NOV/DEC 2021

NSC

Trusses span Manchester Factory

BCSA draws net-zero Roadmap

Steel goes golden in Swansea

Steel creates UK net-zero first

NEACH

PEDDI XDM-630 PROCESSING POWER

RYZA GARBACZ
Managing Director

"The Peddi XDM-630 has increased our production by 30%. By implementing layout marking, NEACH reduced project schedule times by 2-3 weeks on a 12 week schedule. We now have better quality and increased schedule flexibility, which means more customers. There's no more profile outsourcing as we can rely on ourselves to meet project deadlines. I know my exact hourly machine cost, which is driving my profit margin as well."

-RYZA GARBACZ

THE
PEDDI XDM-630

Peddinghaus **STRONGER** THAN STEEL®

www.peddinghaus.com | info@peddinghaus.com | +44 01952 200377

NSC

NOV/DEC 2021
Vol 29 No 10

Cover Image
The Factory, Manchester
Main client: Manchester City Council
Architect: OMA
Main contractor: Laing O'Rourke
Structural engineer: Buro Happold
Steelwork contractor: William Hare
Steel tonnage: 4,900t

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

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

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

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

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

NSC IS PRODUCED BY BARRETT BYRD ASSOCIATES ON BEHALF OF THE BRITISH CONSTRUCTIONAL STEELWORK ASSOCIATION AND STEEL FOR LIFE IN ASSOCIATION WITH THE STEEL CONSTRUCTION INSTITUTE

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

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

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

CONTRACT PUBLISHER & ADVERTISING SALES
Barrett, Byrd Associates
7 Linden Close,
Tunbridge Wells, Kent TN4 8HH
Telephone 01892 524455
Website www.barrett-byrd.com

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

5 **EDITOR'S COMMENT**
Editor Nick Barrett reports that the three major structures being used to host the COP26 conference in Glasgow all make extensive use of steel, and have shown great flexibility and adaptability. The just released BCSA Decarbonisation Roadmap points the way towards even more low carbon, more sustainable steel structures in the future, he says.

6 **NEWS**
Tata Steel reduces its energy bill and emissions with a new generator and the BCSA begins Responsible Painting Coordinators' courses.

10 **STEEL FOR LIFE: HEADLINE SPONSOR**
Having fully prepared for new Brexit regulations, Jamestown says it began the year with a strong order book and is now looking forward to the challenges ahead.

12 **STEEL FOR LIFE: GOLD SPONSOR**
voestalpine Metsec produces light gauge steel purlins, rails and mezzanine sections, which are components used on a wide variety structures.

14 **STEEL PRICES**
Despite misperceptions that steel price rises were different from those of other materials steel remains the cost-effective framing material of first choice. Nick Barrett reports that communication and collaboration with clients and all along the supply chain are proving a winning strategy.

16 **DECARBONISATION ROADMAP**
NSC previews the BCSA's recently produced Roadmap that sets out the route to net-zero steel construction to be achieved by 2050.

20 **ENTERTAINMENT**
Containing a theatre and a large concert venue, The Factory in Manchester is one of the world's largest purpose-built cultural buildings

24 **LEISURE**
A multi-million pound leisure and day care centre in Scotland is utilising steelwork's long-span qualities to create the required column-free spaces.

26 **DISTRIBUTION**
Steelwork's flexibility and adaptability has come to the fore as an existing steel-framed temperature-controlled warehouse is being enlarged for the fourth time.

28 **BRIDGE**
Fabricated from gold-painted perforated steel plate, a landmark footbridge forms a central element in Swansea's Copr Bay development.

30 **COMMERCIAL**
A commercial scheme in London is utilising the P-DfMA construction method, which is said to offer numerous advantages over traditional techniques.

32 **TECHNICAL**
This issue's article discusses the specification of low carbon concrete for use in composite construction.

35 **ADVISORY DESK**
AD 473 – Holes in beams for temporary lifting attachments.

35 **CODES AND STANDARDS**

36 **BCSA MEMBERS**

38 **REGISTER OF QUALIFIED STEELWORK CONTRACTORS FOR BRIDGEWORKS**

celebrating excellence in steel

Call for entries for the 2022 Structural Steel Design Awards

The British Constructional Steelwork Association and Trimble Solutions (UK) Ltd have pleasure in inviting entries for the 2022 Structural Steel Design Awards.

Now in their 54th year, the Awards celebrate the excellence of the United Kingdom and the Republic of Ireland in the field of steel construction, particularly demonstrating its potential in terms of efficiency, cost-effectiveness, aesthetics and innovation. The Awards are open to steel-based structures situated in the UK or overseas that have been built by UK or Irish steelwork contractors.

“Trimble are proud to again be associated with the SSDA and look forward to another successful Awards that showcases the breadth and depth of talent and expertise within our steel construction industry”, Steven Insley, National Sales Manager, Trimble Solutions (UK) Ltd.

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

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

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

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

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

Closing date for entries: Friday 25th February 2022

BCSA

Trimble

Roadmap goes full scale towards net-zero carbon

Nick Barrett - Editor

The United Nations Climate Change conference - better known as COP26 - was in full swing as we went to press, with over 100 world leaders and thousands of delegates gathered in Glasgow to discuss decarbonisation measures to combat climate change.

The UK has shown the world a way forward by taking a lead in adopting 2050 as a target date for net-zero carbon, so it is fitting that this crucial meeting is taking place on UK soil. It is also fitting that the main buildings housing the event - the Scottish Event Campus Centre (SECC), the Armadillo and the OVO Hydro - all make extensive use of steel.

The buildings have been showcases for steel throughout the years since they were built, with the first building - what we now call the SECC but was originally known in Glasgow as the Big Red Shed - having been easily extended a few years after opening in 1985. It also demonstrated great flexibility in being quickly converted into the NHS Louisa Jordan critical care hospital to treat COVID-19 patients. It didn't have to be used for that so was quickly adapted again to be used for medical appointments, blood donations, staff training and vaccinations. Work to further adapt it to host COP26 got underway as recently as July.

Delegates also used the 3,000-capacity Norman Foster designed Clyde Auditorium, nicknamed the Armadillo, which opened in 1997. Norman Foster was the designer of the third main COP26 venue, the 12,500-seat concert arena called the OVO Hydro which opened in 2013, topped by a 120m-span steel roof, one of the largest free spanning roof structures in Europe. It is Scotland's largest entertainment venue, the second busiest in the world after New York's Madison Square Gardens in 2019, regularly attracting one million visitors a year before COVID-19 restrictions started last year.

No doubt sustainability issues were considered when the COP26 organisers assessed venues for suitability for a climate change event, and steel's sustainability credentials were easily established. The steel sector's track record is strong, with a Sustainability Charter for its members launched in 2007 and carbon footprint measuring tools also being available since 2007, both recently updated.

The point of COP26 though isn't to focus on past achievements, but to discuss what to do next. The way forward to a decarbonised future for the UK steel construction sector has been detailed in the BCSA's Roadmap which is summarised in this issue of NSC (page 16). It shows the steps that are being, and will be taken, towards a genuinely circular and sustainable steel construction sector.

There is no wishful thinking in the Roadmap. The route to be taken towards net-zero carbon by 2050 is based on adopting known technologies that are either already available or at least at the pilot stage. Others also have roles to play and much will depend on the adoption of appropriate policies by governments, but the steel construction sector has already set out on the road to net-zero carbon.

Tata Steel reduces energy bill and emissions with new 30MW generator

Combating current energy price rises, Tata Steel's Port Talbot site has installed a new 30MW generator that will reduce its energy bill by millions of pounds every year as well as providing environmental benefits.

The generator will allow more process gases from the blast furnaces, steelmaking plant and coke ovens to be converted into useful energy – reducing emissions from external power generation by more than 40,000 tonnes of CO_2 a year.

As part of a wider £37M investment in the site's power station, the generator has been installed in a new turbine hall. The project also included creating a new landscaped area, which has been planted with Kidney Vetch – the main food source of the UK's smallest resident butterfly, the Small Blue.

Tata Steel's Project Manager, Guy Simms, said: "Our onsite power plant uses process gases to heat water into steam, which then drives a turbine - like a propellor. This, in turn, drives an electrical rotor to generate our own electricity.

"We have a number of these 'turbo-alternators' but not enough to use all the steam we can create.

"This latest addition, however, will make a step-change to our energy-generation capacity. We've been commissioning the plant, and have run it up to its capacity of 30 megawatts."

New mixed-use quarter rising up at London Olympia

Due to be completed by 2024, the £1.3Bn Olympia redevelopment scheme is progressing on schedule as the initial steelwork elements have begun to be erected.

A total of seven new buildings are to be built on the site of the historic west London events venue. To make space for the redevelopment, the Olympia Central Hall has been demolished, while the Olympia National and Olympia Grand, both Grade II-listed, are being incorporated into the new scheme.

Working on behalf of Laing O'Rourke, BHC is erecting the steelwork, which includes 12,000t for the Central Venue building, and a further 7,000t for another smaller venue, an office building, an hotel and a public realm podium.

University research hub gets steel staircase

Work is progressing at Cardiff University where a Translational Research Hub (TRH) is being constructed by Bouygues.

Designed by HOK's London Studio, the TRH will foster partnerships with national and international enterprises to promote academic-to-business and business-to-business relationships and fuel economic growth in Wales and beyond.

High-tech lab space will support research alongside facilities designed for industrial collaboration, helping to overcome traditional barriers between academia and commercial application.

An integral part of the scheme is a steel cantilevered staircase, fabricated, supplied and erected by Taunton Fabrications that serves the full-height of the new building.

Requiring 60t of steelwork, the staircase flights and quarter turn landings were all fabricated, painted and then delivered to site as individual pieces.

In total, 20 sections of staircase were delivered to site and lifted into place by tower crane, prior to the building's roof being installed. Due to the staircase being cantilevered, each section was temporarily propped until all the sections were in place and stability was guaranteed.

The entire TRH project is due to be completed in 2022.

BCSA starts courses for Responsible Painting Coordinators

Following the publication in January of the 7th edition of the National Structural Steelwork Specification (NSSS), the British Constructional Steelwork Association (BCSA) has begun a series of courses for steelwork contractors on how to specify, apply and inspect paint systems.

One of the significant changes to the latest NSSS is an improved and enhanced Section 10 for the specification of both corrosion and fire protection treatments.

"During the development of Section 10, it was recognised that steelwork contractors would benefit from additional training and consequently we held our first Responsible Painting Coordinators (RPC) course on 19th October," said BCSA CEO David Moore.

The key topics covered in the course were: basic corrosion – an understanding; environmental testing and the use of instruments; surface preparation and surface profile measurement along with the use of test methods; coating fundamentals and calculating paint consumption; intumescent fundamentals and the legal obligations; application methods – airless spray; wet and dry film

measurement and the use of instruments; specification essentials; and safety, health and the environment.

Essential European Standards were explained and a comprehensive technical manual of course content and lectures were provided to the first cohort of course students (pictured).

There were also written and practical exams at the end of the course, which were accredited and certified by the BCSA.

Further RPC training courses are planned for November and in 2022.

Steel landscraper takes shape in King's Cross

Work is currently progressing on Google's new UK headquarters building at King's Cross in London.

Designed by lead consultant BDP, working alongside concept architects Heatherwick Studio and Bjarke Ingels Group, the 11-storey building has been described as a horizontal skyscraper, or landscraper, because of its more than 300m length.

Located alongside King's Cross Station, the building will comprise more than 60,400m² of office space, set above retail and an events training centre at ground floor.

The office accommodation will also provide ancillary spaces including cafes, a gym, multi-use games area (MUGA) and pool facilities. At roof level, landscaped terraces and a running track will provide outdoor amenity and recreation space for employees.

A combination of active and passive environmental design considerations have been incorporated, with the project targeting a minimum of BREEAM 'Excellent' and LEED 'Gold', with an aspiration of achieving 'Outstanding' and 'Platinum' respectively. This new building, combined with the current building at 6 Pancras Square and an additional third building, will create a Google campus with the potential to house 7,000 Google employees.

The new building will contribute to the Knowledge Quarter and King's Cross's growing knowledge-based economy. This building will be the first wholly-owned and designed Google building outside the United States.

Working for main contractor Lend Lease, Severfield is fabricating, supplying and erecting 17,000t of steel for the project.

Fabrication underway for Essex new town bridge

Steel beams up to 3m-deep and 48m-long are being fabricated by Briton Fabricators for the Beaulieu Bridge in Essex.

Forming an integral part of the Beaulieu Park housing development near Chelmsford, which will eventually have its own railway station, the bridge will span the Great Eastern Railway.

Working on behalf of Graham Construction, Briton Fabricators will eventually fabricate, supply and erect 891t of weathering steel for the 171m-long bridge.

The beams will be transported to site in braced pairs weighing up to 132t. They will be delivered to a temporary yard close to the bridge's final position, where the entire structure, including its concrete deck, will be assembled before being manoeuvred into place by self-propelled modular transporters (SPMTs) next Spring.

The bridge curves on plan, is four beams wide and will be supported on two intermediate piers.

NEWS IN BRIEF

Kloeckner Metals UK has been awarded a 'Good' BES 6001 certification rating for its Leeds, Westok, London and Dudley sites by the British Standards Institute (BSI). The certification is awarded for responsible sourcing of construction products and allows manufacturers and re-sellers to demonstrate that their products are made with constituent materials that have been responsibly sourced.

Balfour Beatty has been appointed by Fife College to construct its new Dunfermline Campus. The project is expected to deliver a huge boost to the regional economy, with 80 per cent of contracts for the build being awarded to local businesses, and tens of millions of pounds set to be spent in the Fife region.

An online consultation has been launched to gather feedback on the future development of **New Stanton Park**, a 200-acre, rail-connected site near Junction 25 of the M1 in Derbyshire. Verdant Regeneration purchased part of the former Stanton Ironworks site at the end of 2020. Since then it has been working with Erewash Borough Council and a wide range of stakeholders to draft proposals for the regeneration of the brownfield site in Ilkeston.

Galliford Try's Building London and South East Commercial business has won a £12.7M contract to build a sustainable commercial office building for CLS Holdings. The 10-storey scheme, at Vauxhall Walk in south London, is targeting a BREEAM 'Excellent' rating and will feature passive ventilation, smart lighting and PhotoVoltaic (PV) panels.

Bouygues UK has been appointed to build a five-storey high-tech development that will provide space for 600 jobs in Swansea city centre. Work is expected to start this year on the multi-million-pound scheme at 71/72 The Kingsway, on the site where the former Oceana nightclub once stood. It is set for completion in early 2023.

PRESIDENT'S COLUMN

In October, British Steel announced their 'Low-Carbon Roadmap' demonstrating its commitment to long-term sustainable steelmaking and the delivery of net-zero steel by 2050. It's important that the domestic section producer for the UK has issued this plan, which includes the building of an EAF plant and to facilitate carbon capture and storage for its BF-BOF plants by 2035.

Some clients are asking for their buildings to have EAF produced steel right now, due to the immediate embodied carbon argument. The problem with this approach is that it is a local approach, rather than thinking of how steel is produced globally. In the order of 99% of structural steel is already recovered in the UK for recycling or reuse, which is a great story for our material. The downside to this is that the total amount of scrap available now for EAF is pretty much at its maximum. So, if clients specify EAF rather than BF-BOF, there will simply not be enough EAF steel to go around.

Globally, BF-BOF accounts for 73% of all steelmaking, so we need both routes of manufacture at the current time. This is why the targets are set for 2035 and 2050, as the industry needs time to adapt in a financially stable manner.

Sharp increases in material prices have already proved challenging for the steel construction supply chain, and future energy price increases are likely to create further problems with cost plans for future projects. So, it is important that any further increases to fund the transition to low-carbon steelmaking are well thought out.

The embodied carbon in buildings is clearly important in light of the climate emergency and the idea that a steel-framed building must be designed for absolute minimum weight to drive down the embodied carbon is an admirable aim. But, the consequence of an absolute minimum-weight design approach will be likely to produce designs that will be more costly to build, both in terms of money and carbon. The reason for this is that minimum-weight design is likely to lead to complex connection designs, which will be time consuming to fabricate, and have increased temporary works requirements. Sometimes, adding a small percentage to the steel weight will give the most economic cost for a practical design incurring only a nominal increase in embodied carbon in the permanent works of the building. Also, bearing in mind that most steel-framed buildings are designed for a 50-year lifespan, and that 99% of the structural steel can be reused or recycled at end of life, is the nominal increase in embodied carbon such a burden?

There are also carbon savings to be made by increasing the reuse of the structural steel in buildings that are due to be demolished, rather than recycling it, and some clients are moving in that direction. Again, this is doable, but for the most part this is cost prohibitive at the present time. In the future though, I think there will be a time when cost will not be an issue for reusing steel. Recycling and reuse are fundamental to developing a sustainable circular economy, which is one of the "levers" in our own UK Structural Steelwork: 2050 Decarbonisation Roadmap published this month. I would encourage you to read it, to have patience during the transition and to have confidence that our steel construction industry, which is fiercely competitive, will adapt accordingly.

Mark Denham
BCSA President

Steel link bridges arrive at Mersey Ferry terminal

Working with main contractor John Sisk, Adey Steel has fabricated, supplied and installed two new 50m-long link bridges for Seacombe's Mersey Ferry terminal.

