding its Construction Conference 2018 in London from 17-18 April, with a number of British Constructional Steelwork Association (BCSA) and Steel for Life members speaking at the event.

This year's theme is 'The role of steel in spurring productivity improvements in construction', with four main topics being addressed to cover the theme. The topics are: improving construction industry productivity; downstream collaboration in the construction industry; steel's competitive advantage in construction, and coordination among steel construction promotion bodies.

Construction Coalitions Head at Worldsteel, Terrence Busuttil said: "The goal of the conference is to show that steel is part of the solution to increasing construction industry productivity.

"Steel has the solutions for any construction project in any region of the world and in any natural environment."

Some of the conference highlights include BCSA Director General Sarah McCann-Bartlett chairing a discussion on productivity improvements in the steelwork supply chain, and BCSA Director of Engineering David Moore speaking about steel in fire.

Anyone interested in attending the two-day event can register online at: *www.constructsteel.org/events/worldsteel-construction-conference-2018*

Barnshaws offers expanded induction bending capacity

Steel bending specialist Barnshaws Section Benders is now offering customers induction pipe bending up to a size of 32 inches at its West Midlands headquarters in Tividale.

The new capacity is said to have been added to further support end-users in the structural, oil and gas, and machinery markets.

Induction bending is claimed to offer an advantage because it reduces many of the problems usually associated with cold bending pipes, such as wall thinning and distortion of the section.

As well as tackling large pipes, Barnshaws said it can also offer the same induction pipe bending service down to two inch sections.

Multiple bends can be incorporated on the same section and this can include different radii. Full traceability is offered as standard, as well as all relevant certifications.

Barnshaws Commercial Director Greg North said: "This new induction bending machine is one of largest of its kind, and gives us increased ability to support requirements for pipes in demanding industries.

"Our focus on metal bending quality and accuracy means we are well-placed to service customers in a variety of sectors, where fabrication standards are high. While we operate a number of similar machines, we are constantly looking for ways to improve our service, and offer more choice to our customers."

Steel creating new Littlehampton leisure facility

A new £17M steel-framed leisure centre is taking shape in the West Sussex seaside town of Littlehampton.

Replacing an existing centre, the new facility will include an eight-lane 25m-long swimming pool, 17m-long training pool with a moveable floor, 100 station gym, dance studio, spinning studio, four-court sports hall as well as a café and meeting rooms.

According to project architect Space & Place, the replacement facility is located close to the existing centre to enable continuity of service provision and re-use of the existing car park, in order to maximise both the potential of a site and the client's budget.

Furness Partnership Project Engineer Joe Haines said: "We have worked on a number of leisure centres in collaboration with architects Space & Place, and together we have developed an optimised design solution which always uses structural steelwork."

Steelwork has offered the design team the most efficient method of forming the long uninterrupted spans needed within the centre, as well as being a material that is quick to erect, thereby helping to keep the construction programme on schedule.

Main contractor Willmott Dixon started on site late last year, inheriting a plot that had already been cleared of its previous buildings. William Haley Engineering is currently erecting the project's steelwork package.

SCI starts product certification

Following a four-month market research programme on product certification in the cold rolled steel sector, the Steel Construction Institute (SCI) has developed its own product certification to this sector.

The research was carried out by Mark Wilkinson, a consultant employed by SCI who has almost 30 years' experience in the construction industry.

Mr Wilkinson visited and talked with manufacturers, warranty providers and trade associations to gain an understanding of the current certification available. His discussions are said to have had a particular focus on the service levels and support received from the certification bodies, as well as the value of carrying such certification.

"As a result of the high levels of interest and very positive research results we are pleased to announce that from the 1st March SCI began the detailed development of a certification scheme, for which it will seek UKAS accreditation," said Mr Wilkinson.

The initial focus will be on the following product sectors: cladding/roofing/decking/flooring, non-load bearing infill panels, light steel frames and modular units.

Companies interested in the potential scheme should contact: *m.wilkinson@steel-sci.com*

British Steel opens new Scunthorpe Metal Centre

British Steel has opened a new metal centre facility at its Scunthorpe headquarters to supply a wide range of constructional steel products and services to businesses of all sizes.

The new Scunthorpe Metal Centre, which replaces a smaller facility on the outskirts of the town, has created 10 jobs and is said to have further strengthened British Steel's nationwide network of metal and service centres.

Richard Farnsworth, British Steel's Managing Director Construction, said: "Our new metal centre is an exciting development, not only for us but for the region's construction industry.

"Moving to bigger facilities allows us to offer customers an extended range of steel products including our UK manufactured structural sections with next day delivery as standard. We'll also have further processing facilities including cutting to length so we can tailor our products to customers' precise requirements.

"We want to become the supplier of choice to this region's construction industry and believe our new Scunthorpe Metal Centre, supported by our facility in Hull, will help us lead business and community re-development throughout the Yorkshire and Humber area."

Dublin shopping centre expands with steel

The Frascati Shopping Centre in Blackrock, south Dublin, is undergoing a major redevelopment which includes the construction of new retail extensions.

Because the shopping centre will remain open during the construction programme, the works have been scheduled into four phases.

Working on behalf of main contractor Collen Construction, Steel & Roofing Systems has completed the initial two stages that comprise 500t of structural steelwork and 7,000m² of metal decking.

A further 350t of steel is now being erected for the last two phases. The project is due to complete in early 2019.

NEWS IN BRIEF

Trimble has introduced three new versions of its software for structural engineering, fabrication and construction teams: Tekla Structures 2018, Tekla Structural Designer 2018 and Tekla Tedds 2018. These solutions are said to provide increased control and improved documentation through constructible Building Information Modelling workflows for stakeholders in structural steel, including designers, detailers and steelwork contractors, general contractors and structural engineers.

Sunderland City Council has confirmed it is now rebidding Carillion's stalled Vaux brewery project, which was the first speculative office scheme in the city for many years. A tender process for the large regeneration scheme has now begun with tenders due to be returned on the £16M project later this month (April).

Architect **Skidmore, Owings & Merrill** (SOM) has revealed visuals for a 56-storey tower in the City of London featuring a slanting glass façade that resembles the nearby Cheesegrater building. Expected to rise 263m-high, the 100 Leadenhall development would provide up to 110,000m² of office and shopping space, with public plazas planned at the front on Leadenhall Street and adjacent to St Andrew Undershaft church.

The States of Jersey has selected J3 Limited as pre-construction partner for the ongoing project to develop Jersey's new hospital. J3 is a joint venture between Sir Robert McAlpine, Channel Islands construction company Garenne Construction Group, and infrastructure, support services and facilities management business FES Group.

McLaughlin & Harvey has been appointed by Liverpool City Council to prepare a new cruise terminal on the River Mersey. The new facility will enable the city to welcome the world's biggest cruise ships to its UNESCO World Heritage listed waterfront.

PRESIDENT'S COLUMN

The UK economy is bumping along, we have read about construction material costs rising across the board, tightening labour availability, and the latest Construction PMI shows subdued growth conditions.

So, what does 2018 and beyond hold for the structural steelwork sector?

Given these general conditions, the outlook is solid – as is the sector itself. In 2017 structural steelwork consumption in the sector was 894,000 tonnes. We did see an easing in consumption last year, but 2018, 2019 and 2020 are forecast for an increase of 1.4%, 2.5% and 2.2% respectively giving total structural steelwork consumption of 950,000 tonnes by 2020.

The largest sector for structural steelwork is industrial buildings, accounting for around 47% of structural steelwork consumption in the UK in 2017. This includes warehouses, factories, portal framed superstores, infrastructure buildings such as airports and stations, and cold stores. This sector saw massive growth in structural steelwork consumption between 2012 and 2016 – 30% by volume. In 2017 structural steelwork consumption in industrial buildings fell by just under 3% as the building boom in massive distribution centres eased, but demand is set to pick up again in 2018 and beyond, leading to further rises in structural steelwork consumption in 2018 (+ 1.4%), 2019 (+0.2%) and 2020 (+0.9%).

Things will remain a bit softer in the offices sector, one renowned for economic cycles, especially in the London market. In terms of structural steelwork consumption, this sector accounted for a 13% share in 2017. Our analysis shows that there will be falls in the construction of office buildings in London in 2018 and 2019, only partially offset by solid growth in the construction of offices in regional cities. This will result in a reduction in structural steelwork consumption for the sector. However, a pickup is due in 2020.

HS2 will have a positive effect on structural steelwork consumption in both bridges and other rail structures from 2019 onwards, with 50% growth in consumption in the sector expected between 2017 and 2020.

I'm often asked about the capacity of the sector to manage increases in demand for structural steelwork; this becomes pertinent as we move back towards the 1 million tonnes mark of structural steelwork consumption. A recent study on the UK's structural steelwork capacity showed that there was ample latent capacity in the sector to meet increased demand. As our member companies look forward many are investing in new automated machinery and equipment, as well as other technology to boost productivity.

Tim Outteridge
BCSA President & Sales Director Cleveland Bridge

Steel starts for Ulster church scheme

The Green Pastures Church is rapidly taking shape on the outskirts of the Northern Ireland town of Ballymena.

The large and imposing steel-framed structure, set within a 96-acre site, will comprise a main 1,600-capacity auditorium, sports hall, classrooms, meeting spaces, crèche, a gym, café, offices, a fitness studio, wedding and reception venue, as well as a large car park.

According to a Green Pastures spokesperson, the church is only one phase of its mini-village project.

Construction of the church got under way last year with an enabling works package that included installing drainage and preparing the plot for the building by levelling the sloping ground.

Locally-based contractor martin & hamilton (m&h) started on site during July and began by installing pad foundations in readiness for the steel frame to be erected.

Steelwork contractor Walter Watson is fabricating, supplying and erecting 840t structural steel for the project.

Race on to complete trackside hospitality

Work is revving up for the completion of a flagship hospitality centre at the Thruxton Motorsports Centre in Hampshire.

The state-of-the-art complex will include a restaurant, bar, exhibition gallery, function rooms, hospitality suites, catering facilities, viewing terraces and a balcony.

Steelwork contractor REIDsteel has designed, manufactured and supplied all of the steelwork, cladding and glazing for the modern, two-storey building alongside local contractor Mata Construction.

The £1.5M centre's innovative design includes a grand atrium and entrance lobby said to reflect the dynamism of motorsport and Thruxton's rich heritage.

"We chose a steel frame for a combination of reasons. Our architectural intent was to emphasis the high-tech nature of motorsport in the building's design. The steel frame facilitated the complex roof geometry and cantilevers that echo the famous curves of Thruxton's iconic circuit," said Zac Chapman of project architect Chapman Partnership.

Marketing Manager at Thruxton Ben Norton said: "Our flagship hospitality centre is the latest addition as part of ambitious modernisation and growth plans in our 50th anniversary year.

"It is an exciting and innovative development which will allow us to deliver stunning and memorable events for groups of all sizes with hospitality of the highest standard."

Thruxton's 2.4 mile circuit is the fastest in the UK. It also has paddocks for different activities, a top-class kart and 4x4 centre, and state-of-the-art skid pan facility.

