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NSC

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EDITOR
Nick Barrett Tel: 01323 422483
nick@newsteelconstruction.com

DEPUTY EDITOR
Martin Cooper Tel: 01892 538191
martin@newsteelconstruction.com

PRODUCTION EDITOR
Andrew Pilcher Tel: 01892 553147
admin@newsteelconstruction.com

PRODUCTION ASSISTANT
Alastair Lloyd Tel: 01892 553145
alastair@barrett-byrd.com

COMMERCIAL MANAGER
Fawad Minhas Tel: 01892 553149
fawad@newsteelconstruction.com

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The British Constructional Steelwork Association Ltd
4 Whitehall Court, Westminster, London SW1A 2ES
Telephone 020 7839 8566
Website www.steelconstruction.org
Email postroom@steelconstruction.org

Steel for Life Ltd
4 Whitehall Court, Westminster, London SW1A 2ES
Telephone 020 7839 8566
Website www.steelforlife.org
Email steelforlife@steelconstruction.org

The Steel Construction Institute
Silwood Park, Ascot, Berkshire SL5 7QN
Telephone 01344 636525 Fax 01344 636570
Website www.steel-sci.com
Email reception@steel-sci.com

CONTRACT PUBLISHER & ADVERTISING SALES
Barrett, Byrd Associates
7 Linden Close,
Tunbridge Wells, Kent TN4 8HH
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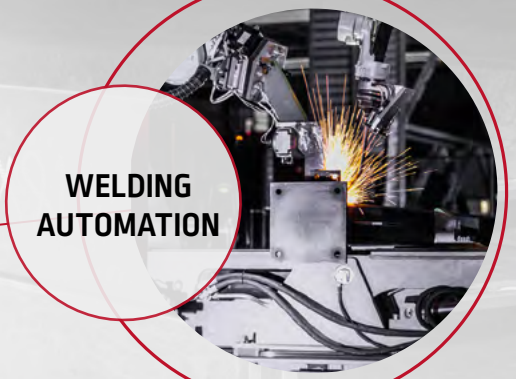

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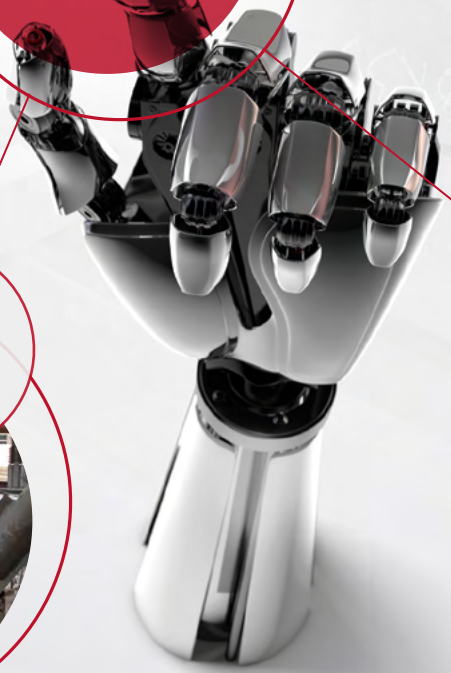

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Steel provides solutions in a fast-changing world

Nick Barrett - Editor

Nothing stays still in the commercial property world for long, although one fairly constant feature is the preference for steel construction for most multi-storey and high-profile projects. Developers who chose steel framing solutions in the past are reaping further benefits from their original wisdom, as major properties are being reconfigured to suit changing uses, and the opportunity to easily add vertically is often being seized on.

We see examples of this frequently in the pages of NSC, this month at Canary Wharf whose development in the late 1980's and 1990's set the pace for so much of what followed. One of the biggest changes though is the consideration that can be given to alternative uses of the space, both the original and the new additions. New space being provided on top of the old 30 South Colonnade is designed to allow for multiple potential uses, from Boardroom meetings to yoga sessions, or any of the other new uses that versatile space can be put to as employers increasingly recognise that they have to offer at-work facilities to attract and retain staff.

Piled foundations of steel-framed buildings frequently have spare capacity, despite having originally been smaller than they would have been had concrete been used as a framing material. Time on the construction programme, as well as money, is saved as result, allowing three floors to be added to the original 10-storey 30 South Colonnade, for example, while the original floors are stripped back to the structural frame and reconfigured.

Steel is often chosen for its offsite capabilities on congested sites, keeping nuisance to adjacent building users to a minimum, with fabricated steelwork brought to site only when required for swift and safe erection. Seldom is this more important than at a site such as the new five-storey clinical block at Evalina London Children's Hospital, sandwiched between the busy St Thomas' Hospital the existing Evalina hospital, which is featured in this issue.

In our other healthcare article this month we read about the reasons why steel is going to be so valuable for meeting the challenge of the government's ambitious commitment to provide 40 new hospitals by 2030. This is being hailed as the biggest hospital building programme for a generation and will promote the use of modern methods of construction - modular construction and offsite construction in particular. This is welcome news to the steel sector as it has been emphasising that it is a modern method of construction for a long time.

Other welcome aspects of the New Hospital Programme will be a focus on quality and value for money. Steel's ability to meet or exceed vibration performance demands of the health service has been soundly established for over 15 years. All new hospitals are certain to be designed and built using Building Information Modelling which steelwork contractors have long experience of.

Flexibility will also be a key demand and hospitals will have to be designed to be adaptable and easily converted to changing uses. Future expansion may be vertical as well as horizontal and this will have to be allowed for in designs - again favouring steel solutions as we see in this month's Canary Wharf article. Whatever changes in building user demands the future brings, the solution is often going to be steel.

Demand for high-rise buildings remains strong

According to the latest construction report from AMA Research, the pipeline of high-rise buildings across the UK remains strong, with around 549 projects currently in development, of which 58% are in London.

The construction of high-rise buildings has increased considerably in recent years, with a rise in both the number and height of buildings being constructed.

Across the UK in July 2021, there were 1,277 existing high-rise buildings and structures that are at least 50m-tall and 266 that are over 75m-tall. The UK has 31 buildings over 150m-tall and just one structure – the Shard – over 300m-tall.

AMA Research Analyst Alex Blagden said: "Historically, high-rise construction has been driven by demand for offices in the City of London, London Docklands and central Manchester. Since 2010, however, there has been a marked shift towards high-rise residential schemes, mainly driven by speculative investments."

Although London, and to a lesser extent Manchester, Salford and Birmingham, will remain important locations for high-rise construction, the report says other cities are emerging as major centres – especially Leeds, Liverpool, Glasgow and Sheffield.

Pocket guide to steels published by ICE

The Institution of Civil Engineers (ICE) has published *ICE Pocket Guide to Steels in the Built Environment*, which is said to be a quick and handy reference guide to using steels in construction projects and structural design.

Over 150 steels and subgrades are listed, with each entry containing its naming convention, steel number and a description of its properties. This is combined with infographics describing the format in which each steel is available.

Guide author and CMF Technical Director Stephen Hall said:

"The pocket guide was primarily written to help designers better understand, and correctly specify, complete steel grade designations.

"With reference to relevant material and design standards, it provides readers with the tools to translate standard steel names and identify key material characteristics.

"It's hoped that through using the guide designers will be better equipped to make informed decisions on material specifications and will feel more able to have robust discussions with the supply chain regarding grades, qualities, and other delivery conditions. More broadly, it's hoped that readers will gain a greater appreciation of the variety and availability of steels used in the built environment."

The book is priced at £45 and is available online at: *www.icebookshop.com* or email: *orders@icepublishing.com*

Steel creates major south London mixed-use scheme

Working on behalf of Carey Group, Kiernan Structural Steel has fabricated, supplied and erected 400t of structural steelwork for the London Square mixed-use scheme in Bermondsey.

Based around the former Branston Pickle factory, which ceased production in 2004, the south London scheme will eventually offer residential, commercial and retail space.

A large portion of the new structural steelwork has been erected on top of an existing structure and provides support for metal decking to form new composite floors.

On Unit 7a, Kiernan erected a two-storey upper extension, while on the adjacent Unit 7, three new levels were added to the existing five-storey building.

Elsewhere on the project, structural steelwork has been used to construct Unit 8. This includes a new three-storey building and a link building that includes an atrium roof over the new commercial area, which links Units 8 and 7 together.

New stands open at home of cricket

Marylebone Cricket Club (MCC) President and Sri Lankan cricket great, Kumar Sangakkara, officially opened the new £53M Compton and Edrich stands at Lord's Cricket Ground before the recent second test match between England and India.

The redeveloped Compton and Edrich stands, designed by WilkinsonEyre and constructed by ISG, are said to have replaced old structures with significantly improved facilities that will future-proof the Home of Cricket, while complementing the unique character of the ground.

The MCC said the spectacular and innovative stands accommodate 11,600 spectators and provide an experience to be enjoyed by a range of cricket supporters. Ticket holders will benefit from the numerous integrated catering and washroom facilities located in

close proximity to seats at all levels, ensuring minimal time away from the cricket action, while providing excellent sightlines and unparalleled views of Lord's.

A walkway bridge links the two stands, offering views of both the main ground and the iconic pavilion. Completing the new stands are two state-of-the-art canopy roofs that honour the adjacent RIBA Stirling prize-winning media centre.

Working on behalf of ISG, Severfield fabricated, supplied and erected 2,000t of steelwork for the project.

Plans in for next mini Shard office block

Developer Edge has revealed plans for another office development in the London Bridge area surrounding the iconic Shard structure.

Known as Edge London Bridge, the state-of-the-art building aims to turn the 23,500m² 26-storey commercial tower into London's most sustainable office block. The design aims to achieve a BREEAM 'Outstanding' rating and a WELL Platinum certification.

Edge said there will be a strong focus on tenant wellbeing and so the development will include a new park adjacent to the building. The green space will connect to the ground floor area of the office block, which will contain numerous public amenities.

The green landscaping surrounding the scheme will continue into the building with generous displays of vegetation on balconies.

The developer also said that underfloor air supply in combination with natural ventilation will provide optimal air quality, which together with good natural light from the floor-to-ceiling windows and radiant cooling, will give a healthy environment for users.

The façade of Edge London Bridge is said to celebrate the character of the area's Victorian engineering heritage with plenty of shading and closed elements to avoid unwanted thermal gains and losses. This will contribute to a reduction in regulated carbon emissions.

Designed by architects Pilbrow and Partners, the project could start on site next year.

Investment secured for West Midlands logistics hub

Oxford Properties Group and Logistics Capital Partners (LCP) have formed a new investment joint venture to acquire a 734-acre site near Birmingham, which they will develop into a major new logistics hub with an associated rail freight terminal known as West Midlands Interchange.

Oxford and LCP will jointly invest £1bn to bring forward the project over a number of years. It is said that the West Midlands Interchange will be a technologically advanced and environmentally sustainable development, which meets modern occupiers' efficient operational and environmental requirements.

Planning consent has already been secured by the vendors, which allows for

the delivery of around 740,000m² of prime logistics space and provides flexibility around the project timeline and scale of units. Infrastructure works are expected to commence in the first half of next year with the first buildings starting on site in 2022 ready for occupation in 2023.

The site can accommodate new warehouses ranging in size from 18,500m² to over 90,000m², with building heights up to 30m. This scale and flexibility will create space for some of the most efficient operations in the country, maximising cubic storage capacity and the possibility for occupiers to deploy the latest technology.

NEWS IN BRIEF

South Tyneside and Sunderland NHS Foundation Trust has unveiled plans to build a new Eye Hospital in the centre of **Sunderland** as part of the City's ambitious riverside masterplan at the former Vaux Brewery site.

Plans for **Preston**'s 'Animate' leisure complex have taken a significant step forward after city councillors approved a funding package. The development will be located on the site of a former indoor market and will feature an eight-screen cinema and bowling alley, along with five new restaurants and bars, a street-food hub, a car park and a new public square.

Premier League **Leicester City Football Club** plans to expand its King Power Stadium with 8,000 new seats in order to increase capacity to 40,000. The club's plans also include the construction of a 220-room hotel and a multi-purpose event and entertainment venue to be situated adjacent to the stadium.

Muse Developments, working in partnership with Stockport Council, has submitted reserved matters planning to accelerate the delivery of the fourth phase at Stockport Exchange. It will include 5,900m² of Grade A offices, along with a 400-space multi-storey car park for office occupiers, featuring electric vehicle charging points, solar photovoltaics and a green 'living' wall.

Hitachi Zosen Inova has been appointed to contract Skelton Grange, an energy-from-waste (EfW) plant in West Yorkshire that will annually recycle 410,000 tonnes of residual waste. The process will generate up to 49MW of electricity, which will be fed into the National Grid as partially renewable energy – enough to meet the electricity needs of more than 100,000 homes.

PRESIDENT'S COLUMN

Compared to the last six months, the atmosphere in the industry today does seem a lot more stable. The majority of steelwork contractors seem to be much busier now and for the next six months than they were the preceding six months; for many a "feast" after a "famine".

COVID-19 has, however, created some problems that many of us wouldn't have expected. The general workforce of the UK has been through a turbulent time with working from home, reduced overtime, furlough or worse. All of these have been forced upon the employee and the employer alike, and it's been very difficult for both parties to work through these different phases.

Due to lockdowns, many families have saved money and the immediate requirement to need overtime to supplement their basic pay packages is no longer there. Many companies are struggling to entice employees to work overtime during this mini-boom when the company is desperate to increase production. It is not easy to find experienced staff and many companies are juggling the salary expectations of employees with the gross profits on the budget sheets being squeezed, with large increases in material prices over a very short period.

One of the things I encounter is a growing resentment amongst "skilled" workers with their hourly rate in comparison to the rate of the "unskilled" worker. Year-on-year, both the National Minimum Wage and National Living Wage (NLW) hourly rates have increased significantly due to government stimulus, the age threshold for the NLW has reduced from 25 to 23 and the government are committed to lowering the NLW threshold further to 21 by 2024.

