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NSC

March 2015
Vol 23 No 3

Race on for Gold Cup

Twin Sails Bridge revisited

Steel goes to the Ball

New home for lifeboat builders

Notts sports logistics centre

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Cover Image
Twin Sails Bridge, Poole
Main client:
Borough of Poole
Structural engineer:
Ramboll
Steelwork contractor:
Cleveland Bridge
Steel tonnage: 1,000t

NSC

March 2015 Vol 23 No 3

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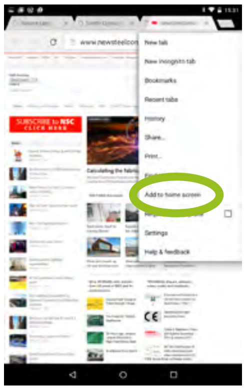


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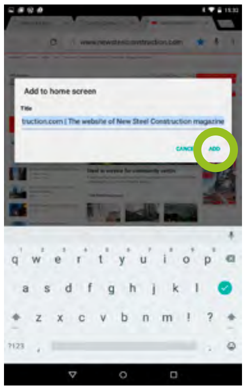
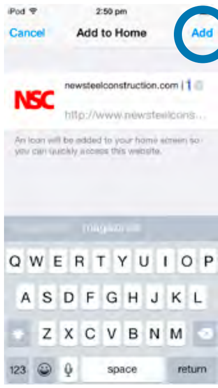

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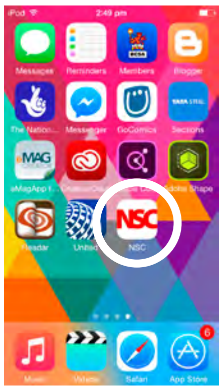

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Shaping the future for steel

Nick Barrett - Editor

Getting off the start line quickly is often key to success in racing; getting to the finish line quickly is the other key. Selecting steel for the new grandstand at the home of National Hunt Racing at Cheltenham ensured both a quick start and on time finish, as you can read in this issue.

Steel was a safe bet for the Cheltenham construction team partly because of its long span capabilities, which can be taken advantage of with maximum speed of construction and minimum disruption to the racing calendar, particularly the all important Gold Cup event being held this month. Steel construction's inherent flexibility also means that work can be halted while the Gold Cup race is run, and the next phase then gets seamlessly under way. Future extensions and reconfigurations are easily made as well.

Flexibility and long span capabilities are some of the most appreciated attributes of steel construction, which we can see elsewhere in this issue. The new InterContinental London hotel in Greenwich for example – designed to BREEAM 'Excellent' standard - incorporates spans of some 42 metres to create a 3,200m^2 column free space for what is thought to be the largest pillar free ballroom in Europe.

The flexibility delivered by the steel solution means the ballroom can be subdivided into 14 individual spaces as small as 200m^2, enhancing the marketing potential of a space that can seat up to 2,500 for lunches or dinners, or 3,000 people standing. As well as all this flexibility, steel delivered the only economical solution to the challenge of creating such a large column free space.

Long spans and flexibility come together again in the new Sports Direct distribution centre in Nottinghamshire, a 300m X 150m structure using portal frames with spans of up to 34.5m. A variety of spans are incorporated in the design to cater for the constraints of the busy site as well as the client's fit out requirements. As is common with projects in the logistics market, this was a fast track project that could only be met by taking advantage of the speed made possible by steel construction.

As well as enjoying some of London's finest views towards the Houses of Parliament, students at the new student accommodation under construction along with a new private college on Westminster Bridge Road will enjoy the benefits delivered by steel's flexibility and long span capabilities.

Steel was essential to cope with the design's long spans, especially in the central atrium area. The client also values the built in flexibility that means classrooms can be configured in line with changing needs. Working in such a congested inner city area is all the more easier thanks to offsite fabrication and just-in-time delivery.

Congratulations if you are lucky enough to back this month's Gold Cup winner; the more certain bet for the projects highlighted in NSC this month though was to choose steel.

NSC

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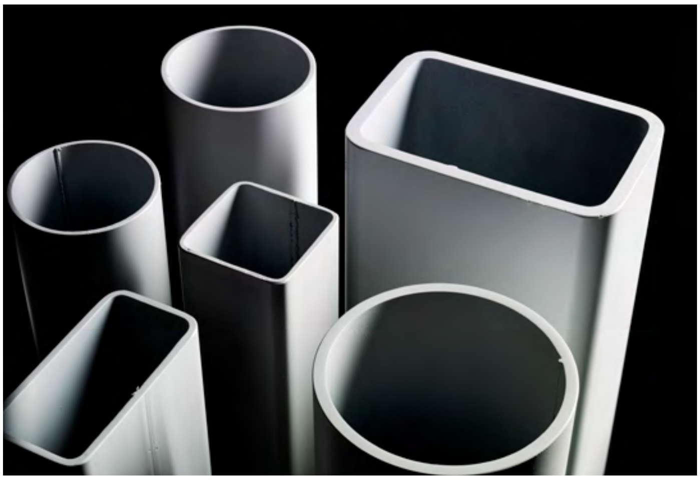
New structural steel tube from Tata Steel



Tata Steel has launched Celsius® 420, a stronger hot-finished structural steel hollow section that reduces the weight of mechanical products and can speed up the construction of new buildings.

This next-generation in hot finished structural steel, developed in conjunction with construction customers primarily for use in applications where structural performance at minimum weight is required, Celsius® 420 represents innovative advances in steel manufacturing.

Tata Steel Chief Commercial Officer in Europe Henrik Adam said: "Our Celsius® range is already very well established in the structural hollow sections market. But we know our customers are constantly on the look-out for new materials with enhanced properties, which is why we focus so much on innovation to develop next-generation products.

"In Celsius® 420 we're bringing to market an entirely new range of hot-finished hollow structural sections that we think is in a class of its own."

Tata Steel says the steel used to make Celsius® 420 hollow sections has a high yield strength (420 megapascals), which enables structural engineers to reduce the weight of the structural hollow sections they use by up to 17%.

The chemical properties of Celsius® 420 steel ensure it can be easily welded, despite its additional strength. This property – unique in high-strength tube products – means high-strength structures can be fabricated without changing standard weld procedures.

Tata Steel Head of Marketing, Construction & Infrastructure for European operations Jonathan Clemens, said: "Being a hot-finished welded product with added strength, Celsius® offers customers big advantages through lower material costs, good weldability and improved performance because of the high degree of uniformity in wall thickness."

The Celsius® 420 range of circular, rectangular, square and elliptical hollow sections is now in production and available to the market. The sections are made from strip produced at Tata Steel's plants in south Wales, which is formed into hot-finished tubes at the company's Hartlepool and Corby mills in the UK.

Steel to kick start Manchester and Salford regeneration scheme

On the site of the former Manchester Exchange railway station, famous for having the world's longest platform, a multi-million pound regeneration scheme is about to reinvigorate the boundary between the north-west's twin cities of Manchester and Salford.

Known as Greengate Embankment, the scheme centres on the old station and Manchester Cathedral and will ultimately deliver a host of retail, commercial and residential buildings, alongside new public realms and a new footbridge spanning the River Irwell.

One of the first parts of the project to get under way is a three-storey steel-framed car park constructed within the footprint of the old Exchange station and adjacent 12-storey steel-framed Grade A office development.

Steelwork erection is due to begin in April and be complete by the end of the year. Elland Steel Structures will fabricate, supply and erect approximately 3,000t of steel for the project.

Greengate Embankment is a joint development between Ask Developments and Network Rail that will regenerate a long-neglected and underused site into a vibrant new residential, retail and business destination right in the centre of two cities.

A brace of steel-framed schools for South Wales

ISG and architect Stride Treglown's Agilis schools template has been selected by Vale of Glamorgan County Council to deliver a further two new primary schools with a combined value of £5.5M.

ISG's first Agilis project for the council was successfully handed over last year, with Ysgol Gymraeg Nant Talwg in Barry becoming the first template school to be delivered in Wales. The steelwork for this school was erected by Overdale Construction Services.

Following this success, the Agilis template will be used for the new £2.2M Ysgol Gymraeg Dewi Sant primary school in Llantwit Major and the £3.3M Oak Field Primary in Barry.

Ysgol Gymraeg Dewi Sant will be constructed on the site of an existing school, which will remain operational throughout the programme. The 210 pupil, single-storey steel-framed school will be constructed on a sloping site with a central learning zone leading to eight classrooms and a flexible sports/dining hall space.

The flexible Agilis template will be modified at Oak Field Primary School, creating a two-storey building that addresses the restrictions of a confined site.

The new steel-framed building will sit on piled foundations and feature a double height hall and central learning zone, with classrooms positioned around these spaces at both ground and first floor level.

Cabinet Member for Children's Services, Cllr Chris Elmore said: "It is a truly exciting time for education in the Vale of Glamorgan. The new Llantwit major learning community and the redevelopment of Oak Field Primary School provide opportunities to deliver 21st Century facilities across the primary and Welsh language sectors of education.

Both schools are scheduled for completion by September.

Cleveland Bridge to build 500 more Sri Lankan bridges

Darlington based steelwork contractor Cleveland Bridge has won a second contract to supply 537 permanent road bridges to rural locations in Sri Lanka.

The contract follows on from a similar ongoing contract, which currently involves the company fabricating, delivering and constructing a total of 210 steel composite road bridges on the island.

Working on behalf of the Sri Lankan Ministry of Economic Development, the permanent bridges for both contracts range in length from 6m to 30m, and are sent to the island nation in kit form.

Once in Sri Lanka, Cleveland Bridge is responsible for constructing abutments, erecting the steelwork and installing the concrete decks.

The initial project is due for completion in March and was commissioned to improve mobility in isolated communities. The second contract for 500 more bridges will begin later this year.

Cleveland Bridge Project Manager Rob Mcbride said: "Overseeing the project has been a pleasure and we were very happy to be able to provide our expertise to the Sri Lankan Ministry to provide permanent long lasting structures, particularly for such a potentially life-changing initiative that will provide safe roadways and walkways for local communities.

Worksop Galvanizing, part of Wedge Group Galvanizing, teamed up with Cleveland Bridge to galvanize over 2,750t of steelwork for the initial 210 road bridges.

Due to the scale of the project, Worksop Galvanizing was required to treat the components and containerise them into 14 respective shipments, with each shipment containing components categorised into 15 individual sets.

Separating the bridges in this way ensured they could be unloaded from the containers, and easily constructed onsite.

Three steel towers set to rise at Canary Wharf

Designs for an iconic 28-storey sloping office tower on one of the last remaining sites on the Canary Wharf estate have been given the go-ahead, while work has also started on a 58-storey residential tower.

The London borough of Tower Hamlets' planning committee has granted consent for the sloping 146m high building, which will be located at One Bank Street at Heron Quays West on the Isle of Dogs.

The distinctive steel diagrid building has been designed by KPF and will be constructed by Canary Wharf's own construction arm Canary Wharf Contractors.

The detailed plan contains an atrium giving the office design a wider skirt on the lower floors and roof terrace.

Cofferdam works have been ongoing at One Bank Street for some time and works started on site this January. The building is due for completion in January 2019.

French bank Société Générale has taken a pre-let for 26,000m² of the building's floor space commencing in the summer of 2019.

Meanwhile, utility diversion and preliminary site works are currently under way for the residential block, while construction of the 21-storey 10 Bank Street, another office block, is anticipated to start in January 2017.

Second renewable energy centre for Lincolnshire

Steelwork contractor Caunton Engineering is erecting its second renewable energy centre in Lincolnshire working on behalf of Burmeister and Wain Scandinavian Contractor (BWSC).

The two companies previously worked on a similar project in Sleaford (see NSC Sept/Oct 2013), where more than 1,600t of steel was erected.

The £90M Brigg project, based on the town's former British Sugar works, will generate renewable electricity using straw and woodchip as a sustainable fuel source.

Caunton is fabricating, supplying and erecting 1,300t of structural steelwork for a boiler house, turbine hall, office building, two straw barns, a straw conveyor and wood chip storage buildings.

The company is also responsible for designing connections, detailing, galvanizing, fire protection, secondary steelwork, cladding and the installation of metal decking.

The Brigg facility will generate 40MW of power on a continuous basis, equivalent to the needs of every home in North Lincolnshire.

NEWS IN BRIEF

The final part of Swindon's steel framed £16.6M Regent Circus scheme – a six-screen Cineworld – has opened completing the town centre project. Anchored by a 4,600m² Morrisons store, which opened last October, the Regent Circus development occupies a former college campus site and also includes eight smaller retail outlets and a 450 space three level car park. Steelwork for the project was erected by **Hambleton Steel**.

Plans have been revealed for the super-strength cladding that will adorn London's proposed **Garden Bridge** giving it a maintenance-free 120-year life. The £175M steel bridge has been described as a floating garden and will create a new connection across the River Thames between Temple and the South Bank. The steel superstructure will be surrounded in a copper-nickel alloy coating from its feet on the riverbed up to the base of the balustrades on the bridge deck.

Cleveland Bridge has installed a 35m-long steel box girder bridge deck at Pudding Mill Lane in east London, during a 51-hour rail possession, as part of the wider multi-million pound Crossrail scheme. The bridge will carry three rail lines (two Crossrail tracks and one Network Rail line) over the Northern Outfall, which is one of London's largest sewers and topped by a public footpath known as the Greenway.

