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NSC

Gateway opens for Carlisle retail

Vol 28 No 7 July/August 2020

Manchester commercial noses ahead

SSDA shortlist revealed

New BCSA President interviewed

Cover Image
Brazennose House, Manchester
Main client: Marshall CDP
Architect: Jon Matthews Architects
Main contractor: Marshall Construction
Structural engineer: Ramboll
Steelwork contractor: Caunton Engineering
Steel tonnage: 1,250t

The images used in this month's project features were all taken before the new coronavirus social distancing restrictions came into force. As such, some may show operatives in close proximity to each other.

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These and other steelwork articles can be downloaded from the New Steel Construction Website at *www.newsteelconstruction.com*

Shortlist projects push the design envelope

Nick Barrett - Editor

The shortlist for the Structural Steel Design Awards has been announced and the 22 selected projects can be seen in this issue of *NSC* (p 14). Together they are as worthy a representation of the best that our steelwork construction industry produces as has been seen in the Awards' 52-year history.

The projects selected to go forward for the final judging exhibit the high quality that the Award finalists traditionally do, as well as being a diverse range of project types in locations throughout the UK and Ireland. We will learn what the judges thought of the overall quality in October, but they can hardly fail to be impressed.

The SSDA shortlist shows how steel construction is developing to keep pace with changing demands of designers, themselves responding to changing requirements of the users of buildings and other structures, and to changes in society, always providing a window into developing trends, pointing towards the directions the industry will be moving in. Some key pointers can be picked up from this year's outstanding crop.

For example, all of these projects demonstrate a high level of sustainability benefits, some including ground-breaking savings in embodied carbon as well as costs. Re-purposing of existing buildings is increasingly finding favour with developers, and sustainability can be significantly boosted when existing buildings are given new leases of life by adding floors and other extensions, as we see in the shortlisted Post Building in London and Bath Schools of Art and Design, which were both subject to a substantial change of use.

Overcoming technical challenges thrown up by ambitious designs and producing steelwork to the tightest tolerances is the day-to-day task of steelwork contractors, and there are some outstanding examples among this year's projects. The shortlist also shows the construction teams taking full advantage of the latest technology. For example, the envelope has been pushed in the use of Building Information Modelling on several projects.

Others show the benefits of bringing steelwork contractors onto projects early so that their experience can be shared with the rest of the construction team. Involving a steelwork contractor from project inception is the best way to capture the full value.

Full scale trial erections are sometimes used on complex projects to ensure fit-up and minimise risk on site, as we see this year with the high-rise office block at 52 Lime St, London.

Changes to construction procurement are increasingly acknowledged as essential to the sustainability of the industry itself, and we can see how progressive procurement has added value to projects on the SSDA shortlist.

The need for procurement change chimes with a key message from the BCSA's new President Mark Denham who is profiled in this issue (p 12). He is asking for architects and engineers to specify BCSA membership as a precondition of being invited to tender for steelwork. BCSA membership is not a condition of entry to the SSDA, but it is surely no accident that most of the shortlisted projects for over 50 years have been produced by BCSA members - possibly enough of an argument in itself for ensuring that the steelwork contractor you use, is a fully accredited member of the world's leading constructional steelwork association.

2020 Structural Steel Design Awards Shortlist Announced

The shortlist for the 52nd Structural Steel Design Awards (SSDA), jointly sponsored by the BCSA and Trimble Solutions (UK) Ltd, has been announced.

A strong field of entrants has been scrutinised and the remaining 22 strong shortlist of projects once again showcase steel's flexibility and versatility in a number of different and varying applications throughout the UK and Ireland. This year's entries also reflect the wide geographical spread of steel's appeal for a variety of projects (see page 14).

The winners will be announced on 1 October.

The SSDA 2020 shortlist is:

- 52 Lime Street, London
- A14 Cambridge to Huntingdon Improvement Scheme
- Barton Square, intu Trafford Centre, Manchester
- Bath Schools of Art and Design
- Boeing GoldCare Aircraft Hangar, Gatwick Airport
- Bridgewater Place Wind Amelioration Scheme, Leeds
- Brunel Building, London
- Centre Building, London School of Economics
- Drake Circus The Barcode, Plymouth
- Mary Elmes Bridge, Cork City
- National Infrastructure Laboratory, University of Southampton
- One Bank Street, Canary Wharf
- One Bartholomew, Barts Square, London
- Scarborough Footbridge, York
- The Balfour, Kirkwall, Orkney
- The Curragh Racecourse Redevelopment, Kildare
- The Gravity Bar, Guinness Storehouse, Dublin
- The Post Building, London
- The Standard Hotel, London
- The Wave, Coventry
- Tintagel Footbridge, Cornwall
- Waterloo Station Roof Infill

Congratulating the shortlisted entrants for their architectural and engineering excellence, David Moore, Chief Executive Officer of the BCSA, said: "Structural steelwork is the original offsite framing material with the ability to deliver the most efficient and cost-effective solutions for a building or a structure. It is also able to provide practical, flexible and beautiful spaces.

"But it doesn't stop here, the sector is still evolving and is now looking to the future to deliver structures that meet the climate emergency and a more complex level of design for manufacture and assembly.

"Since the Structural Steel Design Awards were launched in 1969 the winning projects have demonstrated sustainability, engineering excellence, innovation and attention to detail. The range and quality of entries for the 52nd year of the awards are no different. Once again, the entries submitted are exceptional and we have a very strong shortlist. Congratulations to all the shortlisted project teams."

Trimble Buildings' Regional Business Director Richard Fletcher also acknowledged the quality and ingenuity shown by the shortlisted projects: "It is encouraging to see that the projects shortlisted for the Structural Steel Design Awards once again illustrate the quality and ingenuity that the world-class structural steel industry within the UK and Ireland regularly displays.

"Our industry continues to deliver projects of high complexity and scale utilising appropriate technology and data driven design, manufacture, assembly and erection. With increased digitalisation of the construction workflow we are well placed to continue to adapt and change to a post-COVID world. Trimble are proud to again be associated with the Structural Steel Design Awards. Good luck to all those shortlisted."

For more information on this year's awards, please visit: *http://www.steelconstruction.info/Structural_steel_design_awards*

Nightingale Hospital deadline met with steel

Taunton Fabrications has supplied approximately 80t of structural steelwork for the new Nightingale Hospital being built on a former Homebase DIY store site in Exeter.

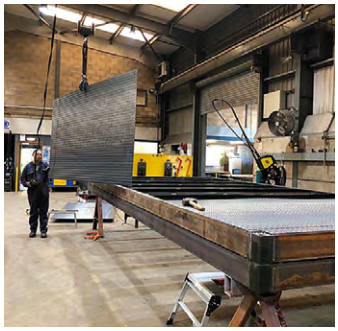
Working to an extremely tight deadline, the company initially manufactured and supplied 15 large steel frames that have been used in the construction of the new emergency hospital.

After this work was successfully completed, main contractor BAM Construction subsequently requested Taunton Fabrications to design and manufacture 11 large roof plant decking support frames together with guardrails and walkways.

Taunton Fabrications Managing Director Jason Rigby said: "We originally received an urgent request from BAM asking if we could design, manufacture and install a number of steel frames within two weeks, ready for the hospital to open in June.

"Each frame measured 12m-long x 3m-wide and weighed approximately 3t. By re-scheduling our work and mobilising our workforce and steel suppliers, we've been able to help out with this important work."

The 120-bed hospital will take COVID-19 patients from Devon and neighbouring counties.



Scottish steelwork contractor wins prestigious Ghana project

BHC has been named as the structural steelwork contractor by UK-based Contracta Construction, in association with UK Export Finance (UKEF), to work on the redevelopment of Kumasi central market in Ghana.

UKEF has provided £70.3M of support to develop and modernise Kumasi central market with a requirement that UK-based companies are awarded the contracts.

BHC will be fabricating over 8,000t of structural steelwork at its 55-acre fabrication facility in Carnwath, South Lanarkshire, which will be shipped from Grangemouth to the Port of Tema, Ghana in containers.

Additionally, BHC will be procuring and supplying over 100,000m² of metal decking and cladding.

Kumasi central market is a major trading centre in the Ashanti region, which is visited by thousands of people daily from Ghana and the surrounding countries of Benin and Togo.

The market will feature 6,500 market spaces to lease, 5,400 cold stores, 800 kiosks, 50 restaurants, 210 stalls for fishmongers and butchers, 40 livestock stalls, a police station, fire station, post office and a hospital.

Contracta Construction UK Director Fabio Camara said: "UKEF's flexible financial support played a key part in securing the Kumasi contract. Kumasi is a vital trading hub for the Ashanti region and West Africa's largest market, and this modernisation will have huge benefits for vendors and customers, as well as for our continued international growth and UK supply chain."

New Presidential appointments at the BCSA

At its recently held AGM, the British Constructional Steelwork Association (BCSA) elected Mark Denham, Chairman and Managing Director of Elland Steel Structures as President (see page 8), while Gary Simmons, Chief Engineer at William Hare was elected Deputy President.

The BCSA has also published its Annual Review for 2019-20, which is now available for download.

Highlighting its membership's expertise, the Annual Review covers topics such as Commercial and Contracts, Process and Technical, Sustainability, Health and Safety, Training, and Steel for Life.

Out-going BCSA President, Tim Outteridge said: "In my three years as President, and three years a Deputy, I have very much enjoyed working closely with the BCSA's committed team and its dedicated members as the BCSA continues to help us shape a safer, better and fairer working environment for the constructional steelwork sector.

"During my presidency there have been challenges, some of which are still ongoing; not least of which is Brexit, mapping the future trading relationship between the UK, the EU and the rest of the world and presently the global

challenge of the Coronavirus pandemic.

"The global effect of COVID-19 is still uncertain, and specifically how deeply and for how long it will directly impact us all in the construction sector. As I've said before, we are a resilient and agile sector and I feel certain that we will get through this.

"There is little doubt that the constructional steelwork sector will rise to the new norms and will very quickly adapt to change as it has in the past."

Schools to get 'transformative' investment

A ten-year 'multi-wave' and 'transformative' school building programme has been announced by Prime Minister Boris Johnson, with over £1,000M promised to fund the first 50 projects. The programme represents the biggest schools investment programme since Building Schools for the Future was scrapped in 2010.

The Prime Minister said work on the first of the 50 school building projects will start in September 2021. Details of which schools will be given the money are to be announced in the government's Spending Review later this year.

Some schools and colleges are to receive funding this year for refurbishments, £560M for schools and £200M for colleges. The further education investment represents bringing forward part of the £1,500M five-year investment programme promised in the Conservative General Election manifesto.

The Education Department said investment will be targeted at school buildings in the worst condition across England. Rebuilding projects are to be greener to help meet the government's net zero target and will focus on modern construction methods to create highly skilled jobs and boost the construction sector.

Education Secretary Gavin Williamson said: 'Replacing and upgrading poor condition school and college buildings with modern, energy-efficient designs will give our students and teachers the environment they deserve and support them to maximise their potential.'

Before Mr Johnson's speech, it was announced that £1,500M would be made available for hospital maintenance and construction, the removal of mental health dormitories and increasing A&E capacity. The Department of Health and Social Care says the £1,500M is in addition to a £1,100M increase in capital investment announced in the Spring Budget.

Derby footbridge installed over A52

Working on behalf of main contractor Galliford Try and the client Derby City Council, S H Structures has successfully installed a new foot and cycle bridge spanning the A52 in central Derby.

Forming an important link between the residential district of Chaddesden and the retail and business parks surrounding Derby County's Pride Park stadium, the bridge is part of the Wyvern Transport Improvement Scheme.

Designed by AECOM, the steel bridge is 81m-long × 4.3m-wide and features an arch fabricated from 559mm x 25mm CHS members that reaches a maximum height of 14m. In addition to the main bridge, the steelwork contract also included the installation of extensive access ramps.

The bridge deck will have a resin anti-slip surface, while handrail lighting and decorative arch lighting, designed to have minimal impact on nearby residential properties will provide a safe environment for bridge users.

With a total steel tonnage of 180t, the bridge was delivered to site in sections and then assembled on temporary works alongside the A52 close to its final position.

The complete bridge was lifted into place using a 600t-capacity crawler crane during a weekend road closure.

Councillor Matthew Holmes, Deputy Leader and Cabinet Member for Planning, Regeneration and Transportation said: "The new bridge will provide improved accessibility from the retail and business parks, enhancing walking and cycling facilities for all."

NEWS IN BRIEF

Severfield has reported a healthy level of tendering in key market sectors in its annual results for the year to 31 March 2020. Chief Executive Officer Alan Dunsmore reported turnover up 19% to £327.4M (£274.9M) and underlying pre-tax profits ahead 16% to £28.6M (£24.7M), beating the strategic profit target for the year of £26M.

Plans to build London's largest film studios on former industrial land in **Dagenham** have been approved by Barking and Dagenham Council's planning committee. The project will feature a total of six sound stages as well as flexible accommodation for uses such as production offices, hair and makeup or dressing rooms.

Contractor **John Sisk & Son** and developer **Osborne+Co** have announced the signing of a contract for the construction of a new state-of-the-art campus for Santander in Milton Keynes. The new office, which represents an investment of £150M in the town, will be home to over 6,000 employees and will bring together staff from the bank's existing locations into one site.

The proposed £42M transformation of **Paisley Museum** into a world-class cultural destination has received a major boost with an additional £200,000 funding from The Wolfson Foundation. When Paisley Museum reopens, it is expected to attract 125,000 visitors each year from Scotland, the UK and overseas and provide a £72M economic boost to the area over the next 30 years.

The next phase of **Blackpool**'s town centre regeneration is set to get underway at Talbot Gateway. The development will see the demolition of an existing Wilko store, the completion of the new tramway interchange at Blackpool North Station, a new underpass, a four-star Holiday Inn hotel and restaurant, and new retail outlets.

PRESIDENT'S COLUMN

My predecessor, Tim Outteridge, introduced the 'President's Column' as a new item in *New Steel Construction* in his president's profile in the July/August 2017 edition of *New Steel Construction* and I'm very pleased to continue with this popular column.

