NOV/DEC 2022

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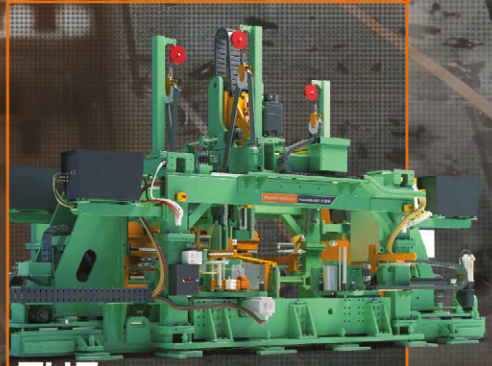

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Steel carbon reduction commitment strengthens

Nick Barrett - Editor

Fears have been raised that the UK's commitment to tackling the climate emergency may be waning in the face of the multitude of immediately pressing issues facing the government. Much fretting was sparked by Prime Minister Rishi Sunak's initial decision not to attend the COP27 event, which was reversed shortly before NSC went to press.

The Prime Minister certainly has a lot on his plate right now and his initial decision to stay in the UK and focus on UK issues looked reasonable. The background for that decision has seldom been more challenging, with the UK economic outlook uncertain following the bond market crisis sparked by the Liz Truss-Kwasi Kwarteng lower tax and higher spending plans; the war continuing in Ukraine; rising COVID-19 levels and warnings of a possible upsurge in flu. Dealing with the illegal immigration upsurge on its own could justify cancelling ministerial foreign trips for a while. There is also the small matter of the Autumn Budget being prepared for release on 17 November.

Turning away from commitments to net zero carbon however would be swimming against a strong tide of support for measures to tackle the climate emergency that has built up across the world in recent years. A single decision not to go to an event that is unlikely to adopt major new climate emergency measures, beyond what was committed to at last year's COP26 meeting in Glasgow, should not be taken as evidence that efforts such as the steel sector's plans for its net zero carbon journey that were detailed in its 2050 Roadmap are in danger of being wasted. UK government commitment to playing a leading role in the drive to reduce carbon emissions also seems to remain strong, which is underlined by the Prime Minister's decision to after all attend COP27.

The steel sector is certainly not diluting its support for the net zero carbon drive, and the commitment is only strengthening as measures promised in the Roadmap are developed. British Steel for example has just announced an extension to its Advance range of structural sections that represent a significant aid to achieving the design efficiency targets in the BCSA's 2050 Roadmap (see News).

Tata Steel has just released its new Optemis Carbon Lite product range, lower certified CO_2 steel that is verified by independent assurance. Tata Steel aims to reduce all CO_2 emissions by 30% by 2030 and be a CO_2 neutral steelmaker by 2045. Arcelor Mittal's XCarb steel initiative points the way towards becoming carbon neutral by 2050, reducing European CO_2 emissions by 35% by 2030.

Looking ahead, BCSA will soon publish its new guide to sustainable procurement, reinforcing the objectives and strategies detailed in last year's 2050 Roadmap. The BCSA's Sustainability Charter that members sign up to has been updated and relaunched in line with the government's 2050 target, new carbon footprint tools have been developed to help members to accurately calculate their carbon emissions. Across BCSA's membership, companies of all sizes are pressing ahead with their own carbon reducing initiatives, and we will bring you news of some of them in future issues of *NSC*.

SCCS extends its BS EN ISO 3834 accreditation scope

The Steel Construction Certification Scheme (SCCS) has further extended its scope of accreditations and can now offer certification to the newly issued BS EN ISO 3834:2021 – quality management in the field of welding.

"This is a significant addition to the service that SCCS offers its clients and further develops our strategic objective of offering a one stop shop for certification," said SCCS Director of Certification, Stephen Blackman.

The SCCS is a wholly-owned subsidiary of the British Constructional Steelwork Association. It was established in the early 1980s to provide quality management certification for steelwork contracting organisations.

SCCS now offers a wide range of certification and monitoring services for the structural steelwork sector, including integrated or separate UKAS accredited Quality management systems, Environmental and Health & Safety management systems, Factory Production Control systems and selected National Highways Sector Schemes.

For more information about SCCS go to *www.steelcertification.co.uk*

Urban forest office block to use reclaimed steel

Investor Fabrix has appointed Mace as main contractor to deliver the Roots in the Sky office development in Southwark, south London.

The innovative scheme will provide over 26,000m² of net lettable area alongside 4,200m² of external terraces, including a fully publicly accessible garden and the UK's first rooftop urban forest. The roof will have 125 mature trees and 10,000 plants, requiring 1,000 tonnes of soil.

The all-electric building will be net zero carbon in both construction and operation and is targeting a BREEAM 'Outstanding' rating. Setting a new benchmark for the circular economy and saving more carbon, the project will use reclaimed steel, obtained from the demolition of another building.

Fabrix CEO Clive Nichol, said: "Roots in the Sky represents a step-change for the future of the office market. It will be an office building that works not just for a progressive occupier but also for the local community and wider London. There is set to be a supply/demand imbalance for organisations looking for sustainable and impactful HQ buildings and we expect Roots in the Sky to be a major beneficiary of this."

Designed by Sheppard Robson, the building delivers much-needed highly sustainable, quality office space, with unprecedented access to nature and community, at a time when occupiers are asking for more from their buildings.

The design reintroduces original features of the 1950s former Blackfriars Crown Court building through its façade retention, such as opening sash windows, which will flood the new spacious workspaces and six-storey atrium with light.

Work is expected to start on site in January 2023.

Barking's innovative industrial development tops out

The steel-framed Industria development in Barking, east London, which will accommodate four-storeys of light industrial spaces, has topped out.

The project (see *NSC* September 2022) is said to be the first multi-storey light industrial development to be built in the UK. It is being constructed by McLaren Construction with BHC fabricating, supplying and erecting the steelwork.

Leader of Barking and Dagenham Council Darren Rodwell, said: "Industria will be a hive of industry hosting a range of makers, shakers and creators, which will provide hundreds of jobs for local people. Industria will reach new heights in business development not only in east London but the UK."

Industria will house tenants in flexible units arranged around a vehicle accessible multi-storey hub. The experience for visitors and neighbours will be enhanced by green walls, business lounge, lively shopfronts, and a new local café.

Paul Heather, Group Managing Director, McLaren Construction, said: "Working collaboratively with our client, Be First, our team is successfully managing rising costs in some materials on the project with fixed-priced contracts, including structural steelwork, precast concrete panels, lift shafts and stairs, composite and built-up external cladding systems for the façade and roof, helping us stay on programme and on budget to complete the scheme in February 2023."

British Steel extends range of Advance structural sections

Steelmaker British Steel has further enhanced its offering to the construction sector by extending its range of Advance structural sections.

Manufactured in the UK, the range has been extended by 71 additional beams and columns and is available in both standard grades, as well as in British Steel's premium S460M and weathering steel grades.

British Steel Commercial Director, Construction, Ben Cunliffe said: "The wide range of sizes and gauges available in our Advance structural sections range gives designers and engineers the flexibility to achieve the most effective structural solutions for their clients.

"Optimising steel structures by precisely matching often difficult-to-find dimensions has the potential to provide sustainable, efficient and cost-reducing solutions through savings in structure weight, fabrication effort and logistical costs.

"Using our high-strength S460M grade, which is available across most sizes, doubles these benefits and allows further optimisation such as wider spans and reduced structure weight."

Initially developed to reflect structural design practice for CE-marked structural sections compliant with EU regulations, the new Advance range is also UKCA-marked in compliance with UK regulations on construction products.

British Steel said it started manufacturing weathering steel structural sections just over a year ago. Self-protecting, durable and attractive, weathering steel is said to be ideal for a range of outdoor structures in exposed locations including bridges, buildings and catenary gantries on railway lines.

Riverside development expands with steel-framed offices

Occupying the former Vaux brewery site, Riverside Sunderland is a new mixed-use scheme breathing new life into the city centre.

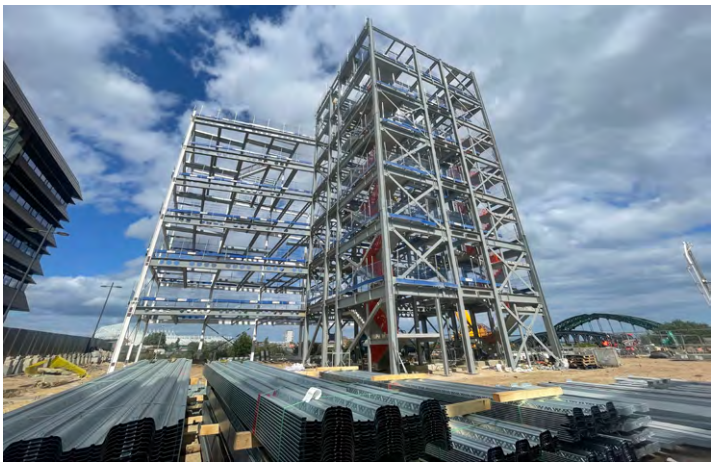
Located on the south bank of the River Wear, the development is already home to the city's new steel-framed Civic Hall (see NSC September 2020), while other planned projects include an eye hospital, library hub and a multi-storey car park.

Currently under construction are two office blocks known as Maker and Faber. The steel-framed buildings, which have six storeys and five storeys respectively, will together create 13,900m² of prime office space.

Working on behalf of Sir Robert McAlpine, Elland Steel Structures is fabricating, supplying and erecting 1,600t of steelwork for the buildings.

The scheme is being developed by Landid and its Managing Director, James Silver, said: "Riverside Sunderland is a world-class urban quarter, and a place that will have a transformational impact on the wider city centre. We're enormously proud to be playing a part in this game-changing programme for Sunderland with two buildings that will add to the city's vibrant office market."

Maker and Faber are due to complete in 2024.



Steel forms major Midlands logistics spaces

Steelwork erection has been completed on three warehouses at the Coventry Logistics Park, a development that forms part of the UK's leading distribution location, which is also known as the Golden Triangle.

Working on behalf of Glencar Construction, Caunton Engineering designed, fabricated, supplied and erected 2,000t of steelwork for the scheme.

Being developed by Bericote Properties and designed by architects Corstorphine & Wright, the three speculative warehouses will provide 44,900m², 23,300m² and 4,300m² of floor space respectively.

Reaching an eaves height of 15m, each of the warehouses include integrated Grade A offices, while the largest unit also includes attached hub offices.

Covering an area of 42-acres, the Coventry Logistics Park is located close to the M6 and M69 motorways.

NEWS IN BRIEF

Kirklees Council has revealed plans to redevelop Huddersfield town centre with a £200M Cultural Heart as part of its ten-year vision. The scheme will include the refurbishment of the town's Queensgate Market and library to create a new piazza, and the construction of a food hall and a museum. Elsewhere on the site, the plans also include a new art gallery, a multi-purpose entertainment and conference venue and a multi-storey car park.

Developer **Inland Homes** has received planning permission for a multi-million-pound mixed-use scheme on the former Cavalry Barracks site in Hounslow, west London. Occupied by the Army since the 1790s, the former Ministry of Defence site will be redeveloped with offices, workspaces, leisure space and more than 1,500 homes. The planning application stipulated that no gas heating will be used on the site. Instead, solar panels and air-source heat pumps will provide heating and hot water.

MWD Healthcare (a partnership between Mace and Willmott Dixon) has been appointed to build a major facility at University Hospitals Plymouth in its first NHS ProCure23 win. Work on the new 17,000m² purpose-built Urgent and Emergency Care Centre at Derriford is planned to start in 2023. The facility will include state-of-the-art diagnostic equipment to support faster diagnosis, as well as new interventional radiology theatres and surgical theatres to be able to treat patients more quickly and improve patient outcomes.