Installation of the first of 14 new floodlight towers at the former Olympic Stadium in east London has begun. Each floodlight tower measures 18m in length, weighs 45t and will take up to 12 hours to be lifted into place. **William Hare** is undertaking the structural steel package for the project which will be the new home of West Ham United from 2016.

AROUND THE PRESS

The Structural Engineer
February 2015
Engineering the Kelpies

The structure was manufactured in SH Structures' own workshops with each adjacent frame test-matched with its neighbour prior to delivery to site, the complete structure being too large to test assemble in full. The erection on site was remarkably straightforward with a staged process involving the primary structure erected first, then the secondary structure, then the skin panels.

Construction News
13 February 2015
Rocket science for Willmott Dixon

[Rutherford Appleton Lab]
"Besides the building services, the steelwork is quite complex," says Willmott Dixon project manager Noel Cafferty. 'There are 13 high-level gantry cranes which have to be fitted to structural steel beams, and we had to plan the construction sequence so that these cranes could be installed during the steel erection."

Construction News
4 February 2015
Cheltenham Racecourse's £45m redevelopment races to festival deadline

The main frame of the building features columns in an 8 m grid with balconies being supported off the main frame using bespoke manufactured plate welded steel brackets that are fixed back through into the structure. "We used plate welded sections because of the massive loadings they are taking. The balconies weigh in at 22 tonnes across their 8 m length so it is quite a weight," Kier design manager Andy Bolas says.

Call for industry Eurocode revisionists

Industry experts are being sought to help with the Eurocodes revision which will result in a more user-friendly set of codes for the construction industry.

The Eurocodes are a set of harmonised technical rules developed for the structural design of construction works throughout Europe. Their use has grown since the existing national standards were withdrawn in 2010.

Last year a number of systematic reviews of the Eurocodes were undertaken and now it has been decided that a full-scale review, with industry help, will be launched with the end result being a revised set of codes by 2020.

"Users should find the revised Eurocodes better cover common practice, they contain fewer alternative methods, they are easier to navigate around, and there are fewer inconsistencies between them. Mistakes will hopefully be corrected, ambiguities clarified, and a number of other changes made to improve use," said Steel Construction Institute (SCI) Chief Executive Graham Couchman.

In order for the revision to be thorough and as useful as possible, industry experts are being sought to join project teams for the various construction sectors.

The British Constructional Steelwork Association (BCSA) and the SCI are involved with the revision of the Eurocodes relevant to the steel construction sector.

"We are encouraging the steel industry community to get involved and help us draft a revised set of Eurocodes that reflects current practice," said BCSA Director of Engineering Dr David Moore.

The call for candidates will go out in March / April. An assessment of prospective candidates will take place in May and all project teams should be selected and finalised by mid June. Those interested in joining a project team should contact g.couchman@steel-sci.com

Another Pancras Square development completes

The 11-storey high 6 Pancras Square building has been completed by Vinci Construction, adding another steel framed piece to the ongoing regeneration of the former industrial zone north of King's Cross Station.

Providing a new London headquarters for BNP Real Estate, the 39,500m² office structure also boasts ground floor retail outlets and a large central atrium.

"A steel option was the only realistic choice for this project as the client wanted a City spec office building with long clear open spans," said AKTII Project Director Steve Toon.

Erected by Severfield, the building is formed with a total of 2,900t of steelwork.

Using Fabsec cellular beams has allowed the project team to integrate all of the services within a constant and efficient structural zone created by the consistent depth of the beams.

Pancras Square will eventually consist of nine retail and commercial buildings arranged around a wedge shaped podium and public realm.

It is part of one of the largest regeneration schemes currently taking place in Europe. Described as a new piece of London with a brand new postcode, London N1C (as it will be known) will eventually include 50 new buildings, 2,000 new homes, 20 new streets and 10 new public squares spread over 67 acres.

Free Fire and Steel Construction Webinar invitation

A free one hour webinar on Fire and Steel Construction is being hosted by the BCSA and Tata Steel on Thursday 12 March at 12.30pm.

Topics to be covered include an

introduction to developments in state-of-the-art techniques of structural fire engineering. BCSA's in-house fire expert John Dowling will explain new developments in this area which gives designers an alternative to restrictive prescriptive approaches, leading to more cost effective and efficient fire protection.

The webinar will highlight the benefits available from having a world class and competitive structural fire protection industry in the UK, using case studies of highly complex as well as more straightforward buildings and other structures.

The webinar will give designers an overview of what fire protection materials are available, their costs and the pros and cons associated with each. The case studies of fire engineering in buildings will include guidance on when and where fire protection should be applied.

The legislative background to why fire protection must be provided to buildings will be covered.

Details of how to enroll for the event can be found at http://www.steelconstruction.info/Fire_and_steel_construction_webinar_2015

Highland academy under way

Work on the new Inverness Royal Academy is progressing on schedule with steelwork erection expected to begin in April.

Said to be the largest school in the Highlands, the £34M project will see a new 1,420-pupil school built next to the existing buildings.

Overall the new four-storey school will have 80 classrooms, two games halls, a fitness suite, dance studio, gymnasium as well as a variety of outdoor sports facilities.

"The new school build is a huge investment and a major boost to the local community and economy. It will also provide major support for the further development of gaelic education and improved provision for pupils with additional support needs," said Councillor Alasdair Christie, Chair of Inverness Council's Education, Children and Adult Services Committee.

Main contractor for the project is Galliford Try, and the steel contractor is BHC.

Car park aids West Midlands station expansion

Bourne Parking, part of Bourne Construction Engineering, will be erecting a single deck car park as part of the Four Oaks Station expansion programme.

The station is one of a number of railway stations in the West Midlands due to undergo works as part of a £2M scheme.

The new steel-framed car park will increase the existing parking spaces by 50. Bourne Parking will also be responsible for landscaping, lighting and CCTV installation.

The construction will be carried out in a phased programme to maintain as many parking spaces onsite as possible throughout the works. Completion is scheduled for July.

Paddington's Kingdom Street scheme expands

Work is set to begin this month on British Land's 4 Kingdom Street office development in west London.

Main contractor Wates Construction will build the 13,500m² steel-framed office project over part of the existing deck of the Crossrail station box next to the Westway in Paddington.

The project is expected to cost around £80m to build and at nine-storeys high it is the smaller of two office blocks planned in the Paddington Central development area.

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

In 2014, Westminster City Council approved changes to the scheme, and this has increased flexibility to the office floorplates along with improving amenities for occupiers.

The redesigned nine-storey building will have typical floorplates of 1,400m² with each floor having a large corner terrace and a glass pod designed as a creative meeting space.

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

Practical completion of the scheme is expected in early 2017.

Robert Samuel, Head of Office Development at British Land, said: "We are excited to be starting our development plans at Paddington Central, and are pleased with the enhanced design of 4 Kingdom Street. The campus already attracts high calibre occupiers from a broad range of industry sectors, and is increasingly seen as a natural extension of London's West End office market."

Diary

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

Tuesday 10 March 2015
Portal Frames Design - Part 2: Member Design
1 hour lunchtime webinar free to BCSA and SCI members, offering an overview of member design.

Thursday 12th March 2015
Fire and steel construction
This webinar will provide practical guidance on fire protection of structural steelwork and also on fire engineering of steel structures.
For details click here

Thursday 17 March 2015
Essential Steelwork Design
Introducing 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.
2 day course.
Nottingham.
For details click here

Tuesday 24 March 2015
Portal Frames Design - Part 3: Connections and Detailing
1 hour lunchtime webinar free to BCSA and SCI members, offering an overview of connection design.

Thursday 26 March 2015
Connection Design
For designers and technicians wanting practical tuition in steel connection design.
Bristol
For details click here

Tuesday 21 April 2015
Light Gauge Steel Design
Introduces the uses and applications of light gauge steel in construction. Explains methods employed by Eurocode 3 for designing light gauge steel members in bending and compression and calculation of section properties. Dublin
For details click here

Tuesday 28 April 2015
Steel Building Design to EC3
Making the change to EC3
Bristol. For details click here

Giving Poole a lift

In the latest of our Projects Revisited series, Martin Cooper reports from Poole harbour's iconic second crossing which has become a benchmark for future developments in the Dorset town.

FACT FILE

Twin Sails Bridge, Poole

Main client: Borough of Poole

Architect: Wilkinson Eyre Architects

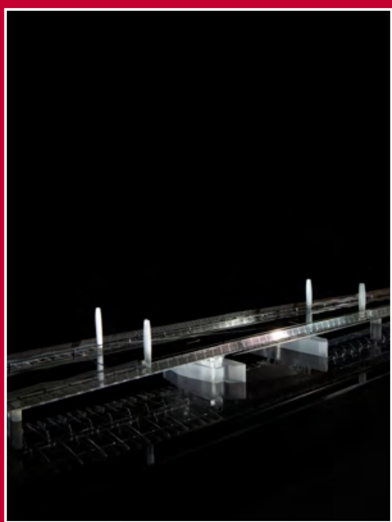
Main contractor: Hochtief Construction

Structural engineer: Ramboll

Steelwork contractor: Cleveland Bridge

Steel tonnage: 1,000t

The bridge provides a new landmark for Poole harbour



The bridge gives easier access across the harbour

The Twin Sails Bridge opened in 2012 and has over the intervening years become an iconic landmark symbolising the aspirations of the Dorset town.

Spanning the harbour, the bridge connects Poole Old Town to Lower Hamworthy. Working in conjunction with an existing bridge, it opens almost hourly for maritime traffic and therefore the design has been driven by the need for robustness and reliability.

As well as providing a much-needed second crossing, the Twin Sails Bridge provides critical infrastructure for 26 hectares of brownfield land, one of the largest regeneration areas in the South West. Over the next 10 to 15 years, the regeneration is expected to deliver around 2,000 homes and create up to 5,000 jobs.

"The bridge is and will act as a spur for regeneration," says Borough of Poole Engineering Manager John Rice. "But as a second crossing it has also helped to alleviate congestion in the town and make the local bus services more reliable."

A boost to the regeneration of the area it may be, but the bridge has also gained an iconic status due to its shape and design. Poole is proud of its maritime and industrial heritage and this is reflected in the world-class design of the bridge – with its two triangular shaped lifting leaves symbolising the sails of a yacht.

"It has become a benchmark for any future developments in Poole," adds Mr Rice. "The design is highly individual and the local community and visitors alike have all responded very positively about the bridge."

Wilkinson Eyre Project Architect Simon Roberts agrees: "The public has definitely warmed to the bridge and it has become a local landmark.

"This is especially evident when it opens bacause you don't need to be at the quayside to view the structure as the tips of the lifting spans can be seen from certain parts of the town centre."

Lightweight design

The low level bridge has five spans, with the mid-span dividing in half as two lifting elements. Structurally the bridge is designed and configured as a simple bascule, with a flat deck and two hydraulically operated lifting sections. ▶26

All photos except top of p12: Dave Morris - Spiers+Major

The mid-span of the bridge divides into two lifting parts and once they are in their open configuration the Twin Sails name of the structure becomes clear.

Utilising its maritime location much of the steelwork was floated into position using barges

"There are no other structures in the vicinity, so being a low level bridge it blends into the landscape," explains Ramboll Design Project Manager Steve Thompson. "However, drama unfolds when it opens at mid-span to reveal its elegant yet simple maritime shape."

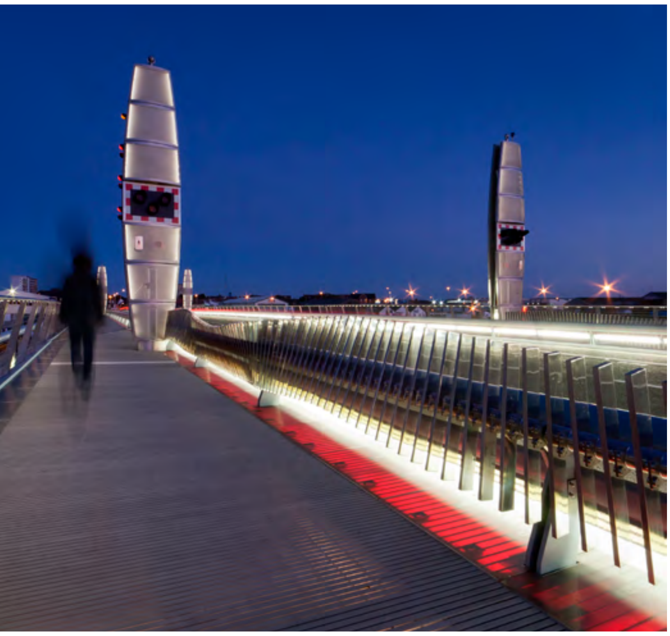
As well as designing a landmark opening bridge, materials had to be selected to maximize durability and minimise maintenance requirements throughout the life of the structure. The main deck of the approaches comprises a reinforced concrete deck slab on steel box girders, for the footways the decking is lightweight aluminium, supported on steel cantilevers.

Parapets comprise corrosion resistant stainless steel, while the main bridge spans are orthotropic steel boxes fabricated from weathering steel to remove the need for internal painting.

According to Mr Thompson steel was the only option for this project as the bridge needed to be a lightweight structure that could open at least 15 times a day. A low level bridge, which mirrored the height of the quayside, was another important design criterion best achieved with steel.

The quaysides on both banks of the harbour are old structures and in places in an uncertain condition. Building a lightweight bridge, and constructing it in sections that were floated into position using the tidal movements, avoided time-consuming and costly surveys and possible strengthening works to the quayside.