Stage set for Hull Venue opening

Hull Venue, a £36M state-of-the-art music and events complex with a capacity of 3,500 people is nearing completion and will host its first live acts later this year.

Working on behalf of Hull City Council, BAM Construction is main contractor for the scheme and it has subcontracted James Killelea to fabricate, supply and erect all of the steelwork.

The Venue will allow the city to host large corporate conferences, exhibitions and trade shows, as well as concerts and sporting events.

The facility has been designed to be flexible and it can be reduced to a 2,500-capacity for an all-seated event and a 2,000m² exhibition space, as well as an 800-capacity auditorium.

According to Hull City Council, the Venue will also provide 30 full time jobs with more than 100 temporary jobs on event days, as well as an annual £13.5M boost to the city's economy.

Steel delivering new Highlands distillery

Located 30 miles north of Inverness in the Averon Valley, the £15M Ardross Distillery is taking shape with the aid of steel construction.

The scheme includes constructing a new two-storey steel-framed main distillery building, which incorporates some retained stone walls from the site's previous farm complex.

Stone and slate is being salvaged from the old buildings and will be used to rebuild walls and roofs of the development.

Working on behalf of main contractor Morrison Construction, Mackay Steelwork & Cladding is erecting approximately 200t of steel for the project.

The Ardross Distillery will produce spirits and expects to launch its first product onto the market later this year.

Rushden Lakes phase two under way

Main contractor Winvic has begun phase two works on the retail and leisure development at Rushden Lakes in Northamptonshire.

The steel frame for the 28m-high cinema building is currently being erected. At the same time, the western retail terrace and the leisure facility steel frames have also commenced.

LXB Retail Principal Jon McCarthy said: "Working with tenants to accommodate over 300 variations and enhancements without delaying the programme was a particularly satisfying accomplishment in the first phase, and I'm looking forward to continued liaison with the 20 plus occupiers that will have new premises in Northamptonshire in less than a year's time."

The LXB Retail Properties scheme funded by The Crown Estate is the first example of an innovative design that reimagines the retail experience; the varied leisure facilities are said to offer a more memorable experience.

Winvic Construction completed Rushden Lakes phase one in July 2017 (NSC Nov/Dec 2016). Phase two will be completed by January 2019, and boasts a 14-screen cinema and four other leisure units, between 10 and 13 restaurants, 5 spaces for retailers and additional car parking.

Caunton Engineering, which was the steelwork contractor for phase one works, is fabricating, supplying and erecting 2,500t of steel for this latest phase.

Winvic Construction Project Manager Richard Black said: "When steelwork is going up and buildings become more than drawings, it is an exciting stage for any project. However, Rushden Lakes is a landmark development in the UK for its size and modern take on how people will interact in a retail and leisure space. Therefore, we are thrilled to have been contracted by LXB to drive this second phase for them and The Crown Estate, following the success of the first phase."

UK supplier decks twin Dubai skyscrapers

Structural Metal Decks (SMD) has completed a major contract worth more than £1M, shipping more than 100,000m² of steel decking to the United Arab Emirates for the construction of twin skyscrapers.

Located in Dubai, Tiara United Towers is a development of two 46-storey towers with each structure reaching a height of 193m.

The two towers will house 50,500m² of office space and a 5-star 370-room hotel.

SMD, which has a satellite office in Dubai and celebrated its 30th anniversary in 2017, has been working on the project since 2016.

SMD International Manager Jane Biddle said: "The first shipment arrived in October 2016 and during the ensuing period we shipped a total of 101,270m² of our TR80+ 0.9mm floor decking."

She added: "The value of this project was £1.08M and was a significant step forward for SMD as we look to expand our overseas market."

The Tiara United Towers is set to feature a coloration technique, by which the building façades appear in multiple colours.

The exterior of the building will also feature veins, like those on a leaf, spreading across the surface from the corners and 'embracing' the building.

The development is aiming to be the first building in Dubai to be certified by the US Green Building Council for achieving LEED (Leadership in Energy & Environmental Design) 'Gold' status.

Diary

For SCI events contact Jane Burrell, tel: 01344 636500 email: *education@steel-sci.com*
For Institution of Structural Engineers events email: *training@istructe.org* or telephone 0207 201 9118

Tuesday 22 & Wednesday 23 May 2018
Design for Torsion
This 1 hour webinar covers the design steps, best practice and practical recommendations for members and connections when torsion must be accommodated in design.

Tuesday 12 & Wednesday 13 June 2018
Fire Design of Beams and Columns
This 1 hour webinar covers how a little extra design can be used to calculate more realistic behaviour under fire conditions.

Tuesday 26 & Wednesday 27 June 2018
Essential Steelwork Design 2 day course
This course introduces the concepts and principles of steel building design, before explaining in detail the methods employed by Eurocode 3 for designing members in bending, compression and tension. Bristol

SSDA reaches 50

Having started in 1969, the Structural Steel Design Awards are this year celebrating their 50th anniversary. In the first of a series of articles, NSC looks back at each of the past five decades starting with the first awards and the 1970s.

Since the Structural Steel Design Awards (SSDA) were initiated in 1969 by the British Constructional Steelwork Association (BCSA) and the British Steel Corporation there have been many changes in the construction and steel sectors, however one constant asset is the way that steel not only confers efficiency and economy, but also has an aesthetic which designers are able to exploit to the benefit of the built environment.

Steel continues to be the most popular framing material and each year's SSDA entries reflect the increasingly high standards that are being achieved, not only in design and all aspects of fabrication, but also in the short programmes and accuracy on-site.

The qualities of engineering excellence, innovation, attention to detail, economy and speed of construction have been brought together in each of the structures that have been given awards during the past 49 years.

Eight projects achieved awards in the inaugural year, with bridges accounting for four of the winners; the Maryville Interchange in Glasgow; Tinsley Viaduct, M1, Sheffield; White Cart Viaduct, M8, Glasgow Airport; and the Riverside Shopping Precinct Footbridge in Thetford.

London Heathrow Airport's expansion was well under way in 1969 and the new Terminal 1 building was another SSDA winner, along with a high-rise residential tower in east London's Watney Market Estate known as Winterton House. Having been redeveloped 18 years ago Winterton House is still a landmark building and one of the tallest structures in Tower Hamlets.

Demonstrating steelwork's wide appeal, the other two awards were for a Service Tower for the International Students Club and a Water Tower for GKN Group Research Centre.

Matt Brown, Flickr

Alan Padley, Flickr

Two of 1969's SSDA winners, Winterton House in east London and Tinsley Viaduct, Sheffield


A C Manley, Shutterstock

Going strong: the Sainsbury Centre for the Visual Arts was an SSDA winner in 1978

Throughout the following decade the SSDA became an increasingly prestigious competition, with awards granted only to the most worthy schemes. Awards went to construction teams for schemes across of all types and sizes, honouring their construction excellence and high calibre design credentials.

Two examples of 1970s award winning schemes, and ones which are still in use today, are the St Katherine-by-the-Tower Inner Lifting Bridge, London (a 1974 winner) and the Sainsbury Centre for the Visual Arts (a 1978 winner).

Still regarded as a centrepiece in the redeveloped St Katherine Docks, the bridge was described by the SSDA judges as a simple functional moving bridge that matches its attractive setting.

The open steel grid for the carriageway and the direct action lifting mechanism are novel and contribute to the overall success of a cleverly designed structure, they added.

According to the SSDA submission, the client required a bridge which was simple and inexpensive and which would add some character to the Dock development.

There was no room for a bascule or drawbridge, so a lifting bridge using cables was chosen as the best option. The bridge's main side frames and deck crossbeams are made from universal sections of high yield steel.

The steelwork contractors for this project were Boulton and Paul (Steel Construction) and Mole Richardson, both working with structural engineers Ove Arup & Partners.

Described by the SSDA judges as an extreme example of a flexible shed, the Sainsbury Centre for the Visual Arts is a lordly space that embraces exhibition areas, teaching spaces, restaurants and offices.

Located at the University of East Anglia and designed by Foster Associates and Anthony Hunt Associates, the structural concept of this 133m × 34m × 10m-high building was to provide a large-scale, lightweight elegant structure fabricated offsite for accuracy and speed.


Viktor Kiev, Shutterstock

The St Katherine Docks bridge has withstood the test of time and is still in regular use

Approximately 290t of structural steel was used for the project, which was erected in an impressive 18 weeks by the steelwork contractor Tubeworkers.

A full list and description of all Award winners can be found at: *https://www.steelconstruction.info/SSDA_2018_–_50th_Anniversary_Year*

The 2018 Awards, which are jointly sponsored by the BCSA and Trimble Solutions (UK) Ltd, will be announced in early October.


Bildagentur Zoonar, Shutterstock

Space constraints dictated the design of the St Katherine Docks bridge which was an SSDA winner in 1974

Design and construction with light gauge steel

NSC highlights some of the advantages that can be had from using light steel framing solutions.

Model showing a light steel residential frame

Light steel framing is an offsite manufacturing process that uses light steel sections to produce pre-fabricated infill wall panels and load-bearing walls that are used in light steel-framed buildings and modular construction. Common light gauge products include C-sections, purlins, side rails, walling, composite panels and built-up cladding solutions.

Lightweight components are produced by cold forming thin gauge strip material to specific section profiles. In most cases, galvanized steel strip material is used. Light steel components are produced in high volumes by cold rolling and in low volumes by press braking. Thicknesses typically vary from 1.2 to 3.2 mm.

Light steel components are widely used as secondary structural steelwork in single storey industrial buildings. Other common uses for light steel framing are residential type buildings of 4 to 10 storeys e.g. apartments, hotels and student accommodation. It is also used in housing, particularly 2 and 3 storey houses with habitable roof space, and applications where its light weight is beneficial such as mixed-use buildings, including residential space over supermarkets.

William Worthington, Metframe Sales Manager, Metsec, says: "The general interest in offsite construction is at an all-time high, with several reports and research being published focusing on this method of building.

"With the residential construction market under pressure, it's becoming increasingly apparent that the construction industry is currently unable to meet the housing demand, and government-backed publications and professionals are highlighting problems with quality and capacity."

Design and Detailing

Light steel framing is a highly engineered structural system which is linked through BIM systems to sophisticated manufacturing. The structural characteristics and the critical design checks for light steel frames can be significantly different to those of hot rolled steel frames. Light steel frames must be designed for the consideration of uplift forces at the foundations due to lateral wind loads and suitable anchorage details designed to resist the uplift forces. It may be the case that hot rolled steel sections are incorporated into the light steel frame to resist heavy point loads, e.g. for balcony connections. The hot rolled sections should be detailed such that they fit within the depth of light steel walls and floors.

Installation of Light Steel Framing

Installation of light steel framing requires the use of a crane. Depending on the project and the subsequent craneage needs, the responsibility to provide craneage may rest with the light steel installer or the main contractor.

Light steel framing uses storey-high wall panels that are delivered to site in bundles appropriate for the build sequence. These are unloaded from the lorry and placed on the floors near to where they are to be installed. One lorry can deliver 30 to 50 wall panels which are typically required to build two houses or four apartments.