I believe that the members of the British Constructional Steelwork Association (BCSA) bring added value to a project and are amongst the most knowledgeable, professional, and competent steelwork contractors in the world. I have been a member of the association for 20 years and I've been the chairman of the BCSA's Process and Technical Committee since 2011. During this time, I've seen the quality and competence of BCSA's steelwork contractors increase in line with issue of the various versions of the National Structural Steelwork Specification and with the introduction of CE marking. Responsible Welding Co-ordinators (RWC) were introduced as part of CE marking to make one person accountable for the welding processes from the pre-contract stage through to final production and any work done on site. Many initially thought that CE marking was just an additional burden but, in most cases, it has improved knowledge of the fabrication process, increasing the quality and reducing the amount of remedial work. The concept of getting it right first time is vitally important and the additional checks required to be undertaken before, during and after welding has built in more quality into our fabricated product. As we all know it's a lot more difficult to produce a quality product by testing after welding alone. I'm pleased to say that the vast majority of BCSA members have invested in the necessary weld procedure qualification records (WPQR's) to ensure their welding procedures are up to scratch.

During the pandemic and the lockdown BCSA has further increased the quality of fabrication through the development of the seventh edition of the National Structural Steelwork Specification for buildings. This publication will be issued shortly and represents probably the biggest change in the NSSS since it was first published in 1989.

Following the tragic events at Grenfell Tower the constructional steelwork industry decided to take ownership of intumescent fire protection systems. The 7th edition of the NSSS includes new sections on the specification, application and inspection of intumescent systems and requires them to be applied in the workshop to better control the quality of application. In addition, BCSA is developing a training course for 'Responsible Painting Co-ordinators' – someone with overall responsibility for the application of both intumescent systems and painting systems to structural steelwork. This is new to the industry and will further enhance the quality of paint and intumescent systems.

The improvements in welding quality management systems and in the application of intumescent and painting systems will further enhance the quality and competence of BCSA members and will make it easy for specifiers to select the right steelwork contractor. The NSSS includes a complete list of BCSA steelwork contractors together with contact details.

I am a firm believe that BCSA members are amongst the best in the world at delivering steelwork contracts for a discerning client and that the average BCSA member is better prepared to design, detail, fabricate and safely erect structural steelwork buildings than other non-members.

Mark Denham
BCSA President

New station inspired by steel

High Speed 2 (HS2) has shortlisted three contractors that will be invited to tender for the project's £570M Birmingham Curzon Street station.

The firms through to the final bidding for HS2's Birmingham city centre terminus are Bam Ferrovial – a joint venture of Bam Nuttall and Ferrovial Construction (UK); Laing O'Rourke Construction; and a Mace Dragados joint venture.

An earlier tendering exercise was scrapped last year after HS2 reported that not enough main contractors had appeared interested in taking the project on.

The station design by WSP and Grimshaw Architects is said to be inspired by the steel arched roofs of Victorian railway stations. The new station is to be net zero carbon in operation, helped by incorporating eco-friendly design and sustainable technologies. The station will have over 2,800m² of solar panels located on platform canopies.

HS2 Ltd procurement and commercial director David Poole said: "Birmingham Curzon Street is absolutely at the heart of the HS2 project and will help transform the city and the economy of the wider region."

Archaeological work is underway with demolition, ground investigation and utility diversions set to start this summer. The contract for construction of the station is expected to be awarded next year.

Bridge to Newhaven port successfully installed

Cleveland Bridge has installed a new three-span steel composite bridge as part of the Newhaven Port Access Road scheme.

Requiring an overall steel tonnage of 360t, the bridge spans two waterways and the Seaford to Newhaven railway line. The middle Mill Creek span is 46.7m-long, while the outer spans of the structure are both 37m-long.

The project needed a total of nine bridge beams to be delivered to site and due to the size of the vehicles needed to transport the components a police escort was required.

A local council spokesperson said: "We are extremely grateful to residents and road users around Newhaven for their patience during these deliveries.

"Our contractors managed to keep disruption to a minimum by using boats for many material deliveries, but the logistics of getting bridge beams measuring up to 46.7m to site meant they had to come by road."

The Newhaven Port Access Road is expected to be completed by autumn this year and will create a direct access to the East Quay. It will form a route to allocated development land, which will open up 80,000m² of business space, allowing the creation of new jobs.

The scheme is being funded by a £10M grant from the Local Growth Fund money through the Coast to Capital Local Enterprise Partnership and £13.2M from the county council's capital programme.

Mega shed targets BREEAM 'Excellent'

Tenders are being invited for construction of what will be one of the UK's largest sheds, a four-storey, 213,000m² 'mega shed' to be built on the site of the disused Littlebrook Power Station at Dartford, Kent.

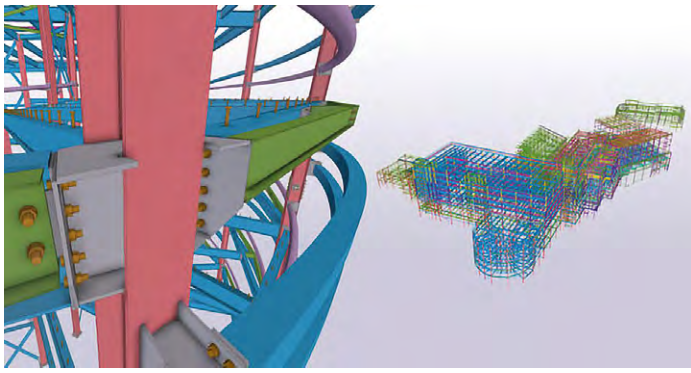
The warehouse has been pre-let, reportedly to online retailer Amazon, although the developers will only confirm that the pre-let is to a major online retailer. Amazon is known to have been seeking a site for what would be its largest distribution centre in Europe.

Planning permission was granted to Tritax Big Box and Bericote Properties for the £200M scheme that will transform a 45 acre plot, part of a 119 acre site of a four oil and coal fired power station complex close to the Queen Elizabeth II Bridge and the Dartford Tunnel. Contractor ISG has been reported to be front runner for the main contract award.

The project is to target a BREEAM 'Excellent' rating, employing a range of emission-reducing features including a 3.5MW roof solar panel system, energy saving lighting, low water use and electric car charging points.

The developers say the project will not only deliver much sought-after high specification logistics space for London, but also bring enhanced local infrastructure and significant employment opportunities to the local area.

BCSA members win Tekla Awards



Four projects involving BCSA steelwork contractors are winners of 2020 UK Tekla Awards, following another year of impressive entries received across a range of categories.

The annual UK Tekla Awards are open to projects of all shapes and sizes, which demonstrate the effective use of Tekla software during the design, modelling and construction phases of a project.

Richard Fletcher, Regional Business Director at Trimble, said: "Our annual awards are a great opportunity to recognise those companies using BIM to help plan, manage and deliver their projects successfully. Given the recent and current challenges, it has perhaps never been more a more fitting time to celebrate the ongoing hard work and success within the industry.

"Upon reviewing the entries, our judges were particularly impressed with how some customers really demonstrated the software's modelling capabilities, such as Hewson Consulting Engineers and Severfield on the Luton DART Station project – winner of the Public Project award - and the level of detail in some of the models, such as Billington Structures' impressive and highly-detailed connections and trusses on The Glass Works (pictured)– winner in the Sports & Recreation category."

ASME Engineeering won the Commercial Projects category for the Hawley Wharf scheme, while The Barcode, Drake Circus in Plymouth picked up the Tekla Structural Designer award.

Evolve Consulting Engineers and steelwork contractor BHC worked on this project.

Steel rises for new Leeds University business school

More than 650t of structural steelwork has begun to be erected for the Leeds University Business School and School of Law's new teaching facility.

Designed by DLA Architecture, it has been named the Esther Simpson building in honour of a former graduate. The four-storey structure will provide flexible teaching spaces, lecture theatres and trading rooms, and a large entrance foyer. As many of these areas are large column-free space, a steel framing solution was chosen as the most economic.

Working on behalf of main contractor BAM Construction, Elland Steel Structures is fabricating, supplying and erecting the steelwork.

BAM Construction Director Kelvin Pollard said: "It is fantastic to be building another world-class teaching facility at the University of Leeds, where we are already on site delivering the Sir William Henry Bragg building. We have well-established, strong working relationships with the University and this is an excellent basis to work from."

The project is due to be completed in 2021.

Major redevelopment plans revealed for former steelworks

The South Tees Development Corporation has submitted game-changing plans for a 400,000m² state-of-the-art manufacturing space on the site of the former SSI steelworks in Redcar, which will create 9,000 jobs.

The huge scheme, led by Tees Valley Mayor Ben Houchen (pictured left), would see more than 430 acres of land alongside the River Tees remediated and developed into a world-class manufacturing zone that could welcome its first tenants as soon as 2022.

The construction phase of the development would create 1,000 construction jobs during its eight-year build, with 9,000 more in permanent roles when complete, significantly boosting the regional economy for the long-term.

The transformational plans come just three months after Mayor Houchen succeeded in his bid to secure the former SSI steelworks through a compulsory purchase order.

Mr Ben Houchen said: "This is the biggest planning application in the North of England. We have worked tirelessly to take ownership of this site to allow us to get on with my plan for jobs, creating good quality high skilled local jobs for local workers.

"This planning application represents a huge step forward in reaching this goal and represents a modest portion of the site, while creating many thousands of jobs, which shows why this site is so important – not just to Redcar and Cleveland but to the future success of our whole region.

Diary

For SCI events contact Jane Burrell, tel: 01344 636500 email: *education@steel-sci.com* web: *https://portal.steel-sci.com/trainingcalendar.html*

Wenesday 5 August 2020
Steel design at elevated temperatures
Webinar available to all
Often, designers simply design for resistance at normal temperatures and expect the structure to be fire protected. This webinar will discuss the behaviour of steelwork at elevated temperature and the simple calculation models in the Eurocode.

Wenesdays 2, 9, 16 & 23 September 2020
Portal frame design
Online course
The course aims to provide in-depth coverage of the major issues surrounding the analysis, design and (crucially) the detailing of portal frames. This online course covers frame design to BS EN 1993-1-1 and will be delivered over 4 sessions.

Tuesday 15 September 2020
Seismic design of steel structures to Eurocode 8
Webinar for SCI/BCSA Members only
This webinar will give the fundamentals of seismic design of steel structures according to Eurocode 8. A short introduction about seismic actions and design options will be given. Capacity design for steel structures according to Eurocode 8 section 6 will be discussed, highlighting the differences with the common Eurocode 3 design rules.

Tuesday 29 September 2020
Light gauge steel design
Online course
This online course introduces the uses and applications of light gauge steel in construction, before explaining in detail the methods employed by Eurocode 3 for designing light gauge steel members in bending and compression and calculation of section properties. Specific design issues related to the different uses of light gauge steel are addressed.

President with a Big Hairy Audacious Goal*

New BCSA President Mark Denham of Elland Steel Structures wants specifiers to demand that all structural steelwork tenderers are members of the Association as a minimum requirement. This is his 'Big Hairy Audacious Goal', as he explains to Nick Barrett.

BCSA President Mark Denham

Steelwork contracting involves collaboration between people with diverse skills, including metallurgy, structural engineering, design and welding, through to experts on safe erection of the most complex structures, but there can't be many with backgrounds as research aerodynamicists in the aerospace industry.

BCSA's new President Mark Denham might in fact be in a minority of one. Now Chairman and Managing Director of the successful, independent, Halifax-based steelwork contractor Elland Steel Structures, Mark was once part of the Computational Fluid Dynamics Group of the Aerodynamics Department at British Aerospace's Sowerby Research Centre, Bristol.

Mark graduated in 1990 from Swansea University with a Honours Degree in Engineering Mathematics with Computational Methods, but his earliest career ambition was to fly aeroplanes with the Royal Air Force. Before University, he took part in the RAF's Flying Scholarship Scheme, which earned him a Private Pilot's Licence by the age of 18. "Unfortunately, Top Gun had just been released and every would be 'Maverick' in the world wanted to be a pilot all of a sudden, and I wasn't selected for pilot training," he remembers. "It was a disappointment, but I decided if I can't fly them, I need to go to Plan "B", why don't I help to make them, which is why I joined British Aerospace."

While at Swansea Mark had his first experience with mathematical modelling including finite element analysis, which was to stand him in good stead when he later went on to become a structural engineer. "I had studied mathematics, physics and computer studies at 'A' level, so it was a straightforward switch."

A year at Imperial College earned him a Masters in Structural Steel Design in 1994, and he has been a member of the IStructE since 1999 and a Fellow since 2018.

Mark is also proud of his achievement of Diploma of International Welding Engineer in 2013, proof of a high level of expertise in a key skills area for steelwork fabricators. Mark's father was a plater and founded Elland Steel Fabricators in 1973 as a subcontractor in general engineering before finding a ready market for the company's skills in fabricating for the steel construction industry.

"I had found myself at a crossroads at British Aerospace, there didn't seem to be much opportunity in the field I specialised in, so after discussions about a career change with my father I decided to jump into engineering with both feet, and went to Imperial College."

After a one-year placement with a leading steelwork contractor, where he worked as an estimate steel designer in the design office, he was ready to start at the family-owned business as a Design Engineer. Mark became responsible for all design and drawing office activities when promoted to Technical Manager in 2000, and became Technical Director in 2002. "I have been lucky to be able to learn from some outstanding engineers like Trevor Griffiths, who was Chief Engineer at Elland Steel Structures when I joined."

Mark's early interest and experience of computing at University and at British Aerospace gave him the skills to be responsible for all IT for the company early in his career. He became Managing Director in 2008 and then Chairman on his father's retirement in 2013.

Mark's BCSA commitment is of long standing, having become Technical Representative of the Association's Northern Region on the BCSA's key Process and Technical Committee in 2001. He has been committee Chairman since 2011.

After imbibing all that the Masters course had to teach him about structures, and picking up how it all worked in practice during his placement at a large steelwork contractor, Mark was undaunted at having to learn about accountancy, marketing and management skills needed to successfully run what is now a £25 million turnover business with over 90 employees.