Contractor **Tilbury Douglas** said formal planning approval has been granted for the new Catterick Integrated Care Campus, bringing construction of a brand-new health and care facility for the North Yorkshire a step closer. It will provide a range of healthcare services for Armed Forces personnel and their families based at Catterick Garrison and residents of the wider area.

Pharmaceuticals company, **Vectura** has been given planning permission for a new 10,000m² facility on the Bristol & Bath Science Park in south-west England. The state-of-the-art £58M building, which is anticipated to complete in 2025, is aiming to achieve a BREEAM 'Excellent' rating.

DEPUTY PRESIDENT'S COLUMN

Today, we all rely on computers, whether it's our basic pocket calculator, our mobile phone, or our home PC. But do we have the experience to know if these computers are giving us the right results?

In certain instances, we most certainly do. For example, if you tapped 13 x 13 into your calculator and it presented you with the answer 1234, then you would immediately know that this result was wrong and you may then decide to find that elusive pencil and paper and go back to the basics we were all taught at school.

Unfortunately, the same logic doesn't apply to more sophisticated computer programmes. Using these we can now analyse and design huge 3D structural frames, produce CAM data for automated manufacturing, tell us what thickness of fire protection to apply, or determine the capacity of large and complex (or even small and simple) steelwork connections.

So, should we be relieved or concerned?

Like the maths question above, we can sometimes test the computer results by using more traditional methods such as comparisons to full-scale tests. And if your workshop plant suddenly starts to drill holes in the wrong place then we can assess and fix the computer fault. We can even check the design results of simple computer outputs by comparison to existing (although likely conservative) design codes. But what if these design codes don't exist or require a level of interpretation given our increasing desire to design taller, longer, greener, and eye-catchingly iconic steelwork structures?

Is this when we turn to FEA and place our full trust in the computer programme? Or should we be turning back to more tried and trusted methods based around hand-calculations that are derived from the existing design codes that we understand and are more familiar? After all, we haven't made too many disastrous mistakes in the past.

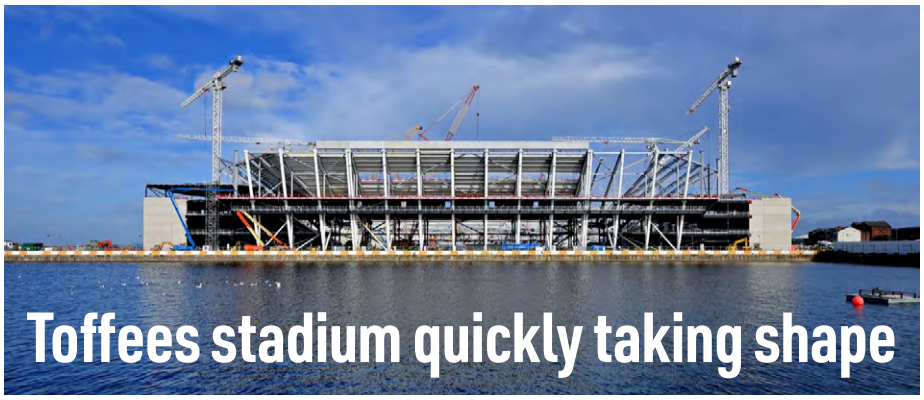
I am in no doubt that our industry's future lies with the use of computer analysis, but I strongly believe that, even though we have now been using computers for many years, we are still in a transition period and have to tread very carefully. After all, it's not just the computer output that we should be wary of, it's equally down to the computer input. So, as we move from an industry filled with engineers who once relied on a pencil and paper, to an industry filled with engineers who have grown up with nothing but computers, then we must ensure that we maintain the experience and knowledge that are needed within our combined ranks.

To clarify, I am not saying that computer-reliant engineers won't have the necessary experience and knowledge to design and build our iconic structures of the future, this will surely depend upon their qualifications and individual route to the design team. What I am saying is that we simply shouldn't accept what the computer throws out without having an approximation of what results were expected. For me it's simple, if you don't know what the ballpark answer should be then you shouldn't be pressing the button.

And speaking of ballparks, as sports arenas around the world become more adventurous and aesthetically challenging, they are the perfect example of where the computer analysis can help to create the unique combination of structural excellence and visual pleasure.

So, it seems that I'm not a complete computer non-believer after all.

Gary Simmons
BCSA Deputy President



Toffees stadium quickly taking shape

One of the Premier League's oldest stadiums is set to be vacated as Everton Football Club's (the Toffees) new ground is quickly rising up on the banks of the River Mersey.

Set to open in 2024, the Bramley-Moore Dock stadium will replace the club's Victorian-built Goodison Park with a new state-of-the-art ground with a 52,888 all-seater capacity.

Working on behalf of main contractor Laing O'Rourke, Severfield is fabricating, supplying and erecting the project's steelwork. Work is currently progressing on the four stands and terracing, while the installation of the cantilevering roofs is due to start before the end of the year.

Chief Stadium Development Officer, Colin Chong, said: "The certainty we originally achieved by advance pre-ordering has ensured there will be no delays to our critical activity and recently, along with senior project leaders from Laing O'Rourke, I had the pleasure of another visit to Severfield, where all remains firmly on track."

Plans revealed for £1.5bn Liverpool Street Station transformation

Developer Sellar, in partnership with Network Rail, has revealed its initial plans for an upgrade to Liverpool Street Station as part of a new sustainably developed scheme.

The vision for Liverpool Street Station is being developed in collaboration with Pritzker Prize-winning architectural practice Herzog & de Meuron, with the £1.5bn project aiming to create a world-class transport hub and landmark seven-day-a-week destination in its own right, delivering a new retail and leisure hub for visitors, passengers, and the local community.

Working sensitively with the station's heritage features is a key priority. The historic elements and façade of the Grade II listed Andaz hotel, which originally opened as the Great Eastern hotel in 1884, will be sensitively restored. The building will be sensitively and sustainably adapted so it connects to the concourse and creates a new public realm.

The plans also include a new mixed-use commercial development above the concourse comprising up to 10 floors of workspace.

The sustainable and wellness-focused office space is being designed to meet the current high and projected demand for modern Grade A space in the City of London that has strong environmental and wellness credentials and is flexible enough to accommodate future changes to working habits.

Plans ticked for Galashiels Academy

Planning permission has been granted for the construction of a state-of-the-art campus in Galashiels, marking an important next step in the replacement of the outdated existing school.

The local council said the decision will pave the way for further planning, design and development to be undertaken alongside further consultation with the local community to talk through the approved plans and the immediate next steps before construction begins.

Designed with involvement from the community, the campus will benefit the wider community providing an active landscape with opportunities for team sports, exercise classes, and routes for walking and running.

Councillor Leagh Douglas, Executive Member for Education & Lifelong Learning, said: "As well as offering major educational benefits, the new school

will also provide significant benefits to the wider community through improved social and sporting facilities which can be accessed by all."

Construction is scheduled to begin in Spring 2023 with the new facility to be constructed while the existing school remains operational, avoiding significant disruption for pupils. The entire development is due to be completed in 2025.

Go-ahead given for St Helens town centre redevelopment

The transformation of a large swathe of St Helens town centre has received the green light from St Helens Borough Council's planning committee.

Images have been released following the approval, which show new views of the proposed bus interchange transformation and how clear focal lines will be created to the impressive Parish Church, drawing visitors into the town centre, together with striking visuals of the new market hall which will be an anchor of the redevelopment.

The English Cities Fund (ECF) – a joint venture between developer Muse, Legal & General and Homes England – will now advance detailed designs for phase one of the masterplan, which will include high-spec sustainable office space, an internationally branded hotel, new family homes, alongside a new market hall, shops and landscaped public spaces. This is part of ECF's 20-year, borough-wide, strategic partnership with St Helens Borough Council.

Councillor David Baines, Leader of St Helens Borough Council, said: "Less than a year ago we asked the public what they thought of our plans for St Helens town centre and their overwhelming support for this project shows that this is the right plan. Gaining planning permission for this exciting first phase of development shows that, with thanks to our partnership with ECF, we are delivering on residents' wishes to see our town centre revitalised at the very earliest opportunity."

Principal contractor appointed for London's most sustainable office tower

Mace has been appointed principal contractor by developer Edge, in partnership with Goldman Sachs Asset Management and their funding partners, LPPI and the London Fund, for their flagship 'EDGE London Bridge' scheme, which aims to become London's most sustainable office tower.

Targeting both BREEAM 'Outstanding' and WELL Platinum certification, the 24,100m² development will provide 28 floors of state-of-the-art commercial office space, including a large shared green roof terrace to promote occupier wellbeing, as well as a new adjacent public park.

The building will provide a healthy environment for occupiers by harnessing natural ventilation through underfloor air supply and maximising natural light through floor-to-ceiling windows.

EDGE London Bridge has a targeted regulated energy consumption of less than 23 kWh/m² which aligns with the RIBA 2030 Climate Challenge operational intensity targets for new-build offices.

The scheme is located on St Thomas Street - near London's vibrant South Bank - and is the latest project led by Mace in the London Bridge Quarter area, with the company having built the iconic Shard and Shard Place.

Construction will begin in January 2023, with completion expected in early 2026.

Green light for Barrow learning campus

Forming part of a wider educational programme, the Government has confirmed it will fund a new University of Cumbria campus in the centre of the Barrow-in-Furness.

Forming part of the wider Barrow Learning Quarter (BLQ), the project is a partnership between the University of Cumbria, Furness College, Barrow Borough Council, the town's most important employer, BAE Systems, as well as other local businesses.

BLQ will enhance progression into, and participation in, higher education and with funding now secured, plans for construction are now ongoing.

University of Cumbria Vice Chancellor, Professor Julie Mennell said: "A new learning quarter in Barrow will see the creation of a new university campus at its heart and help transform the town for future generations.

"This is a once-in-a-generation opportunity to transform education in Barrow."

The project is expected to be complete by mid-2024.

Diary

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

Thu 17 & Tue 22 November 2022
Floor Vibrations
Online
This course introduces the topic of vibration and the analysis of vibrations in the context of buildings excited by the footfall of occupants. The fundamental principles of vibration are discussed before moving on to examine the guidance provided in SCI publication "P354 – *Design of Floors for Vibration: A New Approach*". A pdf copy of this book will be provided to each delegate.

Tue 6, Wed 7, Wed 14, & Thu 15 December 2022
Portal Frame Design Course
Online
This course aims to provide in-depth coverage of the major issues surrounding the analysis, design and (crucially) the detailing of portal frames. The course covers frame design to BS EN 1993-1-1.

Tue 13 December 2022
Hollow Sections: Connections (Part 2)
Webinar, SCI/BCSA Members only
This webinar will cover the connections of hollow sections – including bolted options and the resistance rules for welded joints in EN 1993-1-8. Hollow sections are structurally efficient, and are often preferred when steelwork with architectural appeal is exposed. Although considered to be more expensive than open sections, there are many circumstances when hollow sections should be specified.

Construction partner achieving net zero aims

Barrett Steel has continuously invested in best-in-class service for its customers by acquiring the latest processing technologies and thereby strengthening its position as the UK's leading steel stockholder.

Long-established, as a pivotal partner to the construction industry, Barrett Steel is a 6th generation family business that has always prided itself on being a versatile steel stockholder, ever since the business began with Henry Barrett in Bradford back in 1866.

This year, has seen an exciting period of growth for the business with the building of a new 18,500m² dedicated distribution centre at Groveport in Scunthorpe.

An exciting element of the construction of the new Barrett Steel Distribution Centre is the fact that it is the first building in the UK to be constructed with XCarb steel supplied by ArcelorMittal.

XCarb is recycled and renewably produced (R&RP) with an upfront carbon (A1-A3) of 333 kgCO_2e/t. The XCarb steel used on the project is made using 100% recycled content and 100% renewable energy.

The newly constructed facility utilises 650t of XCarb steel for its frame, giving an embodied carbon of 216.45t CO_2e, which compared to blast furnace produced material offers an estimated 1408.55t CO_2 saving.