Providing pedestrian and vehicle access from the passenger ferry terminal to the berthing pontoon, the bridges replace two out-dated structures.

Each bridge was fabricated in eight welded sections at Adey Steel's main factory. In order to make sure the steelwork fitted together seamlessly, they were both trial assembled before leaving the workshop.

The bridge sections were then transported to Liverpool Docks, were they were assembled once again, before being delivered to Seacombe via barge.

A combination of barge-mounted cranes and MEWPs were used to install the bridges in their final positions, where they were fitted on to complex bearing arrangements that allow for both the rise and fall of the tidal river, as well as the drag movements of the incoming and outgoing flow.

Lindapter launches new updated website

Lindapter the manufacturer and inventor of steelwork clamping systems has launched an updated website including new technical resources for steelwork connections.

The company said the website (www.lindapter.com) has numerous innovative features and design tools to help structural engineers, consulting engineers, M&E contractors and specifiers involved with the design of steelwork connections to quickly find the optimum solution for their steel-to-steel connections.

New features include a Girder Clamp Configurator that produces fully-detailed connection drawings for customers to download as PDFs; a Hollo-Bolt Selector Tool that automatically filters products to assist with the correct specification; an Application Selector that filters popular connection assemblies; and BIM and CAD files, designed by Lindapter from its own resource library.

Website users can also book in-person or online technical presentations, view a range of new case studies and download product technical data to assist with their product selection and specification.

As well as pioneering steelwork clamping systems, Lindapter can also provide an independently approved range of steelwork fixings, cavity fixings, decking fixings and floor fixings.

The company said it has been specified on countless projects across the globe from the Antarctic to the Caribbean, in diverse applications as varied as the London's Tower Bridge, Target Field Ballpark in the USA, Dubai Shopping Mall and Gautrain Rapid Rail Link in South Africa.

Edinburgh low carbon innovation centre gets green light

Danish-based company Danfoss has received planning permission from Midlothian Council for a £25M low carbon innovation centre in Edinburgh.

Located in the Shawfair Business Park, the 6,900m² centre will provide a home for Danfoss teams working on next-generation, climate-friendly technologies in hydraulics, digitalisation and electrification, as well as including new manufacturing facilities.

The centre will be the first building in Danfoss' global portfolio to be operationally carbon-neutral, an important first step for the company to achieve its goal of becoming carbon neutral in all of its global operations by 2030.

Canopy work completed at Temple Meads station

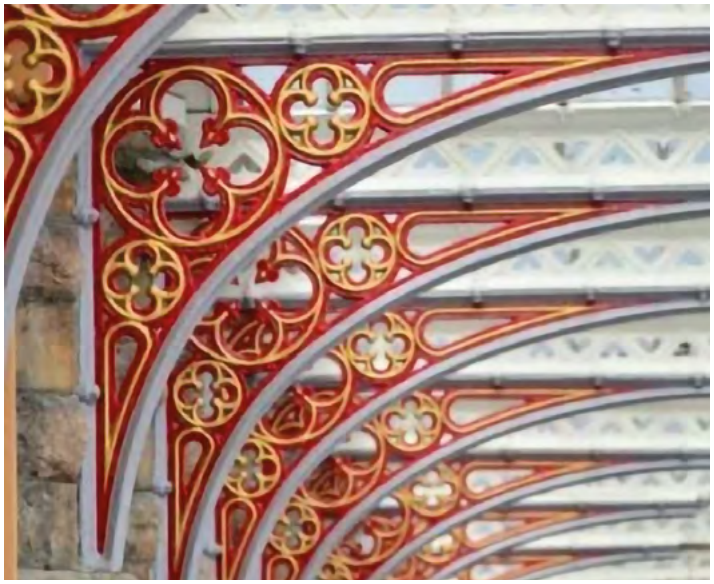
Network Rail and Taziker Industrial have completed the initial refurbishment programme at Bristol Temple Meads station by repainting the entrance canopies with a new colour scheme.

Prior to the painting work, the project team had to strip back the old paint coatings from the wrought and cast-iron columns, trusses (roof beams), and brackets within the station.

Nearly 900 litres of paint have been used to spruce up the station canopies, with the new colour scheme bookending London Paddington station, whereby the colour of the forecourt canopies and main station roof at Bristol Temple Meads feature an off-white colour, with hints of mid-grey tones on the trusses and brown-red details. This is reversed at London Paddington station where the roof is a brown-red colour with small grey details on the trusses.

The next phase of the works will see the erection of thirty two 36m-long roof beams across the platforms inside the station's main train shed. These will be used to support a large safety screen that will give engineers access to the roof to carry out the reglazing and painting, while protecting passengers and staff from the work being carried out overhead.

Neil Harrison, Managing Director Infrastructure, Taziker said: "The painting work at Bristol Temple Meads really gives the station a new improved look and, whilst the work has been challenging dealing with the weather and a live station environment, we are pleased with the final outcome, which our team can be really proud of."



High-tech food hub planned for Derbyshire

SmartParc, partnered with SEGRO, plans to deliver a 172,000m² high-tech food manufacturing and distribution campus on a 112-acre site at Spondon, Derbyshire.

As development partner, SEGRO will provide a multi-million-pound investment to regenerate the brownfield site. SmartParc will provide the onsite managed services, supporting the food community to increase production efficiency and drive reduced operational costs through collaborative working.

SmartParc said its revolutionary energy sharing infrastructure will utilise wind and solar, combined with central services, to deliver the most sustainable food production community in the country.

Blackpool indoor theme park given green light

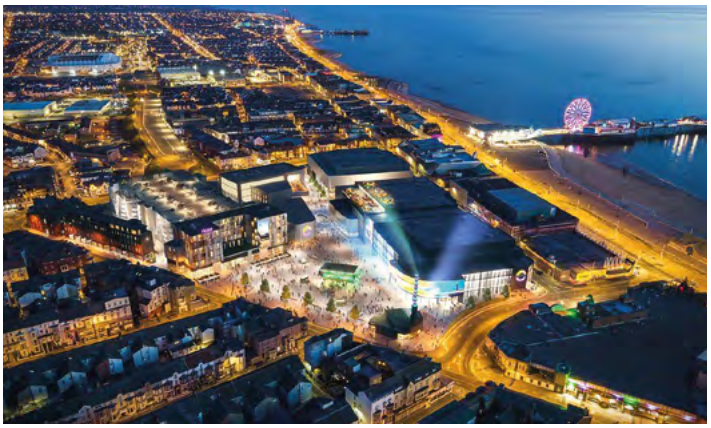
Blackpool Council has given the green light for a £300M leisure complex for the town's Golden Mile seafront.

Councillors backed plans to build Blackpool Central that will consist of three indoor theme parks, an artisan food hall and boutique holiday apartments.

Construction work could begin in 2022, with overall completion set for the end of the decade.

The plans include converting the Grade II-listed former King Edward VII Cinema into a food hall with outdoor dining areas, refurbishing the locally-listed King Edward VII pub and turning the King Edward VII apartment building into a hotel.

A 1,306-space seven-storey car park was also approved, which will be the first part of the scheme to be completed by developers.



Diary

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

Tue 16 Nov 2021
Design of Steel and Composite Bridges - Part 2
Webinar, SCI/BCSA members only
In this webinar, the provisions given in the Eurocodes for the design of steel bridges and their components against fatigue will be presented. A brief introduction about fatigue and the methods used for the assessment of bridges will be provided. Examples will be used to discuss structural detailing and the fatigue verification of various bridge parts.

Wed 24, Thu 25 Nov, Wed 2, Thu 3 Dec 2021
Steel Connection Design Course
Online
This course is for designers and technicians wanting practical tuition in steel connection design. The course concentrates on the design of nominally-pinned connections, in accordance with BS EN 1993-1-8, considering vertical shear and tying.

Tue 14 Dec 2021
Wind Actions and Snow Loads
Webinar, SCI/BCSA members only
This webinar will provide an introduction to wind actions and snow loads in accordance with the Eurocodes and the UK National Annexes. The presentation on wind actions will cover the recommended approach of considering quadrants around the site for hand calculations. After covering the uniform snow condition, the course will discuss the UK provisions for drifted snow.

Rising to the challenge

Jamestown has had to quickly adapt to numerous new challenges, such as border checks, custom declarations and associated transport issues that have arisen because of Brexit.

Having prepared for new Brexit regulations before the New Year by executing several trial runs to its UK customers, Jamestown says it began 2021 smoothly with a strong order book and is now looking forward to the challenges ahead.

"In this business, we are used to dealing with challenges on an almost daily basis," says Jamestown UK Business Development Manager Mark Stewart. "But on the back of COVID-19 and then Brexit, who could have foreseen the impact that the steel supply problems would have on each and every company working in this business?"

According to Mr Stewart, customers and suppliers alike have suffered due to almost weekly price increases and the resultant shortage of supply. No one escaped the impact of this significant challenge as businesses failed, major projects were cancelled or suffered significant delays and companies like Jamestown had to reassess how it managed its business going forwards.

Fortunately, Jamestown says its growing order book required that major materials were purchased early in the year, lessening the pressure on its purchasing team.

"That said and looking to the future, Jamestown continues to explore new steel supply sources in order to strengthen our ability to support our customers old and new," says Jamestown General Manager Niall Fortune.

Throughout the steel sector, recruitment is becoming a constant challenge as the marketplace gets busier, and the required skills are in short supply. Jamestown has continued to build and strengthen its team as Mr Fortune explains: "It is

A double-web plate girder in the Jamestown fabrication facility.

"Jamestown continues to explore new steel supply sources in order to strengthen our ability to support our customers old and new."

more important than ever before to continue the recruitment process, to get staff with the necessary skills to operate both existing and new equipment as we maintain our valued investment programme.

"With a growing order book and a customer portfolio that is increasingly demanding more complex and bespoke fabricated beams and columns to keep pace with architects' and designers' demands for exoskeleton-type structures, showcasing steel in construction, our management team are constantly searching for better methods of manufacture."

Columns being fabricated for a project in central London.

Complex box girder and plate girder fabrication has been a regular feature at Jamestown throughout the year. It is not uncommon for these bespoke members to be fabricated using material thicknesses of up to 100mm-thick, with complex welded joints often requiring a combination of partial penetration and full penetration welds.

The company says that recent investment in two new automatic welding machines has allowed it to have the necessary capacity to increase production of this type of work, whilst maintaining the throughput of the more standard plate girders and cellular beams.

This has increased the throughput of this type of bespoke work, while maintaining flexibility to enable smaller projects to be fast-tracked and at the same time allowing the management of varying customer deliveries, due to drawing changes and other variations.

Another recent addition to Jamestown's extensive equipment range is a large milling machine that has enabled it to finish machine end plates and bearing surfaces on heavy columns and beams, thereby guaranteeing that the company can meet the tightest of tolerances and removing a potential subcontract step from what is generally a short lead time.

Despite the challenges that COVID-19, Brexit and the steel supply problems have brought to its door, Jamestown says it has not just risen to the challenge, but gone far beyond in using its skills and expertise to produce some outstanding pieces of work over the past few months.

This has included double and triple web plate girders, many with additional features such as internal stiffening, drilling and finish machining, all of which are a regular feature on Jamestown's fabrication shop floor.

Items such as trusses, crane grillages, bridge structures and other more complex fabrications often require trial assembly prior to being broken down and delivered to site.

For these trial assembly procedures, Jamestown says its generous shop floor size is invaluable, while substantial laydown areas outside of the main facility are also continually in demand as client's often want materials stored before or after fabrication.

Summing up, Mr Fortune says: "No one knows what the future holds, and, in this business, we are well accustomed to challenges and changes alike, so how do we prepare for the future?

"Further ongoing investment in our people is a priority. Our customers demand the best, not only in the quality of our products and services, but how we deal with our customers daily. Ger Dollard, Jamestown's recently appointed Production Process Manager has quickly gained plaudits from our regular customers thus strengthening our Jamestown team." ■

Getting the purlin specification right

Purlins are manufactured as bespoke elements for each individual project.

Available in three section types, Z, C and M, light gauge steel purlins, rails and mezzanine sections are an ubiquitous component in a wide variety of structures.

Light gauge steel purlins are used on many projects, such as sports stadia, industrial units, out of town retail stores, distribution centres and many more where lightweight, high strength structural support systems are essential.

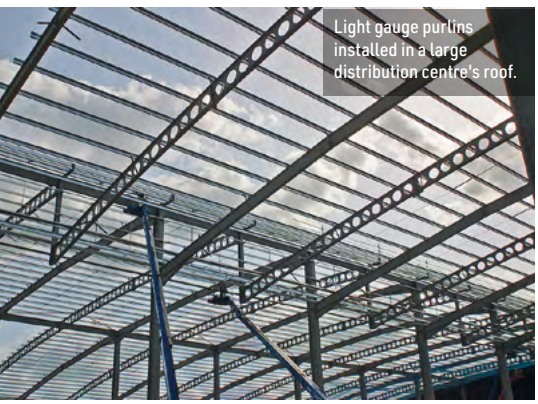
Purlins are most often designed and manufactured to meet the specific needs of each individual project, with section type, depth, length and gauge being selected according to the project's requirements.

Getting it right

Design and specification are crucial to the process, not only in ensuring that the final structure meets the necessary performance standards but also in delivering value for the end client; over-specified and the project could cost more than is necessary.

In the UK market of Great Britain (GB), comprising England, Scotland and Wales, the Construction Products Regulation (CPR) places legal obligations on manufacturers, distributors and importers of construction products used within the GB market to place the UKCA (UK Conformity Assessed) mark on their products where they are covered by a UK-designated standard.

The requirements of the CPR and UKCA marking apply to construction products used on a project irrespective of the design standard adopted for that project; for example, BS 5950 or BS EN 1993.



Light gauge purlins installed in a large distribution centre's roof.

For fabricated structural steelwork, engineers, contractors and steelwork contractors should ensure that their specifications require only UKCA marked (or CE marked until 31 December 2022) products are used on their projects in GB.

Similar requirements apply in the EU (CE marking) and the UK market of Northern Ireland (CE and UKNI marking).

Execution

For any project, the required quality of fabrication, or Execution Class, must be specified according to the procedures set out in Annex C of BS EN 1993-1-1 and its associated UK National Annex. The Execution Class should be specified for:

- The works as a whole
- An individual component
- A detail of a component

The engineer is responsible for specifying the Execution Class for the structure (the works as a whole). If the Execution Class for components and details is different to that specified for the structure, the Execution Class for these should not be lower than that specified for the works as a whole and should be clearly identified in the execution specification.

For the majority of buildings constructed in the UK, EXC2 will be the appropriate requirement.

The engineer should always derive the Execution Class based on the design parameters appropriate to each project. The quality requirements to each Execution Class are listed in Table A3 of BS EN 1090-2 and can be reviewed by the engineer if desired.

As mentioned, there is a danger for solutions to be over-specified and incur unnecessary costs. For example, if a project has an Execution Class of EXC2 but the engineer requires full traceability (an EXC3 requirement) instead of the partial (or batch) traceability requirement of EXC2, rather than specifying EXC3 on the basis of achieving this single clause requirement, it is suggested that EXC2 is still specified but with the higher level of traceability added to the specification.

BS EN 1993-1-1 states that the selection of Execution Class should be based on the following three factors:

1. The required reliability
2. The type of structure, component or detail; and
3. The type of loading for which the structure, component or detail is designed.

Guidance on straightforward procedure for determining the Execution Class for buildings is freely available on www.steelconstruction.info.

Getting the numbers right

With mandatory requirements covered, the engineer/designer needs to consider a number of additional factors in determining the specification and number of purlins required for a given application. Depending on what the purlins are being used for, these might include snow drifting, tiled roof, steep slope and wind loading.

Most purlin manufacturers will offer assistance in the design process, but Metsec leads the market with its dedicated software package, MetSPEC. Freely available for download, the package incorporates both British Standards and Eurocodes as well as the full range of Metsec purlin sizes to ensure that the specification process is as easy as possible.

The company also offers a comprehensive library of standard connections and macros for use with the Tekla Structures 3D modelling software.

Combined with expert technical support, these software packages ensure that the purlin specification process is as smooth and painless as possible, saving the engineer/designer time and ensuring that the end client receives value for money. ■

Visit **www.SteelConstruction.info**

All you need to know about Steel Construction

Everything construction professionals need to know to optimise the design and construction of steel-framed buildings and bridges can be easily accessed in one place at **www.SteelConstruction.info**, the largest and most comprehensive database of steel design guidance and advice available anywhere.

This online encyclopedia is an invaluable first stop for steel construction information. Produced and maintained by industry experts, detailed guidance is provided on a wide range of key topics including sustainability and cost as well as design and construction.

This is supported by some 250 freely downloadable PDF documents and over 500 case studies of real projects.

The site also provides a single portal, one-stop-shop access to key resources including:

- The Green Books
- The Blue Book
- Eurocode design guides
- Advisory Desk Notes
- Steel section tables
- Steel design tools

Explore the full content of **www.SteelConstruction.info** using the index of main articles in the quick links menu, or alternatively use the powerful search facility.