The consequence is that it won't be long before the "skilled" and "unskilled" worker will be on the same hourly rate, which has already happened in the textile industry. How will we be able to encourage young people to embark on apprenticeships in plating, welding and CNC machine work, when they believe they can earn the same money stacking shelves at the local supermarket?

Throwing money at "skilled" staff is one option, but in a fiercely competitive market, gross profits will be seriously compromised. So, the challenge for us is to demonstrate that they will earn more in our industry, at the same time as having an exciting and rewarding career, rather than just a "job".

We have a lot to offer. Our "skilled" staff are not on zero-hours contracts, which provides certainty of income, and regular overtime opportunities combined with staff bonus schemes can boost that income significantly. I also suspect that stacking shelves is monotonous and boring compared to working with the latest BIM and 3D modelling software, operating cutting-edge robotic fabrication equipment, or erecting steelwork. To be able to say that you helped to build an iconic skyscraper, new school, hospital or Amazon distribution centre has to be worth something.

Nobody is going to fix the skills shortage for us, so even though we are in a bit of a boom at the moment, we need to think long-term and encourage more people into our industry via the apprentice route. BCSA is there to help us with the CRAFT scheme and investing in school leavers today has to pay dividends. Working in our industry may not be the best paid job in the world, it can be more than frustrating at times, but it could never be called dull.

Mark Denham
BCSA President

Coatings specialist hails apprenticeship successes

Jack Tighe's second intake of apprentices on the Industrial Coatings Applicator Apprenticeship scheme have completed their End Point Assessment (EPA).

Having started in February 2020, the youngsters have all achieved passes with distinction, surpassing coating specialist Jack Tighe's expectations. The company hopes its third intake will be equally successfully with their EPA in 2022.

Jack Tighe Chairman Martin Hillyard said: "All of the apprentices have shown great attitude and enthusiasm, which they will be able to bring forward into our industry.

"We would like to thank all the people who have mentored the apprentices both on site and within our factory facilities. Taking the time to pass on your valuable skills, knowledge and experience is invaluable to the success of the candidates on the course.

"The Jack Tighe Group feels very strongly towards the apprenticeship programme and we have taken the decision to commence intake number four in September 2021."

The British Constructional Steelwork Association (BCSA) helped to develop the apprenticeship standard with Highways England, through its National Highways Sector Scheme (NHSS) Committee for Corrosion Protection (NHSS 19A).

BCSA Director of Health, Safety & Training Peter Walker said: "Jack Tighe has recognised the value of this trailblazer apprenticeship standard in addressing a skills shortage in coating applicators and it is now reaping the rewards.

"For others wishing to follow, the costs are minimal, as out of the 18 months to complete the apprenticeship, which is mostly spent at the employer's facilities, students only attend the training facilities in Scunthorpe for a total of 16 weeks and the standard attracts an apprenticeship funding of £9,000 to pay for the training and EPA."

More information on the apprenticeship standard and EPA are available at: *https://www.instituteforapprenticeships.org/apprenticeship-standards/industrial-coatings-applicator-v1-0*

Contractor named for wine merchant warehouse

Winvic Construction has been appointed by Goodman to deliver a 10,900m² state-of-the-art warehouse in Andover for Berry Bros. & Rudd, a London-based fine wine merchant.

The steel-framed structure, to be erected by Caunton Engineering, has been designed to be carbon neutral utilising BIM Level 2. The building will generate its own energy supply, will operate with rainwater harvesting and have electric vehicle charging points.

The single storey warehouse located at Andover

Business Park will have the capacity to store over 14 million bottles of wine at optimum temperature and in a humidity-controlled environment. This will be achieved through an enhanced specification roof and wall system that is said to provide a superior building envelope with excellent thermal performance and internal climate control, removing the need for a secondary internal construction.

An EPC rating of A+ and BREEAM rating of 'Very Good' will be achieved.

The facility will be operational in summer 2022.

Steel rises for Dunbartonshire leisure and care hub

East Dunbartonshire Council is investing £42.5M for the construction of the Allander Leisure and Day Care Centre in Bearsden.

The large steel-framed complex will include an eight-lane swimming pool, a 20m training pool with moveable floor, an eight-court sports hall, two squash courts, and a separate area accommodating day care facilities for adults with learning disabilities.

The entire project, which also includes a light steel-framed 'Sportsdrome' that will house indoor football pitches and tennis courts, is due to complete in mid-2023.

Working on behalf of main contractor McLaughlin & Harvey, Walter Watson is fabricating, supplying and erecting 1,075t of steelwork for the project.

St Modwen awards Glencar two contracts

Glencar Construction has been awarded two projects by St. Modwen Logistics at strategic development sites in Exeter and Chippenham.

At the site in Exeter, within St Modwen's Skypark Development in Clyst Honiton, Glencar will construct an 18,200m² build-to-suit manufacturing facility for Stovax, said to be the UK's largest stove and fireplace producer. In addition to the base build works, Glencar will undertake Cat A and Cat B fit out together with associated external works.

At the site at St Modwen Park in Chippenham, Glencar will undertake the construction of a single 8,200m² industrial distribution and storage unit, complete with integral offices, internal plant deck and associated external works for online furniture specialist Furniturebox.

Steven Smith Construction Director, St Modwen Logistics said: "We are absolutely delighted to be welcoming Stovax and Furniturebox to two of our most high-profile developments in Exeter and Chippenham respectively."

Both projects are due to commence soon and be completed by mid-2022.

Plans revealed for major Hertfordshire film studio

Blackstone and Hudson Pacific Properties plan to create a major new centre for film, TV and digital production in Broxbourne, Hertfordshire.

The companies have acquired a 91-acre site, 17 miles north of central London, through a joint venture for £120M. The acquisition, with an expected total investment of over £700M, will be the partners' first expansion of their Sunset Studios platform outside of the USA.

The proposed development, which is subject to planning permission, would transform the site into one of the largest world-class film and television studio campuses. The project is expected to create over 4,500 permanent jobs for Broxbourne and the surrounding community and contribute more than £300M annually into the local economy.

James Seppala, Head of Blackstone Real Estate Europe, said: "We are excited to expand our partnership with Hudson Pacific into the UK, and intend to deliver a world-class studio facility that will help ensure that the UK continues to be a premier destination for content production. This is a continuation of our thematic investment focus and long-term conviction in media, entertainment and content creation."

Contractor named for prestigious Mayfair commercial scheme

Mace has been appointed by Astrea to deliver a new office development at 38 Berkeley Square.

Located in the heart of London's Mayfair district, 38 Berkeley Square will provide 7,800m² of premium office space across nine storeys with over 650m² of communal terracing. The scheme will also include 800m² of retail space on the ground and lower floors.

Mace said it will collaborate with the Astrea team to deliver innovative low carbon solutions, working towards the highest sustainability standards of BREEAM 'Outstanding', WELL Platinum and LEED Gold.

Designed by architects Piercy & Company, the transformation of 38 Berkeley Square will complement the character of the surrounding properties by using a mix of precast façades and Portland stone.

The project is expected to complete in the first quarter of 2024.

Diary

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

Tue 12 October 2021
Design for Construction
Webinar - SCI/BCSA members only
It is important that designers remember that buildings don't just 'appear', they need to be constructed and that may result in temporary conditions that are more onerous than the final condition. Proper consideration at an early stage of how a building will, or can, be constructed can save money, effort and indeed improve health and safety.

Wed 20, Thu 21, Wed 27, Thu 28 Oct 2021
Portal frame design
Online course
Portal frames account for around 50% of the structural steel used in the UK. Despite the extensive history in portal frame design, some design issues are not well understood.The course aims to provide in-depth coverage of the major issues surrounding the analysis, design and (crucially) the detailing of portal frames. The course covers frame design to BS EN 1993-1-1.

Tue 9 Nov 2021
SCI Annual Event
Online
Our Annual Event will be online this year and is open to both SCI Members and non-members to attend. Our key focus will be on 'net zero' solutions and we will report on the various decarbonisation initiatives that the sector, in particular the steel producers, have embarked upon.

More leisure facilities for Cumbria

Structural steelwork has provided an economic framing solution for the £25M redevelopment of Carlisle's Sands Centre.

Located on the south bank of the River Eden and close to Carlisle city centre, the Sands Centre is said to be the region's premier entertainment venue and currently it is undergoing a redevelopment with the construction of new sport and leisure facilities.

The facilities will replace an older leisure centre, which was demolished as part of the current works. Once complete, the sport and leisure extension will link to and share an entrance with the existing entertainment venue, which is a retained portion of the original building.

For the first time, the Sands Centre will include a swimming pool hall, containing a 25m-long eight-lane pool, a learner pool with a moveable floor and a spectator seating gallery.

This will allow the Council to close a nearby pool and bring the city's entertainment and leisure amenities together on a single site.

Leader of Carlisle City Council, Cllr John Mallinson, says: "The Sands Centre redevelopment is a major project that will provide significant benefits. It represents a cornerstone in our plans to support our communities to continue to improve their health and wellbeing. There is a necessity to do the work. Carlisle desperately needs new swimming facilities. This is a one-off opportunity with a dual benefit of all the facilities being on one site."

Other facilities will include: a four-court sports hall with a spectator gallery; a 120-station fitness suite; two dance studios; a spinning studio; changing rooms; an NHS physiotherapy suite, and a reception desk with offices.

The new build consists of a steel-framed structure, stabilised by vertical bracings around the perimeter walls and horizontal roof bracings. The original building was also steel-framed, but the new and retained structures, although abutting along one elevation, are independent of each other and separated by a row of double columns.

"Steel was the obvious choice for the project because of the long spans in the sports hall and pool area," says Buro Happold Project Engineer Kathleen Higgins.

"Another benefit of using a steel-framed solution is the fact that we've been able to reuse some of the existing foundations for the new columns. An alternative framing solution would have increased the weight and consequently couldn't have used existing pads."

Primarily, the reused foundations are located in the Street, which is a single storey, double-height area adjoining the retained venue. The 12.5m-wide Street is the main circulation route and will contain the Centre's new main entrance foyer, with access points for the new sport and leisure facilities via turnstiles, and doors into the retained entertainment venue.

Overlooking the Street, as well as the main entrance, is the fitness suite, which is located on the first floor. This upper level, which is predominantly formed with steel beams supporting metal decking and a concrete topping for a composite flooring solution, is a T-shaped area, that also forms a spine between the sports hall and pool hall.

Part of the gym is located above the main entrance, on an area of the first floor that cantilevers out by a maximum of 5.4m to form a feature element of the project. A glazed façade will allow people entering the Sands via the new entrance to see part of the first-floor fitness suite.

A steel-framed solution was chosen because the material could economically form the required long internal spans

Cantilevering steel beams at first floor and roof level form the cantilever that spans over the ground floor NHS suite, while the entrance area has bracing on the elevation to take the loads back to the supporting columns.

Having a fitness suite on the upper level meant that transference of vibrations could have been an issue. In order to negate this, the free weights zone of the fitness suite has been acoustically-isolated to limit noise transfer through the floor structure into the NHS suite below.

Steelwork contractor Border Steelwork

The new steel frame creates the Centre's new feature cantilevering entrance.

"Steel was the obvious choice for the project because of the long spans in the sports hall and pool area."

FACT FILE
The Sands Centre, Carlisle
Main client: **Carlisle City Council**
Architect: **GT3 Architects**
Main contractor: **Wates**
Structural engineer: **Buro Happold**
Steelwork contractor:
Border Steelwork Structures
Steel tonnage: **418t**

Structures, erected 418t of steel for the job and also installed precast concrete lift shafts, stairs and flooring, metal decking and roof decking.

The largest individual steel elements are the 24.5m-long roof rafters spanning the pool hall and the 21m-long members that span the sports hall.

The majority of the steelwork erection was completed using a variety of cranes ranging in capacity from 55t up to 100t. However, the largest single steel element of the entire project needed a 180t-capacity mobile crane.

This large element is a 24.5m-long truss, which is positioned at roof level at one end of the pool hall. The truss varies in depth from 2.4m to a minimum of 1.8 and supports the pool hall's roof, the adjacent roof over the first-floor changing rooms and supporting hangers for an area of precast flooring over the learner pool.

The roof over the swimming pool falls in one direction and the roof over the changing rooms falls in the other, so the roof height difference is variable over the length of the truss. The changing room roof beams connect into the verticals of the truss to account for this variable height difference.

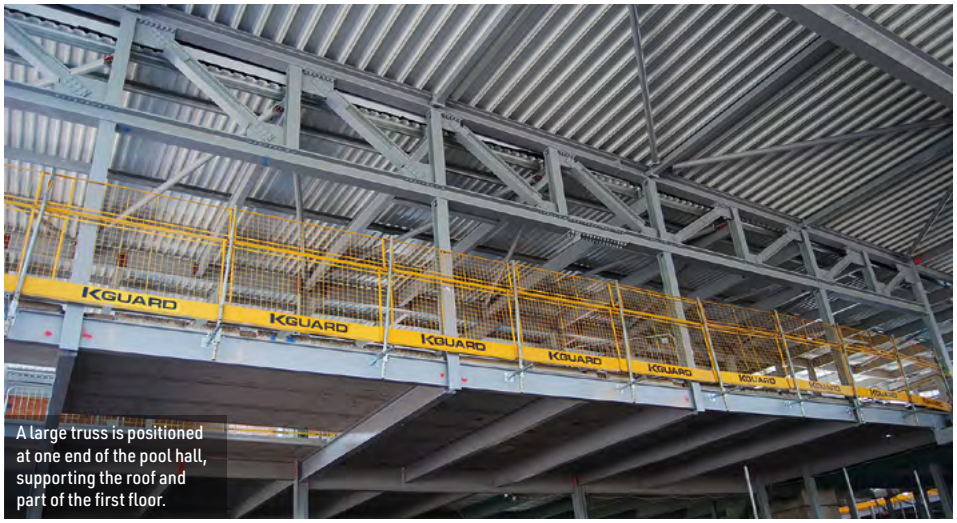
The truss was fabricated and supplied in 28 separate pieces, which were then assembled on site into the complete truss, weighing 13.5t, and lifted into place.

