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NSC

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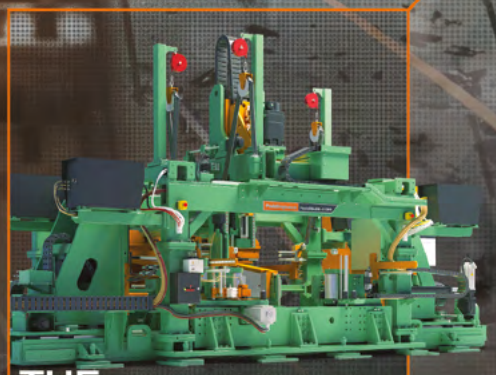

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NSC

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Vol 31 No 2

Cover Image
Wisbech Green SEMH School
Main client: Horizons Education Trust, Cambridgeshire County Council
Architect: Frank Shaw Associates
Main contractor: Kier
Structural engineer: Peter Dann Associates
Steelwork contractor: SDM Fabrication
Steel tonnage: 190t

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Sustainability will boost future market shares

Nick Barrett - Editor

There is good news for steel construction in the latest Market Shares survey results, which shows steel with a commanding lead in key sectors like multi-storey buildings and sheds, which are performing such a key role in the transformation of growth sectors like online retail and the data centres that all computer-based systems depend on (see News).

In a growing market for structural frames, steel achieved a record share in the multi-storey offices sector; more broadly the survey confirms that steel remains the preferred choice of the UK construction market across all the building types analysed. There are many good reasons for that, ranging from cost-effectiveness, speed of construction, flexibility and adaptability to a very strong sustainability case.

Last month we looked ahead to what promised to be a busy year for the steel construction sector in 2023, alerting readers to further sustainability initiatives to be announced soon as the push towards achieving the government's net zero carbon target gathers pace.

Details about the first of these new initiatives will be available from next month with the release of a new guide to what procurement professionals along the supply chain need to know about the sustainability benefits of steel. Regular readers of NSC will of course appreciate that there are many benefits, and that it pays to take care that proper sustainability assessments are being made when comparing alternative materials.

We also promised to report on positive responses to the imperative of combatting climate change by reducing carbon, and we can see examples of promises being turned into action in this issue of NSC. For example, the new distribution centre at Ellesmere Port (p16) is targeting the highest level of sustainability certification achievable and will be certified as net zero carbon in operation for the base build works.

The building has been pre-let to car manufacturer Peugeot as its UK parts distribution centre, exactly the kind of company that will increasingly demand the highest achievable sustainability performance from all of its suppliers.

Also in this issue, we see 'low carbon' steel being used on one of London's largest mixed-use regeneration schemes, at the Canada Water Dock Shed (p14). ArcelorMittal's XCarb steel is being used there, which is manufactured using the electric arc furnace method, reducing embodied carbon emissions by some 1,400 tonnes on a scheme that has considered sustainability from the design stage.

In news this month you can read that the Steel for Life interactive Blue Book upgrade for S460 has just gone live and can be accessed from *SteelConstruction.info* or directly at: *https://www.steelforlifebluebook.co.uk/*

The Blue Book upgrade represents, among other things, another significant contribution to the sustainability case for steel, showing how specifying a higher grade of steel can mean a design that uses less steel, so lowering carbon. This chimes with the BCSA Roadmap to net zero strategy which places an emphasis on design efficiency as a key way to reduce carbon. High strength steel is also mentioned in the recent NSSS Annex J Sustainability specification, and will be touched on in the above mentioned sustainable procurement guide.

As the pressure to combat climate change grows, we can expect the strong sustainability messages of steel construction to receive an increasingly warm welcome from developers and potential end users of buildings. Expect to see this reflected in future Market Shares surveys over the coming years.

Steelwork further strengthens its structural frames market share

Steelwork continues to be the structural framing material of choice for a number of key construction sectors, according to the latest survey from independent market research consultants Construction Markets.

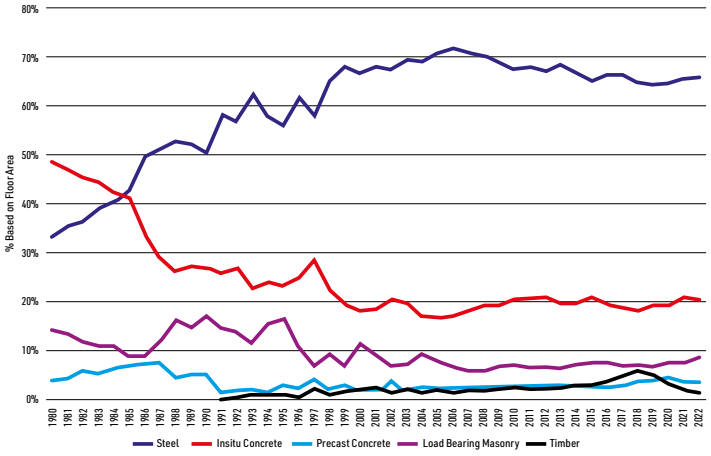
The 2022 survey, commissioned by Steel for Life and the British Constructional Steelwork Association (BCSA), is the latest in a series going back to 1980 and is thought to be the biggest of its type in the UK, involving over 750 interviews with construction specifiers.

The overall structural frames market in the UK for 2022 was up 6.7% which highlights that the post-pandemic recovery is continuing. Steelwork's overall market share stood at 45.4%, the biggest share of any material.

Steelwork has traditionally dominated the single storey non-domestic building market (sheds) and in 2022 it had a 94.2% market share, compared to 93.3% in 2021. Year on year, the sector, which accounts for almost 50% of the overall structural steelwork market by tonnage, increased by 19.7% with a total floor area of 12,486,000m².

In the multi-storey non-domestic sector, steelwork's share for 2022 was up from 65.5% in 2021 to 65.9%. Within this sector, steel accounted for 77.2% of the private offices market, which is an all-time high.

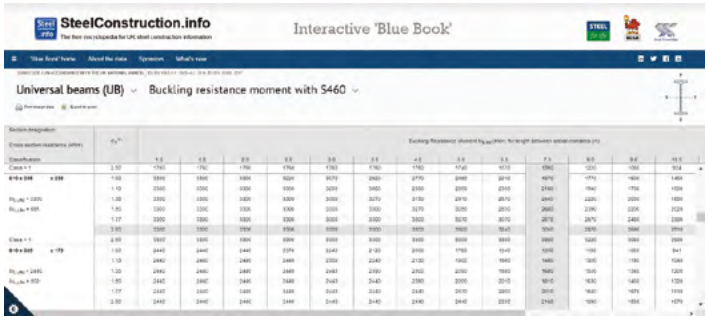
Elsewhere, steelwork's market share was also up by 6.9% for multi-storey private retail buildings and up by 3% for health buildings.



The market for structural frames - market shares.
Total multi storey non domestic buildings market, Great Britain 1980 to 2022.

Blue Book updated to include higher grade steel

The interactive (online) version of the Blue Book, the essential aid for the design of steelwork, has been updated to include resistance tables for S460 steel.



The use of S460 higher grade steel facilitates design efficiency with smaller lighter sections and less embodied carbon. This grade of steel is said to be particularly useful for columns in multi-storey buildings.

With future developments in mind, resistance tables in S460 for steel angles and channels have also been added in the updated Blue Book, but designers are advised to check their availability before specifying these sections in the higher grade.

Steel Construction Institute Associate Director David Brown said: "Resistances in S275 are still included, but with a greyed-out font on the index pages, reflecting the gradual move towards higher strengths.

"The S275 resistances may be used to verify existing members, but S275 should not be specified for new beam and column sections."

Section ranges for hollow sections have been comprehensively updated to reflect those produced by Tata Steel in S355, S420 and S460. The resistance tables for hollow sections clearly indicate which sections are readily available. Other sections and steel grades may be subject to minimum order sizes.

The updated and enhanced Blue Book is available at: *www.steelconstruction.info*

Steel frame creating Sunderland gigafactory

Celebrating the first phase of work at the new Sunderland gigafactory, a traditional Japanese ceremony has been held, with AESC CEO Shoichi Matsumoto tightening the bolt on one the building's first columns.

The ceremony also marked a decade of EV battery production on Wearside with the first electric vehicle battery built back in 2012, to support production of the first-generation Nissan LEAF.

Wates Group is constructing the new steel-framed gigafactory in Sunderland, for Envision AESC - a world-leading Japanese electric vehicle battery technology company.

The project – the largest by single value in Wates' 125-year history – is AESC's second Sunderland battery plant. It will have a capacity of 12 GWh and will employ more than a 1,000 people when operational in 2025. It will be powered by 100% net zero carbon energy, aligning with the company's global commitment to sustainability.

Severfield is fabricating, supplying and erecting the steelwork for the state-of-the-art facility, which will produce AESC's latest generation batteries.

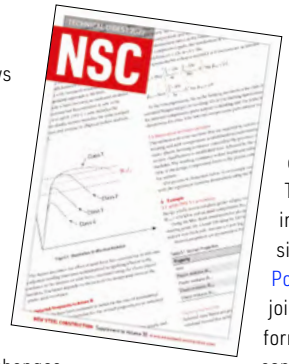
It forms part of a wider £1bn partnership with Nissan and Sunderland City Council to create EV36Zero, an electric vehicle hub supporting next generation EV production and accelerating the transition to net zero carbon mobility.

New Steel Construction Technical Digest now available online

New Steel Construction's (NSC) seventh Technical Digest, which brings together a year's worth of technical guidance, is now available for download at: *www.steelconstruction.info*

Helping to keep engineers and architects up-to-date with the latest steel construction related guidance, NSC's Digest compiles all the magazine's Technical Articles and Advisory Desk Notes from 2022, which can be downloaded as a pdf or viewed online.

Advisory Desk Notes reflect recent developments in technical standards or new knowledge that designers need to be made aware of. Some of them arise because a question is being frequently asked of the steel sector's technical advisers. They have always been recognised as essential reading for all involved in the design of constructional steelwork.



The longer Technical Articles cover more detailed insights into what designers need to know, often the result of legislative changes or changes to codes and standards.

Technical updates will occasionally be provided following a number of relatively minor changes, perhaps made over a period of time, that it is felt could usefully be brought together in one place.

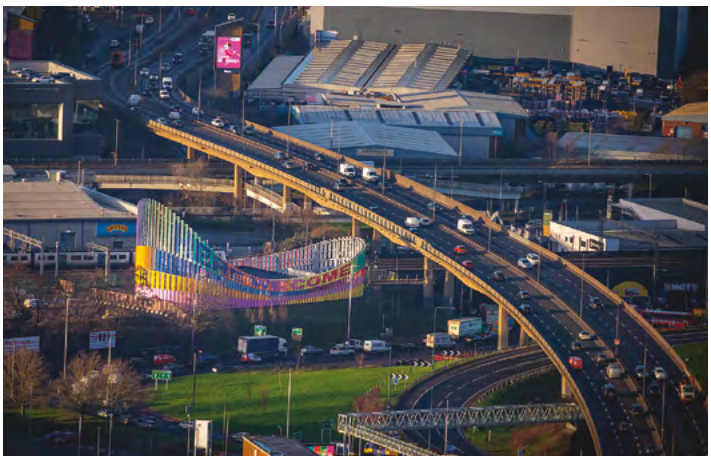
Some of the topics covered in last year's Technical Articles include: Wind actions on single storey buildings; Portal frames with flexible joints using Kleinlogel-type formulae; The use of semi-continuous joints to reduce steel weight and cost; Proposed changes to assessment of frame stability; Design of angles and Bolted connections to hollow sections and column webs.

Iconic public artwork revealed at Brent Cross

An innovative steel-framed artwork that wraps around an electrical substation has been completed in north London at Brent Cross Town, one of Europe's largest urban regeneration projects.

Located adjacent to the busy A406 North Circular at the junction with the M1 motorway, the 21m-high and 52m-long permanent artwork has been created by artist Lakwena and architects IF_DO.

Formed with a series of CHS columns that are linked by box section beams, the steel frame has brackets that support painted lenticular-shaped aluminium panels that create a kaleidoscopic visual effect to emphasis the idea of movement as viewers move around the structure.