"I think about 95% of everything I have ever learnt at school or university I've utilised at some point in my career one way or another, and it has been a case very much of stepping-stones all along the way. I learned a lot about mathematical modelling and visualisation at British Aerospace and that is coming into our industry more and more."

Mark is looking forward to his three-year term as President of the BCSA, which Elland Steel Structures joined in 1986. "We have enjoyed a lot of benefits from our membership of the BCSA and have always played a full role in its work, which the whole

* 'Big Hairy Audacious Goal' from 'Good to Great' by Jim Collins.

Elland Steel completed the steelwork for the twin office blocks at Salford Embankment.

constructional steelwork sector benefits from."

Not all steelwork contractors make a financial contribution though, as they are not BCSA members. Mark says his 'Big Hairy Audacious Goal' for his Presidency is to have BCSA membership made a minimum requirement in architect's and engineer's specifications.

"Some steelwork contractors stubbornly refuse to become members, and that is a loss to them as well as to those who do join and pay their contribution to funding the invaluable work we do. Without BCSA's staff and members playing the role they do in producing design guidance, and providing designers with all the information and advice they need to make using steel in their designs as straightforward as can be, these non-members wouldn't have the businesses that they do today.

"They have been having a free ride and I think it is time for them to start contributing. Country's like New Zealand have a $10 tariff put on all steelwork brought into the country that funds their equivalent of the BCSA. That system seems a lot fairer to me, everybody contributes.

"They would find other benefits if they became members. For example, we had the heads up about the potential impact of CE marking well ahead of non-members, so we had the opportunity to better prepare our businesses to be ready for that challenge.

"I think we need to get the message across to engineers and architects that the benefits of specifying BCSA membership are strong enough that it should be demanded in their tender requirements. The average BCSA member is demonstrably better set up than the average non-member to satisfy client requirements and build quality into their structures."

Mark says the steel construction sector is in survival mode for the rest of this year, with a bounce back expected in 2021. "Clients had been nervous because of Brexit, but we thought we were just about over that when COVID-19 hit. We are however well placed as a company to be ready for the recovery.

"We got better technically as an industry in the last recession and currently BCSA members are in good shape financially to withstand the storm."

The BCSA is getting ready to start work for a new generation of design guides. "These are crucial to the future of constructional steelwork in the UK," says Mark. "The BCSA has beefed up its technical strength internally in the past year or two and we have technical strength in depth among our active members, so we are well set up for the challenge.

Changes in construction procurement seem to be in the wind post the Grenfell tragedy, which Mark welcomes. "We can all see that the procurement system is not fit for purpose. When I explain how construction procurement works to people from outside the industry you can visibly see their jaws drop. We need to stop the race to the bottom that lowest price obsessions create. Quality can't survive that long term."

"The average BCSA member is demonstrably better set up than the average non-member to satisfy client requirements and build quality into their structures."

The Mark Denham Presidency will have been a success in his own eyes if the message about the advantages of being a BCSA member get across to more steelwork contractors, and more specifications demand that tenders come from BCSA members only. "There isn't any need for root and branch change, but small marginal gains can and should always be pursued," he says.

Elland Steel transported its steelwork by sea to Jersey to complete an office scheme in St Helier.

SSDA Shortlist 2020

A total of 22 diverse projects from around the UK that highlight steelwork's numerous attributes have made it onto the shortlist for the 2020 Structural Steel Design Awards, which are jointly sponsored by the British Constructional Steelwork Association and Trimble Solutions (UK) Ltd.

A14 Cambridge to Huntingdon Improvement Scheme

Structural engineer: Atkins, CH2M Hill Joint Venture
Steelwork contractor: Cleveland Bridge
Main contractor: A14 Integrated Delivery Team
Client: Highways England

Photo © Chris Wakefield

Bath Schools of Art and Design

Architect: Grimshaw Architects
Structural engineer:Mann Williams
Steelwork contractor: MJ Patch Structures Ltd
Main contractor: Willmott Dixon
Client: Bath Spa University

Barton Square, intu Trafford Centre, Manchester

Architects: Corstorphine + Wright, Leach Rhodes Walker
Structural engineers: Cameron Darroch Associates, Mott MacDonald
Steelwork contractor: S H Structures Ltd
Main contractor: VINCI Construction UK
Client: intu Properties plc

Boeing GoldCare Aircraft Hangar, Gatwick Airport

Architect: D5 Architects LLP
Structural engineer: Mott MacDonald
Main contractor: John Sisk & Son
Client: Boeing United Kingdom Limited

Bridgewater Place Wind Amelioration Scheme, Leeds

Architect: Chetwoods Architects
Structural engineer: Buro Happold
Steelwork contractor: S H Structures Ltd
Main contractor: Lendlease
Client: CPPI Bridgewater Place LP

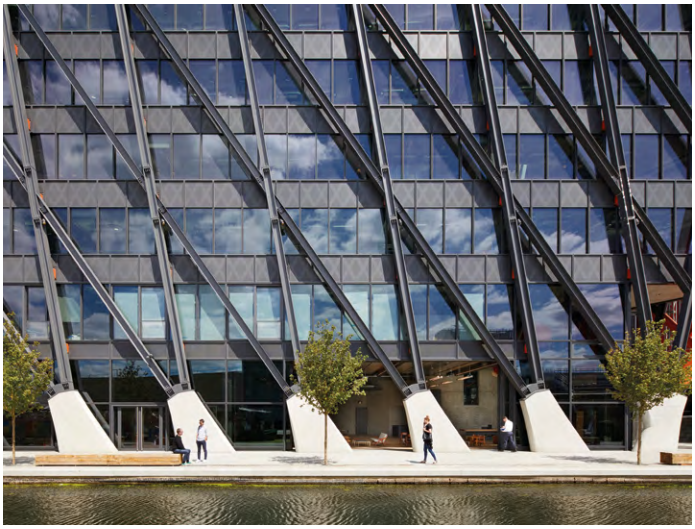


Photo © Jack Hobhouse

Brunel Building, London

Architect: Fletcher Priest Architects
Structural engineer: Arup
Steelwork contractor: Severfield
Main contractor: Laing O'Rourke
Client: Derwent London

Drake Circus The Barcode, Plymouth

Architect: Corstorphine + Wright
Structural engineer: Evolve Consulting Engineers
Steelwork contractor: BHC Ltd
Main contractor: McLaren Construction Group
Client: British Land

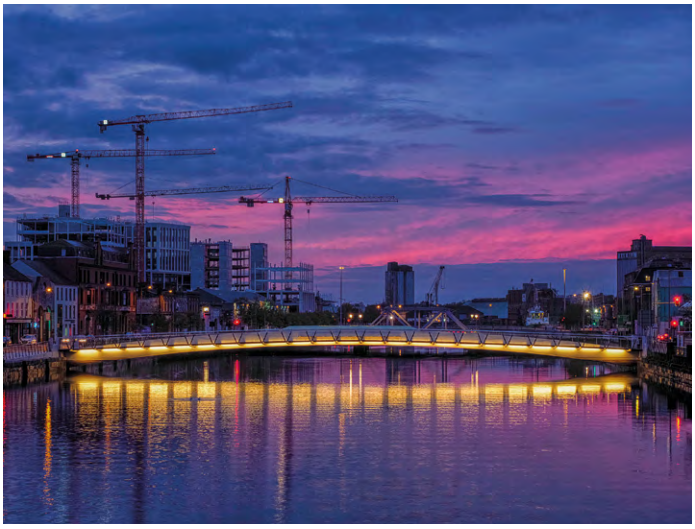


Photo © Henry O'Brien

Mary Elmes Bridge, Cork City

Architect: WilkinsonEyre
Structural engineer: Arup
Main contractor: Keating
Client: Cork City Council

Photo © fotohaus

National Infrastructure Laboratory, University of Southampton

Architect: Grimshaw Architects
Structural engineer: Buro Happold
Main contractor: Wates Construction Limited
Client: University of Southampton

Scarborough Footbridge, York

Architect: Network Rail
Structural engineer: AECOM
Main contractor: AmcoGiffen
Client: City of York Council

The Balfour, Kirkwall, Orkney

Architect: Keppie Design
Structural engineer: AECOM
Steelwork contractor: BHC Ltd
Main contractor: Robertson
Client: NHS Orkney

Photo © Gareth Byrne

The Curragh Racecourse Redevelopment

Architect: Grimshaw Architects
Structural engineer: AECOM
Steelwork contractor: Kiernan Structural Steel Ltd
Main contractor: John Sisk & Son
Client: The Curragh Racecourse Ltd

The Gravity Bar, Guinness Storehouse, Dublin

Architect: RKD
Structural engineer: Arup
Steelwork contractor: Steel & Roofing Systems
Main contractor: P.J. Hegarty & Sons
Client: Diageo

Photo © Timothy Soar

The Standard Hotel, London

Architect: Orms
Structural engineer: Heyne Tillett Steel
Main contractor: McLaren Construction
Client: Crosstree Real Estate Partners LLP

Photo © Billington Structures

The Wave, Coventry

Architect: FaulknerBrowns Architects
Structural engineer: Engenuiti
Steelwork contractor: Billington Structures Ltd
Main contractor: Buckingham Group Contracting Ltd
Client: CV Life

Photo © Jim Holden

Tintagel Footbridge, Cornwall

Architect: William Matthews Associates
Structural engineer: Ney & Partners
Steelwork contractor: Underhill Engineering Limited
Main contractor: American Bridge UK
Client: English Heritage

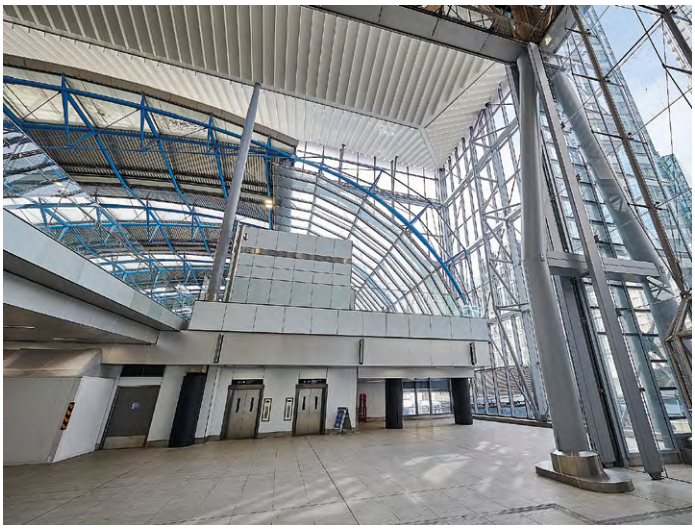
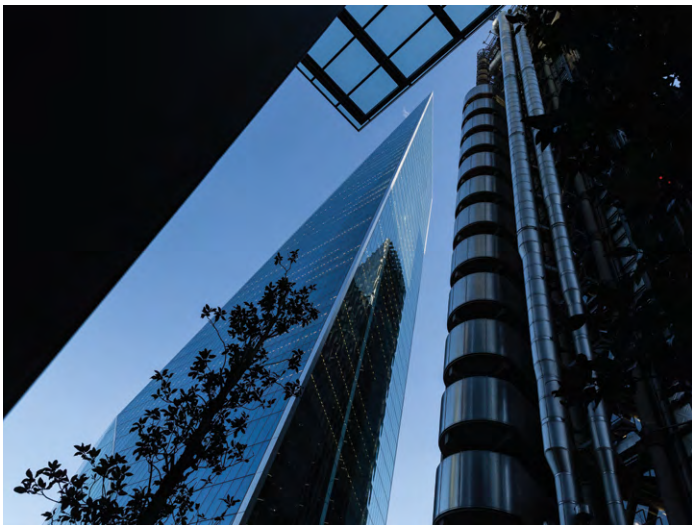


Photo © Michael Cockerham

Waterloo Station Roof Infill

Architect: AECOM
Structural engineer: Mott MacDonald
Steelwork contractor: Bourne Steel Ltd
Main contractor: Wessex Capacity Alliance
Client: Network Rail



52 Lime Street, London

Architect: Kohn Pedersen Fox
Structural engineer: Arup
Steelwork contractor: William Hare
Main contractor: Skanska
Client: WRBC Development UK Limited

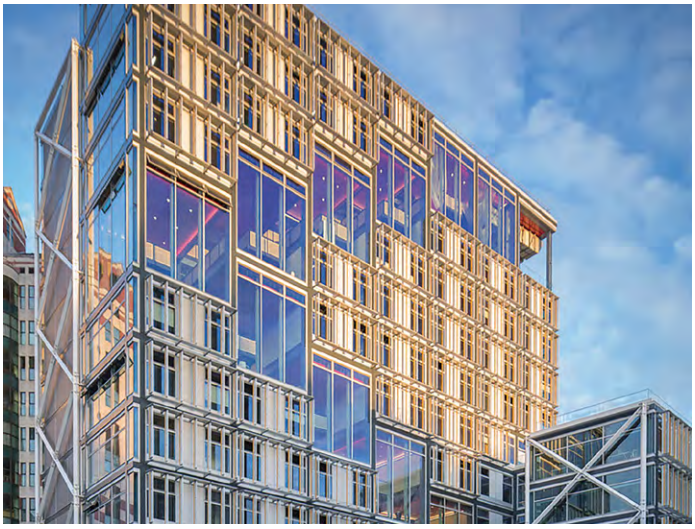


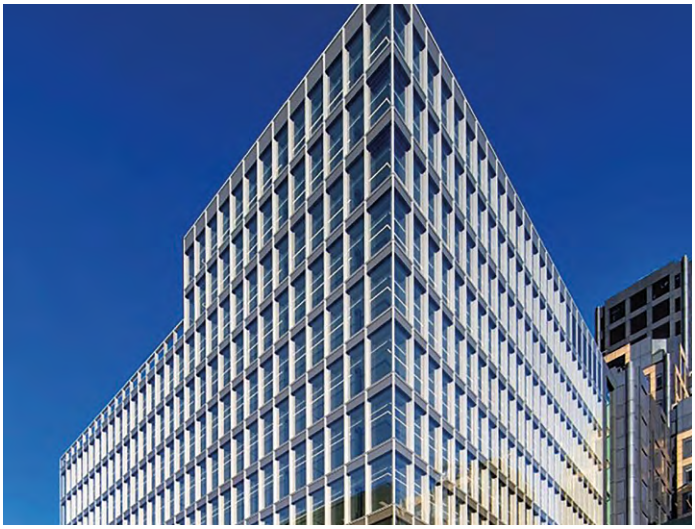
Photo © Mark Gorton, RSHP

Centre Building, London School of Economics

Architect: Rogers Stirk Harbour + Partners
Structural engineer: AKT II
Steelwork contractor: Billington Structures Ltd
Main contractor: Mace
Client: London School of Economics

One Bank Street, Canary Wharf

Architect: Kohn Pedersen Fox
Structural engineer: Arup
Steelwork contractor: William Hare
Main contractor: Canary Wharf Contractors
Client: Canary Wharf Group



One Bartholomew, Barts Square, London

Architect: Sheppard Robson
Structural engineer: Waterman
Steelwork contractor: William Hare
Main contractor: Mace
Client: Helical

The Post Building, London

Architect: Allford Hall Monaghan Morris
Structural engineer: Arup
Steelwork contractor: BHC Ltd
Main contractor: Laing O'Rourke
Client: Brockton Capital LLP and Oxford Properties Group

Retail boost for Cumbria

A steel framing solution has provided a new retail development in Carlisle with the required open-plan floor space and a quick construction programme.

