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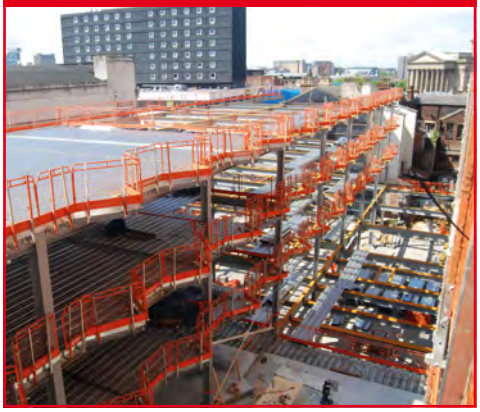
NSC

Regenerating Liverpool



Vol 25 No 8 September 2017

High-rise lifts Elephant & Castle

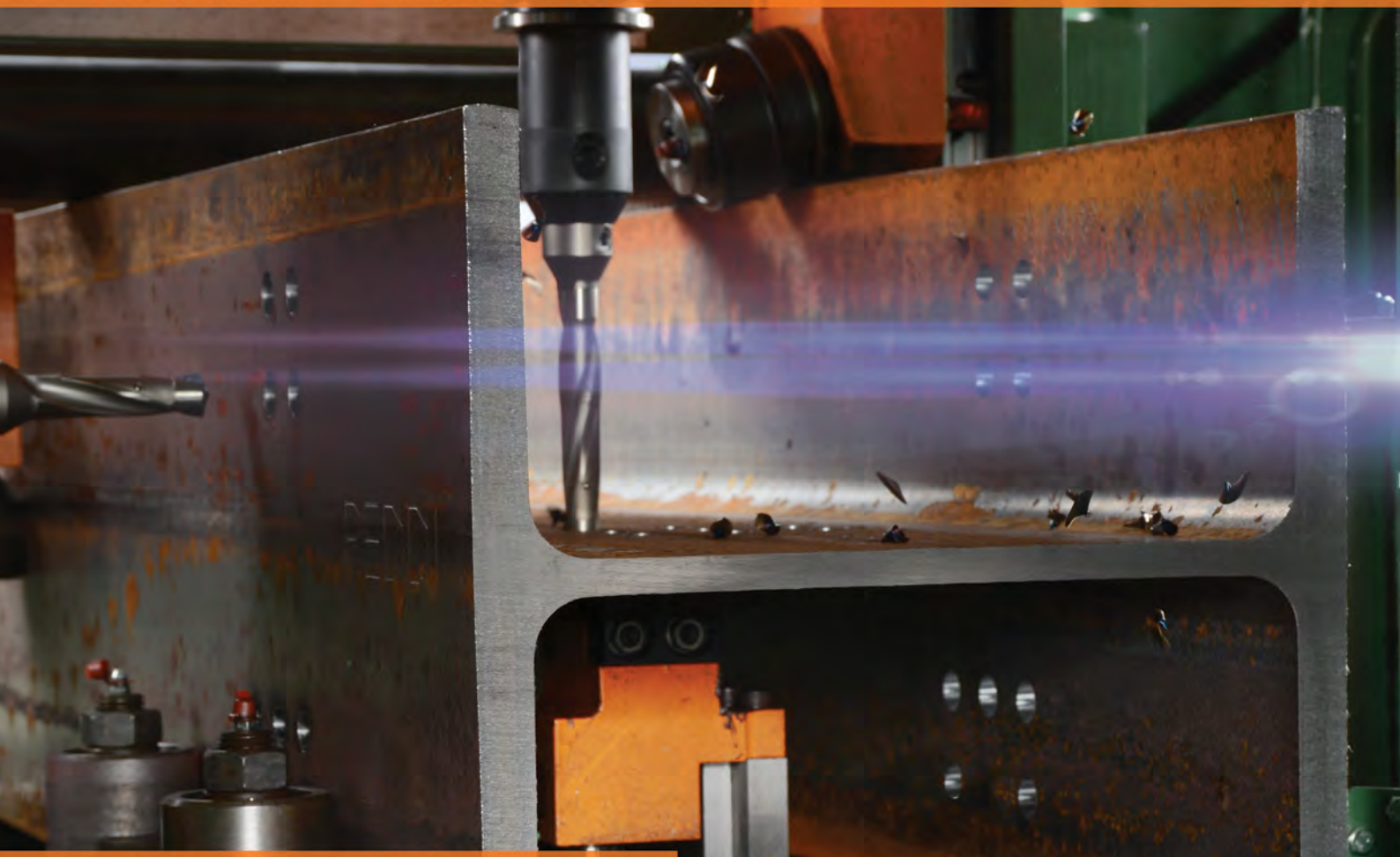
Complex services accommodated

Steel married with wrought iron

Leisure boost for County Down

STRONGER THAN STEEL

TWO IN ONE DRILLING AND SAWING



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Cover Image
Highpoint crown steelwork, London
Main client: Newington Butts Developments
Design Architect: Rogers Stirk Harbour + Associates
Delivery Architect: Axis
Main contractor: Mace
Structural engineer: AKT II
Steelwork contractor: Bourne Steel
Steel tonnage: 55.5t

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The Tipo G31 - heralds the dawn of a new era in the processing of heavy plate

This is the new technologically advanced, gantry CNC Machining Centre for drilling, milling, marking, scribing, tapping, chamfering and cutting of heavy steel plates up to 100mm thick x 3100mm in width

The Tipo G31 system is one of the most productive and versatile lines currently available for manufacturers of heavy structural steelwork, agricultural, earth moving and mining equipment who are looking to maximise productivity, minimise production costs and increase accuracy when processing large, heavy plate.
It can be equipped with dual spindles with independent sub axis which increase the productivity over single spindle lines by approximately 40%.
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For more details on how this innovative, small footprint machine can help you to maximise productivity and profitability call - **01924 223530**, e-mail **info@ficep.co.uk** or visit our website at **www.ficep.co.uk**

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Steel supply chain sets a lead to follow

Nick Barrett - Editor

Construction seems to have been on the edge of one of its periodic crises of confidence this summer, perhaps not entirely without good reason. Pundits point to this being one of the most prolonged periods of political uncertainty that they can remember, mostly due to the referendum vote to withdraw from EC membership. Not the ideal background against which to make major investment decisions.

Official statistics are providing some justification for caution. After five relatively good years some commentators think the construction sector is due a cyclical downturn. With luck what we are seeing now could be nothing more than 'the pause that refreshes' and a cyclical upturn might be under way before too long. Other hopes are that the Brexit negotiations will soon show the shape of a post-EC world, giving investors in commercial property more confidence to bring forward their plans again.

Investment decisions are always likely to be delayed against a background like this, but a lot still goes ahead. Retail investment seems to have been hit recently by the continuing growth of online shopping, but there are some significant projects still going ahead and we have also been seeing significant rises in construction of very large distribution facilities for the major online retailers like Amazon, which have been well reported in NSC.

Discount retailers Aldi and Lidl have announced major store developments which we expect to report on over the next few years. It is interesting to see steel playing a key role in the ongoing development of the world-famous landmark Selfridges store on London's Oxford Street, which we report on in News. The store is thought to be the second oldest steel framed building in London, first erected in 1909. Steel was used for additions in the 1930s and in the 1950s, and again today. Old Ironwork and new steel construction are also being merged successfully in the restoration of the Grade II listed covered Market Hall in Preston.

This month's NSC shows a busy industry in the news section alone, with Cleveland Bridge investing in some of the latest fabricating equipment to support future structures and infrastructure projects. A growing number of projects demand profiled steel, a market demand that Cleveland Bridge and other steelwork contractors are responding to.

Projects in locations as far flung as Orkney, County Down, Liverpool, Preston and the City of London can be seen taking advantage of the innovative and high quality service that can be provided as standard thanks to these kinds of investments.

To some people the steel manufacturing process is shrouded in mystery, but we have an article this month explaining the key details of the major steelmaking processes. The basic processes are well established but leading steel manufacturers like ArcelorMittal and British Steel continually invest heavily in developing new processes to provide new grades of steel with enhanced properties.

Investments like this in steel manufacturing and by steelwork contractors in leading edge fabricating equipment show a high degree of confidence in the future along the steel construction supply chain. Let's hope others soon feel able to follow their lead.

SCCS achieves revised ISO 14001 Environmental Management Systems standard

Following a UKAS assessment, the Steel Construction Certification Scheme (SCCS) has successfully transitioned to the revised BS EN ISO 14001:2015 standard.

The standard has been updated from the previous 2004 version because it is recognised that business has changed radically. Geographical boundaries are almost insignificant in today's global economy, supply chains are increasingly complex and the information companies have to manage has multiplied exponentially.

To ensure that ISO 14001 continues to serve the business community and maintain its relevance in today's market place, the standard has been revised to address these changes.

"For the SCCS to achieve this transition is a significant milestone," said SCCS Certification Scheme Manager Stephen Blackman.

"Severfield is the first of our 41 ISO 14001 clients to achieve certification to the revised standard through SCCS. Companies have until September 2018 to achieve certification to the revised standard."

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

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

V&A underground extension opens to the public

Designed by Amanda Levete Architects, the Victoria & Albert Museum's new underground extension has been officially opened.

Known as the Exhibition Road Quarter, the steel-framed project consists of a new 1,100m² temporary exhibition space - The Sainsbury Gallery - and 1,500m² of art handling and conservation space all sitting underneath a new courtyard, entrance hall, 30-seat café and shop.