The project is said to have put circular economy principles into action with around 50% of the structural steel being salvaged from unused oil pipelines, reducing embodied carbon emissions by over 40%.

The fabrication and erection of the steelwork was completed by Bourne Steel, who also installed the aluminium panels, which are all unique.

Mayor of London, Sadiq Khan said: "Lakwena has created an incredible artwork that brings together creativity and sustainability and will be enjoyed by millions of people. London is a world-class cultural capital and this major addition to our public realm in the heart of Brent Cross is another example of how we're working together to build a better London for everyone.

Steel supports new Wakefield rugby stadium

Structural steelwork is playing a leading role in the redevelopment of Wakefield Trinity's historic Belle Vue Stadium.

Working on behalf of main contractor Morgan Sindall, Billington Structures is fabricating, supplying and erecting 248t of steelwork for the project, which is due to complete this year.

The stadium has been the home of Wakefield Trinity since 1879 and is one of the oldest rugby league grounds in the country.

Designed by AFL Architects, the scheme consists of a new 2,600-capacity steel-framed east stand, the refurbishment of the north stand with new steel elements, floodlight upgrades to the latest LED technology and a hybrid grass pitch. Overall, the completion of the work will increase the stadium's capacity from its current 7,258 up to 8,866.

Measuring approximately 95m-long x 30m-wide, the new east stand forms the most important element of the redevelopment and replaces an old structure that was previously demolished as part of the scheme.

Topped with a 17m-deep cantilevering roof, the new single tiered stand is formed with raking members that support precast units to form the seated terrace. Behind the seated area, steel beams support a metal decked composite floor to create a first-floor hospitality restaurant, kitchen and plant decks.

NEWS IN BRIEF

The British Constructional Steelwork Association can be found at stand H72 at **FutureBuild**, held from 7th to 9th March at ExCEL, London. Sustainability Manager, Michael Sansom will be running a panel session in the Materials Zone, entitled: Decarbonising structural steelwork. Also, taking part are: SCI Associate Director David Brown; William Hare Associate Director Jonathan Davis; and Graeme Peacock, Marketing Manager - Engineering and Tubes, Tata Steel.

Founder and former Chairman of Caunton Engineering **David Bingham** has been honoured for his contribution to his local community by being admitted as a new Honorary Freeman of the Borough of Broxtowe. Mr Bingham, who was BCSA President between 1994 and 1996, started the steelwork contractor in 1969.

Glencar has been appointed by UK logistics and industrial property business PLP to construct a 32,000m² speculative warehouse at the Stone Business Park in Stafford. The site will feature the redevelopment of a redundant and recently vacated data centre into a new, high-specification logistics warehouse that will include over 1,850m² of office accommodation.

Bouygues UK has begun enabling works for the Pentre Awel development, which is said to the largest regeneration scheme in south west Wales. It will bring together life science and business innovation, research, education, community healthcare and modern leisure facilities at the 83-acre Delta Lakes site on the Llanelli coastline.

One City Park, a new state-of-the-art office scheme in Bradford city centre has celebrated reaching its highest point with a topping out ceremony. On completion, it will create 5,240m² of sustainable office space and it is being developed by Muse, in partnership with Bradford Council. The steel frame was erected by Elland Steel Structures.

Developer Firethorn has appointed **McLaren Construction** to deliver four high-spec Grade-A warehouses ranging from 5,300m² to 26,000m². Set across 37 acres, the site lies adjacent to the Sherburn Enterprise Park in Leeds, and will be constructed to net zero carbon, with an 'Excellent' BREEAM rating.

PRESIDENT'S COLUMN

At the time of writing this article, 16th January, I read an article on the BBC quoting Anders Opedal (Chief Executive) of Equinor one of Europe's biggest energy companies, who stated that windfall taxes on energy firms were affecting investments in projects in the UK. "Poor you", I thought, it must be terrible making pre-tax profits of $24.3bn between July and September compared to $9.7bn in the same period the year before. He was further quoted as saying that he didn't expect gas and electric bills to return to the levels they were before COVID-19. I'm left wondering how many companies have had to reduce or delay investments due in part to the large increases in energy prices. I think we are all hoping that steelwork contractors will be eligible for the higher level of support suggested in the Energy Bill Discounts Scheme (EBDS). I'm sure the BCSA will be doing everything it can to lobby the Department for Business, Energy & Industrial Strategy (BEIS) on your behalf.

The BCSA is constantly liaising with BEIS and MPs to lobby on the behalf of BCSA members, to inform them what we do and how important we all are in the construction chain, continually delivering a fantastic product to the end client. I understand there is a new Procurement Bill on the horizon. The BCSA and Professor Rudi Klein in collaboration with Debbie Abrahams MP for Oldham East and Saddleworth will be laying an amendment to the bill, which requires contracting authorities to use project bank accounts (PBAs) on their projects where the net value of the contract is over £2 million, ringfenced in a trust arrangement, and ensure that sub-contractors' retention monies are protected either in the PBA or in a separate deposit account, also held under a trust arrangement. Even taking a cash retention at all means a reduction in cash or a reduction in the amount a company can borrow which hampers all Tier 2 sub-contractors, but at the very least, if retentions are taken these monies need to be protected from the risk of upstream insolvency. It is estimated that approximately £800m of subcontractors' retentions were lost in the Carillion collapse alone.

The introduction of the Buildings Safety Bill will gather pace in 2023, with the emphasis on proving competence, where we will see the launch in April 2023 of the Industry Competence Committee. On the face of it, our industry is highly competent, so we won't have too much trouble proving competence, once again the BCSA will be able to provide help with this regard, running refresher training courses and through RQSC for Buildings (which members are already awarded). I've never really found incompetence to be the real problem with the steelwork construction industry, it's more the unseemly rush to get started on a project, the endless drive to squeeze every penny out, and then pressure to complete the works, such that no one party has enough time or money to be able to do their jobs properly, and that is the real villain. A blame culture also effects genuine collaboration, with more thought being how not to be responsible for something rather than the right people getting on with the issue at hand.

Mark Denham
BCSA President

Tata Steel makes CO_2 savings with blast furnace improvement programme

Steelmaker Tata Steel said its programme of improvements at its two Port Talbot blast furnaces will reduce the site's carbon footprint by about 160,000 tonnes of CO_2 a year.

The savings are equivalent to the annual emissions from 100,000 cars or those from the energy used by around 50,000 households.

The blast furnaces are powered by high-pressure hot blast air that is superheated to temperatures of more than 1,100°C in seven refractory brick-lined stoves.

An improvement programme of work in three of the seven stoves will upgrade the burners that generate heat, with two new best available technology units being installed. Many of the refractory bricks that store heat and make hot blast air are also being replaced. The work is being carried out while the remaining operational stoves are in use.

Tata Steel Project Manager Andrew McGregor, said: "The stoves are absolutely critical to the running of our blast furnaces. Any loss of efficiency in heating the air means we either have to use more gas than is optimum, or we have to replace that lost energy by using more metallurgical coke to chemically reduce the iron ore inside the furnaces."

Greenmarket scheme set to transform Dundee city centre

Working on behalf of main contractor Ogilvie Construction, Hescott Engineering is fabricating, supplying and erecting more than 650t of steelwork for the Greenmarket scheme in Dundee.

Set to reinvigorate a large plot in the city centre, the scheme consists of two steel-framed buildings. Building One is a retail and residential block, while the larger Building Two is a new regional headquarters for BT.

Working within the confines of a very tight site, Hescott Engineering is having to use a variety of lifting options, including a tower crane, two 60t-capacity mobile cranes and variety of MEWPs.

Building Two's steel frame includes 250t of cellular beams and a large 5.5t plate girder all supplied by Kloeckner Metals UK Westok.

The new BT office, which will be home to around 1,000 staff when it opens in 2024, forms part of Dundee's £1bn regeneration area.

Teesworks service complex plans unveiled

Including a 160-bed hotel, two parades of shops, a petrol station and restaurant units, Teesworks has unveiled plans for a service complex to serve the thousands of construction personnel that will begin work on the site in the coming years.

Tees Valley Mayor Ben Houchen said: "Teesworks is the single biggest development in the UK.

"We're already putting in roads and vital infrastructure to meet the demand of all the work we've got going on – and Teesworks Service Complex is yet another step on this path. This will serve workers coming to Teesworks, while also offering a welcome boost for nearby Grangetown and Teesville through stores and restaurants.

"More Teessiders in good well-paid jobs means better livelihoods, more disposable income, and more opportunities for local people."

Designed by architects Corstorphine & Wright, the outline plans will be submitted to Redcar and Cleveland Borough Council in the coming weeks.

Teesworks Development Director Matt Johnson added: "This complex is a key part of the wider masterplan and will offer vital facilities for an array of tenants we've got on site. Getting this planning secured at an early stage will allow us to create a successful and sustainable development."

South Wales steel fabrication site gets governmental recognition

Steelwork contractor William Hare discussed its plans for growth with Chris Evans, MP for Islwyn, during a visit to the Risca Steel facility in Newport, South Wales.

Chris Evans was given a tour of the facility and was shown some of the work being processed, which includes Hinkley Point C and a transport bridge for the Head of The Valleys improvement works. Following his tour, he was then introduced to several workers at the facility, including apprentices and trainees.

To increase fabrication outputs and to enable more staff recruitment, William Hare hopes to receive planning permission to extend its working hours at the Risca plant in the coming weeks.

Matthew Nesbit, Group Board Director from William Hare said: "It was fantastic to welcome Chris Evans to our fabrication facility in Risca and show him how much the facility has benefitted from significant investment and how we are providing opportunities in the Newport area, through skilled jobs, training and focussing support on the local supply chain.

"We take great pride in our apprenticeship scheme, which currently represents 13% of William Hare's entire workforce and offers young adults the opportunity to forge a successful career in the steel industry and beyond."

Chris Evans, MP said: "The steel industry is a vital part of the economy, and it was brilliant to see that William Hare's site in Risca is contributing to important national projects across the UK. I was pleased to meet the apprentices and see first-hand the skilled work that they do".

Carlisle's steel-framed Sands Centre completed

The new redeveloped Sands Centre, funded by Carlisle City Council with support from a £2.2M Sport England grant, has been officially opened.

Set across two storeys and accessed by a bespoke, internal street, the new steel-framed extension has added 3,700m² to the existing building, with the redeveloped leisure centre offering state-of-the-art facilities including a 25m main pool and a 20m learner pool complete with an innovative moveable floor.

Other facilities include a four-court sports hall with a spectator gallery, fully equipped gym, a spinning studio and dance studio, and a café.

Working on behalf of main contractor Wates, Border Steelwork Structures fabricated, supplied and erected 418t of steel for the project.

Leader of Carlisle City Council, Cllr John Mallinson, said: "I'm delighted that work has been completed on The Sands Centre redevelopment and I would like to pass on my thanks to our project team, partners and contractors.

"Massive improvements have been made to the site and it will provide huge benefits for the wellbeing of our communities. The project has had to overcome lots of challenges, but the benefits will last for many generations to come."

Contract for new Fife College campus awarded

Balfour Beatty has been awarded the £90M contract by Fife College for the design and construction of a new learning campus in Dunfermline, Scotland.

The company will be responsible for the delivery of three interlinked buildings covering an area of 20,000m², which will house state-of-the-art teaching facilities and learning spaces for students, staff and business clients.

As part of its commitment to leaving a lasting legacy, Balfour Beatty said 50% of its workforce will be made up of local people. Once complete, the campus will bring together around 4,500 school pupils and college students from the nearby Fife College, St Colomba's High School and Woodmill High School.

Hector MacAulay, Managing Director of Balfour Beatty's regional business in Scotland, said; "We are delighted to have been appointed to design and construct the new campus.

"We will remain steadfast in our commitment to positively impacting local communities and stimulating economic growth, providing numerous employment opportunities for local people as well as work experience placements for students."

Diary

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

Tue 14, Thu 16, Tue 21 & Thu 23 March 2023
Steel Connection Design
Online
This course is for designers and technicians wanting practical tuition in steel connection design. It will concentrate on the design of nominally pinned connections, in accordance with BS EN 1993-1-8, considering vertical shear and tying.