BCSA

STEEL for life

Onsite steel erection is always undertaken by fully-trained operatives.

Early involvement helps manage price instability

Despite misperceptions that steel price rises were different from those of other materials, steel remains the cost-effective framing material of first choice. Nick Barrett reports that communication and collaboration with clients and all along the supply chain are proving a winning strategy.

NSC's last update on steel prices and availability in the summer was against a background of global rising raw material prices affecting all construction materials; consequent price rises in concrete, timber, plastic products and steel; and shortages, threatened and otherwise. Despite the fact that all construction materials have been affected, steel seemed to be getting singled out for the more alarmist stories about price rises, while lower technology materials like concrete and timber never attract the same attention.

Steel is frequently in the news, usually when either large investments are made in steelworks, or manufacturing job losses are threatened. "The plain fact that steel prices are as stable as any other construction material, and that its supply chain is well-founded, always seems to have to be argued against a background of misinformation implying that steel is doing worse than other materials in terms of price or availability," says BCSA President Mark Denham, Chairman of Elland Steel Structures.

"In fact, the true situation is the reverse of that. The proof is seen in the regular costs analysis carried out by independent researchers like AECOM, whose latest update will be issued shortly".

Developers and other clients are keen to use steel, convinced of its sustainability advantages that the sector has been advising on for many years; but further carbon reduction action is demanded by the climate change crisis. The COP26 meeting in Glasgow has highlighted the crucial need to combat climate change by reducing carbon emissions in all of our activities, including manufacturing, construction of buildings and infrastructure, heating our homes and public buildings and transport.

The entire steel supply chain is acutely aware of the need to make its contribution, and is making every effort to minimise carbon impacts, starting from design, through manufacture, construction, operation and eventual decommissioning, which might involve demolition and, for steel, recycling or re-use. Other construction materials will never achieve the re-use and recycling - and without degradation of the material's properties - that steel delivers.

Steel's Net-Zero Roadmap

Steel construction is in strong demand to deliver projects in fast-growing, key sectors of the economy while providing the high sustainability credentials which are highlighted by the BCSA's Net-Zero Roadmap that is summarised in this issue of NSC (see page 16). The Roadmap spells out the steel construction sector's commitment to achieving net-zero carbon by 2050, decarbonising operations in line with government ambitions. Steel manufacturers like BCSA industry members Tata Steel and British Steel are also making their own efforts to support the global push to combat climate change.

Steelwork contractors say the strength of their supply chain has been proven in recent months as supplies of sections and most other steel products have been maintained. Communication with clients has been key in helping them understand the global problems affecting supply; after a short-lived pause by some, while the implications of price rises and supply issues were absorbed, client

"The plain fact that steel prices are as stable as any other construction material, and that its supply chain is well-founded, always seems to have to be argued against a background of misinformation implying that steel is doing worse than other materials in terms of price or availability"

confidence has been revealed as strong.

Steve Duffield, Group Sales Director of William Hare, said: "Our workshops are fully staffed by locally-employed specialists and there are no labour supply challenges to be met. Site erection is swiftly carried out by small, highly-skilled specialist teams, minimising time spent on site. For steel construction, just-in-time deliveries of offsite fabricated sections as demanded by modular construction, is just the normal way of working.

"Issues have been explained in regular conversations with clients, who tend to be realistic business people, and they appreciate the issues and what we are doing to help. They now realise that other materials prices are rising rapidly, and are taking a cooperative and long-term approach."

Client confidence remains high and new orders are flowing through steelwork contractors. Caunton Engineering is typical, where Executive Chairman Simon Bingham says orders are being booked now for the third quarter of 2022. "The message about getting your steelwork contractor involved early is getting through. Clients used to order materials and services sequentially in line with the construction programme, but they have learned to order the element with the longest lead-in first, so steel comes higher up on the priority list. Procurement is becoming more strategic.

"We have heard that alternative materials had been looked at by client's estimating teams, but steel is still emerging as the best option. We haven't suffered any drop off in orders or our ability to deliver to clients on time and to budget."

A 46m- long space frame for the Wine Society warehouse built at Caunton Engineering's Works

Power of steel supply chain

Steve Govier, Chief Executive of Bourne Group says the power of the steel construction supply chain has been proven in recent months as availability of steel is not an issue. "Availability issues are behind us, the supply process has been de-risked. Enough of world steel manufacturing capacity is back on stream and we have been able to allay any client concerns. Communication and collaboration have helped enormously.

"We have never faced problems with securing drivers to take materials to site and the erectors are our own highly-trained employees. Prices for steel have stabilised, particularly for steel sections, and temporary surcharges have been manageable. Steel manufacturers are able to make profits now for the first time in a number of years, which is essential to pay for innovation and carbon-reducing investments."

Mr Govier confirms that clients are responding well to the case made for issuing early instructions. "Buying materials in advance locks prices in, although not all clients are able to do that. We see demand rising across the board and despite short-term anxieties earlier in the year, steel is still wanted by its customers."

Mr Duffield confirms that prices have settled, there are no supply problems and the market is active. "British Steel adding their temporary surcharge was a highly visible event, which helps us as all of our customers can see why we had to increase prices. There was some misinformation being spread at one time about the length of lead times for steel, but there are no issues with steel supply.

"We look at projects differently now from a procurement point of view, and have convinced clients that it is important to pin prices down as soon as possible, and focus on the quality and quantities of steel that will be needed. That knowledge then helps the manufacturers plan production. This is the sort of collaboration that helps us all.

"Early engagement has never been more important, it is key. Pressing the button at the last minute is not the way the market operates any longer."

Mark Smith, Chief Executive of Billington Holdings says after being 'blindsided' by some of this year's price rises, prices have stabilised. "Price is still an issue but no more so than other materials like concrete and timber. We talk to client's cost consultants regularly so they can have up-to-date information. We identify the critical supply elements of their projects and negotiate fluctuation clauses when appropriate. Regular contact and positive conversations with customers have been helpful.

"There are some inefficiencies in the construction supply chain being caused by driver shortages affecting deliveries, however, these have improved greatly working closely with our supply partners. We are all planning ahead more than before, which helps the whole supply chain and ultimately our customers." ■

Roadmap to decarbonised steel construction

The route to net-zero carbon for steel construction has been clearly set out in a Roadmap from the BCSA, signposting the new and developing technologies that will allow net-zero steelmaking to be achieved by the 2050 target date.

The world now accepts that it has to grapple with the climate change emergency on a broad range of fronts, and all construction materials have found themselves under a harsher sustainability spotlight than ever before. The steel industry is committed to achieving net-zero steelmaking by 2050 and is already investing significant sums in new technologies to decarbonise steelmaking while investigating how best, and how quickly, decarbonising can be made to happen.

Decarbonised steel structures will be a reality by the UK net-zero carbon target date of 2050 thanks to the collaborative efforts of designers, steelwork contractors and steel producers to devise both demand side and supply side reduction measures. There will be costs associated with the transition, but steel is regarded as the cheapest to decarbonise of all the 'harder to abate' industries, with a McKinsey report putting the average abatement costs at £90 per tonne of steel.

The route to our decarbonised steel future has been clearly set out in a Roadmap produced by the BCSA, with substantially reduced emissions by 2030 as a key milestone along the way. As the Roadmap shows, there are multiple options to decarbonisation, using technologies which are either available now or at the industrial pilot stage.

The destination at the end of the Roadmap is a genuinely circular and sustainable structural steel sector in which steel structures are sustainably constructed, adapted and extended to prolong their lifetimes, and easily deconstructed for either re-use or recycling at end of life.

Progress already made

Steel already has a strong sustainability benefits to build on:

- Steel structures are lightweight and structurally efficient
- Steelwork is efficiently fabricated offsite offering quality assured, fully tested and traceable products
- Steelwork design and fabrication is BIM-led providing a digital-twin enabling future reuse
- On-site construction is safe and fast with minimal local adverse environmental impacts
- Structural steel is fully recyclable and many structural elements are reusable
- Steel-framed buildings are flexible to change of use and steel structures are easily adapted

The steel industry has always been aware of its sustainability responsibilities and significant progress has already been achieved in decarbonising steelmaking. The carbon intensity of UK steel production for example has been reduced by around 60% since 1960 and 20% since 1990, which is the baseline for the UK's 2050 net-zero reduction targets.

The £1.6 billion a year UK structural steelwork sector is the most successful in the world, with 98% of single storey industrial buildings and 65% of multi-storey non-residential buildings framed in steel. Some 60,000 people are employed in fabricating and erecting structural steelwork.

UK steel production is currently around 7.1 million tonnes per annum; 0.4% of global

The circular economy revolves around reusing and recycling products and materials for as long as possible.

Structural steelwork is fully recyclable and many structural elements are reusable.

Steel-framed buildings offer a number of advantages, such as flexible open-plan spaces that can easily be reconfigured by a tenant.

production. The UK sources some 90% of its structural steel from domestic and European steel manufacturers, most of whom have already committed to decarbonising steelmaking by 2050.

The steel industry has a worldwide significance, much of modern life would not be possible without it. Global crude steel production was 1.88 billion tonnes in 2020 and is still rising due to industrialisation in developing economies and growth in China which accounted for 57% of all steel production in 2020.

Rising to the challenge

BCSA steelwork contractor members have been measuring and managing their carbon footprint for many years as part of BCSA's sustainability drive and the introduction of the BCSA sustainability charter and carbon footprint tools in 2007. The structural steelwork sector recognises that more remains to be done and the Roadmap acknowledges this while setting out the measures that will be adopted to achieve decarbonisation. The challenge is one that the industry is determined that it will rise to.

Others also have a role to play and a lot will depend on adoption of appropriate policies by governments, incentives and other financial support. The technologies to deliver on the Roadmap's promise already exist and are identified. The structural steelwork sector will retain its flexibility to respond and react to policy developments and to the emergence of new and improved technologies as they become available.

As well as technologies, decarbonisation success will depend on policies and frameworks being provided in the UK and globally to provide a 'level playing field' for steel producers in areas like energy costs and to ensure finance is available to commercialise new steelmaking technologies and adapt existing ones. Cooperation with other sectors like renewable energy, Carbon Capture Utilisation and Storage (CCUS) and hydrogen will also play a key role, and the steel sector is already engaged with the developers at the leading edge of these technologies.

Steel's vision for a circular zero-carbon future

The role and value of structural steel in the circular economy is already proven. A well-established scrap network recovers 99% of all UK structural steel sections, of which some 86% is recycled and 13% reused.

Steel manufacture today is dominated by two production processes. Blast furnace-basic oxygen furnace (BF-BOF) production is where iron ore is converted to iron and then steel in a process fuelled by burning coke to create primary steel. Some 73% of all steel is produced this way and as the blast furnace accounts for around 70% of the greenhouse gas emissions associated with steel manufacture, it is unsurprisingly the priority for decarbonisation.

Electric arc furnace (EAF) production mostly uses scrap steel rather than iron ore as raw material to create secondary steel. EAF production can also use direct reduced iron (DRI) on its own or in a scrap and alloy mix. Some 26% of steel is manufactured this way. The limiting factor in increasing this is the finite supply of scrap. Demand for steel from developing economies is growing and can only currently be met by production of primary steel via the BF-BOF method.

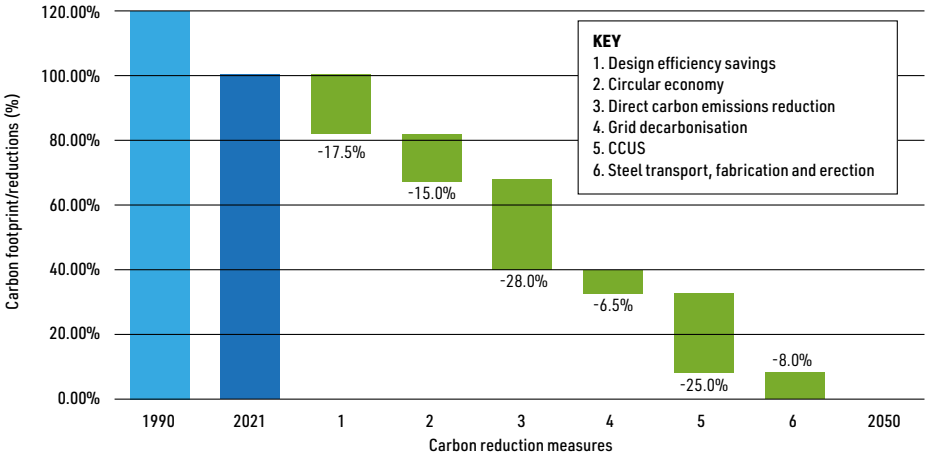
Taking a look into the future, the steel sector sees a time, possibly the end of the century, when all blast furnaces have been decommissioned. ■

Technologies and strategies ►

Steel-framed structures offer a lightweight and more efficient solution than alternative framing methods.

Technologies and strategies

The 2050 Roadmap is based on six decarbonisation strategies or 'levers' that will be deployed, each of which has already reached the pilot or demonstration project stage. The estimated carbon reduction achievable by 2050 for each of these is declared. The transition to net-zero will involve a complex journey involving a mix of these technologies, and the precise mix is likely to change as technologies and related policies evolve.



1. Design Efficiency:

The first of the six is reducing demand for steel by greater design efficiency which will deliver early and significant carbon reductions, and by 2050 will reduce carbon by 17.5%, with most efficiencies achieved by 2035. The options for increasing design efficiency are at hand, partly thanks to steel manufacturing advances like high strength steels; using these allows the same structural function to be performed with less material.

Designers in the past might have been over conservative but have learned how a less conservative approach can lead to more efficient designs. Similarly, design loads have been sometimes over specified, but designers now have and are eager to use the skills to deliver greater material efficiencies - but incentives and targets have to be introduced to bring these designs forward, and higher design fees might be needed to reflect the additional time needed to refine designs for steel efficiency.

2. Whole Life impacts:

Steel is widely recognised as having inherently strong circular economy benefits, which will generate 15% carbon reduction to 2050.

These benefits are strengthened when proper consideration is given to calculating whole life impacts and benefits of buildings and the materials they are constructed with. In the context of the Roadmap, the circular economy delivers carbon emission reductions through demand reduction measures relating to extending building lifetimes and preserving the value of steel products through reuse and recycling.

A Whole Life Cycle Assessment approach should be taken when measuring these impacts, which considers all emissions produced over the entire life of buildings and other structures, from sourcing through construction and use to disposal (cradle to grave).

Steel structures give predictability to the reuse and recycling potential of buildings and construction products. In Life Cycle Assessments the benefits of recycling and reuse are accounted for separately as beyond-life credits, technically referred to as Module D in CEN standards. For steel products, Module D generally gives a benefit by accounting for not having to manufacture virgin material in the future, although for some less-well recycled materials, the opposite could be true.

Steel delivers many other whole life benefits, including durability and resilience, flexbility and adaptability, versatility, reuse and remanufacture. A key sustainability advantage of steel is that it is 100% recyclable with no loss of its inherent properties. It is the most recycled material in the world with over 650 Mt recycled annually.

These inherent properties mean that beyond life cycle credits can be considered on a project-by-project basis if they are recorded separately along with an appropriate reuse / recovery recycling strategy being put in place.

Steelwork offers the best solution to create large column-free spaces.

3. Reducing emissions:

The third of the six is improving the emissions performance of steel manufacturing. Some 28% of carbon emitted from direct steelmaking can be eliminated by 2050 from a range of measures already being adopted, and by the development of new energy sources like hydrogen.

There are already a wide range of emission reduction technologies being employed in UK and EU steelworks that will deliver incremental improvements as their use spreads. They include waste heat recovery systems that reduce the amount of energy consumed or export electricity externally, to district heating schemes. The increased use of scrap in the BF-BOF and EAF steelmaking processes can reduce carbon emissions, but there are limits on the amount of scrap that is available.

Biomass and biowaste materials such as sustainable forestry and agriculture residues, can be used to produce bioenergy for steelmaking. In addition, plastic waste can be used as the source of energy, in combination with carbon capture and use technology, the emitted CO_2 can be converted into hydrocarbon liquids (ethanol) or solids (plastics), creating a carbon-neutral, circular

carbon cycle while addressing society's waste challenge with plastics.

Pilot and demonstration projects underway include ArcelorMittal's development of district heating schemes in Europe, at facilities in Belgium, Luxembourg and France.

Tata Steel has invested in BOS gas and BOS heat gas recovery systems which increased the local electricity generation on site at the Port Talbot steelworks reducing external grid requirements by 15%. This also reduced the CO_2 intensity on site by over 300,000 tonnes per year.

A radical new technology for making iron called HIsarna has been in development since 2011, where the pre-processing of ores and coal into sinter and pellets can be eliminated. It's concentrated CO_2 off-gas is ideally suited to carbon capture and storage (CCS). It has many other unique benefits, such as eliminating the emissions of other pollutants like nitrogen oxides and sulphur dioxide from the processes it replaces. HIsarna is expected to be commercially available in 2030-35, when it could lead to blast furnace replacement. Combined with Carbon Capture and Storage, HIsarna can cut up to 100% of CO_2 emissions.