The large column-free subterranean spaces are formed by a series of steel roof trusses that also support a new courtyard public domain.

There are 13 triangular trusses which are orientated to point downwards towards the gallery floor so that from below the ceiling will appear as a series of peaks and troughs.

The 3m wide × 3m deep trusses measure up to 20m in length. In addition to supporting the roof and courtyard above, the trusses' other main role is to prop the secant retaining walls at high level.

They span in a north-south direction between a series of fin-walls, which abut the secant piled wall adjacent to the existing Aston Webb building, and a large 40m long primary truss that bisects the gallery roof in an east-west direction.

On the opposite side of the primary truss a further space, including a mezzanine floor, is formed by a steel framework incorporating spans of up to 10m.

Working on behalf of main contractor Wates Construction, Bourne Steel fabricated, supplied and erected the project's steelwork.

Manchester's Ordsall Chord nears completion

One of the final steel elements of Manchester's Ordsall Chord, which will improve connectivity across the north of England, has been lifted into place.

Two steel cascades, each weighing 40t, represent the completion of the UK's first network arch bridge.

A Programme Manager for Network Rail said: "The installation of the cascades completes the final and unique steel ribbon effect which runs along the outside of the bridge.

"We are a step closer to providing the infrastructure for more frequent trains and better connections, not only within the city but the north of England."

BDP Transport Architect Peter Jenkins said: "The overall concept for the bridges is that of a continual, flowing ribbon which incorporates individual structures into a single over-arching identity.

"This latest piece of steelwork connects the River Irwell and Trinity Way bridges with a twisting, sinuous form which smoothly brings the concept of the structure to fruition.

"The process began with pen and paper concepts which were explored through structural analysis and developed into complex three-dimensional modelling."

The cascades, along with a further 1,300t of steelwork for the project's other bridges was fabricated and supplied by Severfield.

The Ordsall Chord will create the first rail link between Manchester's three main rail stations, Piccadilly, Oxford Road and Victoria (see *NSC*, May 2017).

Royals visit the Kelpies

Her Majesty The Queen and The Duke of Edinburgh visited the Kelpies to unveil a commemorative plaque and open a new section of the Forth & Clyde Canal.

During the visit, the Royal couple had a close look at the Kelpies and were escorted by artist Andy Scott to look at the complex engineering within one of the steel equine structures.

Her Majesty was also introduced to various members of the project team, including steelwork contractor S H Structures' Managing Director Simon Holden (far right) and Sales & Marketing Manager Tim Burton (second from right).

The colossal Kelpies are the centrepiece of the £43M Helix project.

The scheme was driven by a partnership of Falkirk Council and Scottish Canals, and supported by an award of £25M from the Big Lottery Fund.

It has transformed 350 hectares of underused land between Falkirk and Grangemouth into a vibrant parkland, visitor attraction and marine hub, with the canal and the Kelpies at its heart.

The project was recognised by the Structural Steel Design Awards in 2014 as a unique and iconic artwork, and was honoured with an Award.

Steel completes at west London school

Elland Steel Structures has completed the steel erection for the £25M Nishkam School in west London.

Working on behalf of main contractor BAM Construction, Elland Steel has installed precast staircases, 7,500m² of 200mm-deep precast flooring, structural roof decking and 570t of structural steelwork.

The new school, which will include a sixth form, will provide places for 1,400 pupils.

Architecturally, the school is set over two and three-storeys, with four wings radiating from a central hub.

The project also includes a four-court sports hall, two dining halls, main assembly hall, and a central faith area with an ETFE dome.

An extensive solar array on the roof will allow it to meet the requirements of the London Plan, which is a strategic plan for the capital setting out an integrated economic, environmental, transport and social framework

There will be electric charging points in the car park, and the football field will be used for storm attenuation.

Council offices under way in North Wales

Structural steelwork erection is under way on a prestigious project for the local authority in Colwyn Bay, North Wales.

Conwy County Council has contracted Bowmer & Kirkland to build the new steel-framed four-storey office building and an adjacent 354-space multi-storey car park.

The 9,200m² office block is aiming to achieve a BREEAM 'Excellent' rating and will replace up to 13 existing offices in and around Colwyn Bay.

Steelwork contractor EvadX is using cellular beams throughout the scheme. For the three-level car park, the beams are supporting precast planks, while in the offices they work compositely with metal decking.

Work on the project began in November 2016 with a site clearance and demolition programme of existing buildings. Completion is set for October 2018.

NEWS IN BRIEF

Lindapter's Type AAF clamps have been specified for attaching multiple support brackets to steel beams at the Allerton Waste Recovery Park in North Yorkshire. BHC has erected 1,866t of steelwork for the project, which is on track to be complete by the end of this year.

Graitec, the international BIM, simulation and fabrication software developer has launched Graitec Advance 2018, which it claims provides unrivalled modelling and design solutions to the steel fabrication market. The 2018 release enhances a set of new functionalities which help the user to apply a streamlined structural workflow, sharing intelligent BIM data between Autodesk products (Revit®, Advance Steel, BIM 360®) and Graitec products (Advance Design®, BIM Designers®, PowerPack®) as well as automating modelling, analysis, design, detailing and fabrication tasks.

Internet provider **Google** has been given the go-ahead by Camden Council's planning committee to build its new £1bn headquarters in King's Cross, London. Main contractor Lendlease will start on site next year on a contract believed to be worth around £350M. The 11-storey building, designed by Heatherwick Studios and BIG, in collaboration with BDP, will feature steel-framed elements.

Coatings manufacturer **Hempel** has introduced Hempaprime Multi 500, a new epoxy intermediate coating that is said to offer a longer service life for industrial assets and steelwork.

Developer **Palace Capital** has been given the go ahead for a major mixed-use scheme in the centre of York. The project will see the existing Hudson House site at Toft Green redeveloped into a four-block scheme of 127 flats, and offices totalling around 12,300m².

PRESIDENT'S COLUMN

BCSA steelwork contractors add value

I often ask myself at what point in the process do main contractors realise that BCSA members are specialists and that they can work with us to unlock additional value. This year, I have seen examples of great procurement and, disappointingly, some poor procurement.

For the specialist sub-contractor, good procurement starts with early engagement with the main contractor. We are by nature natural innovators, finding the best way to turn a tender into an order, in the same way that our customers do. By engaging early, the steelwork contractor can input to the design, often reduce costs, and even shorten the programme. The message that I'd like to send to our customers is that the earlier we are involved the better. We all know that a job that starts good, stays good.

Some of the poor procurement I've seen recently includes the engagement of blatantly unqualified steelwork contractors, leaving sub-contractor selection to the very last minute and even the immoral playing-off of one company against another.

BCSA members have set themselves very high standards, often beyond mandatory requirements. BCSA supports members with daily memos keeping them up-to-date with technical codes and standards as well as best practice. I'm not sure that I understand how non-members are able to keep up with their statutory obligations without access to such a service.

With over 90 registered steelwork contractor members, the customer has plenty of choice to ensure a suitably qualified and competitive tender list. Not only can they be confident that they are choosing the most appropriate steelwork contractor for the project, but one who also supports the UK economy. Access to a pre-assessed, qualified steelwork contractor who values quality is easy through our searchable database which can be found at *www.steelconstruction.org/directories*. Sub-contractors belonging to a high-quality trade association like BCSA have a vested interest in adding value to the tender process as well as maintaining strong values. The two go hand-in-hand.

I plan to write a column in each of the NSC editions, and I hope that they will be topical. Having said that, if you have a subject that you'd like a comment on, please send them to me: you can email me directly at *tim.outteridge@clevelandbridge.com*

Tim Outteridge
BCSA President & Sales Director Cleveland Bridge

Steelwork contractor increases capacity

Cleveland Bridge said it has increased production capacity with an investment in a new production line, which includes specialist equipment to cut steel plate.

The company has added a FICEP Gemini HD36 CNC plasma plate processing machine and a FICEP 1101DZB automated saw and drill line to its fabrication site in Darlington, County Durham.

The new machines will increase the company's capacity to cut profiles from steel plate by around 50%, supporting both structures and infrastructure projects with small fitting components.

Cleveland Bridge Managing Director Chris Droogan said: "This investment demonstrates our commitment to increasing both our manufacturing capacity and productivity. It is also a welcome opportunity to upskill a number of members of the Cleveland Bridge team.

"While the principles behind engineering don't change, the technology does, and in the UK this is more important than anywhere, given the importance of efficiency and innovation to our competitive edge.

"A growing number of projects require large volumes of profiled steel and this equipment will increase the speed at which we are able to deliver it. The work we do at Cleveland Bridge is in demand around the world and in the domestic market, so this is an ideal time to grow our capacity."

London department store shops for steel

Phase Two of Selfridges multi-million pound revamp of its Oxford Street department store has begun with the transformation of the Duke Street elevation.

Having created new loading bays and egress ramps as part of Phase One, the latest phase consists of creating a new east entrance and a larger Accessories Hall by in-filling the area where the old bays were previously located.

A complex engineering procedure is required to install a new free-standing steel structure within a tight footprint, which is surrounded by retail areas that will remain open throughout the construction works.

Working on behalf main contractor Blue Sky Building & Sir Robert McAlpine JV, William Hare is the steelwork contractor for the project.

Phase One of the Selfridges redevelopment has been

shortlisted for this year's SSDA, while Phase Two will be covered more extensively in *New Steel Construction* Nov/Dec issue.

Contractor named for sports facility

Morgan Sindall Construction & Infrastructure has been appointed to design and build a £28M steel-framed sports facility for Southampton Solent University.