Steel erection



The steel sections for the bridge were fabricated at Cleveland Bridge's Darlington facility and transported by road to Poole. The company initially assembled the first three spans of the bridge and positioned them during July of 2011.

"We had to keep the harbour open to maritime traffic at all times," says Cleveland Bridge Project Manager Ben Binden. "So working from the western bank we first erected three spans, which included the two lifting segments for the central span. Once the hydraulic lifting gear was installed and commissioned we then erected the final two spans."

Although the spans vary in length (span one and five are 36m-long, two and four are 21m-long and the lifting central span is 23.4m-long, divided into two segments) they were all, with the exception of the central span, assembled on-site from four large box sections and four walkway sections, welded together to form an 18m wide span. Each half of the central span was assembled from two large box sections and two outer walkway sections to form a triangle.

Once each span had been fully welded and painted they were ready to be positioned.

Each completed span was loaded onto a self-propelled mobile transporter (SPMT) which then carried it the short distance down to the water's edge and onto a flat-deck barge.

Once the barge was in the bay, tugs helped nudge the barge into position so the span was positionally aligned with its final bearings.

However, before the final positioning could take place the construction team had to wait for the correct tide. "Each span was taken onto a barge via an access ramp from our assembly point," explains Mr Binden. "The barge then had to wait for high tide before moving the span into a position above and between its supports."

Ballroom challenge completed with steel

A series of 42m-long steel trusses has been erected to form the roof of Europe's largest pillar free ballroom at a hotel development in south London.

An important part of the Greenwich Peninsula redevelopment scheme, the 19-storey high five star InterContinental London - The O2, which is currently under construction adjacent to the O2 arena, will on completion boast 453 rooms and Europe's largest pillar free ballroom.

The scheme, which also includes a multi-storey apartment block, is the latest stage in revitalising a former industrial area of south London into a key part of the capital's commercial landscape.

The hotel has been designed to BREEAM 'Excellent' sustainability standards with features such as a green roof and partaking in the local district heating scheme.

Leisure facilities will include a health spa with an indoor swimming pool, several restaurants and a panoramic sky bar. But it is the massive 3,200m² column-free space that adjoins the main hotel tower and is situated above two basement car parking levels that really stands out.

"This large space is a ballroom for up to 2,500 guests seated for dinner or a 3,000 person standing event," explains RTKL Associate Director Mike Dooling. "The ability to have one large column-free area is a big marketing driver for the venue and the hotel targeting a number of large events. It can be subdivided into 14 individual spaces providing a highly flexible range of spaces from 200 to 3,200m². More than 250m of sliding acoustic partitions running on ceiling tracks supported by the steel structure provide the acoustic separation between these individual areas."

Designing the space required the project team to think outside of the box, in this case the reinforced concrete box that not only forms the basement car park upon which the ballroom sits, but also the surrounding walls.

The ballroom measures 40m × 80m and the only way the project team say they could economically construct a roof over this space without any internal columns was to use a series of steel trusses.

"A number of issues, as well as the long spans, led us down the steel route," explains Fairhurst Technical Manager James Toon. "Importantly steel could be procured and erected quickly and this was important as we had to incorporate some design changes quite late in the day."

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FACT FILE
InterContinental London – The 02, Greenwich
Main client: Grove Developments
Architect: RTKL
Main contractor: Balfour Beatty
Structural engineer: Fairhurst
Steelwork contractor: Apex Steel Structures
Steel tonnage: 900t

A series of steel trusses form the large open ballroom

The trusses are deep enough to allow maintenance access

One of the challenges revolved around how to distribute the extra loadings that would be exerted to the structure's steelwork after it was decided that the ballroom's trusses would need to accommodate heavier hanging exhibition items.

Fairhurst along with the project's steelwork contractor Apex Steel Structures designed the trusses with larger member sizes and added a series of 2t capacity lifting eyes, which are spaced at approximately 8m centres that will allow exhibits such as cars to be hung from the steelwork.

There are nine central trusses in total, spaced at 8m centres and each one is 42m long × 2.5m high and weighs 39t.

Apex fabricated each truss in four separate pieces for ease of delivery and erection.

"Before delivering the steel sections to site we trial erected each truss to make sure they could be bolted together exactly," says Apex Steel Structures Owner Scott Jarvis.

Each truss section was fully welded up at the fabrication works and each connection required a full butt weld. To make the onsite assembly quicker, fin plates were welded on to each member to form the connection points between truss sections. This made the on-site assembly quicker, but even so, approximately 140 bolts per splice joint were still required.

Once on-site three moveable temporary steel towers, built especially for the project, were then used to support the sections during the erection process. Once four sections had been bolted together and a truss was in place, the towers were jacked down and repositioned in readiness for the next steel sections.

Speed was of the essence on this project and Apex says it erected three trusses, including all of the interlinking members - that comes to a total of 175t, every week.

For the erection process two mobile cranes were used, each one positioned either side of the ballroom, and working in tandem with a 300t capacity self-erecting tower crane together with a mini crane on the first floor ballroom slab.

"It would have been easier to erect the trusses one at a time with one large mobile crane positioned centrally on the ballroom floor," says Mr Toon. "But the concrete frame construction sequence couldn't accommodate this."

By the time the steelwork was ready to be erected the ballroom's concrete walls had already been cast, which meant the project team needed to hire in cranes with a capacity and reach to lift truss members over the two-storey, 8m high walls.

The steelwork programme has been completed on the project and the venue is booked for the first major events to take place towards the end of 2015.

Steelwork in action

A further 400t of structural steelwork is being erected by Apex Steel Structures on other parts of the overall project. On the opposite side of the hotel tower to the ballroom, the company has erected a three-storey extension that will house a ground floor swimming pool with a conference space above.

Steel was chosen as the only option for the hotel extension as clear column-free areas were required with spans of up to 18m.

The top of the residential tower will feature rooftop penthouse accommodation with a winter garden, formed with tubular steel members. Together with further steel required at the top of the hotel this work comprises a further 100t of steel. These structures have been designed to be erected in small light sections, as each member has to be lifted into place by one of the site's tower cranes.

Temporary supports were set up to allow the trusses to be installed in three sections

Steel trusses

Dr Richard Henderson of the SCI discusses the steel truss roof over the InterContinental London - The O_2 ballroom.

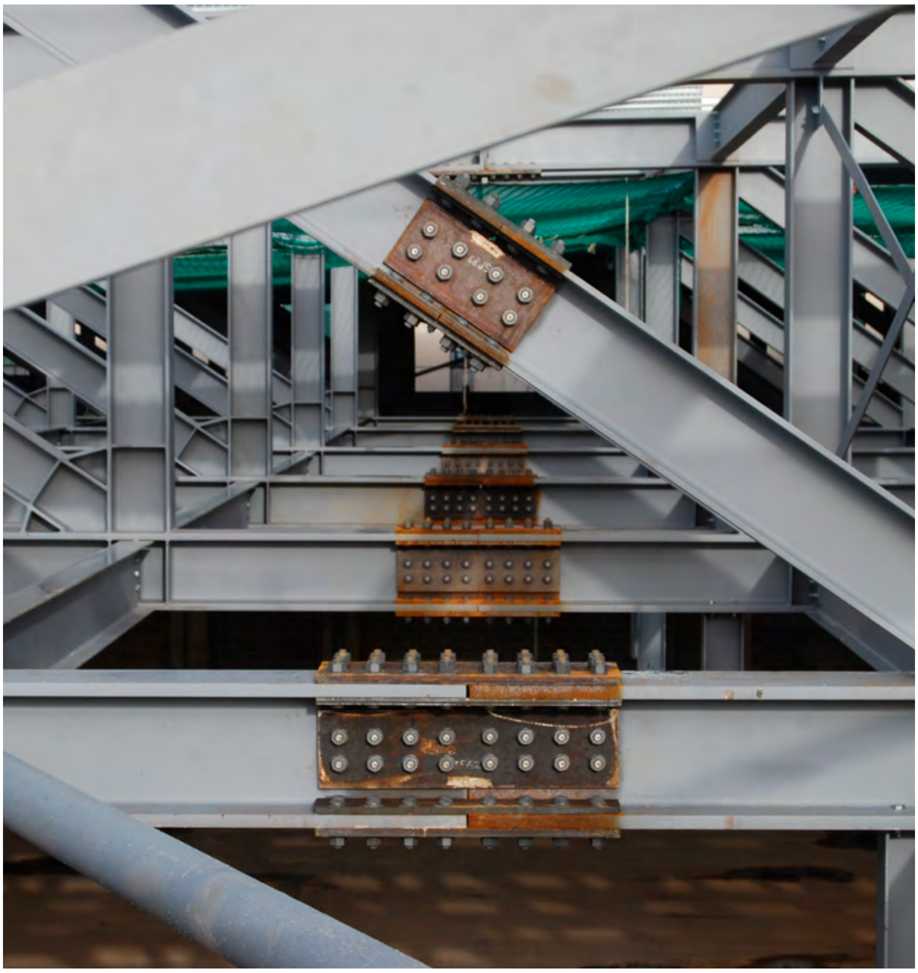
The span of the roof over the ballroom is about 42m, equal to 11.5 standard motorway traffic lanes and the clear height is 8m. Vertical structure like much of the rest of the hotel development is in reinforced concrete with shear walls providing lateral stability to the building. Speed of procurement and erection was a major criterion in the choice of roof structure. Consideration of the possible options for materials of construction and the corresponding implications for design risk, off-site manufacture, delivery and speed of erection rapidly leads to identifying structural steel as the favoured material.

Conventional wisdom (as set out in the Steel Designers' Manual) suggests that parallel chord trusses have an economic span of between 6m and 50m with a spacing of one quarter to one fifth of the span. Economic span to depth ratios for such trusses are 15 to 25. Elements of 42m span about 2.5m deep at 8m centres fall squarely within these ranges.

A concrete roof deck at the level of the top chord, supported on transverse beams spanning 8m between trusses, provides lateral support in the permanent condition. This deck also ensures that the principal design combination of actions for the trusses is gravity so a Pratt truss (with the longer diagonal web members in tension) is an economic truss form. The top chord is in fact sloped at 1° to the centre of the span, giving a rise of about 360mm over 21m. The trusses are provided with vertical bracing at the ends of the span and two further panels of bracing within the span to stabilise them out of plane, which is necessary during erection. A sliding bearing is provided at one end, allowing plus or minus 35mm of movement.

The steelwork is all concealed and individual members are hot rolled UC sections with all webs in the vertical plane. The trusses are fabricated in four sections about 10.5m long for ease of handling, with fully welded joints between chords and web members. Splices in tension members are detailed with welded cover plates on one side of the joint and tension control bolts. In the top chord, the splices are detailed with end plates to provide a bearing connection. Cover plates are also detailed to carry the strut-moment.

Trusses are a well-understood, straightforward form of construction and provide an effective solution for the 3200 m^2 column-free ballroom.



Lifeboat centre in the frame

Steel construction was the only solution to create the Royal National Lifeboat Institution's all-weather maintenance and manufacturing facility. Martin Cooper reports from Poole harbour.

FACT FILE
Royal National Lifeboat Institution All-weather Lifeboat Centre, Poole
Main client:
Royal National Lifeboat Institution
Architect:
Ellis Belk Associates
Main contractor:
Leadbitter (Bouygues UK)
Structural engineer:
Ramboll
Steelwork contractor:
H. Young Structures
Steel tonnage: 1,000t

Founded in 1824, the Royal National Lifeboat Institution (RNLI) has the responsibility of keeping the seas around the British Isles safe. Looking after one of the longest coastlines of any European nation is a mammoth task and during its lifetime the RNLI has saved more than 140,000 lives.

The charity has a fleet of 346 lifeboats operating out of 237 lifeboat stations and the nature of the work has meant that it has always been at the forefront of nautical design and development.

However, as the technology used on its lifeboats has advanced in recent times, the pool of suppliers able to produce them to the required exacting specifications has reduced.

The RNLI's solution is to build a world-class centre of excellence in lifeboat engineering, production and manufacture at its headquarters in Poole. Known as the All-Weather Lifeboat Centre (ALC), the facility will bring together the production for the RNLI's new generation of Shannon class all-weather lifeboats, as well as providing a maintenance and refit facility for its existing Tamar and Severn class fleet.

The ALC consists of two large steel-framed buildings (A and B), both approximately 85m long × 30m wide, connected by a central covered courtyard.

Long clear spans for the main areas of both buildings were an important part of the design and were the main reason behind the choice of steel as the project's framing material.

"Spans up to 20m, the requirement for various roof curves and the need for the frame to be constructed quickly, meant that a steel framed structure was the optimum solution," says Ramboll Structural Engineer Ben Punton.

Both buildings' main production areas have been formed around 10m × 20m bays as this provides the necessary open column-free space. A slightly smaller 10m × 8m grid pattern is then used for adjoining mezzanine levels and first floor office areas.

The steel design is a hybrid with portal action providing stability in one direction and diaphragm action, in combination with strategically positioned cross bracing, providing stability in the other direction. Although both buildings are structurally independent, the interconnecting 23m wide canopy also provides some extra stability.

The first part of the lifeboat manufacturing process will take place in building A, where composite hulls, decks and wheelhouses will be cast in large moulds. Overhead cranes will allow the hulls to be moved around the building as work progresses, while the structure's 20m internal height makes winching the hull out of its mould for the first time a safe and controlled operation.