In addition to this, the centre has also been optimised for future installation of photovoltaic panels, as well as the lighting in the warehouse utilising energy efficient LED luminaires. Once stocked, the new distribution hub will hold 20,000 tonnes of structural steel, taking Barrett's stock holding at the Groveport site to over 50,000 tonnes of steel that can be easily accessed and distributed across the UK.

Guy Barrett, Group Purchasing Director says: "This new facility will increase our capacity and ability to offer a just-in-time solution for steel fabricators across the UK.

"Being able to deliver the project using a low embodied carbon structural steel frame, the first of its kind in the UK, not only demonstrates our commitment to our own net zero goals but also showcases a tangible solution to the questions being raised by clients and contractors in the industry."

Barrett Steel were the first steel stockholder in the UK to join The Climate Group's #SteelZero initiative, and in doing this joined key steel industry partners in a commitment to procure 100% net zero steel by 2050.

In addition to this, the group also announced its strategy to be a net zero carbon business by 2035. The building of the Groveport site in XCarb highlights the Group's commitment to the environment and its net zero carbon goals.

These goals can be seen in action across the

At Barrett Steel, we work seamlessly with our customers to not only ensure stock availability at short notice but to ensure, where we can, that our investments in advanced processing can assist our customers to hit ever tightened and constrained schedules."

New investments have been made at Barrett Steel's Bradford facility.

The company's new Groveport facility will soon be completed.

Barrett Steel and PD Ports staff at the new Groveport facility.

business, from the complete transfer to LED lighting, and the sustained investment in an electric material handling fleet with the aim of being 100% electric by 2030.

In addition to the new facility in Scunthorpe, this year has also seen Barrett Steel Shoreham (Barrett Steel's own dedicated port facility) grow its stock holding to a minimum of 15,000 tonnes. While in the north of the UK, the new Barrett Steel Processing Centre at Scunthorpe (previously Omega) now carries an additional 2,500 tonnes of stock on site for a reactive 24/48 hour processed steel service. Combined, these locations now offer unrivalled quick turnaround service and stock availability to support the construction industry across the UK market.

Barrett Steel's central processing and distribution hubs were not the only areas to see substantial investment in 2022. Both the Newbridge site (Barrett Steel Scotland) and the Dartford site near London (Barrett Steel Dartford) have seen investment in two new structural saw lines this year.

Its historic Bradford headquarters has also seen substantial upgrades this year with the installation of a new fully automated shot blast and preservation line that features a Ficep Valiant Saw Drill Line and a K115 Auto CNC Band Saw Line. This line was part of a recent £3M investment to complement existing cut/drill lines and processing facilities within the group.

For more than 20 years, Barrett Steel has been using 2D and 3D software to process parts for the construction sector and the company is now utilising this experience to advise on larger, heavier, and more challenging fabrication projects, thanks to continued investment.

Barrett Steel's dedicated plate profiling centre has increased its capacity by 50% this year alone, while the Centre of Processing Excellence for tubular products in Dudley (Barrett Steel Tubes) has also expanded its 3D processed offering with the additions of an LT8 as well as LT7 Fibre Laser that will be installed by the end of the year.

Group Managing Director James Barrett comments: "Over 150 years of working hand-in-hand with the construction industry has enabled us to be in tune with the challenges our customers are facing daily.

"At Barrett Steel, we work seamlessly with our customers to not only ensure stock availability at short notice but to ensure, where we can, that our investments in advanced processing can assist our customers to hit ever tightened and constrained schedules."

The experience entwined in the Barrett Steel operation means not only does the group have the scope to supply a wide variety of stock and processed products, but additionally its long-established supply chain relationships pass on an enormous number of benefits to customers.

Whether it's sourcing different types of stock, such as non-standard specification material, or by reducing costs for end-users thanks to its single-source operation, its supply chain allows reduction in costs and transport requirements across the board.

This level of knowledge and understanding of the sectors they are servicing allows Barrett Steel to not only create tailored solution-based offerings to assist its customers with the ever-changing challenges they face, but backs that up with the investment in stock, transport and the processing capabilities required to cater perfectly to the construction industry for many generations to come. ■

Steelwork branches out

The centrepiece for a spectacular city centre garden event was five fully-demountable and reusable steel-framed tree structures.

Once erected, the steelwork trunks and branches were clad with mesh fabric.

FACT FILE
PoliNations, Birmingham
Concept design team: **Trigger, Carl Robertshaw Design, THISS Studio**
Production team: **Dock Street Events, Format Engineers**
Steelwork contractor: **S H Structures**
Steel tonnage: **40t**

For two weeks in September, Birmingham city centre hosted a pop-up garden featuring hundreds of plants and flowers, and five giant architectural steel trees that towered over the display.

Known as PoliNations, the garden was commissioned as part of UNBOXED: Creativity in the UK (a nationwide celebration of creativity that took place from March to October) and also presented as part of the Birmingham 2022 Festival.

PoliNations was produced and led by the Bristol based arts organisation Trigger, and a collective of creatives and experts in horticulture, arts, science, and architecture.

The end result was that Victoria Square was transformed into an urban oasis, hosting free events, workshops and performances including live music and dance.

The inspiration for the garden was to inform and educate people about the origins of well-known plants, highlighting the fact that around 80% of plants found in UK city gardens came from overseas.

"The idea was to create a forest within the garden display and the five steel trees did just that," says Carl Robertshaw, who was part of the concept team. "People would generally look at the plants on the ground, but the trees had that Wow-factor and made visitors look up."

During the initial design process a number of options were investigated, but steelwork was chosen as the material for the tree frames as it offered the most cost-effective and sustainable choice.

"We wanted the trees to be as lightweight as possible, but also robust enough to withstand quite high wind loadings, so steelwork was the best option," explains Dock Street Events' Technical Director Chris Clay.

Reusability was another key requirement as the concept design team always envisaged the tree structures being used again at future events, either individually or as a group of five. To fulfil this precondition, the structures have a series of bolted connections that allows them to be erected and disassembled numerous times.

"Four of the trees are 11m-tall and identical, while the fifth, known as the mother tree is 12m-tall and has three extra extension trunk members. Other than that, all the steelwork is the same and theoretically the steelwork is inter-changeable and could fit any of the trees," explains S H Structures (SHS) Project Manager Rob Binks.

As the trees were, and probably will be again in the future, erected on a public space, no foundations could be installed. Consequently, they were founded and supported on triangular steel base plates, 6m long on each side, that incorporate approximately 16t of concrete ballast each.

The trees will be re-erected at future events.

"We wanted the trees to be as lightweight as possible, but also robust enough to withstand quite high wind loadings, so steelwork was the best option."

Bolted on to the base plates, the tree steelwork forms a cocktail glass shape, consisting of three complex twisting trunks that diverge into six branches near the top, which in turn support an uppermost 8m-diameter ring.

The twisting shape of three trunks is formed with facetted CHS members, using 355mm-diameter sections for the lowest parts. The CHS members, which are generally up to 3m long, sequentially decrease in size as they go up the structure, with the branches formed with 219mm-diameter sections. Adding some stability to the structures, the trunks are tied together at three points within their height.

Supported by the six branches, the ring creates the uppermost canopy part of each tree structure. The ring is also fabricated from tubular steelwork and is formed with six 219mm-diameter CHS sections.

Highlighting the ease with which the trees can be erected and then taken down, it took the erection team approximately one week to install trees and the same amount of time to disassemble them at the end of the two-week event.

Getting the trees erected quickly was an important requirement, as after each structure was fully assembled, a whole range of follow-on trades were waiting to start their work.

Once handed over, the tree steelwork had a series of lights fixed to it and then they were clad with a mesh fabric. The lights shine through the cladding during night-time performances, while the mesh also hides the bolted connections and gives the structures a more tree-like appearance.

Meanwhile, at the top of the structures, the canopy ring works very hard as numerous items are hung from it. This includes five pringle-shaped aluminium rings that are bound together with the same mesh cladding to form framework's that resemble foliage.

The canopy ring also supports speakers for the music part of the event's sound and light shows.

For peace of mind and before arriving on site, steelwork contractor S H Structures trial erected each tree to make sure they fitted together perfectly. A further trial, using one tree, was then carried out using all of the other elements, such as the aluminium rings and cladding.

All of the trees are now packed away in containers, awaiting their next event, when SHS will be called upon to use its expertise to erect and take them down again.

Summing up, Format Engineers Director James Solly says: "Structural steel was the logical choice as it combined the strength needed to support the huge feature canopies under high winds, while achieving the slimness of profile needed to accentuate the tall slender tree-like structures.

"Alternative materials were considered but rejected in favour of steel as this had good dynamic performance, ease of erection and low embodied energy via the extensive use of repurposed section profiles sourced from Cleveland Steel & Tubes." ■


Steelwork was the only viable material for intricate design of the tree structures.

Visualisation of how the completed office block will look.

Steel provides office flexibility

A mixed-use hub within the nearly-complete King's Cross development, has used a steel-framed solution for its commercial office element.

Provisionally known as Building R8, McLaren Construction is currently building one of the last significant commercial and residential buildings on the 67-acre King's Cross estate in central London.

The building comprises two 13-storey blocks that are sat atop, and linked by, a two-storey podium that accommodates a landscaped roof garden for users of both buildings. The eastern block is a concrete residential building with 72 social rented apartments, while the western block is a steel-framed structure containing 16,400m² of office and retail space.

Building R8 is positioned in the middle of one of the largest regeneration schemes in Europe. Over the last 20 years, construction work has radically changed this former industrial site, which lies directly behind King's Cross and St Pancras stations, into a vibrant business, dining, shopping and residential neighbourhood.

Once complete, the King's Cross neighbourhood will include 50 new buildings, 1,750 new homes, 20 new streets, 26 acres of public realm and even has its own new postcode – London N1C.

On a plot previously used as a holding area for the many buildings that have been built on the development in recent times, McLaren started on site in July 2021.

The early part of the programme included the excavation of a basement that covers the entire plot, the installation of piled foundations and casting the concrete sub-structure.

As the scheme is utilising a hybrid method for its structural framing design, the concrete works also included the construction of a two-storey podium and four cores for the steel-framed west tower.

The podium incorporates a ground floor reception below the office tower and retail units, while the first floor will accommodate a series of small business units.

"The steel frame springs off of the podium and so the steel erection programme could only begin once this had been constructed," explains McLaren Construction Package Manager Michael Moore.

"We then had both towers being built simultaneously, with the steelwork and concrete teams using the site's three tower cranes."

Explaining the reasoning behind the choice of a hybrid design, Arup Senior Structural Engineer Gordon Clannachan says:

"We had to be conscious of the self-weight of the structural frame and ground settlements given the proximity of the shallow Network Rail tunnels to King's Cross Station.

"The steel frame for the commercial office was a lightweight solution that also provided flexibility in the office floor layouts and future tenant adaptation."

The steelwork also provides greater flexibility to incorporate "soft-spots" for future tenant staircases between floors and for the potential introduction of future lifts should the use of the top floor change.

The overall project design, by architect Piercy & Co, is said to draw inspiration from industrial warehouses, with exposed finishes and spacious high ceilings.

This design ethos includes the steelwork in the office block, where all of the internal columns and cellular beams, as well as soffit and services, will be left exposed to create the desired industrial-look. To this end, there is no provision for a suspended ceiling.

Lateral stability for the steel frame is provided by the building's four reinforced concrete cores (two stair cores and two lift cores). The podium structure also acts as a diaphragm to share lateral load between the two buildings.