4. Decarbonising energy:

Decarbonisation of the electricity grid is a major plank of the UK's decarbonisation strategy, one which will lead to an estimated 6.5% reduction in carbon emissions created by steel. Decarbonisation of the UK electricity grid will reduce the carbon intensity of both BF-BOF and EAF production. The impact of grid decarbonisation has a greater influence on scrap-based EAF production because electricity is the primary energy source and can contribute over 50% of the carbon footprint.

The impact of grid decarbonisation is also heavily dependent on whether there is a shift from BF-BOF to scrap-based EAF steel production. In the UK a shift from BF-BOF to scrap-based EAF production yields a greater benefit from grid decarbonisation. To facilitate a large-scale shift to scrap-based EAF will require a supply of affordable renewable energy.

5. Carbon capture and use and storage:

An important part in the decarbonisation Roadmap will be played by Carbon Capture and Use (CCU) and Carbon Capture and Storage (CCS). Whereas CCS permanently stores captured carbon, CCU converts carbon into commercially viable products such as bio-oils, chemicals, plastics and fuels. These can be used in place of products made from fossil fuels, with the net effect of reducing greenhouse gas emissions.

A key attraction of CCUS technologies is that they can be retrofitted on existing BF-BOF steel plants without significant changes to existing equipment, which makes it easier and lower cost to deploy. In the UK, CCUS hubs or clusters are being developed including the Zero Carbon Humber which includes British Steel. Tata Steel and ArcelorMittal are also making significant investments with partners in developing these technologies.

6. Steel transport, fabrication and erection:

Improvements in steel transport, fabrication and erection are expected to deliver a carbon reduction of 8%. BCSA steelwork contractor members have been measuring and managing their carbon footprint for many years as part of BCSA's sustainability drive and the introduction of the BCSA sustainability charter and carbon footprint tools in 2007.

The Scope 1 and 2 carbon emissions associated with the fabrication of constructional steelwork come mainly from the energy used in the fabrication shop and associated offices, together with transport of finished products to site, business travel and on-site erection activity. These emissions can be minimised through the increased use of renewable energy, best available fabrication technologies and the use of electric plant and vehicles where possible.

Some steelwork contractors are investing in renewable technologies such as wind turbines, biomass units and anaerobic digestion plants. Some of the technologies used in the fabrication shop include simple ideas such as changing to LED lighting, the use of compressed air leak detection and efficiencies to reduce leaks in compressed air and gas systems, power optimisation, inverters to control the speed of electrical drive motors and the use of new generation weld sets. Many steelwork contractors are also investing in hybrid/electric company vehicles, maintenance vans and electric equipment on-site to reduce emissions.

S460M grade high strength steel section

Commenting on the Roadmap, BCSA Chief Executive Officer Dr David Moore said: "The UK structural steelwork sector is committed to deliver sustainable steel buildings in line with UK 'net-zero' 2050 targets. Decarbonising steelmaking, as for many industrial sectors, is a significant challenge, but this Roadmap shows a credible pathway to transition to net-zero by 2050.

"A major strength of the Roadmap is the breadth of available technologies that provide flexibility to respond and react as they are commercialised at different timescales. However, technologies are only part of this transition. Policies and frameworks, both nationally and globally, are needed to ensure a 'level playing field' for steel producers and to provide the financing necessary to adapt existing steelmaking technologies and commercialise new ones. Integration and cooperation with other sectors including renewable energy, CCUS and hydrogen will also be key."

The Roadmap is available at *www.steelconstruction.org.* ■

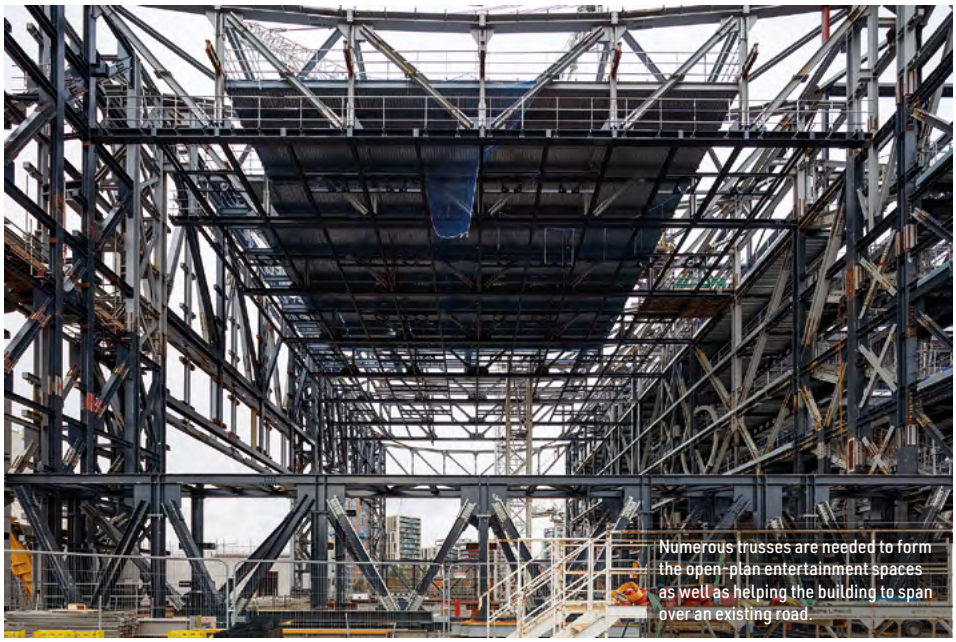

Tata Steel, along with British Steel and ArcelorMittal, are committed to net-zero steelmaking by 2050.

Factory of trusses

FACT FILE
The Factory, Manchester
Main client: **Manchester City Council**
Architect: **OMA**
Management contractor: **Laing O'Rourke**
Structural engineer: **Buro Happold**
Steelwork contractor: **William Hare**
Steel tonnage: **4,900t**

The Factory is supported by Manchester City Council, HM Government and Arts Council England

Providing a permanent home for the biennial Manchester International Festival (MIF), one of the largest purpose-built cultural buildings in the world is taking shape on the site of the old Granada TV studios.



Numerous trusses are needed to form the open-plan entertainment spaces as well as helping the building to span over an existing road.

Cranked steel members form the building's signature curved facade.

Steel construction has come to the fore with the erection of interlinked trusses, mega-columns and numerous long-span plate girders, all of which form a new cultural building on a constrained inner-city site in Manchester.

Known as The Factory, the building is a multi-purpose creative venue being built by the council. It will be run by the team behind Manchester International Festival (MIF), the city's biennial arts celebration.

The project's name, in part, is a nod to Manchester's Factory Records, the label that spearheaded the post-punk era of the late 1970s and 1980s with bands such as Joy Division, New Order and the Happy Mondays.

The record label was run by Tony Wilson, who was also a presenter on the north west's Granada TV channel. Creating some symmetry to the scheme, The Factory, which is expected to deliver a £1.1bn boost to Manchester's economy and attract up to 850,000 visitors over ten years, is a landmark project within the St John's mixed-use neighbourhood, which is being largely constructed on the site of the TV channel's former studios.

MIF usually includes a diverse repertoire of events and shows, consequently The Factory needs to be a venue able to accommodate several performances at once, without comprising sound or acoustics.

"Flexibility is key to the project's design," explains Laing O'Rourke Project Technical Leader Andy Bell. "The performance spaces have moveable partitions and are acoustically-isolated so they can be used individually or as one large area."

The Factory's venues consist of a theatre that has the flex for a 1,500-2,100 capacity, depending on its set up, and a large open area known as the warehouse that will be able to accommodate 5,000 standing people. Overall, The Factory's steel-framed structure can be divided into four main parts, the aforementioned venues, an office and back-of-house zone, and a truck lift. The latter is structurally-independent from the rest of The Factory and is enclosed in an in-situ concrete box cantilevering over Water Street. The 2 lifts within are formed from steel frames and have an impressive 40t capacity each, which will allow The Factory to move the largest of exhibits in and out of the building from ground floor level to the performance floor on level 2.

The biggest of the two venues is the warehouse and it measures 65m-long, 33m-wide and 20m-high. It can be one large performance space, or divided in two by closing a set of huge steel-framed acoustic partitions, that will retract around the interior walls on tracks.

Meanwhile, the interconnected theatre can also be used simultaneously as another individual venue, but the addition of two 60t acoustic proscenium doors, that can be raised, will allow it to connect into the warehouse, significantly enlarging the stage. The doors are supported by a 23m-long x 5m-deep truss, which weighs 125t.

"Because each venue needs to be acoustically-isolated from the other, as well as from the outside world, we have adopted a box-in-a-box design for these parts of the structure," explains Buro Happold Associate for Buildings Mark Cunliffe.

This structural design means there are two isolated inner boxes (theatre and warehouse), both surrounded by a void (up to 2.5m-thick) and then a

larger outer box. The latter box is formed by series of 300mm-thick concrete panels, which are isolated from the main steel frame via acoustic bearings.

The inner steel-framed warehouse box has an attached series of 200mm-thick precast isolation panels, while the theatre has 200mm-thick timber panels supported by its steelwork.

This complex acoustic treatment not only negates noise ingress between performance spaces but also prevents sound penetrating the venues from potentially noisy neighbours.

These neighbours include the other buildings being constructed as part of the St John's development, the Science and Industry Museum, the Ordsall Chord railway line and Water Street - a B-road The Factory spans over.

As well as creating the box-in-a-box design, structural steelwork has formed trusses and transfer structures that help the building bridge over a number of site constraints – Water Street being one – and create the necessary column-free venue spaces.

One of the more challenging parts of the steel frame is known as the west mega wall, that spans over Water Street, separates the warehouse from the theatre and contains the connecting proscenium arch.

"These constraints mean there are only three localised zones along the wall's length where vertical structure can be located down to ground via braced steelwork towers termed mega columns," says Mr Cunliffe.

On the opposite side of the warehouse, the east mega wall is slightly less complex and has more locations where vertical structure can continue down to foundation level, and so it has four mega columns, one more than the west wall.

Each of the so-called mega columns are approximately 2.5m × 2.5m on plan, 34m in height and are made up of heavy UC columns in each corner with UC bracing between.

Limited space for the mega columns has been compounded by the fact that the middle member of the west wall's three columns had to be located directly above numerous important arterial service routes.

To solve this conundrum, a large truss, dubbed the mega-pig due to its porcine shape, supports this central mega column, diverting 5,000t of load via a cantilever into the ground and away from the subterranean services.

An interlinked series of trusses spanning between the mega columns, form the warehouse and theatre roofs. What is known as a 'collector truss', consisting of two parallel roof trusses braced together along top and bottom chords, spans between the mega columns within the west wall.

The collector truss over Water Street is 12m-deep and supports the main warehouse floor via a series of hangers. Meanwhile, over the proscenium arch the collector truss decreases to 10m-deep. The collector trusses also support more trusses, up to 36m-long and 5m-deep that form the warehouse roof. Within their depth, theses trusses support walkways and associated services, which are needed by the multi-purpose venue.

The roof trusses carry considerable loadings as they also support a crane and its two runway beams, which will allow the warehouse to display and move large exhibits hung from the roof.

The theatre roof truss also spans onto the west wall's collector trusses, connected via acoustically- ▸22

▸21

isolated bearings to mitigate noise transfer between the theatre and warehouse.

A similar truss arrangement has been used along the east mega wall, although it is made up of a single planer truss, which spans between the four mega columns to support the floors.

"For wind loading perpendicular to the mega walls, the collector trusses work together with the mega columns as moment frames to resist wind loads and equivalent horizontal forces in plane," explains Mr Cunliffe.

The size of the steelwork elements on this project are considerable, as William Hare Operations Director Tony Whitten sums up: "We've had a number of crane lifts involving elements exceeding 100t in weight.

"The proscenium truss and one of the warehouse trusses are each over 100t, while lifts of 75t, such as the theatre north truss, have been quite common."

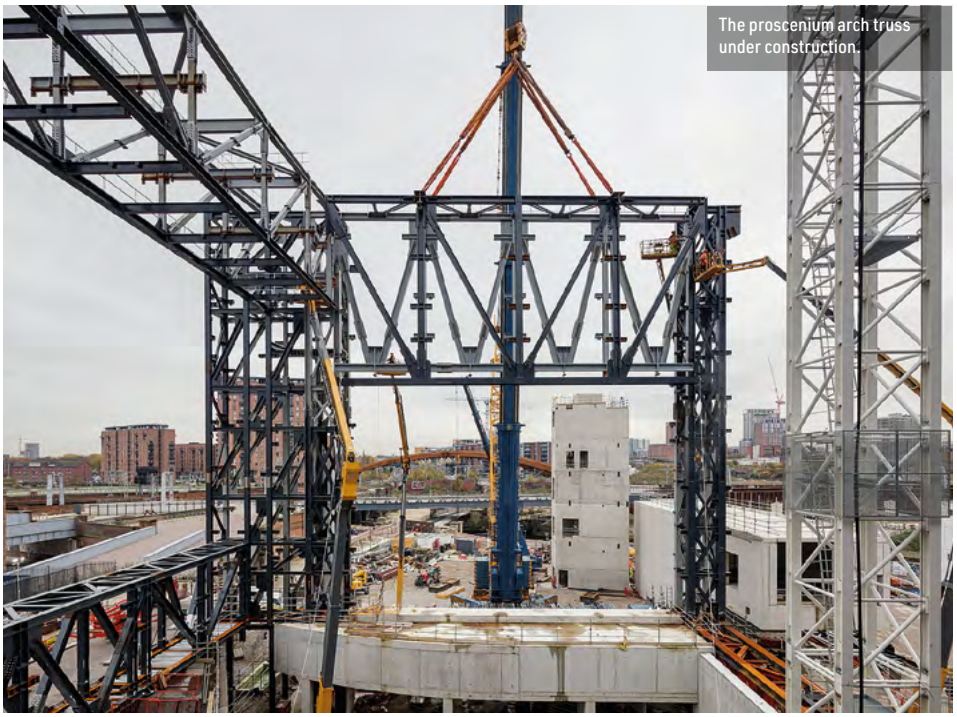
Because of the size of the trusses, they arrived on site piece-small and were assembled on the ground before being lifted into place. The largest trusses required the project team to use a 1,000t-capacity mobile crane.

The Factory is due to open early 2023, but a special commission called Arcadia by Deborah Warner during the 2021 festival in July provided a first glimpse of the building. For one weekend only, the space was transformed into a one-off installation featuring a field of tents accompanied by a soundscape of poetry inspired by the natural world.

"In order to make the venue safe, we had to undertake a very challenging logistical exercise, in what is a 'live' construction site," says Laing O'Rourke Project Director Neville Hodson.

"We felt privileged to play our part in bringing the first artwork into the building." ■

The Factory will feature two large entertainment spaces that are interconnected via moveable partitions.



The proscenium arch truss under construction.

Truss details

David Brown of the SCI reflects on the steel truss details used at The Factory

It is easy to see why trusses feature so prominently in the description of The Factory. Vertical trusses for the mega-columns, a 'collector truss' and the 'mega-pig' transfer truss form major parts of the superstructure. In addition, trusses are used to provide long spans and support significant loads – all the reasons that designers should consider steel trusses. In this case, steel trusses are probably the only reasonable solution.

As always, the joints are generally the most challenging part of truss design. Although some parts of a large truss might be welded in the fabrication workshop, completed sections must be connected on site. The Factory steelwork shown is a mixture of factory welded and site bolted connections.

Generally, the connections of the diagonal members have been achieved with a large, thick gusset plate. In most connections, the flanges of the diagonal members stop short of the chords, so all the load must be taken in the gusset plate. For the welded connections seen in the transfer truss, the load from each flange of the diagonal member (usually around 40% of the total load) will be transferred over the length of the longitudinal welds into the gusset plate. Some distribution of this force will be assumed in the gusset plate and the force transferred into the chord and vertical members. It is likely that designers would have diverse ways to assess the way the load is distributed, what checks are required for the gusset and how to establish the forces on the welds to the chords and to the vertical members – so early discussion and agreement is important.

The bolted connections of internal members at The Factory follow the same philosophy using a large gusset plate at the joints and bolted splices to the internal members. The gusset plate side of the joint is fabricated to match the internal member, and then relatively orthodox cover plate splices can be used.

In some locations, the joints at The Factory show the effect of very steep (or very shallow) setting out of internal members – the gusset plates become long in one direction requiring additional verification (certainly if the gusset is in compression). Internal members of small length can also be problematic – in some cases once the joint is detailed, the member is effectively a splice between gusset plates. This shows the importance of recognising that a member in an analysis model has a finite size and will demand joints at each end – which are sometimes difficult to accommodate. ■

SCI COURSES

SCI
Steel Knowledge

www.steel-sci.com

Trusted expertise for over 30 years

SCI supports the steel industry by providing technical in-depth training.

SCI's technical courses keep engineers updated with the latest developments within steel design and equip them to design competently, efficiently and safely.

Courses are run online and vary in content and duration ranging from 3 to 4 two-hour sessions. Examples and workshops are included to enable a greater understanding and appreciation of the subjects.

CPD certificate are provided.

See SCI's full range of courses, webinars and events on the SCI Information Portal.

The SCI is committed to helping members meet their design, manufacture, construction and commercial objectives.