"The halls in both buildings have been designed around the largest class of lifeboat," says RNLI Project Supervisor Iona Evans. "Building A can accommodate five Severn Class vessels at one time, while B can house seven."

One end of building A accommodates spray booths, three for the boats themselves, and one smaller booth to be

The steel frame takes shape

used for painting components. Formed and painted boats will then be transferred across to building B where the engines and wheelhouses will be installed.

Each of the buildings features a mezzanine walkway that runs along one elevation at a 3m high and will allow engineers and technicians to walk straight onto the deck level of lifeboats for maintenance work. Above the mezzanines both buildings have office space, a canteen, and toilets and showers. Building B will also have a viewing gallery and "visitor experience" suite with windows looking out over the maintenance and production hall.

Leadbitter, a Bouygues UK company, delivered the new building. Summing up the project, Bouygues UK Senior Project Manager Mike Harrington says: "This is a unique and bespoke project. The timescales for delivering the project and the budget were a challenge initially. However, we've worked hard to build a centre that will serve the RNLI and its staff and volunteers for many years to come."

The ALC was handed over in late February and will be officially opened in August.

The two buildings are connected by a covered courtyard

Steel erection programme

Steelwork contractor for the project was Norfolk based H. Young Structures. The company fabricated and supplied approximately 1,000t of structural steelwork for the project, with the entire package then erected in a fast-track 12-week programme.

Using Ramboll's original design, H. Young Structures designed all of the connections as well as the secondary steelwork for the envelope support.

"Speed and quality were of the essence as far as getting the steel frame up," explains H. Young Structures Projects Director Peter Smith. "We had two gangs erecting steel simultaneously at one stage."

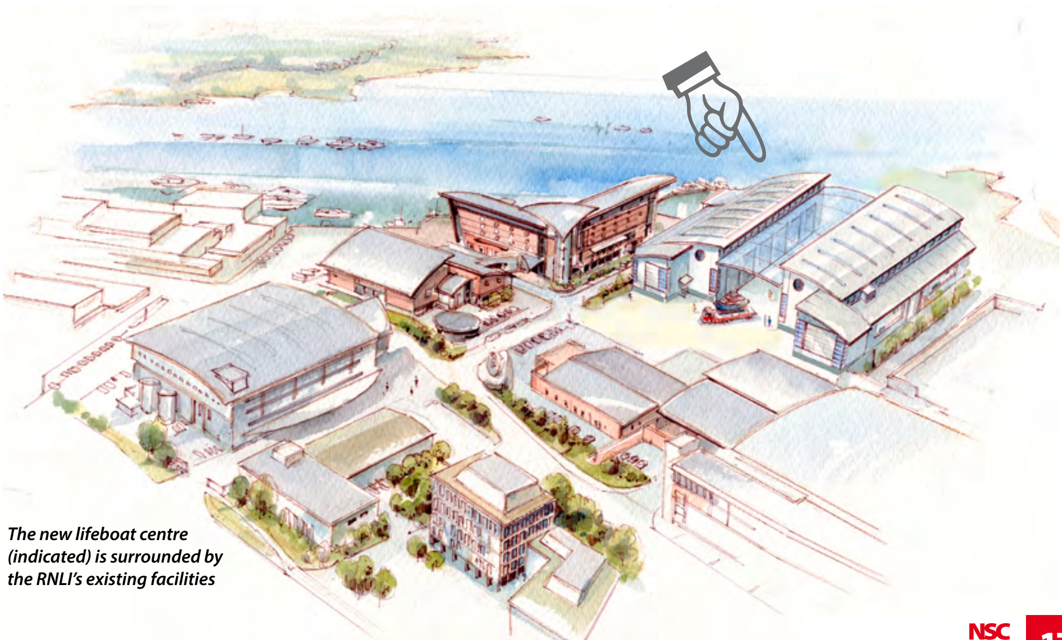
Steel erection began on building A, with a second gang commencing work on building B five weeks later. As the second building was erected the 25m-long galvanized rafters spaced at 10m intervals, which form the canopy over the central courtyard, were also installed.

Only the main rafters for the canopy were initially erected as this left large enough gaps to allow the cladding system to be installed to the building's inside elevations. Once the main frame steelwork was up and the cladding finished, H. Young Structures completed the installation of canopy purlins on a return visit.

"This has been a prestigious project for us to be involved in," sums up Mr Smith. "We had no access issues erecting the steelwork as we had the site pretty much to ourselves. The biggest challenges were the tight tolerances we were working to around the building's large doorways and the internal crane beams."

The roof canopy will allow daylight to illuminate the courtyard

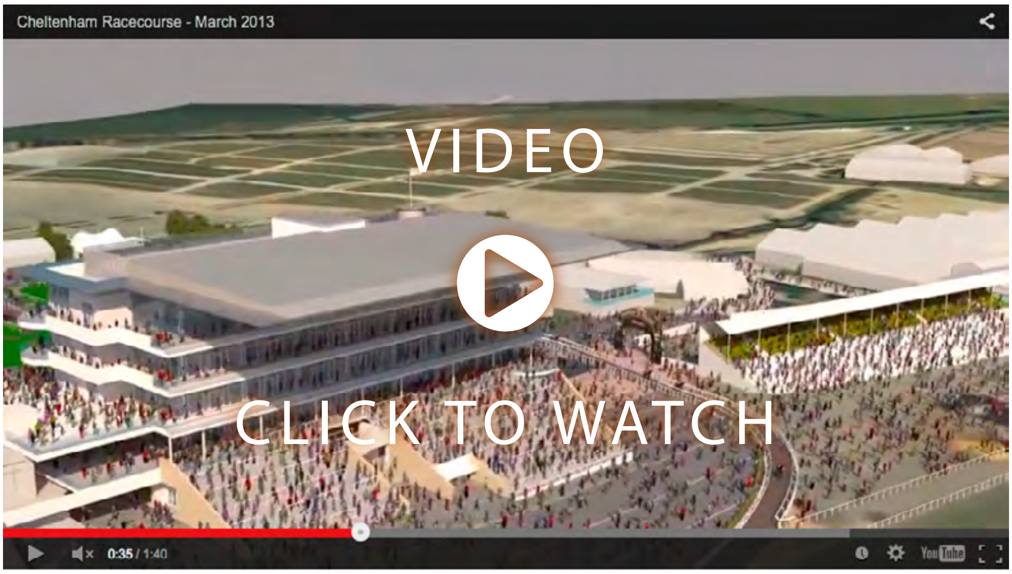
Steelwork's speed of construction was important to this project



The new lifeboat centre (indicated) is surrounded by the RNLI's existing facilities

Steel in the running for grandstand finish

A new multi-million pound five-storey grandstand is the centrepiece of Cheltenham Racecourse's redevelopment plans. Martin Cooper reports.



FACT FILE
Cheltenham Racecourse Grandstand
Main client: The Jockey Club
Architect: Roberts Limbrick Architects
Main contractor: Kier Construction
Structural engineer: Furness Partnership
Steelwork contractor: Hambleton Steel
Steel tonnage: 1,660t

The four-day Cheltenham Festival that includes the prestigious Gold Cup race is one of the nation's top sporting events with more than 230,000 spectators in attendance and hundreds of millions of pounds gambled every year.

In order to keep the Festival at the forefront of the horseracing calendar The Jockey Club has embarked on a £45M redevelopment of Cheltenham Racecourse with the construction of a new state-of-the-art five-storey 6,500 capacity grandstand.

The overall project will also see the creation of elevated walkways to the rear of the grandstand, to ease mobility for spectators and provide a multi-tiered 'amphitheatre' experience around the parade ring, allowing even more people to enjoy the equine stars at the heart of all Cheltenham's race days.


Large bespoke brackets support the balconies

Main contractor Kier Construction started on-site last March (2014) straight after that year's Cheltenham Festival had finished. During its time on-site Kier will be subject to 12 sectional handovers as various parts of the project are completed.

"We handed over the refurbished weighing rooms last October, while the lower terracing of the new grandstand will be handed over for this year's Festival," explains Kier Design Manager Andy Bolas.

Working around the Racecourse's calendar has been one of the project team's main challenges. The course remains open throughout the construction programme and this has required the site to be closed down and secured ahead of and during each race meeting.

Although the lower terracing will be used for this month's (March 10-13) Festival, the remainder of the grandstand is not complete and consequently it will be secured ahead of the meeting.

"Closing the site down for each meeting and especially the Festival, which requires us to prepare the area at least week before the meeting, is certainly a challenge for the team," adds Mr Bolas. "However, the day after each meeting finishes we are back on-site and working normally."

The intermittent racing meetings have not hindered the construction programme. The steel erection for the grandstand was recently completed with Hambleton Steel erecting the last roof and eaves overhang members in February.

Founded on piled foundations, the five-storey steel-framed structure includes a part basement and is predominantly based around an 8m × 11m grid pattern.

"This grid is replicated in the roof structure and also provides the boxes and hospitality areas with large flexible column-free spaces," says Furness Partnership Director Paul Haines.

"Behind this grid line the structure then has a slightly smaller 8m × 5.5m pattern which accommodates the back-of-house areas."

Although it is linked via public access ways to the adjacent stand, the new grandstand is structurally independent and gains all of its stability from a combination of vertical bracing, rigid frame action, and diaphragm action through composite floors.

All of the bracing is located within stair and lift cores that are located in the back-of-house area of the stand. The front grid line is a five-storey, seven bay, rigid frame with full-height glazing to provide unobstructed viewing to race-goers as well as access to the balconies.

Composite construction, utilising metal decking has been used to construct all of the internal floors; while balconies and terraces are formed with steelwork supporting bespoke reinforced concrete units incorporating viewing steps and a white Dolomite finish.

Initially the structural design was for precast planks to be used internally, but Kier changed the design to composite flooring as this form of construction was preferred for its improved buildability, avoiding craneage issues of the large planks and the formation of works holes and service openings.

The structure's layout consists of basement toilets, ground floor public areas including access to the main terrace, first floor members bars, second floor owners and trainers bars, third floor royal and private boxes, and fourth floor Cheltenham Club premium boxes.

The last steel sections for the roof are lifted into place

Each of the levels from first floor upwards incorporates a row of balconies giving the adjoining boxes an outside vantage point for the races.

The balconies cantilever out by up to 4m and are all supported by large plate girder brackets bolted to the main columns. The moments are primarily resisted by the 11m back spanning members, requiring intricate continuous connections across the columns.

The brackets range from 2.4m long up to 3.7m and weigh a maximum of 1.3t each.

"The balcony brackets are bespoke, varying in size, shape and arrangement. With the aesthetic considerations conventional hot rolled sections did not work and the only solution was for Hambleton to fabricate brackets from steel plate," says Mr Haines.

Soaring over the grandstand is the structure's most visual element, a 21m deep cantilevering roof. A series of trusses, spaced at the same 8m centres as the main frame steelwork, supports this aluminum Kalzip clad roof structure.

The 21m-long Warren trusses taper from a maximum depth of 3.6m and are connected to an 11m-long × 4.2m deep backspan truss section that is incorporated into the roof structure above the hospitality zone.

"The tapered trusses were erected with one 80t capacity mobile crane. We erected them one at a time, but as soon as we had a pair in place they were tied in with all the connecting steelwork before we erected the next truss," sums up Hambleton Steel Contracts Director Andy Fixter.

The works are scheduled to be completed in time for the Festival in March 2016.

Wind loadings

Cheltenham Racecourse is renowned for its breezy conditions and, as the new grandstand is situated near the top of a slope which culminates with the course's winning post, the structural design has taken strong winds into consideration.

"We looked into the site in great detail with regards to wind so we could accurately assess the impact on the canopy roof structure. Given the aerofoil nature of the roof it was important to have a comprehensive understanding of the magnitude of wind loads, which can be amplified by the roof's own geometry and the physical structure of the building from which it is supported.

"This enabled us to limit any unacceptable deflections, and analyse for unstable oscillatory motions such as flutter or galloping which can be fundamentally detrimental to the structure," says Furness Partnership Director Paul Haines.

The grandstand is situated on the brow of a hill and offers views over the entire racecourse

The large warehouse, at the former colliery site, takes shape

Sports company expands with steel

The only viable option for Sports Direct's new distribution centre was a steel framed solution.

FACT FILE
Sports Direct distribution centre, Shirebrook, Nottinghamshire
Main client: Sports Direct
Architect: RPS
Main contractor: Winvic
Structural engineer: RPS
Steelwork contractor: Severfield
Steel tonnage: 3,700t

On the site of the former Shirebrook colliery, just north of Mansfield in Nottinghamshire, Sports Direct is currently expanding its operations with the construction of a vast new distribution centre.

Sports Direct already has a presence on the site dating back to 2005, and this new retail/distribution centre has a footprint measuring 300m × 150m and a height of 12.5m to the underside of the eaves.

A two-storey high 30m-long bridge structure will span a service yard and link the new structure with the existing facilities, creating a combined distribution centre with more than 90,000m² of floor space.

The new structure consists of a series of portal frames, with spans of up to 34.5m wide on an 8.5m grid.

"Steel portal frames are the only viable solution for this project and offer an economical solution to carry a lightweight roof for industrial building applications. This is a tried and tested solution for this type of facility," says RPS Associate Scott Harrison.

The varying spans of the project have been coordinated with the client's proposed fit-out and the Shirebrook site constraints.