Tue 18 April 2023
Design for Torsion
Webinar, SCI/BCSA Members only
This member's webinar covers the design steps, best practice and practical recommendations for members and connections when torsion must be accommodated in design. The examples and design charts in SCI publication P385 form the basis of the advice, together with simplified approaches which can be useful as a conservative assessment.

19, 20, 25, 26 & 27 April 2023
Steel Building Design to EC3
Online
An overview of the Eurocode provisions for steel building design. The course focuses on orthodox construction, covering the primary design issues. It follows the process of determining actions, considering combinations of actions, frame analysis and the assessment of second order effects. The course will demonstrate how the resistance of members are calculated, and how they can be extracted immediately from resources such as the 'Blue Book'.

Customers are demanding bigger and heavier plate girders.

Bridging the gap

Jamestown says it is now fabricating bigger, heavier and more challenging sections to meet customer demands.

"We start the New Year as we finished 2022, building bridges," says Jamestown UK Business Development Manager Mark Stewart.

"It seems that with each new project plate girder sections are increasing in size, both flange and web thicknesses increase proportionately, and customers need our support in both trial assembly and transport of longer sections thus reducing the erection time on site."


The company has diversified its work with the production of offshore assemblies.

The company says it is constantly searching new markets where there is a synergy with its construction methods, and Jamestown are able to assist customers based on its extensive experience.

Consequently, the past year has seen the company open the door to new markets including wind energy and sub-sea, in addition to its ever-growing commitment to crane building and bridge manufacturing.

"These sectors are all in addition to our core and long-established general construction related business," adds Mr Stewart.

Continuing Jamestown's investment programme, the company has started the New Year with plans to revise its shop floor layout and introduce greater oxy-fuel and plasma profiling capacity. A revised plate storage and handling facility, together with a more efficient conveyor system, will complete this first stage of investment, and the throughput of flanges and webs for plate girder production will also be increased.

Jamestown General Manager Niall Fortune, comments: "Working on such heavy structures demands that we constantly review our manufacturing techniques and all processes including cutting, welding, fabrication, painting, and handling.

"While Jamestown has more than ample space to expand and accommodate trial assembly and storage of large structures, investment must continue to maintain the high level of support expected by our customers."

A second round of investment, later this year, will see the planned installation of two 65-tonne overhead gantry cranes in the company's heavy fabrication workshop. It will have the capacity to accommodate structures up to 160m in length, ensuring Jamestown has the capability to handle many of the larger structures currently being encountered.

"It seems that with each new project plate girder sections are increasing in size, both flange and web thicknesses increase proportionately, and customers need our support in both trial assembly and transport of longer sections thus reducing the erection time on site."

"So where will 2023 take us?" concludes Mr Fortune. "We are certainly on a journey to expand both the business sectors and geographies that we supply and, with a strong pipeline of challenging projects ahead in a diverse range of market sectors, we are looking forward to another busy year.

"Of course, the forthcoming arrival of new, larger and more advanced profiling machines, plus the later investment this year of heavy craneage, demands the talents and expertise of the necessary personnel to both operate and get the very best results from them.

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Steelwork was chosen for its speed and efficiency.

Top marks for steel

A London school's expansion plans are being realised with the aid of structural steelwork, as a new building containing a multi-purpose hall and teaching spaces is taking shape.

Located in Islington, the City of London Academy Highgate Hill has expansion plans afoot, that include the introduction of a sixth form, to be accommodated in a new building currently under construction.

The school's collection of Victorian and more recent buildings does not provide enough space for its needs. To this end, the new steel-framed building will provide a school hall and dining area on the ground floor, with new teaching spaces on the first and second floors. The third floor will provide social and study space for sixth form pupils as well as further general classroom spaces.

Squeezed into a plot surrounded by existing school buildings and a thoroughfare, the project team have had to overcome a number of logistical challenges.

"We only have one access route into our site, from a residential street, which at times has parked cars along both sides, making it quite narrow," explains Galliford Try Project Manager Ralph Mills.

"It can be tricky getting delivery trucks to our project, so we have had to manage the size of steel members so they can be manoeuvred through the street and then into the site."

Main contractor Galliford Try started on site last May, demolishing a single storey building that contained the school's dining hall, to make space for the new structure.

Once the demolition was completed and the plot cleared of some asbestos, which was discovered in the ground, a piling programme was undertaken. More than 100 piles, with a diameter of between 350mm and 400mm, were installed to a depth of 20m in and around existing piles.

Steelwork contractor Snashall Steel Fabrications (SSF) were then able to begin the steel erection package, which was completed in five weeks.

"Logistically, it was quite challenging. We started using a 90t-capacity crane, but due to site restrictions and not being able to access the entire footprint, we later used a larger 100t-capacity unit to finish the frame," says SSF Project Director Mike Austin.

Levels around the site are quite varied so much of the steel frame was erected from within the footprint of the new building. However, a crane position outside of the footprint did have to be used for the final steel sections.

"The frame's columns are 18m in length, too long to manoeuvre on to the site, so we had to design them with a splice using preloaded bolts," adds Mr Austin.

Forming the roof of the double-height main hall are four 16.6m-long × 1.4m-deep trusses. Each weighing 5t, the trusses were delivered to site as complete units and represented the longest pieces of steelwork that could be delivered to the project.

Explaining the choice of steelwork for the project's main frame, Mr Mills says it would have been difficult to form the main hall's long spans in any other material.

Overall, the steel frame is stabilised by strategically-positioned bracing, mostly located around stairwells and in walls. The upper floors are formed compositely with steel beams supporting metal decking and concrete topping.

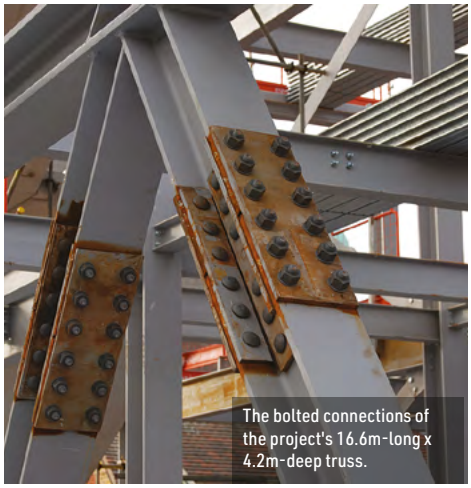
Adjacent to the main hall, the remainder of the ground floor consists of a dining area, classrooms, storage and plant rooms, and toilets.

Although the new steel-framed building is structurally-independent, in does link into the adjacent existing kitchen via a large counter hatch, which previously served the old hall.

The design for the new dining area has allowed for a 5.5m floor-to-ceiling height, which has been carried through to the rest of the ground floor (excluding the main hall). The upper floors of the building have a more traditional 3.5m floor-to-ceiling height.

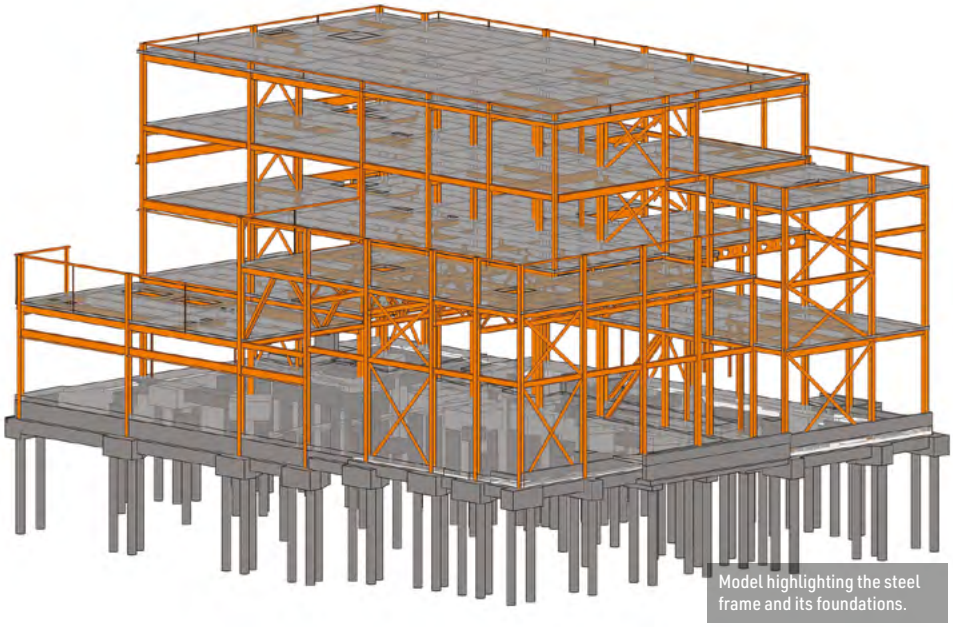
"Some flexibility has been designed into the

FACT FILE
City of London Academy Highgate Hill
Main client: **Department for Education**
Architect: **Bowker Sadler Architecture**
Main contractor: **Galliford Try**
Structural engineer: **AKSWard**
Steelwork contractor: **Snashall Steel Fabrications**
Steel tonnage: **250t**



The bolted connections of the project's 16.6m-long x 4.2m-deep truss.

Visualisation of the completed building.



Model highlighting the steel frame and its foundations.

Four 16.6m-long x 1.4m-deep trusses span the main hall.

The storey high truss had to be brought to site piece-small and assembled onsite.

building as the main hall and dining area can used as one large space, or separated via a folding partition," says AKSWard Senior Engineer Freya Berkin.

"To create a seamless link between the two areas, without any columns, a storey-high truss, positioned at first floor level, supports columns at second and third floor."

The 16.6m-long × 4.2m-deep truss was too deep to be manoeuvred into the site, and so it had to be delivered in nine pieces. It was then assembled on the ground before being installed by the 100t-capacity crane.

Wrapped around the double-height main hall, and taking into account that half of the area above the dining room is an outdoor plant deck, the first floor has a smaller footprint than the ground floor. First floor accommodates two classrooms, a staff room, IT hub, storage areas and a double-height drama studio.

The majority of the steel frame for the upper floors is based around a 7.6m × 7.8m column grid pattern, but as the drama studio is slightly larger, its roof – at third floor level – is formed with a couple of Westok beams that act as transfer structures by supporting columns that are only present on the uppermost level.

The second and third floors have six and seven rooms respectively. The former has access to an outdoor terrace positioned above part of the main hall, while the latter will be used mainly by the sixth form.

The new school building is due to be ready for teachers and pupils in time for the 2023 Autumn term. ■

Featuring a saw-tooth roof, the Dock Shed will combine a leisure centre with commercial office space.

Low carbon steel creates leisure and office space

One of three trusses that span the sports hall is manoeuvred into place.

Structural steelwork is playing an integral role in the ongoing Canada Water Masterplan, one of the capital's largest mixed-use regeneration schemes

Covering an area of 53 acres and positioned on the River Thames between London Bridge and the Canary Wharf financial hub, the Canada Water Masterplan will create a new town centre for the London Borough of Southwark.

In all, it will deliver up to 230,000m² of workspace and more than 90,000m² of retail, leisure and entertainment space, alongside 3,000 net-zero homes and a range of public facilities.

The scheme will also create the first new high street in London for a generation, as well as 16 other new thoroughfares, radically changing an area that was once part of the vast Surrey Commercial Docks.

One of the Masterplan's public facilities, and one of the initial schemes to get under way, is the Dock Shed, which will incorporate offices and a leisure centre, and is due to open in autumn 2024.

Described by the project architect, Allies and Morrison as a hybrid structure, it combines BREEAM 'Outstanding' office space on the upper six floors and a leisure centre with four sports courts, two swimming pools, a gym and exercise studios below.

Each use has its own dedicated entrance, with the offices opening towards Canada Dock and the leisure centre facing onto a new community square that is developing around the adjacent former dock office buildings.

The leisure centre's facilities are largely accommodated within a two-level deep basement, which is a secant piled concrete box substructure.