Floors in light steel frame buildings are generally either; light steel joisted floors with timber boarding, panelised floor cassettes or composite slab floors. The installation process for each of these floor types is appreciably different, with each having its own best practice considerations.

"Kingspan are fully committed to providing economic and sustainable light steel framing solutions to the construction sector. Our load-bearing building system "Kingbuild" and our infill wall framing system "Kingframe" are proving to be very popular with contractors and developers as a fast, economic, accurate and high quality method of construction," says Kingspan Insulated Panels Business Unit Director Phil Jasper.

Benefits of Light Steel Construction

Some well-known benefits associated with light steel construction are speed, light-weight and quality which also lead to supplementary advantages, such as early completions, fewer snags and minimal rework. However, there are also many other advantages including;

- High levels of thermal installation and air-tightness.
- The light-weight attribute of these construction systems means that foundation loads and sizes are significantly reduced relative to concrete and masonry construction.
- Productivity and speed of construction is increased considerably which reduces site impacts.
- Site safety is improved by a factor of 5 according to HSE statistics due to the offsite construction process.
- Site waste is virtually eliminated due to the use of pre-fabricated light steel and modular components.
- Embodied carbon in the building fabric will also be reduced when using light steel framing and modular construction.
- Light steel structures can be modified and extended easily. Modular units can be dis-assembled and re-used.
- Manufactures' light steel profiles are readily available in 3D format from the National BIM Library for easy inclusion into 3D BIM models.

STEEL for life

Sponsors Light Gauge Steel Framing

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The project sits next to a former landmark viewing tower

Pooling resources

Steel construction has come to the fore to create two large wedge-shaped halls, topped with wave-like roofs to house a waterpark and leisure space. Martin Cooper reports from Rhyl.

The scheme features two structures topped with wave-like roofs

The North Wales town of Rhyl is in the midst of a wide redevelopment programme of its promenade and seafront. The centrepiece of this work is a steel-framed waterpark, which on completion should help to boost the local economy by increasing visitor numbers.

Working in partnership with Denbighshire County Council, Alliance Leisure is developing the project and has appointed ISG to deliver the work as part of a long-standing framework agreement.

Located alongside Rhyl's long and sandy beach and next to a local landmark known as the sky tower (a former viewing tower), the project sits on a plot once occupied by a Victorian pavilion and, in more recent times, a skate park.

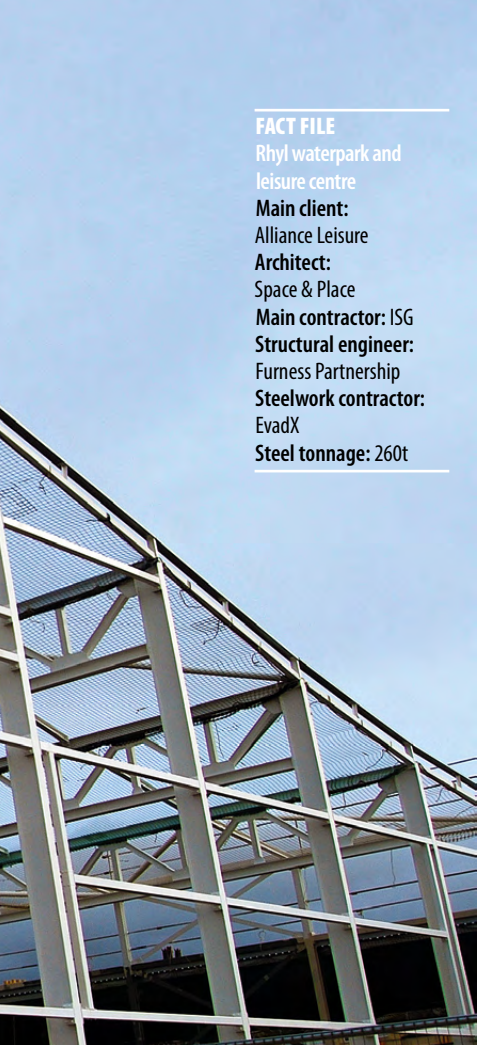
Housed within a double wedged-shaped structure, topped with wave-like roofs, the contract will deliver a 1,200m^2 pool hall with flumes, slides and water play features, an adventure area containing a multi-level adventure play structure, a changing village and a café and bar area.

Externally, an existing splash pad will be retained but with additional water play equipment installed, various terraced seating areas and an external food and beverage pod.

One large steel frame houses the entire facility with a line of columns and a partition wall running down the middle of the building. This essentially separates the wet zone (aquatics area) from the dry multi-level play area.

Each of these zones is housed within

FACT FILE
Rhyl waterpark and leisure centre
Main client: Alliance Leisure
Architect: Space & Place
Main contractor: ISG
Structural engineer: Furness Partnership
Steelwork contractor: EvadX
Steel tonnage: 260t



The facility will sit in the middle of a redeveloped seafront

The steel was erected in six weeks

a large column-free hall topped with a wave-like roof, with each one sloping in the opposite direction to the other.

The wet zone's wave descends from a high nearest the seafront and ends with a single-storey element with a flat roof which houses the café and bar.

On the opposite side, the dry zone's wave ends with a similar single-storey flat roofed zone which houses changing rooms and plant rooms, as well as supporting further plant on its roof.

As well as being a nod to the waterpark's location, the wave-like roofs, and in particular the wedge shapes, have been chosen for their efficiency.

According to the project architect, Space & Place, the two wedge shapes provide optimum volumetric arrangements offering better views through to the seafront, reducing the overall visual mass of the building and creating a more interesting architectural form.

The concept was then progressed with the introduction of opposing curved wave-like roofs to reflect the tranquility of the sea.

Locally-based EvadX was contracted on a design and build basis for the project's steelwork, and once on site the company completed its erection work in six weeks. This work included installing approximately 600m² of metal decking for a plant deck.

Perimeter columns are generally spaced at regular 6m centres. However, due to the potential for excessive wind loadings because of the building's seafront location, these members were changed from UC sections to UBs.

"Using UBs was an economical design procedure as it gave us a deeper steel member, which offered better resistance against the wind," explains EvadX Project Manager Steve Morris.

"Because of the close proximity to the sea we have also had to paint the steelwork with a high-spec protective coating to prevent corrosion in this aggressive environment."

To create the wave-like forms of the two adjacent halls' roofs, a series of 28m-long × 500mm-deep trusses spans the wet zone, while 28m-long 838UB sections span over the dry zone. The steelwork is set in stepped formation, with shorter and higher supporting columns rising and falling to create the wave appearance.

"Trusses were needed to accommodate the wet zone's ductwork and services," says ISG Project Manager Steve Lowton. "The dry zone has fewer services and these will be accommodated under the long-span beams."

A couple of trusses support flumes and consequently they have been designed to accommodate the associated extra loadings of the water and movement. EvadX welded nodes to the underside of these trusses which will act as a connection to the flumes when they are installed by the specialist contractor.

One of the flumes exits the building at a height of 13m and then re-enters the structure 4m lower down and two bays further along the structure. To support the flume an external steel column tree, embedded in a deep concrete base, will support the flume at the tips of its four steel branches.

EvadX used a single 50t-capacity mobile crane for most of the steelwork erection. Both the trusses and the 28-long roof beams were brought to site in two pieces, which were spliced together on the ground before being individually lifted into place.

"The form of the building has been designed as a modern structure, but also one in keeping with its surroundings, and as such we are using materials that are in keeping with the overall Rhyl master plan," says Mr Lowton.

A 3m-high masonry wall skirts the structure at ground level where impact resistance is required. Above, generous elevations of glazing and polycarbonate translucent panels are fixed to three rings of steel box sections that wrap around the frame at 3m, 4.2m and 8.4m-high levels.

Alliance Leisure Senior Business Development Manager Julia Goddard says: "The development in Rhyl will completely transform the town's leisure provision, creating a standout attraction which will draw an estimated 35,000 extra visitors to the area each year.

"Creating sustainable leisure facilities which inspire community engagement is always our ambition and this latest development project will certainly achieve this."

The Rhyl waterpark and leisure centre is due to open in early 2019.

Weathering steel elements were chosen because they need little or no maintenance

Bridge links city bypass

Forming an important part of the Lincoln A15 Eastern Bypass, a weathering steel bridge carrying two railway lines has been successfully installed.

Covering a distance of 7.5km, the Lincoln Eastern Bypass is a new road designed to improve infrastructure, minimise congestion and encourage economic growth for the historic city.

When complete, it will link with the existing northern relief road, thereby becoming the next step towards creating a complete ring road around Lincoln.

One of the crucial elements of the scheme is the new bridge carrying the Lincoln to Spalding railway lines over the new dual carriageway.

A steel solution, using weathering steel, was chosen for its low maintenance requirements and cost-effectiveness.

Repainting the bridge at a later date for maintenance would have been logistically difficult, bearing in mind the necessity for a road and rail closure.

"Because we've used weathering steel, once this structure is erected there is no need for any future painting," says Cleveland Bridge Project Manager Rob McBride.

In contrast to other steels, which always look their best immediately after being erected, weathering steel is said to improve after a couple of years' exposure to the elements. It is not only on bridges that the material is used, architects increasingly specify it for use on buildings, fully exposed.

Bridge girders on their way to site

The installation was completed in 72 hours

"The colour of weathering steel will change from grey blasted steel as it undergoes the rusting process to a light orange / brown and then a dark brown. Weathering steel contains specific alloy elements that produce a stable rust layer that develops over time to form a protective barrier which significantly reduces corrosion", explains Mr McBride.

"The appearance of mature weathering steel bridges often blends in with the environment which looks aesthetically pleasing and surprises many people who think the steel will just look rusty."

There is also an environmental and cost advantage connected with using weathering steel. No painting in the future will obviously save money, but issues associated with VOC emissions from paint coatings are also avoided, which is good for the environment.

Cleveland Bridge was subcontracted by BAM Nuttall to fabricate and erect the critical rail bridge for its end clients, Lincolnshire County Council and Network Rail. A trial assembly was undertaken at Cleveland's Darlington facility in order to identify and resolve potential snags, and to ensure the installation would go smoothly and to plan.

"In our substantial operational facility we were able to do a trial assembly, so we could check connections, alignment and reduce the amount of time spent on site doing remedial work. This increased cost-effectiveness and ensured a high-quality project outcome," adds Mr McBride.

Additionally, as part of the company's requirement to significantly reduce site time, Cleveland Bridge's scope of works included both the waterproofing of the steelwork and concrete works, which were also done at its facility in Darlington.

Cleveland Bridge says it was engaged early in the design stage to ensure the optimum solution was developed for the bridge, which needed to have a longer span than the old structure as it carried the rail lines over a new and wider road.

"The new bypass was under construction simultaneously, so our work involved collaborating closely with all partners to ensure we met BAM Nuttall's Beyond Zero sustainability objectives," says Mr McBride.

Cleveland Bridge supplied a fabrication and assembly package which involved its engineering, project management and site services departments. The structural weathering steel was a grade that complied with BS EN 10025-5 and fabrication was in accordance with BS EN 1090-2 for Execution Class 3.

The bridge deck is 40.5m long, 9m wide and weighed just over 620t. All bolts used were weathering grade TCBs, chosen for their durability and slip-resistant characteristics.