The project has been split into three fire-rated chambers with structurally independent portal frame structures to safeguard the business in case of a fire. These interlinked sections are known as C1, C2 and C3 (see diagram on opposite page) and all accommodate three-level cross-dock mezzanines.

"Consideration had to be given to Severfield's programme to allow the mezzanines to be constructed early in the construction programme," adds Mr Harrison.

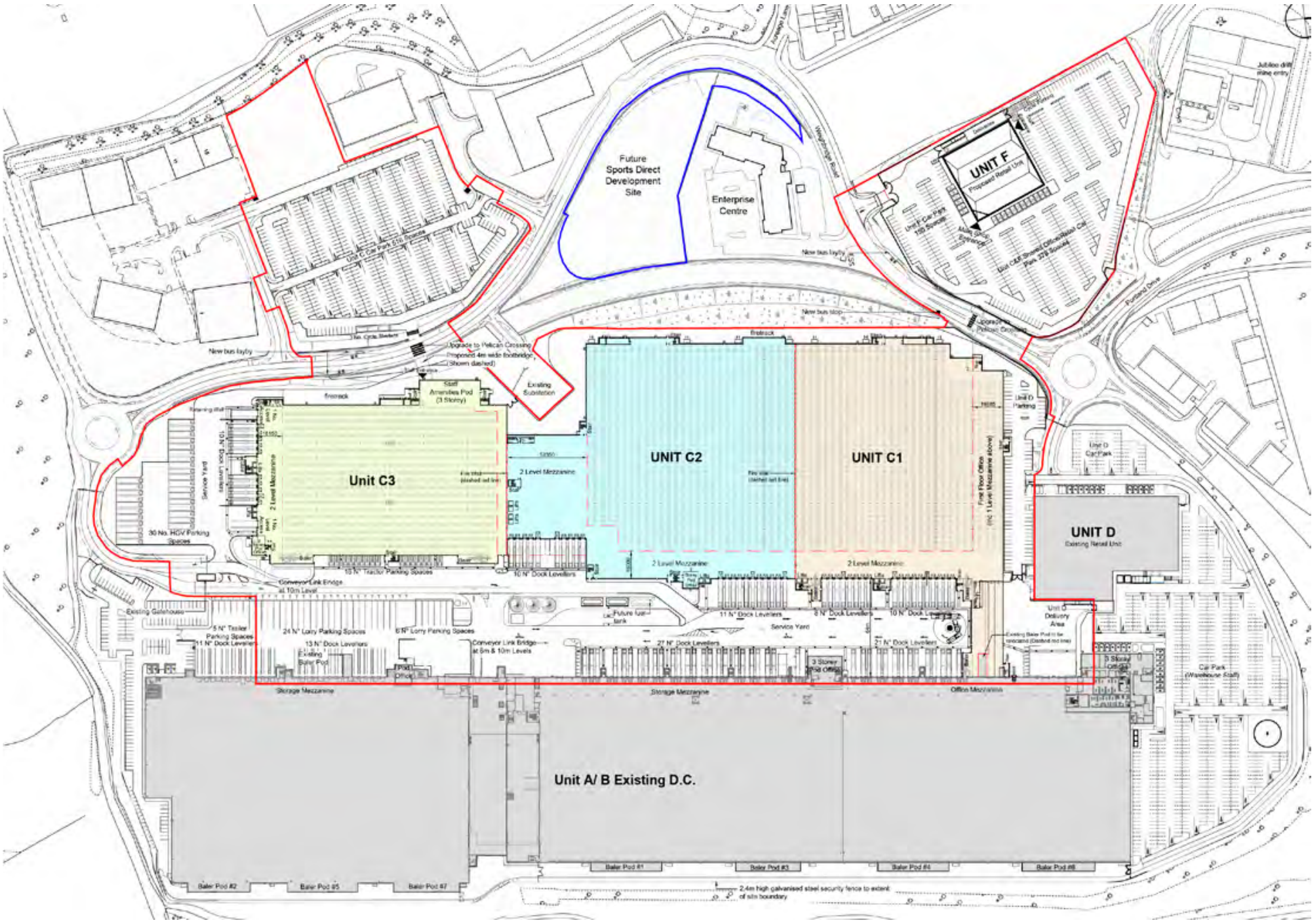
The C1 section of the project is purely a distribution area and consists of eight spans of up to 33m with 17 column bays spaced at 8.5m centres.

C2 is also a distribution zone with four portal frames with spans up to 35m wide, but it also accommodates three levels of offices housed within two smaller 24m wide portals. Large trusses have been used to form the office zones as they span over a recessed dock area, and the steelwork needed to be protected against the potential for vehicular damage during the operation of the busy dock area.

Finally, the interlinked C3 sector is orientated in an east-west direction to suit the site, as opposed to the other areas that have their spans running in a north-south direction.

C3 consists of four 24m wide portal frames each with 20 × 8.5m wide bays.

All three sections contain three levels of 16m-wide mezzanines and these floors, along with the offices in C2, have been constructed compositely with steel decking.



The office floor supporting structures take lateral support from the main portal frames and bracing systems.

The need for bracing to maintain structural stability cannot be designed out, says Mr Harrison. However, bracing locations have been designed with due consideration to building operational requirements.

Severfield is fabricating, supplying and erecting 3,700t of steel for this job. All columns arrive on-site in single pieces with the majority being 610 × 350 members. The portal frame rafters however arrive on-site in two sections that are bolted together on the ground before being lifted into place.

"Steel erection is being undertaken during an 18 week programme," says Severfield Project Manager Bill Armstrong. "To complete this schedule we have up to eight cranes working on-site doing four spans at time."

Summing up the project, Winvic Project Manager Jason Bright says: "This is a fast-track project and steelwork's speed of construction has helped us achieve our objectives on what is a very busy site. The logistics of bringing materials onto the site are also challenging and need to be scheduled in advance as we are situated next to Sports Direct's existing facility."

Three interlinked portal framed structures form the distribution centre

Foundations

The portal frames are built on reinforced concrete pad bases on the dynamically compacted remediated colliery site. Special attention had to be given to the site's backfilled former coal workings that contain a mixture of mudstone sand and clay. A large reinforced concrete raft has been designed for one area of the project that could not be accessed for ground treatment.

The shape of the structure is dictated by the site's footprint which is circular

Steel college supports residential scheme

Long internal spans and a lightweight roof structure were the reasons why steel construction was chosen for a prestigious student accommodation and college project in London.

FACT FILE
Urbanest 199 Westminster Bridge Road, London
Main client: Urbanest
Architect: Allford Hall Monaghan Morris
Main contractor: Balfour Beatty
Structural engineer: Ramboll
Steelwork contractor: Bourne Steel
Steel tonnage: 1,650t

Scholars lucky enough to get a room at student accommodation provider Urbanest's latest London scheme will have some of the most sought after views in the capital.

Located next to County Hall and Waterloo Station, 199 Westminster Bridge Road overlooks the River Thames affording views of the Houses of Parliament and Big Ben.

Designed by architects AHMM, the hybrid scheme will deliver 1,092 rooms in a variety of formats including bedsits, two bedroom units and larger four bedroom duplex flats. Student accommodation is spread over 16 levels from floor three to the uppermost level 18.

Below level three the lower part of the scheme includes four floors of college (ground, mezzanine, first and second floors), flexible and affordable workspace for small local start-up businesses, as well as a double height basement containing plant rooms, music rooms, a gym and a 16m × 5m swimming pool.

Level three of the scheme is essentially a transfer deck and the most crucial element of the project design as this is the main interface between the reinforced concrete residential zone and the steel framed college below. Level three also supports a private roof garden that will only be accessible to residents.

From basement level up to the third floor structural steelwork with metal decking has been used as the framing material and Bourne Steel fabricated, supplied and erected 1,570t of steel for this part of the scheme.

Steel was chosen for the college as the design includes a number of long span areas, such as a large central atrium.

"These areas are much easier to construct with steel," adds Balfour Beatty Senior Project Manager Geoff Grant. "And

using steel for the college also means the classrooms have more in-built flexibility."

Bourne Steel's erection sequence has been split into two programmes. Initially the company erected the bulk of the project's steelwork from basement slab up to third floor transfer level during a 12-week period in early 2014.

Currently Bourne is working on a return visit to site erect a further 80t of hot rolled steel to form the project's sloping roof (see box).

As busy roads and railway lines surround the site logistics and planning played a key role in the erection programme. With little room for material storage as the structure takes up most of the site's footprint, all of the steelwork had to be delivered on a just-in-time basis.

"We delivered about 25t of steel to site each day and with space at a premium and no room to position a mobile crane, all of the steelwork for the lower levels was erected by the two on-site tower cranes," says Bourne Steel Project Manager Iain Griffiths.

The basement contains the initial elements of steelwork to be erected. This area contains a plant mezzanine formed with 3.5m high steel columns supporting metal decking, while longer 7m columns in the basement support the reinforced concrete ground floor slab.

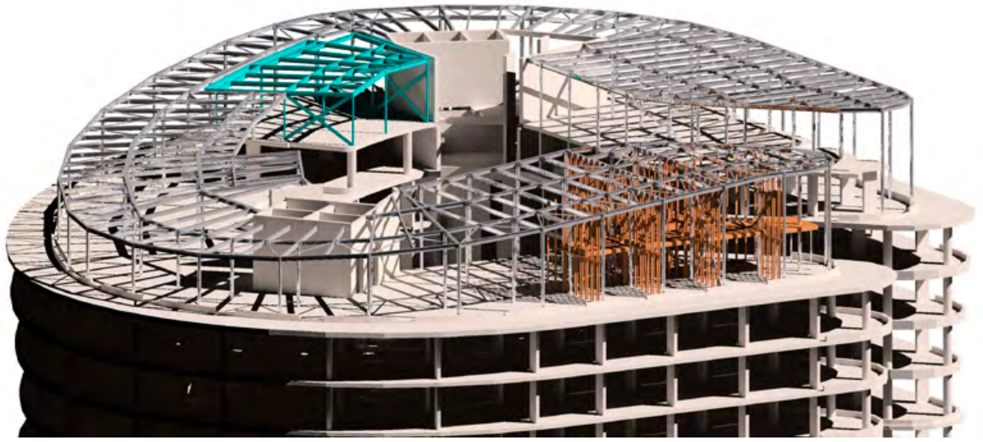
From ground floor upwards the scheme's steelwork zone incorporates a central atrium around which the college's mezzanine, first and second floor facilities are arranged.

"Typically college floors are formed from a composite steel frame construction with concrete slab on profiled metal decking, while stability is provided by the cores and an additional stair core that runs from basement to third," says Ramboll Project Director Mitesh Patel.

Most of the steel beams are designed as downstand beams acting compositely with the slab above. Shear studs welded to the top flange of the beams provide the required composite action.

However, there are a few areas of the building where composite construction was not suitable as Mr Patel explains: "Around the building's perimeter and the internal atrium, primary beams are required to cantilever out from the columns. These beams are designed as non-composite as the top flanges will be in tension under hogging action. ▶24

The ground floor includes a mezzanine level



Topping the project

A sloping steel roof structure, designed with sightlines of the Houses of Parliament in mind, tops the building and incorporates the uppermost residences.

Slightly longer spans are required for this floor and so a lightweight steel solution was chosen. Steel decking forms the roof itself and spans between steel beams providing them with lateral restraint. The roof beams are also designed to support a green roof.

Two cores provide stability along with two sections of vertical cross bracing at the ends of the two 'wings'. Horizontal cross bracing is provided at roof level to ensure the frame can span between the various vertical stability elements.

Several of the studios at level 18 contain duplex-style sleeping decks. These sleeping decks are designed as lightweight timber structures spanning between the room partitions.

"Getting the steel to the top of the building has been a challenge as we have 800 pieces of steel to erect," says Bourne Steel Project Manager Iain Griffiths. "In order to reduce the number of crane lifts we've invested in two 3.5t capacity lifting cradles to enable the cranes to hoist a number of steel sections in one lift."

The project nears completion with only the steel roof to be erected

Deep trusses on the third floor support the residential tower

"To ensure the internal spans still behave as composite sections all the moment from the edge cantilevers (both internal and external) are taken by the columns with pinned connections between the column and internal primary beams."

At first floor level, hangers are used to support areas of the mezzanine below where there a large cantilevers or long internal spans. In these instances, the depths of the beams were increased so that the top of the steel is level with the top of slab and this then acts non-compositely but fully restrained.

At mezzanine level, due to restrictions on the structural depth, all beams sit within the slab level and are designed as non-composite.

The largest sections of steelwork to be erected were a series of fabricated plate girders, up to 22m long and weighing up 19t each, which spans the college's central atrium and forms the third floor transfer deck.

"The project needed a transfer structure at this floor level as an entire row of concrete columns are removed necessitating the use of deep fabricated steel beams to transfer the load back to the steel columns below," says Mr Patel.

All transfer beams at this level are at the same level as the top of the slab and designed as non-composite. Typically, the transfer beams cantilever out past the perimeter steel column below, picking up the full length of the concrete column above and supporting the cladding line on the building perimeter.

The scheme is scheduled be to completed and ready in time for the start of this year's autumn term.

Eurocode verification of a runway beam subject to wheel loads – Part 2

In Part 1 of this article, Dorota Koschmidder-Hatch of the SCI described the checks covering the design of a runway beam in accordance with BS EN 1993-6. In this Part, a worked example is presented. Readers should refer to Part 1 for nomenclature and detail on the design verifications.