@SCIsteel

steel-construction-institute

SCI Course List

education@steel-sci.com

+44 (0)1344 636500

https://portal.steel-sci.com

Steel creates leisure and care hub

Structural steelwork is playing a major role in the construction of the multi-million-pound Allander Leisure and Day Care Centre in the East Dunbartonshire town of Bearsden.

Long span cellular beams are used to create the required column-free spaces.

Leisure and adult day care services are being brought together at one state-of-the-art facility as part of a £42.5M investment by East Dunbartonshire Council.

An existing leisure centre in Bearsden, which will remain open during the construction works, is being redeveloped during a three-phase programme.

Once complete, the new steel-framed Allander Leisure and Day Care Centre will include: an eight-lane swimming pool and a 20m training pool with movable floor; a hydrotherapy pool; a gym and high & low intensity studios; a state-of-the-art spin room; an eight-court games hall; two squash courts, changing facilities and a café.

Alongside these sport and leisure facilities, the main steel-framed building will also accommodate day care for adults with learning disabilities, replacing an existing centre in nearby Kirkintilloch.

Phase one of the construction works began earlier this year and includes the construction of the new steel-framed facility as well as an adjacent steel-framed plant building. Once this is complete in autumn 2022, phase two will see the decommission and demolition of the existing leisure centre, which in turn will clear the ground for phase three that includes the installation of a light steel-framed, fabric-clad, sportsdrome. To be completed by summer 2023, this structure will accommodate two indoor football pitches and a tennis court.

Using a steel-framed solution was the only realistic option for this project's main building according to BakerHicks Associate Engineer and Civil and Structural Lead on the project, Neal Shaw.

"There are a number of areas, in the leisure part of the building, that are long-span column-free spaces, and these could not have been economically formed in any other material other than steel."

On the ground floor, the long-span zones include the pool hall, which is created by a series of 26m-long cellular beams. These members were delivered to site in three pieces; a 17.5m-long middle section and two end sections measuring 2.5m and 6m-long respectively.

"The end section's lengths were dictated by the fact that we had to hide the splice connections in the bulkheads, either side of the main pool," explains Walter Watson General Manager Structural Division Trevor Irvine.

Also on the ground floor, a 25.5m-long cellular beam, weighing 6.9t, has been installed across the back of the main reception area to help form the desired open-plan design.

Meanwhile on the first floor, the games hall is another column-free space, formed with a series of 18m-long trusses, that vary in depth from 3.3m down to 2m in order to create a pitched roof.

Many leisure centres would ordinarily locate their sports hall on the ground floor, but the Allander complex had a restricted footprint, due to the other phases of work that needed space. This led to a stacked-up design being adopted, with a first-floor sports hall. The extra vibration the sports hall may generate required this part of the composite floor slab to be increased to a 240mm-thick concrete topping, from a 150mm thickness elsewhere on first floor.

Next to the leisure and sport part of the complex, which is a two-storey and/or double height part of the structure, the adult day care centre is accommodated in a single storey element.

Based around a regular column grid pattern, the day care zone accommodates a number of diverse spaces such as meeting rooms; quiet spaces; offices; dementia, rebound, sensory and physiotherapy treatment rooms; arts & crafts, dance and music rooms, changing rooms and a training kitchen for learning.

"We wanted to keep the steel design as simple as possible, following a regular column lay-out where possible and trying to avoid large and heavy transfer structures," says BakerHicks Structural Engineering Lead for the project, Ross Harris.

"However, one area where we could not avoid a transfer structure was above the hydrotherapy pool."

Because of the stacked-up design, one wall of the sports hall sits directly above the pool, and as no supporting columns could be taken to the ground in this area, a series of large transfer beams, each weighing 2.5t, support the wall at first-floor level. A steel truss arrangement within

FACT FILE
Allander Leisure and Day Care Centre, Bearsden, Glasgow
Main client: **East Dunbartonshire Council**
Architect: **Holmes Miller**
Main contractor: **McLaughlin & Harvey**
Structural engineer: **BakerHicks**
Steelwork contractor: **Walter Watson**
Steel tonnage: **1,075t**

The project represents a significant investment by the local council in community facilities.

the wall then provides a secondary load path.

Summing up the project, East Dunbartonshire's Joint Council Leader Vaughan Moody, said: "I am very pleased that the project to replace Allander Leisure Centre is helping to fulfil a long-held aspiration within the local community.

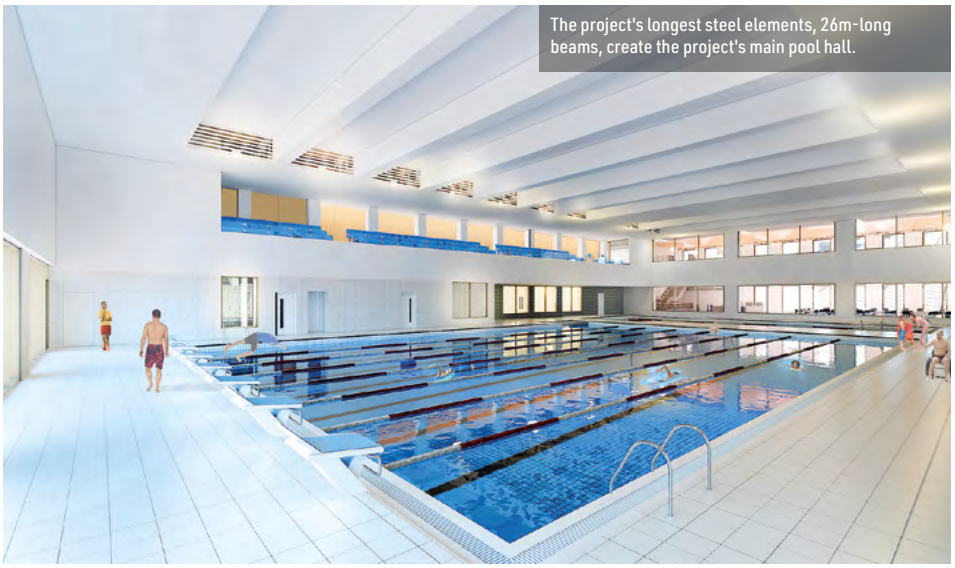
"I'm also delighted the plans for this state-of-the-art complex includes brand new support facilities for adults with learning disabilities."

Councillor Andrew Polson, Joint Leader of the Council, adds: "It has been a long road to reach this stage of the construction programme – with the steel frame now complete - and I want to thank everyone who has taken part in the journey - including local residents, organisations and partners.

"Allander Leisure and Day Care Centre represents a major capital investment by the Council and will help to change local lives for the better. I can't wait to welcome the completed project, which will offer a range of facilities to help inspire and support people of all ages." ■

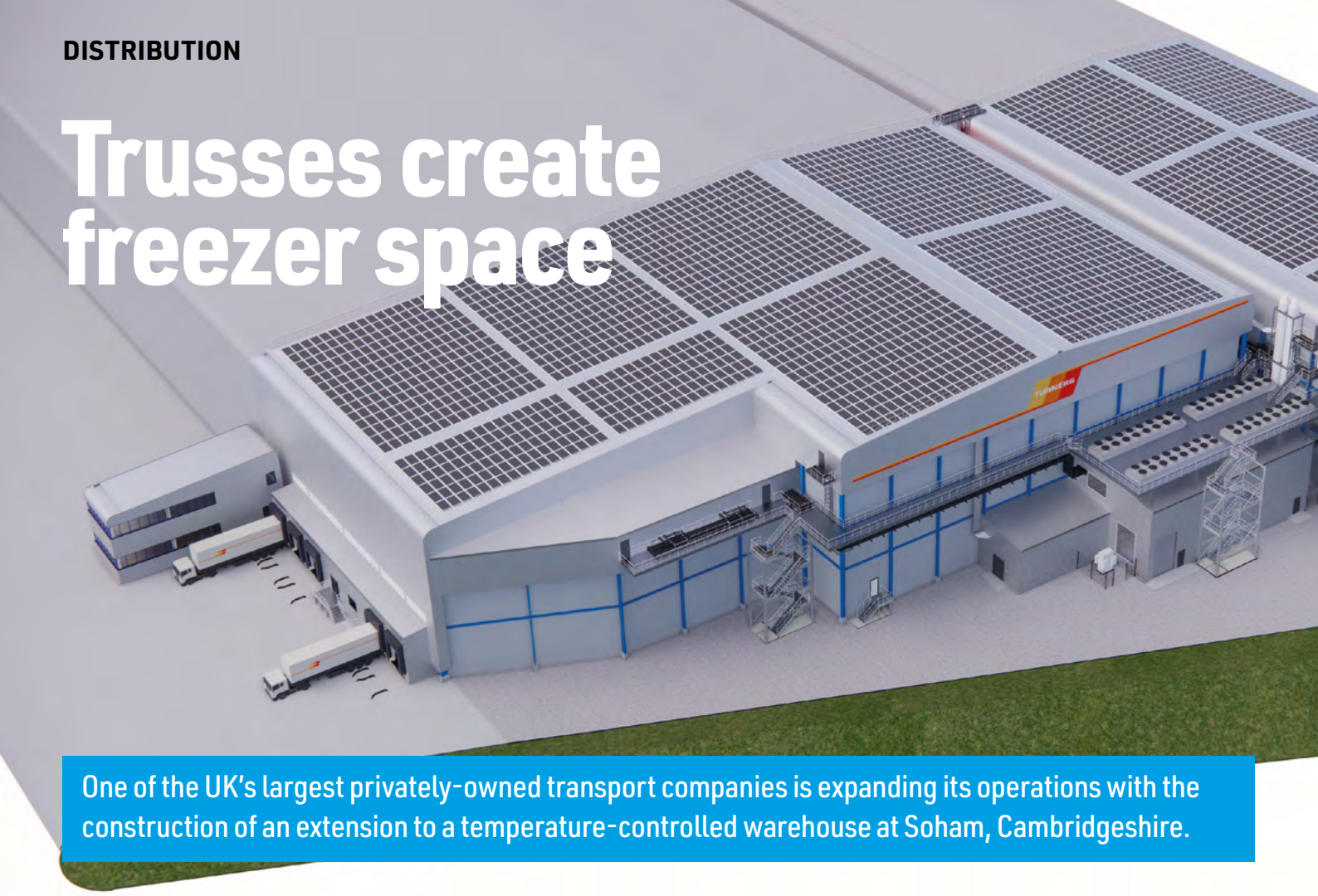
"There are a number of areas, in the leisure part of the building, that are long-span column-free spaces, and these could not have been economically formed in any other material other than steel."

Visualisation of the completed scheme.



The project's longest steel elements, 26m-long beams, create the project's main pool hall.

Trusses create freezer space



One of the UK's largest privately-owned transport companies is expanding its operations with the construction of an extension to a temperature-controlled warehouse at Soham, Cambridgeshire.

From humble beginnings in 1930 when brothers Wallace and Frank Turner purchased a solitary truck to transport and deliver loads from their father's farm in Soham, Cambridgeshire, the Turners Group has since grown into one of the UK's largest transport companies.

Today it operates in excess of 1,850 vehicles from 32 sites and employs more than 3,400 people. The company specialises in a range of activities, from container logistics, distribution as well as temperature-controlled transportation and warehousing.

To help better fulfil the latter, Turners is building a large extension to one of its main temperature-controlled warehousing facilities, which will expand the building's footprint by approximately 10,000m² and create space to accommodate up to 22,000 pallets of frozen food in seven bespoke freezers.

The extension consists of three large spans of 55m, 41m and 38m, with these areas also measuring 80m-long, 60m-long and 54m-long.

These large column-free spaces, which are formed by a series of steel trusses, are crucial to the project's structural design, as the spans will accommodate large freezers that in turn house 15m-high mobile racking systems for the frozen produce. Internal columns would obstruct this equipment, so as few internal columns as possible is an important design criteria.

"Using structural steelwork is the most economical solution for this type of building, especially with such long spans," says FJB Partner Edwin Bowater.

Working as international turnkey designers, FJB completes a number of these temperature-controlled warehouses every year, and always opts for a steel-framed solution in the UK.

"We've built concrete-framed facilities overseas, due to various country's local preferences, but the UK's steel sector has a lot of expertise and using steel is also a quicker more versatile option," adds Mr Bowater.

This current work is not the first job FJB has done on the site, as it previously designed the original three-span steel structure in 2005. Subsequently, it has been expanded four times, in 2008, 2012, 2014 and now again this year with the latest steel extension.

Each successive extension has been bolted to the existing frame, highlighting steelwork's flexibility and adaptability. The completion of the latest work will create a structure that is more than 300m-long.

Steelwork contractor SDM Fabrication has fabricated, supplied and erected 1,250t of steel for this current steel-framed extension, a tonnage that also includes secondary steelwork such as internal and external walkways, gantries, ladders, mesh flooring and staircases.

In order to erect the steel braced frame, SDM was one of the first sub-contractors on site, following on behind the installation of the pad foundations.

The preliminary groundworks also included the construction of a retaining wall along two elevations, that reaches a height of 5m. Once infilled, the wall helps to create a flat platform for the ground slab by eliminating the footprint's slope.

The foundations support a series of columns that follow the grid pattern of the existing structure. They are up to 27m-high and arranged in five rows, two perimeter lines and three internal lines.

Two spans share a row of columns, while the widest two spans are divided by a double row of columns, that create a gap for maintenance walkways.

"We delivered the columns to the project as single pieces, but the trusses had to be assembled on site as they are too big to transport," explains SDM Fabrication Director Richard Melton.

"Once the bolted connections were complete, each truss was lifted into place using two mobile cranes performing a tandem lift. The heaviest truss was 16t."

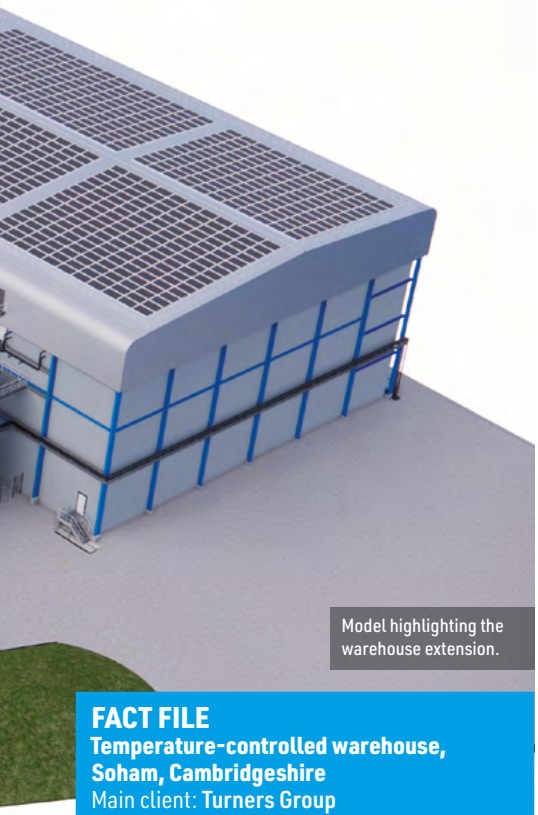
The trusses are up to 6m-deep and, as well as forming the all-important column-free spaces, these large steel elements are working extremely hard as they are integral to the internal equipment and the building's envelope.

"The bottom chord of each truss supports insulation panels that form the roof of the internal temperature-controlled area, which is basically a box-within-a-box," explains Mr Bowater. "There are also loads of up to 5t, as the bottom chords also support pipework, as well as refrigeration coolers.

"Meanwhile, the top chords support and carry loadings not just from the roof cladding, but also from solar panels."

As well as these important functions, within many of the trusses there is space for maintenance walkways and platforms.

For the stability of each span, the trusses work



Model highlighting the warehouse extension.

FACT FILE
Temperature-controlled warehouse, Soham, Cambridgeshire
Main client: **Turners Group**
Architect and turnkey designer: **FJB**
Main contractor: **Patrick B Doyle**
Steelwork contractor: **SDM Fabrication**
Steel tonnage: **1,250t**

"Using structural steelwork is the most economical solution for this type of building, especially with such long spans."

as independent portalised systems, but some extra bracing was included, as SDM Fabrication Lead Structural Designer Matt Kidd explains:

"Bespoke tension only bracing is present in the gable elevations and its main function was to provide stability during the construction phase. It was positioned in permissible locations so that it could be left in place and increases the inherent structural robustness properties of the frames in the permanent condition."

The trusses are designed to act individually, but plan bracing systems are linked via lines of longitudinal CHS ties at top and bottom chord levels. This was done for two main reasons: to make sure the structure is not solely reliant on purlins and rails to distribute the wind loads between braced bays, and secondly to ensure adequate tying provisions were present for the accidental load cases.