The two main bridge girders were assembled and welded in the factory to form two 40m-long sections, each weighing 107t, which were then delivered to site as complete pieces. This created complicated planning for transportation as it necessitated road closures and required police access permissions.

However, this method improved installation speed and accuracy, while reducing the requirement for on-site services and works such as welding.

The bridge sections, including the two main girders and the connecting cross members, were installed using two cranes - a 750t-capacity unit and a 200t-capacity crane - to lift each section into place.

Supported on the cross members, the steel decking was laid diagonally to address the complexities of the camber.

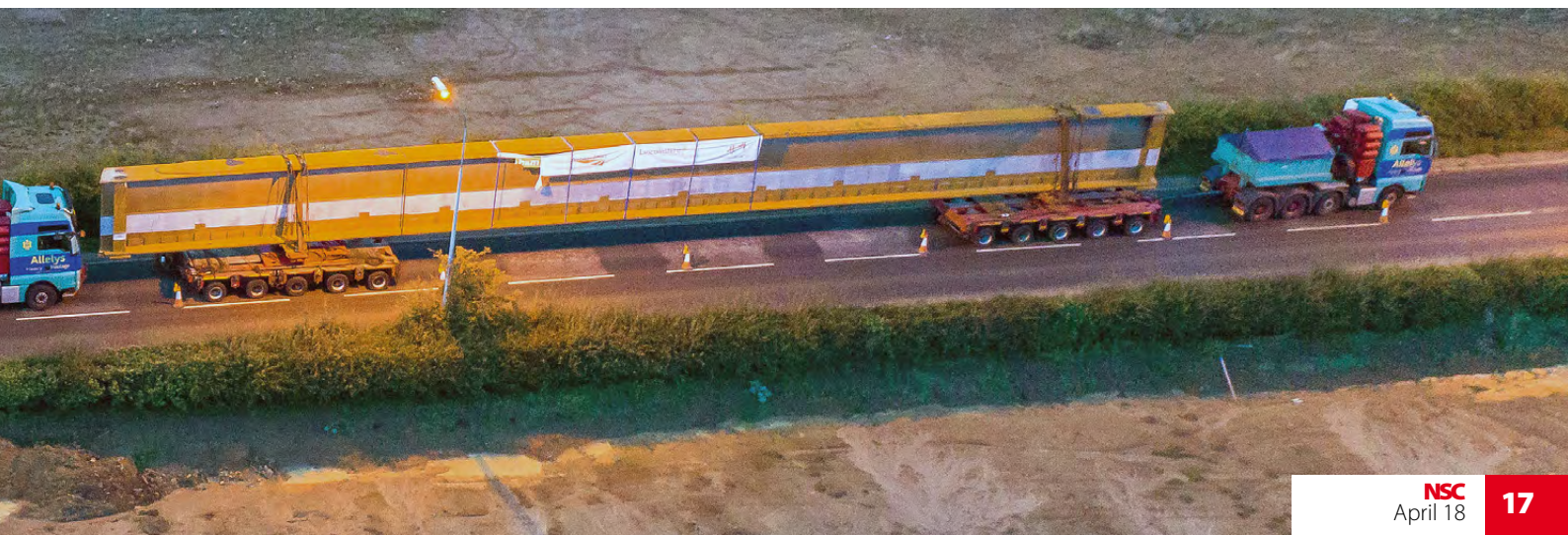
The assembly of the entire bridge took Cleveland Bridge approximately two weeks. This work also included designing and supplying temporary bracing for supporting the steelwork during site assembly.

To ensure as little rail disruption as possible was caused, the new structure was assembled close to the existing bridge to very tight tolerances. During a 72-hour rail blockade the old bridge was demolished and the new one slid into place.

Cleveland Bridge says this was a complicated process and was achieved via the accurate setting and loading of the beams, which required both its site team and clients to work as one team. The Lincoln Eastern Bypass LEB Railway Bridge was completed on time and within budget. Essential to this success was the collaborative working relationship with the client.

The entire Lincoln Eastern Bypass is due to open at the end of 2019.

FACT FILE
Lincoln Eastern Bypass Railway Bridge
Main client: Lincolnshire County Council/Network Rail
Main contractor: BAM Nuttall
Structural engineer: Arcadis
Steelwork contractor: Cleveland Bridge
Steel tonnage: 620t



Spanning the centuries

English Heritage is undertaking a major conservation programme to repair and conserve the world's first single span cast iron arch bridge.

FACT FILE
Iron Bridge conservation
Main client:
English Heritage
Main contractor:
Taziker Industrial

Spanning the River Severn in Shropshire, Iron Bridge has become an iconic and universally recognised symbol of the industrial revolution. Opened in 1781, it pioneered the path to using cast iron on a large scale and consequently the construction industry was never the same again.

Having stood for more than 230 years, the UK's best-known industrial monument is today suffering in its old age. In fact, there are numerous cracks in the structure, due to stresses in the ironwork dating from the original construction, ground movement over the centuries, and an earthquake that struck in the late 19th Century.

To remedy these ailments and preserve the bridge for future generations, English Heritage, with the aid of steelwork contractor: Taziker Industrial, has embarked on a conservation programme. This work will see the different elements of the bridge - the iron radials and braces holding the structure together, the deck plates and wedges, the main iron arch, and the stone abutments on either side of the Severn – examined and repaired.

Taziker Industrial Project Manager Duncan Warburton explains: "This is a conservation job and not a refurbishment, and so as much of the original materials have to be retained in an unaltered condition. All of our work must not remove, alter or permanently bond, cross or link to any original part.

"Consequently, all of the work must be reversible and removable without affecting the condition of the original material now or in the future."

Unusually for a steelwork contractor, Taziker is not only working with the original cast iron elements, all new metal added to the bridge must also be iron. The company is employing a specialist ironwork firm to fabricate and supply new material for this project.

All of the new ironwork is bespoke and each new piece is different and unique. Many parts of the main arch structure have cracks, these are being repaired by adding a new iron brace that is bolted to the existing iron, and then wraps around it to keep it in place. In this way, no original iron member is removed even if it is cracked.

Other repairs are being done to the bridge's deck as ongoing corrosion of the packing pieces between the plates and supporting beams is causing the deck to slowly lift. New iron packing pieces are being fabricated and will be installed, while broken deck plates will be strengthened with new ironwork.

In order to carry out this work, Taziker had to erect an access scaffold to the bridge. This has a fixed sheeted roof and sides, shrouding most of the structure from view.

Within this encapsulated space, the initial works began with the entire ironwork being cleaned and the rust build-up removed by pressure grit blasting.

English Heritage made a commitment to maintain public access between the communities on either side of the bridge throughout the works, so Taziker has divided the bridge deck in half, working on the downstream half first and allowing pedestrians to use the upstream half. Once the first half of the deck is complete, the procedure will be reversed.

On the underside of the bridge, the main works continue unhindered by the need to give public access. However, a public walkway is being erected on the upstream ▶20

Scaffolding allows access to areas beneath the deck

A protective shroud now covers the bridge

Rust removal continues prior to the ironwork repairs

Numerous cracks in the ironwork are being repaired

A public walkway, allowing people to see the works in progress, is being incorporated into the scaffold

▶18

side of the scaffold and this will allow guided tours during the summer to see the work in progress.

Over the years there have been numerous repairs done to the bridge, most notably in the early 20th Century, and all of this work is being kept in place.

"The old repairs are now historic and integral to the bridge," says Mr Warburton. "We are repairing and conserving the old repair work in much the same way as the original bridge structure."

According to English Heritage, once the repair work has been completed Taziker will repaint the entire bridge. Detailed historic paint analysis is being undertaken in order to ensure the most suitable colour is chosen.

The conservation work on Iron Bridge is due to be complete by the end of the year.

The bridge that started a revolution

Iron Bridge sits in what is today a rural area, but in the late 18th century this part of Shropshire was an industrial powerhouse because of its rich coal deposits.

In 1709, Abraham Darby I, a former brass founder from Bristol, had begun to smelt local iron ore with coke made from Coalbrookdale coal.

The expansion of industrial activity here in the upper Severn gorge, however, was handicapped without a bridge, the nearest being at Buildwas 3km away. Intense barge traffic along the river also required a single-span bridge, as the steep sides of the gorge ruled out rising approaches to a stone central arch.

It was the Shrewsbury architect Thomas Pritchard who first suggested in 1773 to the ironmaster John Wilkinson that an iron bridge be built over the Severn. The chosen crossing point, where a ferry had crossed from Benthall to Madeley Wood, had the advantage of high approaches on both sides and relative stability.

Pritchard drew up the designs, but he died in 1777, a month after work had begun on the 30m-long single-span bridge. Abraham Darby III, grandson of the first foundry owner, agreed to continue the project, and all the necessary iron was cast at his Coalbrookdale furnace.

The masonry and abutments were constructed between 1777 and 1778, and the iron ribs were then lifted into place during the summer of 1779. The 378t of ironwork was installed using two large wooden derricks powered by horses positioned along the riverbanks.

The world's first iron bridge was formally opened on New Year's Day 1781, having cost over £6,000.

The bridge had a far-reaching impact on the local society and economy. It was always intended as a monument to the achievements of Shropshire ironmasters as well as a river crossing – it was an advertisement that gave their ironworks a competitive edge over their rivals.

The bridge remained in full use for over 150 years by ever-increasing traffic. It was finally closed to vehicles in 1934, when it was designated an Ancient Monument. The whole area of Iron Bridge Gorge was designated a World Heritage Site in 1986.

Cumbrian airport takes off

Carlisle Lake District Airport has received significant investment to build a new steel-framed terminal building, which will allow the facility to begin commercial flights this summer.

The terminal building's upper floor will accommodate offices

FACT FILE
Terminal Building, Carlisle Lake District Airport
Main client: Stobart Group
Architect: Ashton Smith Associates
Main contractor: Stobart Rail & Civils
Steelwork contractor: Border Steelwork Structures
Steel tonnage: 700t

Recognised as the gateway to the Lake District and southern Scotland, Carlisle has received a £4.95M boost to its connectivity as the city's airport gets a significant upgrade.

The Cumbria Local Enterprise Partnership (LEP) has provided the investment, which is being used to improve the runway and build a new terminal building.

The work has also proven to be the catalyst for the Stobart Group, which owns and operates Carlisle Lake District Airport, to announce that it plans to begin commercial flights to London Southend Airport, Belfast and Dublin from 4 June.

Cumbria Chamber of Commerce CEO and Board Member of Cumbria LEP Rob Johnston says: "Carlisle Lake District Airport is crucial to Cumbria's growth ambitions. It is a key strategic asset for the county. Developing the airport's passenger offer will play an important role in maximising Cumbria's tourism potential, as well as allowing easier business travel to and from the county."

It is also hoped the airport will aid wider economic growth, and reinforce the county's position in the nuclear and renewable energy sectors, as the facility has the potential to become a regional logistics hub.

This is borne out by the fact that a 21-acre distribution scheme, known as Eden Park, has begun on a previously unused part of the airfield.