Beam and loading details (Figure 1)

The beam is a 406 × 178 × 60 in S355, which spans 6 m.

The maximum lifted load is 3 T, or 30 kN

The hoist is assumed to weigh 750 kg, or 7.5 kN

The wheels are assumed to be at 300 mm centres, and to be located very close to the edge of the flange (μ = 0.1)

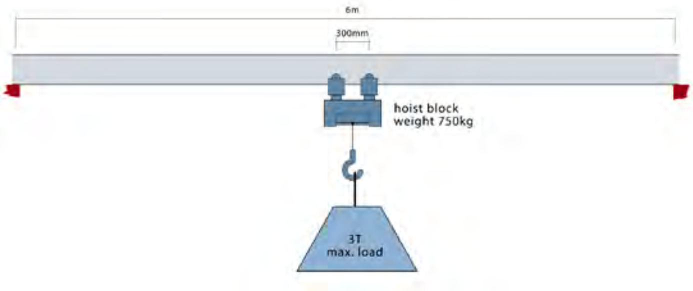


Figure 1: Details of monorail beam

ULS checks

LTB resistance

The design bending moment, $M_{y,Ed}$, depends on the design value of the point load. BS EN 1991-3 prescribes several design combinations conditions to be considered, with amplification factors depending on the type of hoist, hoist speed, static and dynamic test loads etc (see Table 2.2 and Table 2.4 of the Standard).

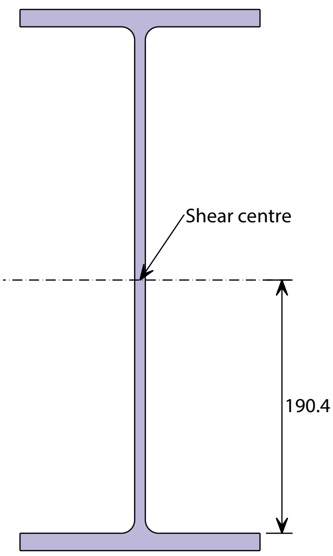


Figure 2: Application of the wheel loads

Following this guidance, the design point load is calculated as 61.8 kN

As an approximate check, note that 1.35 × (30 + 7.5) = 50.6 kN, so with some amplification to allow for dynamic effects, the design point load is of the correct order. Note that the use of 1.35 for the lifted load is prescribed in Table A.1 of BS EN 1991-3 and confirmed by clause NA.2.6 the UK National Annex.

The design bending moment is therefore 97.2 kNm, including self weight of the beam.

With a central point load, the C_1 factor is 1.35

From the Blue Book, $M_{b,Rd}$ = 215 kNm

In fact, clause 6.3.2.2(3) of BS EN 1993-6 allows the benefit of stabilising loads to be taken into account, as explained in Part 1. With loads applied on top of the bottom flange, z = -190.4 mm, as shown in Figure 2 (negative as the loads are applied below the shear centre). If advantage is taken of this effect, $M_{b,Rd}$ increases to 280 kNm.

Even without the benefit of stabilising loads, the LTB resistance is satisfactory.

From the Blue Book, the shear resistance is 709 kN. The applied shear is 30.9 kN, which has no impact on the cross sectional moment resistance, $M_{c,y,Rd}$. Since the LTB resistance is satisfactory, the cross sectional moment resistance must be satisfactory. For completeness, $M_{c,y,Rd}$ = 426 kNm, which is significantly greater than 97.2 kNm.

Flange resistance

The geometry of the applied wheel loads must be established. Dimension *m* is from the wheel load to the root radius. Dimension *n* is from the wheel load to the edge of the flange, and relates to the ratio μ, as given in clause 5.8(4). The dimensions are shown in Figure 3.

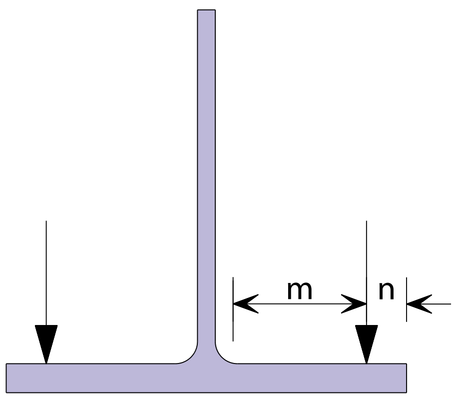


Figure 3: Nomenclature for flange resistance checks

$n = \mu\,(b - t_w)/2 = 0.1\,(177.9 - 7.9)/2 = 8.5$ mm (expression 5.7, rearranged)

$m = 0.5\,(177.9 - 7.9) - 0.8 \times 10.2 - 8.5 = 68.3$ mm (expression 6.3)

Assuming that the wheels are remote from the end of the beam (case (b) of Table 6.2), the length of yield line is established by first calculating the length $4\sqrt{2}\,(m + n)$ and comparing this to the wheel centres.

$4\sqrt{2}\,(m + n) = 4\sqrt{2}\,(68.3 + 8.5) = 434.7$ mm

Because this is larger than the wheel centres, x_w, which were assumed to be 300 mm, the effective length of yield line is given by:

$l_{eff} = 2\sqrt{2}\,(m + n) + 0.5\,x_w = 2\sqrt{2}\,(68.3 + 8.5) + (0.5 \times 300) = 367.3$ mm

The resistance of the flange is reduced by the stress at the midline of the flange, as given by clause 6.7(1).

Stress at the midline of the flange is given by:

$$\sigma_{f,Ed} = 97.2 \times 10^6 \times \frac{(406.4 - 12.8) \times 0.5}{21600 \times 10^{-3}} = 88.6\text{ N/mm}^2$$

Design resistance of the bottom flange to a wheel load:

$$F_{t,Rd} = \frac{l_{eff}\,t_f^{\,2} f_y / \gamma_{M0}}{4m}\left[1 - \left(\frac{\sigma_{f,Ed}}{f_y/\gamma_{M0}}\right)^2\right]$$

$$= \frac{367 \times 12.8^2 \times 355/1}{4 \times 68.3}\left[1 - \left(\frac{88.6}{355/1}\right)^2\right] \times 10^{-3} = 73.3\text{ kN}$$

The applied load is 61.8 / 4 = 15.4 kN, which is satisfactory.

SLS checks

Deflection

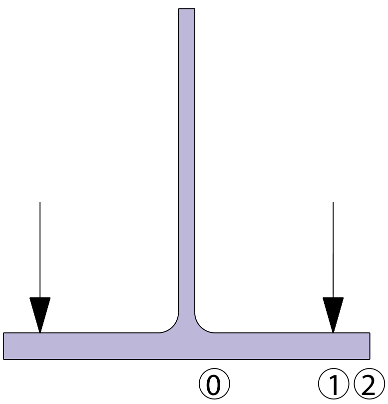
The SLS load = 30 + 7.5 = 37.5 kN. This load has not been amplified to allow for dynamic effects. With this load at midspan, the calculated deflection is 3.7 mm. According to case (a) of Table 7.2, the limiting deflection is span/600 or 10.0 mm.

Combined stress checks

With $\mu = 0.1$, and using the formuale in Table 5.2 (rather than the coefficients in Table 5.3), the calculated local stresses are as follows:

Position	Stress (N/mm²)	
	longitudinal	transverse
0	11.0	-108.6
1	131.8	31.4
2	124.1	0.0

The locations are shown in Figure 4.



⓪ at the root radius

① under the load

② at the flange tip

Figure 4: Locations for SLS stress checks

The longitudinal stress at the extreme fibre, under the SLS load of 37.5 kN is given by

$$\sigma_{f,ser,Ed} = \frac{37.5 \times 10^3 \times 6000}{4}\;\frac{406.4 \times 0.5}{21600 \times 10^4} = 52.9\text{ N/mm}^2$$

From the shear resistance of 709 kN taken from the Blue Book, the shear area, A_v can be calculated, since $V_{pl,Rd} = \dfrac{A_v\left(f_y/\sqrt{3}\right)}{\gamma_{M0}}$

Therefore, $A_v = 3459$ mm²

The shear stress at SLS is therefore = 5.4 N/mm²

Conservatively assuming that the maximum longitudinal stress, plastic shear stress and local stresses are coincident, the expressions in clause 7.5 can be verified. The sign convention of the local transverse stress is reversed if required to produce the most onerous combined stress result, reflecting that the more onerous position may be on the underside or top side of the bottom flange.

At each location, 0, 1 and 2, (see figure 5.6 of BS EN 1993-6) the local longitudinal stress is added to the overall longitudinal stress.

Although each position must be verified, for conciseness only the most onerous, position 1 in this case, is shown below.

Location 1

$\sigma_{x,Ed,ser} = 52.9 + 131.8 = 184.7$ N/mm²

$\sigma_{y,Ed,ser} = 31.4$ N/mm²

$\tau_{xy,Ed,ser} = 5.4$ N/mm²

$\sqrt{(184.7)^2 + 3\,(5.4)^2} = 185.0$ N/mm² (expression 7.2c)

$\sqrt{(184.7)^2 + (31.4)^2 - (184.7)\,(-31.4) + 3\,(5.4)^2} = 202.4$ N/mm² (expression 7.2d)

The maximum permissible stress is given in clause 7.5 as $f_y/\gamma_{M,ser}$ is given by the UK NA to BS EN 1993-6, in clause NA.2.12 as 1.1, (a variation from the recommended value of 1.0) so the maximum permissible stress is

$355/1.1 = 322.7$ N/mm²

Thus the local stress checks are satisfactory.

Vibration of the bottom flange

Distance between lateral restraints $L = 6$ m

For simplicity, the inertia of the bottom flange will be taken as half of I_z.

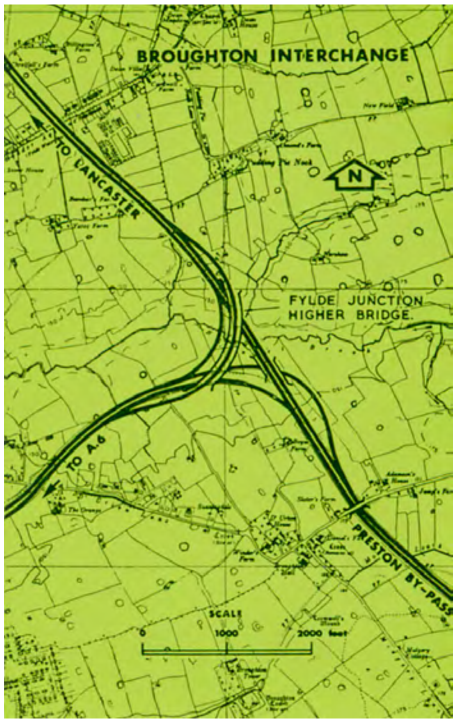
Thus the bottom flange inertia = 0.5 × 1200 × 10⁴ = 600 ×104 mm⁴

The radius of gyration of the flange, $i_z = \dfrac{600 \times 10^4}{177.9 \times 12.8} = 51.3$ mm

Slenderness, $L/i_z = 6000/51.3 = 117 < 250$, so vibration is satisfactory.

Motorways of Britain

Fylde Junction Higher Bridge on the Preston By-Pass



When the 13½-mile length between Preston and Lancaster is completed next spring (1965), some 60 miles of continuous motorway will be available on the Lancashire section of the M6 North-South Motorway. This is the fourth section, the three finished and already in use being the 8-mile Preston By-Pass, the 12-mile Lancaster By-Pass and the 26-mile length running from the Preston By-Pass to the Thelwall viaduct. The only remaining work to complete the Lancashire section of the M6 will be a small length north of Lancaster.

A prominent feature of all motorways is the considerable number of bridges and the Lancashire section of the M6 is no exception, having a total so far of 169. A useful innovation is the painting of the steelwork on the many bridges in different colours.

Under construction at the northern end of the Preston By-Pass is the Broughton Interchange, a three-level junction enabling the free flow of traffic between the North-South Motorway (M6) and the present A6 trunk road. This includes two bridges, ie the Fylde Junction Lower which will carry the Motorway over the link road serving traffic from the A6 and the Fylde to the south, and the Fylde Junction Higher which is to carry the link road serving traffic from the north to the A6 and the Fylde. This latter bridge passes over the M6 and the link roads from the A6 to the south and from the south to the A6.

THE FYLDE JUNCTION HIGHER BRIDGE

The Fylde Junction Higher Bridge is a welded steel box girder viaduct supported on steel piers and having a curve length of 1,300 ft.; the width between parapets is 44 ft. It is in two continuous sections with an expansion joint over one of the central piers. The 715-ft. southern section consists of four 130-ft spans and two ends spans of 97 ft. 6 in., and the 585-ft. northern section is similar but has only three 130-ft. spans. The whole viaduct is on a horizontal curve of 1,164-ft. radius and the vertical profile has a 3.06% gradient for 790 ft. from the south abutment and then a 0.75% vertical curve over the rest of the structure. A constant super-elevation of 1 in 19.5 is applied across the carriageway and a fall in 1 in 36 to the hard shoulder.

The piers comprise 22 ft. 6 in. high twin welded mild steel hollow box columns 2-ft wide laterally and tapering from 7 ft. at the top to 4 ft. at the bottom longitudinally. The material is 1-in. thick and additional strength is provided by a 1-in. thick solid diaphragm down the centre.