Sustainability is a key part of the project design and the new and improved facilities will include a range of sustainable features which will support Carlisle City Council's plans for reducing carbon emissions, improving energy efficiency and providing sustainable, healthy transport options.

Summing up, Wates Project Manager Chris Duffy says: "All of the trades, including the steelwork erection team, have had to successfully negotiate a number of site challenges. We have the busy A7 to our west, the River Eden and a flood wall to the north and the retained entertainment venue to the east. What at first glance looks like a nice open site, is actually a very tight plot and is more akin to working in a city centre."

The redeveloped Sands Centre is due to open in Summer 2022. ■

How the completed Sands Centre will look when it opens in 2022.



A large truss is positioned at one end of the pool hall, supporting the roof and part of the first floor.

Steel scores for Wiltshire leisure facility

The need for long internal column-free spans and a quick construction programme meant a steel-framed solution was the project team's choice for the Melksham Community Campus.

A single 40t-capacity mobile crane was used for the majority of the steel erection.

Community facilities in the Wiltshire town of Melksham are set to get a significant boost as a new steel-framed leisure centre and library is set to open next year.

The £20M Melksham Community Campus, which has received funding from Sport England Lottery Award, is being delivered by Pellikaan Construction, a company that specialises in sport and leisure facilities. It's design and build ethos for such projects usually involves steel-framed structures, in order to achieve the long column-free spans leisure and sports clubs require.

The Melksham project is no exception as 230t of steelwork has been erected by Adstone Construction to form the structural frame. Interestingly, this is the tenth leisure centre Adstone has completed for Pellikaan, proving the importance of building long-term supply chain relationships.

"The campus will offer a host of top-class facilities under one roof," says Wiltshire Council Senior Project Manager Suzanne Gough.

"The use of the steel frame, particularly in the large spaces with significant clear spans, such as the sports hall and swimming pool, allowed us to keep the roof build-up to a relatively slim profile, reducing the overall building height and lessening the impact on the adjacent neighbours."

Located in the town centre, on land previously owned by the adjacent Grade-II listed Melksham House, the Community Campus will include a six-lane, 25m-long, swimming pool, a learner pool, fitness suite, fitness studio, library, a six-court sports hall, associated changing rooms, community meeting rooms, a café and office space.

The completed £20M Melksham Community Campus will complement its surroundings.

"The use of the steel frame, particularly in the large spaces with significant clear spans, such as the sports hall and swimming pool, allowed us to keep the roof build-up to a relatively slim profile, reducing the overall building height and lessening the impact on the adjacent neighbours."

Melksham Town FC previously played their home matches on the site, but they moved to a new stadium a few years ago, freeing up the plot for the Community Campus project.

Following an archaeological dig, that unearthed a range of multi-period artefacts, Pellikaan started on site in March, with a ground stabilisation programme and the installation of pad foundations.

Adstone, employed on a design and build contract for the main steel superstructure, was then able to begin its steelwork erection, a task it completed in four-weeks, fulfilling the requirement for a quick construction programme. The company used a 40t-capacity mobile crane for the majority of the lifting, although it needed to bring a slightly larger crane to site for the installation of the precast stairs and lift shafts.

Overall, the project consists of one large steel frame, that gains its stability from strategically-positioned cross bracings. The Campus is a two-storey structure, although there are two double-height single storey elements within the project, which accommodate the sports hall and the main swimming pool.

A series of Westok cellular beams, measuring 27.4m-long and weighing 4.1t each, which represent the longest and heaviest steel sections on the project, has been used to create the sports hall's column-free space.

The area containing the main pool is also topped with a series of Westok cellular beams, to create another large column-free space. Cellular beams were chosen for these two areas as they offer a lightweight and cost-effective method for accommodating building services.

"Steel is the only viable solution for this type of project as the material offers the best way of creating the necessary long spans," says Pellikaan Project Manager Santana Rodrigues. "It is also quick to erect, which is another important consideration as it helps us to get the structure watertight as quickly as possible, which allows the follow-on trades to get started as soon as possible."

The rest of the ground floor consists of wet changing rooms, in a single storey element adjacent to the main swimming pool, the learner pool, further changing rooms for the sports hall, a reception area and the library.

Much of the steelwork within the project will be left exposed in the completed scheme. Hence, the steelwork in the main and learner pool areas, as well as the wet changing rooms, has been galvanized to protect it against the corrosive chlorine environment inherent in aquatic centres.

The internal columns that will remain exposed within the building are all circular hollow section (CHS) members, chosen because they are said to be more aesthetically-pleasing than standard UC sections.

The first-floor area of the Campus occupies the central area of the project, overlooking and wrapping around two sides of both the main pool and sports hall.

This upper floor accommodates the gym, dance and fitness studios, meeting rooms, offices and further changing facilities. The first-floor gym is positioned close to the library below, which has meant the floor has been acoustically-isolated to prevent noise and vibration transference into a facility where a quiet environment is of upmost importance. An acoustic partition wall also separates the library from the adjacent sports hall.

Giving the completed project a stand-out appearance, the external envelope of the Campus will be clad with a mixture of rainscreen cladding, Bath stone and traditional brickwork.

To facilitate the installation of the cladding, Adstone fabricated fixing plates that were welded to the perimeter steelwork sections prior to arriving on site.

Summing up the construction work, Adstone Construction Structural Engineer Elliott Laidlaw says: "Design and build leisure and sport facilities are demanding projects to work on, due to various internal clear height requirements and intricate secondary steel support details, requiring a proactive relationship with the design team.

"However, we have a successful relationship with Pellikaan as they, alongside the client, create the main building configuration themselves, such as the grids and levels, aiming for a degree of standardisation across all of the leisure centres they construct. This gives us the blueprint for the member design, connection design and the fabrication process."

The Melksham Community Campus is due to open by Autumn 2022. ■

FACT FILE
Melksham Community Campus
Main client: **Wiltshire Council**
Architect: **Roberts Limbrick Architects**
Main contractor: **Pellikaan Construction**
Sub-structure engineer: **Hydrock**
Steelwork contractor: **Adstone Construction**
Steel tonnage: **230t**

Many of the perimeter beams have welded brackets that will be used to connect to cladding panels.

Westok cellular beams have been used as an economic solution for creating the column-free swimming pool hall.

FACT FILE
YY London at 30 South Colonnade, Canary Wharf
Main client: **Quadrant**
Architect: **Buckley Gray Yeoman**
Main contractor: **Skanska**
Structural engineer: **Waterman Structures**
Steelwork contractor: **Severfield**
Steel tonnage: **1,500t**

Commercial reinvention

The original building was stripped back to its steel frame and elements, such as new upper floors, have been added.

One of the first buildings to be built on the Canary Wharf financial estate in east London is being innovatively reconfigured and enlarged to be a Grade-A commercial scheme with the aid of steel construction.

How the completed building, with its distinctive Y-shaped cladding, will look.

Once home to one of London's busiest docks, Canary Wharf is today recognised as an important domestic and global financial centre.

The transformation from a leading dock, trading primarily in the importation of fruit from the Mediterranean and the Canary Islands – hence the name – into a finance centre that complements rather than rivals the City of London, began in the late 1980s.

A number of high-profile steel-framed buildings began to take shape, including One Canada Square, which is the UK's third tallest structure, although on completion in 1991 it was the nation's highest.

In the past 30 years, the Canary Wharf estate has continued to grow, with numerous commercial and residential schemes adding to the high-rise skyline.

In what is seen as a cost-effective, ESG (environmental, social and governance) alternative to constructing new commercial buildings, one of the district's original steel-framed offices, 30 South Colonnade, is being refurbished and enlarged with the aid of steel construction.

Built in 1991, YY London, named due to its new Y-shaped cladding, is being stripped back to its structural frame, extended upwards with three new floors and reconfigured internally from the ground up.

"The goal was very much to design a building that was striking and beautiful, but also that

"By infilling the atrium with new steel beams and lightweight concrete deck, and adding new stories at the top, we were able to find an additional 25% NIA, while saving 10,260 tonnes of embodied carbon, the equivalent of 798 million cups of tea."

changed the ground floor experience locally. It will be active, lively and welcoming to members of the public," says Quadrant's Partner, Julian Neave.

"The terrace on top of the building has been designed with a pavilion that will be communal to a multi-let building or private to a single-let building, and could be used for board meetings right through to Yoga sessions, art installations or drinks parties."

Skanska Project Director Tony Boorer adds: "Reconfiguring an existing building is an economic method of creating modern commercial space. On this project for example, the piled foundations are being reused, which means we have had no groundworks to do and consequently we have a quicker programme."

Early site investigations and further pile evaluation by Waterman Structures revealed the piled foundations had significant spare capacity. Significantly enlarging the structure to the plot, without new foundations or supplementing the foundations was possible, but keeping the weight down was critical and so steel was the only viable option.

Mr Boorer was Skanska's Project Director on a recently completed and very similar steel-framed scheme at Sixty London Wall. Much of the experience gained from that job has been applied on this project.

Sequencing the works in order to get the structure watertight as soon as possible has been one of the key drivers for Skanska at the YY London project. To this end, steelwork contractor Severfield began its work by infilling the existing atrium, that originally occupied a large portion of the building's central zone from level five upwards. New floors and a roof are being erected, making the structure watertight and allowing many of the follow-on trades to start on site.

Using the retained fifth floor slab to support its MEWPs, Severfield was able to begin erecting new internal steelwork while preparatory works, which included stripping back the existing fabric to reveal the steel frame, continued below.

The preparatory work also included the demolition of some areas of the existing building, such as cores, and the strengthening of steel columns and beams, allowing them to carry the extra loadings from the new steelwork.

Infilling the atrium and extending the upper floors will help to create more office space, while also allowing the design to enlarge and move the east core. The project has two steel-framed cores, with the western one remaining the same size, with the exception of new adjacent risers.

"It's a balancing act, as the atrium allowed natural light into the central areas of the old building. We've now moved the east core and toilet blocks into this infilled zone, with additional lift openings, as they don't need a lot of natural light. New office space is accommodated where the core once was and in an area where there's plenty of natural daylight," says Waterman Structures Director Julian Traxler.

"Full-height glazing around the entire building also guarantees more light will penetrate into the floorplates."

Keeping to the original column grid pattern, which incorporates spans of up to 10m, all of the atrium infill steelwork involves new steel connecting to existing steelwork.

The original steel structure consists of UB sections supporting metal decking and a concrete topping, which forms a composite flooring solution. The services generally run beneath the beams' bottom flanges and will generally be hidden from view by ceiling panels.

The new steel areas are constructed in the same way, with the exception of the new upper floors, where cellular plate girder beams have been used to accommodate services within their depth.

"Using cellular beams will allow the new upper floors to adopt modern exposed steelwork design with the services on view in the completed scheme," says Severfield Project Manager Gavin Rogers.

The new steel design will have increased the building's floor area by 9,000m², most of which is accounted for by the new floors and the reconfigured and infilled atrium.

However, on the north-east corner of the building, a circular rotunda area has been removed and this has allowed each floor to be further extended. A new column line, that extends from ground floor up to the new uppermost level, has allowed the building to be squared-off at the corner and extended with a new 8m × 8m section of floorplate to accord with the new façade design.

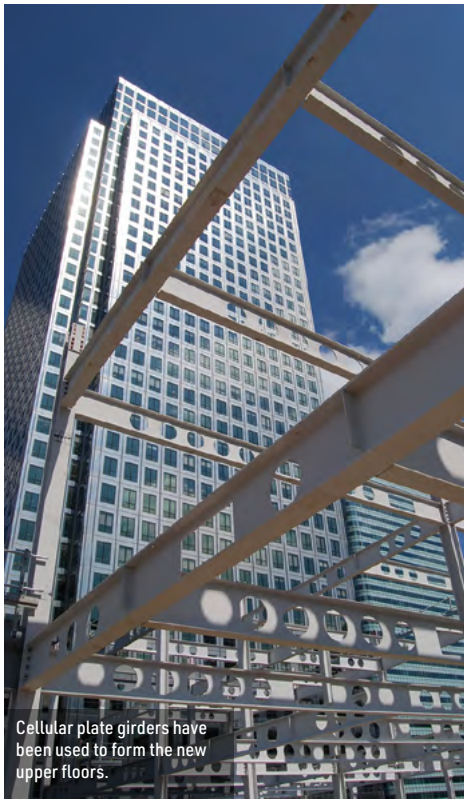
At level eight, the old building had an outdoor terrace, that extended from the north-east corner around two elevations to the opposite south-east corner.

A new row of perimeter columns around this elevation support beams that span back to the existing columns and create another extra bay of office space on all floors above level eight.

Elsewhere on the scheme, below the fifth-floor slab, Severfield are installing further infill steelwork from ground floor up to level four, as well as a new mezzanine floor at plaza floor level.

Because the building steps down from South Colonnade street level to the dockside, there are two ground floors. The main entrance and retail area is on what is termed plaza level, which steps down to promenade level that sits adjacent to the waterfront.

Summing up, Buckley Gray Yeoman Senior Associate Adam Wood says: "As a practice, we very rarely knock down a building and start again, so we're always looking to see what's possible and how far we can take the existing structure. The building's location over the dock was also a major deterrent to demolition.



Cellular plate girders have been used to form the new upper floors.

Replacing an eighth-floor terrace, new steelwork has been used to extend the building's office space.

"By infilling the atrium with new steel beams and lightweight concrete deck, and adding new stories at the top, we were able to find an additional 25% NIA, while saving 10,260 tonnes of embodied carbon, the equivalent of 798 million cups of tea."

Aiming to achieve a BREEAM 'Outstanding' rating, the landmark YY London at 30 South Colonnade is due to complete in November 2022. ■

Building for future health

As featured on television, a logistically-challenging site in the middle of two London hospitals has utilised steel construction to build a new five-storey clinical building.