The terminal is 60m long and has two floors

So far one Stobart-owned steel-framed air freight distribution centre has been completed, but several more, ranging in size from 1,400m² to 30,000m², are planned in the near future.

A new roundabout on the A689 and an access road have been completed to serve the initial distribution centre amenities, which will also link to the new terminal.

Construction work at the airport began towards the end of last year with completion set for the end of May. As well as resurfacing the 1,800m-long runway, the works consist of the construction of a new steel-framed terminal building along with associated aprons, taxiways, car parking and a new airport access road.

Located on a previously unused part of the airfield, the new two-storey terminal building will accommodate offices on the upper level, with the arrivals/departures lounge, baggage area and a cafe on the ground floor.

Inclement winter conditions did not prevent the steel completing on time

Sat on pad foundations, the terminal building was always going to be a steel structure according to Stobart Rail & Civils Project Manager Roy Hill.

"A steel portal design was the preferred method because of the project's location and for the speed of construction."

Border Steelwork Structures has been employed as the design and build contractor for the building, as well as the flooring, roofing and cladding installer.

Highlighting the speed and ease of the steel construction process, the entire frame was erected in less than two weeks and all of the beams and columns were transported to site from Border's fabrication yard in Annan in just two truckloads.

The structural frame uses a composite design with steelwork supporting steel metal decking and a 150mm-deep concrete floor topping. The building's 457UC perimeter columns are spaced at 6m centres and the overall dimensions of the structure are 60m-long x 18m wide.

The majority of the internal steelwork will be left exposed along with soffits and services – positioned below the first-floor slab - giving the facility an industrial look.

The upper floor has a clear 18m-span, offering column-free flexible modern office space, while the ground floor has a central row of internal columns positioned at mid-span, creating the most cost-efficient design for the building.

Once the composite steel frame, metal decking and roofing were installed, Border then created a full watertight envelope by cladding the elevations with Kingspan insulated wall panels.

"The panels are an anthracite colour and the cladding creates curved corners at each end of the building to form the desired modern crisp-looking structure," explains Ashton Smith Associates Project Architect Rob Brown.

Summing up, Stobart Group Head of Corporate Projects Kate Willlard says: "We are working with our partners to develop packages and promotions to make sure that our air services match the needs of our visitor.

"We will then be able to attract more visitors to Cumbria and the surrounding area and support the local economy through the development of a sustainable airport."

Airport history

Carlisle Airport began life in 1941 as RAF Crosby-on-Eden, a base used to provide day training for Hawker Hurricane pilots.

After the war it closed and the airfield was returned to Carlisle City Council. After a refurbishment programme in the 1960s commercial flights were offered to London, the Channel Islands and Belfast.

These flights ceased in 1994 and the airport was sold to Haughey Airports on a 150-year lease in 2000.

In 2006 Haughey Airports was acquired by WA Developments, which had acquired Eddie Stobart, the UK's largest haulage contractor, in February 2004. Haughey Airports was renamed Stobart Air, a sub-division within WA Developments. The airport was then re-branded Carlisle Lake District Airport.

The initial steel elements are erected

Steel leaves hospital design in good health

The flexibility of steelwork has come to the fore on a hospital project where an expandable and adaptable design has been successfully used.

FACT FILE
Circle Health private hospital, Edgbaston, Birmingham
Main Client: Circle Health
Architect: Bryden Wood
Main contractor: Simons Group
Structural engineer: Bryden Wood
Steelwork contractor: Caunton Engineering
Steel tonnage: 925t (Phases One & Two)

Rising up on the site once occupied by Birmingham's BBC Pebble Mill studios, a new private hospital is quickly taking shape.

The £21.5M facility, located in the heart of what has been dubbed Edgbaston's Medical Quarter, is the latest addition to Circle Health's portfolio which includes hospitals in Bath, Nottingham and Reading.

Utilising a steel-framed design sat atop a concrete podium containing a car park, the hospital is based around an expandable model which can be adapted and enlarged to meet clinical demand now and in the future.

Being constructed over two phases, the hospital will include three operating theatres (expandable to five), an endoscopy procedure room, recovery gym, and in-patient bedrooms.

Circle's Health's Chief Executive, Paolo Pieri, says: "This state-of-the-art hospital will bring to Birmingham the high-quality care and excellent hospitality for which Circle Health is well-known, and is an important part of Circle's strategy to add scale to the group. The intention is also to add a significant number of beds for physical and neurological rehabilitation, along with the latest rehabilitation technology."

The key aspect of the architect's design approach has been to create a form of 'adaptive architecture', giving the client the ability to adapt the building as their needs change.

Bryden Wood Director Paul O'Neill explains: "In this instance, we have the ability to double the size of the initial phase, harnessing advanced construction techniques causing minimal disruption. This future-proofing makes this hospital highly adaptable and cost-effective. This provides our client with a building, which can be adaptable to their business plan as it evolves and responds to local demand throughout its lifetime.

"Our approach has meant that the future

The main block sits atop a car park podium

incorporation of rehabilitation services into the scheme is made possible. It shows that it is essential to rethink healthcare design, and there is a clear need to provide spaces to be continuously adaptable to the future needs of healthcare requirements and technology. Circle Health successfully responds to these challenges," he said.

Phase One, which amounted to some 550t of steel and 6,885m² of metal decking, which was supplied to steelwork contractor Caunton Engineering by Composite Profiles, was completed at the end March. Phase Two, which will add another 375t of steel and a further 6,200m² of metal decking, will begin in May.

"A second phase was always on the cards during the initial design, but it only became a reality once the construction programme got under way," explains Simons Group Project Manager Stuart Partlow. "It's not necessarily ideal to have Phase Two steelwork being erected above areas that are already erected and occupied by other trades, but we will have a suitable logistical working plan in place."

As far as the project's Phase One steelwork is concerned it has been designed to accept further phases. As well as having slightly larger members than would ordinarily be needed, Caunton has pre-welded a series of stubs to the top of the uppermost columns and beams. This will allow the easy installation of Phase Two steelwork members.

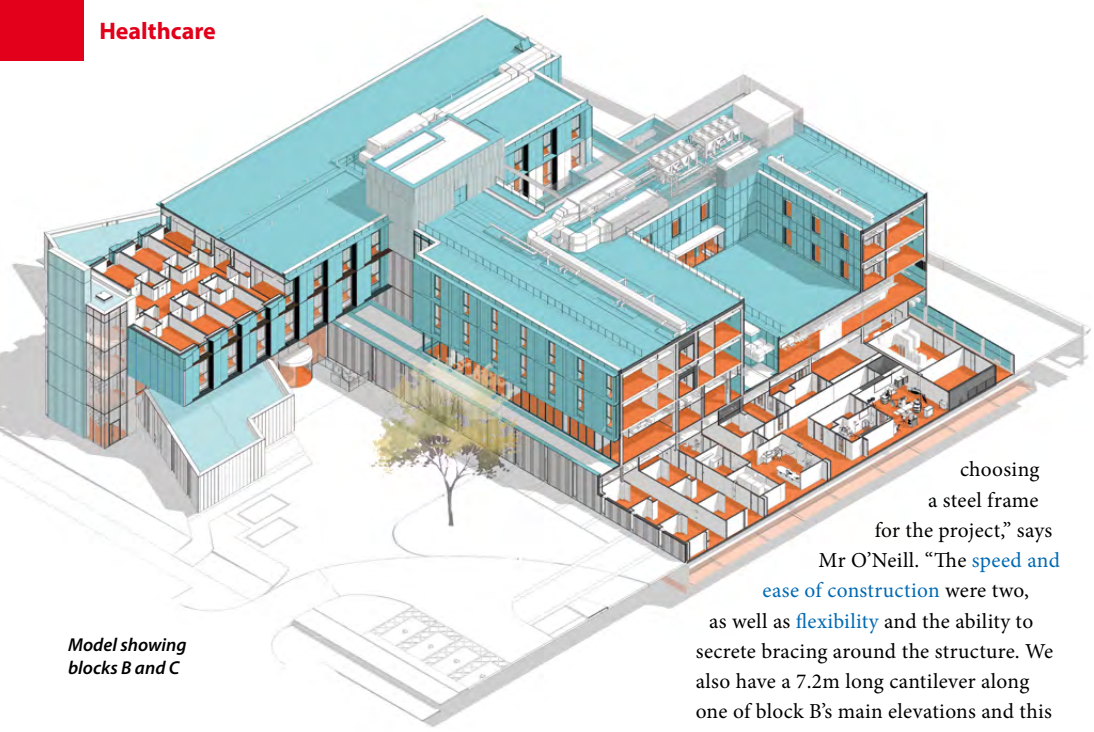
The hospital consists of three blocks, with the main building known as block C measuring 75m-long × 32m-wide. Sat entirely above the concrete podium, this structure's steel grid pattern has been dictated by concrete columns forming the car park below.

Its ground floor will accommodate the operating theatres, recovery rooms and X-ray department. Also included in the initial steelwork phase, a first-floor plant area has been erected that covers just under half of block C's footprint.

To accommodate Phase Two, a number of transfer beams have been included along the ground floor ceiling to support the column grid change for a first-floor rehabilitation gym that will cover the area adjacent to the plant area. Because of the need to have a large column grid for the exercise equipment, the grid changes from a 7m × 15m pattern to a 15m × 15m formation.

Phase Two will also include a block C second floor, where the grid pattern

▶26



Model showing blocks B and C

▶25 will change yet again to accommodate 60 patient bedrooms.

Attached to one end of block C, block B is 40m-long × 20m-wide and will accommodate the hospital's main public areas, such as the main entrance and a ground floor café/restaurant, with the first floor used entirely for administrative offices. Also included in the first phase is block B's second floor, which will contain 24 patient bedrooms.

"There were a number of reasons for choosing a steel frame for the project," says Mr O'Neill. "The speed and ease of construction were two, as well as flexibility and the ability to secrete bracing around the structure. We also have a 7.2m long cantilever along one of block B's main elevations and this would have been difficult to build in anything other than steel."

As well as being a highly architectural part of block B's design, the cantilever also increases the floorplate for the second-floor bedrooms. It will also carry on up to include a further floor to be added in Phase Two, while another – fourth level – could even be added in the future.

"We had to work collaboratively with the engineer and the contractor to design and then work out the best position for the temporary works, needed to support the cantilever during both phases of the construction programme," explains Caunton Engineering Contracts Manager Michael Firth.

Adjoining block B is block A, which measures 30m-long × 15m-wide. Used entirely for consulting rooms, this block will remain as a single-storey structure, although it has been designed to be extended to the rear to add up to 10 additional consultation rooms, again exemplifying steel construction's flexibility.

Phase One of the project is due to complete by early 2019.

Cantilevers help to enlarge block B's floorspace

Future-proofing

Richard Henderson of the SCI discusses designing buildings for future phases of development

Expanding businesses often require extensions to premises or process plant. The amount of disruption caused by such extensions depends on the degree of forethought that has been applied to them. If development is ad-hoc and haphazard, the structural work required to realize the extensions may be inefficient and messy whatever are the materials of construction.