Retail in Carlisle is set to get a significant boost as a further out-of-town shopping destination is due to complete this autumn.

Located adjacent to Junction 44 of the M6, Gateway 44 is an extension to the city's existing Kingstown Retail Park, which currently includes a number of popular outlets such as Asda and M&S, alongside a Premier Inn hotel and car showrooms.

On completion, Gateway 44 will provide 3,900m² of retail space on a 2.8-acre site, which will also include 181 parking spaces.

Commenting on the scheme, Leader of Carlisle City Council, Cllr John Mallinson, said: "Carlisle is a growing city and this new development will create more jobs and will provide a boost to the local economy. We encourage other retailers and businesses to invest in Carlisle. The city has a lot to offer and is an ideal location for established and new businesses."

Main contractor Caddick Construction began work on the previously greenfield site in February. After a groundworks programme, which included the installation of ground-bearing pad foundations, the steelwork erection was able to begin within a couple of months.

Caddick Construction Contracts Manager Derek Billows said "The team is delighted to have been appointed on this project to work with Carlisle City Council. This is a further boost for our new Kendal office following the recently completed Mercedes Dealership in Carlisle and the JLR Dealership in Kendal along with the ongoing development of a Blue Light Hub for Cumbria County Council and the recent award of the Kendal town hall redevelopment, all of which indicates that the future in the county looks good."

The entire development consists of one large steel-framed structure, next to a smaller frame to house the Costa drive thru. According to the project architect, the choice of a steel framing solution was a simple decision.

A portal frame design offered the project a number of benefits, including the desired column-free spaces.

The steelwork erection programme nears completion

How the completed retail structure and the adjacent drive thru will look

"A steel frame was the preferred method of construction as it allowed us to maximise floor area and minimise construction time on site," says Fletcher Rae Senior Architect Andrew Thompson.

Steelwork contractor Border Steelwork Structures (BSS) has erected a total of 217t for the main retail structure and a further 19t for the drive thru.

The main retail building is 127m-long with a maximum width of 40m and a height of 10.2m (9.4m-high to parapet). Structurally, it is three distinct, but inter-connected, portal-framed sections with hipped ends.

Stability for the main building is achieved via portal frame action in the transverse direction, and by pinned braced frames in the longitudinal direction. Lateral loads in the roof are transmitted via plan bracing to the main stability elements, with vertical bracing down into the ground.

Explaining the steel erection sequence for the main structure, BSS Contracts Director Stuart Airey says: "The structure was erected as a normal span portal, whereby we erected the gable end steel and three columns up each side and then tied it in with bracing and tie beams.

"We then spliced up the first pair of rafters on the ground and lifting them to connect to the columns. We then erected the hip rafters and bracing and continued with the sequence over again."

The erection process was completed using a single 55t-capacity mobile crane in conjunction with three MEWPs.

Most of the retail units are typically open to roof, thereby offering just a ground floor level, although there is scope to add extra mezzanine floors, which two units already have.

Within the retail units the longest portal span is 36m, creating the client's desired open-plan column-free spaces. Meanwhile, the building's column bays vary between 6m-wide and 7.5m-wide.

Other than the main frame, another notable and highly visible steel element of the main building is a full-length canopy to shop front, which forms a concourse. The canopy rafters are fixed back to the main structure with thermal break connections.

As well as fabricating, supplying and erecting the project's steelwork, BSS has also supplied and installed roof and wall cladding. Different lifting equipment was needed for this part BSS's package. For the roof cladding, the company used a five-axle mobile tower crane due to the limited access around one of the perimeter elevations, while a 40t-capacity mobile crane was brought to site to install the wall cladding.

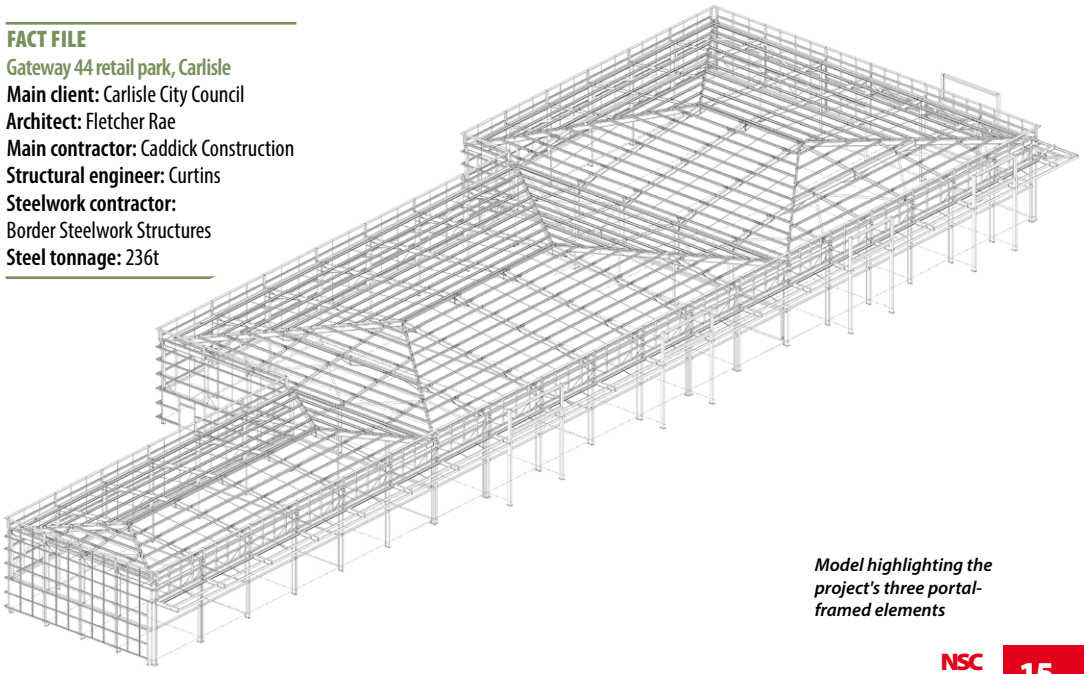
BSS will complete its work in August and Gateway 44 is due to be completed in the autumn.

"A steel frame was the preferred method of construction as it allowed us to maximise floor area and minimise construction time on site."

FACT FILE

Gateway 44 retail park, Carlisle

Main client: Carlisle City Council
Architect: Fletcher Rae
Main contractor: Caddick Construction
Structural engineer: Curtins
Steelwork contractor: Border Steelwork Structures
Steel tonnage: 236t



Model highlighting the project's three portal-framed elements

FACT FILE
Brazennose House, Manchester
Main client: Marshall CDP
Architect: Jon Matthews Architects
Main contractor: Marshall Construction
Structural engineer: Ramboll
Steelwork contractor: Caunton Engineering
Steel tonnage: 1,250t

Brazennose House will be the centrepiece of a regenerated Lincoln Square.

Steel tower provides regeneration centrepiece

Structural steelwork continues to be the preferred framing material for Manchester's burgeoning commercial sector.

Manchester's commercial sector shows little sign of slowing down, as a raft of office developments are currently underway, while a number of prestigious schemes have been completed in the past 12 months.

Structural steelwork is playing a leading role in this sector, as the majority of high-rise office developments, not just in Manchester, are usually constructed with a steel framing solution.

Developers and designers choose steelwork for their projects because the material offers a quick and speedy construction programme, while also efficiently providing the long spans and column-free spaces, most modern commercial schemes crave.

An example of the burgeoning Manchester market is Brazennose House, which is situated near to the busy Deansgate thoroughfare in the city centre.

Designed by Jon Matthews Architects, the new building will on completion be the centrepiece of a regenerated Lincoln Square. Replacing an older structure, which was demolished as part of the early works, the new building will provide six floors of 9,300m² Grade A office space, a roof terrace, and retail and restaurant units at ground level.

Manchester City planners believe the development by Marshall CDP will act as a catalyst for regeneration by delivering high quality architecture, attractive uses and increased levels of activity within an improved public realm.

According to the architects, it will revitalise Brazennose Street, animating the important pedestrian link between the Town Hall and Deansgate.

The scheme is also said to respond to complex rights to light issues and provides a contextual response to the adjacent

buildings and conservation area, as well as offering a respectful relationship to the adjacent listed St Mary's Roman Catholic Church.

Clad in riven and polished pre-cast concrete with bronze etched detailing the building is a modern interpretation of the design details used in some of the nearby historic buildings including the town hall and John Rylands library.

The main office entrance fronts Lincoln Square and the building kicks back to reveal a new piazza created to provide an improved setting for the listed church.

The civic and historic context of Brazennose is said to have influenced the façade treatments, materials, activation of the ground floor and the way the building's design has economically used the available plot. In order to maximise the site and available space, one end of the building, opposite the church, culminates in a tip, giving the structure a nautical ship-like appearance. Meanwhile, at the other end of the building, a terrace at fifth floor will provide views to the town hall.

Main contractor Marshall Construction started work on site towards the end of 2019, once the demolition of the previous building had been completed.

"This is a prestigious job for our company as it is located on an important city centre plot," explains Marshall Construction Contracts Manager Paul Stokes.

"The old building had a basement, which we had to infill to create a piling platform so we could install foundations, which consisted of piles up to 18m deep."

"We then had to undertake a mass excavation to dig-out a new basement, before the steelwork erection could begin."

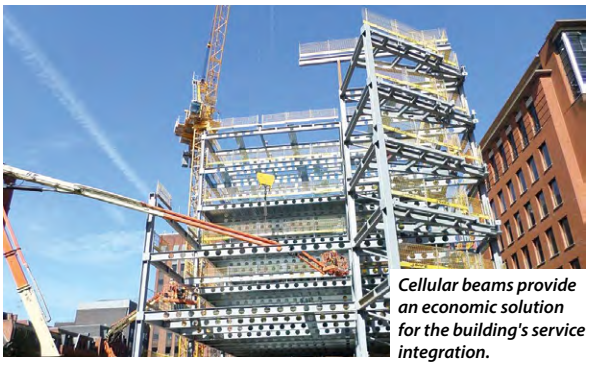
Steelwork starts at basement level and is based around a varying grid pattern, which corresponds with the structure's irregular rectangular shape with internal spans of up 14m-long.

A concrete core, located along one of the main elevations, provides the steel frame with its stability. By placing the core alongside one of the perimeters, the designers have maximised the available space.

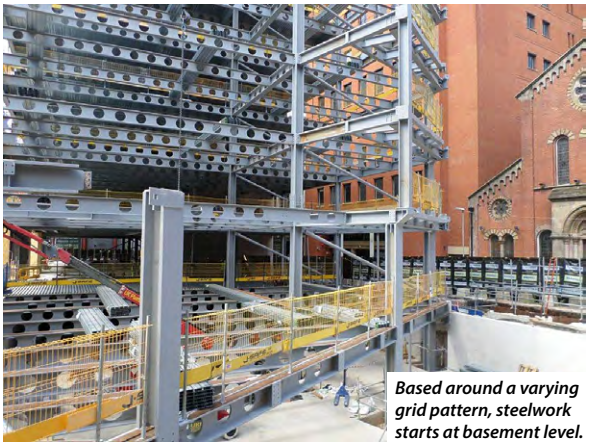
Cellular beams have been used throughout to provide an economic and efficient method of accommodating the building's services within the structural void. The steel beams support metal decking and concrete topping to create a composite flooring design.

Steelwork contractor Caunton Engineering erected the steelwork using the site's one tower crane, in conjunction with MEWPs positioned in the basement and at ground level around the structure's perimeter.

"There were a lot of individual steel elements for this project, due ▶18



Cellular beams provide an economic solution for the building's service integration.



Based around a varying grid pattern, steelwork starts at basement level.

"Structural steelwork offers certainty and a quicker construction programme than alternative framing solutions"

Stability for the steel frame is provided by one concrete core.

Brazennose House will be clad with precast panels giving the exterior envelope a granite appearance.

▶17

to the irregular shape, however all of the steelwork was within the tower crane's lifting capacity as the heaviest members were only 6t," explains Caunton Engineering Contracts Manager Gary Hatton.

The 6t members are plate girders, used as transfer structures to create the set-back outdoor terrace.

Commenting on the use of steel, Mr Stokes says the design of this project was always going to utilise steel construction.

"Structural steelwork offers certainty and a quicker construction programme than alternative framing solutions, which is always an important consideration when designing a city centre office block.

Summing up, he adds: "We are genuinely honoured to be working on what is a true civic location and this is a once in a generational opportunity to mend and enhance this part of the city."

Brazennose House is due to be complete by summer 2021.

Fabricated plate girders

Beams with web openings are a common solution for lightweight, long span members with the opportunity to integrate services within the depth of the member. David Brown of the SCI comments on the fire protection of this type of steel member.