Overall, the steel frame is typically based

FACT FILE
King's Cross Building R8
Developer: **Argent**
Architect: **Piercy & Co**
Main contractor: **McLaren Construction**
Structural engineer: **Arup**
Steelwork contractor: **Severfield**
Steel tonnage: **1,200t**

"We had to be conscious of the self-weight of the structural frame and ground settlements given the proximity of the shallow Network Rail tunnels to King's Cross Station. The steel frame for the commercial office was a lightweight solution..."

around a 7.5m × 7.5m column grid pattern, with the spacing increasing to 7.5m × 9.5m adjacent to the cores. This is said to provide the scheme with the desired flexible floorplates, as there is just one internal line of columns.

All of the steel columns are positioned above a corresponding concrete member in the podium below that transfers the loads to the foundations. Steel column base plates bolt to reinforcement bars cast into the reinforced concrete columns.

"This detail provides continuity for the vertical ties as part of the project design robustness requirements," says Mr Clannachan.

The only exception to this column configuration is along the western elevation where the ground floor main entrance is positioned.

Here, one of the ground and first floor concrete columns is omitted to create a wider entrance area. However, the steel-framed part of the structure above still has a column in this area, so this member is connected to a raking section that extends from second floor up to the underside of the fourth floor. Loads that would have ordinarily gone downwards into the podium, are transferred by the raking column into the internal steelwork and then to the cores.

During the early construction sequence, a temporary ground and first floor steel column was connected to the underside of the second-floor member and stayed in place the until raking member and the majority of the upper steelwork was installed.

The western elevation also features a saw-tooth façade design, created by the steel edge beams being slightly offset between the perimeter columns, to form the architectural pattern.

Sustainability is at the heart of this project and the entire King's Cross development. Consequently, this latest building will be connected to the onsite Energy Centre, which supplies zero carbon hot water and heating via one of the largest district heating networks in the UK.

Aiming to achieve a BREEAM 'Excellent' rating, Building R8 is scheduled for completion in 2024. ■

The western office façade features a saw-tooth design, created with offset edge beams that sit between the main columns.

A podium column is omitted to create the main entrance and so a raking steel member, positioned above, transfers loads back into the main frame and the core.

The uppermost office floor is set back to form an outdoor terrace.

Steel is just the ticket

Steelwork was chosen for its speed of construction and its ability to create column-free spans.

A steel-framed solution, featuring exposed CHS columns, is ensuring a new bus station will arrive on time in Halifax.

Aimed at improving local connectivity and capacity, a multi-million-pound scheme is underway to redevelop Halifax Bus Station.

More than 15,000 passengers use the bus station every day and the project will ensure they have improved facilities, fit for the 21st Century, which will include a range of environmentally-friendly features such as measures to enable the future introduction of electric bus charging points, bike parking, solar panels, and a living roof.

Cllr Susan Hinchcliffe, Chair of the West Yorkshire Combined Authority's Transport Committee and Leader of Bradford Council, said: "We have been working closely with bus operators and our partners at Calderdale Council to minimise disruption and ensure people can continue to access Halifax town centre by public transport.

"It is more important than ever that we continue to invest in a modern, accessible transport network, which supports economic growth by connecting more people with job, training and education opportunities."

The redevelopment incorporates two listed structures.

The new bus station is a Y-shaped single-storey building topped with a cranked mono-pitched roof.

Initially a number of framing solutions were looked at, but the final design choice was for a steel-framed structure.

"Steel has enabled the creation of large open spans to form a flowing and flexible space," says Roscoe Project Engineer Jack Calvert.

"Section depths were able to be designed to be relatively slim, helping to achieve the architectural vision of a light open space, while also keeping the overall weight of the frame to a minimum to produce an efficient foundation solution despite some challenging ground conditions."

The steel frame is founded on reinforced concrete pad footings, which are relatively shallow and bear on to vibro-improved earth. The entire site underwent a ground improvement programme, once a bulk excavation had been completed. This work reduced the steepness of the plot's sloping topography, allowing the new facility to have fewer steps and be more accessible.

Coupled with the introduction of retaining walls, the eastern side of the site is now only 2.5m lower than the western end, compared to the 11m difference the plot previously had.

The site has been occupied by the existing bus station since 1989, and the redevelopment involves main contractor Willmott Dixon working in phases in order to keep part of the site open for bus services throughout the construction programme.

As well as the challenge of working in a busy town centre, the project team are having to manage a

Exposed steel CHS columns will be an architectural feature of the completed bus station.

FACT FILE
Halifax Bus Station redevelopment
Client: **West Yorkshire Combined Authority**
Architect: **SGP**
Main contractor: **Willmott Dixon Construction**
Structural engineer: **Roscoe**
Steelwork contractor: **Elland Steel Structures**
Steel tonnage: **192t**

scheme that shares a site and is adjacent to a 'live' transport hub.

"We've installed a temporary bus station on the eastern side of the site, while we work on the new facility at the western end, where the existing buildings have been demolished," explains Willmott Dixon Construction Manager Colin Tilley.

'Once the new facility is complete next year, we will hand over the current site and start work on the eastern side, by removing the temporary bus station and constructing the permanent works within this area."

Using one mobile crane, locally-based steelwork contractor Elland Steel Structures (ESS), erected the entire steel frame in five weeks.

The steel frame forms two concourse wings, 72.5m-long and 70m-long respectively, as well as an ancillary building that occupies the internal wedge-shaped area at the top of the structure's Y-shape.

The concourse's primary columns are 323mm-diameter circular hollow sections (CHS), which have been used as they are aesthetically-pleasing and will remain exposed in the completed project. CHS's are also considered to be a safer option for circulation spaces as they have no corners, compared to square or rectangular sections, and passengers knocking into them are less likely to injure themselves.

Structural engineer Roscoe worked closely with ESS to detail the moment connections between the CHS columns and main rafters that provide much of the stability to the structural frame.

Stability is provided by a series of portal frames along the spine of the concourses, with CHS columns, supporting rafters to form 9m-wide open-plan concourses.

"This allowed structure-free access routes along the full length of the bus station," adds Mr Calvert. "Longitudinally, a hybrid mix of moment frames and feature stainless steel bracing will be provided as it works best with access routes and the glazed building façade."

On the external elevations, the concourse roof rafters form 4m-deep cantilevers to create canopies. The rafters are typically 457UBs, which taper down to 275mm-deep sections at the tip. This facilitates the architectural vision of the canopy soffit tapering down to a slim edge profile.

The rafters also support a lightweight roof that will, in turn, support the project's green roof, which will include a mix of sedum and wildflowers.

Due to site's slope, the green roof will be visible from road level at the town centre western end, helping the building to blend into its surrounding, as well as providing ecological benefits.

Complementing the new steel-framed facility, the scheme also incorporates a couple of listed historical structures. Forming a new entrance to the bus station, the two-storey 19th Century Sion Chapel is being renovated to create a bus station entrance with retail outlets. Adjacent to the ancillary building within the steel frame, the two structures remain structurally-independent, but will be joined by a glazed canopy.

An old Sunday school façade is to remain as part of the new scheme and will receive some small element of renovations as it will remain part of the site's eastern boundary.

The redevelopment of Halifax Bus Station is due to complete in summer 2023. ■

"Steel has enabled the creation of large open spans to form a flowing and flexible space."

The roof rafters cantilever by 4m to create canopies to shelter passengers as they board and disembark buses.

Designed for the future

A steel-framed solution has proven to be the ideal choice for a new advanced manufacturing plant in Rotherham.

Described as a 'factory of the future', Rotherham-based AESSEAL, a global supplier and manufacturer of products including advanced seals and water management equipment, is currently constructing a new steel-framed premises.

When completed in January 2023, the site, which extends the company's existing headquarters facility, will house one of the world's most advanced and environmentally-friendly precision-engineering factories.

Alongside the new 16,250m² factory building, which is being constructed to the highest environmental standards, the existing plant is also being updated and refurbished as part of the overall scheme. In total, the entire project will almost double the manufacturing company's capacity.

Chris Rea, Managing Director of the parent group AES Engineering says: "This investment gives us room for expansion and paves the way for an additional £20M of investment in the Rotherham area over the next five to ten years depending on the continued growth of our global customer base."

As well as the construction of the steel-framed factory, the 10-acre also site includes a 'Tree Walk' for educational and leisure purposes with a wetlands area, and accommodation for bees, hedgehogs and other wildlife.

Project spending includes £5.8M of 'green-only' investment, such as solar panels, battery storage, and other energy-saving or environmental measures.

Designed by Sheffield-based architects, Race Cottam Associates (RCA), the new building creates an advanced precision engineering factory together with office space, new entrance, statement reception and café. RCA is targeting a BREEAM 'Excellent' rating for the building, which is designed to store its own energy and be all-electric.

"The initial concept was to provide a new manufacturing facility capable of supporting state-of-the-art robotic machines while simultaneously creating new workspace and a statement entrance for AESSEAL's international clients and colleagues," explains RCA's architect and project lead, Mark Eden.

"In addition, part of the brief was to create an open-plan production area that would not only

The new factory expansion will allow the company to install state-of-the-art manufacturing equipment.

Visualisation of the completed factory. Race Cottam Associates

FACT FILE
AESSEAL factory, Rotherham
Main client: **AESSEAL**
Architect: **Race Cottam Associates**
Main contractor: **BDB Design Build**
Structural engineer: **Eastwood Consulting Engineers**
Steelwork contractor: **James Killelea**
Steel tonnage: **330t**

allow for internal reconfigurations as the business grows, but also provide significant viewing platforms for staff and visitors.

"Our design integrates AESSEAL's original facility via a two storey, linked structure which incorporates the new entrance. Large areas of glazing ensure full exposure of the precision engineering manufacturing and world-leading robotics."

The new L-shaped factory has been designed as a steel portal frame, with twin 20m-wide spans in the main area and minimal internal columns throughout. The horizontal part of the L-shape is divided in half and also includes a two-storey office.

"In order to create the size and column-free space required by the client, steelwork was the only option that could form the long spans within the building," adds Mr Eden.

The portal frame has a hit-and-miss central column configuration, allowing the building to have maximum open-plan space. The columns that support the ridge of the pitched roof are 10m-high, while the perimeter columns – set at 6.5m centres – are 8.1m-high.

For the majority of its erection programme, steelwork contractor James Killelea used a single mobile crane, but for the assembly and lifting of the roof rafters, two mobile cranes were required.

The 40m-long roof rafters were brought to site in two pieces, which were then assembled

▸20

Twin 20m-wide spans, are incorporated into the portal-framed L-shaped structure.

"The project is a symbol of our commitment to keep pushing beyond net zero and encourage our customers and suppliers to do the same."

A large glazed frontage will allow people a view of the manufacturing processes.

▸19

into a complete section before being lifted into position.

One of the final elements of the steel frame to be erected was the two-storey office area. The upper floor of this part of the factory is formed with steel beams, supporting metal decking and concrete topping to create a composite flooring solution.

A high-end car showroom aesthetic is part of the scheme's design and to this end, much of the steel frame will be left exposed within the completed project, while a glazed gable will be accommodated at one end of the building. This large window will afford people a view into the building to observe the state-of-the-art manufacturing processes.

Summing up, Mr Rea says the 'factory of the future' is a sign of commitment, not just to the Rotherham area, but also to the continuing contribution of precision engineering and reliability services to a greener future for the planet.

"The project is also a symbol of our commitment to keep pushing beyond net zero and encourage our customers and suppliers to do the same."

AESSEAL's new 'factory of the future', which will bring the company's total investment in Rotherham to £61M, is expected to complete in May 2023. ■

Two mobile cranes were used by James Killelea to install the roof rafters.

One of the steel frame's final sections is lifted into place.

Portal frames

Portal frames are so widely used that one might expect that they are simple structures. Not so, suggests David Brown of the SCI – their apparent simplicity hides a host of structural behaviours requiring thoughtful design.

The steel frame for AESSEAL might look like any other portal – rightly used throughout the UK as the appropriate solution for single storey structures. The familiar sight of this type of frame belies the complex behaviour and the need for thoughtful design and detailing. A correctly analysed frame can be compromised by the omission or incorrect position of secondary members. The restraints to the inside flanges of the rafters and columns are of critical importance in providing stability to the members – in all loadcases. These small details have a significance which far outweighs their size.