If the extensions can be foreseen, the structure can be designed for the anticipated final state and the elements sized for the final loads. Thus, to allow for an upward extension, foundations and columns can be designed to carry the floors which are to be added in the future. Provision must also be made in the size of utility supply, space for future plant, sizing of ducts and circulation (eg the capacity of escape stairs must be sufficient for the future). Such provisions can be effective if the future needs of the business can be anticipated with confidence. The issues are clearly less significant if site constraints are such that expansion can be made sideways instead of upward.

Potentially the most impacted area of a building subject to future extension is the building envelope which clearly must provide an efficient enclosure at the end of the first phase and be capable of being made weathertight when the building is extended.

The Circle health project was conceived in two phases, presumably with the second phase to be built after the first was completed. It seems that the building was designed as a whole and the Phase One structure sent for fabrication with some provision made to reduce the disruption of the future connections of the Phase Two steelwork – namely stubs welded to beams and columns on the highest level of Phase One.

The second phase was given the go-ahead before completion of the first so that erection of the Phase Two steelwork is taking place concurrently with work by following trades on Phase One. The short interval between the erection of Phases One and Two probably rendered the stubs superfluous but such is the impact of reacting to rapid changes in business requirements.

The resistance of cross sections subject to shear and bending – theoretical analysis and practical design rules

Sections subject to both bending and shear have a reduced bending resistance where the shear force is greater than half the shear resistance. Richard Henderson of the SCI discusses the background and design rules.

Work carried out between 1930 and 1965 on the resistance of cross sections capable of being designed plastically was presented by Baker, Horne and Heyman[1]. Theoretical treatments of the effect of shear force on the resistance moment of sections were developed and were subsequently compared with tests. The design rules presented in BS 5950-1:2000 and subsequently in BS EN 1993-1-1 were based on this work.

Horne[2] examined rectangular and I sections and developed expressions for the reduction in the bending resistance of cross sections where the sections are subject to both bending and shear. In the examination, the sections are assumed to be capable of carrying their full plastic moment: sections are assumed to be restrained from global buckling and I sections are either class 1 or class 2 according to EC3.

Rectangular Section

A rectangular section will carry a bending moment equal to its elastic moment of resistance where only the extreme fibres reach yield stress. The remainder of the cross section is able to resist a shear force. The shear stress distribution is parabolic over the depth of the section and is zero at the extreme fibres with a maximum value at the neutral axis. The average shear stress is two thirds of the maximum value. If the bending moment is increased above the elastic moment of resistance, the area of the section available to resist shear is reduced until it vanishes when the plastic moment of resistance is reached. At this point, the whole section reaches its yield stress. The plastic resistance moment of the section is $M_p = (bh^2/4)f_y$, and its plastic shear resistance is $V_y = bh\tau_y$ if the bending and shear are each considered on their own.

When the bending moment is between the elastic and plastic moment of resistance, the elastic core of the section has a depth y_o above and below the neutral axis and $y_o < h/2$ where h is the depth of the section. The resistance moment is given by the sum of the plastic moment of resistance of the outer portion and the elastic moment of resistance of the core:

$$M = b/4(h^2 - 4y_o^2)\sigma_y + 2/3by_o^2\sigma_y$$

and the shear resistance is provided by the core and given by $V = 4/3by_o\tau_y$.

Eliminating y_o and using the expressions for M_p and V_p gives:

$$M_{pr}/M_p = 1 - 3/4(V/V_p)^2 \qquad (1)$$

M_{pr} is the reduced plastic moment of resistance in the presence of shear. The expression is valid for values of V up to that for which $y_o = h/2$ ie $V/V_p \le 2/3$.

Horne showed that using the Tresca yield criterion, a less conservative estimate is given by $M_{pr}/M_p = 1 - 0.444(V/V_p)^2$ provided $V/V_p \le 0.792$.

The interaction between shear and bending according to this expression is shown in Figure 1

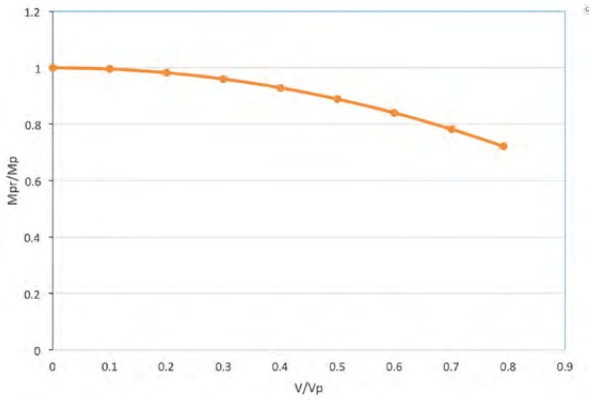


Figure 1: Interaction of shear and bending – Rectangular section

According to the less conservative estimate, the bending resistance of the section is about 89% of the plastic resistance moment when the shear force is half the shear resistance.

I Section

A similar analysis can be made of an I section, if the shear stresses are assumed only to be in the web. The plastic resistance moment of the web is denoted by $M_{pw} = (d_w^2 t_w/4)\sigma_y$ and the shear resistance by $V_{pw} = d_w t_w \tau_w$, where d_w and t_w are the depth and thickness of the web. Using equation 1, the reduced plastic moment is given by:

$$M_{pr} = M_p - 3/4(V/V_{pw})^2 M_{pw}.$$

This equation is valid provided $V/V_{pw} \le 2/3$ which means that the plastic zones in the section extend beyond the flanges and into the web.

Horne and Morris[3] discussed the effect of shear force on the plastic moment, assuming the web of the I section provides all the shear resistance and the shear stress τ_w is assumed to be uniform over the depth of the web. The longitudinal bending stress in the web is reduced because of the presence of the shear stress to a value which can be determined using the Von Mises yield criterion: $\sigma_w = [f_y^2 - 3\tau_w^2]^{0.5}$. The reduction in longitudinal bending stress in the web results in a reduced bending resistance given by:

$$M_{pr} = M_p - M_{pw}[1 - \{1 - (V/V_{pw})^2\}^{0.5}]$$

The interaction between the bending moments and the ratio of the applied shear force and shear resistance is shown in Figure 2.

▶28

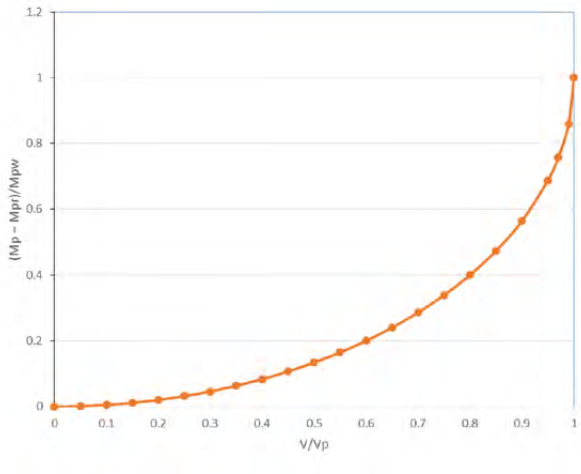


Figure 2 Effect of shear force on plastic moment of resistance of an I section

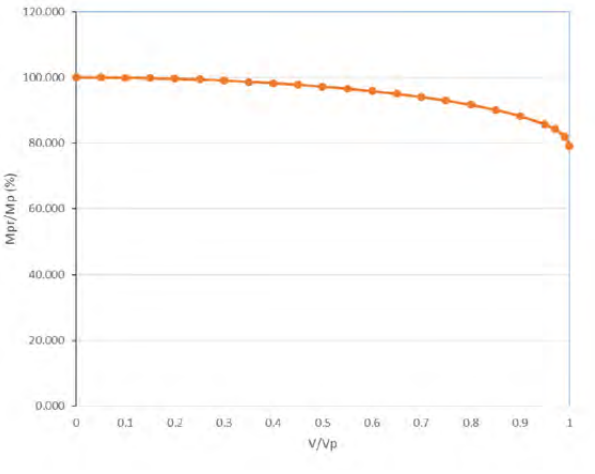


Figure 3 Reduction in plastic resistance moment for increasing ratio of shear force to shear resistance

▶27 The value of $(M_p - M_{pr})/M_{pw}$ where the shear force is half the shear resistance of the web is 0.134. The reduction in plastic bending resistance of the section is therefore about 13% of the plastic bending resistance of the web. For a 400 mm deep I section with 180 mm wide flanges 15 mm thick and an 8 mm thick web, the reduction in the full plastic bending resistance is only 3% under a shear force of half the shear resistance of the web. Figure 3 shows the relationship between plastic resistance moment and the ratio of shear force to shear resistance of the web for the I section discussed.

If bending about the minor axis of an I section is considered the behaviour is similar to a rectangular section and the shear stress is distributed parabolically over the width of the flanges and the bending stress distribution is also non-linear. The reduced bending resistance is given by Horne and Morris as:

$$M_{pr} = M_p[1 - 0.45(\tau_w/\tau_y)^2]$$

where τ_w is the shear stress calculated on the area of the flanges. If the shear force on the section is half the shear resistance of the flanges then the reduced resistance moment is about 89% of the full plastic resistance moment ie as found earlier.

Results of tests and design rules

Despite the foregoing analysis, the results of tests and also of advanced theory shows that there is no reduction in the resistance moment due to the presence of shear unless the shear force approaches the shear resistance of the section. This is because the portions of a beam section which are subject to both high shear and high bending stresses are limited in extent and are surrounded by elastic zones so plastic flow is largely prevented. The locations in a structure where both bending and shear may be significant are limited: the root of a cantilever and at the central support of a two–span beam are two possible locations.

The design rules in BS 5950-1:2000 and BS EN 1993-1-1 adopt a safe approach to the effect of shear force on the resistance moment and allow the full plastic resistance moment to be used in conjunction with a shear force of up to half the shear resistance of a beam. In fact BS 5950 was slightly more generous than EC3 and no reduction in bending resistance was required for shear force up to 60% of the shear resistance. The contribution of the shear area of the section to the bending resistance is reduced when the shear force on the section exceeds half the shear resistance. Figure 4 shows the percentage reduction in resistance

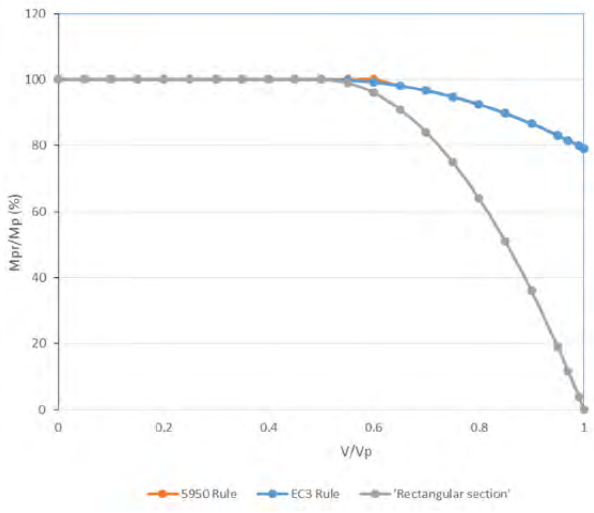


Figure 4 Reduction in resistance moment due to shear

moment according to both EC3 and BS 5950 for the 400 mm deep beam. The difference in the treatment is insignificant.