Steel members with web openings, such as those used in Brazennose House, offer the opportunity to minimise the overall construction depth of the floor by integrating the services within the structure. If used compositely, the lever arm between the compression in the concrete slab and the tension in the lower flange can lead to a highly efficient design. Openings are often circular, elongated (oval) or rectangular, and may be at a regular spacing or located to suit the services layout.

The fire protection of steel beams with web openings demands special attention, primarily because a web with openings is likely to heat up faster than a plain web. In addition, intumescent coatings – the common protection system for this type of member – demonstrate subtly different performance characteristics when applied to members with openings. For many beams with web openings, the resistance of the web posts may be the critical check, so careful assessment of the web temperature and necessary fire protection is required.

A fire engineering assessment will generally specify that a certain temperature (the "critical temperature") must not be exceeded at the specified fire resistance period. All elements must be protected to ensure that the steelwork remains below this specified temperature. The thickness of fire protection will generally be constant over the entire cross section, but must respect the different thermal response of a beam with web openings compared to a member with a plain web. If the bottom flange is at a certain temperature, a "web post factor" or "web modification factor" is used to determine the higher temperature of the web posts, which must remain below the "critical temperature" specified for the structure.

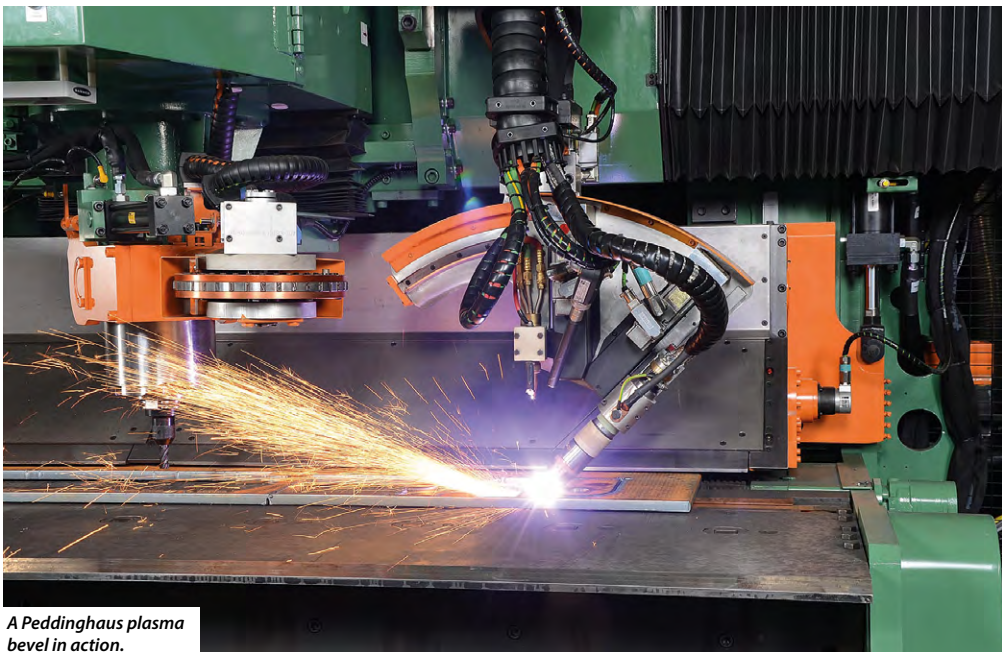
The performance of the intumescent coating on members with web openings depends both on the geometry of the openings and tested product performance, so is specific to each coating product. Coating manufacturers test their products in accordance with a test procedure published by the Association for Specialist Fire Protection (ASFP) (The "Yellow book", 5th edition), which complements a structural resistance model presented in SCI Report RT 1356.

If critical temperatures have been established for the web and the flanges, the necessary thickness of protection for all elements may be determined, allowing for the product-specific web modification factor. Alternatively, an iterative process may be used, adjusting the coating thickness (and consequently the temperature of the steel elements) whilst completing a structural assessment at each stage, which will also require product-specific performance data. A further alternative approach is to assume a bottom flange steel temperature, determine the necessary protection thickness and use the web modification factor to determine the thermal distribution through the cross section. An iteration of structural assessments can be undertaken, adjusting all steel temperatures by the same proportion until the resistance just exceeds the design effects.

Generally, for practical reasons, a uniform protection thickness is adopted over the whole cross-section based on the maximum thickness required, although different elements could have different coating thicknesses. An optimised solution would involve a balance between steel material and coating, determined at the member design stage, if the product-specific coating performance characteristics were known.

Continual customer support

Being a family business, Peddinghaus says it has taken onboard a kinship culture to engender an extremely close relationship with its worldwide network of customers.



A Peddinghaus plasma bevel in action.

"We never forget that we are a family company. We have more than just a business culture, we have a family culture."

Peddinghaus Corporation has been serving the metalworking industry for more than 110 years and says it is more than just a manufacturer of machines for structural steelwork and heavy plate processing.

''We keep customers ahead of the fabrication curve through strong partnerships, constant research and development, 24/7 customer service, cutting-edge technology and quality components to create machines that are built to last," says Managing Director of Peddinghaus Corporation UK, Gemma Home-Roberts.

"We never forget that we are a family company. We have more than just a business culture, we have a family culture. This culture starts with the commitment of the skilled craftsmen who build our machines and ends with our customers all over the world."

An example of this partnered approach is Peddinghaus's long-standing 50-year relationship with steelwork contractor Caunton Engineering. Currently Caunton's fabrication facility comprises four Peddinghaus drill/saw tandem systems, three Peddinghaus plate processing lines, along with a Peddinghaus coping machine helping to maintain a 35,000t per year shop capacity.

"One of the key drivers for our relationship with Peddinghaus machinery is reliability and speed. It's not simple machinery, but it's not too complicated for what we want it to do. There's no extra bells and whistles that get in the way. It's exciting, strategic and it's all about very small gains adding up to very big wins. They have good levels of service and you can pick up the phone and Peddinghaus is there. That's how we feel we're part of the Peddinghaus family," says Caunton Engineering CEO Simon Bingham.

Peddinghaus continues to work closely with Caunton and over the years it has offered support to enable them to alter the fabrication process from a linear to a parallel line, which has greatly improved efficiency. More recently, Peddinghaus has worked with Caunton on a workshop upgrade and during the COVID-19 lockdown period, managed to safely and successfully renew two drill and saw lines.

"The combination of how we run our Peddinghaus machines gives us a better all-round throughput, with each process seamlessly going through to the next. The Advantage-2 milling facility with carbide cutting, is probably one of the best functions we've used on a machine, as it saves days in labour time," says Caunton Engineering Production Director Mark White.

"The thing that sticks out today is how fast the machines are in comparison to the older machines and typically, when you've got two older machines sat there with two new ones around it, it's so obvious. The difference is five or six times quicker it's quite mind-blowing at times, which was the main driver for our recent upgrade."

Peddinghaus says the year 2020 has invited an abundance of challenges and uncertainty upon its customers, here in the UK and to others across the globe. While many are still gauging what the short-term and long-term impacts of these challenges will be on business, Peddinghaus will continue to offer customers a long-term partnership, 24-hour based technical support and machines that are built to last for the best possible return on investment.

For further information about Peddinghaus please contact *info@peddinghaus.co.uk.*

Peddinghaus says it provides steelwork contractors with a strong partnership

Peddinghaus is a Gold sponsor of *Steel for Life*

Restraints around portal frames

In this second technical article on portal frames, David Brown of the Steel Construction Institute reviews the all-important correct positioning and arrangement of restraints to the inside flanges of columns and rafters. Having considered in-plane buckling in the previous article, the focus is now on controlling out-of-plane buckling.

The problem(s) identified

Charles King, well-known to many in the portal frame world and responsible for much of the guidance on this popular form of construction, used to comment when leading SCI courses that some errors in the analysis and design of a portal frame may not lead to collapse, but incorrect detailing almost certainly would. It is clear from inspecting some bare frames during erection and from questions received at the SCI that some designers remain uncertain about where restraints should be located, and what form an effective restraint might take.

Fundamental Physics

The bending moment diagram around a portal frame due to primarily "gravity loads" is well known, shown in Figure 1. At various locations, notably the column and around the haunch in the rafter, the inside flange is in compression under this combination of actions. Elements in compression wish to buckle, and eventually, if unrestrained, will buckle in the out-of-plane direction. The moment is greatest at the eaves – consequently the compression in the inner flange is at a maximum, resulting in great enthusiasm to buckle out-of-plane – which must be restrained if the frame is to remain stable.

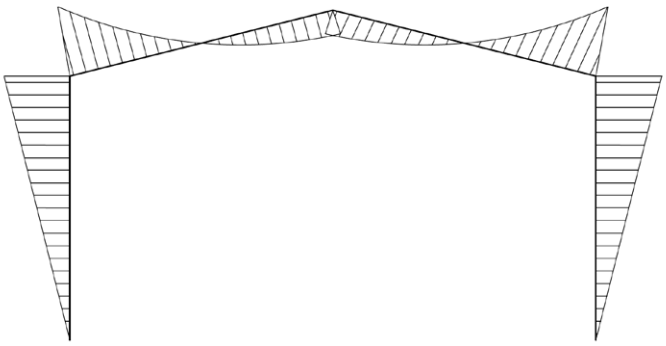


Figure 1: Being moment diagram – "gravity" combination of actions

The classic assumption about members is that they have "fork" supports, as shown in Figure 2.

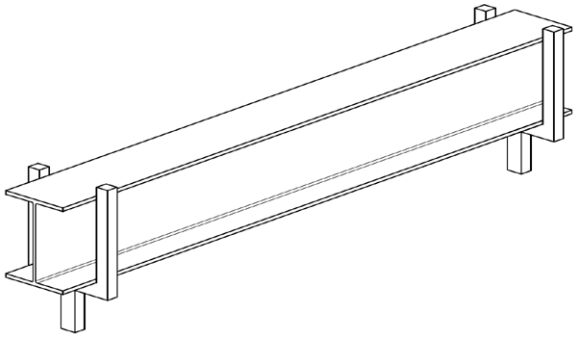


Figure 2: End fork supports – a torsional restraint

It should be noted that a "fork" support provides lateral positional restraint to each flange, thus forming a torsional restraint. It should be equally obvious that a restraint to one flange only, as shown in Figure 3a, is not providing a torsional restraint at that location.

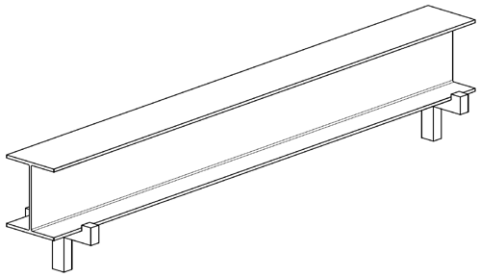


Figure 3a: Lateral restraint to one flange only

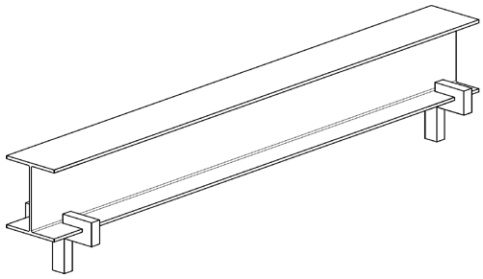


Figure 3b: Lateral and torsional restraint to one flange only

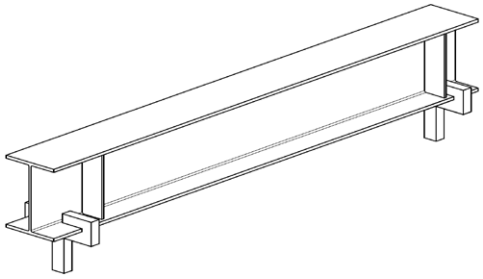


Figure 3c: Lateral and torsional restraint to one flange with web stiffeners

Some arrangement to "clamp" the one flange, as shown schematically in Figure 3b, is still not a torsional restraint, as the unattached flange is free to buckle. An arrangement with stiffeners to connect the flanges together, and a "clamped" flange, as shown schematically in Figure 3c is the only way to provide restraint to the "other" flange, but note the requirement for both stiffeners and a "clamped" flange.

These schematic diagrams illustrate the sorts of questions – and answers - which arise concerning restraints around portal frames. In summary:

1. A side rail or purlin connected to one flange only provides lateral restraint to that flange only, but does nothing of value for the other flange.
2. Introducing full depth stiffeners in isolation does nothing to prevent lateral-torsional buckling – the whole cross section is still able to move laterally and twist. In this situation the AISC (American equivalent of SCI) ▶22

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▶20

note that "transverse stiffeners are simply along for the ride"

3. Introducing stiffeners on their own, even when aligned with a side rail, does not constitute a torsional restraint, as the connection to the side rail or purlin is in no way equivalent to the "clamp" shown in Figure 3c. Bolts in clearance holes in very thin material cannot be considered to provide a rigid joint.

In the UK, the common way to restrain the inside flange is to provide small diagonal links from the inside flange to the side rail or purlin, as shown in Figure 4.

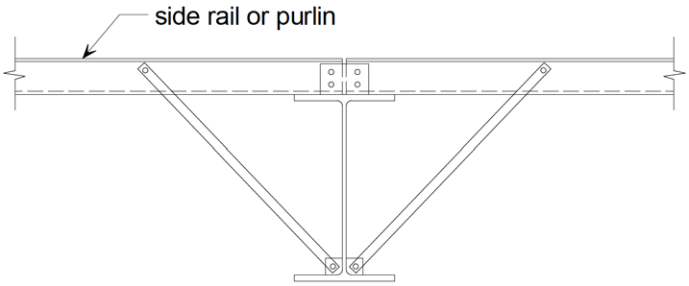

Figure 4: Stays from secondary steelwork to inner flange

Conceptually, this triangulated system is equivalent to the web stiffeners shown in Figure 3c and the secondary steelwork provides lateral restraint. The necessary torsional restraint, equivalent to the "clamping" described above, is delivered by the stiffness of the secondary members acting as "U-frames" as shown in Figure 5.