Each pier is supported on a two-tier grillage encased in concrete integral with the pile cap. The lower tier comprises seven 27-ft. long 14 in. by 16 in. @ 158 lb. UC sections and the top tier two sets of three 24 in. by 12 in. @ 160 lb. UB sections, one set under each column.

Each hollow column is filled with concrete which is covered with a 1-in. thick stiffened plate. Another 1-in. thick plate over both columns forms the cap and provides a seating for the deck girder bearings, which are screened by steel box framing mounted on the cap plate.

The structural deck consists of a 14-ft. wide by 8-ft. deep three-cell welded steel box girder or spine beam running through the centre of the bridge with 14-ft. long cantilevers welded to both sides, generally at 10 ft. 10 in. centres, the whole supporting a reinforced concrete slab made to act compositely with the steel.

The box girder is of all welded construction in two continuous spans of 715 ft. and 585 ft. on the centre line. It consists of 1¼-in. thick top and bottom flanges in ND.1 steel and fours webs of ¾-in. thick mild steel plate dividing the girder into three cells of equal width. At each cantilever arm solid steel diaphragms are welded into the three cells. The diaphragms are generally of ¾-in. and ½-in. thick mild steel but over the piers and abutments where they act in bearing they are of $1\frac{3}{8}$-in. thick ND.1 steel. Flanges, webs and diaphragms are all stiffened where necessary and appropriate manholes are provided to give access to the whole of the inside of the spine girder.

The welded cantilevers are of mild steel, tapering from 5-ft. deep at the junction to 10 in. at the tip. The web is ¾-in. thick, the top flange is 12 in by $1\frac{9}{16}$ in. and the bottom flange is 9 in. by ¾ in. On both sides the cantilevers are shaped so that the top flanges follow the slope of the finished road surface. This entails a transition in the top flange of the cantilevers on the outside curve so that it meets the top of the box girder which has a horizontal top flange.

The reinforced concrete deck slab has a minimum thickness of 9½ in. and is generally reinforced with ¾-in. dia. bars at 4½-in.

This illustration shows the top surface of the three-cell box girder or spine beam and the cantilevers forming the structural deck.

The underside of the viaduct, showing how the twin-tapered hollow box column piers support the spine beam and cantilevers.

centres in both directions, top and bottom. It is covered with a waterproof membrane and 3 in. of hot rolled asphalt in two layers - a base course of 1¾ in. and a 1¼ in. thick wearing course. the carriageway is finished with ¾-in. green granite chippings.

The deck is supported on fixed bearings at the abutments and expansion bearings at all piers. The fixed bearings consist of mild steel bearing plates with rocker plates to allow for angular displacement. Two complete bearings are provided under the end of the box girder at each abutment and short 1-in. diameter prestressed bars resist uplift at the ends under adverse live load conditions.

Because of the very high loads expected on the expansion bearings to all piers, accentuated by the deck curvature producing eccentricity of loading, special 'Hi-load' bearings have been specified. A test load of 1,000 tons had been applied to these bearings, for each of which the maximum calculated load is 700 tons.

At the expansion ends of the deck girder two additional bearings of Meehanite metal type S.P. are used, in conjunction with four 1⅛ dia. prestressed bars to resist uplift and, at the same time allow for movement due to changes in temperature.

Allowance for expansion is made where the two continuous girders meet over one of the central piers. Movement is accommodated generally by means of a toothed expansion joint of cast steel plates over the roadway, sliding plates at the verges and the stainless steel cover plates over the parapet plinths.

Fabrication and erection of the viaducts are of considerable interest. The columns for the piers and the cantilevers were completely shop welded but shop fabrication of the spine girder was limited to complete preparations of all diaphragms and web plates, the shaping of the flange plates to follow the curve of the viaduct, and their preparation for single-V transverse butt-welds, and the welding together of the two widths to form each length of flange. Flanges and webs were made in lengths mainly about 32 ft. 6 in long and they were cut to the nearest 9/64 in.

Erection and assembly of the deck steelwork were carried out on temporary trestles and bearer beams erected between the piers to form a working platform at the correct finished height of the bottom flange. Work started at the north abutment and followed four definite stages which were repeated throughout the length of the bridge.

Stage I

Bottom flange plates were laid in position on the bearer beams and pre-set to enable the single-V automatic butt welds to be completed.

Stage II

After the butt welds were cleared by X-ray, the flange was lowered to the correct level and bulb flats and central diaphragms tack welded in position, followed by inner webs, forming an egg crate construction. Vertical butt welds were then completed joining the webs longitudinally together and, following this operation, the internal fillet welding was commenced.

Stage III

This consisted of assembling the top flange plates in position, presetting to complete the transverse butt welds, lowering down to the correct level and welding to the webs and diaphragms.

Stage IV

This included fitting the cantilever arms, completing all internal welding and finishing the external cover welds.

To limit built in stresses, Stage II was never less than one plate behind Stage I, and the top flange remained unwelded on plate behind the vertical web plates.

The transverse welds in both flanges were carried out by automatic CO_2 welding, the operator being protected from the weather by a sheeted steel framed housing mounted on wheels which was either rolled or transported by crane from each position to the next. All other welding was carried out by manual or semi-automatic CO_2 process, the operator being protected during the placing of external welds between flanges and outer webs by a similar sheeted housing.

As erection of the spine girder proceeded, cantilever sections were raised on a lifting beam with trolleys attached, mounted on the top flange of the spine girder, and then rolled into position and welded to the spine girder.

Prior to delivery to site, all steelwork was blast-cleaned after fabrication and given one coat of protective paint. Treatment after erection consists of six coats of paint to all exterior surfaces and three coats to enclosed surfaces.

An interesting point in connection with the protection of the internal surfaces of the totally enclosed box girders is the use of silica-gel to reduce the relative humidity. Approximately 2,000 lb is distributed in bags throughout the length of the spine beam. Re-charging will be necessary only at three year intervals and thus maintenance painting costs for the interior of the girders will be negligible. This system is being adopted as a result of successful experiments with the box girders of the Samlesbury Bridge on the Preston By-Pass.

The Lancashire County Council is responsible for the whole Preston-Lancaster Motorway as agents for the Ministry of Transport. The design and contract for all the road and bridge works were prepared in the office of the County Surveyor and Bridgemaster, Mr James Drake, C.B.E., B.Sc., M.I.C.E., M.I.Mun.E., PP.Inst.H.E.

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
- **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	SCM	Guide Contract Value (1)
A C Bacon Engineering Ltd	01953 850611			●	●		●										2		Up to £2,000,000
A & J Stead Ltd	01653 693742			●	●					●	●			●	●		2		Up to £100,000
Access Design & Engineering	01642 245151				●	●			●	●	●			●	●	✔	2		Up to £4,000,000
Adey Steel Ltd	01509 556677				●	●	●	●		●	●			●	●	✔	3	Silver	Up to £2,000,000
Adstone Construction Ltd	01905 794561			●	●	●	●									✔	2	Silver	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 £1,400,000
AKD Contracts Ltd	01322 312203				●					●	●			●	●		2		Up to £100,000
Angle Ring Company Ltd	0121 557 7241												●			✔	4		Up to £1,400,000
Apex Steel Structures Ltd	01268 660828			●	●	●	●			●	●			●			2		Up to £1,400,000
Arminhall Engineering Ltd	01799 524510	●			●	●		●		●	●			●	●	✔	2		Up to £400,000
Arromax Structures Ltd	01623 747466	●		●	●	●	●	●	●	●	●	●		●	●		2		Up to £800,000
ASA Steel Structures Ltd	01782 566366			●	●	●	●			●	●			●	●	✔	2		Up to £800,000
ASD Westok Ltd	0113 205 5270												●			✔	4		Up to £6,000,000
ASME Engineering Ltd	020 8966 7150				●	●				●	●			●	●	✔	3	Silver	Up to £1,400,000
Atlasco Constructional Engineers Ltd	01782 564711			●	●	●	●				●			●	●	✔	2		Up to £1,400,000
Austin-Divall Fabrications Ltd	01903 721950			●	●		●	●		●	●			●	●	✔	2		Up to £800,000
B D Structures Ltd	01942 817770			●	●	●	●				●	●		●		✔	2		Up to £800,000
Ballykine Structural Engineers Ltd	028 9756 2560			●	●	●	●	●				●				✔	4		Up to £1,400,000
Barnshaw Section Benders Ltd	01902 880848												●			✔	4		Up to £1,400,000
BHC Ltd	01555 840006	●	●	●	●	●	●	●			●	●		●	●	✔	4		Above £6,000,000
Billington Structures Ltd	01226 340666		●	●	●	●	●	●	●	●	●	●		●		✔	4	Gold	Above £6,000,000
Border Steelwork Structures Ltd	01228 548744			●	●	●	●				●				●		2		Up to £3,000,000
Bourne Construction Engineering Ltd	01202 746666		●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	Gold	Above £6,000,000
Briton Fabricators Ltd	0115 963 2901	●		●	●	●	●	●	●	●	●			●	●	✔	4		Up to £3,000,000
Builders Beams Ltd	01227 863770				●					●				●	●	✔	2		Up to £1,400,000
Cairnhill Structures Ltd	01236 449393	●			●	●	●	●	●	●				●	●	✔	4	Gold	Up to £3,000,000
Caunton Engineering Ltd	01773 531111	●	●	●	●	●	●	●		●	●	●		●	●	✔	4	Gold	Up to £6,000,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	●	●	●		●		✔	4	Gold	Above £6,000,000*
CMF Ltd	020 8844 0940				●		●	●		●	●				●	✔	4		Up to £6,000,000
Cook Fabrications Ltd	01303 893011				●					●	●			●	●		2		Up to £800,000
Coventry Construction Ltd	024 7646 4484			●	●	●	●		●	●	●			●	●	✔	2		Up to £800,000
D H Structures Ltd	01785 246269			●	●		●				●						2		Up to £100,000
Duggan Steel Ltd	00 353 29 70072		●	●	●	●	●	●			●					✔	4		Up to £4,000,000
ECS Engineering Services Ltd	01773 860001	●		●	●	●	●	●	●	●	●			●	●	✔	3		Up to £2,000,000
Elland Steel Structures Ltd	01422 380262		●	●	●	●	●	●	●	●	●	●		●		✔	4	Gold	Up to £6,000,000
EvadX Ltd	01745 336413			●	●	●	●	●	●	●	●	●				✔	2	Gold	Up to £3,000,000
Four Bay Structures Ltd	01603 758141			●	●					●	●			●	●		2		Up to £1,400,000
Fox Bros Engineering Ltd	00 353 53 942 1677			●	●	●	●	●			●				●		2		Up to £2,000,000
Gorge Fabrications Ltd	0121 522 5770				●	●	●	●		●				●		✔	2		Up to £800,000
Gregg & Patterson (Engineers) Ltd	028 9061 8131			●	●	●	●	●				●		●		✔	3		Up to £2,000,000
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	Silver	Up to £2,000,000
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
Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	SCM	Guide Contract Value (1)

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	SCM	Guide Contract Value (1)
Intersteels Ltd	01322 337766				●	●	●	●					●			✔	3		Up to £2,000,000
J & A Plant Ltd	01942 713511				●	●									●		2		Up to £200,000
James Killelea & Co Ltd	01706 229411		●	●	●	●	●					●		●			4		Up to £6,000,000*
John Reid & Sons (Strucsteel) Ltd	01202 483333		●	●	●	●	●	●	●	●	●	●		●	●	✔	4		Up to £6,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445			●	●	●	●	●	●	●	●	●		●	●	✔	4	●	Up to £3,000,000
Leach Structural Steelwork Ltd	01995 640133			●	●	●	●	●			●					✔	2	○	Up to £4,000,000
Legge Steel (Fabrications) Ltd	01592 205320			●	●		●		●	●	●			●	●		2		Up to £400,000
Luxtrade Ltd	01902 353182									●	●				●	✔	2		Up to £800,000
M Hasson & Sons Ltd	028 2957 1281			●	●	●	●	●	●	●	●				●	✔	4		Up to £2,000,000
M J Patch Structures Ltd	01275 333431				●					●	●			●		✔	2		Up to £800,000
M&S Engineering Ltd	01461 40111				●				●	●	●			●	●		2		Up to £1,400,000
Mabey Bridge Ltd	01291 623801	●	●	●	●	●	●	●	●	●	●	●	●	●		✔	4	●	Above £6,000,000
Mackay Steelwork & Cladding Ltd	01862 843910			●	●		●			●	●			●	●	✔	4		Up to £800,000
Maldon Marine Ltd	01621 859000				●	●		●	●	●					●	✔	3		Up to £1,400,000
Mifflin Construction Ltd	01568 613311		●	●	●	●	●				●						2		Up to £3,000,000
Murphy International Ltd	00 353 45 431384	●			●		●				●				●	✔	4		Up to £1,400,000
Newbridge Engineering Ltd	01429 866722	●		●	●	●	●				●				●	✔	3		Up to £1,400,000
Nusteel Structures Ltd	01303 268112						●	●	●	●						✔	4		Up to £4,000,000
Overdale Construction Services Ltd	01656 729229			●	●		●	●			●				●		2		Up to £400,000
Painter Brothers Ltd	01432 374400								●		●				●	✔	2	●	Up to £6,000,000
Pencro Structural Engineering Ltd	028 9335 2886			●	●	●	●	●	●		●			●	●	✔	2		Up to £2,000,000
Peter Marshall (Steel Stairs) Ltd	0113 307 6730									●					●	✔	2		Up to £800,000*
PMS Fabrications Ltd	01228 599090			●	●	●	●		●	●	●			●	●	✔	2		Up to £1,400,000
R S Engineering SW Ltd	01752 844511				●					●	●			●	●	✔	2		Up to £100,000
Rippin Ltd	01383 518610			●	●	●	●	●						●	●		2		Up to £1,400,000
S H Structures Ltd	01977 681931						●	●	●	●		●				✔	4	○	Up to £3,000,000
SDM Fabrication Ltd	01354 660895	●	●	●	●	●	●				●			●	●	✔	4		Up to £800,000
Severfield plc	01845 577896	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	●	Above £6,000,000
Shaun Hodgson Engineering Ltd	01553 766499	●		●	●					●	●			●	●	✔	3		Up to £800,000
Shipley Structures Ltd	01400 251480			●	●	●	●		●	●	●			●	●		2		Up to £1,400,000
Snashall Steel Fabrications Ltd	01300 345588			●	●	●	●	●			●				●		2		Up to £1,400,000
South Durham Structures Ltd	01388 777350			●	●	●				●	●	●			●		2		Up to £800,000
Southern Fabrications (Sussex) Ltd	01243 649000				●					●	●			●	●	✔	2		Up to £800,000
Temple Mill Fabrications Ltd	01623 741720			●	●	●	●				●			●	●	✔	2		Up to £200,000
Traditional Structures Ltd	01922 414172			●	●	●	●	●	●		●	●		●	●	✔	2	○	Up to £2,000,000
TSI Structures Ltd	01603 720031			●	●	●	●										2		Up to £1,400,000
Tubecon	01226 345261						●	●	●	●				●	●	✔	4	●	Above £6,000,000*
W & H Steel & Roofing Systems Ltd	00 353 56 444 1855			●	●	●	●	●						●	●		4		Up to £2,000,000
W I G Engineering Ltd	01869 320515				●					●					●	✔	2		Up to £200,000
Walter Watson Ltd	028 4377 8711			●	●	●	●	●				●				✔	4		Up to £6,000,000
Westbury Park Engineering Ltd	01373 825500	●		●	●		●	●	●	●	●				●	✔	4		Up to £800,000
William Haley Engineering Ltd	01278 760591			●	●	●			●	●	●			●		✔	4	○	Up to £4,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	●	Above £6,000,000
Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	SCM	Guide Contract Value (1)