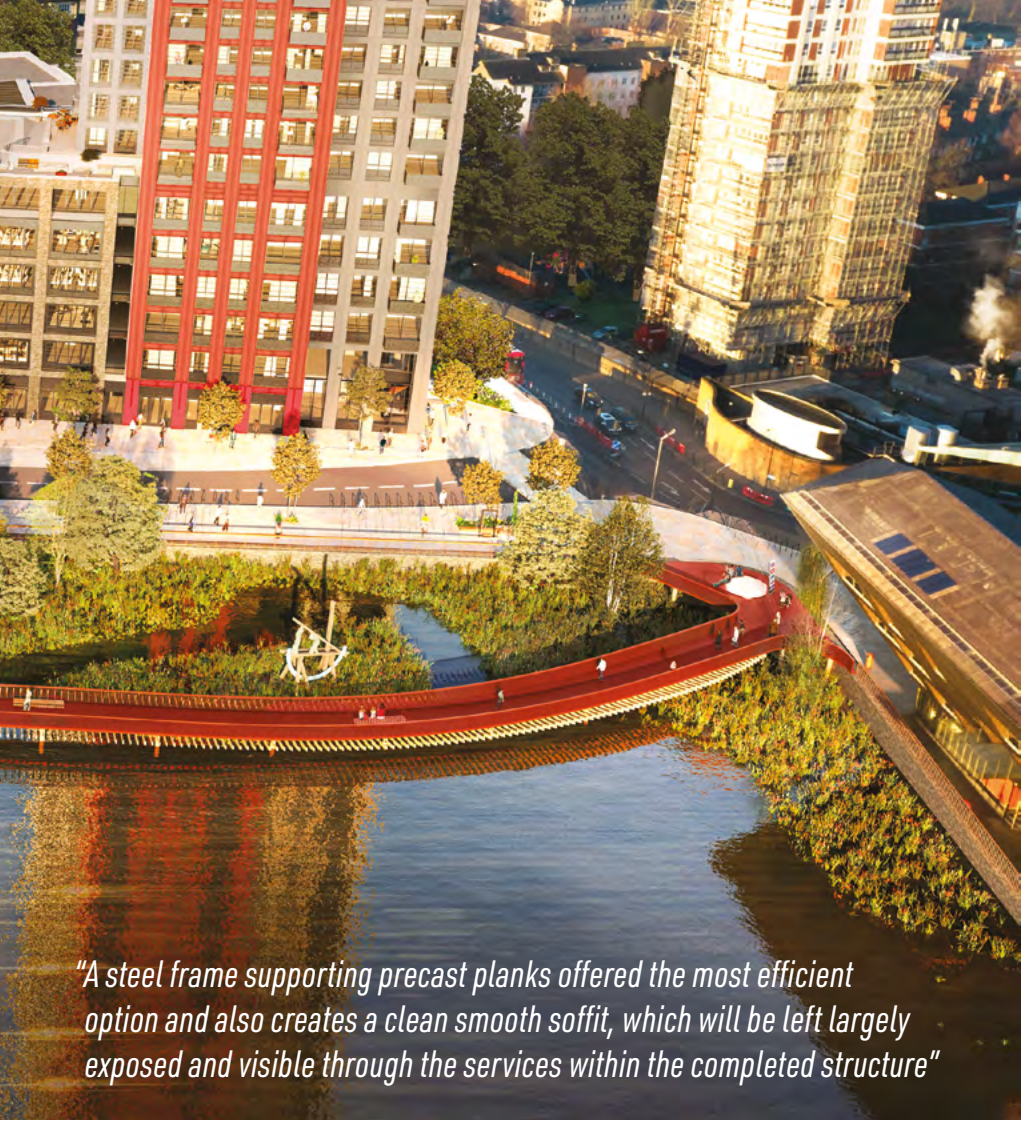
Adding some complexity to the groundworks, the basement does not cover the building's entire footprint, as one portion of the plot is above a London Overground tunnel, which prevented any excavation in this area.

From ground floor upwards, the structure is a steel frame that includes a series of 24m-long trusses that span over the pool and sports hall, allowing them to be large column-free spaces.

"When it came to designing the building, we gave full consideration to all material framing options, as well as carbon, cost and programme. A steel frame supporting precast planks offered the most efficient option and also creates a clean smooth soffit, which will be left largely exposed and visible through the services within the completed structure," explains Waterman Structures Director Andrew Sherlock.

Spanning the swimming pool at ground floor level are three 24m-long, 5m-deep trusses each weighing 34t, which were some of the earliest parts of the steel frame to be erected.

"These trusses were too deep to be transported



"A steel frame supporting precast planks offered the most efficient option and also creates a clean smooth soffit, which will be left largely exposed and visible through the services within the completed structure"

FACT FILE
Canada Water Dock Shed: Offices & Leisure Centre, London
Main client: **British Land**
Architect: **Allies & Morrison**
Main contractor: **Mace**
Structural engineer: **Waterman Structures**
Steelwork contractor: **Severfield**
Steel tonnage: **2,500t**

to site in single pieces, and so they were delivered in halves, which were then bolted together on site before being lifted into place using a 450t-capacity mobile crane," explains Mace Associate Director Thomas Kercel.

Three further trusses have also been installed over the sports hall. These are 3m-deep and 24m-long, which means they are of a size that is transportable and so they arrived on site as complete sections and were lifted into place directly from the delivery truck using a 650t-capacity crane.

Adding to the project's sustainability credentials, British Land, Mace and steelwork contractor Severfield, specified that ArcelorMittal's XCarb steel was used wherever possible. XCarb is said to be made from high levels of recycled steel using 100% renewable electricity in an electric arc furnace. Using XCarb steel reduced embodied carbon emissions for the project by around 1,400 tonnes.

Similar to the office scheme above, most of the trusses will be left exposed within the completed scheme as architectural features. The steelwork spanning the pool will support the ground floor slab from its top boom, while below, the rest of the truss will be visible from within the leisure centre.

The trusses spanning the sports hall are multi-functional as well as architectural highlights. Positioned at first floor level, they support the offices above as well as the ground floor slab that spans over the sports hall via a series of 76mm-diameter Macalloy hangers. Spaced at 9m centres, the hangars as well as most of trusses will be architectural features visible in an area that will be the main double-height office entrance foyer.

The ground floor slab in this area was cast early in the programme and is supported by three temporary steel columns, positioned in the basement. They will only be removed, once the floor slabs in the upper parts of the building are complete, at which point, stability will be achieved, and the ground floor will then be supported by the Macalloys.

Above the leisure facilities and the entrance foyer, the structure reverts to a traditional office format, incorporating a 9m × 12m column grid pattern. The precast concrete plank floors are supported by Fabsec cellular beams that accommodate the building's services within their depth.

The uppermost fifth level of office accommodation is topped with a saw-tooth portal-framed roof, designed as a nod to the area's former industrial heritage, while creating generous ceiling heights of nearly 5m. The exposed pitched steelwork will also support precast elements that complete the structure's roof.

Commenting on the project, Emma Cariaga, Joint Head of Canada Water Development, British Land, said: "The new leisure centre we are building for Southwark Council will offer a wide range of activities for people who live and spend time in the area. The learner pool will even have a moveable floor to make it suitable for all ages and abilities.

"We're committed to ensuring that our development supports active and healthy lifestyles both by providing new public spaces, and by supporting access to leisure and recreational facilities that everyone can enjoy. We're really excited to bring forward this modern facility to support the evolving health and wellbeing offer here at Canada Water." ■

Exposed trusses will be a feature of the main entrance lobby.

Outstanding steel frame

A new distribution centre at Ellesmere Port is targeting the highest level of sustainability certification and will be certified as net zero carbon in operation for the base build works.

Visualisation of the completed project.

Steelwork erection has recently been completed on a new 61,966m² distribution centre for developer Stoford, located on the former Hooton Park Airfield at Ellesmere Port in Merseyside,

Aiming to achieve the highest sustainability certification, such as BREEAM 'Outstanding' and an EPC 'A' rating, the building has been pre-let to Peugeot, a subsidiary of the global automaker Stellantis Group and will be used as its UK parts distribution centre.

Measuring 344m-long × 174m-wide and 22m-high, the structure is said to be the biggest single cross-docked warehouse to be developed in the North West during 2022.

Commenting on the scheme, Stoford Managing Director Dan Gallagher, says: "This is a modern, purpose-built distribution building that will create new jobs and deliver significant economic benefits. Sustainability has been a key factor throughout the design process, with consideration given to minimising embodied carbon and reducing the building's energy consumption. The development forms part of the expansion of Ellesmere Port and will ensure the longevity of Hooton Park as a significant employment site."

A steel-framed option has been used to construct the building. Winvic Design Manager Mihir Mehta, says the material was chosen for its speed of construction – the frame was erected in nine weeks – and because it offered the most efficient method for creating the large spans required for the distribution centre.


A steel-framed solution was chosen for its speed of construction.

The portal-framed design features perimeter columns set at 8m centres, with four 43.5m-wide spans stretching along the building's entire length. In order to provide even more column-free space, the internal valley columns are arranged in a hit-and-miss configuration, meaning they are installed on a 16m grid pattern.

Caunton Engineering completed the steel erection using four mobile cranes with capacities of up to 130-tonne. The sequence to install the 43.5m-long spans, required the rafters to be delivered to site in two sections that were individually lifted into place using two cranes. Once the rafter sections were connected to their supporting columns and still being held in place by the cranes, the central bolted splice was made to

"Sustainability has been a key factor throughout the design process, with consideration given to minimising embodied carbon and reducing the building's energy consumption."

FACT FILE
Ellesmere Port distribution centre
Main Client: **Stoford**
Architect: **Webb Gray**
Main contractor: **Winvic Construction**
Structural engineer: BWB Consulting
Steelwork contractor: **Caunton Engineering**
Steel tonnage: **2,700t**

The distribution centre features four 43.5m-long spans.

complete the span.

The rafter sections used for the roof spans are typically 762 × 267 × 173UBs and weigh up to 4.2t each.

The design of the portal frame, and the roof steelwork in particular, includes scope for future flexibility.

Winvic Project Manager Sam Vickers, explains: "The steel frame is designed to accommodate future loads from a fire rated baffle ceiling. This ceiling will span an area of approximately 17,000m² above the goods in/out area and will be supported by secondary steel hung from the roof structural steel with a drop height of 9m from the haunch."

The building will feature an array of sustainable features including photovoltaic roof panels, rainwater harvesting, LED lighting and an energy monitoring system. Staff will also benefit from an external wellbeing area, bicycle storage and EV car charging points.

The distribution centre will also have an attached three-storey 1,850m² office block and a smaller two-storey 185m² transport office. Both are steel-framed extensions, attached and linked to the main distribution centre and formed with steel columns and beams supporting a steel metal decking composite flooring solution.

Externally, the distribution centre's steel frame will support a composite cladding system, while Stoford has sympathetically designed the building to preserve the integrity of the existing listed structures on the former airfield, (this includes WWII air raid shelters), which means some of the surrounding ground and building floor levels of the new facility are recessed into an existing slope.

Winvic started on site in June 2022 and began its work by removing an old concrete runway and tarmac. This amounted to approximately 35,000 tonnes of material, which was broken down, graded and reused on the overall project.

Also forming part of Winvic's early works was the installation of pad foundations in readiness for the steelwork programme.

Winvic's Head of Industrial, Distribution and Logistics, Danny Nelson, added: "We're thrilled to be working with Stoford once again and to add another low carbon industrial facility to our roster of live projects. The relationships already built with the Stellantis team are driving the facility forward and we look forward to exceeding their expectations all the way to delivery in the second half of 2023."

Gemma Davies, Director of Economy and Housing at Cheshire West and Chester Council, said: "This is another significant investment in Ellesmere Port, not only does the new building contribute to the green credentials we are striving for, it continues the historic association Ellesmere Port has with the motor industry and creates a new modern workplace."

Winvic says, the development is programmed for completion in the second half of 2023. ■

Steel provides the tools

Requiring a series of long clear spans and a quick construction programme, a well-known manufacturer has chosen a steel-framed solution for its new UK facility in Camberley.

Strategically placed bracing provides stability to the warehouse.

FACT FILE
STIHL headquarters and warehouse, Camberley
Main client :**Andreas STIHL**
Architect: Hale Architects
Main contractor: Glencar Construction
Structural engineer: Alan Wood & Partners
Steelwork contractor: Adstone Construction
Steel tonnage: 770t

Steel construction is enabling the construction of a new UK headquarters and distribution facility for STIHL, a manufacturer of chainsaws and outdoor power equipment, to proceed on schedule with an expected completion date set for May.