The reduction in minor axis bending resistance when the section is subject to a shear force is also shown in Figure 4, labelled Rectangular Section. Unlike the I section, the bending resistance reduces significantly under high shear and reduces to zero when the shear force reaches the shear resistance because the maximum shear stress of $f_y/\sqrt{3}$ is present over the full extent of the flanges. This effect also applies to rectangular sections. For a Tee section, the stem of the Tee provides the shear resistance but also develops longitudinal stresses to provide the bending resistance. These stresses are reduced in the presence of shear in a similar way to those in a rectangular section.

References

1 Sir John Baker, M R Horne and J Heyman, The Steel Skeleton, Volume Two, Plastic behaviour & design, 1956, Cambridge University Press

2 M R Horne, Plastic theory of structures, 1979, Pergamon Press

3 M R Horne and L J Morris, Plastic design of low resistance rise frames, 1981, Granada Publishing

AD 417: Resistance of sections to combined shear and bending

This Advisory Desk note reminds designers that the form of the section has a significant impact on the reduction of bending resistance under high shear.

Clause 6.2.8 of BS EN 1993-1-1:2005 deals with the resistance of cross sections to combined bending and shear and first of all states:

(1) Where the shear force is present allowance should be made for its effect on the moment resistance.

It then goes on to say:

(2) Where the shear force is less than half the plastic shear resistance its effect on the moment resistance may be neglected except where shear buckling reduces the section resistance, see EN 1993-1-5.

(3) Otherwise the reduced moment resistance should be taken as the design resistance of the cross-section, calculated using a reduced yield strength … for the shear area.

The reduced yield strength depends on the ratio of design shear force to the shear resistance of the section.

For an I section, the shear area approximates to the area of the web and the flanges still provide their full resistance moment so the reduction in bending resistance may not be more than about 20% when the design shear force equals the shear resistance. For a rectangular section, the full section forms the shear area so the bending resistance reduces to zero under the same circumstances. A Tee section would also behave in a similar way.

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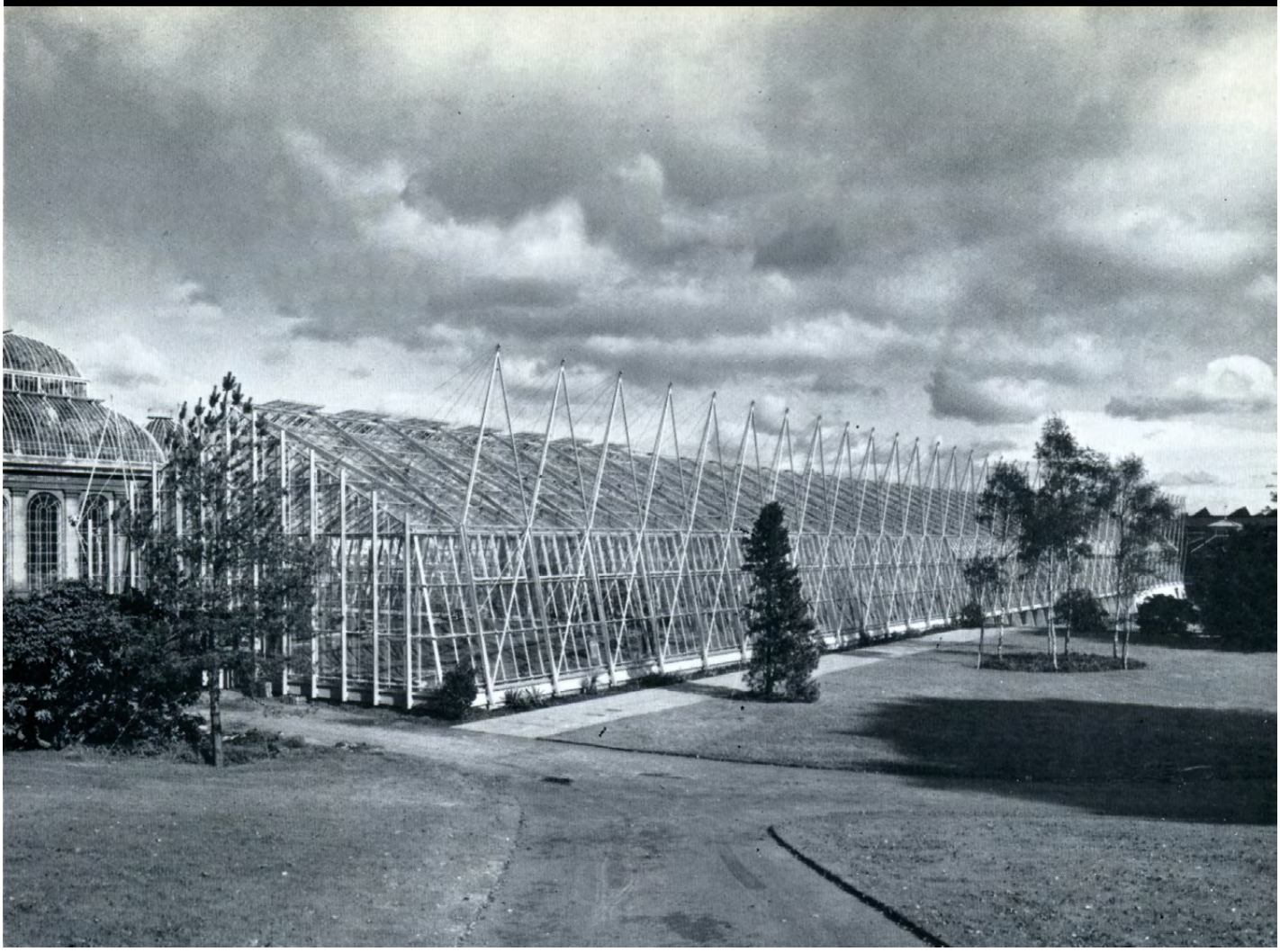

General view from the west of the main exhibition plant house

New plant houses have been built 'inside out'

The new exhibition plant house and orchid house at the Royal Botanic Garden, Edinburgh, are structures of unusual shape and design. The buildings have been erected 'inside-out' with the supporting structures outside the glazing to protect them from the corrosive conditions normally existing in plant houses.

Designed by the Ministry of Public Building and Works they are unique buildings which have no internal framework and which depend for support on an intricate external structure of steel tubes and cable from which the glass is suspended.

The design has enabled exotic plants to be displayed in a natural setting on a scale never before achieved in a glasshouse anywhere and it has also minimised the risk of corrosion common to ferrous metals in plant houses.

The new main exhibition house is a single structure encompassing the entire plant area. It is sub-divided into five compartments of differing climatic environments and has an orchid house adjacent to it.

Their spans are 60 ft and 50 ft and their lengths 420 ft and 100 ft respectively. The height to the eaves is 15 ft and to the ridge 28 ft with 36 ft to the large centre section.

The buildings have been erected from east to west for maximum daylight and are intercommunicating with access to the existing Victorian Palm House. The single-span structure gains height in the centre environment by taking advantage of the existing site levels. This permits changes of level to accommodate larger plants and encourages the illusion of natural landscaping.

Preliminary design studies showed that a structural solution of this sort would produce minimum shadow and light interference to the plants inside and at the same time produce an architectural result pleasing and well suited to its position in the Royal Botanic Garden. Initially, the structure was conceived as a three-pinned portal of tubular steel members, but as the scheme developed a more subtle shape emerged which may be described as a 'suspended portal frame'.

This structure, which had to be as light as possible, is a mixture of basic portal frame and a suspension-type structure in which the action of the suspenders relieves the high bending moments in the rafter members, thereby allowing a considerable reduction in their section sizes.

The side framework consists of diamond-shaped lattice tetrahedra made up of light tubular members which project upwards above the rafters to twice the height of the eaves. The main tubular members are 3-in diameter, while the lacing members are solid bars ¾-in diameter. The rafters, which are of rectangular hollow section (RHS) 6 in. by 3 in., are prevented from sagging by the suspenders, which ride over the apex of each of the side frames. Interaction between the suspenders and the framework also provides resistance to side sway from the wind.

Suspension-type structures depend upon achieving the right forces within the suspenders to maintain them in tension under all conditions. They are prone to more movement than conventional frames and the control of this movement was very necessary because of the large glass areas involved. Because of the delicate balance of the load between the suspension action and the bending resistance of the portal frame, it was necessary to carry out a structural test on a full-scale mock-up of two bays of the framework and as a result of this a decision was taken to stiffen the rafter members. A computer was used during the structural design to establish the correct relative stiffness of portal and suspension action.

Transverse movement in the building has been taken care of by additional internal stiffening panels using aluminium members at two points in the 420 ft-length. Internally a 40-ft span prestressed concrete footbridge has been provided linking the east and west environments of the building and at the same time providing a viewing platform about 9 ft above ground level in the large central section.

High yield stress steel to BS 968 was used for the whole of the structural framework, all steel being galvanized by hot dipping. This produced a practical problem with the vertical tetrahedra since they were too large to be dipped in one piece. This was resolved by making each frame in two pieces. The protection at the joint was made good after welding with two coats of zinc-rich paint. The suspenders were all of ¼ in diameter and because of maintenance difficulties were made from stainless steel wire EN 58 to BS 1554. All external steelwork other than the wires is treated with aluminium paint to provide additional protection and for aesthetic reasons.

A revealing shot of the interior

The Royal Botanic Garden, one of the world's main centres of knowledge and practice in its sphere, extends to about 74 acres. It is visited annually by more than half a million people.

Its foundation dates back to 1670, which makes it the second oldest botanic garden in Britain. the oldest, founded in 1621, is in Oxford. The primary task of the Edinburgh Garden is botanical research, especially research in that branch of botany known as taxonomy, which comprises the accurate identification of plants and their classifications, affinities and distribution.

More than one and a half million plant specimens are kept in the Herbarium at the garden and its library of 40,000 volumes is one of the richest taxonomic libraries in the world.

The project was the responsibility of the Ministry of Public Buildings and Works, Scotland. Architect – G. A. Pearce, ARIBA, FRIAS, assisted by J. J. Johnson, ARIBA: Structural Engineers – L. R. Creasy, OBE, BSc(Eng), MICE, MIStructE, F. W Walley, MSC, MICE, H. E Mills, AMIStructE.