The new building will provide a state-of-the-art sport and physical activity space for all students and staff at the university.

The four-storey building will include; two sports halls, three fitness studios, a health and well-being

gym, a strength and conditioning high performance gym and teaching facilities. The scheme will also include an underground car park.

The Morgan Sindall project team is now on-site and the project will be completed in the Summer of 2019. The building will be located next to the Spark building on the university's East Park Terrace Campus.

The scheme is Morgan Sindall's eleventh project win under the Southern Construction Framework (SCF) and is targeting a BREEAM 'Excellent' rating.

Southampton Solent University's Vice-Chancellor, Professor Graham Baldwin, said: "Starting work on the new sports building is great news for our students and staff, as well as our local community and the city.

"It forms the latest phase of our exciting, ongoing estates development and, in addition to our sector leading Spark building, it's a further physical manifestation of our commitment to excellence in learning and teaching."

Former BCSA President remembered by steel sector

Guy C Barrett OBE, President of the British Constructional Steelwork Association (BCSA) from 1983 to 1986, has passed away at York Hospital after a short illness.

Born on 17 March 1925, Guy leaves behind three children, Elizabeth, James and Richard. His wife Mavis, died in 2015. They had been married since 1950 and lived in Horsforth, Leeds.

After leaving school, Guy studied structural engineering at Bradford Technical College and eventually became a Fellow of The Institution of Structural Engineers.

His career was however interrupted by the Second World War, and once old enough he joined the RAF as a corporal. After the War, Guy worked with the RAF installing radar at Berlin and Heathrow airports.

Guy eventually left the RAF and joined the Bradford-based family business, the steel stockholder and structural engineer, Henry Barrett and Sons. He became Managing Director and later Chairman of the business.

As well as holding the position of BCSA President, Guy was also President of the European Convention for Constructional Steelwork from 1988 to 1989.

During this time and under his leadership, the BCSA successfully hosted an International Conference and European Steel Design Awards in 1989, welcoming 1,000 visitors from 27 countries.

Guy was awarded an OBE in the Queen's Birthday Honours in 1986, for services to the constructional steelwork sector and, his other great passion, pigeon racing.

Steelwork begins for Orkney hospital

Steel has started to be erected for the NHS Orkney's new £65M hospital and healthcare facility in Kirkwall.

Steelwork contractor BHC is working on behalf of principal contractor Robertson on the state-of-the-art development that will transform the way healthcare services are delivered in the islands.

Designed by Keppie Architects, the hospital, which is due to be completed in 2019, will replace the existing Balfour Hospital, two local GP Practices and the Public Dental Service.

The 14,500m^2 development will provide 49 en-suite bedrooms for in-patients, assessment, maternity and mental health needs. Additionally, the new purpose-built hospital will include accident and emergency, surgical theatres, day surgery and cancer and palliative care units.

Cathie Cowan, NHS Orkney Chief Executive, said: "This development will match our aspirations to deliver the highest quality care and services from fit-for-purpose facilities.

"Delivering a major healthcare project in Orkney presents a unique set of challenges. To solve these, we have taken into account the remoteness of the island, supply chain logistics, local landscape and challenging climatic conditions, as well as specific archaeological and environmental considerations.

For example, procuring and shipping construction materials to the island and storing on site well in advance of programme requirements will reduce the vulnerability of the project to extreme weather conditions.

Structural steelwork will be fabricated offsite wherever possible to enable speedy completion of the building structure. The envelope of the building is designed to take into account the available trades on the islands and to achieve an early wind and watertight position, thus allowing internal trades to progress despite inclement weather."

Prestigious accolade for steel-framed City tower

The Monument Building has won the best large commercial building of the year 2016 category in the Local Authority Building Control (LABC) London regional awards.

Recognising quality in all types of building projects, the prestigious accolades are the largest business-to-business awards in the building control sector.

Completed two weeks ahead of schedule in May 2016, The Monument Building is a 8,733m^2 nine-storey office-led development and was main contractor Skanska's first London development.

Designed by architect Ken Shuttleworth's make, it features four terraces, a large reception area, state-of-the-art cycle storage and shower facilities. The building has been fitted with a 'curtain' of twisted, anodised aluminium fins on the south façade.

Structurally, the building has been designed with a steel frame based around one eccentrically positioned concrete core. Arup were the project's structural engineer, while Severfield fabricated, supplied and erected 650t of steel for the project.

Most of the building is built around a grid pattern offering spans of up to 12m. The steel erection programme was completed ahead of the planned 20-week schedule.

Skanska Project Director Brian Nunn said: "It has been a pleasure to be involved with The Monument project, a great project with a great team. Being awarded this prestigious award is a result of dedication and hard work from the whole team."

Diary

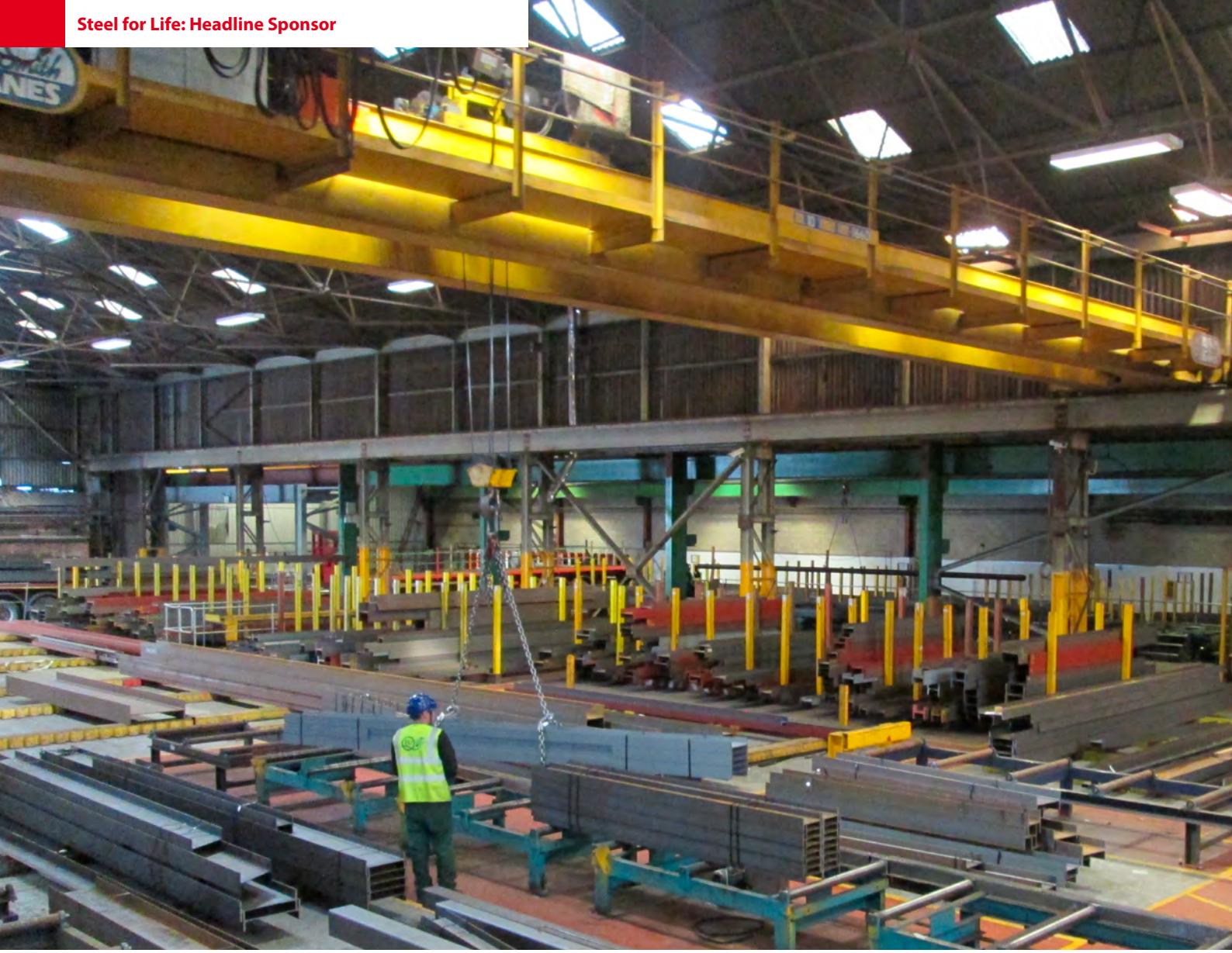
For SCI events contact Jane Burrell, tel: 01344 636500 email: *education@steel-sci.com*
For Institution of Structural Engineers events email: *training@istructe.org* or telephone 0207 201 9118

Monday 11 September 2017
Modular Construction
This webinar will cover the various forms of modular construction and examples of recent projects in the residential , health and educational sectors.
Repeated on Tuesday 12 September 2017

Wednesday 13 September 2017
Steel Essentials – Practical Design of Structural Steelwork
The aim of this course is to present practical guidance on key aspects of preliminary scheme development and detailed scheme design in structural steelwork. London

Tuesday 26 September 2017
Designing Stainless Steel
This one day seminar will launch the Fourth Edition of the Design Manual for Structural Stainless Steel and will equip engineers with the skills necessary to design structural stainless steel in accordance with current European design practice. Each delegate will receive a copy of this new publication. London

Tuesday 10 October 2017
Steel Connection Design
This 1 day 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. Nottingham



Barrett Steel raising the bar

Barrett Steel's investment-led growth is consolidating the steel stockholder's position at the fore of supplying the thriving steel construction market. Customers are reaping the benefits as the investment plan gathers pace, as NSC reports.