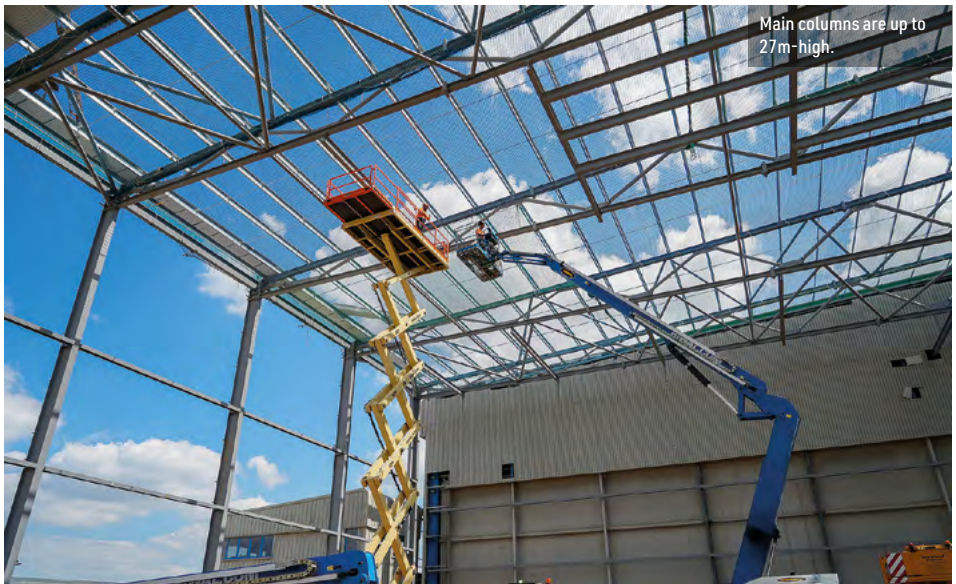
"Various forms of out-of-plane vertical bracing have been utilised along critical gridlines to achieve global stability, with their arrangement based on functionality, optimisation and permissible locations," adds Mr Kidd. "Where elevations are in public view, aesthetics and symmetry were also born in mind. Heavy duty wind portals were used along grid line A to accommodate the loading docks, which were linked at eaves level via a continuous 533 × 210UB section to maximise out-of-plane resistance to sway."

Completing the three internal boxes, the temperature-controlled areas' elevation panels are supported by bracketry attached to the inside of the structure's columns.

Speed is of the essence on this and many other construction projects. So, once the steel frame was complete, the other follow-on trades were able to begin. This work included the casting of the ground slab, the installation of the refrigeration and racking systems and the fixing of the wall and roof cladding panels.

Reaffirming steelwork's speed of construction, the Soham temperature-controlled warehouse extension is scheduled to be completed and ready for use before this year's busy Christmas period, less than one year after the project began. ■

The extension consists of three large spans.



Main columns are up to 27m-high.

The extension follows the same column grid pattern of the existing building.

Golden gate bridge

A landmark steel footbridge forms a central element in phase one of Swansea's £135M Copr Bay development.

The architectural design consists of perforated steel plate with a gold paint finish.

Swansea city centre is undergoing one of the largest urban transformations currently being delivered in the UK. Approximately £1Bn is being invested in comprehensive projects across the South Wales city and one of the most important is the Copr Bay phase one district being developed by Swansea Council, supported by its development managers RivingtonHark.

The scheme includes a 3,500-capacity indoor arena, a 1.1-acre coastal park, new homes, car parking as well as spaces for leisure and hospitality businesses.

Creating a highly visual statement and connecting this development to the city centre by spanning six lanes of traffic, a gold-painted steel pedestrian and cycle bridge has been installed.

According to the Council, the crossing will serve as both a statement bridge and a striking visual representation of the work Swansea Council is carrying out to create an urban destination that brings together the best of city living and access to nature.

Designed by a local artist Marc Rees and architectural practice ACME, the 49m-long single span bridge is an eye-catching structure that is 12m-wide × 7.5m-high and has a structural skin of 15mm-thick steel plate. Featuring a distinctive gold paint finish, the side panel plates are perforated with numerous laser profiled cut-outs and pressed into complex shapes.

The bridge creates a spectacular gateway to the redeveloped Copr Bay district.

"Steel gave us flexibility to work with an interesting structural solution."

The bridge forms an important part of the Copr Bay scheme, which also includes a new indoor arena.

The design is said to balance a contemporary aesthetic with references that celebrate the city's heritage. The 2,756 laser-cut origami-inspired shapes, each dispersed across the panels, create a visually interesting pattern that in places form a complete origami swan image.

ACME Design Director Friedrich Ludewig says: "The new bridge is a true piece of international innovation for Swansea.

"The iconic arch stabilises the super-slender bridge deck and creates a new urban space floating over the road, enclosed by patterned steel offering glimpses across the road, the arena and the new coastal park.

"Until now, Oystermouth Road was for cars, not people. The bridge will be a stepping stone for a greener and more liveable Swansea city centre."

He adds: "Steelwork was chosen primarily because of its structural properties and ability to span large distances. It gave us flexibility to work with an interesting structural solution, essentially a deformed bow truss formed of plate steel, allowing the creation of the sculptural form, super thin bridge deck, and the opportunity to create a clear identity through the development of perforations in the truss walls and application of a gold paint finish."

Fabricated, supplied and installed by S H Structures, on behalf of main contractor Buckingham Group, the 140t bridge was delivered to site in sections, consisting of four deck pieces, six roof sections and 11 side panels.

The roof sections measured 10.5m × 4.1m × 600mm and the side panels were 2.8m × 6.9m × 15mm.

The largest steel elements to be transported to site and also the heaviest, where the deck sections, measuring 24.5m × 6m × 2m and weighing 24.6t each.

"As the deck is only 15mm-thick and needed to be split longitudinal for transportation, the open end was extremely lively, both when being transported and during lifting," says S H Structures Project Manager Will Sharples.

"We had to come up with a bespoke transport lifting beam that strengthened the deck and allowed a multiple eight-point pick up procedure."

Once on site, the bridge deck was assembled on temporary works positioned in an area adjacent to the bridge's final location. The curved plates, which form the sides, arch and roof were then welded into place, before the complete structure was given its final topcoat of gold paint.

The completed structure was then lifted onto self-propelled modular transporters (SPMTs) and manoeuvred onto its two concrete abutments during a Saturday night road closure.

After the bridge structure was in its final position, the steel deck had an anti-slip resin and aggregate finish applied.

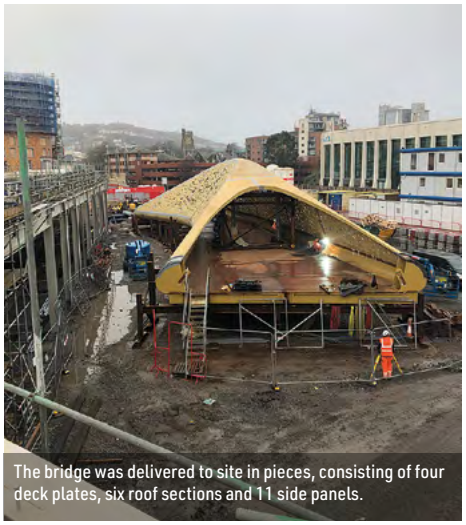
Commenting on the bridge installation, Rob Stewart, Leader of Swansea Council, says: "Connecting our new city centre to the sea is an iconic moment in our ambitious transformation of our city. This bridge will be a permanent beacon that tells people what Swansea is all about: an open, vibrant destination where opportunities are created and barriers overcome."

Summing up Mr Rees says: "It has been the thrill of a lifetime to be involved in such an iconic part of the regeneration of my hometown. Dylan Thomas infamously described Swansea as an "ugly, lovely town" – whatever the merits of that when he said it, Swansea's aspiration to change, grow and flourish is more than apparent now. The council's transformation of the city is creating a modern, vibrant city and opportunities for residents, artists and businesses, both those who call Swansea their home and those who should."

The bridge will officially open in time for the first performances at the arena in early 2022. ■

FACT FILE
Copr Bay footbridge, Swansea
Main client: **Swansea Council**
Architect: **ACME**
Main contractor: **Buckingham Group**
Structural engineer: **Ney & Partners**
Steelwork contractor: **S H Structures**
Steel tonnage: **140t**

During one overnight lifting operation, the bridge was manoeuvred into place using SPMTs.



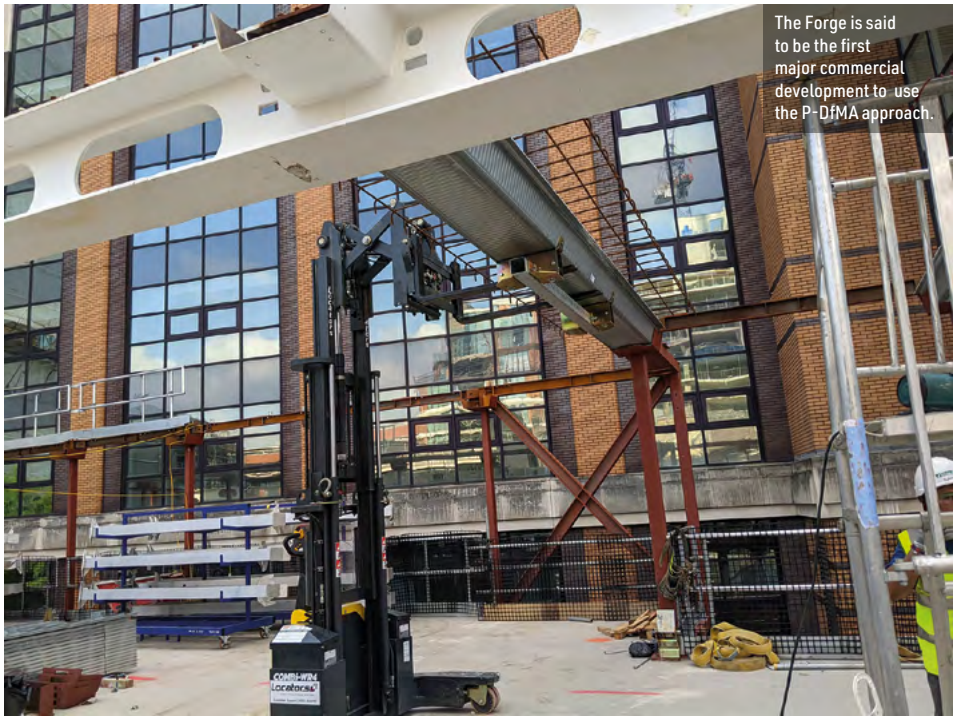
The bridge was delivered to site in pieces, consisting of four deck plates, six roof sections and 11 side panels.

How the project will look when it completes in late 2022.

FACT FILE
The Forge, Southwark, London
Main client/Developer: **Landsec**
Architect/Designer: **Bryden Wood**
Construction manager: **Sir Robert McAlpine Mace JV**
Steelwork and concrete installer: **J Coffey Construction**
Steelwork contractor: **DAM Structures (a Severfield Group company)**
Steel tonnage: **1,000t**

Forging a new way

Steelwork is playing a significant role at the Forge project in London, where an innovative method is being used that could transform the construction industry into a leaner and greener sector.



The Forge is said to be the first major commercial development to use the P-DfMA approach.

The race to complete the UK's first net-zero carbon commercial development is likely to be won by a ground-breaking scheme in Southwark, south London.

An ambitious project, known as the Forge, is aiming to take this noteworthy accolade and developer Landsec says the scheme is testament to its desire to tackle the climate change crisis head-on.

Landsec believes developers, construction firms, architects and occupiers must start working together to deliver buildings that minimise whole life carbon and to this end the Forge is being constructed - and will be operated - in line with the UK's Green Building Council's (UKGBC) framework definition of net-zero carbon buildings.

Located behind the Tate Modern and close to the south bank of the River Thames, the project comprises two nine-storey office blocks, that will together offer close to 13,000m² of floor space.

Known as The Forge, as the site was once occupied by a foundry, the two office blocks have been named Bronze and Phosphor.

To help achieve its lofty ambitions, the scheme is said to be the first major commercial project to use the platform approach to design for manufacture and assembly (P-DfMA). The project has been awarded funding from Innovate UK for its innovative design and ground-breaking construction techniques, which has the potential to act as a catalyst for change in the construction sector.

P-DfMA uses standardised components assembled using a 'kit of parts' methodology, whereby most elements are fabricated offsite in repeatable sections. By utilising this ground-breaking construction method, the job is expected to be completed 40% faster than a similar sized commercial scheme using more traditional construction techniques.

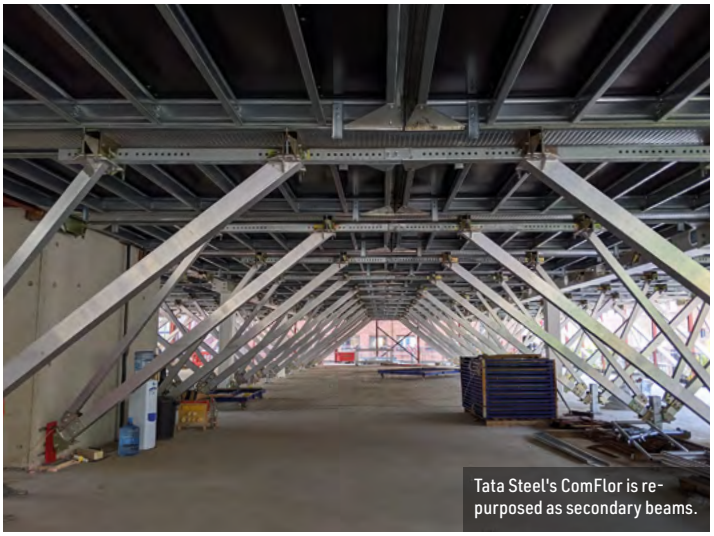
The Forge's P-DfMA method uses a hybrid steel and concrete framing solution to construct the buildings. Steelwork was chosen for the primary structure due to its speed of delivery and because the beams and columns can be fabricated offsite, in line with the project's industrialised construction-based philosophy.

"The Forge is setting new industry standards for sustainable and cost-effective construction. The use of an innovative P-DfMA structure and 'kit of parts' approach is a world-first for a commercial office project," says Landsec Head of Design Innovation and Property Solutions Neil Pennell.

"By developing a platform structure with a repeatable format and one that interfaces easily with services and cladding, we improve delivery, reduce the amount of materials needed and lessen the project's carbon footprint."

Prior to The Forge development, Landsec worked closely with designers Bryden Wood


ComFlor beam elements are spaced at 3m intervals.


Tata Steel's ComFlor is re-purposed as secondary beams.


By using the P-DfMA method, it has been estimated that the scheme will be completed 40% faster than a similar sized job using a traditional construction technique.


Structural steelwork forms the building's main frame and was delivered in a modular format.

and prototyping specialists Easi-space who had previously pioneered the P-DfMA structure and automated construction methods with a test-run in 2019, whereby a full-scale offsite prototype was constructed.

During the planning stage, Landsec were keen to explore the opportunity to use modern methods of construction to build faster, better and greener. So, following the success of the prototype the decision was taken to adopt the innovative P-DfMA 'kit of parts' led approach on the project.

DAM Structures (a Severfield Group company) fabricated and supplied 1,000t of structural steelwork for the project. The P-DfMA approach dictates that only one installer is used on site, and so in this instance, the concrete installer took delivery of the steel elements and erected the steelwork.

"We supplied as much of the steelwork as possible in modular frames, which reduced the amount of lifts and bolting that needed to be done on site," says DAM Structures Managing Director Joshua Emerson.

The project team decided that Tata Steel's ComFlor repurposed as a secondary beam, offered a proven, cost effective and off-the-shelf solution which could be used as an essential component of the 'kit of parts' approach.

A standardised grid of vertical hollow section columns, spaced at 9m centres, are linked together horizontally by Tata Steel ComFlor composite deck elements. The product has been designed specifically for this project with the addition of steel reinforcement members to create a completely new type of structural beam assembly.

The ComFlor beam elements are in fact used as a secondary steel frame, spaced at 3m intervals within the main frame. Once installed, they were filled, floor-by-floor, with in-situ self-compacting concrete. The structure is completed using reusable mobile formwork to support the casting of a concrete slab between the primary and secondary frame, which is moved up the building as work progresses.

The ComFlor beam profile is said to have provided the scheme with a number of benefits including better floor-to-ceiling heights. The trapezoidal shape forms a shallow beam which when combined with an integrated services solution minimises the resulting combined structure and services zone, maximising the clear height and apparent volume of the space.

Bryden Wood Associate Director Bernat Csuka says: "The detailing of reinforcement proved to be easier with ComFlor beams as well as achieving continuity at supports, especially around columns.

"The sections are also readily available, cut to length with tight fabrication tolerances. This is beneficial in achieving high accuracy on the structural frame."

The Forge is scheduled to complete in late 2022 ■

What is P-DfMA?

Following the 2017 budget, the UK Government announced that it was fully behind the modernisation of the construction sector and one way in which this could be achieved was to support offsite construction.

Subsequently, it set out a new approach to building, to be adopted across all government departments where it presents value for money. They called this a platform approach to design for manufacture and assembly (P-DfMA).

DfMA (Design for Manufacture and Assembly) is a process by which building products and components are designed in a way that enables them to be made on large scale in a factory and then transported to a project to be assembled on site.