Located just off the A331, near Camberley, Surrey, the project has been designed by Hale Architects and includes a 9,000m² warehouse and an adjoining three-storey headquarters building.

Commenting on the scheme, STIHL GB Managing Director Kay Green, says: "STIHL has

How the completed offices and warehouse will look on completion.

"Steel was the obvious choice for this scheme, not just for its quick construction programme, but because it offers the most efficient way to form the required long spans in the warehouse."

The three-storey office block is linked to the warehouse.

enjoyed a sustained period of growth in recent years and, as a consequence, we have outgrown our existing warehouse and office facilities.

"Our new purpose-built headquarters represents a significant capital investment and is a commitment to the future for our local workforce. This cutting-edge facility will allow us to plan for many years of future growth, which will continue to benefit the local economy."

The warehouse will utilise state-of-the-art picking and storage systems to maximise productivity, efficiency and the use of space. The adjoining 2,300m² HQ will boast dedicated retailer training facilities, an onsite restaurant, flexible collaborative workspaces and a technical workshop.

The overall development will also incorporate new car parking, a service yard, landscaping – featuring native shrubs and trees -and the construction of a new access route from the A331.

The design of the new HQ building will have first-class environmental credentials including two-thirds of the total roof area covered with photovoltaic solar panels to provide power to the new facility. In addition, there will be provision for 26 EV charging points in anticipation of the continued move towards the use of electric vehicles.

Located close to Blackwater railway station, employees will also be able to commute by train or travel by bicycle using the adjoining off-road cycle path.

Main contractor Glencar Construction started onsite last summer, inheriting a site that was previously wooded, but had already been cleared of its trees. Prior to the steel-framed buildings being erected, preliminary works included a ground improvement programme, followed by the installation of pad foundations.

On the decision to use a steel-framed solution for the entire project, Alan Wood & Partners' Engineer Peter Drenon, says: "There had been a few delays to the project, because of COVID-19, and the client wanted to get the scheme up and running as quickly as possible. Steelwork's speed of construction has been vital in achieving our programme."

Steelwork contractor Adstone Construction began its package with the erection of the HQ building, returning a couple of weeks later to complete the warehouse and the link between the two structures.

Based around a 7.5m × 7.5m column grid pattern, the HQ building is a braced steel frame, with the bracing secreted in walls. The frame comprises two spans, with one line of internal columns, positioned in one of the central corridor's partition walls. Aiding the overall stability system for the structure, a composite flooring solution has been used as a diaphragm, comprising steel beams supporting metal decking and a concrete topping.

Allowing workers to see the outside amenities as well as creating an architectural feature, the HQ's main elevation will be predominantly glazed. Within the glazed elevation, the main entrance is positioned in front of a full-height void that will contain a feature staircase, serving the upper two floors.

Adding an architectural flourish to the HQ, the steelwork within the entrance foyer and the staircase void will be left exposed in the completed scheme.

Glencar Construction Senior Project Manager Mark McLean, says: "Steel was the obvious choice for this scheme, not just for its quick construction programme, but because it offers the most efficient way to form the required long spans in the warehouse."

Having completed the HQ, Adstone returned to site and erected the warehouse. This part of the development measures 102m-long × 88m-wide and ▸20

▸19

is 16.2m-high to the underside of the haunch.

Including one line of internal valley columns, the width of the structure is divided into two 44m-wide spans that provide the required open-plan floor area.

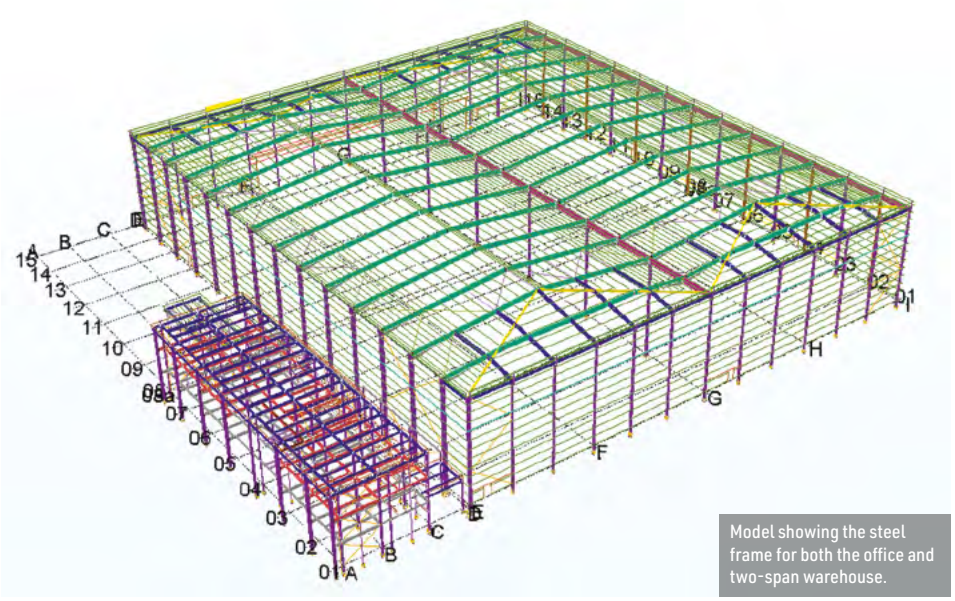
Each span is formed with two 22m-long 762UB sections. Using two mobile cranes – lifting one rafter each – the beams were bolted together at height, once they were in position, and connected to their supporting columns.

Supporting each of the warehouse spans internally, the valley columns are 356 × 406 × 340UCs, weighing up 6.2t each. They are arranged in a hit-and-miss configuration to provide extra column-free space and each of these members represented the heaviest steel sections to be installed on the project.

The warehouse is a portal frame, but not a traditional one as it contains added bracing in its roof. "This design was chosen as each end of the structure is hipped, as an architectural feature, and to compensate for the deflections, bracing was required," explains Mr Drenon.

Summing up, Glencar Construction Managing Director London and South, Roy Jones, says: "STIHL are world leaders when it comes to chainsaws and garden power tools, setting the standard for over 90 years, so Glencar are both honoured and proud to have been appointed to design and build their new headquarters and distribution facility.

"This state-of-the-art project goes to serve as a further example of our design and build credentials and proven ability to construct buildings tailored to our customer's exacting specifications." ■



Model showing the steel frame for both the office and two-span warehouse.

Once the office block was up, the erection of warehouse was able to begin.

Solar panels on roofs

David Brown of the SCI comments on the increasingly common use of solar panels on the roofs of industrial buildings and the iteration necessary with "hit and miss" frames.

Notable features of the new STIHL warehouse seen in the construction photographs are the purlin arrangement and the hit and miss frame configuration. The closer spacing of purlins to accommodate drifted snow (and possibly to provide additional restraints in the zones with higher bending moments) can be clearly seen in the valleys and zones behind the parapets. Designers should also note that in common with many other new structures, the STIHL HQ has solar panels on the roof. The loading due to solar panels is typically around 0.15 - 0.2 kN/m², which is a significant addition to the permanent actions and service loading commonly allowed for in design. Ballasted solar panels are sometimes specified for flat roofs, which are ballasted to prevent uplift without fixing through the roof covering. The loading from ballasted panels may be in the order of 0.35 kN/m. Loading due to solar panels should be considered as a variable action – they may not be present in an uplift condition.

Hit and miss frames require some careful consideration. Without the internal column, the stiffness of the "miss" frame differs from that of the "hit" frame, yet the two frames must move together in reality. SCI publications P399 and P164 present a design approach for hit and miss frames. If designing as separate frames (albeit usually with the same rafter and column sections), the design procedure involves some iteration between the design of each frame. A horizontal force is applied to the "hit" frame at the valley (increasing the lateral movement) and an equal and opposite force applied to the "miss" frame, which is the support provided by the "hit" frame. The lateral movement at the valley is checked and the force applied to both frames adjusted until the difference in movement is not significant.

The calculated force must be transferred between the two different frames. Usually, bracing is provided in the longitudinal direction to ensure the frames move together. In some cases, it may be possible to design the valley beam for bending in both directions, but this also introduces the complication that the lateral stiffness of the valley beam must be considered when calculating the movement of the "miss" frame. Simple is often best, so longitudinal bracing is recommended.

A further consideration in multi-bay frames is longitudinal stability. Plan bracing from one elevation to the other is possible, though deep trusses extending over more than one bay may be needed for wide structures. Vertical bracing on the valley lines would be structurally attractive, but usually unwelcome for the client. Rigid frames in one or more bays on the valley line is a common solution. More advice on the longitudinal stability of multi-span portals is given in *New Steel Construction*, May 2007. ■

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Visualisation of the completed school.

A steel-framed solution has provided the most durable and cost-effective design for a new special school in Wisbech.

Due to open in September, Cambridgeshire County Council is funding the construction of a new school for 60 young people with social, emotional and mental health (SEMH) needs, to be run by the Horizons Education Trust.

According to the Council, the new steel-framed purpose-built accommodation will provide a much-needed replacement for the existing school in Wisbech, which is considered to be outdated and unsuitable for current needs and learning. Aiming to achieve a BREEAM "Very Good' rating, the new school will provide a modern learning environment with outdoor spaces for primary to secondary aged young people.

Cllr Bryony Goodliffe, Chair of Cambridgeshire County Council's Children and Young People's Committee, says: "This school marks a significant milestone in our strategy to provide more places for children and young people with special educational needs in Cambridgeshire. We are extremely grateful for the support of our partners in delivering these places which are so vital to the future aspirations of these young people."

Located to the west of the town, the site of the new school was chosen for its rural and peaceful location, criteria which are of particular benefit for children with SEMH needs.

"The plot was previously occupied by a farmhouse and outbuildings," explains Kier Construction Eastern & Midlands' Pre-Construction Manager Mark Rowney.

"Work started on the project last year, with one of the initial tasks being the installation of precast concrete piled foundations, which along with ground beams, support the steel-framed school structures.

"We chose steel for this project as it offered the most cost-effective solution, relative to the client's programme."

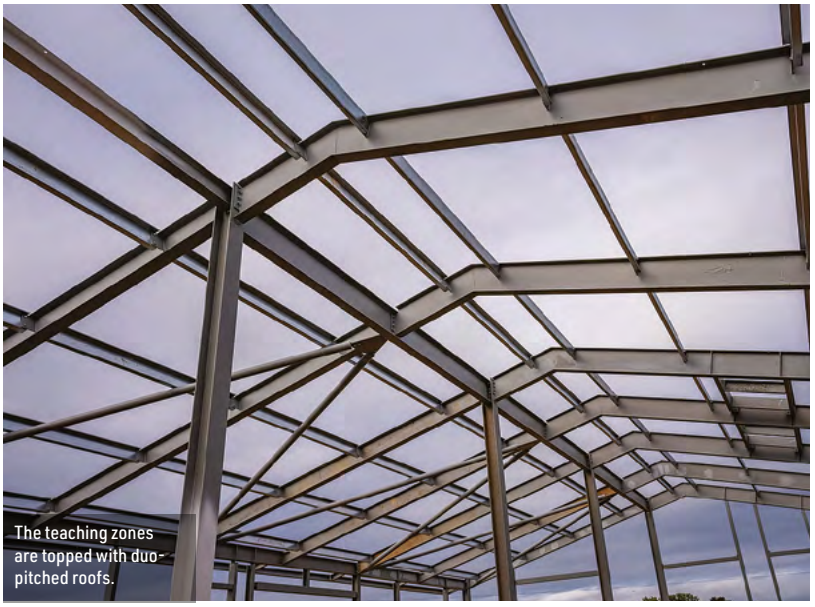
As well as a quiet location, another design stipulation for the school was to have a modern learning environment, which was also easy navigate around.

To this end, the new school is a single-storey building, split into six inter-linked areas or boxes, with each part designed to be structurally independent and separated from its neighbours by movement joints.

The boxes are arranged around a central landscaped courtyard, while around the outside of the school, there are further gardens, adding to the project's calm and relaxing environment.

The school's six boxes consist of three teaching blocks, which are denoted by their duo-pitch roofs, and a sports hall, dining hall and therapy building

Roof bracings help stabilise each of the six blocks.