One part of the AESSEAL facility is a propped portal with hit and miss columns on the ridge line, adding complexity to the in-plane stability of the frames, which though different in form, must work together as one in the completed structure. The large areas of glazing pose challenges for the preferred location of vertical bracing. Where vertical bracing is not possible (and the architect cannot be persuaded to change) continuous frames in one or more bays may be used to provide stability. In this case, the columns are normally fabricated as cruciform members, with the flange of one member welded to the web of the main column.

The structure perpendicular to the propped spans is a standard (unpropped) portal. One important consideration with this arrangement is the transition of vertical deflections between the propped frames and the unpropped.

A further challenge at the AESSEAL facility is the valleys formed between the two parts of the structure. Here, snow may drift as it is blown from other parts of the roof. This is an accidental combination of actions, verified with partial factors set to 1.0. Although this accidental case may have no impact on the sizing of the main members, it is likely to mean that the purlin spacing must be reduced, or the resistance increased by specifying a thicker section. Perpendicular roof slopes meeting at a valley demand very careful detailing – before computer aided drawing was common, the purlin connections to the valley member and the connections of the valley member to the supports were a complex three-dimensional challenge.

The ASSEAL facility may look straightforward, but has plenty of design challenges and detailing issues to manage. SCI publication P399 contains comprehensive guidance on the design of portal frames to the Eurocodes. ■

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Demand is high for prime office accomodation, and Building 6 has been leased to the Student Loans Company.

Clydeside regeneration

One of the final elements of a prime city centre regeneration project on the banks of the River Clyde is quickly taking shape with the aid of steel construction.

Glasgow's commercial sector is currently bouncing back after the COVID-19 pandemic with a number of projects either under construction or expected to start in the near future.

One of the largest ongoing schemes is Buchanan Wharf, located on the south bank of the River Clyde between the King George V Bridge and the Tradeston Bridge (Squiggly Bridge).

This £500M development has regenerated a large brownfield site opposite central Glasgow with a mix of commercial office blocks, residential buildings and public amenity spaces.

One of the final elements of this scheme is a six-storey commercial block known as Building 6. The steel-framed structure will provide over 6,000m² of Grade A office space and has been leased to the Student Loans Company (SLC) as its new headquarters.

SLC Chief Executive Paula Sussex, said: "This is a fantastic and timely opportunity for us as we continue to transform the company to become a modern, responsive and sustainable organisation. This purpose-built office at Buchanan Wharf allows SLC to shape a new office experience that optimises opportunities for collaboration, supports future ways of working, enabling us to deliver an outstanding experience to our customers across the UK."

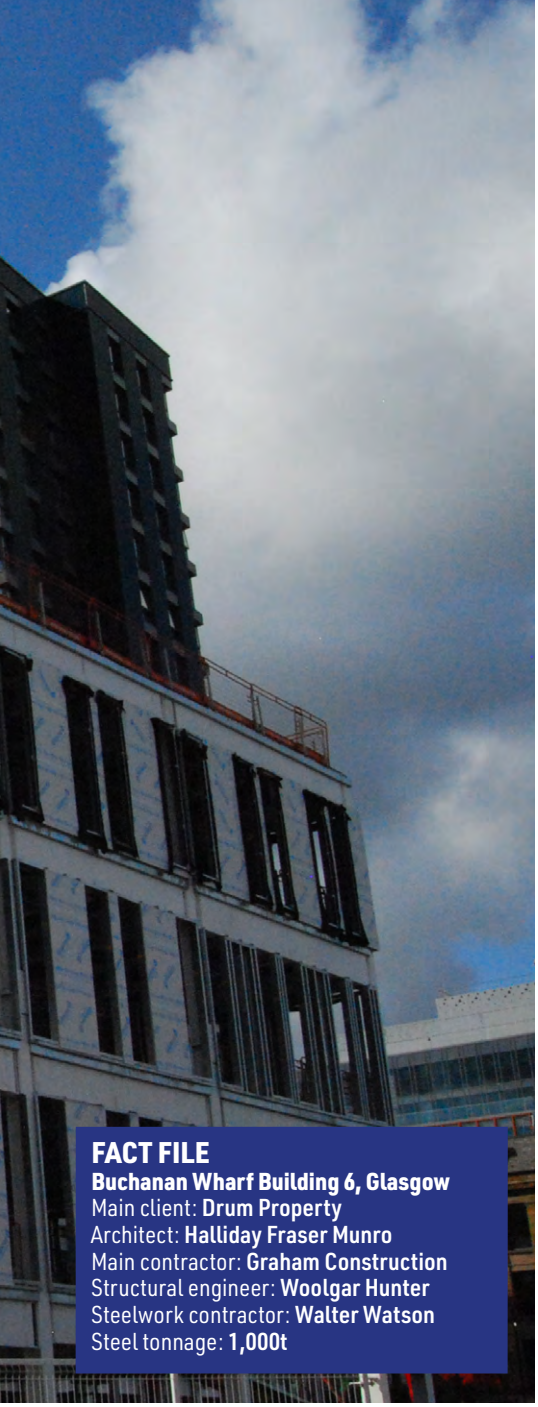
The new building has been designed to meet future climate change goals and meets the UK Green Building Council 2025 to 2030 interim energy performance target for offices.

To achieve these sustainable goals and create an office block with the column-free floorplates that will allow future flexibility, a steel-framed solution was chosen for the building.

"Steelwork enabled a clear span solution providing a column-free floorplate. This maximises the value and adaptability of the space for the client. Furthermore, the structural grid used enabled an efficient piece count, generally assisting with the speed of construction of the frame," says Woolgar Hunter Project Engineer Sean Baird.

"Embodied carbon was also a factor on this project and Woolgar Hunter undertook an analysis of various frame options and the chosen steel frame solution represented the most economic solution, minimising embodied carbon."

Main contractor Graham Construction started on site with Building 6 earlier this year. Its initial



FACT FILE
Buchanan Wharf Building 6, Glasgow
Main client: **Drum Property**
Architect: **Halliday Fraser Munro**
Main contractor: **Graham Construction**
Structural engineer: **Woolgar Hunter**
Steelwork contractor: **Walter Watson**
Steel tonnage: **1,000t**

works included the installation of piled foundations that are up to 30m-deep. Once complete, a centrally-positioned slip-formed concrete core was constructed, along with the project's ground floor slab.

The completed slab provided steelwork contractor Walter Watson with a conveniently clean and flat surface for its MEWPs to be positioned on during the erection programme.

This is said to have contributed to a faster and easier steelwork programme that was completed in just six weeks.

As the project is one of the last jobs on the development, the site is constrained with very little space around the building's footprint for materials to be stored or for cranes to be positioned.

Helpfully, Graham Construction is also currently constructing the adjacent Building 5, which is a high-rise residential scheme. As the two sites are next to each other, their boundary lines have been merged in places in order to allow each site some extra space for storage.

Due to the lack of space, finding locations for the two mobile cranes needed for the steel erection was also challenging.

Graham Construction had to use a GPS system in order to locate two optimum spots for the cranes, both of which were just inside the site's boundary.

Working with two erection gangs, each with their own crane, Walter Watson erected the steel frame in four phases. Each phase was erected to the full-height of the building, with the main columns spliced at second and fourth floor levels.

A modern industrial-looking interior is part of the architectural vision for this project and, to that end, most of the internal steelwork will be left exposed within the completed structure.

This includes the internal beams, which radiate outwards from the core to the perimeter columns, creating the desired column-free spans of up to 12m. All of the internal beams are cellular members with 400mm-diameter holes, spaced at 900mm centres that accommodate the building's services, which will also be left exposed.

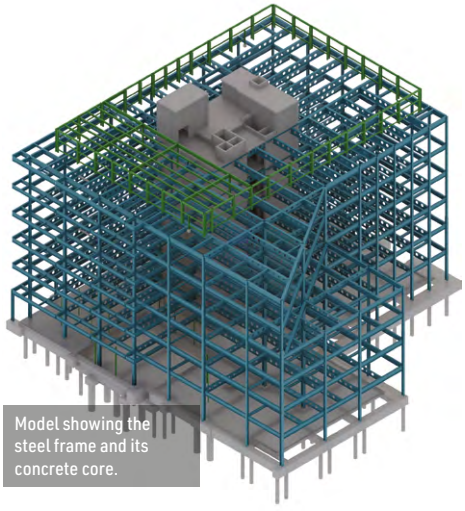
The beams are typically UB 686 × 254 × 140 sections, alongside four fabricated plate girders on each level that form the change in span direction in each corner of the structure.

Adding some outdoor breakout or entertaining space, the building partially steps back at fourth floor level to create a triangular terrace on the north-eastern elevation.

Although Building 6 has for the most part column-free floorplates, the requirement to support the outdoor terrace means the structure has one internal column that is positioned within the four lowest floors, central to the step back.

The roof of the structure, which will accommodate the building's plant within an enclosed secondary steel structure, is typically formed with UB 838 × 292 × 226 sections that have a fabricated tapered top flange forming a 1:80 fall on the roof to facilitate drainage.

Building 6 is due to complete in Spring 2023. ■



Model showing the steel frame and its concrete core.

Buchanan Wharf – the story so far

Work on the Buchanan Wharf development began in 2018 with the construction of Buildings 1 and 2. These two steel-framed commercial structures share a common basement and are seven-storeys and 10-storeys high respectively. They were built my McLaughlin & Harvey, with BHC fabricating, supplying and erecting 4,820t of steelwork for the buildings.

This was quickly followed by Building 3 (pictured), which is now the Northern Europe HQ for Barclays Bank. The 1,200t of steelwork for this four-storey structure was fabricated, supplied and erected by Walter Watson, working on behalf of Graham Construction.

Building 4 is the scheme's energy centre, while Building 5, consists of two concrete-framed 19-storey residential towers. ■

The steel frame was completed earlier this Autumn.

Composite slabs with in-plane loading

Although composite slabs are normally designed as one-way spanning and subject to (out-of-plane) gravity loading only, they often need to do more than this. Graham Couchman of the SCI discusses aspects of composite floor behaviour when subject to in-plane loading. The use of shear studs on non-composite beams is explained and justified, and guidance is given on how to design slabs subject to large in-plane forces.

Introduction

Two aspects of composite floors that feature behaviour that is sometimes not fully considered relate to edge beams that are designed non-compositely but are provided with shear studs, and the effect of in-plane forces in the slab due to diaphragm, or similar, action. These behaviours are considered below.

Edge Beams

At the SCI Advisory Desk we often get asked about the provision of shear studs on edge beams, where the studs are not needed to provide composite action for the beam, but rather to provide a structural connection to tie the slab to the beam. This makes sense, with detailing rules identifying any special provisions for slab geometry and reinforcement – U-bars must pass around the studs when the distance to the edge of slab is less than 300 mm, because straight bars would have insufficient anchorage.

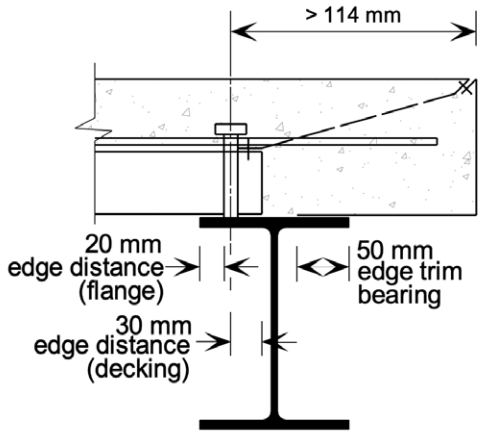


Figure 1: U-bar reinforcement wrapped around shear studs on an edge beam

Of course, even though the beam is designed to be non-composite, it doesn't know that. Because the shear studs have some stiffness they cannot avoid attracting force as the concrete slips over the top of the downstand beam, so some composite action is going to be developed. A question then arises, do the rules for minimum degree of shear connection need to be satisfied?