Figure 5: U-frame behaviour with secondary steelwork

U-frame action and its application to portal frames was discussed at length in *New Steel Construction* in June 2018.[1] This article included advice on when and how the stiffness of the secondary steelwork forming the U-frames should be assessed.

The small diagonal ties shown in Figure 4 are normally designed for a lateral force equal to 2.5% of the compression force in the flange, but their stiffness is equally important. If out-of-plane buckling is prevented in the first place, there is no lateral force. Since in the UK we believe that U-frame action is the underlying structural mechanics, we do not believe that the restraint forces translate into tension and compression in the side rails or purlins, nor do we insist that to be effective as part of a restraint system, the side rails and purlins must intersect with the nodes of bracing. Some other European countries make this a requirement. The secondary members must be continuous, otherwise there is no U-frame. Side rails interrupted by roller shutter doors, for example, are clearly not forming a "U" with the adjacent frame.

It is self-evident that a purlin or side rail must be located at the position where a restraint is needed, which means that judicious positioning of secondary steelwork is required, to suit both the cladding and the out-of-plane restraint to the members.

Figure 6 shows a frame during construction. The judicious spacing of purlins is evident – closer spacing in zones of high bending moment and more widely spaced purlins elsewhere.

Figure 6: Portal frame with thoughtfully spaced purlins

An alternative approach often used at the most heavily loaded location – where the underside of the haunch meets the column flange – is to position a member at this level, immediately adjacent to the inner flange. It is not adequate to simply tie all frames together at this point, as all the frames could buckle in the same out-of-plane direction. The members at this point must be triangulated back to the outside flange at some point, or connected to the foundation.

Where are restraints needed?

The short answer is wherever the member verification demands. Member verification demands a buckling length, which in the out-of-plane direction depends on the position of the restraints. It is surprisingly difficult to find this fundamental requirement in the Eurocode. Clause 6.3.3 which covers combined bending and axial compression and is therefore applicable to members in portal frames points out in Note 1 that "the interaction formulae are based on the modelling of simply supported single span members with end fork conditions….". As shown in Figure 2, end forks provide a torsional restraint.

During the recent SCI webinars on the design of portal frames, most discussion centred on the restraint where the underside of the haunch meets the column flange, generally referred to as "Point A". Horne and Ajmani, who were responsible in the 1970s for much of the research relating to portal frames which we see in BS 5950 and now repeated in the Eurocodes, described this important location as "Point A" and the description has remained ever since.

A number of designers were not convinced that a restraint was essential at "Point A". It can be inconvenient, because if the cladding is supported at the top of the column, the next side rail down could usually be far below "Point A" if support to the cladding was the only requirement. However, there is nowhere around the frame where the compressive force in the flange is higher, so nowhere more deserving of an effective restraint. A side rail positioned for that purpose (if that system is adopted) is not an expensive and unnecessary addition, but an essential contribution to prevent collapse.

Some designers suggested that with a restraint to the inner flange some way down the column, and another restraint some way along the haunch, the situation would be adequate. The SCI response is to ask which clause is being used to verify the member – which is partly tapered and includes a change of direction of usually 84°. There are no clauses that cover a member with a nearly right-angle kink within the length.

The second common question recognised that there is very often a compression stiffener in the column at "Point A", and suggested that this combined with a side rail would restrain the inner flange. However, as explained above, a connection in the very thin material of the side rail with ordinary bolts in clearance holes is hardly the "clamp" necessary for this system to be effective.

Designers using bespoke software for portal frame design should make sure they are entirely clear what type of restraint (one flange only, or torsional, demanding restraint to both flanges) they have modelled. "Point A" will invariably be modelled in software with a torsional restraint, which must be provided in the physical structure.

Figure 7: The result when Point A is not restrained

Figure 7 should serve as a dramatic warning. No restraint at "Point A" has simply allowed the point to buckle laterally. This should not be allowed to happen – and yet – it is sometimes possible to see buildings under construction without this point restrained. It is also possible to see structures where the restraints have been detailed and provided to the bottom flange of the rafter, rather than the bottom flange of the haunch. At the deep end of the haunch, we would expect the compression to be in the bottom flange of the haunch and this location should be restrained. The bottom flange of the rafter, being approximately on the neutral axis of the compound section, should have hardly any force at all.

Conclusions

The importance of restraints to the compression flange (the location of which will vary in different combinations of actions) cannot be over-emphasised. Such restraints are fundamental to the structural stability of the frame, and omission could lead to collapse. Restraints to the inner flange must be identified, specified and provided in the actual structure.

1 U-frames in bridges
New Steel Construction, June 2018

New and revised codes & standards

From BSI Updates July 2020

BS EN PUBLICATIONS

BS EN ISO 7539-10:2020
Corrosion of metals and alloys. Stress corrosion testing. Reverse U-bend method
supersedes BS EN ISO 7539-10:2014

BS EN ISO 8502-6:2020
Preparation of steel substrates before application of paints and related products. Tests for the assessment of surface cleanliness. Extraction of water soluble contaminants for analysis (Bresle method)
supersedes BS EN ISO 8502-6:2006

UPDATED BRITISH STANDARDS

PD 6694-1:2011+A1:2020
Recommendations for the design of structures subject to traffic loading to BS EN 1997-1:2004+A1:2013
Amendment, May 2020

BRITISH STANDARDS REVIEWED AND CONFIRMED

BS EN ISO 7441:2015
Corrosion of metals and alloys. Determination of bimetallic corrosion in atmospheric exposure corrosion tests

NEW WORK STARTED

EN ISO 9016
Destructive tests on welds in metallic materials. Impact tests. Test specimen location, notch orientation and examination
will supersede BS EN ISO 9016:2012

EN ISO 4136
Destructive tests on welds in metallic materials. Transverse tensile test
will supersede BS EN ISO 4136:2012

EN ISO 17639
Destructive tests on welds in metallic materials. Macroscopic and microscopic examination of welds
will supersede BS EN ISO 17639:2013

ISO PUBLICATIONS

ISO 21678:2020
Sustainability in buildings and civil engineering works. Indicators and benchmarks. Principles, requirements and guidelines
Will be implemented as an identical British Standard

AD 447: Openings in composite slabs

It is now over ten years since the revised edition of P300 was published by SCI. This work, in collaboration with the Metal Cladding and Roofing Manufacturers' Association (MCRMA), covered best practice for the design and construction of composite beams and slabs. It benefitted from considerable practitioner input from the members of the MCRMA's now disbanded Decking Group, remains widely referenced and is mostly still applicable.

One perennial problem with anything composite is that other aspects of a building, such as the need to accommodate services, often result in an inconvenient desire to cut holes in structural concrete (and composite) slabs. In P300 we collated what individual decking manufacturers were saying in their literature in order to provide guidance on how to deal, structurally, with small, medium and large openings:

Small - openings up to 300 mm square. Unlikely to present a problem structurally and do not normally require additional reinforcement.
Medium - openings between 300 mm and 700 mm square. Normally require additional reinforcement to be placed in the slab (see Figure 1, which is taken from P300). This is also the case if the openings are placed close together.
Large - openings greater than 700 mm square. Should be trimmed with additional permanent steelwork back to the support beams.

Two aspects of this guidance are worthy of further consideration, namely what is the critical dimension, and how to deal with openings which are placed close together.

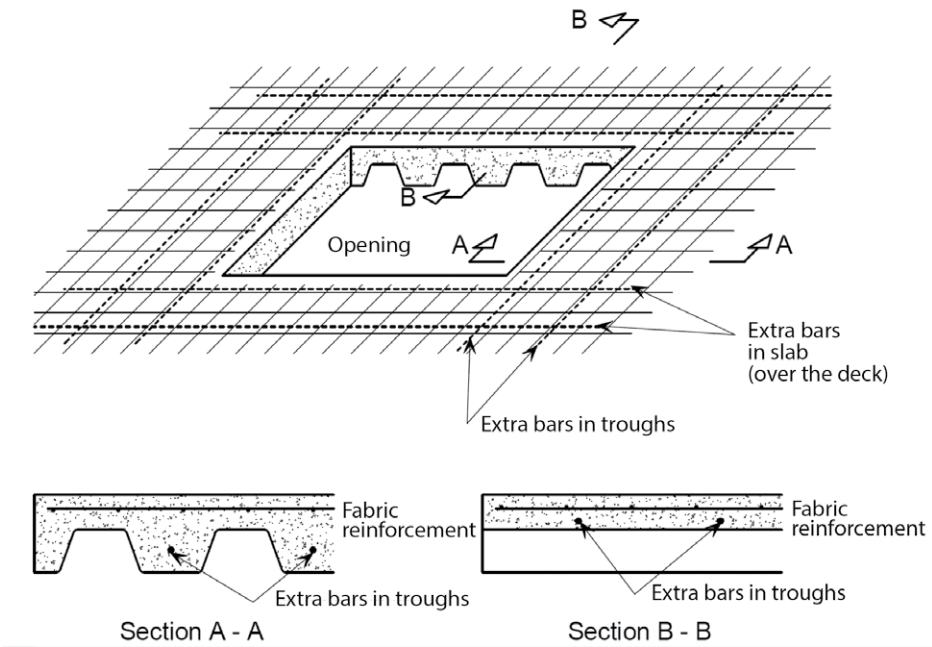

Figure 1: Beam strips around a medium sized opening

The critical dimension of an opening

Although the guidance given in P300 refers to square openings, the dimensional limits actually need only apply to the width of the opening (perpendicular to the direction of span of the slab). This is because they are based on the ability of the slab, without additional measures for small openings and with additional measures for anything larger, to transfer self-weight and loads transversally between ribs. A small opening could be over one metre long, so long as it wasn't more than 300 mm wide.

It is also worth adding that although 300 mm is provided as general guidance, for the unusual (in the UK) case of a slab with extra bars in the troughs, their positioning relative to the opening needs to be considered. A 300 mm wide opening could very easily 'interrupt' a bar in a trough. Such interruption would need to be compensated for by placing additional longitudinal bars in the adjacent troughs using the beam-strip model adopted for medium-sized openings.

For medium-sized openings it is also worth remembering that some of the reinforcement in the beam-strips will be relatively susceptible to fire. Bars in troughs may have sufficient concrete cover to keep them cool, but bars (and fabric) in the slab between the ribs will become hot and loose considerable strength. Fire protection may be needed to ensure that the beam-strips retain their integrity in a fire.

Multiple openings

In some situations with multiple small or medium-sized openings it will not be possible to accommodate beam-strips between adjacent openings (with or without supplementary reinforcement) to carry the additional loads around the opening. They should then be treated as one (larger) effective opening. Beam-strips are designed using the same philosophy around, and potentially within (to pick up any local areas of otherwise unsupported slab), this larger area.

Health and safety and site practice

The above considerations only concern the structural ability of the slab. Of course, attention must be paid to some form of protection when there is any kind of opening, to avoid a potential hazard on site.

And finally, as noted in P300, small and medium-sized holes in the deck should not be cut until after the concrete around the opening has cured.

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FROM
Building with Steel
August 1970

OKURA HOTEL AMSTERDAM

General view during construction

A type of high-rise building growing in use is that with a reinforced concrete services core with a surrounding structural steelwork frame. JG Buisman, Project Leader, Ingenieursburo ir.B.v Rossum c.i. and C Roberti, Head, Structural Steelwork Department, Ingenieursburo ir.B.v. Rossum c.i., here describe a recent example in Amsterdam.

General

In addition to a group of large hotels in Japan, the Japanese Okura hotel concern has built a network of hotels throughout the globe. The increasing Japanese tourist traffic, in addition to the increasing number of Japanese firms being established in Western Europe, provided the reason for building the Okura Hotel in Amsterdam. In the NV Amsterdamse Hotelonderneming, set up for this purpose, KLM, Philips and Heineken are participating, in addition to the Okura concern. The plan of the building is shown bottom right on p27.

The hotel can be divided into three sections, as follows: The tower block, 80 m high (24 floors), The low building, 11 m high (3 floors) and an underground car park.

In the low building, there are offices, various large and small halls, conference rooms and kitchens, as well as three restaurants, Japanese, Chinese and European. A fourth restaurant with a French cuisine is situated on the top of the tower block. In the basement there is a shopping centre. From the third to the 21st floor in the tower block, there are 439 rooms with 840 beds and above there are the French restaurant and two service floors.

Constructional Details

The framework of the low building comprises concrete columns and steel beams encased in timber. The framework of the tower block consists of a concrete service core, erected by means of sliding shuttering, surrounded with an inner and outer ring of steelwork. The inner ring is linked to the core by means of steel beams, which support the concrete floor, while the outer ring is largely connected to the inner ring by the concrete floor alone. Until the outer concrete floors had been poured the inner and outer rings were braced together by means of temporary steelwork comprising light HE 100-A steel beams. Horizontal and vertical wind bracing was also provided until the concrete floors had matured sufficiently to stabilize the building. The inner and outer rings of steelwork are supported by columns which are, in general, continuous over three floors. The cap and base plates on these columns are accurately machined to provide perfect contact and ensure efficient transmission of force.

It was assumed in design that the compressive strain in the loaded columns over the full height of the building would be 25 mm, equivalent to 1 mm per floor. As a consequence, the steel beams between the concrete core and the inner ring of columns are supported on flexible seatings (see illustration bottom left on p27) placed in pockets formed in the core. The floor beams were made composite with the in-situ concrete floors by means of connectors at about 50 cm centres.