A platform approach to DfMA (P-DfMA) is the use of a set of digitally designed components across multiple types of built asset that are then used wherever possible, minimising the need to design bespoke components for different types of asset. For example, the same component could be used in the construction of a school, hospital and prison. ■

Low carbon concrete – what you need to know

Graham Couchman (SCI) and Jenny Burridge (the Concrete Centre) discuss the specification of 'low carbon' concrete for use in composite construction

Globally, concrete is the second most used material after water. In the UK we produce about 109 Mt of ready mixed concrete and precast concrete products annually (2017 figures). As structural engineers we therefore specify a lot of concrete every year, even when specifying steel-framed solutions given that most steel-framed multi-storey buildings use composite floors. More of us are now trying to lower our carbon footprint and produce lower carbon intensive projects. One of the ways we can do this is to look at how we specify the concrete we use, to ensure the most appropriate material is adopted. Significant improvements are possible, so alternatives are well worth considering.

Concrete mix and embodied CO_2

Concrete is made from aggregate, cement, and water. Admixtures can be (and normally are) included in the mix. In terms of embodied carbon for the different elements, aggregates and water have very low embodied carbon. Locally sourced primary aggregates have an embodied carbon of about 4kgCO_2/tonne. It is the cement, forming about 10-15% of the mix, which holds most of the embodied carbon.

All concretes to BS 8500[1] are based on Portland cement, or CEM1, but mostly contain additions, or other cementitious materials. These include:

- Ground granulated blast-furnace slag (GGBS)
- Fly ash
- Silica fume
- Limestone powder
- Pozzalana

These additions have a much lower embodied carbon than CEM1. Significant savings can be made to the embodied carbon of concrete by specifying mixes that include additions. Table 1 gives an indication of the savings that can be achieved by specifying the different cements.

Broad designation of cement type in concrete	Percentage of addition	Embodied CO_2 kgCO_2/m³ of concrete
CEM1	0	283
IIA	6 – 20	228 – 277
IIB	21 – 35	186 – 236
IIIA	36 – 65 GGBS	120 – 198
IIIB	66 – 80 GGBS	82 – 123
IVB	36 – 65 fly ash or pozzalana	130 - 188

Table 1: Embodied CO_2 of UK concretes complying with BS 8500 (based on a cement content of 320kg/m³ of concrete)

It is also worth noting that higher strength concrete requires a larger proportion of cement, all other things being equal, although this can be more than offset if the higher strength allows a lower volume to be used. Superplasticiser admixtures can also help reduce the embodied carbon by reducing the water/cement ratio. This provides a stronger concrete for the same quantity of cement.

To supplement concretes in accordance with BS 8500, most of the larger concrete producers have low carbon proprietary concretes. These are formulated to keep the embodied carbon down to a given level, and may therefore be particularly interesting to the specifier. The producers are happy to provide advice on what can be achieved for the location and needs of the project, but it is important that the structural designer knows how to interpret the information they provide. This is discussed here.

Concrete properties that may affect structural behaviour

Although the potential benefits may be significant, care is needed when specifying alternatives to concrete covered by BS 8500. This is because concrete is specified on the basis of compressive strength alone (other than any special requirements for pouring etc). However numerous other concrete characteristics will, or could, affect the behaviour (short-term, long-term, fire) of composite construction, as considered below. The relationships between these various characteristics are only guaranteed, such that the material can be specified on the basis of compressive strength alone, for concrete mixes complying with BS 8500. It is worth noting that future versions of design software may therefore need the ability for certain properties to be inputted independently, to cover the presence of proprietary mixes on the UK market.

Mechanical behaviour

The strength and stiffness of the slab, and the mechanical interaction between steel and concrete *may*, and in some cases certainly *will*, depend on:

- Characteristic (compressive) cylinder strength f_{ck}
- Secant modulus E_{cm}
- Tensile strength f_{ctm} (which may be important for shear stud resistance as concrete 'cone' failure often governs in the presence of transverse trapezoidal decking)
- Crushing strain ε_{c1} – the upper fibres of concrete in compression must not lose strength before the steel decking reaches the anticipated level of stress

Figure 3.2 of BS EN 1992-1-1[2], reproduced here as Figure 1, shows the compressive stress-strain behaviour to be used in structural analysis, and defines some key variables.

Table 3.1 of BS EN 1992-1-1 defines certain rules that directly link various material properties. The key resulting values for a typical C30/37 (i.e. characteristic cylinder strength of 30 MPa) concrete are included in Table 2 here, for information and comparison purposes.

As noted above, these relationships mean that when a compressive strength is explicitly defined, the other properties are implicitly defined by the various formulae. Unless all those relationships are respected, or the derived properties are 'exceeded' (i.e. the value defined by the BS EN 1992-1-1 relationship is in fact conservative), for types of concrete not in compliance with BS 8500 the mechanical behaviour of the composite slab or beam could be adversely affected. Of course, performance could also be improved, depending on the concrete characteristics.

It is also worth noting that BS EN 1994-1-1[3] clause 9.8.2(4) allows explicit calculation of deflection to be ignored for composite slabs with a span to effective depth within certain limits. This relaxation inherently assumes a certain relationship between material strength and stiffness.

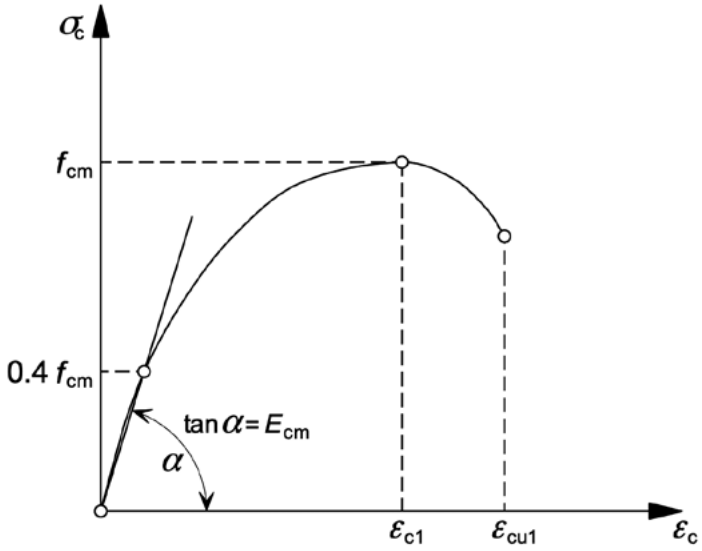


Figure 1: Schematic representation of the stress-strain relationship for structural analysis (the use of 0.4 f_{cm} for the definition of E_{cm} is approximate).

Property	Notation	Value for C30/37
Characteristic compressive cylinder strength at 28 days	f_{ck}	30 MPa
Mean value of concrete cylinder compressive strength	f_{cm}	38 MPa
Mean value of axial tensile strength	f_{ctm}	2.9 MPa
Secant modulus of elasticity	E_{cm}	33 GPa
Compressive strain in concrete at peak stress	ε_{c1}	2.2 °/₀₀
Ultimate compressive strain	ε_{cu1}	3.5 °/₀₀

Table 2: Material properties influencing mechanical behaviour for C30/37 concrete (according to BS EN 1992-1-1)

Long-term behaviour

The long-term behaviour of a composite floor is a function of the creep and shrinkage characteristics of the concrete. Generally, these 'deteriorations' in the concrete are less significant with composite construction than reinforced concrete, because the steel elements resist the concrete strains. Relevant properties are:

- Creep coefficient ø. BS EN 1992-1-1 Fig 3.1 provides a simplified method, in the form of a number of graphs from which ø can be determined.
- Total free shrinkage strain ε_{cs} which is defined in BS EN 1994-1-1 Annex C as 325×10^{-6} for normal weight concrete in a dry environment.

BS EN 1994-1-1 clause 5.4.2.2 allows for both shrinkage and creep using a modular ratio approach for determining long-term deflections. The modular ratio increases with time as the steel modulus is unchanged, and the concrete modulus reduces (reducing the contribution of the concrete part of a composite cross-section). In the majority of cases, for buildings, a simplified approach is taken whereby the concrete properties described above are not explicitly considered (nor are inputs otherwise required, such as time of first load application and duration of loading). The modular ratio for a member under a mixture of short and long-term loading is taken as $2n_0$, where $n_0 = E_a/E_{cm}$ (i.e. the modular ratio at time zero). The validity of this assumed halving of the concrete stiffness with time should be justified, or otherwise, by considering the creep and shrinkage characteristics of any 'non-standard' concrete.

BS EN 1992-1-1 Annex B defines the relationship between modular ratio, and shrinkage and creep properties.

Fire behaviour

BS EN 1994-1-2 clause 3.2.2 Table 3.3 shows strength retention (it's actually reduction) with temperature. As an example, normal weight concrete has lost 25% of its strength at 400 degrees, and over half its strength at 600 degrees. Strain capacity also reduces with temperature. Current design software adopts these values, with no allowance for user modification. Any higher, or lower, rate of loss of strength with temperature of a given material would adversely, or beneficially, affect the mechanical resistance of a composite floor in fire.

BS EN 1994-1-2 clause 3.3.3 Fig 3.8 gives thermal conductivity values. Conductivity is important because the insulation provided by a concrete floor controls the temperature of the upper surface when the floor is exposed to fire from below. Fire tests on floors consider three failure criteria, one of which concerns the temperature achieved on the upper surface after the regulated period of fire exposure. Lower insulation would therefore invalidate a fire test result for a given slab. Clearly the existence of a relevant fire test, using the concrete material under consideration for substitution, would avoid the need for material properties to be defined.

Density

From a loading point of view, it is important to know dry density and wet density, and if stated values include an allowance for reinforcement (or are the concrete alone). Clearly the appropriate values must be used in any design software. The Eurocodes state 2600kg/m³ wet and 2500kg/m³ dry, but we reduce these by 50kg/m³ because composite slabs have less reinforcement than a typical RC slab.

Density may also affect the acoustic performance of a slab.

Rate of strength gain

An important point to note is that the higher the proportion of additions within the concrete, the slower the strength gain of the concrete. This might not influence the programme if the concrete does not need to be struck quickly or support load shortly after being cast. For composite construction, lower strength (and stiffness) gain may be less relevant than for in-situ reinforced concrete, because of the permanent formwork provided by the steel decking. However, it could impact on timing of removal of props, or application of loading. SCI publication P300 states that props should not be removed until a floor has reached 75% of its design strength, and suggests that this is normally achieved in seven or eight days. That indicative timing may no longer be valid, depending on the concrete type and the external temperature.

Conclusions

Any designer, contractor or manufacturer considering using 'non-standard' concrete (i.e. not covered by the scope of BS 8500) – whether to reduce carbon or for any other reason - should ensure that all relevant properties are known for the concrete they are considering, and justify the assumed performance of the composite construction. Doing this correctly, in consultation with all relevant parties involved in the design, material supply and construction of the project, should ensure that significant benefits are achieved without structural performance being compromised.

SCI offers a third-party assessment service whereby we will review the claimed performance characteristics of any proprietary concrete and confirm suitability for use (or advise how performance may be affected).

Acknowledgement

Content concerning the different types of concrete originally appeared in 'How to Specify Lower Carbon Concrete', authored by Jenny Burridge and published by The Institution of Structural Engineers (*https://www.istructe.org/resources/guidance/how-to-specify-lower-carbon-concrete/*). ■

1. BS 8500-1:2015 + A2:2019: Concrete – Complementary British Standard to BS EN 206. BSI, 2019
2 BS EN 1992-1-1: 2004: Eurocode 2: Design of concrete structures. General rules and rules for buildings (+A1:2014) (incorporating corrigenda January 2008, November 2010 and January 2014)
3 BS EN 1994-1-1:2004: Eurocode 4: Design of composite steel and concrete structures. General rules and rules for buildings (incorporating corrigendum April 2009)

AD 473:
Holes in beams for temporary lifting attachments

The SCI has been asked to consider the requirement of clause 6.2.5(6) in BS EN 1993-1-1, which covers the allowance for fastener holes when calculating cross sectional resistance in bending. The clause states that ordinary fastener holes need not be allowed for, provided they are filled by fasteners.

This requirement can lead to problems when – for example – bolts must be placed in holes used for temporary lifting brackets, which then prevents other components such as precast units or decking sitting correctly on the top flange.

BS 5950 presents a less restrictive rule for members in bending in clause 4.2.5.5. According to BS 5950, no allowance need be made for bolt holes in a compression flange in bending.

SCI recommend that, within limits, bolt holes in the compression flange of beams used for temporary attachments need not be allowed for and need not be filled with bolts. In an element with holes subject to compression, if the flange yields locally, the strength of the material increases as the cross section deforms, due to strain hardening.

Some limitation on the reduction in cross section is appropriate, to prevent multiple holes in a cross section being neglected on the basis of the above recommendation.

SCI consider there is no requirement to apply the material factor γ_{M2} = 1.1 (from the UK NA, used in the net area tension checks) when calculating the compression resistance. SCI recommend that the resistance of the net section of the flange in compression may be based on the ultimate strength.

At full utilisation, the assumed design resistance of the flange is $f_y A_g$

The resistance of the net area in compression may be taken as $f_u A_{net}$

No allowance for bolt holes need be made when

$$A_{net} > \frac{f_y A_g}{f_u}$$

If the member is not fully utilised, the design resistance of the flange may be based on a reduced stress when completing the above verification.

In the final condition, for example in a composite beam, holes in the top flange for temporary lifting attachments have little impact.

It should be noted that this advice contradicts the specific requirements of the Eurocode, so should be agreed with the designer with overall responsibility for the structure. In due course it is hoped that this advice will be presented in the NSSS.

Contact: **David Brown**
Tel: **01344 636555**
Email: **advisory@steel-sci.com**

New and revised codes and standards

From BSI Updates October2021

BS EN PUBLICATIONS

BS EN ISO 7539-9:2021
Corrosion of metals and alloys. Stress corrosion testing. Preparation and use of pre-cracked specimens for tests under rising load or rising displacement
supersedes BS EN ISO 7539-9:2008

UPDATED BRITISH STANDARDS

BS EN 15804:2012+A2:2019
Sustainability of construction works. Environmental product declarations. Core rules for the product category of construction products
Corrigendum, September 2021; Corrigendum, July 2020

NEW WORK STARTED

ISO 6819
Steel wire rod for bridge cable wire
will supersede None

ISO 12480-1
Cranes. Safe use. General
will supersede None

DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT – NATIONAL BRITISH STANDARDS

21/30428100 DC
BS 9991. Fire safety in the design, management and use of residential buildings. Code of practice
Comments for the above document were required by 30 October, 2021

DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT – ADOPTIONS

21/30375473 DC
BS EN ISO 12006-3 Building construction. Organization of information about construction works. Framework for object-oriented information
Comments for the above document were required by 2 October, 2021

21/30412922 DC
BS EN ISO 15610 Specification and qualification of welding procedures for metallic materials. Qualification based on tested welding consumables
Comments for the above document were required by 16 October, 2021

21/30427267 DC
BS EN ISO 29481-3 Building information models. Information delivery manual. Data schema and code
Comments for the above document were required by 24 October, 2021

21/30432410 DC
BS ISO 8504-4 Preparation of steel substrates before application of paints and related products. Surface preparation methods. Acid pickling
Comments for the above document were required by 30 October, 2021

21/30437144 DC
BS EN 14439 Cranes. Tower cranes
Comments for the above document were required by 5 October, 2021

CEN EUROPEAN STANDARDS

EN ISO 13918:2018/A1:2021
Welding. Studs and ceramic ferrules for arc stud welding

ISO PUBLICATIONS

ISO 3834-1:2021
Quality requirements for fusion welding of metallic materials. Criteria for the selection of the appropriate level of quality requirements
Will be implemented as an identical British Standard