FACT FILE
Children's Day Surgery Centre, Evelina London Children's Hospital
Main client: **Guy's and St Thomas' NHS Foundation Trust, Mace**
Architect: **ADP Architecture**
Main contractor: **Morgan Sindall**
Structural engineer: **Mott MacDonald**
Steelwork contractor: **SDM Fabrication**
Steel tonnage: **500t**

The new steel frame abuts existing structures along three elevations.

Construction projects probably do not get more challenging than constructing a new hospital building in the middle of a functioning NHS Trust during a global pandemic.

This is the scenario, main contractor Morgan Sindall has been successfully negotiating as it builds a new five-storey clinical block for Evelina London Children's Hospital, based on the site of St Thomas' Hospital, which overlooks the River Thames in Lambeth, south London.

Evelina London, which is the second largest provider of children's services in the capital, has seen demand increase. The new building will enable the hospital to grow and expand capacity, as part of a wider vision to develop as a world-leading centre of life-changing care for children, young people and their families.

The project is squeezed into space between the two hospitals' (St Thomas' and Evelina London) existing facilities, which are functioning as normal throughout the construction works. The new building will accommodate standalone children's day surgery and specialist facilities.

One of the main challenges the contractor has to overcome is the location of the project and its close proximity to existing hospital facilities.

"We have to minimise noise as much as possible as the adjacent wards are looking after patients" explains Morgan Sindall Senior Project Manager Darren Clayton. "However, there is always some noise on a busy construction site, so we have liaised with the client and agreed to stop all potentially noisy work during the hospital's midday protected quiet time for patients."

As well as negotiating the site's many logistical challenges, the project has also recently gained some small screen fame. The job featured on BBC 1's popular *Dom Digs In* programme, when presenter Dom Littlewood visited the project as part of his construction industry episode.

Reflecting the constrained site, the new steel-framed building has an irregular footprint, but it is broadly rectangular measuring 40m-long × 16.5m-wide at the northern end, tapering down to 11.6m at the southern end, while reaching a maximum height of 26m.

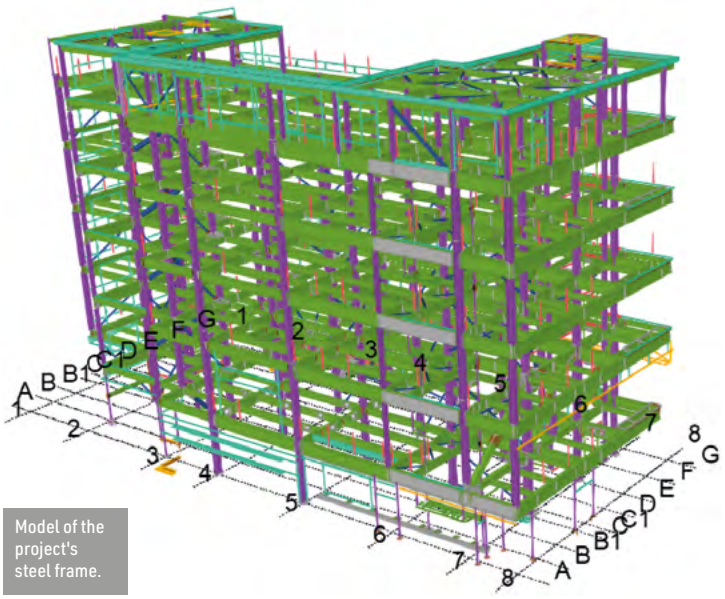
Three sides of the new building abut existing structures, with the only exception being the southern elevation, which accommodates the main entrance.

The northern elevation and the eastern elevation are both cantilevered due to the proximity of the existing buildings, which meant piles could not be installed along the regular column line. There is also a main sewer that runs close to the eastern elevation that had to be avoided by subterranean works.

The steel frame is founded on 30m-deep piles and a concrete slab, which were both installed once the demolition of the previous building had been completed.

Arranged around a regular column grid pattern, the steel frame has internal spans of up to 7m. Steel beams support metal decking and a concrete topping to create a composite flooring solution throughout the structure.

Commenting on the steelwork erection, SDM Fabrication Project Manager Mike Harding says: "The first section of the building that we erected was the cantilever section on the north elevation. We had to design and install temporary bracing to allow us to erect this. We have also installed



Model of the project's steel frame.

The north elevation features a stand-out cantilever.

temporary bracing around the lift shafts and this will be removed once the frame has been completed."

The new building has two lift shafts, which also have permanent bracing that contributes to the overall stability of the structure. However, the majority of the stability-giving bracing is located around the three elevations that abut the existing buildings. These façades are ideal locations for positioning bracing as they have no windows. However, these bracings are not sufficient and so there is additional bracing within some of the building's internal partitions.

The northern elevation will link into St Thomas' Hospital's main access route between its South and East Wings. Consequently, bracing along the ground floor needed to be minimised so it would not impede a new access route. The project designers came up with an idea for a Y-shaped column that extends from ground to first floor level, which takes the load from the cantilever in this area and avoids the need for any cross bracing in this location.

Once the northern elevation's bays were erected to the full height of the structure, SDM continued the steel erection programme by working their way to the southern end of the project, again erecting each bay to its full height. Using this working sequence was the ideal choice as the southern end of the building faces the only access route which can be used for material deliveries.

As well as erecting the steelwork, SDM also installed edge protection and metal decking. The majority of the lifting work was done using an Artic Raptor tower crane, a model specifically designed for working in tight and confined sites. Due to the constrained nature of the site and the need to avoid over-slewing the existing buildings, the crane had to be moved to three different locations during the programme.

The new children's day surgery centre at Evelina London is due to open in March 2022. ■

The steel frame's stability-giving cross bracing is primarily located along the elevations.

Squeezed in between two existing buildings, the site only has one access route, which dictated how the steel frame was erected.

Second city paradise

Spanning the A38 dual carriageway, the steel-framed 13-storey One Centenary Way is the first building to be constructed in phase two of Birmingham's Paradise development.

A new mixed-use scheme is taking shape in the centre of Birmingham, changing an historic area of England's second city into a new vibrant business and leisure destination.

Formerly known as Paradise Circus, and now renamed simply as Paradise, the redevelopment is being constructed in three phases, with the initial phase including the completion of two office blocks known as One and Two Chamberlain Square. Phase two is now underway, and this involves the construction of One Centenary Way, a 13-storey commercial building.

Containing more than 7,000t of structural steelwork, the project will on completion be a stand-out building featuring an exoskeleton on all four elevations. The expressed and exposed nature of the steel frame also extends to the interior of the building, where columns, beams and connections will also be on display.

Below ground level, the steelwork is no less impressive as just over 60% of the total footprint of the building is sat on top of a series of trusses that span the A38 dual carriageway tunnel; a key transport artery through the city.

In addition, the site overlays a major services tunnel. This, along with the proximity of the adjacent above ground highway results in an unusually challenging site for a development in Birmingham.

"One Centenary Way is an important building for the Paradise masterplan as it will be the first building of Phase Two to complete. It will also be an important building for Birmingham, not least for its green credentials, but it will be the first commercial exoskeleton building in the region," says Glenn Howells Architects Partner Dav Bansal.

Approximately 1,950t of structural steelwork has

FACT FILE
One Centenary Way, Birmingham
Main client: **MEPC**
Architect: **Glenn Howells Architects**
Main contractor: **Sir Robert McAlpine**
Structural Engineer: **Ramboll**
Steelwork contractor: **BHC**
Steel tonnage: **7,450t**

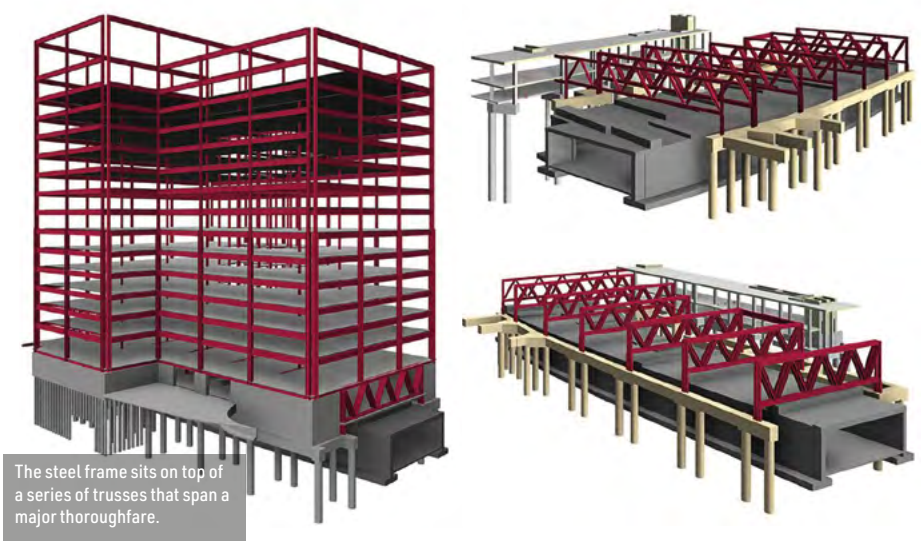
The 13-storey One Centenary Way will be Birmingham's first commercial scheme to feature an exposed exoskeleton.

Complex Foundation Solutions

Ramboll designed the complex piled substructures for the building to transfer the structural loads safely into the ground while avoiding any overloading of the tunnels.

Sophisticated geotechnical modelling was utilised to demonstrate to the asset owners that the new development would not negatively influence the existing tunnel structures, as required by the rigorous approvals process.

Ramboll's survey team produced a 3D laser scan of the tunnels to allow their positions to be accurately recorded and provide a full 3-D photographic record of their condition. Continuous tunnel monitoring throughout the works ensures that tunnel movements are always within acceptable limits.



The steel frame sits on top of a series of trusses that span a major thoroughfare.

Much of the steelwork will be exposed in the completed scheme.

been used to fabricate the 16 storey-high trusses, which are up to 34.6m-long and weigh up 130t.

Fabricated at BHC's Lanarkshire facility, the trusses were transported to site as complete sections, measuring up to 6m-wide. Once on site, a 1,200t-capacity mobile crane, one of the largest in the UK, erected each of the trusses.

According to Ramboll Principal Engineer Daniel Yoxall, the trusses are said to be among the largest ever designed and constructed in the UK for a commercial building.

"Although the trusses were delivered and lifted into place as individual items, 14 of them are installed as pairs, tied together in-situ with cross members, as this configuration was better suited to transferring the loads from the building above to the foundations below. The exceptions are two single trusses at either end."

The trusses form part of the basement level and their top chords help form a platform to support the majority of the building's structural frame. One of the building's two basement levels is accommodated within the trusses' depth. This upper basement floor will house a well-equipped and accessible cycle hub for the whole estate. With just over 300 spaces, this will be Birmingham's first city centre major cycle hub offering associated facilities including showers and locker rooms together with servicing and bike hire. The part of this floor level that is not within the trusses will accommodate a retail basement area and vehicular ramps for the car parking that is also located in the basement.

Approximately two-thirds of the project's steel frame is supported by the truss steelwork. The steel frame structure is fundamental to realising the development potential of the site and is architecturally celebrated in the form of Vierendeel exoskeleton frames, which provide lateral and vertical support to the building.

"Due to the tight site constraints, we couldn't have a typical load-bearing core with columns going into the ground to hold the building up and give it stability. The solution, therefore, was using the building's façade to provide the stability in the form of a Vierendeel exoskeleton," says Mr Bansal.

As well as the stability provided by the exoskeleton, there is also a centrally-positioned steel braced core that provides some stability.

"The exoskeleton on its own doesn't provide enough stiffness for the overall structure, so the two stability systems work in tandem," explains Mr Yoxall.

The project is using a steel core, instead of a concrete one as the former offers a lighter solution. This was important, as the core had to be positioned on top of the trusses, so it could sit in a central position within the building and thereby satisfy the desired internal office layout.

▸20

Steel-framed solution has proven to be the ideal choice for a structure built on a logistically challenging site.

▸19

The Vierendeel exoskeleton is formed with a series of vertical and horizontal steel sections forming 12m-wide rectangular boxes.

The rectangles incorporate 3m-wide horizontal windows, encased within an exposed structural steel façade. The innovative, structural-led design is said to be a response to the complex site location.

The interior of the building will offer large office floorplates of up to 2,090m², as well as retail space at ground floor level. The column grid is based around a 12m × 9m spacing, as this layout requires minimal internal columns, while also providing the desired modern open-plan office layout.

Cellular beams have been used throughout to accommodate the building services within their depth. They support metal decking, which along with a concrete topping forms a composite flooring solution for every level above the ground floor slab.

As well as retail, the ground floor also has a triple-height reception area with a floor-to-ceiling height exceeding 9.5m. To accommodate this much higher and impressive reception area, the first floor does not cover the entire building footprint. The upper floors have a standard 3.8m floor-to-ceiling height.

Summing up, MEPC Regional Development Director Rob Groves says: "One Centenary Way is a truly exemplary building that I am convinced will become one of the city's major landmarks. There's nothing else quite like it in terms of design and it will not only mark out Paradise, but also this whole area of the city centre. With the delivery of the trusses, we see the practical application of one part of our vision not just for this building, but the whole scheme." ■

Truss design

Trusses are a key part of the One Centenary Way structure – Vierendeel trusses for the exposed exoskeleton and Warren trusses supporting the superstructure. David Brown of the SCI comments on truss design.

Truss design appears to be one of the simpler design activities in steel structures – determine the loads, determine the geometry and analyse the truss to calculate the member forces. For a Warren truss, the initial analysis would probably assume pinned joints, so even manual analysis is easy, by resolving at joints or taking moments at selected cross sections. Although simple analysis of a Vierendeel truss is possible, the moment resisting joints mean a computer analysis is the realistic option.

Whichever route is taken, the initial sizing of the truss members is usually straightforward. At this point, the hard work begins, as the joint design – an essential part of truss design – is much more involved. As can be seen in the images of the Warren trusses at One Centenary Way, the truss nodes are three dimensional, complicated details with a physical size that does not match the analysis assumption of a node in an analysis model.