Corporate Members

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

Company name	Tel
Balfour Beatty Utility Solutions Ltd	01332 661491
Bluefin Group	020 3040 6723
Griffiths & Armour	0151 236 5656
Highways Agency	08457 504030
Kier Construction Ltd	01767 640111

Company name	Tel
PTS (TQM) Ltd	01785 250706
Roger Pope Associates	01752 263636
Sandberg LLP	020 7565 7000
SUM Ltd	0113 242 7390
Welding Quality Management Services Ltd	00 353 87 295 5335

Associate Members

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

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

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 = Gold, Silver = Silver, Member = Member

Company name	Tel	1	2	3	4	5	6	7	8	9	CE	SCM
AceCad Software Ltd	01332 545800		●								N/A	
Albion Sections Ltd	0121 553 1877	●									M	
Arcelor Mittal Distribution - Scunthorpe	01724 810810								●		D/I	
ASD metal services	0113 254 0711								●		D/I	
Ayrshire Metal Products (Daventry) Ltd	01327 300990	●									M	
BAPP Group Ltd	01226 383824									●	M	
Barrett Steel Services Limited	01274 682281								●		D/I	
Behringer Ltd	01296 668259					●						
BW Industries Ltd	01262 400088	●									M	
Cellbeam Ltd	01937 840600	●									M	
Cellshield Ltd	01937 840600							●			N/A	
Cleveland Steel & Tubes Ltd	01845 577789								●		M	
CMC (UK) Ltd	029 2089 5260								●		D/I	
Composite Profiles UK Ltd	01202 659237	●									D/I	
Cooper & Turner Ltd	0114 256 0057									●	M	
Cutmaster Machines (UK) Ltd	01226 707865					●					N/A	
Daver Steels Ltd	0114 261 1999	●									M	
Duggan Profiles & Steel Service Centre Ltd	00 353 56 7722485	●							●		M	

Steelwork contractors for bridgeworks

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

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

FG Footbridge and sign gantries
PG Bridges made principally from plate girders
TW Bridges made principally from trusswork
BA Bridges with stiffened complex platework (eg in decks, box girders or arch boxes)
CM Cable-supported bridges (eg cable-stayed or suspension) and other major structures (eg 100 metre span)
MB Moving bridges
RF Bridge refurbishment
AS Ancilliary structures in steel associated with bridges, footbridges or sign gantries (eg grillages, purpose-made temporary works)
QM Quality management certification to ISO 9001
FPC Factory Production Control certification to BS EN 1090-1
1 – Execution Class 1 2 – Execution Class 2
3 – Execution Class 3 4 – Execution Class 4
SCM Steel Construction Sustainability Charter
(Gold = Gold, Silver = Silver, Member = Member)

Notes
(1) Contracts which are primarily steelwork but which may include associated works. The steelwork contract value for which a company is pre-qualified under the Scheme is intended to give guidance on the size of steelwork contract that can be undertaken; where a project lasts longer than a year, the value is the proportion of the steelwork contract to be undertaken within a 12 month period.
Where an asterisk (*) appears against any company's classification number, this indicates that the assets required for this classification level are those of the parent company.

BCSA steelwork contractor member	Tel	FG	PG	TW	BA	CM	MB	RF	AS	QM	FPC	NHSS 19A	NHSS 20	SCM	Guide Contract Value (1)
Briton Fabricators Ltd	0115 963 2901	●	●	●	●	●	●	●	●	✓	4		✓		Up to £3,000,000
Cairnhill Structures Ltd	01236 449393	●	●	●	●			●	●	✓	4			Gold	Up to £3,000,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	✓	4	✓	✓	Gold	Above £6,000,000*
Four-Tees Engineers Ltd	01489 885899	●	●	●	●		●	●	●	✓	3		✓	Member	Up to £2,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445		●		●			●	●	✓	4			Gold	Up to £3,000,000
Mabey Bridge Ltd	01291 623801	●	●	●	●	●	●	●	●	✓	4	✓	✓	Gold	Above £6,000,000
Millar Callaghan Engineering Services Ltd	01294 217711	●						●	●	✓	4				Up to £800,000
Murphy International Ltd	00 353 45 431384	●	●	●					●	✓	4				Up to £1,400,000
Nusteel Structures Ltd	01303 268112	●	●	●	●	●	●	●	●	✓	4	✓	✓		Up to £4,000,000
Painter Brothers Ltd	01432 374400	●		●					●	✓	2			Gold	Up to £6,000,000
S H Structures Ltd	01977 681931	●		●	●	●	●		●	✓	4		✓	Silver	Up to £3,000,000
Severfield (UK) Ltd	01204 699999	●	●	●	●	●	●	●	●	✓	4		✓	Gold	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 £400,000
Cimolai SpA	01223 350876	●	●	●	●	●	●	●	●	✓	4				Above £6,000,000
Concrete & Timber Services Ltd	01484 606416	●	●	●	●	●	●		●	✓	4			Member	Up to £800,000
Donyal Engineering Ltd	01207 270909	●						●	●	✓	3		✓	Member	Up to £1,400,000
Francis & Lewis International Ltd	01452 722200							●	●	✓	2		✓	Gold	Up to £2,000,000
Harland & Wolff Heavy Industries Ltd	028 9045 8456	●	●	●	●	●		●	●	✓	3				Up to £2,000,000
IHC Engineering (UK) Ltd	01773 861734	●							●	✓	3		✓		Up to £400,000
Interserve Construction Ltd	0121 344 4888							●	●	✓	3				Above £6,000,000*
Interserve Construction Ltd	020 8311 5500	●	●	●	●		●	●	●	✓	3				Above £6,000,000*
Lanarkshire Welding Company Ltd	01698 264271	●	●	●	●	●	●	●	●	✓	4	✓		Member	Up to £2,000,000
P C Richardson & Co (Middlesbrough) Ltd	01642 714791	●						●	●	✓	N/A				Up to £3,000,000

Company name	Tel	1	2	3	4	5	6	7	8	9	CE	SCM
easi-edge Ltd	01777 870901							●			N/A	●
Fabsec Ltd	0845 094 2530	●									N/A	
FabTrol Systems UK Ltd	01274 590865		●								N/A	
Ficep (UK) Ltd	01942 223530					●					N/A	
FLI Structures	01452 722200	●									M	●
Forward Protective Coatings Ltd	01623 748323						●				N/A	
Goodwin Steel Castings Ltd	01782 220000	●									N/A	
Graitec UK Ltd	0844 543 8888		●								N/A	
Hadley Group Ltd	0121 555 1342	●									M	○
Hempel UK Ltd	01633 874024						●				N/A	
Highland Metals Ltd	01343 548855						●				N/A	
Hilti (GB) Ltd	0800 886100									●	M	
Hi-Span Ltd	01953 603081	●									M	
International Paint Ltd	0191 469 6111						●				N/A	●
Jack Tighe Ltd	01302 880360						●				N/A	
Jamestown Cladding & Profiling Ltd	00 353 45 434288	●									M	
John Parker & Sons Ltd	01227 783200								●	●	D/I	
Joseph Ash Galvanizing	01246 854650						●				N/A	
Jotun Paints (Europe) Ltd	01724 400000						●				N/A	
Kaltenbach Ltd	01234 213201					●					N/A	
Kingspan Structural Products	01944 712000	●									M	●
Lindapter International	01274 521444									●	M	
Murray Plate Group Ltd	0161 866 0266								●		D/I	
National Tube Stockholders Ltd	01845 577440								●		D/I	
Peddinghaus Corporation UK Ltd	01952 200377					●					N/A	
PPG Performance Coatings UK Ltd	01773 814520						●				N/A	
Prodeck-Fixing Ltd	01278 780586	●									D/I	
Rainham Steel Co Ltd	01708 522311								●		D/I	
Sherwin-Williams Protective & Marine Coatings	01204 521771						●				M	○
Sika Ltd	01707 384444						●				M	
Simpson Strong-Tie	01827 255600									●	M	
Structural Metal Decks Ltd	01202 718898	●									M	●
Tata Steel	01724 404040				●						M	
Tata Steel Distribution UK & Ireland	01902 484000								●		D/I	
Tata Steel Ireland Service Centre	028 9266 0747								●		D/I	
Tata Steel Service Centre Dublin	00 353 1 405 0300								●		D/I	
Tata Steel Tubes	01536 402121				●						M	
Tata Steel UK Panels & Profiles	0845 3088330	●									M	
Tekla (UK) Ltd	0113 307 1200		●								N/A	
Tension Control Bolts Ltd	01948 667700						●			●	M	
voestalpine Metsec plc	0121 601 6000	●									M	●
Wedge Group Galvanizing Ltd	01909 486384						●				N/A	
Yamazaki Mazak UK Ltd	01905 755755					●					N/A	

New and revised codes & standards

From BSI Updates February 2015

BRITISH STANDARDS REVIEWED AND CONFIRMED

BS 5493:1977
Code of practice for protective coating of iron and steel structures against corrosion

BRITISH STANDARDS UNDER REVIEW

BS EN 10024:1995
Hot rolled taper flange I sections. Tolerances on shape and dimensions

BS EN 10029:2010
Hot-rolled steel plates 3 mm thick or above. Tolerances on dimensions and shape

BS EN 10034:1993
Structural steel I and H sections. Tolerances on shape and dimensions

BS EN 10051:2010
Continuously hot-rolled strip and plate/sheet cut from wide strip of non-alloy and alloy steels. Tolerances on dimensions and shape

BS EN 10279:2000
Hot rolled steel channels. Tolerances on shape, dimension and mass

NEW WORK STARTED

EN 10056-1
Structural steel equal and unequal leg angles. Dimensions
Will supersede BS EN 10056-1:1999

EN 16828
Hot rolled steel channels, I and H sections. Dimensions, masses and sectional properties

DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT – NATIONAL BRITISH STANDARDS

15/30296207 DC
BS 8895-2 Designing for material efficiency in building projects. Code of Practice for Concept and Developed Design

15/30302283 DC
BS 8081 Grouted anchors. Code of practice
Comments for the above document are required by 11 March, 2015

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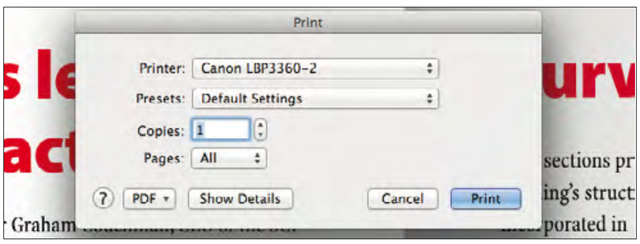

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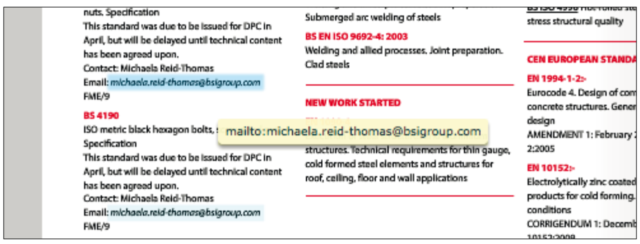

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