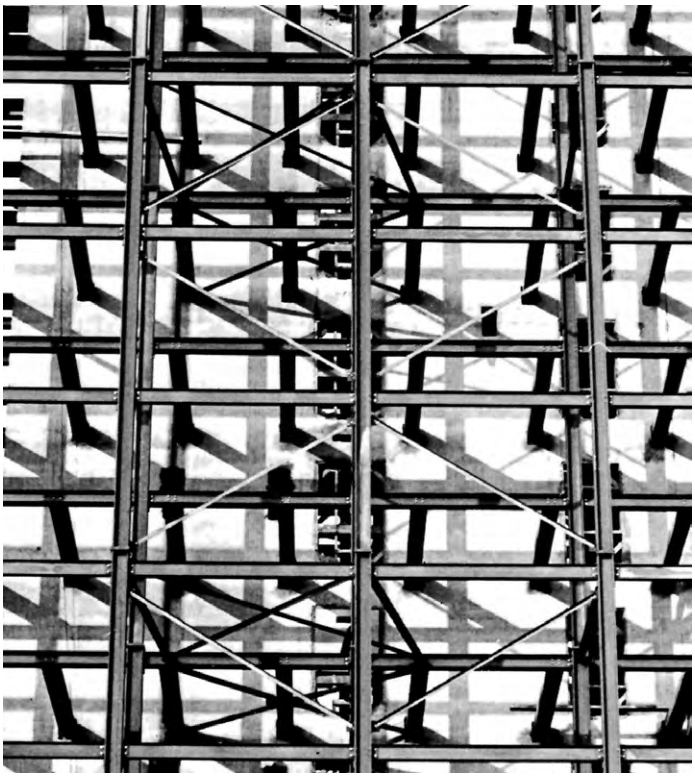
In order to provide the longer spans over the three lowest floors, columns in the inner ring and one column in the outer ring were replaced by heavy plate girders. To provide the required fire resistance, these plate girders, and the columns on which they are supported, as well as the normal continuous columns up to the third floor, were completely encased in concrete. It may be mentioned that as a result, the steel portion of the column carried the load from the 3rd to 24th floor and the concrete portion the loads from the first and the second floor. In a similar manner, to provide fire protection and at the same time allow a continuous jointless floor to be laid, the steel floor beams were encased in concrete prior to erection.

Above the third floor, the columns were surrounded with 9 cm Porisosteen fire resistant bricks to meet the requirement of 4-hours fire protection. The steelwork was cleaned by shot blasting and given one coat of zinc rich paint. The total weight of steelwork, all of which is in mild steel, is about 1100 tons.

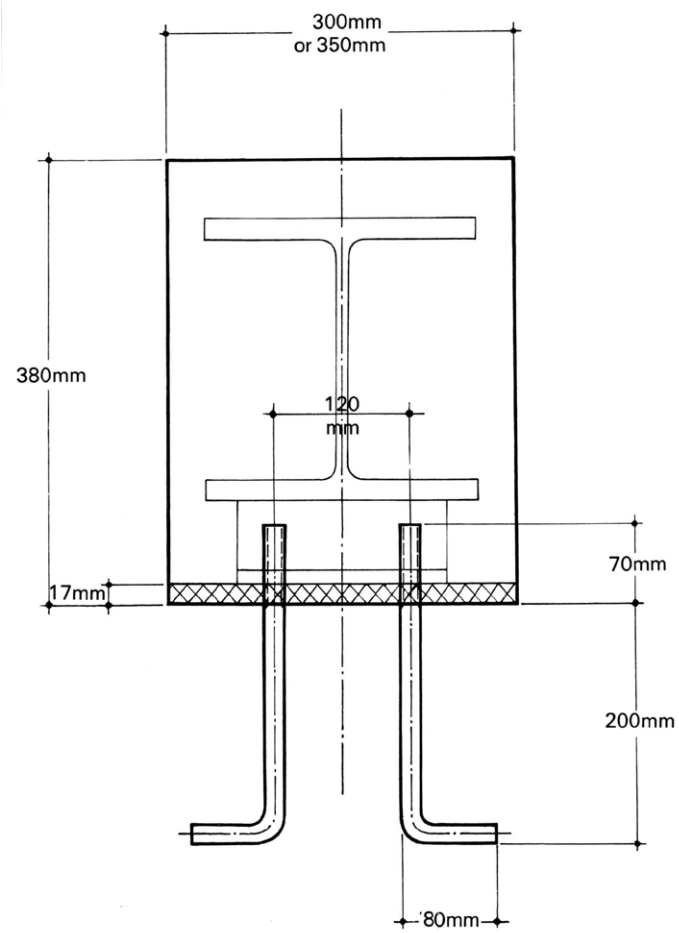
A special problem was brought about by the great difference in settlement of the tower block and the low building. This was solved by separating the two structures and providing a flexible strip, 5 m wide, between them.

Erection of Steelwork in the Tower Block

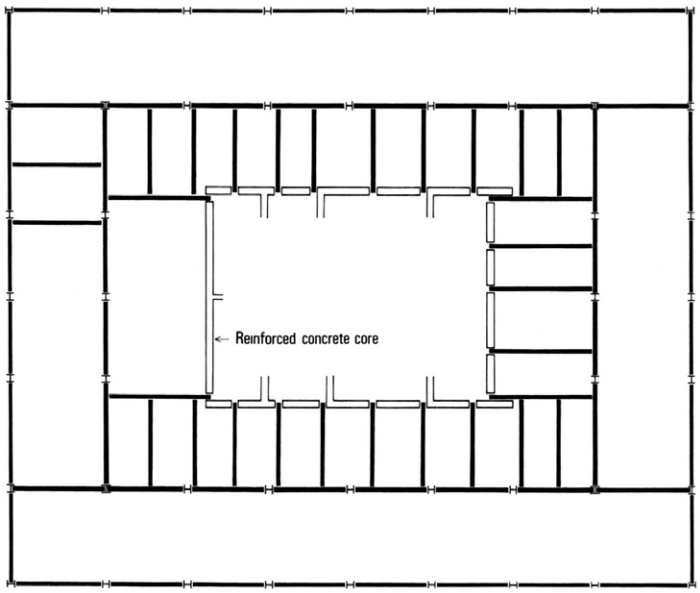
This was carried out with two cranes, one fixed on top of the concrete core and the other situated alongside the tower with a height of about 80 m. Before the actual erection began, a gallery was erected around the core which was supported by overhanging beams with counterweights. This gallery was used, among other things, to adjust and fix the seatings for the steel beams and attach the beams to them. At the same time, two working platforms were used, placed on the last floor and erected. From the third floor upwards, the columns were assembled in sections with their appropriate floor beams and lifted into position with a yoke. The two above mentioned working platforms were used to fix the beams into position. The concrete core was constructed in 23 days and the steelwork erected in about three months.



Details of steelwork looking upwards



Details of connection



Plan (Not all steelwork shown)

Architects
Architectenburo ir. B. Bijvoet and
Professor ir. G. H. M. Holt, Haarlem
Professor Y. Taniguchi and Shibato, Tokyo
Consultants
Ingenieursburo ir. B.v. Rossum c.i., Amsterdam
Main Contractors
Fa. Sanders, Utiliteitsbouw, Arnhem
Structural Steelwork
N.V. Lubbers' Constructiewerkplaatsen 'Hollandia', Krimpen a/d Ijssel

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3 – Execution Class 3 **4** – Execution Class 4

BIM BIM Level 2 assessed
QM Quality management certification to ISO 9001
SCM Steel Construction Sustainability Charter
(● = Gold, ● = Silver, ● = Member)

Notes

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

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Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	BIM	SCM	Guide Contract Value (1)
A C Bacon Engineering Ltd	01953 850611			●	●	●	●				●			●			2			Up to £3,000,000
Adey Steel Ltd	01509 556677	●		●	●	●	●	●	●	●	●			●	●	✔	3		●	Up to £4,000,000
Adstone Construction Ltd	01905 794561			●	●	●	●							●		✔	2	✔	●	Up to £3,000,000
Advanced Fabrications Poyle Ltd	01753 653617				●	●	●	●		●	●			●	●	✔	2			Up to £800,000
AJ Engineering & Construction Services Ltd	01309 671919			●	●		●		●	●	●			●	●	✔	4		●	Up to £3,000,000
Angle Ring Company Ltd	0121 557 7241												●			✔	4			Up to £1,400,000*
Arminhall Engineering Ltd	01799 524510	●			●	●		●		●	●			●	●	✔	2			Up to £800,000
Arromax Structures Ltd	01623 747466			●	●	●	●	●	●	●	●				●		2			Up to £800,000
ASME Engineering Ltd	020 8966 7150			●	●	●		●		●	●			●	●	✔	4		●	Up to £4,000,000
Atlasco Constructional Engineers Ltd	01782 564711			●	●	●	●			●	●			●	●	✔	2			Up to £1,400,000
B D Structures Ltd	01942 817770			●	●	●	●				●	●		●	●	✔	2	✔	●	Up to £1,400,000
Ballykine Structural Engineers Ltd	028 9756 2560			●	●	●	●	●				●			●	✔	4			Up to £1,400,000
Barnshaw Section Benders Ltd	0121 557 8261												●			✔	4			Up to £1,400,000
BHC Ltd	01555 840006	●	●	●	●	●	●	●			●	●		●	●	✔	4	✔	●	Above £6,000,000
Billington Structures Ltd	01226 340666		●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	●	Above £6,000,000
Border Steelwork Structures Ltd	01228 548744			●	●	●	●			●	●				●		4			Up to £3,000,000
Bourne Group Ltd	01202 746666		●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	●	Above £6,000,000
Briton Fabricators Ltd	0115 963 2901	●		●	●	●	●	●	●	●	●		●	●	●	✔	4			Up to £6,000,000
Cairnhill Structures Ltd	01236 449393	●			●	●	●	●	●	●				●	●	✔	4		●	Up to £4,000,000
Caunton Engineering Ltd	01773 531111	●	●	●	●	●	●	●		●	●	●		●	●	✔	4	✔	●	Above £6,000,000
Cementation Fabrications	0300 105 0135	●			●		●	●	●	●	●		●	●	●	✔	3		●	Up to £6,000,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4		●	Above £6,000,000
CMF Ltd	020 8844 0940				●		●	●		●	●				●	✔	4			Up to £6,000,000
Cook Fabrications Ltd	01303 893011			●	●		●			●	●			●	●		2			Up to £1,400,000
Coventry Construction Ltd	024 7646 4484			●	●	●	●	●	●	●	●	●		●	●	✔	4			Up to £1,400,000
D H Structures Ltd	01785 246269			●	●		●				●						2			Up to £40,000
D Hughes Welding & Fabrication Ltd	01248 421104				●	●	●	●	●	●	●		●	●	●	✔	4			Up to £400,000
Duggan Steel	00 353 29 70072	●	●	●	●	●	●	●	●		●				●	✔	4			Up to £6,000,000
ECS Engineering Services Ltd	01773 860001	●		●	●	●	●	●	●	●	●			●	●	✔	4		●	Up to £3,000,000
Elland Steel Structures Ltd	01422 380262		●	●	●	●	●	●	●	●	●	●		●	●	✔	4	✔	●	Up to £6,000,000
EvadX Ltd	01745 336413			●	●	●	●	●		●	●	●			●	✔	3		●	Up to £3,000,000
Four Bay Structures Ltd	01603 758141			●	●	●	●	●		●	●			●	●		2			Up to £1,400,000
Four-Tees Engineers Ltd	01489 885899	●			●		●	●	●	●	●		●	●	●	✔	3		●	Up to £2,000,000
Fox Bros Engineering Ltd	00 353 53 942 1677			●	●	●	●	●		●	●				●		2			Up to £2,000,000
Gorge Fabrications Ltd	0121 522 5770				●	●	●	●		●				●	●	✔	2			Up to £1,400,000
G.R. Carr (Essex) Ltd	01286 535501	●		●	●			●			●			●	●	✔	4			Up to £800,000
Company name	**Tel**	**C**	**D**	**E**	**F**	**G**	**H**	**J**	**K**	**L**	**M**	**N**	**Q**	**R**	**S**	**QM**	**FPC**	**BIM**	**SCM**	**Guide Contract Value (1)**