The usual approach with Universal Column (UC) profiles is to assume the axial force in a member is distributed within the cross section in proportion to the area of the element, so each flange is typically allocated 40% of the axial force. The load paths of each part of the member force can then be considered, verifying if the element within the node can accommodate the design forces. With open sections such as UCs, it might be anticipated that the chord flanges would need stiffening (to ensure the welded connection is fully effective) and that the chord web may need reinforcement over the length

of the node. The main members are usually highly stressed before the additional local stresses are considered.

Practical issues of node geometry are important at this stage – can the welds within the node actually be completed? Are member elements overlapping so much that access is impossible? Best practice in truss design is certainly to consider the joints at the design stage, adjusting the member sizes and geometry (which may affect the truss analysis) to ensure a reasonable solution can be achieved. Careful consideration of the necessary site splices is also critical, since large forces mean many bolts, many bolt holes and significant loss of the cross-sectional area. The net area checks may become critical in these details. ■

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Steel the ideal hospitals prescription

The National Health Service (NHS) and the construction industry are gearing up to deliver the biggest hospital investment programme for a generation. Steel construction will have a key role to play, report Nick Barrett and Martin Cooper.

Funding for what is being called the largest hospital building programme in a generation was officially confirmed by Prime Minister Boris Johnston in October last year, having been first announced in September the year before when £2.8 Billion was confirmed to allow work on six hospitals to go ahead, alongside seed funding for hospital trusts to develop business cases.

The New Hospital Programme (NHP) is part of a Health Infrastructure Plan (HIP) to provide 40 new hospitals in England by 2030, a total of 48 now that eight others have been told to prepare business cases for a future funding round. The programme fulfils an election manifesto commitment so should be protected from any post COVID-19 spending cuts if the Chancellor of the Exchequer decides he has to rebalance the public finances faster than some might anticipate.

Health service commentators have pointed out that much of the programme will not involve new hospitals, but expansions and redevelopments at existing sites, and that the cost of building 40 brand new hospitals would be more like £20 Billion. The construction industry, however, is keenly anticipating whatever level of investment materialises.

The programme will be partly shaped by government levelling up policy, so will be weighted towards hospital buildings in the north of England. It will also be shaped by the drive to support modern methods of construction, in particular modular construction and offsite construction, which the steel sector has been promoting for many years.

The NHS has undertaken major investments on this scale before. Between 1997 and 2010 there were over 50 major schemes to redevelop acute care hospitals in a £10 Billion programme, mostly financed as Private Finance Initiative projects. Much has been learned from earlier investments and procurement and delivery of projects is likely to be very different under the NHP.

Steel construction will play a major part in this new investment, and we can see why from the three recent projects we revisit in this article, and our article on the Evelina Children's Hospital extension opposite the Houses of Parliament, which is under construction. A focus on quality and value for money will be a feature, which is good news for steel. Other key features of steel construction will benefit the programme, including flexibility, vibration performance and delivery as we see in the three projects opposite. The use of Building Information Modelling is certain to be a common feature of all of these projects, and steelwork contractors have long experience of the relevant software and collaborative approach that BIM implies.

Flexibility will be a key demand of health service clients, and spaces provided will need to be adaptable, transformable and convertible. Room sizes will likely have to be more generous to allow for changes and 'soft space' like storage and administration offices will be built around high tech departments to allow expansion with minimal cost and upheaval.

Future hospitals will also need to have the ability to expand, reroute and change services, so steel's ability to incorporate services in frames could become essential. The health service realises that future expansion may be vertical as well as horizontal and this will have to be allowed for in designs - again favouring steel solutions.

Hospitals have needed reconfiguration more often than was foreseen in the previous design process, not just because of COVID-19, but because of factors unique to health services like the emergence of other new diseases, changes in disease management and changes in technology. Government promises to involve the supply chain earlier than in the past, which should help ensure designs for hospitals that can be easily adapted for changing future use. Meetings are being held with the supply chain and BCSA members have been told to expect to be called in for a special steel sector briefing from the NHS. ■

Flexibility in the design

Built on the site once occupied by Birmingham's BBC Pebble Mill studios, the Circle Health private hospital is a project where steelwork's flexibility came to the fore.

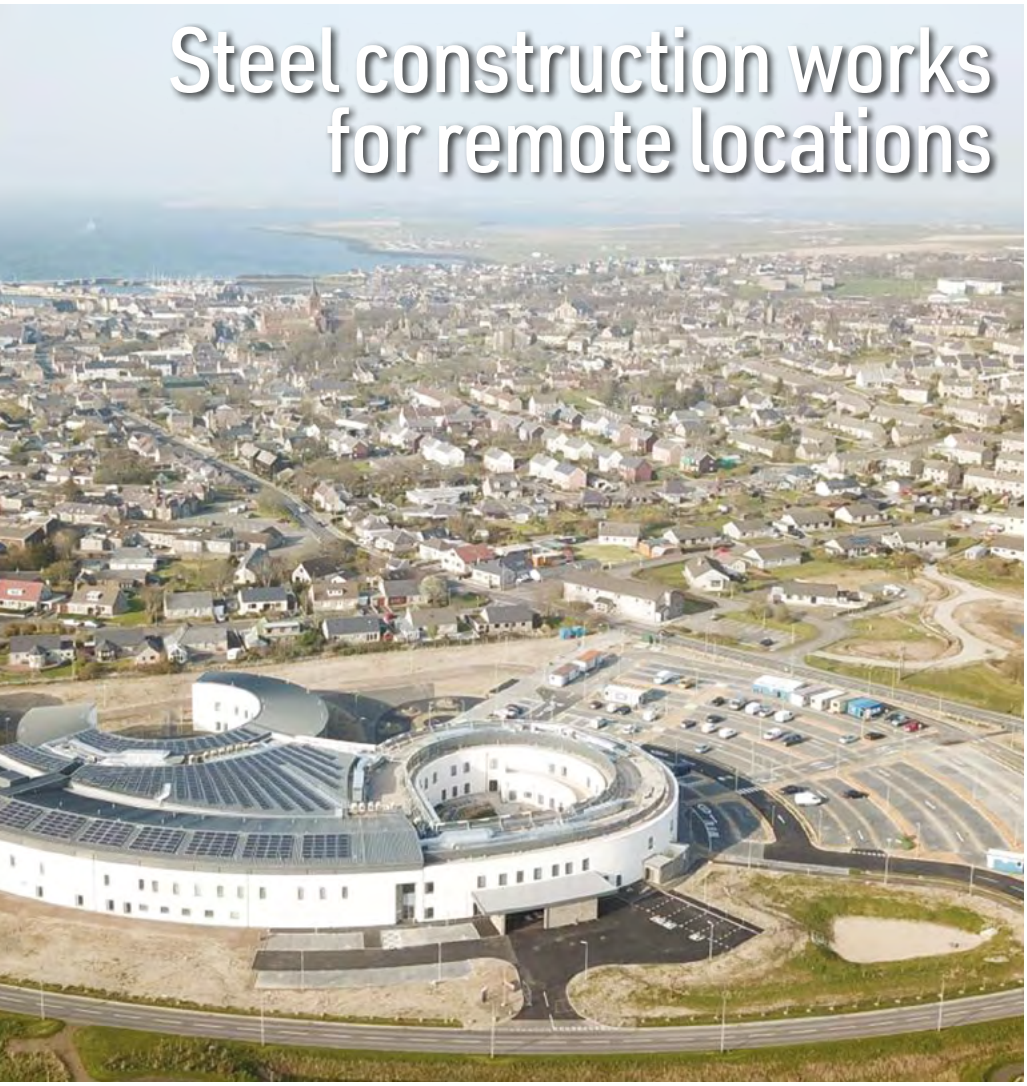
Utilising a steel-framed design sat atop a concrete podium containing a car park, the hospital is based around an expandable model which can be adapted and enlarged to meet clinical demand now and in the future.

The £40M hospital includes three operating theatres (expandable to five via fit-out), an endoscopy procedure room, comprehensive rehabilitation suite and 140 in-patient bedrooms.

Explaining the design, Bryden Wood Board Director Paul O'Neill says: "Future-proofing makes this hospital highly adaptable and cost-effective. It provides our client with a building, which can be adaptable to their business plan as it evolves and responds to local demand throughout its lifetime.

"Our approach has meant that the future incorporation of rehabilitation services into the scheme is made possible. It shows that it is essential to rethink healthcare design, and there is a clear need to provide spaces to be continuously adaptable to the future needs of healthcare requirements and technology."

Steel construction works for remote locations



A steel-framed solution proved to be the ideal solution for the construction of the Balfour hospital at Kirkwall.

Built as a replacement for an older hospital, the new facility, which opened in 2019, was built on a greenfield site on the outskirts of the largest settlement and capital of the Orkney Islands.

"A composite steel solution with metal decking was the best choice for the hospital, as other framing materials simply wouldn't have worked," explains Mark Dalziel, Senior Project Manager for Robertson Construction's Major Projects business.

"For instance, there is only one concrete batching plant on the Orkney Islands and they could not have supplied our needs. Installing our own plant would have been very time-consuming and wouldn't have been cost effective, so steelwork, which can be brought over from the mainland by ferry, ready for erection, was the best option."

Delivering a major healthcare project on the Orkney Islands presented main contractor Robertson with a unique set of challenges. To solve these, it took into account, not only the remoteness of the islands, but also supply chain logistics, local landscape, and challenging climatic conditions.

For example, procuring and shipping construction materials to site, well in advance of programme requirements reduced the vulnerability of the project to extreme weather.

Steelwork's speed of construction was also vital as the envelope of the building was designed to take into account the availability of trades on the islands and to achieve an early wind and watertight position, thereby allowing internal works to progress despite inclement weather.

BHC fabricated, supplied and erected 1,200t of steelwork for the project.

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

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

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

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

Working on behalf of main contractor Simons Group, Caunton Engineering erected 925t of steelwork for the project.

Vibration issues negated at Birmingham hospital

The Queen Elisabeth Hospital in Birmingham represented the first new general hospital to be built in the UK's second largest city for more than 70 years and the largest community healthcare development outside of London.

Opened in 2012, it was dubbed a 'super hospital'. It offers 1,213 beds, 30 operating theatres, 15 laboratories and 300 teaching rooms as well as 3,700 car spaces spread over three multi-storey car parks.

The project required 12,500t of structural steelwork, fabricated, supplied and erected by Severfield.

Ensuring such a large steel-framed structure had no vibration issues was foremost in the project's structural design process.

The result was a preliminary design with a robust steel frame utilising a 225mm composite concrete/profiled metal deck floor slab spanning between composite primary and secondary beams.

The thick slabs were able to provide floor beams with a high natural frequency and a slab with inherent mass to damp induced vibration.

According to the project engineer, it was essential to maintain standard grid arrangements with continuous lines of secondary beams to promote the mobilisation of large areas of floor plate and increase the modal mass for vibration damping.

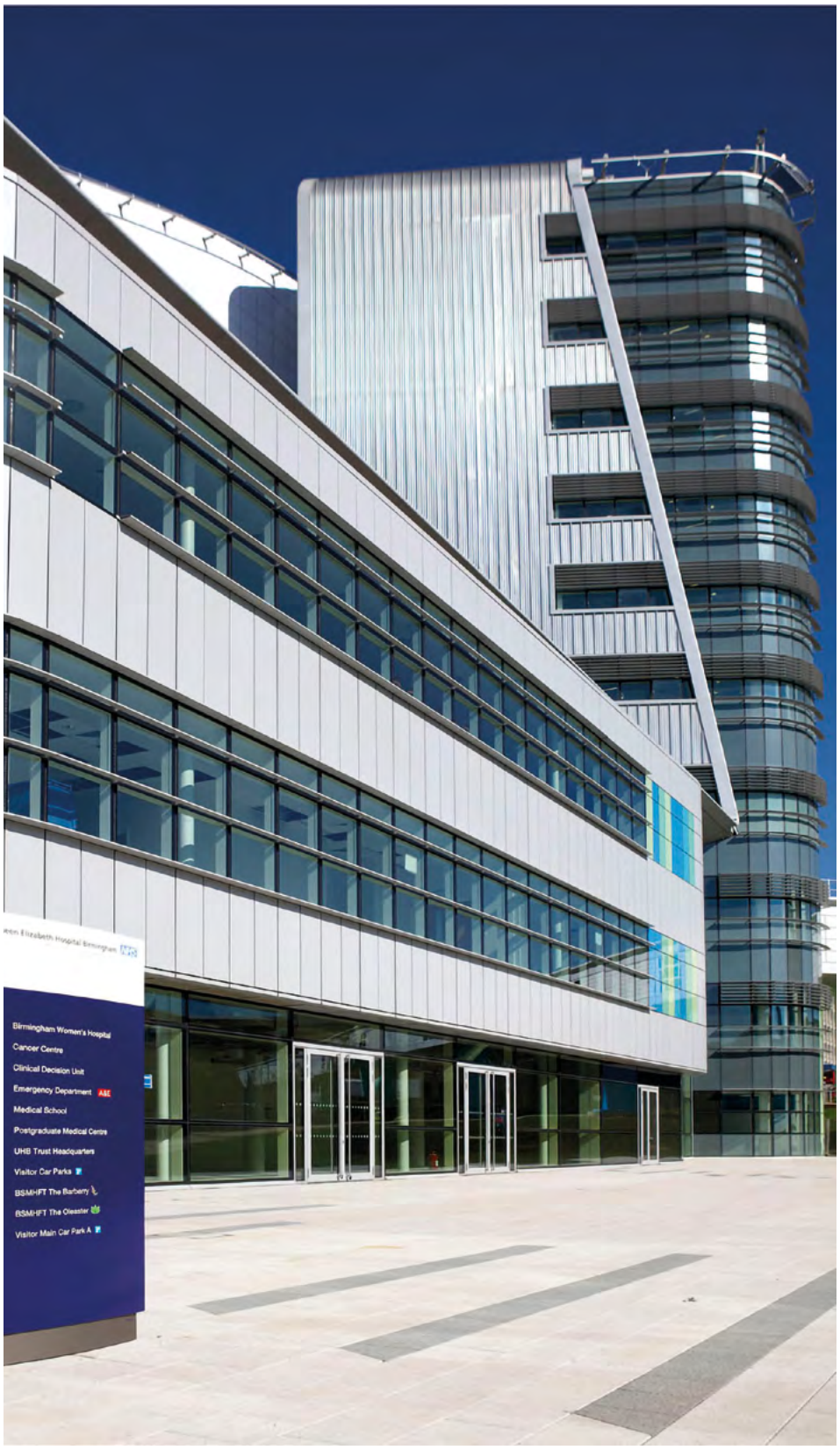
To validate the preliminary vibration design Severfield commissioned the Steel Construction Institute to undertake finite element analyses of the floorplates. From these analyses, it was found that nine reasonably closely spaced modes of vibration existed which were likely to be the basis for resonant vibration. By adopting accurate loadings and damping factors it was confirmed that the design would meet the requirements of HTM2045 Acoustics Design Considerations 1996.