The opening of Bradford based Barrett Steel's new facility at Montrose in Scotland in March marked a key step forward in the company's strategy of growth by investing to maintain its family owned independence, while providing the UK steel construction and other key markets with a class-leading service.

Already one of the biggest stockholders in the UK, Barrett Steel aims to increase its presence in Scotland from a base in Bathgate, West Lothian, which has recently been augmented by the new Montrose distribution centre.

Montrose is conveniently placed to serve the north east Scotland market, lying between Dundee and Aberdeen on the Angus coast. The site holds some 2,000 tonnes of general steels and has extensive on-site steel processing facilities.

The Group's five-year investment programme is on track to achieve an objective of growing turnover in the UK and overseas to £300 million by 2020, from £250 million at the start of the five-year period.

'That is a sustainable and manageable rate of increase,' says Group Managing Director James Barrett. 'It isn't all about growth though, our investments have been carefully considered to enable us to provide customers with the highest quality products and services at the most competitive price.

'The feedback from clients across the sectors we work in, including construction, has been highly positive and we are confident that we are improving the quality of our products and services and the efficiency of our operations at the same time as expanding.'

Barrett Steel operates under four main divisions – General Steels, Engineering Steels, Tubes and International – and construction is a key market. Most construction related products and services are supplied via the largest division, General Steels. A new operating company called Barrett Constructional Steel focuses exclusively on larger steelwork contractors, who are likely to have unique and challenging requirements due to the larger size and complexity of the projects they work on.

The General Steels division provides practically all of the steel elements needed to create modern structures including heavy structural sections, steel plate, tubular sections, light sections, flats and angles.

Barrett Steel prides itself on its advanced steel processing capabilities

A stock of some 100,000 tonnes of steel is available at any one time for just-in-time delivery to wherever customers need it using the company's own vehicle fleet.

The Group is proud of its technically advanced steel processing capabilities aimed specifically at constructional steelwork, a leading edge service that is kept up-to-date by continuous investment in quality and productivity enhancing computer controlled equipment.

State-of-the-art equipment includes machinery for sawing, shotblasting and priming, which is traditionally the sort of service delivered by steelwork contractors, Barrett Steel's main clients. Far from this creating conflicts of interest though, steelwork contractors value having routine operations using this equipment carried out by stockholders, allowing them to focus on design, more challenging fabricating operations and erection.

Recent investment in leading edge processing equipment has included a three spindle drilling line for processing beams and shaped rolled sections with small and large dimensions. This is directly aimed at meeting the needs of UK steelwork contractor customers, a significant step forward in beam processing.

Excellence roll out

Barrett Steel reported a solid trading performance in its latest annual results, for 2016. James Barrett said in his trading statement on the release of the results that Brexit had not yet had any impact on demand in the company's traditional construction markets. Weak sterling was forcing importers to consider increasing prices, which made price rises almost inevitable in any products incorporating imported raw materials or products, he warned.

A notable landmark during the year was achieving ISO 14001 accreditation across all the Group's UK sites, underlining the Group's commitment to sustainability and minimising environmental impacts. New investments in the last year included saw/drill lines at Bradford and facilities in Ireland and Scunthorpe. Over £1 million was invested in IT systems during the year and £1 million on enhancing the HGV fleet.

Quality is being enhanced by the investments in machinery, and also by investing in people, as seen in the Barrett Excellence Programme that is being rolled out across the Group. Several series of courses are under way, ensuring that senior managers and shop floor team leaders are properly equipped to deliver the high level of product and service that clients expect.

The Group's Business Excellence Programme has been branded 'Raising the Bar' and training specialist Qualitrain has been recruited to roll out business improvement techniques across the Group following pilot schemes that have seen 154 of the workforce already trained.

Barrett Steel now has 44 operating companies, with 200 people employed at the Bradford head office and 1,030 across its operations in the UK, as well as overseas in the United States, Middle East and Europe, all of whom will be involved in the Raising the Bar programme.

The Group secured funding of £80m last year to support its development plan, which includes overseas expansion in markets including Southeast Asia and the Middle East. Barrett Steel already supplies steel to cities like Dubai and Abu Dhabi in the United Arab Emirates. The investment programme is focussed on the latest added value steel processing technology, ongoing replacement of the company's fleet of HGV's, upgrading IT systems and ensuring that staff have the skills needed to deliver on quality and productivity targets and compete against international competition.

Group Managing Director James Barrett said: "The construction sector will always be extremely important to Barrett Steel and represents a significant portion of our heavy section sales. Expansion over the years has led us into other markets like offshore, several of which will see continuing growth, but construction remains the core of our business.

Mr Barrett singled out investments to support growth in the Scottish and Irish markets as having opened new opportunities. "Continuous investment in our stock and service offering will ensure that we remain at the forefront of the steel stockholding sector." "We are constantly looking to expand either organically or via acquisition," he said.

"We have come a long way as an independent, family owned company since being founded 150 years ago. Our success is due to the hard work and dedication of our employees and the customers and suppliers who have partnered with us. We look forward to continuing that tradition of success and continuous development to serve changing markets."

Barrett Steel is a headline sponsor of *Steel for Life*

An introduction to steelmaking

People have been making iron and steel for centuries. Steel remains the backbone of modern industrialised economies. It's hard to imagine a world without steel – be it construction, vehicles, engines or machines, steel is ever present in all that we make and all that we use.

Steel's versatility, in terms of its composition and properties, its strength-to-weight ratio and its ability to be infinitely multicycled into new products sets it apart from other materials and makes steel the ultimate product of the future and one that already contributes to the development of the circular economy.

Structural steel is an alloy of iron and other metals with most of the carbon removed to make it tougher and more ductile. There are many grades of steel, each with its own specific chemical composition and properties to meet the needs of the many different applications.

There are two major steelmaking processes used today.

Basic Oxygen Steelmaking

Molten iron (called 'hot metal') produced in a blast furnace from iron ore, coking coal and steel scrap are the principal materials used in Basic Oxygen Steelmaking (BOS). Modern furnaces, or 'converters' take up to 350 tonnes of these materials and convert it into steel in around 15 minutes. A water-cooled oxygen lance is lowered into the converter and high-purity oxygen is blown on to the metal at very high pressure. The oxygen combines with carbon and other unwanted elements, eliminating them from the molten charge. These oxidation reactions produce heat, and the temperature of the metal is controlled by the quantity of added scrap.

After the steel has been refined and samples taken to check temperature and composition, the converter is tilted and the steel is tapped into a ladle. Typically, the carbon content of the steel at the end of refining is about 0.04%. During tapping, alloy additions can be made to adjust the final composition of the steel.

Electric Arc Furnace

The Electric Arc Furnace (EAF) uses cold scrap metal. Modern EAFs can make up to 150 tonnes of steel in a single process or 'melt'.

The electric arc furnace consists of a circular bath with a movable roof, through which three graphite electrodes can be raised or lowered. Once the steel scrap is placed in the furnace the electrodes are lowered. A powerful electric current is passed through the charge, an arc is created, and the heat generated melts the scrap. Lime and fluorspar are added as fluxes and oxygen is blown into the melt to remove impurities.

Samples of the steel are taken and analysed to check their composition and, when the correct composition and temperature have been achieved, the furnace is tapped rapidly into a ladle. Final adjustments to precise customer specification can be made by adding alloys during tapping.

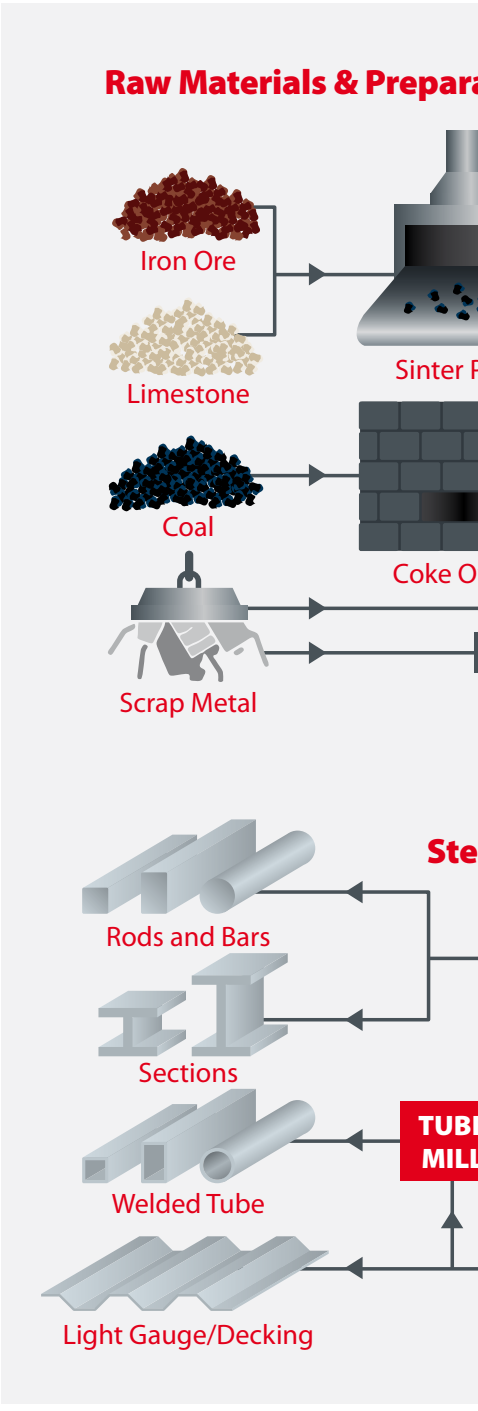
Secondary Steelmaking

After the molten metal is poured into a ladle from either the BOS furnace or EAF it is often given one or more extra treatment(s) depending upon the grade of steel required. These further refining stages are collectively known as secondary steelmaking.