The teaching zones are topped with duo-pitched roofs.

A steel-framed solution was chosen for its speed of construction.

that are topped with flat roofs.

A similar design ethos has been used for each of the school's boxes as Peter Dann Associates' Senior Engineer Tommy Hodgson explains: "The stability solution we have used is provided by roof bracing that transfers loads to vertical bracing and moment frames positioned in the perimeter walls."

The three teaching blocks have been designed with flexibility in mind, whereby changes could be made to the classroom configuration. The rooms, which are arranged either side of a central corridor, could be enlarged if future teaching requirements change. This can be achieved by removing the partition walls, as they contain no bracings and are not structurally integral to the overall design.

The three teaching blocks are 16m-wide and have one line of internal columns set within one of the central corridor's walls, thereby providing one 7m-wide span over one line of classrooms and another 9m-wide span that tops the corridor and the opposite classes.

FACT FILE

Wisbech Green SEMH School
Main client: **Horizons Education Trust, Cambridgeshire County Council**
Architect: **Frank Shaw Associates**
Main contractor: **Kier**
Structural engineer: **Peter Dann Associates**
Steelwork contractor: **SDM Fabrication**
Steel tonnage: **190t**

The dining hall and therapy building have a similar steel design to the teaching blocks, as they both feature one line of internal columns.

The other flat-roofed box – the sports hall – is a column-free space. This building, which is separated from one of the teaching blocks by a changing room zone, is slightly taller, at 8.5m-high, than the rest of the school and measures 18m x 17m.

The 17m-long sports hall roof rafters are the longest steel members on the project. Weighing 2.6t each, these sections are also the heaviest steel members SDM fabricated, supplied and erected for the project.

Steelwork contractor SDM Fabrication erected the entire steel package using two MEWPs and one 60t-capacity mobile crane.

"The steelwork was divided into five phases, with each phase consisting of three deliveries," explains SDM Fabrication Installations Manager Russell Darlington. "Erecting the steel was a nice smooth process as we pretty much had the site to ourselves, with plenty of space for steelwork to be laid down prior to being installed."

Summing up, Horizons Education Trust Executive Head Teacher Dr Kim Taylor, says: "The Trust and I have worked closely with the design and project team to develop a building and landscape design that will help us deliver an exemplary level of service for many years to come, ensuring our pupils have access to facilities that will support their social, academic and vocational development to prepare them for an independent and fulfilling life when they leave us." ■


The teaching blocks have a single line of internal columns.


The sports and dining halls, and the therapy block have flat roofs.

Use of fibre-reinforced concrete in composite slabs (part 2)

Recent years have seen increasing interest in replacing the reinforcement mesh with steel fibres in composite slabs on steel decking. The drivers are largely economic, while the reduction of construction material suggests decreases in the carbon footprint may be possible. Along with reduced waste on site and less labour demand, the use of fibres makes a case for being more environmentally friendly when compared to using steel mesh reinforcement. Nevertheless, certain technical and practical issues should be considered when wishing to use fibres in concrete. In this second of two articles, Constantinos Kyprianou of the Steel Construction Institute reports on the design and construction considerations on the use of steel fibres mixed in concrete instead of conventional mesh reinforcement for a composite slab on steel decking.

Design of composite slabs with steel fibres

By testing

A common approach is design assisted by testing. The basic premise is that the performance of one metre wide composite slabs is representative since composite slabs on steel decking are always one-way spanning slabs. Such an approach has been adopted for almost 20 years ago by the Steel Construction Institute (SCI) for specified combinations of steel fibres and decking, and has been used principally to complement design with BS 5950.

By adapting conventional reinforced concrete design and using a mechanics-based approach

A simple approach adopted by some fibre suppliers is to firstly carry out a conventional design and then replace the area of mesh reinforcement with an equivalent (in terms of tensile capacity) amount of fibre while keeping the slab thickness unchanged. The required dosage of fibre is determined using standard bending theory such that the fibre-reinforced cross-section has the same post-cracking moment resistance as the mesh-reinforced cross-section. Similarly, equivalent tensile strength is used to determine the dosage needed to satisfy the minimum reinforcement requirements of the standards for crack control and longitudinal shear resistance for composite beams.

Flexural capacity can also be calculated using a plastic design approach, as described in TR34[1]. This approach is adopted by SCI to determine the moment resistance in fire when designing with the Eurocodes. This new method allows for more flexibility in design, and acts as an evolution of the approach previously developed by SCI for use with BS 5950. It should be noted that although in principle the methodology is simple, its implementation necessitates significant computation because of the iterations involved to calculate the required stress blocks. Therefore, it is almost always necessary to implement this method within software.

For the axial tensile strength of a flexural member the strength at CMOD 0.5 mm and 3.5 mm are considered, these are σ_{r1} and σ_{r4} respectively, and in accordance with TR34[1] are taken as:

$\sigma_{r1} = 0.45 f_{R1}$

$\sigma_{r4} = 0.37 f_{R4}$

where, f_{R1} and f_{R4} are defined in the first article.

These strengths are used to determine the cross-section resistance.

Fire design

Composite slabs at the normal stage are typically designed as single spanning, even when the deck is continuous over supports and designed as such at the construction stage. For typical UK practice, with no bars in the troughs, this means that the only reinforcement considered in design is that provided by the decking, which enhances the sagging moment resistance. Any hogging resistance provided by reinforcement, or fibres, is ignored. It is only during the accidental fire situation that the presence of mesh, or fibres, is recognised. SCI has produced a method using a plastic design approach of stress blocks to allow the tensile resistance of steel fibre-reinforced concrete (SFRC), deck and potentially bars in troughs to be considered in the determination of hogging and sagging resistances at elevated temperature. The methodology for considering the effects of SFRC is similar to the one described in TR34. Figure 1 shows the stress blocks to be considered for a typical flexural element with SFRC only, of which σ_{r1} and σ_{r4} are the tensile forces of SFRC.

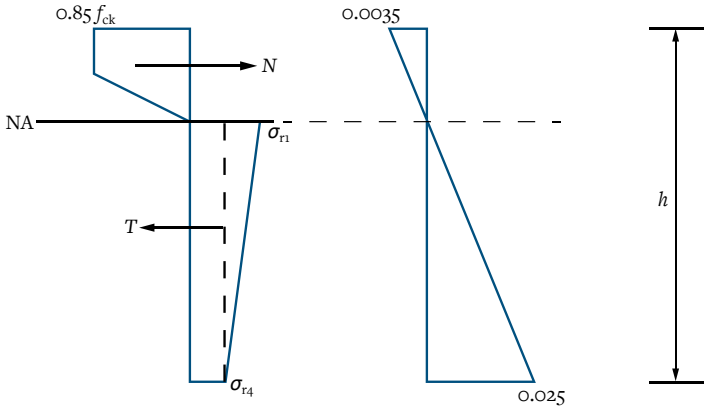


Figure 1: Typical stress block and strains of a flexural member with fibre-reinforced concrete. Adapted from [1]

For a fire scenario, a model for calculating concrete, deck and reinforcement temperatures is described in NCCI PN005c[2]. Based on these elevated temperatures, reduction factors are applied to the compressive strength of concrete and tensile strengths of SRFC, deck and bars in troughs (if present). Reduction factors are taken from the relevant Eurocodes, while for SFRC suitable factors have been determined by SCI based on the codified properties for concrete and reinforcement.

It should be noted that, as with conventionally reinforced slabs in fire, when the slab is physically single spanning (i.e. no end continuity), then a bar in trough is always required. When the slab is physically continuous over a support, this continuity is recognised in design and a semi-empirical rotation capacity check over the supports is performed to ensure that the continuity can be relied upon. A lack of rotation capacity could result in premature fracture of tensile components. ▸26

celebrating excellence in steel

Call for entries for the 2023 Structural Steel Design Awards

The British Constructional Steelwork Association and Steel for Life have pleasure in inviting entries for the 2023 Structural Steel Design Awards.

Now in their 55th year, the Awards celebrate the excellence of the United Kingdom and the Republic of Ireland in the field of steel construction, particularly demonstrating its potential in terms of sustainability, cost-effectiveness, aesthetics and innovation. The Awards are open to steel-based structures situated in the UK or overseas that have been built by UK or Irish steelwork contractors.

Why enter?

If your project is shortlisted, your company would have the kudos of being part of a prestigious Awards scheme - one with a long history, focussed solely on steel construction and the only one where expert judges visit every shortlisted project to truly appreciate its qualities. In addition, you'll receive:

- Free publicity for you, your project and your client, both online and in the construction press.
- Free attendance at a major Awards event in central London for your project team.
- Recognition of excellence for your project, be it large or small.

How to succeed?

Plan ahead and involve the whole project team from the outset in preparing a high-quality submission, don't leave it to the last minute. Read the entry criteria and particularly the 'Submission Material' section on the entry form and provide exactly what is required, nothing more, nothing less. In addition:

- High quality photos will portray your project at its best.
- A well written, flowing description of the context, concept design, outstanding features and key construction details will allow the judges to swiftly appreciate the essence of your project.
- Broad representation from all parties at the judges' visit will demonstrate collaboration and enthusiasm.

To find out more and download an entry form visit https://www.steelconstruction.info/Structural_steel_design_awards or call Chris Dolling (BCSA) on 020 7747 8133

Closing date for entries: Friday 24th February 2023

BCSA

STEEL for life

▸24

Considerations at the normal stage, ultimate limit state

Bending capacity

Typical composite slab design, at ambient temperature, ignores any tensile contribution from SFRC. The calculated shear bond parameters, τ_u and m & k, which are determined from full scale tests are assumed to be unaffected by the presence of fibres. The deck is considered to act compositely in (typically) partial interaction with the concrete, as external reinforcement.

Vertical shear

Currently in EN 1994[3], the vertical shear resistance of a composite slab only considers the role of the concrete, even though this appears conservative in ignoring any enhancement from the deck. The presence of steel fibres in concrete enhances its shear capacity; this is described in detail in the RILEM report[4] and TR34[1]. In current design this effect is conservatively ignored.

Punching shear

A punching shear resistance check is needed in the presence of a concentrated load. Punching shear resistance is partly provided by two cross-sections of the slab that run parallel to the slab span – the tensile reinforcement for these sections is provided by the decking (not mesh), as for vertical shear. Additional resistance is provided by two cross-sections that run perpendicular to the span of the slab – the tensile reinforcement for these is traditionally provided by mesh but can be provided by fibres.

Longitudinal shear – beam check

Satisfying the longitudinal shear resistance, which is a composite beam check even though the reinforcement is associated with the slab, requires a minimum area of transverse reinforcement to be determined in accordance with EN 1992-1-1 Clause 9.2.2 (5)[5]. A strut and tie model is used to determine the minimum area of reinforcement. This may be converted to an equivalent tensile force and compared to a resistance using SFRC.

Considerations at the normal stage, serviceability state

In accordance with EN 1994-1-1 clause 9.8.1 (2)[3], for continuous slabs that are nevertheless designed as simply supported the cross-sectional area of the anti-crack reinforcement above the ribs of the deck should be not less than 0.2% of the cross-sectional area of the concrete above the ribs for un-propped construction, and 0.4% of this cross-sectional area for propped construction.

For fibre design the required area of mesh reinforcement is converted to an equivalent tensile force, which is then used to determine the appropriate fibre dosage.

Construction and design considerations

Advantages

The main benefits of replacing mesh reinforcement with steel fibres are:

- Improvement in impact resistance and fatigue endurance.
- Improved durability of slab as a result of reduced cracking.
- Test evidence of SFRC enhancing the fire resistance of composite slabs [6,7].
- Reduction in construction time since it removes a trade.
- Reduction of site waste with unused mesh reinforcement.
- No issues associated with displacement of conventional mesh within the depth of the slab and clashing with the studs.

Savings in the cost of supplying and fixing conventional mesh reinforcement can offset the extra cost of adding fibres to the concrete. There may also be health and safety benefits resulting from the reduced handling of reinforcement.