To recap, the reason why all composite beams must have a minimum degree of shear connection is to ensure that there are enough studs (with a high enough collective stiffness) to limit the slip at the slab to beam interface. Rather than bothering designers with a need to explicitly consider stud stiffness, which incidentally will be between 50 kN/mm and 100 kN/mm depending on stud size and the slab, the rules for minimum degree of connection assure the provision of a certain level of resistance, to indirectly ensure the total stiffness of the studs present is sufficient. The rules presented in EN 1994-1-1[1], and previously BS 5950-3.1[2], were based on ensuring that the slip at the beam ends (where it is at a maximum) did not exceed 6 mm at ULS. More recent work, for example the more relaxed rules in SCI publication P405[3], recognise that in some situations the stud resistance can be maintained to higher levels of slip. For example, in the presence of transverse trapezoidal decking 10 mm can be achieved. An ability to accommodate greater slip means that fewer studs are needed, because their collective stiffness can be lower. It is worth adding that in addition to needing slip capacity, studs must be stiff enough so that the slip at SLS levels of loading is sufficient to mobilise the shear studs, and therefore justify use of their resistance in design. A shear connector that lacked initial stiffness might have a high resistance, and indeed high slip capacity, but slips would never be high enough to make it 'work' properly. Generation 2 EN 1994[4] addresses this particular aspect by introducing a number of different ductility classes, compared to the previous ductile/non-ductile 'switch'.

All this would make one believe that the minimum degree of shear connection rules should be satisfied, even for beams that are designed to work non-compositely. Failure to do so would result in the studs 'unzipping' as the end slip exceeded their slip capacity as load was increased. However, consideration of the load-slip behaviour for a shear stud, typically determined by a push-out test (Figure 2a), shows us why this is not in fact the case.

Figure 2a:
Push out test specimen

▸26

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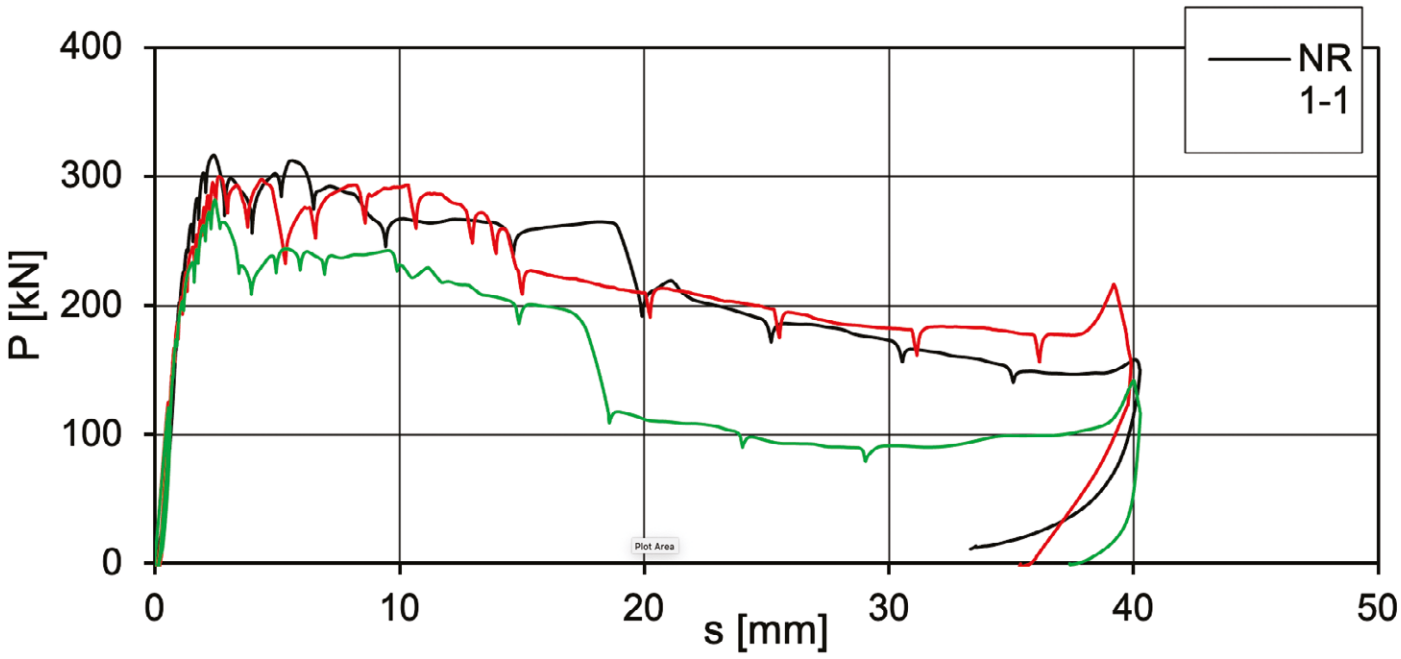

Figure 2b: Load-slip curves determined by a push-out test (courtesy University of Luxembourg)

Figure 2b shows that although there is a value of slip beyond which the stud resistance reduces (for these curves, which were for specimens with transverse trapezoidal deck, a slip of between 10 and 15 mm), it is not a brittle fall-off. The curves in Figure 2b show that the test set-up only allowed slips of up to 40 mm to be recorded (this would have been the distance that the steel section initially protruded above the slabs, see Figure 2a). EN 1994-1-1 defines behaviour from a load-slip curve in terms of:

- Characteristic resistance is the minimum failure load (from a group of three tests) reduced by 10%
  - Provided the deviation of any single result does not exceed the mean of all tests by more than 10%.
- The slip capacity of an individual test is the maximum slip at the characteristic resistance, and the characteristic slip capacity is the lowest slip from a set of three tests, reduced by 10%.

Beyond the characteristic slip capacity, the characteristic (and therefore design) resistance of the stud cannot be assured. But of course if the beam has been designed to work non-compositely, then it doesn't matter if the stud cannot provide its design resistance. All that matters is that it remains attached to the beam, and so continues to tie the slab to the beam. For the example curves shown in Figure 2b this would remain the case for slips up to 40 mm. Taking the extreme case of zero collective stud stiffness, slip would not be expected to exceed such a value. This qualitative conclusion has been quantified by researchers in the past, for example reference 5 used numerical analysis to predict 15 mm slip for a typical size beam over a 15 m

span. This finding can also be confirmed by considering the elastic behaviour of a beam, given the radius of a beam in bending $R = M/EI$, and using this radius to predict end slope and thereby the shortening of the top of the beam. It can also be understood by the analogy of bending two rulers, one placed on top of the other. For 'one foot' rulers one would find approximately 1 mm slip – zero shear connection stiffness does not result in infinite slip.

The studs on an edge beam that tie the beam to the slab transversely will be subject to a combination of shears in two directions, and some interaction that would potentially reduce the shear resistance can be envisaged. For beams that are designed to be non-composite this is irrelevant. For the alternative case where the edge beams (or others) are designed to be composite, EN 1994-1-1 6.6.4.3 provides an interaction equation:

$$\frac{F_l^2}{P_{l,Rd}^2} + \frac{F_t^2}{P_{t,Rd}^2} \leq 1.0$$

For beams supporting composite slabs with trapezoidal decking this may be conservative, given that in the direction of the decking ribs the concrete near the base of the studs is critical, but in the orthogonal direction failure is normally due to failure of a concrete surface passing over the studs.

In-plane diaphragm action

Turning to the slab, there may be a concern that a slab that is loaded in-plane, in whatever direction, may experience different stresses at the interface between the decking and concrete compared to a slab loaded purely in bending. It is easy to imagine that a slab that was lozenging would have a tendency to break the shear bond. Provided in-plane stresses and strains are small, practically it is suggested that such effects can be ignored. The tests used to determine shear bond include a cyclic element to destroy chemical adhesion, so the shear bond used in design is solely due to mechanical interlock and one would expect this to be sufficiently robust.

In extreme cases a slab may be subject to significant in-plane, and coincident out-of-plane, loading. The former could be due to thermal movements. Little is known on how composite slabs would then behave. For example, the shear bond would presumably be adversely affected if the concrete was in tension, and therefore cracked, throughout its depth. In a standard test to determine the level of shear bond that can be generated by a given deck, whilst the extreme (lower) fibres of the concrete will indeed be in tension, those above the deck neutral axis will not. Evidence suggests that much of the shear bond generated by trapezoidal decks is due to the embossments and form of the top flange of the decking. In the absence of any evidence from testing or numerical modelling, the most robust approach in such a situation could be to:

- Design the slab as a reinforced concrete element carrying coincident in-plane and out-of-plane loading
- Use the decking as permanent formwork (ignore any shear bond)

If necessary the decking could also be used to add to the vertical shear resistance of the slab. Its ability to contribute has recently been recognised during the process of developing the Generation 2 EN 1994. The relevance of it being able to do so would be particularly high in slabs that had in-plane tension, the presence of which reduces the shear resistance of the concrete (which is the only contributing element according to the current EN 1994 rules, which are taken from EN 1992).

Conclusions

As engineers we often use our judgement to make pragmatic decisions, and one common example has been the use of apparently insufficient shear studs on non-composite edge beams. No matter what we assume, in this case that the beams are non-composite, the physics of elements with stiffness attracting load cannot be ignored. The discussion above shows why the approach of seemingly adding too few studs can indeed be justified. Consideration is also given to composite slabs in which significant in-plane forces coincide with out-of-plane loading, with a conclusion that such slabs should not be designed compositely (using available shear bond data) without justification. A traditional reinforced concrete approach should be adopted. ■

1. BS EN 1994-1-1:2004. **Eurocode 4: Design of composite steel and concrete structures. General rules and rules for buildings**. BSI, 2005
2. BS 5950-3.1:1990+A:2010. **Structural use of steelwork in buildings. Design in composite construction. Code of practice for design of simple and continuous composite beams**. BSI, 2010 (Superseded).
3. P405. **Minimum Degree of Shear Connection Rules for UK Construction to Eurocode 4**. *Graham Couchman*. SCI, 2015.
4. prEN1994-1-1. **Project Team Final draft April 2021** (this document is not publicly available)
5. **Composite Construction in Steel and Concrete V**. *Edited by Roberto Leon and Jorg Lange*, ASCE, 2004.

AD 496:
Toughness testing of bolts

Bolts used in environments subject to low temperatures that fall outside the range of temperatures usually encountered, such as in cold stores, may require toughness testing at the service temperature. SCI has recently been contacted regarding testing bolts that are smaller than the limiting diameter for normal Charpy impact tests. The purpose of this note is to advise how impact testing can be carried out.

AD 332: Toughness of bolts advised that non-preloaded and preloaded bolts supplied to BS EN 15048:2007 and BS EN 14399-3:2005 would be tested at -20°C and have a Charpy V-notch impact strength of at least 27 joules.

Bolt materials comply with BS EN ISO 898-1:2013[1] which indicates in clause 1 Scope, Note 1 that "Fasteners conforming to the requirements of this part of ISO 898 are used in applications ranging from -50°C to + 150°C. ...". Notwithstanding this, clause 9.14.1 indicates that impact tests are carried out only if required by a product standard or agreed between manufacturer and purchaser. The standard indicates tests are to be carried out in accordance with ISO 148-1 (Charpy V-notch test) at -20°C and are required to achieve a Charpy V-notch impact strength of at least 27 joules, for bolts of size M16 or greater (see Table 3). No tests are carried out to demonstrate impact strength at temperatures below -20°C unless specified but the standard indicates that other test temperatures and impact strength values can be called for.