Following the erection of the steel frame and the installation of the floor slabs, additional elements of sensitive medical equipment were introduced into the building, such as MRI and CT scanners.

The project engineers undertook a review of the now complete structure to assess the feasibility of providing adequately robust spaces to house MRI and CT scanners on areas of existing suspended floor slab.

This exercise required an assessment of the structural capacity of the affected areas of the existing building and a vibration analysis, undertaken firstly by hand and then by in-situ testing, to confirm that the structure met with the stringent performance requirements specified by the equipment manufacturers.

Vibration measurements were then undertaken to evaluate the response of the floors in accordance with BS6472: 2008, which confirmed that the structure successfully met the vibration acceptance criterion specified for the scanners.



The buckling resistance of laced columns

Photo: Winvic Construction, SEGRO Logistics Park East Midlands Gateway Plot 12

Figure 2: 33 m tall laced columns in a high bay warehouse

David Brown of the SCI uses the example of a laced column to demonstrate useful approaches to member buckling.

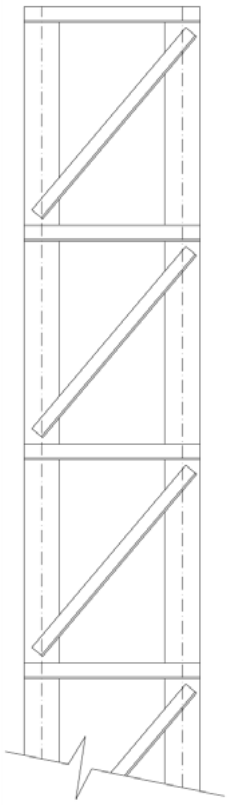


Figure 1: Laced column

Laced columns – a concept past its prime?

The short answer: mostly! A laced column consists of two main members – usually universal sections – acting as chords with a system of diagonal members in a 'N' or 'W' arrangement connecting the two chords, acting as the web of the compound section, as Figure 1. Laced columns involve significant fabrication effort, so enthusiasm for this form of column is influenced by the relative costs of labour and material. In previous decades built-up columns of this form were popular, but in the latest version of the Steel Designers' Manual they receive only a passing reference, perhaps indicating reduced enthusiasm. Laced columns *are* still used – they are very effective for high loads and tall columns found in some buildings, as illustrated in Figure 2. Laced columns may be useful when intermediate restraints are only possible to one axis of a tall, heavily-loaded column.

The primary purpose of this article is to illustrate important concepts relating to member buckling, which are demonstrated in the Eurocode rules.

Flexural buckling of laced compression members in BS 5950

All designers appreciate that buckling must be verified, usually about the two orthogonal axes of the member (a notable exception are angles). For minor axis buckling of a laced column (which is the major axis of the chord members, as shown in Figure 3), there is nothing new. The situation becomes more interesting for major axis buckling of the compound section.

BS 5950 clause 4.7.8 covers the design of laced struts and notes that the compound member may be designed as a single integral member. Table 23

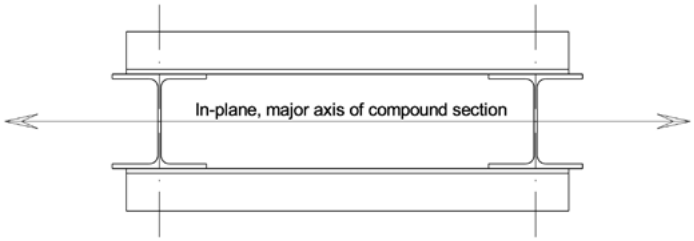


Figure 3: Laced column cross section

allocates strut curve c when calculating the resistance of a laced strut, about either axis. In compression alone therefore, the process is straightforward. The use of a strut buckling curve allows for initial imperfections and second-order effects – notably the increase in the initial imperfection under the axial load.

The challenge becomes much more complicated if the laced column is subject to an in-plane bending moment in addition to an axial compression. The expressions in section 4.8 all refer to the moment resistance of the section, being primarily suited to single rolled sections. It is not clear how to design a laced column under combined axial load and bending – designers are left to work from first principles.

The effect of shear stiffness

The shear stiffness of a laced column is significantly lower than that of a member with a solid web – much of the "web" is missing. The shear deformation of a member with a solid web is so small that it is usually ignored, but this could be significant in laced columns. Increased deformation leads to an increased moment at mid height due to the eccentricity of the cross section with respect to the ends of the member, and therefore a reduced resistance.

In BS 5950, there is no specific reference to allow for the additional deformation due to the shear flexibility. It could be that this effect is allowed for within the choice of curve c, in combination with the rules about local and overall slenderness.

Buckling of laced compression members in BS EN 1993-1-1

The Eurocode might be considered more helpful than BS 5950, since it has guidance for the design of laced columns subject to combined axial force and bending moment. The Eurocode also explicitly allows for the shear flexibility of a laced column. Perhaps of more interest is the design approach, which rather than using a buckling curve, demonstrates an alternative method to allow for imperfections and second-order effects. The following comments relate to in-plane buckling.

Usually, imperfections in members – in the form of an initial bow – and the amplification of that bow when load is applied, are dealt with through the choice of strut curve. An alternative approach is to determine the initial imperfection, amplify the imperfection and then simply complete a check of the cross section of the form:

$$\frac{\text{Force}}{\text{Area}} \times \frac{\text{Force} \times \text{final imperfection}}{\text{selection modulus}}$$

When this expression equates to the design strength of the section f_y, the buckling resistance has been established. The alternative approaches are described in clause 5.2.2.

Previous articles in New Steel Construction have reminded readers of the relationship between the initial imperfection e_0 and the final imperfection $\hat{e}$ shown in Figure 4 which is given by:

$$\hat{e} = \frac{e_o}{\left(1 - \frac{N_{Ed}}{N_{cr}}\right)}$$

Clause 6.4 of BS EN 1993-1-8 uses this method to amplify an initial imperfection, and also to allow for the reduced shear stiffness of the laced column. Once the imperfections and second-order effects have been allowed for, all that remains are "local" checks. This approach is described in clause 5.2.2(7), where "the individual stability of members should be checked... for the effects not included in the global analysis". The effect remaining to be checked is the buckling of the chord between nodes of the lacing system.

Maximum design force in the chord

With two identical chords, the design force in one chord is obviously half the applied force – but the effects of the member initial imperfection, amplification, shear flexibility and any applied moment must all be added.

The design value of the internal moment (equivalent to Force × final imperfection above) is given by:

$$M_{Ed} = \frac{N_{Ed}e_0 + M^I_{Ed}}{1 - \frac{N_{Ed}}{N_{cr}} - \frac{N_{Ed}}{S_v}}$$

In the numerator, $N_{Ed}e_0$ is the applied axial force multiplied by the *initial* eccentricity. This must be amplified, so the fundamental term becomes:

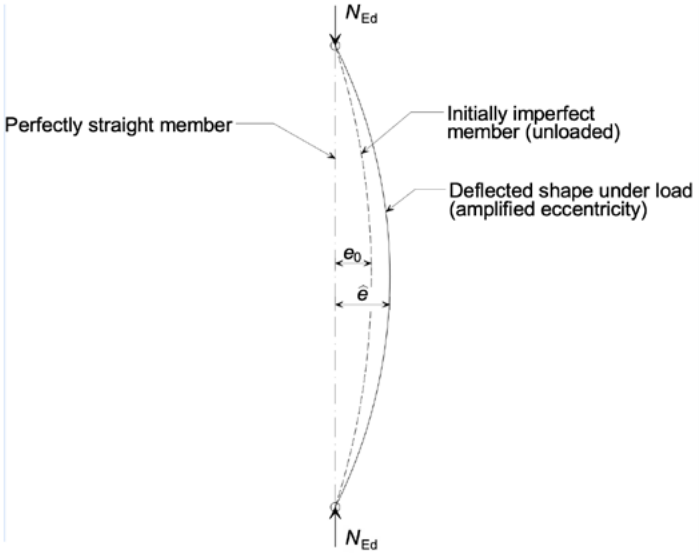


Figure 4: Imperfect strut behaviour

$$M_{Ed} = \frac{N_{Ed}e_0}{1 - \frac{N_{Ed}}{N_{cr}}}$$ which is the same relationship in the first part of the previous expression.

M^I_{Ed} is the moment at the middle of the member (if any), without second-order effects. That too must be amplified.

In the denominator, the final term $\frac{N_{Ed}}{S_v}$ is the amplification of the deformation due to the shear stiffness of the lacings, S_v. Figure 6.9 of the Eurocode gives different values of S_v for various arrangements of lacing.

The design moment M_{Ed}, which allows for the effects described above, is converted into a force in the chord by dividing by the lever arm between the chords, to be added to half the applied compression. Expression 6.69 does not immediately appear to be so straightforward, since it is presented as:

$N_{ch,Ed} = 0.5N_{Ed} + \frac{M_{Ed}h_oA_{ch}}{2I_{eff}}$, but since $I_{eff} = 0.5h_o^2A_{ch}$ the expression simplifies to $N_{ch,Ed} = 0.5N_{Ed} + \frac{M_{Ed}}{h_o}$

Perhaps there was some good reason for the more complicated presentation.

How do the codes compare? – BS 5950

A convenient worked example of design to the Eurocode is contained in Reference 1. Each chord is a HE 220 A, in S355, spaced 800 mm apart. The member is 10 m long. Each chord has an area of 6430 mm². For each chord, i_z = 55.1 mm

The in-plane second moment of area I_{eff} of the compound section is 2058 × 106 mm⁴

BS 5950 clause 4.7.8 g) places a limit on the slenderness of the chord between nodes, and on the slenderness of the overall member, so the best starting point is with a chord length between nodes.

Local buckling of chord

In Reference 1 the buckling length is 1125 mm

In the minor axis of the chord, $\lambda_c = \frac{1125}{55.1} = 20.4 < 50$, OK.

The chord flange is 11 mm, so f_y = 355 N/mm²
From Table 23, the strut curve is curve c (the section is a "H" profile)
From Table 24, p_c = 345 N/mm²
P_c = 345 × 6430 × 10⁻³ = 2218 kN per chord, 4436 kN in total.

Overall buckling of compound member

Radius of gyration in-plane = $\sqrt{\frac{2058 \times 10^6}{2 \times 6430}} = 400$ mm
Slenderness = $\frac{10000}{400} = 25$
However, the minimum value is $1.4\lambda_c = 1.4 \times 20.4 = 28.6$
(for convenience, take 30)
From Table 23, the strut curve is curve c
From Table 24, p_c = 324 N/mm²
P_c = 324 × 6430 × 2 × 10⁻³ = 4167 kN
The resistance of the section in this axis is limited by the overall buckling, not the local buckling of the chords between nodes.

How do the codes compare? – BS EN 1993-1-1

From 6.4.1(1) the value of $e_0 = \frac{10000}{500} = 20$ mm

As given in the example, N_{cr} = 42650 kN and S_v = 134100 kN

Also as given, $N_{b,Rd}$ = 2203 kN (reassuringly similar to 2218 kN calculated above in accordance with BS 5950)

Assuming no externally applied moment, to make the example compatible,

$$M_{Ed} = \frac{N_{Ed} \times 0.02}{1 - \frac{N_{Ed}}{42650} - \frac{N_{Ed}}{134100}}$$

and $N_{ch,Ed} = 0.5N_{Ed} + \frac{M_{Ed}}{0.8}$

The maximum resistance is when $N_{ch,Ed} = N_{b,Rd}$, so using "goal seek" within Excel for convenience, N_{Ed} is found to be 4167 kN

To check: $M_{Ed} = \frac{4167 \times 0.02}{1 - \frac{4167}{42650} - \frac{4167}{134100}} = 95.66$kNm

and $N_{ch,Ed} = 0.5 \times 4167 + \frac{95.66}{0.8} = 2203$ kNm , OK.

Somewhat incredibly, the resistance according to BS EN 1993-1-1, is exactly the same as that calculated to BS 5950.

For interest, the terms in the denominator to calculate M_{Ed} are (1 - 0.098 - 0.03) which together lead to a 15% amplifier in the value of e_0. The values give some indication of the effect of shear flexibility – not very significant in this particular example. The shear flexibility obviously varies with the particular arrangement or lacing members proposed. American standards make a further distinction between lacing members that are welded or use preloaded assemblies, and those that are bolted with ordinary bolts in clearance holes. The latter introduces more flexibility into the system and reduces the overall resistance by up to 10%.

The out-of-plane buckling must be verified separately.

Conclusions

The primary purpose of this article was not to promote laced columns, but to demonstrate that buckling behaviour can be addressed either:

- within the member checks, (section 6.3 of the Eurocode) where member imperfections and second-order effects are automatically included, or
- by including the effects of imperfections and second-order effects within the analysis, leaving only local checks (usually just a cross sectional check but in the case of a laced column, the local check is still a buckling check).