Issues

Some of the issues that could arise with the use of steel fibres are:

- No standing platform for labour (which mesh offers) when pouring concrete, so care should be taken by workers not to damage the steel deck during pouring. Designers are advised to consider an extra construction-imposed load allowance to cover the direct contact with the deck.
- If the steel fibres are not already in a ready mixed concrete when delivered to site, care should be taken to ensure their effective mixing and even distribution during pouring. It can be difficult to control and check the even distribution of fibres. Although offsite mixing is associated with high quality control, contractors and suppliers should ensure that every effort is made for checking the quality of the pour and the even distribution of fibres in the concrete mix during construction of the slab.
- Admixtures such as superplasticisers, water reducers and hardeners may be needed in the concrete to aid with the even distribution of fibres within the concrete mix, and its fluidity, since the presence of fibres can act as a thickening agent.
- The finished surface will be rough because of protruding fibres, and will need additional screed if a smooth surface is needed.
- At the decommissioning phase of slabs, it can be extremely difficult and expensive to separate steel fibres from the concrete mix and re-use them. Similar, if not less onerous, issues exist as those currently faced by the construction industry for concrete-based structures at the end of their life.

Final comments

Although the use of steel fibres with composite slabs is nothing new, uptake is expected to rise as economic and sustainability drivers push this approach forward. With an experienced contractor and ready-mix concrete provider, the benefits can far outweigh the issues. In design, if by testing is not adopted, a mechanics-based methodology implemented within software provides a practical alternative. ■

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3. BSI, 2004. EN 1994-1-1. Eurocode 4: Design of composite steel and concrete structures –Part 1-1: General rules and rules for buildings.
4. RILEM, 2003. TC 162-TDF, Tests and design methods for steel fibre reinforced concrete, σ-ε design method, *Material and Structures*, Vol. 36, pp. 560-567.
5. BSI, 2004. EN 1992-1-1. Eurocode 2: Design of concrete structures –Part 1-1: General rules and rules for buildings.
6. Fike, R. and Kodur, V., 2011. Enhancing the fire resistance of composite floor assemblies through the use of steel fiber reinforced concrete. *Engineering Structures*, 33(10), pp.2870-2878.
7. Bednář, J., Wald, F., Vodička, J. and Kohoutková, A., 2013. Experiments on membrane action of composite floors with steel fibre reinforced concrete slab exposed to fire. *Fire Safety Journal*, 59, pp.111-121.

AD 500:
Tolerance at cantilever tips

Although BS EN 1090-2 and the National Structural Steelwork Specification (NSSS 7th) include a permitted deviation at the tip of a pre-set cantilever, this AD note recommends that the only reliable way of achieving a consistent alignment of several cantilevering elements is by including provision for adjustment.

The NSSS and EN contain identical tolerances (9.6.20 and Table B.16(5) respectively) for the "deviation Δ from intended pre-set *f* at end of an erected cantilever of length *L*". The NSSS limit is *L*/200, which is the Class 1 limit in the EN,

It is presumed that the intended pre-set is to allow for the inevitable deflection of the cantilever, or perhaps to deliberately provide an inclined member (for example, supporting a canopy with a drainage fall back towards the building). The pre-set could be zero, or negative (a fall away from the supporting structure) and would normally be provided by cutting the supported end of the member at a small angle.

The assessment of this permitted deviation is fraught with difficulties. The clause limits the deviation "of an erected cantilever", which means the deflected position is to be assessed. This is a departure from the normal concept that deviations are measured at fixed points such as connections, excluding the effects of gravity. This principle is seen most clearly in the assessment of a truss camber (7.6.1 in the NSSS) which is supposed to exclude the effects of gravity by being measured with the component lying on its side. It may be difficult to do this with some trusses, but the principle is clear.

The position of the cantilever tip after erection depends on a number of uncertain contributions:

- The calculated deflection will assume some stiffness of the connection to the supporting structure, and some stiffness of the supporting structure. Both are unlikely to be as assumed. Any continuity – such as back spans – in the supporting structure will modify the calculated deflection. Any difference in the arrangement at different frames will have an impact on the cantilever tip positions.
- The loading on the cantilever and the supporting structure will affect the position of the tip. If the cantilever tip position is to be verified after erection, which is usually the case and is the requirement in the NSSS, the frame designer should specify the loading condition of the supporting frame and cantilever and the corresponding required position of the cantilever tip.
- The accuracy of the cut angle at the cantilever support and the fit-up between components. A very small difference in the angle of cut can lead to a large difference in tip position.
- The temperature when the measurements are taken. Thermal movement of any back spans or equivalent elements will affect the plumb of the cantilever support and the position of the cantilever tip.
- If cantilevers are connected to an unrestrained beam, the twist will vary along the beam length, leading to variability in the cantilever tip position.

It may be tempting to propose that where possible, each cantilever be connected to its supporting member and the accuracy of the fabrication be measured when the components are lying on their side and unaffected by gravity. However, experience suggests that the positions of the tips of a series of erected cantilevers (such as supporting a canopy) will still not align.

Best practice with cantilever members is to build in provision for adjustment, either with thin shims at the support, or by adjustment at the tip to allow supported members (such as a facia detail at the canopy tips) to be aligned. Expecting good alignment without adjustment is generally unrealistic.

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Telephone: **01344 636555**
Email: **advisory@steel-sci.com**

A milestone in advisory desk notes

The issue of AD 500 marks a significant achievement in the provision of technical advice to the steel construction industry. Advice was issued from 1988 within SCI's own journal. When New Steel Construction was initiated in 1992 the advisory desk note was already at number 126, so about 20 were issued per year over that initial period. BS 5950 was relatively "new" at the time, so perhaps there was plenty of advice needed. Since 1992 advisory desk notes have become less frequent (around 12 per year) but hopefully still relevant and helpful.

AD 001, which was issued in April 1988 is entitled "guidance on compactness" and is really about the classification limits which must have seemed quite new at the time. The introduction to the AD refers to the "many" queries on the subject. AD 002 commences a theme which reoccurs in AD 006 and continues to the present time – correcting mistakes and other errors in the codes (and sometimes in SCI publications!).

Different writing styles can be seen over the years – some more formal and some rather more conversational. AD 003 refers to "Pundits of BS 449" – an expert in their field frequently called upon to give their opinion. AD 008 refers to "unnecessary beefing up", which would probably appear as "over-conservatism" these days.

Presumably AD 100 was also a significant milestone around 1990. AD 100 looks backwards to BS 449 and the clauses covering separators and diaphragms. Advice on withdrawn (but still used) design standards is another theme which continues to the present time.

Looking forward to the next 500, the wholesale revisions to the Eurocode suite will no doubt inspire plenty of AD notes. Most AD notes are prompted by questions sent to the SCI's advisory team, so SCI members are encouraged to keep the enquiries flowing.

David Brown, SCI

Search for Advisory Desk articles on newsteelconstruction.com

Use the search bar at the top of every page of *newsteelconstruction.com* to search out Advisory Desk articles by name, number or subject, or list them (most recent first) by hovering over Technical in the main menu and selecting Advisory Desk from the resulting pop-up menu.

New and revised codes and standards

From BSI Updates January 2023

BS EN PUBLICATIONS

BS EN ISO 11127-6:2022
Preparation of steel substrates before application of paints and related products. Test methods for non-metallic blast-cleaning abrasives. Determination of water-soluble contaminants by conductivity measurement
supersedes BS EN ISO 11127-6:2011

BS EN ISO 11127-7:2022
Preparation of steel substrates before application of paints and related products. Test methods for non-metallic blast-cleaning abrasives. Determination of water-soluble chlorides
supersedes BS EN ISO 11127-7:2011

BS IMPLEMENTATIONS

BS ISO 24084:2022
Curtain walling. Inter-storey displacement resistance. Test method
no current standard is superseded

CORRIGENDA TO BRITISH STANDARDS

BS EN ISO 4042:2022
Fasteners. Electroplated coating systems
Corrigendum, November 2022

BRITISH STANDARDS REVIEWED AND CONFIRMED

BS EN ISO 377:2017
Steel and steel products. Location and preparation of samples and test pieces for mechanical testing

BS EN ISO 6946:2017
Building components and building elements. Thermal resistance and thermal transmittance. Calculation methods

BS EN ISO 10211:2017
Thermal bridges in building construction. Heat flows and surface temperatures. Detailed calculations

BS EN ISO 12631:2017
Thermal performance of curtain walling. Calculation of thermal transmittance

BS EN ISO 23279:2017
Non-destructive testing of welds. Ultrasonic testing. Characterization of discontinuities in welds

NEW WORK STARTED

ISO 18900
Steel structures. Structural bolting. Test method for determining slip factor for faying surfaces
will supersede None

ISO 18954
Steel structures. Structural bolting. Test method to establish bolt tightening procedures
will supersede None

FROM
Building with Steel
February 1973

Saved with Steel

Steel has played an essential part in the recent restoration at York Minster – providing proof of the adaptability of steelwork whilst maintaining minimum costs.

That this beautiful window at York Minster is still standing and will be for a long time to come is in no small way attributable to steel. The Great East Window was designed and built between 1405 and 1408 by John Thornton of Coventry and is the largest of its type in the world. Below the upper tracery are 117 panels, 3ft square, each of which is a complete picture beginning with the Creation and ending with the Revelation of St John the Divine.

Excavation

Steelwork formed the basis of all the excavation and preparatory work undertaken at York Minster. The main contractor (Shepherd Building Group Limited) was faced with the mammoth task of excavating the whole of the earth surrounding the foundations of the four large masonry columns supporting the 24,000 tons of the Central Tower. A depth of 14ft had to be excavated in two 7ft stages before the base of the old Norman foundations could be reached, and in doing this the problem arose of stabilising the surrounding earth and bonded masonry of the foundations, these being under extremely high pressure.

Before any excavation could be undertaken it was necessary to place high tensile steel strapping around the masonry columns as a deterrent against any of the existing fissures opening again. The steelwork grid within the excavation was placed in such a way that points of pressure would be counteracted by steel members. The applied pressure from the steel had to be by means of an expanding endplate operating by screw jacks, and on slides. These, in turn, connected to a vertical runner beam spanning the full depth of the excavation.

Erection of the steelwork was in two phases, the first being down to a 7ft level, and then extended down to the final 14ft level – this method being adopted to maintain the stability of each level.

Once the steel was in position it was possible to support the scaffold above the excavation and create a working platform at the original floor level, thus keeping a maximum clear working area around the foundation masonry to apply the remedial work.

As each stage of excavation around the main Central Tower columns was carried out, pressure steelwork was erected along the main force lines of the masonry. Steelwork in this area was linked together forming large grids to a depth of 14ft. This steelwork formed the basis of preparing to restore the foundations and at the same time provided a suitable structure on which a timber floor was laid, thus allowing the public access at all times.

East Wall restoration

At the same time, an even greater task for steel was required on the East Gable which was leaning out of plumb 2ft at its worst point. Test excavations had shown that it almost had no foundations at all. It was necessary therefore to shore the whole gable before an attempt could be made at underpinning. To counteract

the lean five twin-boom shores were placed (one at each buttress) across the East End, the largest of these being approximately 70ft high and weighing over 22 tons.

When excavation commenced a steel pressure grid was formed to a depth of 14ft below ground level to resist horizontal thrust at the base of the wall. To prevent any movement whilst all the excavation was taking place three horizontal flying steel shores were placed across the priceless East Window, the shores being integrated together with steel columns.

Steel was again chosen for its adaptability and the twin-boom shore was designed about the physical structure of the masonry buttress. They were needled into the masonry and 'saddled' to it as well, at the point where the main horizontal thrust occurred.

Fressinet flat hydraulic jacks were placed within a steel-box retaining base between the base of the shore and the main concrete base. Pressure was then applied so as to ensure that the steel shoring transmitted the necessary loading to the masonry buttresses to counteract the thrust.