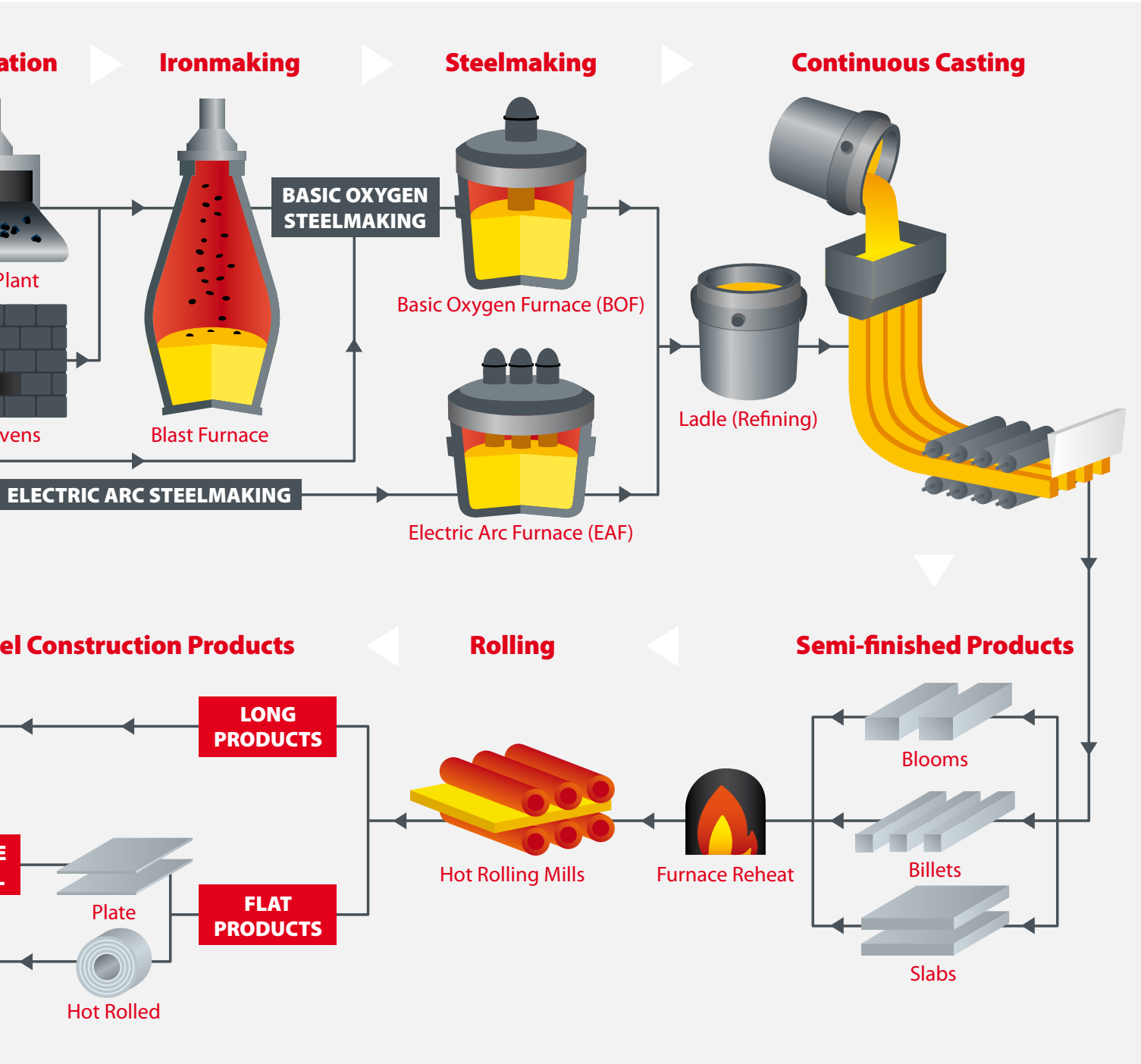
Continuous casting

Before molten steel can be rolled or formed into finished products, it has to solidify and be formed into standard intermediate basic shapes called billets, blooms, slabs or beam blank 'dog bones'. This is done by a process called continuous casting where a number of ladles of the same grade of steel are fed into the caster without stopping the machine. This continuous process is key to efficient production.

The steel flows out of the ladle into the tundish, which is a reservoir that ensures the steel flows at a controlled rate into the water-cooled copper mould of the casting machine. Once the steel has passed into the copper moulds only its outer shell will have solidified. The steel is then drawn downwards from the bottom of the mould through a curved arrangement of support rolls and water sprays until it emerges horizontally as a solid steel strand from the discharge end of the machine, where it is automatically cut to the lengths required.



"From rolling the first metre-high beam in 1911 to modern day QST processes producing S460, Histar and monthly rollings of UCs to 1299kg/m, ArcelorMittal aims to enhance and support steel construction's ability to deliver efficient, economic and sustainable solutions."
ArcelorMittal Senior Technical Sales Engineer & Business Development, Neil Tilley.



Such continuous casting machines can produce several strands in parallel.

Shaping steel

Steel's resistance to shaping reduces at high temperature, so it's generally rolled into finished products at carefully controlled elevated temperatures. The semi-finished shapes are heated to around 1,200°C in a reheat furnace and squeezed between sets of cylinders or rolls. Rolls are arranged in pairs and housed in a 'stand'.

To change the shape of a material as strong as steel, the rolls must exert forces measured in thousands of tonnes, and must also draw the steel continuously through the rolls while reducing the thickness. Two main classes of product are produced - flat products, sheets or strips of uniform thickness, and long products - lengths of a particular cross section, ranging from rectangular bars to double flange H sections. For flat products, two horizontal rolls are set one above the other in an open housing. For long products a series of specially shaped and angled rolls (referred to as 'stands') are used to transform the section to the required shape.

Continuous development

Steelmakers around the world are continually improving the efficiency of steel production to drive down costs and reduce the environmental impact of the process. Steelmakers also invest in research and development to create new steel grades with enhanced properties to meet the ever increasing demands of clients.

"R&D is central to our long-term construction strategy. We embrace new technologies to continually improve the quality of our steel and our manufacturing operations, ensuring customers receive the high-quality products and service they rightly expect."
British Steel Managing Director Construction, Richard Farnsworth

How the completed Market Hall will look

Market trades with steel

The restoration work of a Victorian covered market in Preston has embraced both old ironwork and new steelwork. Martin Cooper reports.

FACT FILE
Preston Market Hall
Main client: Preston City Council
Architect: Frank Whittle Partnership
Main contractor: Conlon Construction
Structural engineer: Sanderson Watts Associates
Steelwork contractor: Border Steelwork Structures
Steel tonnage: 110t

Preston's Grade II Listed Victorian Market Hall is getting a make-over as part of the city's ambitious Markets Quarter redevelopment programme.

A well-known amenity in Preston, the Market Hall was constructed in 1875 and is an open sided structure formed from cast iron columns and wrought-iron girders supporting a slated duo-pitch roof with hipped ends.

The roof and all of the ironwork have recently been renovated and repainted as part of phase 2 of the redevelopment programme. The initial phase one, which was completed last year, saw the adjacent Fish Market, a smaller but similar structure to the Market Hall, renovated.

Work on the interior of the Market Hall is phase three and this consists of the construction of an open topped free-standing part-glazed and part-timber clad structure situated under the renovated roof. Within this enclosure a number of new steel-framed stalls have been erected forming accommodation for 32 traders.

This new structure covers approximately half of the market's overall floor space, as the remainder of the 110m-long covered Market Hall has been resurfaced and will be used to either cater for a further 52 temporary stalls or as an events space during the evening.

"The steel enclosure is designed to be structurally independent to ensure no vertical or lateral loadings are transmitted to the existing Market Hall's historic ironwork," explains Sanderson Watts Associates Technical Director Ryan McMullan.

The new steel-framed stalls are arranged along both of the main elevations, and these are supported off the main perimeter steelwork.

Meanwhile, down the middle of the Market Hall there are more free-standing island steel structures, which will accommodate further stalls.

The main structural frame is typically comprised of fixed base cantilever columns, positioned at 8.1m centres along the longitudinal elevations, and 8m centres on the transverse elevations.

The cantilevered steel column sections are typically tapered welded plate girders on the elevations, and square hollow sections (SHS) at corner locations.

The horizontal glazing support consists of both SHS and rectangular hollow section profile beams, spanning between the cantilever columns.

Additional restraint to the compression flange of the cantilever columns has been required via localised diagonal stays at the

New steel-framed stalls will accommodate 32 traders

connections.

Given the glazed façades, cross bracing elements were not considered suitable and so structural stability is achieved via cantilever action of the perimeter columns on the loaded face, via sufficiently anchored moment resisting base connections.

For the internal Market Stalls, the main structural frames typically consist of a single centralised cantilever column, with four primary cantilever roof beams extending to the four corners. Further secondary infill steelwork is supported off these beams to create the roof structure and to help subdivide the stalls.

Commenting on the steelwork, Frank Whittle Partnership Architect John Bridge says: "Most of the steelwork will be exposed within the completed project, offering a unique juxtaposition between contemporary steelwork and traditional ironwork.