A laced column is one example where the second approach is very helpful, as applied moments can be included in the design – a situation not covered in BS 5950. A second more common example is the in-plane buckling of portal frames. In-plane, imperfections and second-order effects are allowed for (if necessary) in the global analysis, meaning only a cross sectional check is needed. ■

1. Single-storey steel buildings Part 6: Detailed design of built-up columns available from arcelormittal.com

AD 466:
Probability factors applied to characteristic wind and snow loads for non-standard return periods

Wind Loads

The SCI receives queries from time to time on the determination of design actions for wind load for design lives other than the usual 50 years. According to BS EN 1991-1-4:2005[1] para. 4.2, the basic wind velocity v_b is multiplied by the probability factor c_{prob} to give the 10 minutes mean wind velocity having the probability p for a given annual exceedance. Equation 4.2 in the para. named above is:

$$c_{prob} = \left(\frac{1 - K \times \ln\left(-\ln\left(1-p\right)\right)}{1 - K \times \ln\left(-\ln\left(0.98\right)\right)}\right)^{n}$$

The recommended values for K and n are 0.2 and 0.5 respectively. In substituting these values, the denominator gives the constant multiplier 0.75 and the formula becomes:

$$c_{prob} = 0.75\sqrt{1 - 0.2\ln[-\ln(1-p)]}$$

This is as given in SCI publication P394[2] Appendix B, where it is applied to the wind speed derived from the wind map for the UK (Figure NA.1 in the UK National Annex[3]) along with other factors to arrive at the design wind pressure q_p.

BS EN 1991-1-6[4] gives appropriate return periods for the design of structures during execution which may be shorter than 50 years. Example values of the probability factor for other return periods are for a 10 year return period ($p = 0.1$), $c_{prob} = 0.9$ and for 60 years ($p = 0.0167$), $c_{prob} = 1.01$, leading to factors on wind loading equal to 0.82 and 1.02 respectively.

Snow Loads

The adjustment of snow loads for different return periods is also allowed according to BS EN 1993-1-3:2003[5] Annex D, but only for return periods longer than five years, according to the UK National Annex. Here, the characteristic snow load is adjusted for a recurrence interval different from that for the characteristic snow load s_k which is based on an annual probability of exceedance of 0.02 ie a return period of 50 years. The formula for snow load with a return period of n years is given in Annex D as:

$$s_n = s_k\left(\frac{1 - V\frac{\sqrt{6}}{\pi}\left[\ln\left(-\ln\left(1-P_n\right)\right) + 0.57722\right]}{\left(1 + 2.5923V\right)}\right)$$

V is the coefficient of variation for the probability distribution. In the UK V varies depending on location. When determining ψ factors for the UK National Annex to BS EN 1990, a range of values for V were considered[6]. Example values for the factor on characteristic snow load for specific return periods and coefficients of variation are given in the table.

Coefficient of variation V	10 year return period	60 year return period
0.1	0.9	1.01
0.3	0.8	1.02

For site-specific queries, the Meteorological Office should be contacted. The Met. Office suggests using the contact form on the web-page: *https://www.metoffice.gov.uk/services/research-consulting*

Contact: **Richard Henderson**
Tel: **01344 636555**
Email: **advisory@steel-sci.com**

1 BS EN 1991-1-4:2005+A1:2010 *Eurocode 1 - Actions on Structures Part 1-4: General actions – Wind actions.* BSI, 2011
2 A F Hughes, *Wind Actions to BS EN 1991-1-4*, SCI P394, 2014
3 *UK National Annex to Eurocode 1 - Actions on Structures Part 1-4: General actions – Wind actions.* BSI, 2011
4 BS EN 1991-1-6:2005 *Eurocode 1 - Actions on Structures Part 1-6: General actions – Actions during execution.* BSI, 2013
5 BS EN 1991-1-3:2003+A1:2015 *Eurocode 1 - Actions on Structures Part 1-3: General actions – Snow loads.* BSI, 2004
6 Brettle, M E, Currie, D M, Cook N J, *Snow loading in the UK and Eire: Combination of actions given in the Eurocodes*, The Structural Engineer, 18 June 2002

New and revised codes and standards

From BSI Updates August 2021

BS EN PUBLICATIONS

BS EN 10373:2021
Determination of the physical and mechanical properties of steels using models
no current standard is superseded

BS EN 15643:2021
Sustainability of construction works. Framework for assessment of buildings and civil engineering works
supersedes BS EN 15643-1:2010, BS EN 15643-2:2011, BS EN 15643-3:2012, BS EN 15643-4:2012 and BS EN 15643-5:2017

BS EN ISO 28199-2:2021
Paints and varnishes. Evaluation of properties of coating systems related to the spray application process. Colour stability, process hiding power, re-dissolving, overspray absorption, wetting, surface texture and mottling
supersedes BS EN ISO 28199-2:2009

BS EN ISO 28199-3:2021
Paints and varnishes. Evaluation of properties of coating systems related to the spray application process. Assessment of sagging, formation of bubbles, pinholing and hiding power
supersedes BS EN ISO 28199-3:2009

BRITISH STANDARDS REVIEWED AND CONFIRMED

BS EN ISO 4628-1:2016
Paints and varnishes. Evaluation of degradation of coatings. Designation of quantity and size of defects, and of intensity of uniform changes in appearance. General introduction and designation system

BS EN ISO 4628-2:2016
Paints and varnishes. Evaluation of degradation of coatings. Designation of quantity and size of defects, and of intensity of uniform changes in appearance. Assessment of degree of blistering

BS EN ISO 4628-4:2016
Paints and varnishes. Evaluation of degradation of coatings. Designation of quantity and size of defects, and of intensity of uniform changes in appearance. Assessment of degree of cracking

BS EN ISO 4628-7:2016
Paints and varnishes. Evaluation of degradation of coatings. Designation of quantity and size of defects, and of intensity of uniform changes in appearance. Assessment of degree of chalking by velvet method

NEW WORK STARTED

EN ISO 4628-5
Paints and varnishes. Evaluation of degradation of coatings. Designation of quantity and size of defects, and of intensity of uniform changes in appearance. Assessment of degree of flaking
will supersede BS EN ISO 4628-5:2016

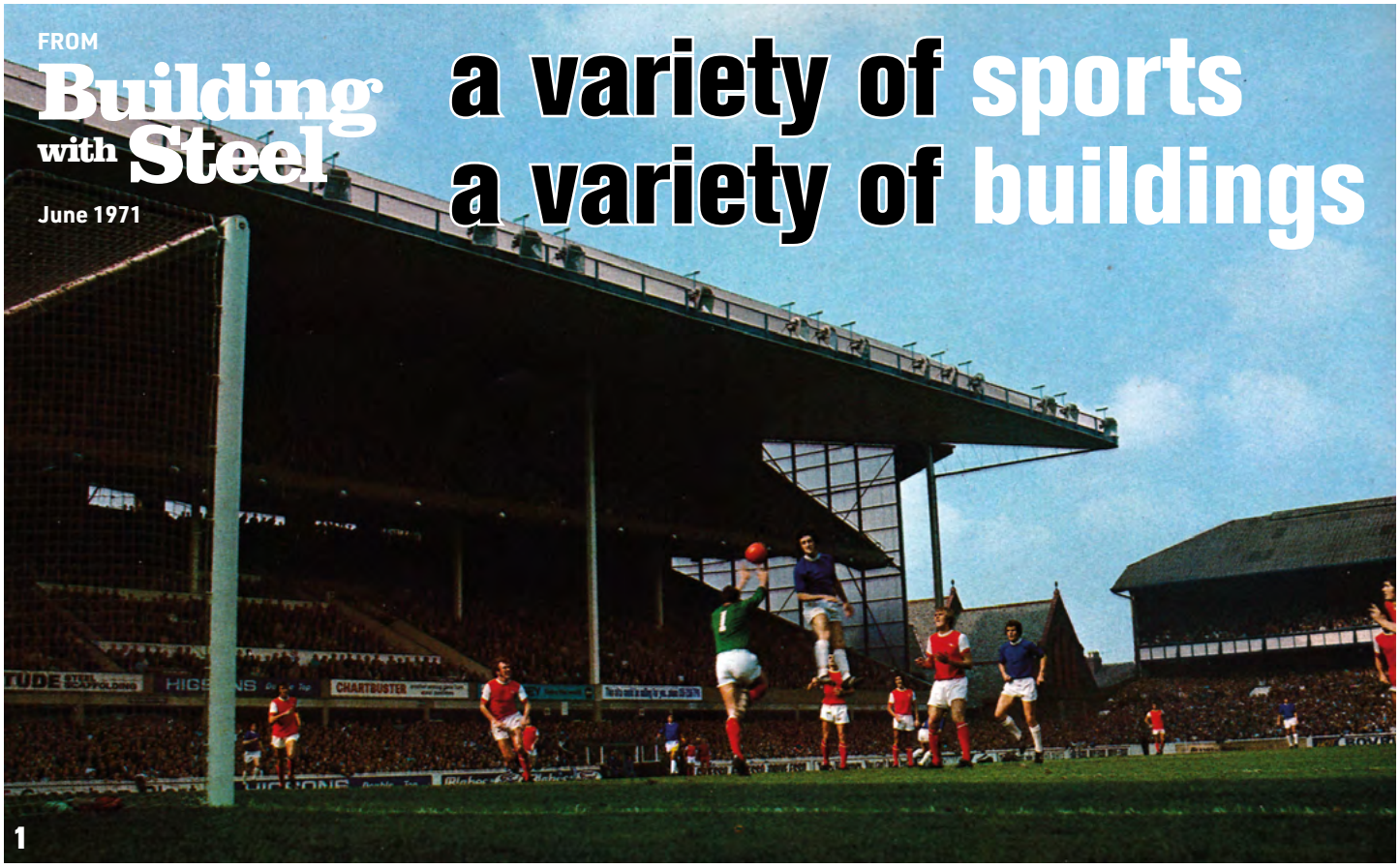
EN ISO 17663
Welding. Quality requirements for heat treatment in connection with welding and allied processes
will supersede BS EN ISO 17663:2009

DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT – ADOPTIONS

21/30428284 DC
BS EN 17680 Sustainability of construction works. Evaluation of the potential for sustainable refurbishment of buildings
Comments for the above document were required by 10 August, 2021

FROM
Building with Steel
June 1971

a variety of sports
a variety of buildings



1

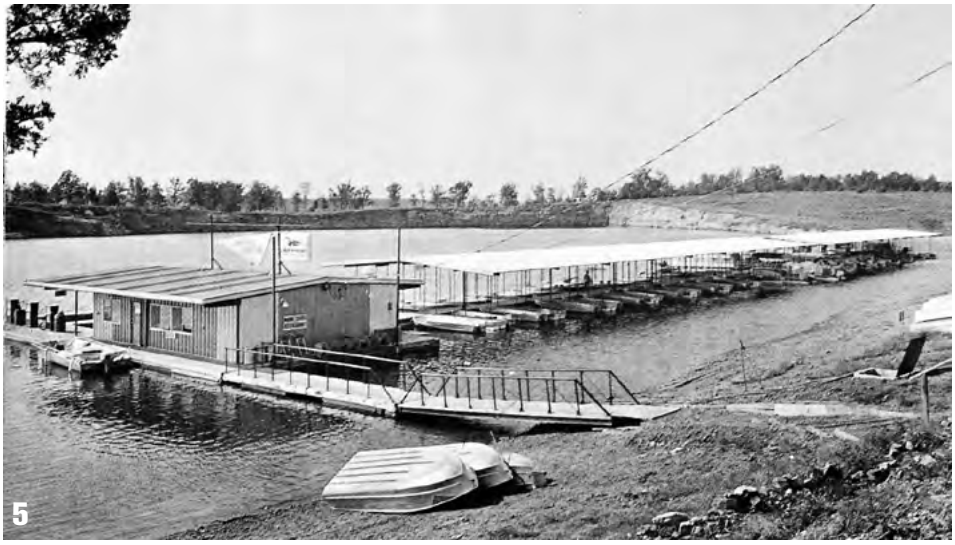
Steel is used for sports buildings of all types and permits free expression of designers' ideas. These images give only an indication of the scope possible. As can be seen, steel is the first choice for a variety of sports and a variety of buildings.