New and revised codes & standards

From BSI Updates March 2018

BS EN PUBLICATIONS

BS EN ISO 11126-10:2017
Preparation of steel substrates before application of paints and related products. Specifications for non-metallic blast-cleaning abrasives. Almandite garnet
Supersedes BS EN ISO 11126-10:2004

BS EN 12681-1:2017
Founding. Radiographic testing. Film techniques
Supersedes BS EN 12681:2003

BS EN 12681-2:2017
Founding. Radiographic testing. Techniques with digital detectors
Supersedes BS EN 12681:2003

BS EN ISO 12944-7:2017
Paints and varnishes. Corrosion protection of steel structures by protective paint systems. Execution and supervision of paint work
Supersedes BS EN ISO 12944-7:1998

BS EN 15773:2018
Industrial application of powder organic coatings to hot dip galvanized or sherardized steel articles (duplex systems). Specifications, recommendations and guidelines
Supersedes BS EN 15773:2009

BS EN ISO 22825:2017
Non-destructive testing of welds. Ultrasonic testing. Testing of welds in austenitic steels and nickel-based alloys.
Supersedes BS EN ISO 22825:2012

BRITISH STANDARDS REVIEWED AND CONFIRMED

BS EN 1677-3:2001+A1:2008
Components for slings. Safety. Forged steel self-locking hooks. Grade 8

BRITISH STANDARDS WITHDRAWN

BS EN ISO 11126-10:2004
(BS 7079-F10:2004)
Preparation of steel substrates before application of paints and related products. Specifications for non-metallic blast-cleaning abrasives. Almandite garnet
Superseded by BS EN ISO 11126-10:2017

BS EN 12681:2003
Founding. Radiographic examination
Superseded by BS EN 12681-1:2017 and BS EN 12681-2:2017

BS EN ISO 12944-4:1998
Paints and varnishes. Corrosion protection of steel structures by protective paint systems. Types of surface and surface preparation
Superseded by BS EN ISO 12944-4:2017

BS EN 15773:2009
Industrial application of powder organic coatings to hot dip galvanized or sherardized steel articles (duplex systems). Specifications, recommendations and guidelines
Superseded by BS EN 15773:2018

BS EN ISO 22825:2012
Non-destructive testing of welds. Ultrasonic testing. Testing of welds in austenitic steels and nickel-based alloys
Superseded by BS EN ISO 22825:2017

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
- **S** Lighter fabrications including fire escapes, ladders and catwalks

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			●	●					●	●			●	●		3			Up to £400,000
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 £4,000,000
Adstone Construction Ltd	01905 794561			●	●	●	●									✔	2	✔	●	Up to £3,000,000
Advanced Fabrications Poyle Ltd	01753 653617				●	●	●	●		●	●			●	●	✔	2			Up to £800,000
AJ Engineering & Construction Services Ltd	01309 671919			●	●		●		●	●	●			●	●	✔	4			Up to £3,000,000
Angle Ring Company Ltd	0121 557 7241												●			✔	4			Up to £1,400,000*
Apex Steel Structures Ltd	01268 660828					●	●			●	●			●	●		2			Up to £2,000,000
Arc Fabrication Services Ltd	01709 557654			●	●	●	●	●	●	●	●			●	●		3			Up to £40,000
Arminhall Engineering Ltd	01799 524510	●			●	●		●		●	●			●	●	✔	2			Up to £800,000
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				●	●	●	●		●	●			●	●	✔	4		●	Up to £4,000,000
Atlasco Constructional Engineers Ltd	01782 564711			●	●	●	●			●	●			●	●	✔	2			Up to £1,400,000
Austin-Divall Fabrications Ltd	01903 721950			●	●		●	●		●	●			●	●	✔	2			Up to £1,400,000
B D Structures Ltd	01942 817770			●	●	●	●				●	●		●	●	✔	2		●	Up to £1,400,000
Ballykine Structural Engineers Ltd	028 9756 2560			●	●	●	●	●				●				✔	4			Up to £1,400,000
Barnshaw Section Benders Ltd	0121 557 8261												●			✔	4			Up to £1,400,000
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 £6,000,000
Builders Beams Ltd	01227 863770			●	●	●	●			●	●			●	●	✔	3	✔		Up to £3,000,000*
Cairnhill Structures Ltd	01236 449393	●			●	●	●	●	●	●				●	●	✔	4		●	Up to £4,000,000
Caunton Engineering Ltd	01773 531111	●	●	●	●	●	●	●		●	●	●		●	●	✔	4	✔	●	Above £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 £1,400,000
D H Structures Ltd	01785 246269			●	●		●				●						2			Up to £40,000
D Hughes Welding & Fabrication Ltd	01248 421104				●	●	●	●		●	●		●	●	●	✔	4			Up to £800,000
Duggan Steel	00 353 29 70072		●	●	●	●	●	●	●	●	●	●			●	✔	4			Up to £6,000,000
ECS Engineering Services Ltd	01773 860001	●		●	●	●	●	●	●	●	●			●	●	✔	3			Up to £3,000,000
Elland Steel Structures Ltd	01422 380262		●	●	●	●	●	●	●	●	●	●		●		✔	4	✔	●	Up to £6,000,000
ESL (GB) Ltd	01482 787986	●					●	●	●	●	●	●	●	●	●	✔	4			Up to £400,000
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
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)
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
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				●	●									●		4			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 £6,000,000
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 £1,400,000
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			●	●	●	●				●						3			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 £2,000,000
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								●		●			●	●	✔	3			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			●	●	●	●		●	●	●			●	●		3			Up to £1,400,000
Rippin Ltd	01383 518610			●	●	●	●	●						●	●		2			Up to £1,400,000
Robinson Structures Ltd	01332 574711			●	●	●	●				●			●	●	✔	3			Up to £3,000,000
S H Structures Ltd	01977 681931	●			●		●	●	●	●	●	●			●	✔	4	✔	●	Up to £2,000,000
SAH Engineering Ltd	01582 584220			●	●	●				●	●			●	●		2			Up to £800,000
SDM Fabrication Ltd	01354 660895	●	●	●	●	●	●				●			●	●	✔	4			Up to £2,000,000
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 £3,000,000
Snashall Steel Fabrications Co Ltd	01300 345588			●	●	●	●	●			●				●		2	✔		Up to £1,400,000
South Durham Structures Ltd	01388 777350			●	●	●				●	●	●			●		2			Up to £1,400,000
Southern Fabrications (Sussex) Ltd	01243 649000				●	●				●	●			●	●	✔	2			Up to £800,000
Steel & Roofing Systems	00 353 56 444 1855			●	●	●	●					●		●	●	✔	4			Up to £3,000,000
Taunton Fabrications Ltd	01823 324266				●					●				●	●	✔	2		●	Up to £2,000,000
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			●	●	●	●	●	●		●			●	●	✔	3	✔		Up to £2,000,000
TSI Structures Ltd	01603 720031			●	●	●	●	●			●			●			2	✔		Up to £2,000,000
Underhill Engineering Ltd	01752 752483				●		●	●	●	●	●			●	●	✔	4	✔		Up to £3,000,000
W I G Engineering Ltd	01869 320515				●					●					●	✔	2			Up to £400,000
Walter Watson Ltd	028 4377 8711			●	●	●	●	●				●				✔	4			Above £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)**

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:

- **FB** Footbridges
- **CF** Complex footbridges
- **SG** 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	FB	CF	SG	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
AJ Engineering & Construction Services Ltd	01309 671919	●			●	●	●	●	●	●	●	✓	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 £6,000,000
Cairnhill Structures Ltd	01236 449393	●	●	●	●	●	●	●		●	●	✓	4			✓	●	Up to £4,000,000
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 £800,000
Donyal Engineering Ltd	01207 270909	●		●						●	●	✓	3			✓	●	Up to £1,400,000
ECS Engineering Ltd	01773 860001	●			●	●	●		●		●	✓	3					Up to £3,000,000
ESL (GB) Ltd	01428 787986									●	●	✓	4			✓		Up to £400,000
Four-Tees Engineers Ltd	01489 885899	●			●	●	●		●	●	●	✓	3			✓	●	Up to £2,000,000
Had Fab Ltd	01875 611711									●	●	✓	4					Up to £3,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445	●				●				●	●	✓	4			✓	●	Up to £6,000,000
M Hasson & Sons Ltd	028 2957 1281	●	●	●	●	●	●	●			●	✓	4			✓	●	Up to £2,000,000
Millar Callaghan Engineering Services Ltd	01294 217711	●						●		●	●	✓	4			✓		Up to £1,400,000
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
Shaun Hodgson Engineering Ltd	01553 766499									●	●	✓	3			✓		Up to £800,000
Taziker Industrial Ltd	01204 468080	●			●	●	●			●	●	✓	3		✓	✓		Above £6,000,000
Underhill Engineering Ltd	01752 752483	●			●	●	●			●	●	✓	4	✓		✓		Up to £3,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	✓	4	✓	✓	✓	●	Above £6,000,000
Non-BCSA member																		
Allerton Steel Ltd	01609 774471	●		●	●	●	●			●	●	✓	4			✓	●	Up to £4,000,000
Centregreat Engineering Ltd	029 2046 5683	●		●	●	●	●	●	●	●	●	✓	4					Up to £1,400,000
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
Hollandia Infra BV	00 31 180 540 540	●	●	●	●	●	●	●	●	●	●	✓	4					Above £6,000,000*
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

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
Control Energy Costs Ltd	01737 556631
Gene Mathers	0115 974 7831
Griffiths & Armour	0151 236 5656
Highways England Company Ltd	08457 504030
Kier Construction Ltd	01767 640111
McGee Group (Holdings) Ltd	020 8998 1101
PTS (TQM) Ltd	01785 250706
Sandberg LLP	020 7565 7000
Structural & Weld Testing Services Ltd	01795 420264
SUM Ltd	0113 242 7390

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	BIM
AJN Steelstock Ltd	01638 555500								●		M		
Albion Sections Ltd	0121 553 1877	●									M		
Arcelor Mittal Distribution - Scunthorpe	01724 810810								●		D/I		
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 Ltd	01724 404040				●						M		
BW Industries Ltd	01262 400088	●									M		
Cellbeam Ltd	01937 840600	●									M		
Cleveland Steel & Tubes Ltd	01845 577789								●		M		
Composite Metal Flooring Ltd	01495 761080	●									M		
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		
Daver Steels (Bar & Cable Systems) Ltd	01709 880550	●									M		
Dent Steel Services (Yorkshire) Ltd	01274 607070								●		M		
Duggan Profiles & Steel Service Centre Ltd	00353 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		
Hadley Industries Plc	0121 555 1342	●									M	●	
Hempel UK Ltd	01633 874024						●				N/A		
Highland Metals Ltd	01343 548855						●				N/A		
Hi-Span Ltd	01953 603081	●									M	●	
International Paint Ltd	0191 469 6111						●				N/A	●	

Company name	Tel	1	2	3	4	5	6	7	8	9	CE	SCM	BIM
Jack Tighe Ltd	01302 880360						●				N/A		
Jamestown Manufacturing Ltd	00 353 45 434288	●									M		
John Parker & Son 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		
Lincoln Electric (UK) Ltd	0114 287 2401					●					N/A		
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		
Pipe and Piling Supplies Ltd	01592 770312	●									M		
PPG Architectural Coatings UK & Ireland	01924 354233						●				N/A		
Prodeck-Fixing Ltd	01278 780586	●									D/I		
Rainham Steel Co Ltd	01708 522311								●		D/I		
Sherwin-Williams Protective & Marine Coatings	01204 521771						●				N/A	●	
Structural Metal Decks Ltd	01202 718898	●									M	●	
StruMIS Ltd	01332 545800		●								N/A		
Stud-Deck Services Ltd	01335 390069	●									D/I		
Tata Steel – Tubes	01536 402121				●						M		
Tata Steel – ComFlor	01244 892199	●									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		


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