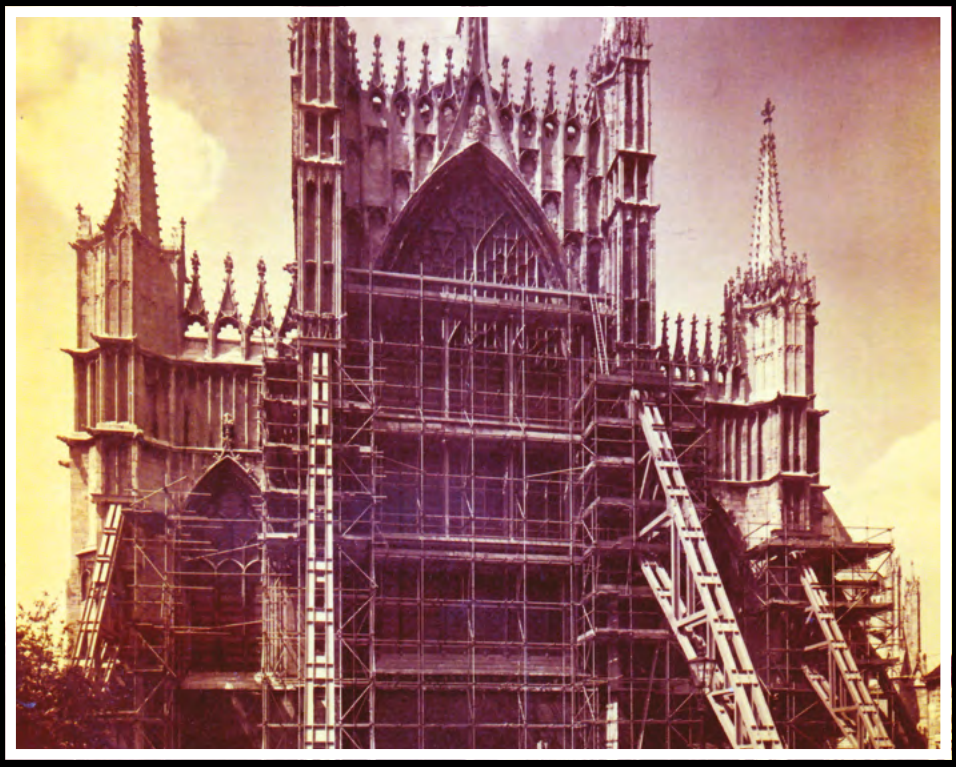
The flying shores were also placed across the face of the huge East Window to prevent any movement and were integrated with the five raking shores against the buttresses. These five steel shores were designed and supplied by the York and Scarborough Steelwork Specialists, H. Pickup Limited, and were fabricated in Scarborough and transported in sections by road to York. Subsequently the shores were repositioned at the West Front - where three are still in position.

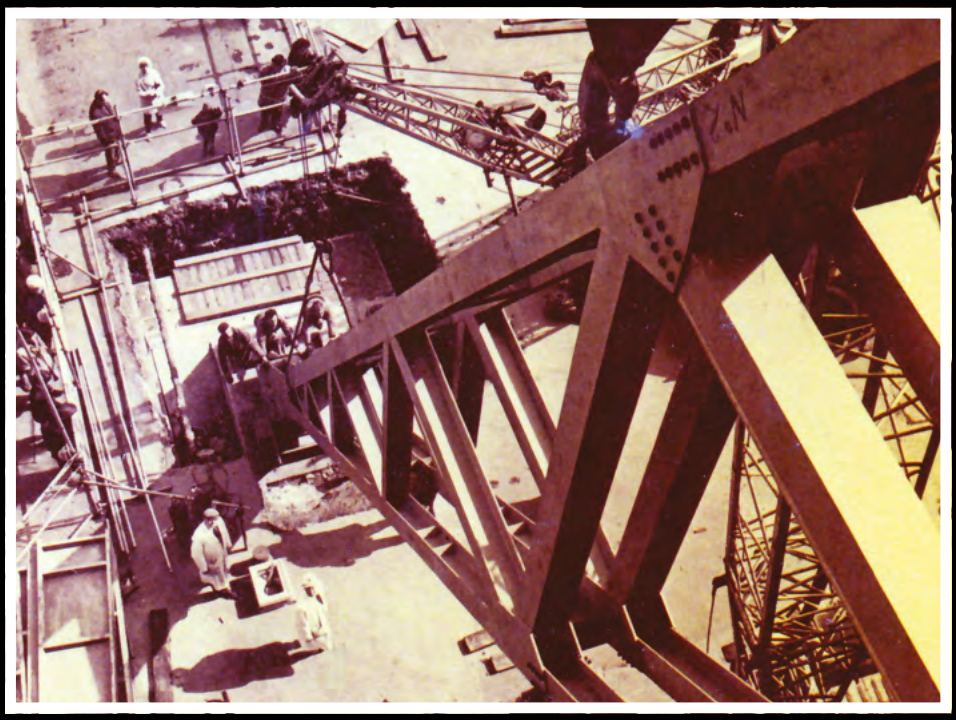
Central Tower roof restoration

Before work could commence on the removal of the existing roof a temporary roof had to be devised to provide weather protection for a programme of approximately fifteen months. It was decided that a steel construction would be the most adaptable. The construction of the temporary roof consisted of three main lattice trusses formed in right angles with steel raker beams at right angles to the lattices. Purlins and braces were then fitted above to carry the roof cladding.

Once the temporary roof was fitted the existing timber roof was removed. For the permanent roof trusses a lattice design was again adopted, the members this time being universal columns and rolled-steel channels to provide the necessary ground for timber connections.

At the end of the restoration, more than six miles of steel had been used for propping, shoring, and permanent structural members.





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, Membership Manager
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
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 £2,400,000
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 £6,500,000
Coventry Construction Ltd	024 7646 4484			●	●	●	●		●	●	●			●	●	✔	4			Up to £1,200,000
D H Structures Ltd	01785 246269			●	●		●				●						2			Up to £400,000
D Hughes Welding & Fabrication Ltd	01248 421104				●	●	●	●	●	●	●		●	●	●	✔	4			Up to £800,000
Duggan Steel	00 353 29 70072	●	●	●	●	●	●	●	●		●				●	✔	4			Up to £10,000,000
ECS Engineering Services Ltd	01773 860001	●		●	●	●	●	●	●	●	●			●	●	✔	4		●	Up to £3,000,000
Elland Steel Structures Ltd	01422 380262		●	●	●	●	●	●	●	●	●	●		●	●	✔	4	✔	●	Above £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
Gorge Fabrications Ltd	0121 522 5770				●	●	●	●		●				●	●	✔	3			Up to £1,400,000
G.R. Carr (Essex) Ltd	01286 535501	●		●	●			●			●			●	●	✔	4			Up to £800,000
Company name	**Tel**	**C**	**D**	**E**	**F**	**G**	**H**	**J**	**K**	**L**	**M**	**N**	**Q**	**R**	**S**	**QM**	**FPC**	**BIM**	**SCM**	Guide Contract Value (1)

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	BIM	SCM	Guide Contract Value (1)
H Young Structures Ltd	01953 601881			●	●	●	●	●			●			●	●	✔	4	✔	●	Up to £3,000,000
Had Fab Ltd	01875 611711				●				●	●	●				●	✔	4			Up to £4,000,000
HBE Services Ltd	01525 854110				●	●				●				●	●	✔	2			Up to £800,000
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 £10,000,000
Kloeckner Metals UK Westok	0113 205 5270												●			✔	4		●	Up to £6,000,000
Leach Structural Steelwork Ltd	01995 642000			●	●	●	●	●			●					✔	2		●	Up to £6,000,000
Legge Steel (Fabrications) Ltd	01592 205320			●	●				●	●	●			●	●		2			Up to £800,000
Littleton Steel Ltd	01275 333431				●					●	●			●	●	✔	3			Up to £1,400,000
Loaninghill Fabrications Ltd	01506 858466				●				●	●	●			●	●		3			Up to £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
Murphy International Ltd	00 353 45 431384	●			●		●	●	●		●				●	✔	4			Up to £5,000,000
Newbridge Engineering Ltd	01429 866722	●	●	●	●	●	●	●			●	●				✔	4		●	Up to £2,000,000
North Lincs Structures	01724 855512			●	●					●	●				●		2			Up to £400,000
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 £2,000,000
PMS Fabrications Ltd	01228 599090			●	●	●	●		●	●	●			●	●		3			Up to £1,400,000
REIDsteel	01202 483333			●	●	●	●	●	●	●	●	●	●		●	✔	4		●	Up to £6,000,000
SAH Luton Ltd	01582 805741			●	●	●				●	●			●	●		2			Up to £400,000
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
Severfield Infrastructure Ltd	01377 271843	●		●	●	●		●	●	●	●			●		✔	4			Up to £6,000,000
Severfield Nuclear and Infrastructure Limited	01204 528393	●		●	●	●	●	●	●		●					✔	4			Above £6,000,000
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
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
Taziker Industrial Ltd	01204 468080	●		●	●		●	●		●	●		●	●	●	✔	3		●	Above £6,000,000
Temple Mill Fabrications Ltd	01623 741720			●	●					●	●				●	✔	2			Up to £400,000
TSI Structures Ltd	01603 720031			●	●	●	●	●			●			●			2	✔		Up to £2,000,000
W I G Engineering Ltd	01869 320515				●					●	●			●	●	✔	2		●	Up to £400,000
Walter Watson Ltd	028 4377 8711			●	●	●	●	●				●				✔	4			Above £6,000,000
Westbury Park Engineering Ltd	01373 825500	●		●	●	●	●	●	●	●	●				●	✔	4		●	Up to £2,400,000
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 £800,000
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 plc	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
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
Beaver Bridges Ltd	01204 668773	●		●	●	●	●	●	●	●	●	●	✓	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 £3,000,000
Cimolai SpA	01223 836299	●	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓	●	Above £6,000,000
CTS Bridges Ltd	01484 606416	●	●	●	●	●	●	●	●		●	●	✓	4			✓	●	Up to £1,400,000
Donyal Engineering Ltd	01207 270909	●		●						●	●	●	✓	3		✓	✓	●	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 £3,000,000
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
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
Malin Group	0141 370 5467	●			●	●	●			●	●	●	✓	4			✓		Up to £4,000,000
North View Engineering Solutions Ltd	01325 464558											●	✓	3					Up to £800,000
Smulders Projects UK Ltd	0191 295 8700	●	●	●	●	●	●	●	●	●	●	●	✓	4					Above £6,000,000
Tecade S.A.U.	00 34 955 833 811		●	●	●	●	●	●	●			●	✓	4		✓	✓		Up to £6,000,000
Total Steelwork & Fabrication Ltd	01925 234320	●		●		●				●	●	●	✓	3			✓		Up to £3,000,000
Underhill Engineering Ltd	01752 752483	●	●	●	●	●				●	●	●	✓	4	✓		✓	●	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
Keiths Welding Limited	07791 432 078

Company name	Tel
MMCEngineer Ltd	01423 855939
Paul Hulme Engineering Ltd	07801 216858
QHSE-Interspect Ltd	07438 413849
Sandberg LLP	020 7565 7000

Company name	Tel
Structural & Weld Testing Services Ltd	01795 420264
SUM ADR Ltd	07960 775772

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			
Farrat Isolevel	0161 924 1600	✓	N/A				
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		**Gold**
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				
Fabsec Ltd	01937 840641		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**				**Silver**
Ficep (UK) Ltd	**01924 223530**		**N/A**				**Silver**
Kaltenbach Ltd	01234 213201		N/A				
Lincoln Electric (UK) Ltd	0114 287 2401	✓	N/A				
Peddinghaus Corporation UK Ltd	01952 200377		N/A				

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**				**Silver**
Highland Metals Ltd	01343 548855	✓	N/A				
International Paint Ltd	0191 469 6111	✓	N/A				
Jack Tighe Ltd	01302 880360	✓	N/A		19A		
Joseph Ash Galvanizing	01246 854650	✓	N/A				
PPG Architectural Coatings UK & Ireland	01924 354233	✓	N/A				
Sherwin-Williams UK Ltd	01204 521771	✓	N/A			●	
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			
Arcelor Mittal Distribution - Scunthorpe	**01724 810810**	✓	**D/I**	**4**	**3B**		**Headline**
Barrett Steel Services Limited	**01274 682281**	✓	**M**	**4**	**3B**		**Headline**
British Steel Distribution	01642 405040	✓	D/I	4	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		
The Alternative Steel Co Ltd	01942 826677	✓	D/I				

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		
Lindapter International	01274 521444	✓	M				

Welding equipment and consumables

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

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