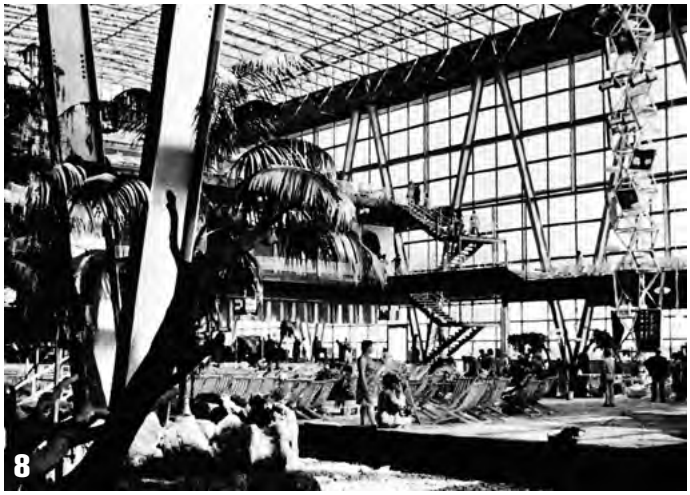

2


3

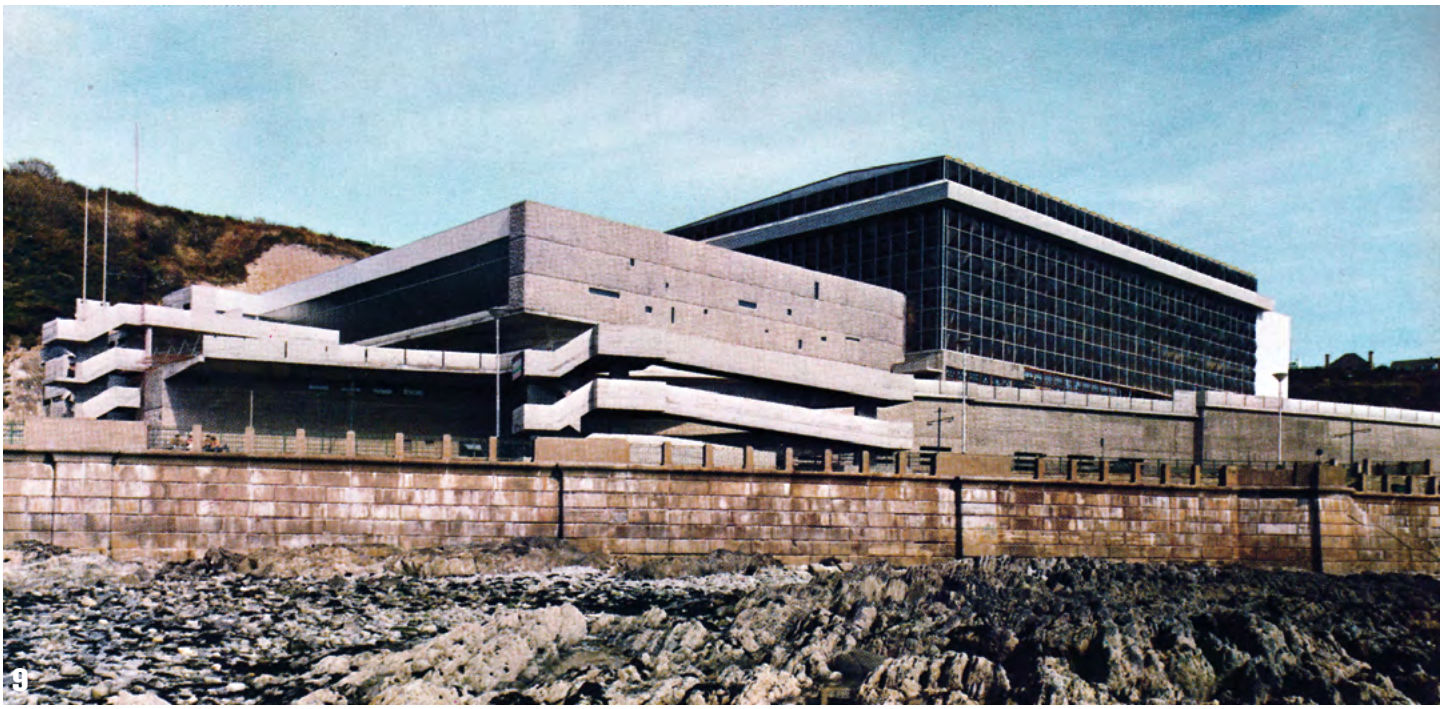

4

1 Three level stand for Everton Football Club. Steelwork by John Booth and Sons (Bolton) Ltd. **2** Gymnasium at Ravenbourne School. Steelwork by Conder (Southern) Ltd. **3** The new 300ft clear-span stand for Celtic Football Club, Glasgow. Main steelwork contractors Westbury Tubular Structures. Girder Steelwork by S.H.S. Structures Ltd. **4** Sports hall for Loughton Community Association, Loughton, Essex. Steelwork by Sanders and Fosters.





5 Marina at Pomme de Terre Dam, Missouri. Steelwork by Butler Buildings Inc. **6** Park Farm School of Riding, Northwood, Middlesex. Steelwork by Croggon & Co. Ltd. **7** Meadowbank Sports Centre, Edinburgh. Steelwork by BSC, CED, Redpath Colvilles Branch. **8 & 9** Summerland, Douglas, Isle of Man. Steelwork by Wright Anderson & Co Ltd.



Steelwork contractors for buildings

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

Lorraine MacKinder, Marketing and Membership Administrator,
The British Constructional Steelwork Association Limited, Unit 4 Hayfield Business Park, Field Lane, Auckley, Doncaster DN9 3FL
Tel: 020 7747 8121 Email: *lorraine.mackinder@steelconstruction.org*

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

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

FPC Factory Production Control certification to BS EN 1090-1
1 – Execution Class 1 2 – Execution Class 2
3 – Execution Class 3 4 – Execution Class 4

BIM BIM Level 2 assessed

QM Quality management certification to ISO 9001

SCM Steel Construction Sustainability Charter
● = Gold ● = Silver, ● = Bronze, ● = Certificate

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

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

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	BIM	SCM	Guide Contract Value (1)
A C Bacon Engineering Ltd	01953 850611			●	●	●	●				●			●			2			Up to £3,000,000
Adey Steel Ltd	01509 556677	●		●	●	●	●	●	●	●	●			●	●	✔	3		●	Up to £3,000,000
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 £6,000,000
Caunton Engineering Ltd	01773 531111	●	●	●	●	●	●	●		●	●	●		●	●	✔	4	✔	●	Above £6,000,000
Cementation Fabrications	0300 105 0135	●			●		●	●	●	●	●		●	●	●	✔	3		●	Up to £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
DAM Structures Ltd	01377 271843	●		●	●	●				●				●		✔	4			Up to £6,000,000
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 £4,000,000
Four Bay Structures Ltd	01603 758141			●	●	●	●	●		●	●			●	●		2			Up to £1,400,000
Four-Tees Engineers Ltd	01489 885899	●			●		●	●	●	●	●		●	●	●	✔	3		●	Up to £2,000,000
Fox Bros Engineering Ltd	00 353 53 942 1677			●	●	●	●	●		●	●				●		2			Up to £2,000,000
Gorge Fabrications Ltd	0121 522 5770				●	●	●	●		●				●	●	✔	2			Up to £1,400,000
Company name	**Tel**	**C**	**D**	**E**	**F**	**G**	**H**	**J**	**K**	**L**	**M**	**N**	**Q**	**R**	**S**	**QM**	**FPC**	**BIM**	**SCM**	Guide Contract Value (1)

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	BIM	SCM	Guide Contract Value (1)
G.R. Carr (Essex) Ltd	01286 535501	●		●	●			●			●			●	●	✔	4			Up to £800,000
H Young Structures Ltd	01953 601881			●	●	●	●	●			●			●	●	✔	4	✔	●	Up to £3,000,000
Had Fab Ltd	01875 611711				●				●	●	●				●	✔	4			Up to £3,000,000
Harry Peers Steelwork Ltd	01204 528393	●		●	●	●	●	●	●		●					✔	4			Above £6,000,000
Hescott Engineering Company Ltd	01324 556610			●	●	●	●			●				●	●	✔	2			Up to £3,000,000
Hillcrest Structural Steel Ltd	023 8064 1373			●	●	●	●	●		●	●			●	●	✔	3		●	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 642000			●	●	●	●	●			●					✔	2		●	Up to £6,000,000
Legge Steel (Fabrications) Ltd	01592 205320			●	●		●		●	●	●			●	●		3			Up to £800,000
Littleton Steel Ltd	01275 333431				●					●	●			●	●	✔	3			Up to £1,400,000
M Hasson & Sons Ltd	028 2957 1281			●	●	●	●	●	●	●	●			●	●	✔	4		●	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 £2,000,000
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									●					●	✔	3			Up to £1,400,000*
PMS Fabrications Ltd	01228 599090			●	●	●	●		●	●	●			●	●		3			Up to £1,400,000
REIDsteel	01202 483333			●	●	●	●	●	●	●	●	●	●		●	✔	4		●	Up to £6,000,000
Robinson Structures Ltd	01332 574711			●	●	●	●				●				●	✔	3			Up to £2,000,000
S H Structures Ltd	01977 681931	●		●	●	●	●	●	●	●	●	●	●		●	✔	4	✔	●	Up to £3,000,000
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 £800,000
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 £800,000
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
Taunton Fabrications Ltd	01823 324266				●					●	●				●	✔	2		●	Up to £2,000,000
Taziker Industrial Ltd	01204 468080	●		●	●		●			●	●		●	●	●	✔	3		●	Above £6,000,000
Temple Mill Fabrications Ltd	01623 741720			●	●	●	●			●	●			●	●	✔	2			Up to £400,000
Traditional Structures Ltd	01922 414172			●	●	●	●	●	●		●			●	●	✔	3	✔	●	Up to £2,000,000
TSI Structures Ltd	01603 720031			●	●	●	●	●			●			●			2	✔		Up to £2,000,000
Underhill Engineering Ltd	01752 752483				●		●	●	●	●	●			●	●	✔	4	✔		Up to £3,000,000
W I G Engineering Ltd	01869 320515				●					●	●			●	●	✔	2			Up to £400,000
Walter Watson Ltd	028 4377 8711			●	●	●	●	●				●				✔	4			Above £6,000,000
Westbury Park Engineering Ltd	01373 825500	●		●	●	●	●	●	●	●	●				●	✔	4		●	Up to £800,000
William Haley Engineering Ltd	01278 760591				●	●										✔	4		●	Up to £6,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	●	Above £6,000,000
Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	BIM	SCM	Guide Contract Value (1)

Steelwork contractors for bridgeworks

The Register of Qualified Steelwork Contractors Scheme for Bridgeworks (RQSC) is open to any Steelwork Contractor who has a fabrication facility within the UK or 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 ● = Bronze ● = Certificate

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)
Adey Steel Ltd	01509 556677	●		●	●	●	●				●	●	✓	3			✓	●	Up to £3,000,000
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 £6,000,000
Cementation Fabrications	0300 105 0135	●		●	●	●	●					●	✓	3			✓	●	Up to £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	●			●	●	●		●			●	✓	4				●	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 £1,400,000
Millar Callaghan Engineering Services Ltd	01294 217711	●	●	●	●	●	●	●	●	●	●	●	✓	4			✓		Up to £1,400,000
Murphy International Ltd	00 353 45 431384	●	●	●	●	●	●					●	✓	4			✓		Up to £2,000,000
Nusteel Structures Ltd	01303 268112	●	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓	●	Up to £6,000,000
REIDsteel	01202 483333	●				●	●	●				●	✓	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	01553 766499											●	✓	3					Up to £800,000
Taziker Industrial Ltd	01204 468080	●		●	●	●	●	●	●	●	●	●	✓	3		✓	✓	●	Above £6,000,000
Underhill Engineering Ltd	01752 752483	●	●	●	●	●				●	●	●	✓	4	✓		✓	●	Up to £3,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●		●	✓	4	✓	✓	✓	●	Above £6,000,000
Non-BCSA member																			
Allerton Steel Ltd	01609 774471	●		●	●	●	●	●			●	●	✓	4	✓		✓	●	Up to £3,000,000
Carver Engineering Services Ltd	01302 751900	●		●	●	●	●		●	●	●	●	✓	4			✓		Up to £3,000,000
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
Eiffage Metal	00 33 388 946 856	●	●		●		●	●	●			●	✓	4					Above £6,000,000
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 £800,000
IHC Engineering (UK) Ltd	01773 861734											●	✓	3			✓		Up to £200,000
In-Spec Manufacturing Ltd	01642 210716									●	●	●	✓	4			✓		Up to £800,000
J&D Pierce Contracts Ltd	01505 683724	●		●	●	●	●	●	●		●	●	✓	4			✓		Above £6,000,000
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
Lundy Projects Ltd	0161 476 2996	●		●	●	●	●			●	●	●		4			✓		Up to £4,000,000
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	0300 123 5000

Company name	Tel
Keiths Welding Limited	07791 432 078
Paul Hulme Engineering Ltd	07801 216858
QHSE-Interspect Ltd	07438 413849

Company name	Tel
Sandberg LLP	020 7565 7000
Structural & Weld Testing Services Ltd	01795 420264
SUM Ltd	0113 242 7380

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

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

SCM
Steel Construction Sustainability Charter
● = Gold ● = Silver
● = Bronze ● = Certificate

SfL
Steel for Life Sponsor

Structural components

Company name	Tel	QM	CA	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		●	
MSW UK Ltd	0115 946 2316		D/I				
Prodeck-Fixing Ltd	01278 780586	✓	D/I				
Structural Metal Decks Ltd	01202 718898	✓	M	4			
Stud-Deck Services Ltd	01335 390069		D/I				
Tata Steel - ComFlor	01244 892199	✓	M	4			
voestalpine Metsec plc	**0121 601 6000**	✓	**M**	4		●	**Gold**

Computer software

Company name	Tel	QM	CA	FPC	NHSS	SCM	SfL
Autodesk Ltd	01252456600		N/A				
Idea Statica UK Ltd	02035 799397		N/A				
StruMIS Ltd	01332 545800		N/A				
Trimble Solutions (UK) Ltd	0113 887 9790		N/A				

Steel producers

Company name	Tel	QM	CA	FPC	NHSS	SCM	SfL
British Steel Ltd	01724 404040	✓	M		3B		
Tata Steel - Tubes	01536 402121	✓	M		3B		

Manufacturing equipment

Company name	Tel	QM	CA	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**				**Bronze**
Lincoln Electric (UK) Ltd	0114 287 2401	✓	N/A				
Peddinghaus Corporation UK Ltd	**01952 200377**		**N/A**				**Silver**

Membership services

Company name	Tel	QM	CA	FPC	NHSS	SCM	SfL
Deconstruct UK Ltd	02035 799397	✓	N/A				

Protective systems

Company name	Tel	QM	CA	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				
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	**01902 601944**	✓	**N/A**				**Gold**

Safety systems

Company name	Tel	QM	CA	FPC	NHSS	SCM	SfL
easi-edge Ltd	01777 870901	✓	N/A			●	
TRAD Hire & Sales Ltd	01614 304666	✓	N/A				

Steel stockholders

Company name	Tel	QM	CA	FPC	NHSS	SCM	SfL
AJN Steelstock Ltd	**01638 555500**	✓	**M**	**4**			**Bronze**
Arcelor Mittal Distribution - Scunthorpe	01724 810810	✓	D/I	4	3B		
Barrett Steel Services Limited	**01274 682281**	✓	**M**	**4**	**3B**		**Headline**
British Steel Distribution	01642 405040	✓	D/I	4	3B		
Cleveland Steel & Tubes Ltd	**01845 577789**	✓	**M**	**3**	**3B**		**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**	**4**	**3B**		**Gold**
Rainham Steel Co Ltd	01708 522311	✓	D/I	4	3B		

Structural fasteners

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

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