The bolt size limitation appears to be indicated so that standard Charpy test pieces can be produced from the bolts. (M16 bolts have a tensile stress area of 157 mm² and a corresponding diameter of 14.1mm. The diagonal dimension of a 10mm square Charpy test piece is 14.1mm). Tests specified in ISO 898-1 are applicable to machined tests pieces made from bolts, screws and studs of diameter at least 16mm. The total length of the test pieces is at least 55mm.

If impact tests are required on bolts of smaller size than M16, these can also be carried out in accordance with ISO 148-1, which allows for 7.5 mm, 5 mm and 2.5 mm square samples of 55 mm length. Such tests are not strictly in accordance with ISO 898-1 but will allow the impact properties of fasteners of smaller size than M16 to be determined at temperatures required by the purchaser. There is however no published basis for correlating test results from the smaller test pieces with results from standard ones so acceptance criteria should be agreed before supply. Test pieces with the standard length, depth and notch size but reduced width can also be used. The impact energy of such test pieces can be adjusted pro rata with the cross-sectional area at the notch for comparison with standard test requirements and would allow the impact properties of M12 bolts to be determined.

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

1. BS EN ISO 898-1:2013 *Mechanical properties of fasteners made of carbon steel and alloy steel Part 1: Bolts, screws and studs with specified property classes – coarse thread and fine pitch thread* (ISO 898-1:2013), BSI

New and revised codes and standards

From BSI Updates October 2022

BS EN PUBLICATIONS

BS EN ISO 4014:2022
Fasteners. Hexagon head bolts. Product grades A and B
supersedes BS EN ISO 4014:2011

BS EN ISO 4016:2022
Fasteners. Hexagon head bolts. Product grade C
supersedes BS EN ISO 4016:2011

BS IMPLEMENTATIONS

BS ISO 8504-4:2022
Preparation of steel substrates before application of paints and related products. Surface preparation methods. Acid pickling
no current standard is superseded

CORRIGENDA TO BRITISH STANDARDS

BS EN ISO 2566-1:2021
Steel. Conversion of elongation values. Carbon and low-alloy steels
Corrigendum, September 2022; Corrigendum, March 2022

BRITISH STANDARDS REVIEWED AND CONFIRMED

BS EN ISO 9223:2012
Corrosion of metals and alloys. Corrosivity of atmospheres. Classification, determination and estimation

BS EN ISO 9224:2012
Corrosion of metals and alloys. Corrosivity of atmospheres. Guiding values for the corrosivity categories

BS EN ISO 9225:2012
Corrosion of metals and alloys. Corrosivity of atmospheres. Measurement of environmental parameters affecting corrosivity of atmospheres

BS EN ISO 9226:2012
Corrosion of metals and alloys. Corrosivity of atmospheres. Determination of corrosion rate of standard specimens for the evaluation of corrosivity

NEW WORK STARTED

EN 1994-1-2
Design of composite steel and concrete structures. General rules. Structural fire design
will supersede BS EN 1994-1-2:2005+A1:2014

ISO 8504-5
Preparation of steel substrates before application of paints and related products. Surface preparation methods. Water Jetting (Water Jet Cleaning)
will supersede None

DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT – ADOPTIONS

22/30439955 DC
BS EN 1998-1-1 Eurocode 8. Design of structures for earthquake resistance. General rules and seismic action
Comments for the above document are required by 22 November, 2022

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- Free attendance at a major Awards event in central London for your project team.
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- 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

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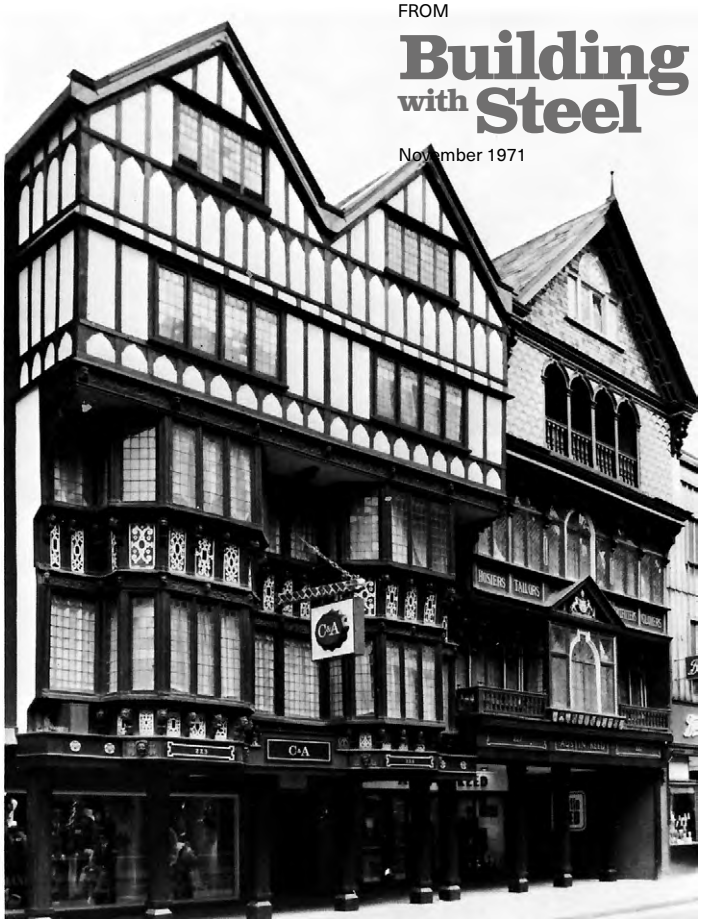
Fig 1



FROM
Building with Steel
November 1971

Frontage made young

Introduction

For its size there can be few cities in the country that are more richly endowed with old buildings than Exeter. It is a town of bustling shopping streets mixed with quiet alleyways, and modern architecture mixed with that of our Tudor ancestors. Exeter has gone to considerable lengths to preserve its heritage, a 600-year-old timbered house was moved 75 yards to make way for road improvements, the stone Guildhall, one of the oldest municipal buildings in the country, is being pinned together and reappointed, and numerous examples of timbered buildings altered to provide shopping facilities exist in central Exeter. The most recent of these and perhaps from the structural point of view, the most extensive and challenging, has recently been completed in the High Street as part of the new C&A Modes and Austin Reed stores in the city.

The frontages that have been preserved are two neighbouring buildings of differing age, style, construction and condition. The C&A portion of the frontage to the left hand of the photograph (Fig. 1) dates from the end of the sixteenth century. In early days, Mr Simon Snow, an eminent city merchant, Member of Parliament, and Mayor in 1653, resided here, but in recent years it has been converted for offices and shop use. The last occupier had closed off the top three of the five storeys, and this upper section of the building had suffered considerably from the ravages of weather, rot, neglect and timber beetle. The roof was in particularly poor condition and any scheme for renovation had to include replacement of the roof timbers and slates.

The Austin Reed frontage dates from about 1650 to 1670 and was doubtless built by one of the wealthy city merchants, who had by this time commenced to forsake the hitherto more fashionable lower end of the town and move higher up. The varied colouring and loud style of architecture present an interesting contrast to the rest of the shopping street.

The street front was restored in 1858 and considerable alterations were also made inside the building in 1883. Generally its state of repair was good, although settlement of the party wall with neighbouring Boots' chemist shop had caused a lean in that direction and distress in some of the internal members. During the rebuilding of Boots, some ten years ago, the planning of the shop had allowed temporary bracing to be provided to arrest the lean of the Austin Reed premises, but any reconstruction of the latter would of necessity allow the removal of these shores.

In order to ease the pedestrian bottle-neck in this part of the High Street, a condition of planning approval for the new development was that a pedestrian way be formed through the ground floor at the front of the existing and future structures. This meant that the existing flank walls, which carried much of the old structure down to the foundations would have to be removed from ground to first floor.

Organization of building work

C&A Modes and the Austin Reed Group agreed to develop concurrently and the consultant team was appointed for both shops. The contract for the support and renovation of the façades and demolition and redevelopment of the remainder of the site was negotiated with Sleeman Construction of Exeter, so that they could contribute to discussions on the retention of the frontages and other critical aspects of the scheme.

A survey with accurate floor levels was made of the old buildings together with an initial examination of the existing framework. From this survey, it became clear that the poor condition of the C&A section required the retention of a portion of the existing floors in order to maintain the stiffness of the frontage, otherwise an extensive system of temporary shores would be necessary. Several schemes were produced and these were compared as far as possible for safety, ease and speed of erection, cost and obstruction of pavement. Basically, the schemes were of two types:

(a) Temporary shoring to allow demolition on the remainder of the site and construction of the permanent support behind the frontage as the rest of the development proceeded.

(b) Construction of the permanent framework immediately behind the frontage before or during demolition on the remainder of the site and connection of this framework to the main structure as the new development was constructed.

Since temporary possessions of the High Street would be required and considerable obstruction to traffic and pedestrians would result from any variation of scheme *(a)*, it was agreed to adopt alternative *(b)*, constructing a steel framework inside the existing buildings. This method did have two disadvantages, namely, that the existing floor levels did not correspond with those proposed, so the space occupied by the steelwork frame would be lost, and, secondly, construction time would mostly be longer.

Discussions were held with the Exeter City Council concerning obstruction to the pavements, column layout and treatment at ground floor. With the guidelines agreed, meetings were convened with the Architect, the Main Contractor and the Steelwork Fabricators, F. Parkin and Sons of Exeter. As a result of these meetings, the Consulting Engineer's proposals were finalized to suit the planning requirements of the Architect and the construction methods of the Main Contractor. A detailed investigation of the existing structure was commenced, which entailed cutting holes in floors and walls to confirm the suitability of the proposed column and beam centres, and removal of internal panelling to investigate more fully the extent of deterioration.

When this had been done, the final design was prepared and a building programme drawn up. Demolition of the remainder of the site was programmed to take six weeks and therefore it was intended to commence the frontage support steelwork two weeks earlier, so that by the time the demolition contractors had progressed to the front of the site where the façade was to be retained the new structure would be in position to stabilize the frontage. However, unexpected difficulties led to problems with regard to phasing the work relative to the main building contract.

The scheme adopted

Basically, from the engineering point of view, a structure had to be designed to carry the vertical loads from the buildings to be retained together with those from the new construction behind the frontage, and be able to withstand wind loads on the frontage in the post-demolition stage. Also it had to be capable of being constructed by manhandling the components, as very little lifting equipment could be accommodated inside the confines of the old buildings.

All the members of the structure were designed generously, as the loading of any particular member could depend on the means of cramping the existing fabric to the new steelwork, and generous sizing would permit last minute adjustments to the positions of cramps to be made.

The main framework consists of two rows of columns and beams, one row just inside the original window line and the second on the new showcase line. Secondary beams then cantilever out to support the overhangs of the frontage at each level. The beams occur above the floor levels in most cases and the floor timbers are 'hung' from the new framework so that the cantilevers are not apparent on the external elevations. Cross-bracing was provided to resist full wind load in the post-demolition, prebuilding stage and beams were inserted at the future main floor levels between the rear row of columns to tie in the new concrete framework.

Site works

A strong scaffold was erected at the front of the façade to give additional support to the works and provide a· working platform for the renovation.

A trial pit had been dug in the region of the frontage during the initial investigations in order to determine the substrata, however, during the more extensive excavations for the foundations, it was clear that much of the ground beneath the C&A frontage was filled, and excavations for the front bases had in some cases to be taken down to 14 feet to find a suitable bearing stratum. Since careful shoring was necessary, the construction of the foundations became a very slow process.

The existing C&A portion of the frontage was supported at the centre by a cast-iron stanchion carrying a pair of wrought-iron bressemers which spanned from the front of the building to a massive brick wall, 20 feet back, and which seemed to mark the extremity of the original building. This iron-work together with several other spans found in the first floor were presumably a relatively recent alteration in order to create an open area at ground floor suitable for shop use. Since this stanchion and its pad base obstructed the foundations for the outer row of columns, a system was devised to erect the front row of columns in stages, employing two temporary diagonal columns. This method is indicated in Fig. 2. A similar procedure was also adopted for the Austin Reed section.