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	BIM	SCM	Guide Contract Value (1)
H Young Structures Ltd	01953 601881			●	●	●	●	●						●	●	✔	4	✔	●	Up to £3,000,000
Had Fab Ltd	01875 611711				●				●	●	●				●	✔	4			Up to £3,000,000
Hambleton Steel Ltd	01748 810598		●	●	●	●	●	●			●	●		●		✔	4		●	Up to £6,000,000
Hescott Engineering Company Ltd	01324 556610			●	●	●	●			●				●	●	✔	2			Up to £3,000,000
Intersteels Ltd	01322 337766	●			●	●	●	●	●	●			●	●	●	✔	3			Up to £3,000,000
J & A Plant Ltd	01942 713511				●	●									●		4			Up to £40,000
James Killelea & Co Ltd	01706 229411		●	●	●	●	●				●	●		●			4			Up to £6,000,000*
Kiernan Structural Steel Ltd	00 353 43 334 1445	●		●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	●	Above £6,000,000
Kloeckner Metals UK Westok	0113 205 5270												●			✔	4			Up to £6,000,000
LA Metalworks Ltd	01707 256290				●	●				●	●			●	●	✔	2			Up to £2,000,000
Leach Structural Steelwork Ltd	01995 640133			●	●	●	●	●			●					✔	2		●	Up to £6,000,000
Legge Steel (Fabrications) Ltd	01592 205320			●	●		●		●	●	●			●	●		3			Up to £800,000
M Hasson & Sons Ltd	028 2957 1281			●	●	●	●	●	●	●	●				●	✔	4		●	Up to £2,000,000
M J Patch Structures Ltd	01275 333431				●					●	●				●	✔	3			Up to £1,400,000
M&S Engineering Ltd	01461 40111				●				●	●	●			●	●		3			Up to £2,000,000
Mackay Steelwork & Cladding Ltd	01862 843910			●	●		●			●	●			●	●	✔	4			Up to £1,400,000
Maldon Marine Ltd	01621 859000				●	●			●	●	●				●	✔	3			Up to £1,400,000
Mifflin Construction Ltd	01568 613311			●	●	●	●				●						3			Up to £3,000,000
Murphy International Ltd	00 353 45 431384	●			●		●	●	●		●				●	✔	4			Up to £1,400,000
Newbridge Engineering Ltd	01429 866722	●	●	●	●	●	●	●			●	●				✔	4		●	Up to £2,000,000
North Lincs Structures	01724 855512			●	●					●	●				●		2			Up to £800,000
Nusteel Structures Ltd	01303 268112						●	●	●	●				●		✔	4		●	Up to £6,000,000
Painter Brothers Ltd	01432 374400	●			●				●	●	●				●	✔	3			Up to £6,000,000*
Peter Marshall (Steel Stairs) Ltd	0113 307 6730									●					●	✔	2			Up to £1,400,000*
PMS Fabrications Ltd	01228 599090			●	●	●	●		●	●	●			●	●		3			Up to £1,400,000
Robinson Structures Ltd	01332 574711			●	●	●	●				●				●	✔	3			Up to £2,000,000
S H Structures Ltd	01977 681931	●		●	●	●	●	●	●	●	●	●			●	✔	4	✔	●	Up to £3,000,000
SAH Engineering Ltd	01582 584220			●	●	●				●	●			●	●		2			Up to £800,000
SDM Fabrication Ltd	01354 660895	●	●	●	●	●	●				●			●	●	✔	4			Up to £2,000,000
Severfield plc	01845 577896	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	●	Above £6,000,000
SGC Steel Fabrication	01704 531286				●					●				●	●	✔	2			Up to £200,000
Shaun Hodgson Engineering Ltd	01553 766499	●		●	●		●			●	●			●	●	✔	3			Up to £1,400,000
Shipley Structures Ltd	01400 251480			●	●	●	●		●	●	●			●	●		2			Up to £3,000,000
Snashall Steel Fabrications Co Ltd	01300 345588			●	●	●	●	●			●				●		2	✔		Up to £2,000,000
South Durham Structures Ltd	01388 777350			●	●	●				●					●		2			Up to £1,400,000
Southern Fabrications (Sussex) Ltd	01243 649000				●	●				●	●			●	●	✔	2			Up to £1,400,000
Steel & Roofing Systems	00 353 56 444 1855	●		●	●	●	●				●	●		●	●	✔	4			Up to £4,000,000
Structural Fabrications Ltd	01332 747400	●			●	●	●	●	●	●	●			●	●	✔	3		●	Up to £1,400,000
Taunton Fabrications Ltd	01823 324266				●					●	●				●	✔	2		●	Up to £2,000,000
Taziker Industrial Ltd	01204 468080	●		●	●		●			●	●		●	●	●	✔	3			Above £6,000,000
Temple Mill Fabrications Ltd	01623 741720			●	●	●	●			●	●			●	●	✔	2			Up to £400,000
Traditional Structures Ltd	01922 414172			●	●	●	●	●	●		●			●	●	✔	3	✔	●	Up to £2,000,000
TSI Structures Ltd	01603 720031			●	●	●	●	●			●			●			2	✔		Up to £2,000,000
W I G Engineering Ltd	01869 320515				●					●					●	✔	2			Up to £400,000
Walter Watson Ltd	028 4377 8711			●	●	●	●	●				●				✔	4			Above £6,000,000
Westbury Park Engineering Ltd	01373 825500	●		●	●	●	●	●	●	●	●				●	✔	4		●	Up to £800,000
William Haley Engineering Ltd	01278 760591				●	●	●									✔	4		●	Up to £6,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	●	Above £6,000,000
WT Fabrications (NE) Ltd	01642 691191			●	●	●	●				●			●	●	✔	4			Up to £40,000
Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	BIM	SCM	Guide Contract Value (1)

Steelwork contractors for bridgeworks

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

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

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

Notes

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

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

BCSA steelwork contractor member	Tel	FB	CF	SG	PG	TW	BA	CM	MB	SRF	FRF	AS	QM	FPC	BIM	NHSS 19A	NHSS 20	SCM	Guide Contract Value (1)
AJ Engineering & Construction Services Ltd	01309 671919	●			●	●	●	●	●			●	✓	4				●	Up to £3,000,000
Billington Structures Ltd	01226 340666	●		●	●	●	●					●	✓	4	✓	✓	✓	●	Above £6,000,000
Bourne Group Ltd	01202 746666	●			●	●				●		●	✓	4	✓		✓	●	Above £6,000,000
Briton Fabricators Ltd	0115 963 2901	●	●	●	●	●	●	●	●	●	●	●	✓	4			✓		Up to £6,000,000
Cairnhill Structures Ltd	01236 449393	●	●	●	●	●	●	●		●	●	●	✓	4			✓	●	Up to £4,000,000
Cementation Fabrications	0300 105 0135	●		●	●	●	●					●	✓	3			✓	●	Up to £6,000,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓	●	Above £6,000,000
D Hughes Welding & Fabrication Ltd	01248 421104	●		●		●			●	●	●	●	✓	4			✓		Up to £400,000
Donyal Engineering Ltd	01207 270909	●		●						●	●	●	✓	3			✓	●	Up to £1,400,000
ECS Engineering Services Ltd	01773 860001	●			●	●	●		●			●	✓	3				●	Up to £3,000,000
Four-Tees Engineers Ltd	01489 885899	●		●	●	●	●		●	●	●	●	✓	3			✓	●	Up to £2,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445	●			●	●				●	●	●	✓	4	✓		✓	●	Above £6,000,000
M Hasson & Sons Ltd	028 2957 1281	●	●	●	●	●	●	●	●	●		●	✓	4			✓	●	Up to £2,000,000
Millar Callaghan Engineering Services Ltd	01294 217711	●	●	●	●	●	●	●	●	●	●	●	✓	4			✓		Up to £1,400,000
Murphy International Ltd	00 353 45 431384	●	●	●	●	●	●					●	✓	4			✓		Up to £1,400,000
Nusteel Structures Ltd	01303 268112	●	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓	●	Up to £6,000,000
S H Structures Ltd	01977 681931	●	●	●	●	●	●	●	●	●	●	●	✓	4	✓		✓	●	Up to £3,000,000
Severfield (UK) Ltd	01204 699999	●	●	●	●	●	●	●	●	●	●	●	✓	4	✓	✓	✓	●	Above £6,000,000
Shaun Hodgson Engineering Ltd												●	✓	3					Up to £1,400,000
Structural Fabrications Ltd	01332 747400	●		●	●	●	●			●	●	●	✓	3				●	Up to £1,400,000
Taziker Industrial Ltd	01204 468080	●		●	●	●	●	●	●		●	●	✓	3		✓	✓		Above £6,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●		●	✓	4	✓	✓	✓	●	Above £6,000,000
Non-BCSA member																			
Allerton Steel Ltd	01609 774471	●		●	●	●	●	●			●	●		4	✓				Up to £4,000,000
Centregreat Engineering Ltd	029 2046 5683	●		●	●	●	●	●	●	●	●	●	✓	4					Up to £2,000,000
Cimolai SpA	01223 836299	●	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓		Above £6,000,000
CTS Bridges Ltd	01484 606416	●	●	●	●	●	●	●	●	●		●	✓	4			✓	●	Up to £1,400,000
Ekspan Ltd	0114 261 1126	●				●			●	●	●	●	✓	2					Up to £400,000
Francis & Lewis International Ltd	01452 722200											●	✓	4			✓	●	Up to £2,000,000
Harrisons Engineering (Lancashire) Ltd	01254 823993			●	●	●	●	●	●	●		●	✓	3		✓			Up to £1,400,000
Hollandia Infra BV	00 31 180 540 540	●	●	●	●	●	●	●	●	●	●	●	✓	4					Above £6,000,000*
HS Carlsteel Engineering Ltd	020 8312 1879									●	●	●	✓	3			✓		Up to £200,000
IHC Engineering (UK) Ltd	01773 861734											●	✓	3			✓		Up to £400,000
In-Spec Manufacturing Ltd	01642 210716									●	●	●	✓	4			✓		Up to £400,000
Kelly's Welders & Blacksmiths Ltd	01383 512 517											●	✓	2			✓		Up to £200,000
Lanarkshire Welding Company Ltd	01698 264271	●	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓	●	Up to £3,000,000
Total Steelwork & Fabrication Ltd	01925 234320	●		●		●				●	●	●	✓	3			✓		Up to £3,000,000
Victor Buyck Steel Construction	00 32 9 376 2211	●	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓	●	Above £6,000,000

Corporate Members

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

Company name	Tel
Gene Mathers	0115 974 7831
Griffiths & Armour	0151 236 5656
Highways England Company Ltd	08457 504030
Inspire Insurance Services	02476 998924
Sandberg LLP	020 7565 7000
Structural & Weld Testing Services Ltd	01795 420264
SUM Ltd	0113 242 7390

Industry Members

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

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
NHSS National Highway Sector Scheme

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

SCM
Steel Construction Sustainability Charter
● = Gold,
● = Silver,
● = Member

SfL
Steel for Life Sponsor

Structural components

Company name	Tel	QM	CE	FPC	NHSS	SCM	SfL
Albion Sections Ltd	0121 553 1877	✓	M	4			
BW Industries Ltd	01262 400088	✓	M	3			
Cellbeam Ltd	01937 840600	✓	M	4	20		
Composite Profiles UK Ltd	01202 659237		D/I				
Construction Metal Forming Ltd	01495 761080	✓	M	3			
Daver Steels Ltd	0114 261 1999	✓	M	3			
Fabsec Ltd	01937 840641		N/A				
Farrat Isolevel	0161 924 1600	✓	N/A				
FLI Structures	01452 722200	✓	M	4	20	●	
Hadley Industries Plc	0121 555 1342	✓	M	4		●	
Hi-Span Ltd	01953 603081	✓	M	4		●	
Jamestown Manufacturing Ltd	**00 353 45 434288**	✓	**M**	**4**	**20**		**Headline**
Kingspan Structural Products	01944 712000	✓	M	4		●	
Lionweld Group	01642 233238	✓	M	4			
MSW UK Ltd	0115 946 2316		D/I				
Prodeck-Fixing Ltd	01278 780586	✓	D/I				
Structural Metal Decks Ltd	01202 718898	✓	M	2			
Stud-Deck Services Ltd	01335 390069		D/I				
Tata Steel – ComFlor	**01244 892199**		**M**				**Silver**
voestalpine Metsec plc	**0121 601 6000**	✓	**M**	**4**		●	**Gold**

Computer software

Company name	Tel	QM	CE	FPC	NHSS	SCM	SfL
Idea Statica UK Ltd	02035 799397		N/A				
StruMIS Ltd	01332 545800		N/A				
Trimble Solutions (UK) Ltd	**0113 887 9790**		**N/A**				**Silver**

Steel producers

Company name	Tel	QM	CE	FPC	NHSS	SCM	SfL
British Steel Ltd	01724 404040	✓	M				
Tata Steel – Tubes	**01536 402121**	✓	**M**				**Silver**

Manufacturing equipment

Company name	Tel	QM	CE	FPC	NHSS	SCM	SfL
Behringer Ltd	01296 668259		N/A				
Cutmaster Machines (UK) Ltd	**07799 740191**		**N/A**				**Bronze**
Ficep (UK) Ltd	**01924 223530**		**N/A**				**Gold**
Kaltenbach Ltd	**01234 213201**		**N/A**				**Silver**
Lincoln Electric (UK) Ltd	0114 287 2401	✓	N/A				
Peddinghaus Corporation UK Ltd	**01952 200377**		**N/A**				**Gold**
Wightman Stewart (WJ) Ltd	01422 823801		N/A				

Protective systems

Company name	Tel	QM	CE	FPC	NHSS	SCM	SfL
Forward Protective Coatings Ltd	01623 748323	✓	N/A				
Hempel UK Ltd	**01633 874024**	✓	**N/A**				**Bronze**
Highland Metals Ltd	01343 548855	✓	N/A				
International Paint Ltd	0191 469 6111	✓	N/A				
Jack Tighe Ltd	**01302 880360**	✓	**N/A**		**19A**		**Silver**
Joseph Ash Galvanizing	**01246 854650**	✓	**N/A**				**Bronze**
Jotun Paints (Europe) Ltd	**01724 400000**	✓	**N/A**				**Bronze**
PPG Architectural Coatings UK & Ireland	01924 354233	✓	N/A				
Sherwin-Williams Protective & Marine Coatings	**01204 521771**	✓	**N/A**			●	**Bronze**
Vale Protective Coatings Ltd	01949 869784		N/A				
Wedge Group Galvanizing Ltd	**01909 486384**	✓	**N/A**				**Gold**

Safety systems

Company name	Tel	QM	CE	FPC	NHSS	SCM	SfL
easi-edge Ltd	01777 870901	✓	N/A			●	

Steel stockholders

Company name	Tel	QM	CE	FPC	NHSS	SCM	SfL
AJN Steelstock Ltd	**01638 555500**	✓	**M**	**4**			**Bronze**
Arcelor Mittal Distribution - Scunthorpe	**01724 810810**	✓	**D/I**	**4**	**3B**		**Headline**
Barrett Steel Services Limited	**01274 682281**	✓	**M**	**4**	**3B**		**Headline**
British Steel Distribution	01642 405040	✓	D/I	4			
Cleveland Steel & Tubes Ltd	**01845 577789**	✓	**M**	**3**			**Gold**
Dent Steel Services (Yorkshire) Ltd	01274 607070	✓	M	4	3B		
Dillinger Hutte U.K. Limited	01724 231176	✓	D/I	4			
Duggan Profiles & Steel Service Centre Ltd	00 353 567722485	✓	M	4			
Kloeckner Metals UK	0113 254 0711	✓	D/I	4	3B		
Murray Plate Group Ltd	0161 866 0266	✓	D/I	4	3B		
NationalTube Stockholders Ltd	**01845 577440**	✓	**D/I**		**3B**		**Gold**
Rainham Steel Co Ltd	01708 522311	✓	D/I	4	3B		

Structural fasteners

Company name	Tel	QM	CE	FPC	NHSS	SCM	SfL
BAPP Group Ltd	01226 383824	✓	M		3		
Cooper & Turner Ltd	0114 256 0057	✓	M		3		
Henry Venables Products Ltd T/A Blind Bolt	01299 272955		M				
Lindapter International	01274 521444	✓	M				
Tension Control Bolts Ltd	**01978 661122**	✓	**M**		**3**		**Bronze**

Welding equipment and consumables

Company name	Tel	QM	CE	FPC	NHSS	SCM	SfL
Air Products PLC	01270 614167		N/A				