Steelwork contractors for buildings

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

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

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

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

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

BIM BIM Level 2 assessed

QM Quality management certification to ISO 9001

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

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

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

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	BIM	SCM	Guide Contract Value (1)
A C Bacon Engineering Ltd	01953 850611			●	●	●	●				●			●			2			Up to £3,000,000
Adey Steel Ltd	01509 556677	●		●	●	●	●	●	●	●	●			●	●	✔	3		●	Up to £3,000,000
Adstone Construction Ltd	01905 794561			●	●	●	●							●		✔	2	✔	●	Up to £3,000,000
Advanced Fabrications Poyle Ltd	01753 653617				●	●	●	●		●	●			●	●	✔	2			Up to £800,000
AJ Engineering & Construction Services Ltd	01309 671919			●	●		●		●	●	●			●	●	✔	4		●	Up to £3,000,000
Angle Ring Company Ltd	0121 557 7241												●			✔	4			Up to £1,400,000*
Arminhall Engineering Ltd	01799 524510	●			●	●		●		●	●			●	●	✔	2			Up to £800,000
Arromax Structures Ltd	01623 747466	●		●	●	●	●	●	●	●	●				●		2			Up to £800,000
ASME Engineering Ltd	020 8966 7150			●	●	●		●		●	●			●	●	✔	4		●	Up to £4,000,000
Atlasco Constructional Engineers Ltd	01782 564711			●	●	●	●			●	●			●	●	✔	2			Up to £1,400,000
B D Structures Ltd	01942 817770			●	●	●	●				●	●		●	●	✔	2	✔	●	Up to £1,400,000
Ballykine Structural Engineers Ltd	028 9756 2560			●	●	●	●	●				●			●	✔	4		●	Up to £1,400,000
Barnshaw Section Benders Ltd	0121 557 8261												●			✔	4			Up to £1,400,000
BHC Ltd	01555 840006	●	●	●	●	●	●	●		●	●	●		●	●	✔	4	✔	●	Above £6,000,000
Billington Structures Ltd	01226 340666		●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	●	Above £6,000,000
Border Steelwork Structures Ltd	01228 548744			●	●	●	●			●	●				●		4			Up to £3,000,000
Bourne Group Ltd	01202 746666		●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	●	Above £6,000,000
Briton Fabricators Ltd	0115 963 2901	●		●	●	●	●	●	●	●	●		●	●	●	✔	4			Up to £6,000,000
Cairnhill Structures Ltd	01236 449393	●			●	●	●	●	●						●	✔	4		●	Up to £6,000,000
Caunton Engineering Ltd	01773 531111	●	●	●	●	●	●	●		●	●	●		●	●	✔	4	✔	●	Above £6,000,000
Cementation Fabrications	0300 105 0135	●			●		●	●	●	●	●		●	●	●	✔	3		●	Up to £6,000,000
CMF Ltd	020 8844 0940				●		●	●		●	●				●	✔	4			Up to £6,000,000
Cook Fabrications Ltd	01303 893011			●	●		●	●		●	●			●	●		2			Up to £1,400,000
Coventry Construction Ltd	024 7646 4484			●	●	●	●		●	●	●			●	●	✔	4			Up to £1,400,000
DAM Structures Ltd	01377 271843	●		●	●	●		●	●	●	●			●		✔	4			Up to £6,000,000
D H Structures Ltd	01785 246269			●	●		●				●						2			Up to £40,000
D Hughes Welding & Fabrication Ltd	01248 421104				●	●	●	●	●	●	●		●	●	●	✔	4			Up to £400,000
Duggan Steel	00 353 29 70072	●	●	●	●	●	●	●	●		●				●	✔	4			Up to £6,000,000
ECS Engineering Services Ltd	01773 860001	●		●	●	●	●	●	●	●	●			●	●	✔	4		●	Up to £3,000,000
Elland Steel Structures Ltd	01422 380262		●	●	●	●	●	●	●	●	●	●		●	●	✔	4	✔	●	Up to £6,000,000
EvadX Ltd	01745 336413		●	●	●	●	●	●		●	●	●			●	✔	3		●	Up to £4,000,000
Four Bay Structures Ltd	01603 758141			●	●	●	●	●		●	●			●	●		2			Up to £1,400,000
Four-Tees Engineers Ltd	01489 885899	●			●		●	●	●	●	●		●	●	●	✔	3		●	Up to £2,000,000
Fox Bros Engineering Ltd	00 353 53 942 1677			●	●	●	●	●		●	●				●		2			Up to £2,000,000
Gorge Fabrications Ltd	0121 522 5770				●	●	●	●		●				●	●	✔	2			Up to £1,400,000
Company name	**Tel**	**C**	**D**	**E**	**F**	**G**	**H**	**J**	**K**	**L**	**M**	**N**	**Q**	**R**	**S**	**QM**	**FPC**	**BIM**	**SCM**	Guide Contract Value (1)

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	BIM	SCM	Guide Contract Value (1)
G.R. Carr (Essex) Ltd	01286 535501	●		●	●			●			●			●	●	✔	4			Up to £800,000
H Young Structures Ltd	01953 601881			●	●	●	●	●			●			●	●	✔	4	✔	●	Up to £3,000,000
Had Fab Ltd	01875 611711				●				●	●	●				●	✔	4			Up to £3,000,000
Harry Peers Steelwork Ltd	01204 528393	●		●	●	●	●	●	●		●					✔	4			Above £6,000,000
Hescott Engineering Company Ltd	01324 556610			●	●	●	●			●				●	●	✔	2			Up to £3,000,000
Hillcrest Structural Steel Ltd	023 8064 1373			●	●	●	●	●		●	●			●	●	✔	3		●	Up to £3,000,000
Intersteels Ltd	01322 337766	●			●	●	●	●	●	●			●	●	●	✔	3			Up to £3,000,000
J & A Plant Ltd	01942 713511				●										●		4			Up to £40,000
James Killelea & Co Ltd	01706 229411		●	●	●	●	●				●	●					4			Up to £6,000,000*
Kiernan Structural Steel Ltd	00 353 43 334 1445	●		●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	●	Above £6,000,000
Kloeckner Metals UK Westok	0113 205 5270												●			✔	4		●	Up to £6,000,000
LA Metalworks Ltd	01707 256290				●	●				●	●			●	●	✔	2			Up to £2,000,000
Leach Structural Steelwork Ltd	01995 642000			●	●	●	●	●			●					✔	2		●	Up to £6,000,000
Legge Steel (Fabrications) Ltd	01592 205320			●	●		●		●	●	●			●	●		3			Up to £800,000
Littleton Steel Ltd	01275 333431				●					●	●			●	●	✔	3			Up to £1,400,000
M Hasson & Sons Ltd	028 2957 1281			●	●	●	●	●	●	●	●			●	●	✔	4		●	Up to £1,400,000
M&S Engineering Ltd	01461 40111				●				●	●	●			●	●		3			Up to £2,000,000
Mackay Steelwork & Cladding Ltd	01862 843910			●	●		●			●	●			●	●	✔	4			Up to £1,400,000
Maldon Marine Ltd	01621 859000				●	●			●	●	●				●	✔	3			Up to £1,400,000
Mifflin Construction Ltd	01568 613311			●	●	●	●				●						3			Up to £3,000,000
Murphy International Ltd	00 353 45 431384	●			●		●	●	●		●				●	✔	4			Up to £2,000,000
Newbridge Engineering Ltd	01429 866722	●	●	●	●	●	●	●			●	●				✔	4		●	Up to £2,000,000
North Lincs Structures	01724 855512			●	●					●	●				●		2			Up to £800,000
Nusteel Structures Ltd	01303 268112						●	●	●	●				●		✔	4		●	Up to £6,000,000
Painter Brothers Ltd	01432 374400	●			●				●	●	●				●	✔	3			Up to £6,000,000*
Peter Marshall (Steel Stairs) Ltd	0113 307 6730				●	●				●	●				●	✔	3			Up to £1,400,000*
PMS Fabrications Ltd	01228 599090			●	●	●	●		●	●	●			●	●		3			Up to £1,400,000
REIDsteel	01202 483333			●	●	●	●	●	●	●	●	●	●		●	✔	4		●	Up to £6,000,000
S H Structures Ltd	01977 681931	●		●	●	●	●	●	●	●	●	●	●		●	✔	4	✔	●	Up to £3,000,000
SDM Fabrication Ltd	01354 660895	●	●	●	●	●	●				●			●	●	✔	4			Up to £2,000,000
Severfield plc	01845 577896	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	●	Above £6,000,000
SGC Steel Fabrication	01704 531286				●					●				●	●	✔	2			Up to £200,000
Shaun Hodgson Engineering Ltd	01553 766499	●		●	●		●			●				●	●	✔	3			Up to £800,000
Shipley Structures Ltd	01400 251480			●	●	●	●		●	●	●			●	●		2			Up to £3,000,000
Snashall Steel Fabrications Co Ltd	01300 345588			●	●	●	●	●			●				●		2	✔		Up to £2,000,000
South Durham Structures Ltd	01388 777350			●	●	●				●					●		2			Up to £800,000
Southern Fabrications (Sussex) Ltd	01243 649000				●	●				●	●			●	●	✔	2			Up to £1,400,000
Steel & Roofing Systems	00 353 56 444 1855	●		●	●	●	●				●	●		●	●	✔	4			Up to £4,000,000
Taunton Fabrications Ltd	01823 324266				●					●	●				●	✔	2		●	Up to £2,000,000
Taziker Industrial Ltd	01204 468080	●		●	●		●			●	●		●	●	●	✔	3		●	Above £6,000,000
Temple Mill Fabrications Ltd	01623 741720			●	●	●	●			●	●			●	●	✔	2			Up to £400,000
Traditional Structures Ltd	01922 414172			●	●	●	●	●	●		●			●	●	✔	3	✔	●	Up to £2,000,000
TSI Structures Ltd	01603 720031			●	●	●	●	●			●			●			2	✔		Up to £2,000,000
Underhill Engineering Ltd	01752 752483				●		●	●	●	●	●			●	●	✔	4	✔		Up to £3,000,000
W I G Engineering Ltd	01869 320515				●					●	●			●	●	✔	2			Up to £400,000
Walter Watson Ltd	028 4377 8711			●	●	●	●	●				●				✔	4			Above £6,000,000
Westbury Park Engineering Ltd	01373 825500	●		●	●	●	●	●	●	●	●				●	✔	4		●	Up to £800,000
William Haley Engineering Ltd	01278 760591				●	●										✔	4		●	Up to £6,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	●	Above £6,000,000
Company name	**Tel**	**C**	**D**	**E**	**F**	**G**	**H**	**J**	**K**	**L**	**M**	**N**	**Q**	**R**	**S**	**QM**	**FPC**	**BIM**	**SCM**	Guide Contract Value (1)

Steelwork contractors for bridgeworks

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

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

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

Notes

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

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

BCSA steelwork contractor member	Tel	FB	CF	SG	PG	TW	BA	CM	MB	SRF	FRF	AS	QM	FPC	BIM	NHSS 19A	NHSS 20	SCM	Guide Contract Value (1)
Adey Steel Ltd	01509 556677	●		●	●	●	●				●	●	✓	3			✓	●	Up to £3,000,000
AJ Engineering & Construction Services Ltd	01309 671919	●			●	●	●	●	●			●	✓	4				●	Up to £3,000,000
Billington Structures Ltd	01226 340666	●		●	●	●	●					●	✓	4	✓	✓	✓	●	Above £6,000,000
Bourne Group Ltd	01202 746666	●			●	●				●		●	✓	4	✓		✓	●	Above £6,000,000
Briton Fabricators Ltd	0115 963 2901	●	●	●	●	●	●	●	●	●	●	●	✓	4			✓		Up to £6,000,000
Cairnhill Structures Ltd	01236 449393	●	●	●	●	●	●	●		●	●	●	✓	4			✓	●	Up to £6,000,000
Cementation Fabrications	0300 105 0135	●		●	●	●	●					●	✓	3			✓	●	Up to £6,000,000
D Hughes Welding & Fabrication Ltd	01248 421104	●		●		●			●	●	●	●	✓	4			✓		Up to £400,000
Donyal Engineering Ltd	01207 270909	●		●						●	●	●	✓	3		✓	✓	●	Up to £1,400,000
ECS Engineering Services Ltd	01773 860001	●			●	●	●		●			●	✓	4				●	Up to £3,000,000
Four-Tees Engineers Ltd	01489 885899	●	●	●	●	●	●		●	●	●	●	✓	3			✓	●	Up to £2,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445	●			●	●				●	●	●	✓	4	✓		✓	●	Above £6,000,000
M Hasson & Sons Ltd	028 2957 1281	●	●	●	●	●	●	●	●	●	●	●	✓	4			✓	●	Up to £1,400,000
Millar Callaghan Engineering Services Ltd	01294 217711	●	●	●	●	●	●	●	●	●	●	●	✓	4			✓		Up to £1,400,000
Murphy International Ltd	00 353 45 431384	●	●	●	●	●	●					●	✓	4			✓		Up to £2,000,000
Nusteel Structures Ltd	01303 268112	●	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓	●	Up to £6,000,000
REIDsteel	01202 483333	●				●	●	●				●	✓	4				●	Up to £6,000,000
S H Structures Ltd	01977 681931	●	●	●	●	●	●	●	●	●	●	●	✓	4	✓		✓	●	Up to £3,000,000
Severfield (UK) Ltd	01204 699999	●	●	●	●	●	●	●	●	●	●	●	✓	4	✓	✓	✓	●	Above £6,000,000
Shaun Hodgson Engineering Ltd	01553 766499											●	✓	3					Up to £800,000
Taziker Industrial Ltd	01204 468080	●		●	●	●	●	●	●	●	●	●	✓	3		✓	✓	●	Above £6,000,000
Underhill Engineering Ltd	01752 752483	●	●	●	●	●				●	●	●	✓	4	✓		✓	●	Up to £3,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●		●	✓	4	✓	✓	✓	●	Above £6,000,000
Non-BCSA member																			
Allerton Steel Ltd	01609 774471	●		●	●	●	●	●			●	●	✓	4	✓		✓	●	Up to £3,000,000
Carver Engineering Services Ltd	01302 751900	●		●	●	●	●		●	●	●	●	✓	4			✓		Up to £3,000,000
Centregreat Engineering Ltd	029 2046 5683	●		●	●	●	●	●	●	●	●	●	✓	4					Up to £2,000,000
Cimolai SpA	01223 836299	●	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓	●	Above £6,000,000
CTS Bridges Ltd	01484 606416	●	●	●	●	●	●	●	●		●	●	✓	4			✓	●	Up to £1,400,000
Eiffage Metal	00 33 388 946 856	●	●		●		●	●	●			●	✓	4					Above £6,000,000
Harrisons Engineering (Lancashire) Ltd	01254 823993			●	●	●	●	●	●	●		●	✓	3		✓			Up to £1,400,000
Hollandia Infra BV	00 31 180 540 540	●	●	●	●	●	●	●	●	●	●	●	✓	4					Above £6,000,000*
HS Carlsteel Engineering Ltd	020 8312 1879									●	●	●	✓	3			✓		Up to £800,000
IHC Engineering (UK) Ltd	01773 861734											●	✓	3			✓		Up to £200,000
In-Spec Manufacturing Ltd	01642 210716									●	●	●	✓	4			✓		Up to £800,000
J&D Pierce Contracts Ltd	01505 683724	●		●	●	●	●	●	●		●	●	✓	4			✓		Above £6,000,000
Kelly's Welders & Blacksmiths Ltd	01383 512 517											●	✓	2			✓		Up to £200,000
Lanarkshire Welding Company Ltd	01698 264271	●	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓	●	Up to £3,000,000
Lundy Projects Ltd	0161 476 2996	●		●	●	●	●			●	●	●		4			✓		Up to £4,000,000
North View Engineering Solutions Ltd	01325 464558											●							Up to £800,000
Total Steelwork & Fabrication Ltd	01925 234320	●		●		●				●	●	●	✓	3			✓		Up to £3,000,000
Victor Buyck Steel Construction	00 32 9 376 2211	●	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓	●	Above £6,000,000

Corporate Members

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

Company name	Tel
Gene Mathers	0115 974 7831
Griffiths & Armour	0151 236 5656
Highways England Company Ltd	0300 123 5000

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

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

Industry Members

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

QM Quality management certification to ISO 9001
FPC Factory Production Control certification to BS EN 1090-1
1 Execution class 1 2 Execution class 2
3 Execution class 3 4 Execution class 4
NHSS National Highway Sector Scheme

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

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

SfL
Steel for Life Sponsor

Structural components

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

Computer software

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

Steel producers

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

Manufacturing equipment

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

Membership services

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

Protective systems

Company name	Tel	QM	CA	FPC	NHSS	SCM	SfL
Forward Protective Coatings Ltd	01623 748323	✓	N/A				
Hempel UK Ltd	**01633 874024**	✓	**N/A**				**Bronze**
Highland Metals Ltd	01343 548855	✓	N/A				
International Paint Ltd	0191 469 6111	✓	N/A				
Jack Tighe Ltd	**01302 880360**	✓	**N/A**		**19A**		**Silver**
Joseph Ash Galvanizing	01246 854650	✓	N/A				
PPG Architectural Coatings UK & Ireland	01924 354233	✓	N/A				
Sherwin-Williams UK Ltd	**01204 521771**	✓	**N/A**			●	**Bronze**
Vale Protective Coatings Ltd	01949 869784		N/A				
Wedge Group Galvanizing Ltd	**01902 601944**	✓	**N/A**				**Gold**

Safety systems

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

Steel stockholders

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

Structural fasteners

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

Welding equipment and consumables

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

STRUMIS

V11.0

Coming Soon...

A WORLD LEADING STEEL FABRICATION MANAGEMENT INFORMATION SOFTWARE SUITE, USED WORLDWIDE TO **REDUCE COSTS** WHILE **MAXIMISING PRODUCTIVITY** AND **INCREASING PROFITABILITY**.

INTRODUCING:
EXECUTIVE DASHBOARDS
HAUNCH & TEE PROFILE NESTING
STRUMIS WEB CLIENT
SAVING YOU EVEN MORE TIME AND MONEY

HAUNCH & TEE PROFILE NESTING -
Advanced linear nesting of haunches and tee's, ensures maximum use of material to minimise waste.

STRUMIS WEB CLIENT -
Receiving Material
Progressing Cut Lists
Employee Timesheet Entry and Review
Web Dashboards
Drawing & NC Viewer

DASHBOARDS -
Customisable dashboards, providing managers with critical project and business performance data.
Simple to configure and easy to use.

COME SEE THE STRUMIS FEATURES THAT OTHER PROVIDERS ARE ONLY TALKING ABOUT.
OTHERS PROMISE; WE DELIVER.

THE FUTURE OF STEEL FABRICATION.

Stay connected to STRUMIS:

STRUMIS

BRINGING STRUCTURE TO STEEL

SALES@STRUMIS.COM | 01332 545800 | WWW.STRUMIS.COM

SOFTWARE BY STRUMIS LTD