The estimated progress in foundations and steelwork erection was not attained and with demolition proceeding at a rapid rate to the rear of the site, temporary dead shores were erected inside the old buildings and connected to the outer scaffold through the windows. Demolition had to stop short of the proposed line in order that the permanent shoring work could continue into the main contract period. During erection, the existing main floor members were cramped to the new framework. It had been intended to retain the front wall by letting 4in × 4in MS plates into the outside of the wall and bolting these through to channels fixed to the extremities of the cantilever beams. The plates and bolts would have been disguised by a timber cover or render, where they occurred on the front panelling. However, the fabric of the outer wall was in such poor condition, through rot and insect attack, that it was agreed to insert continuous bands of 3in × ¼in mild steel strip on each horizontal timber line. These were galvanized and painted black so they are not noticeable, and they are held back at approximately 3ft centres to a timber framework, built on the line of the front row of columns and in turn firmly attached to the steelwork (Fig 3).

As the main works progressed, the old buildings were demolished to the line of the proposed showcase windows and the new concrete structure was tied into the steelwork by encasing the rear line of columns and beams, giving in addition the necessary two-hours fire resistance. A fire wall was also built to isolate the potential fire risk of the old timber fabric.

The final structural operations were to remove the flank walls from the ground to first floor in order to create a pedestrian area at ground-floor level. What remained of the walls above first-floor level was pinned up from the steel framework.

The works were commenced at the end of February 1971 and the structural steelwork and tying back were completed by mid-May. Renovation and redecoration of the façades, which was started towards the end of this period, was completed by mid October. The structural work took longer than was programmed, but, due to unexpected ground conditions in the main structure, work to the frontages was not critical, and the time lost in the early stages was recovered to enable the building as a whole to finish on programme.

Finishes and preservative treatments

The Architect carried out a thorough inspection of both façades and the Main Contractor cut out and replaced all defective timbers, flashings and Wet Dash panels. When this was completed further inspections and discussion took place to decide how best the renovated work could be decorated to blend in with the original structure that remained. The C&A frontage was basically an oak structure with Wet Dash infill panels whilst the Austin Reed structure was of complete timber construction finished with various coloured gloss paints. The aim was to reproduce the original as closely as possible and to retain the character of the fronts that had evolved from age and exposure to the elements.

The C&A façade was treated as follows:

(a) All existing and new oak toned down to match and treated with three coats of Black Solignum.
(b) The Wet Dash panels coated with stabilizing liquid and painted three coats of Walpamur 'Stronghold' white emulsion.
(c) New oak cladding to the steel columns forming the colonnade treated with three coats of 'Sadolins· PX 65 ebony wood preservative.

The Austin Reed frontage was cleaned down and repainted to match the original. The Architects were able to obtain an original colour print of this façade which was used by the Contractor as his colour guide.

An interesting feature on this frontage was the need to renovate and repaint the coat of arms and twelve crafts shields at first-floor level. The original colours had been completely destroyed and help was sought from the City's Reference Library to trace the origins of these and thereby reproduce them in their true heraldic colours.

This work was carried out by Messrs M. T. Sleeman of Exeter, and it is due to the skill of their craftsmen that finally an almost identical reproduction was achieved.

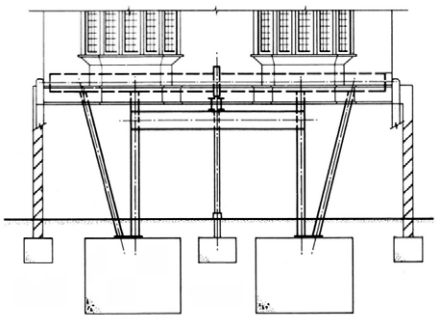


Fig 2, STAGE 1
Two concrete bases were constructed. two steel columns. and two temporary steel raking supports erected to support the main steel beam. which was installed behind the existing shop front. Twin temporary beams were then attached to the steel columns to support the existing bressemers; the existing cast-iron centre stanchion and base being then removed.

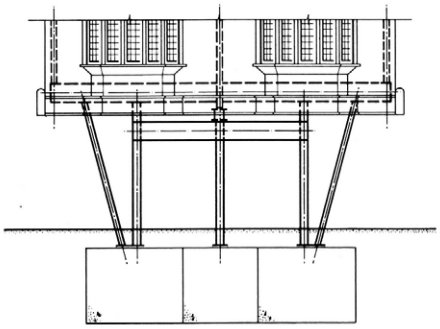


Fig 2, STAGE 2
A central column and base were constructed, and the new centre column was welded to the existing iron bressemers. The erection of the steel framework was completed above first-floor level and the existing timber façade braced to it; the façade now being fully supported by the steel framework within. The old brickwork flank-walls and their foundations were removed.

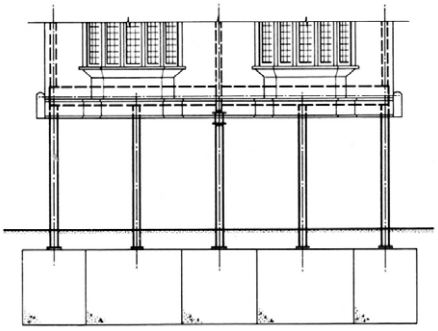


Fig 2, STAGE 3
Finally. the two end bases were constructed and the two end columns bolted up to the main beam; after which the temporary raking supports were removed. The steel columns at street level were later clad with timber to match the existing woodwork.

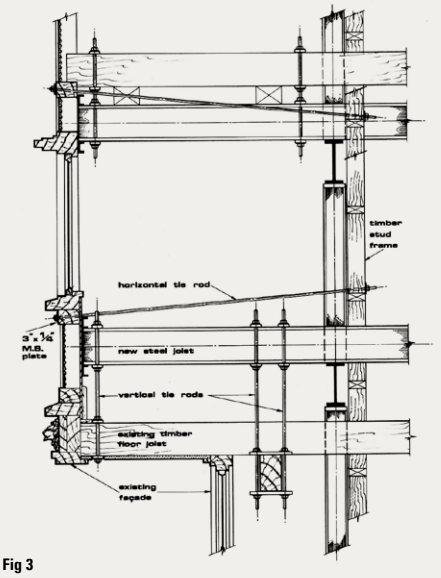


Fig 3

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 £1,400,000
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 £6,000,000
Cook Fabrications Ltd	01303 893011			●	●		●	●		●	●			●	●	✔	2			Up to £1,400,000
Coventry Construction Ltd	024 7646 4484			●	●	●	●		●	●	●			●	●	✔	4			Up to £1,400,000
DAM Structures Ltd	01377 271843	●		●	●	●		●	●	●	●			●		✔	4			Up to £6,000,000
D H Structures Ltd	01785 246269			●	●		●				●						2			Up to £200,000
D Hughes Welding & Fabrication Ltd	01248 421104				●	●	●	●	●	●	●		●	●	●	✔	4			Up to £800,000
Donyal Engineering Ltd	01207 270909	●			●			●		●				●	●		3			Up to £1,400,000
Duggan Steel	00 353 29 70072	●	●	●	●	●	●	●	●		●				●	✔	4			Up to £6,000,000
ECS Engineering Services Ltd	01773 860001	●		●	●	●	●	●	●	●	●			●	●	✔	4		●	Up to £3,000,000
Elland Steel Structures Ltd	01422 380262		●	●	●	●	●	●	●	●	●	●		●	●	✔	4	✔	●	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
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)
Gorge Fabrications Ltd	0121 522 5770				●	●	●	●		●				●	●	✔	3			Up to £1,400,000
G.R. Carr (Essex) Ltd	01286 535501	●		●	●			●			●			●	●	✔	4			Up to £800,000
H Young Structures Ltd	01953 601881			●	●	●	●	●			●			●	●	✔	4	✔	●	Up to £3,000,000
Had Fab Ltd	01875 611711				●				●	●	●				●	✔	4			Up to £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 £6,000,000
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
Mifflin Construction Ltd	01568 613311			●	●	●	●				●						3			Up to £3,000,000
Murphy International Ltd	00 353 45 431384	●			●		●	●	●		●				●	✔	4			Up to £2,000,000
Newbridge Engineering Ltd	01429 866722	●	●	●	●	●	●	●			●	●				✔	4		●	Up to £2,000,000
North Lincs Structures	01724 855512			●	●					●	●				●		2			Up to £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 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
Traditional Structures Ltd	01922 414172			●	●	●	●	●	●		●			●	●	✔	3	✔	●	Up to £2,000,000
TSI Structures Ltd	01603 720031			●	●	●	●	●			●			●			2	✔		Up to £2,000,000
Underhill Engineering Ltd	01752 752483				●		●	●	●	●	●			●	●	✔	4	✔		Up to £3,000,000
W I G Engineering Ltd	01869 320515				●					●	●			●	●	✔	2		●	Up to £400,000
Walter Watson Ltd	028 4377 8711			●	●	●	●	●				●				✔	4			Above £6,000,000
Westbury Park Engineering Ltd	01373 825500	●		●	●	●	●	●	●	●	●				●	✔	4		●	Up to £800,000
William 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
Donyal Engineering Ltd	01207 270909	●		●						●	●	●	✓	3		✓	✓	●	Up to £1,400,000
ECS Engineering Services Ltd	01773 860001	●		●	●	●	●		●			●	✓	4				●	Up to £3,000,000
Four-Tees Engineers Ltd	01489 885899	●	●	●	●	●	●		●	●	●	●	✓	3			✓	●	Up to £2,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445	●			●	●				●	●	●	✓	4	✓		✓	●	Above £6,000,000
M Hasson & Sons Ltd	028 2957 1281	●	●	●	●	●	●	●	●	●	●	●	✓	4			✓	●	Up to £1,400,000
Millar Callaghan Engineering Services Ltd	01294 217711	●	●	●	●	●	●	●	●	●	●	●	✓	4			✓		Up to £1,400,000
Murphy International Ltd	00 353 45 431384	●	●	●	●	●	●					●	✓	4			✓		Up to £2,000,000
Nusteel Structures Ltd	01303 268112	●	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓	●	Up to £6,000,000
REIDsteel	01202 483333	●		●		●	●	●				●	✓	4				●	Up to £6,000,000
S H Structures Ltd	01977 681931	●	●	●	●	●	●	●	●	●	●	●	✓	4	✓		✓	●	Up to £3,000,000
Severfield 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
Underhill Engineering Ltd	01752 752483	●	●	●	●	●				●	●	●	✓	4	✓		✓	●	Up to £3,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●		●	✓	4	✓	✓	✓	●	Above £6,000,000
Non-BCSA member																			
Allerton Steel Ltd	01609 774471	●	●	●	●	●	●	●			●	●	✓	4	✓		✓	●	Up to £3,000,000
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
Eiffage Metal	00 33 388 946 856	●	●	●	●	●	●	●	●			●	✓	4					Above £6,000,000
Harrisons Engineering (Lancashire) Ltd	01254 823993			●	●	●	●	●	●	●		●	✓	3		✓			Up to £1,400,000
Hollandia Infra BV	00 31 180 540 540	●	●	●	●	●	●	●	●	●	●	●	✓	4					Above £6,000,000*
HS Carlsteel Engineering Ltd	020 8312 1879									●	●	●	✓	3			✓		Up to £800,000
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
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				
FLI Structures	01452 722200	✓	M	4	20	●	
Hadley Industries Plc	0121 555 1342	✓	M	4		●	
Hi-Span Ltd	01953 603081	✓	M	4		●	
Jamestown Manufacturing Ltd	**00 353 45 434288**	✓	**M**	4	20		**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				
Tension Control Bolts Ltd	**01978 661122**	✓	**M**		**3**		**Silver**

Welding equipment and consumables

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

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