"The use of tapered steel members, primarily near entrances is purely architectural as they will be on show, while the umbrella style of the island stalls offers a lot of flexibility."

Work on phase three began earlier this year and the project team anticipates completion sometime this winter, in time for the Christmas shopping season.

Initial work included the installation of 25m-deep piles chosen because of the presence of made ground of up to 3.3m below ground level and cantilever nature of the perimeter columns. It was decided that shallow spread foundations, similar to the original Market Hall's design, would not be practical or economical.

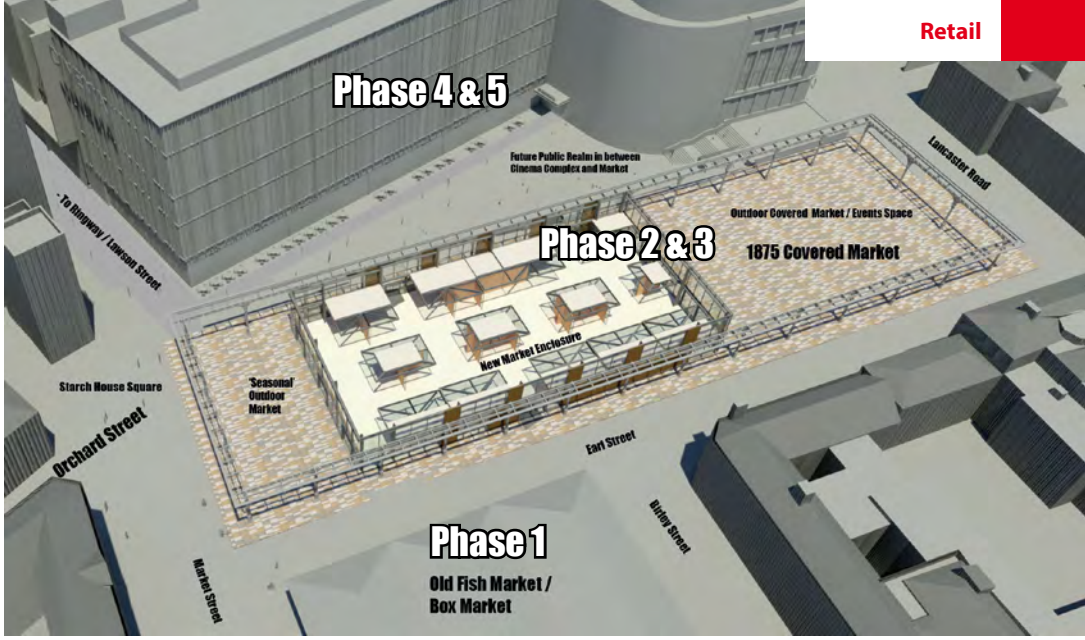
Once the piles and holding down bolts had all been installed Border Steelwork Structures (BSS) was able to begin the steel erection programme. Contending with a sloping site – there is a 1.6m fall in ground level across the length of the structure – and the tight confines of the Market Hall, cranes were deemed to be unsuitable for this job.

Any size of crane would have been too large to work within the Market Hall, and BSS was also very conscious of the recently renovated and repainted ironwork.

Using a couple of MEWPs in conjunction with a telehandler, to perform all of the lifting operations, BSS erected the entire steelwork package in two weeks.

Summing up, Conlon Construction Contracts Manager Terry Fisher says: "Close coordination between all of the different trades has been key to the continuing success of this project so far.

"With everyone using our BIM model from the very early design stages, this ensured that there were no hiccups during the steel design, fabrication or erection phases."



Five phases of Preston Markets Quarter

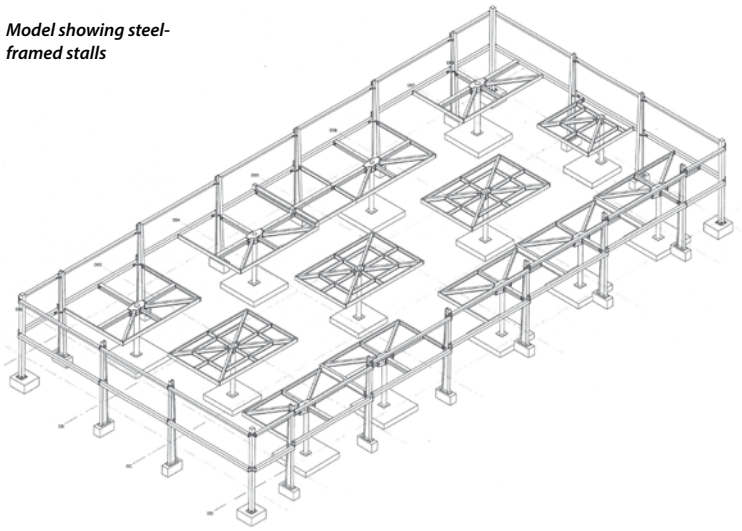
Phase 1 - Completed May 2016 - Restoration on the Fish Market Canopy comprising refurbishment of the metalwork, redecoration and re-lighting.

Phase 2 - Completed December 2016 - Restoration of the 1875 Market Hall Canopy to the same standard as the Fish Market Canopy.

Phase 3 - On site - Building the new steel-framed indoor market hall under the restored 1875 Market Hall Canopy.

Phase 4 - Demolition of current market hall and car park.

Phase 5 - Construction of the landmark steel-framed cinema, restaurant and car park complex on the site of the demolished indoor market hall



Model showing steel-framed stalls

"Most of the steelwork will be exposed within the completed project, offering a unique juxtaposition between contemporary steelwork and traditional ironwork."

Typical stall column and beam connection

A podium separates the hotel from the taller student accommodation block

City centre regeneration

A mixed-use scheme consisting of student accommodation, an hotel and retail/leisure units will revitalise a key gateway into Liverpool city centre. Martin Cooper reports.

The main Lime Street elevation incorporates the listed Vines pub

Big changes are afoot in central Liverpool as a number of projects are set to revitalise large areas of the city.

One of these projects is the £39M Lime Street regeneration development, located next to the city's main railway station.

Here on a prominent but constrained site, a large structural steel frame has recently been completed by Billington Structures working on behalf of main contractor ISG.

The entire scheme has been designed as one large steel frame, albeit with three separate parts; a lower retail podium that supports both a three-storey Premier Inn hotel with 101 guest rooms and an 11-storey, 412-room student accommodation block.

Interestingly, the project forms one of the initial elements of Liverpool's ambitious Knowledge Quarter development. Covering a large area and extending from Lime Street station north eastwards towards John Moores University, the development will consist of a number of new educational, technology, innovation and creative facilities.

Work on the Lime Street project began last year with a large demolition programme. This involved the removal of an entire block of buildings that previously occupied the island site, which is bounded by Lime Street, Skelhorne Street, Bolton Street and Copperas Street.

Once the site was cleared the steel erection programme was able to begin

last April. No piling was necessary as the columns are supported on fixed bases that are on ground beams positioned directly on top of sandstone.

The decision as to which framing material to use was made during the early design stages. Both concrete and steelwork options were thoroughly assessed before the latter was chosen.

"Structural steelwork was the only viable option because of its speed of construction and ultimately cost," says ISG Senior Project Manager Shaun Boylan. "The entire steel frame was up within the 14-week programme, which was good for the project as it meant all of the follow-on trades were able to get an earlier start."

Two listed pubs, positioned either end of the Lime Street block, have been retained. Although the Crown Hotel and the Vines are not connected to the scheme, they bookend the development along with several other non-listed, existing commercial and retail buildings.

In places the new steel frame comes within 12mm of a party wall, making the erection process a little more challenging, but ultimately achievable.

"All neighbouring properties are open for business throughout the construction programme, and not interfering with their operations is one of our main project goals," adds Mr Boylan.

Using steelwork has allowed the team to erect the steelwork close to the two pubs by working from inside the frame's footprint, where no machinery or steelwork needs to over-slew either of the hostelries.

The majority of steelwork is based around a regular 7.3m grid pattern, chosen for its suitability for the project's many end-users.

None of the project's steelwork elements were particularly heavy, some 5.5t columns positioned in the retail zone being the heaviest members. Consequently, the steel was erected using a 90t-capacity mobile crane as well as the on-site tower crane.

Following on behind Billington's steel erection, SMD has installed more than 17,700m² of metal decking for the composite floors.

At ground floor level, the steel frame accommodates a series of retail units that have frontages along Lime Street. Because of the site's slope - a 5m difference from front to back of the site - this lowest floor is actually below ground level along the Bolton Street elevation, where a large retaining wall needed to be constructed.

To get maximum flexibility and allow future tenants the opportunity to combine retail units, cross bracing has not been used for stability. Instead the entire project is a hybrid design using a combination of sway and moment frames.

"Bracing spanning between columns would have got in the way of future shop expansions, so instead we've designed the frame with rigid bolted connections," explains Sutcliffe Project Engineer Sean Keyes.

"This means we have larger columns and beams in the ground floor retail area than we would have ordinarily specified."

The three-storey Premier Inn is positioned above the retail units along Lime Street. As a nod to the demolished buildings, this elevation of the scheme will feature a perforated aluminium artwork cladding by local artist Anthony Brown, depicting the history of Lime Street [see box].

With the exception of the Premier Inn's lowest level, which contains the entrance and a restaurant, a regular grid pattern has been used throughout. The pattern comfortably accommodates a central corridor with regular sized rooms positioned either side.

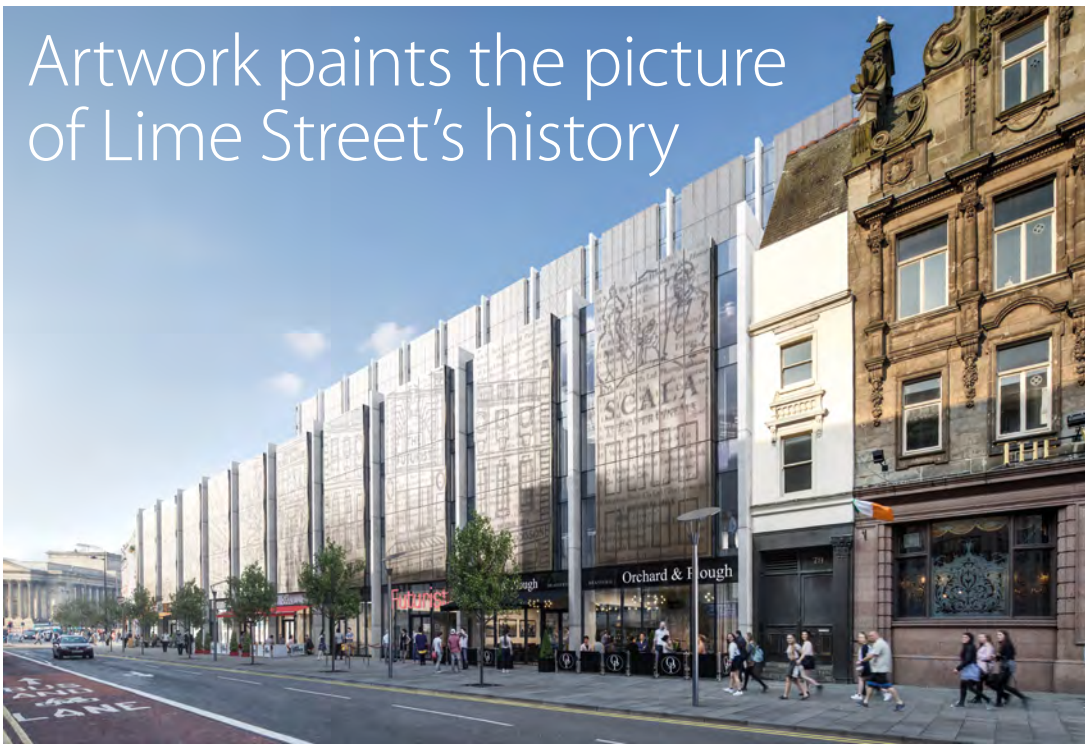
To create the slightly larger spaces needed for the hotel's first floor, a series of transfer structures have been installed to the underside of the second floor.

Likewise, the student accommodation block has been built around a repetitive column grid pattern that creates the desired space for its internal layout. This consists of two cores positioned at either end of the block that serve a double row of central corridors that in turn give access to a series of bedroom pods which are clustered around their individual common rooms.

The only part of the student accommodation block that varies in design are two bays positioned adjacent to the podium's central realm that separates the two buildings. This zone incorporates a double-height space for a reception area.

Liverpool's Lime Street development is due to be complete by Summer 2018.

Artwork paints the picture of Lime Street's history



Leading Liverpool property developer Ion has commissioned a large-scale graphic artwork created by Anthony Brown to decorate the Lime Street development.

Mr Brown says the work's intention is to capture and reflect the history while commemorating the development of a truly unique street - and one of the most important areas in the city of Liverpool.

He adds: 'We have created an accessible 'Quantum Timeline' using illustrative graphic images and archived text to immortalise the development, buildings, business, people and heritage of Lime Street which was formerly known as Limekiln Lane.

A total of 11 aluminium panels tell the story, including depictions of the two cinemas that once stood on the street; Maggie May, the heroine of a famous Liverpool folk song; the Guinness Clock, one of the city's most remembered buildings; and Marks and Spencer, who had one of its earliest stores on Lime Street.

FACT FILE
Lime Street regeneration, Liverpool
Main client: Ion Development
Architect: Broadway Malyan
Main contractor: ISG
Structural engineer: Sutcliffe
Steelwork contractor: Billington Structures
Steel tonnage: 1,300t

Two historic retained pubs bookend the scheme

Complex frame accommodated by steel

FACT FILE
Richmond Wood Norton retirement village, Evesham, Worcestershire
Main Client: Richmond Care Villages
Architect: BAM Design
Main contractor: BAM Construction
Structural engineer: Rodgers Leask
Steel contractor: Adstone Construction
Steel tonnage: 1,080t

A steel-framed solution was the answer for a retirement village containing numerous room configurations, spread over seven different floor levels. Martin Cooper reports.

As the UK has an ageing population, it is no surprise that the construction of retirement accommodation is on the increase.

One of the country's leading providers is BUPA-owned client Richmond Care Villages, who are currently providing a retirement village at Wood Norton near Evesham, Worcestershire.

The £40M development, being built by BAM Construction, will create 61 village apartments for independent living, 46 suites for assisted living, and a 60-bed care home providing nursing and dementia care.

In addition, there will be a wellness spa, lounges, library, terrace café, restaurant and garden bar.

The project is located adjacent to an exclusive hotel and BBC technical and training facility. The retirement village's footprint was previously occupied by a BBC-owned training and conference centre, which was demolished as part of the project's early works.

Work initially included the team removing roof tiles and felt from pitched roofs to prevent bats from roosting, and then stripping out asbestos from the existing buildings prior to demolition. The team then undertook groundworks that consisted of 26,000m^3 of overburden being removed from site.

Most of the accommodation is within one large building, with the exception of 13 individual apartments which are housed within a separate three-storey steel-framed building.

The footprint for the main building has a serious slope, with an 8m difference from the top end to the bottom end. Two 5m-high retaining walls were installed to form two steps for the building.

The walls split the building roughly into thirds, with the top portion consisting of four levels (0, 2, 3 and 4) and the bottom third also consisting of four floors, but these are at -2, -1, 0 and level 2. Incidentally floor 1 only exists in the middle portion, which also includes -1, 2 and 3. The entrance to the village is at the top end and at level 0.

Having such a complicated floor set-up had a huge impact on the initial design of the project as BAM Construction Project Manager Paul Hayfield explains: "The design intent was originally for a load-bearing masonry frame, but we changed

it to a steel frame as masonry would have been impractical for this form of construction. The steel frame construction has certainly given us a programme betterment."

A steel-braced composite solution using structural steelwork supporting metal decking was the final design decision.

Consequently 1,080t of structural steelwork, fabricated, supplied and erected by Adstone Construction was used, along with 14,347m² of metal decking supplied and installed by Structural Metal Decks (SMD).

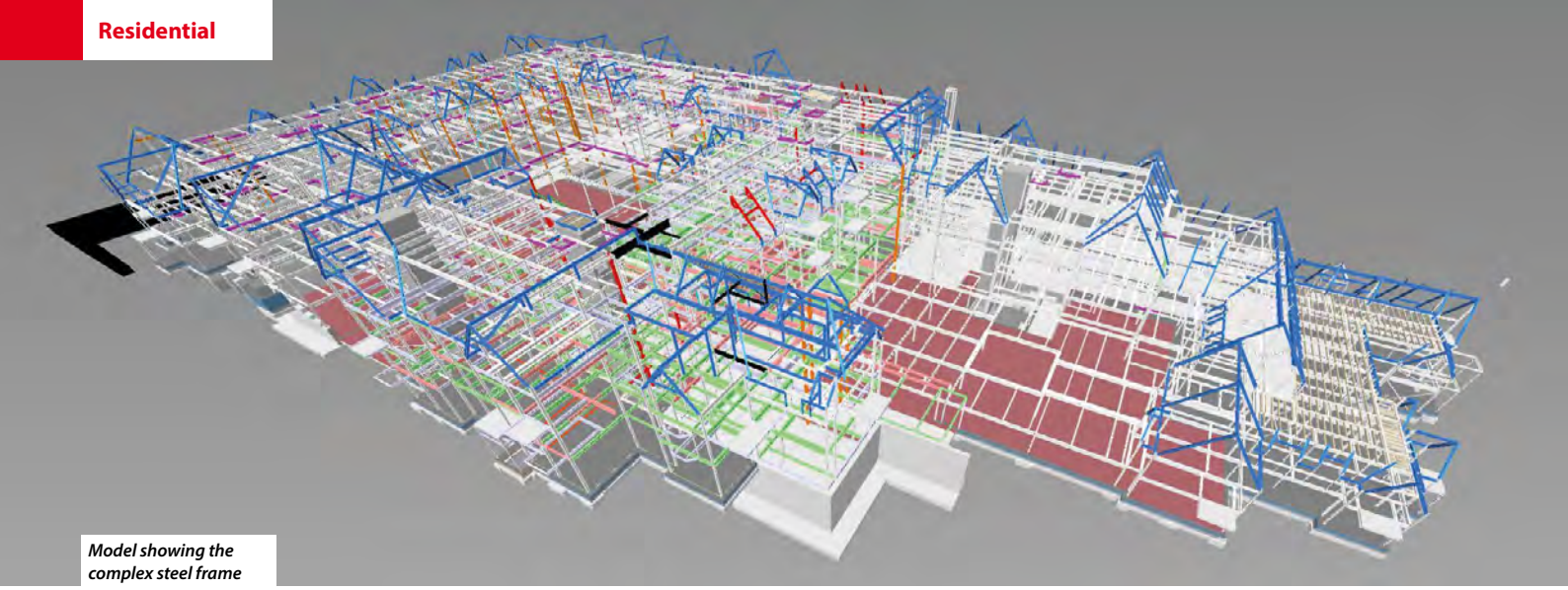
As well as a sloping site and the subsequent floor level changes, most of the building's floors have different uses, which adds to the complicated design, as room sizes and column locations change for each floor.

"The design has to incorporate numerous transfer beams to accommodate column line changes and this is much easier to do with a steel frame," says Rodgers Leask Project Engineer Craig Wynne.

Steelwork was chosen for its speed of construction

Room sizes and uses change for each floor

The project incorporates an 8m slope from one end of the site to the other



Model showing the complex steel frame

With different room sizes and facilities on most floors the retirement village also requires numerous services, such as heating and power, which have had to be integrated within the structural floor zone.

BAM Design says its expertise in 3D co-ordinated design, and working with steelwork contractor Adstone Construction as well as the structural engineer and M&E subcontractor in a collaborative manner, was fundamental to the integration of over 400 services holes through the steel frame.

"We have fabricated and installed a series of universal beams, each with individual holes formed within them to accommodate the services," says Adstone Construction Contracts Director Gary Howson. "It was important to have the services within the beam's depth as this kept the building height down."

The beams spanning the corridors have to accommodate the most services. In order to create enough space, the design team had to change the support level for the metal decking in some locations.

With a total steel tonnage of just over 1,000t, the project has required an unusually large number of individual steel members.

With little repetition, as very few columns reach the full height of the building, the frame also has to incorporate step changes to the layout. Adstone estimates that the project has required 50% more steel members than would ordinarily be needed for a scheme of this size.

During the steel erection programme Adstone delivered 47 loads of steel, with some loads consisting of up to 270 individual members.

"There are a lot of small pieces due to the complex nature of the structure and the requirements of the frame with every connection being bolted. We've calculated there are approximately 53,000 bolts on this complex job," adds Mr Howson.

Because most of the steel frame consists of small light pieces, Adstone was able to use a 40t-capacity mobile crane for the steel erection. The only exception being some large 10t beams spanning the pool, which required a large crane to be brought to site.

The large piece-count of steel also made the erection process quite complicated.

"We couldn't just erect the building sequentially from one end to the other, as the column lines change so frequently and many parts of the building are reliant on adjacent areas for their stability," says BAM Construction Senior Site Manager Alan Whyte. "Consequently, the erection sequence had to jump around a bit, which made it more challenging when organising where the follow-on trades could begin their work."

Completion of the retirement village is scheduled for September 2018.

Service integration

David Brown of the SCI discusses this key requirement in many steel structures.

One of the significant features of the Richmond Wood Norton project is the relatively high level of services needed, which were integrated within the steelwork. Notably, the project utilised information from different disciplines in a three dimensional fully coordinated model, which allowed the necessary service openings to be located. The service openings range from relatively modest circular holes within the depth of the beam to larger rectangular openings with additional plate reinforcement above and below the opening.

A number of beam options are available to incorporate services. Cellular beams with regular openings are often used in highly serviced commercial buildings, especially if the requirements for services are uncertain at the design stage. Alternatives such as notched beams, and tapered beams fabricated from plate may be considered if the services are located close to the column lines. The modelling successfully used in the Richmond Wood Norton project allowed the precise locations and required opening sizes to be identified, and individual openings formed in the fabrication workshop.

General guidance on structure services integration is provided in reference 1, which has helpful information for the structural engineer and the services engineer on both disciplines. For the structural engineer, general guidance is provided about openings in webs which will enable an early assessment of the design issues. Recommendations covering the sizes of unstiffened and stiffened web openings are given in references 1 and 2. Unstiffened openings should not generally be deeper than 0.6h (where h is the beam depth), nor longer than 1.5h. The shear resistance and instability of the web should be checked, and guidance is provided about the location of openings, avoiding point loads and supports. Design guidance for large web openings in composite beams is provided in reference 3. Steel designers may find the information in reference 1 covering typical service sizes (and thus opening sizes) and service layouts helpful at the concept design stage.

Fire protection demands special attention, particularly if the fire partitions must be aligned with the steel members with web openings. It may be appropriate to offset fire and smoke damping arrangements from any fire partition, rather than develop a detail incorporated in the steel beam.

The Richmond Wood Norton project demonstrates that with the adoption of a coordinated building model, service integration can be readily achieved.

References (all available on Steelbiz)

1 Services Co-ordination with Structural Beams (IEP2)
2 Web openings in composite beams (SN37)
3 Design of composite beams with large web openings (P355)

The steel crown tops one of south London's tallest towers

Crowning glory

A trial erection helped overcome a number of logistical challenges involved in the construction of a structural steelwork crown that tops a London high-rise residential tower. Martin Cooper reports.

FACT FILE
Highpoint crown steelwork, London
Main client: Newington Butts Developments
Design architect: Rogers Stirk Harbour + Partners
Delivery architect: Axis
Main contractor: Mace
Structural engineer: AKT II
Steelwork contractor: Bourne Steel
Steel tonnage: 55.5t

Perched atop a 47-storey high-rise residential tower in south London, a steel structure with a difference has been completed following a complex and demanding design, trial assembly and erection programme.

Known as Highpoint, the tower, which is located on Newington Butts overlooking the Elephant & Castle roundabout, will at 150m high be one of the capital's tallest residential buildings.

Being delivered by main contractor Mace, it will accommodate a total of 457 apartments, split between 279 private rental sector flats as well as 115 affordable units and 64 shared ownership flats located on the lower floors.

Giving the project a regal aspect, the uppermost level accommodates a four-pronged steel crown, which has been designed as an integrated architectural and structural system supporting the building's balconies via a series of vertical Macalloy bars.

Vibration could have been an issue for the steel balconies, as they cantilever by up to 4m. However, the crown will provide the necessary dampening effects to reduce the dynamic response of the balconies as the crown will remain stable even under extreme weather conditions.

All of the balconies, which are positioned in each of the building's four corners, are connected to each other via Macalloy bars, and tethered to the crown to create a unified structural system.

Structural engineer AKT II designed a series of bespoke connections for each balcony that limit movement under thermal load cases, but provide restraint under dynamic conditions.

The crown itself is positioned at a height of 154m, and this threw up a number of challenges, one of which was working safety at such a height. All pieces of equipment and tools had to be tethered at all times, as dropping anything from the tower would have been highly dangerous.

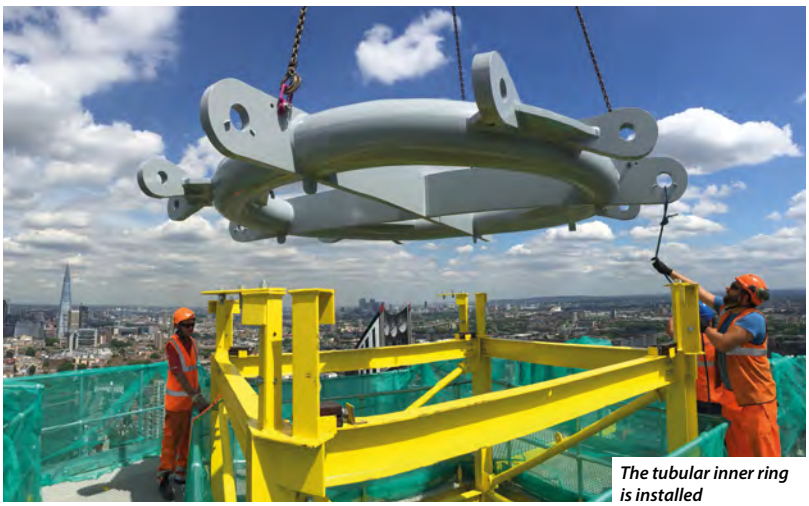
The crown only has 24 main structural steel components, not a large total by any stretch of the imagination. However, it was essential that once each component was lifted up onto the roof, they all fitted perfectly.

"The buildability of the crown was important, especially at such a height. We decided the best way to ensure the erection sequence went to plan was to undertake a trial erection before bringing all of the components to site," says Mace Associate Director Bart Lemmens.

"Mace did a similar trial erection procedure with the top sections of the Shard, known as the Spire, so we've used our company's experience on this project."

Bourne Steel's trial erection, undertaken at its fabrication yard, was done in such a way as to replicate the actual erection even though it was performed at ground level. This went as far as marking out a space around the crown, identical in size to the top of the tower, in which all the work was done.

"We ironed out a number of issues, not just ensuring that all the components fitted and checking tolerances, we also worked out the best position for our MEWPs, bearing in



The tubular inner ring is installed

mind that space was very tight on top of the tower," says Bourne Steel Project Manager Stephane Dubois.

"To ensure the actual erection sequence was also successful, and that all the pieces fitted together the components, such as the four arms that consist of two spliced sections, were kept as pairs even though they are all identical. This was maintained from fabrication, through the trial assembly and to the main erection sequence. This procedure guaranteed that all the pieces fitted perfectly a second time."

The trial erection also included assembling a bespoke temporary trestle, which was designed to cater for jacking members into position, as well as dealing with uplift of members while they were in a temporary condition.

The trestle also has access platforms to provide erectors with safe and convenient working areas during the installation programme.

Once the trial assembly was complete, the trestle was separated into two parts to allow it to be transported to site. Once at the project, the 3.5t trestle was re-assembled before being lifted into place by the on-site tower crane.

Steelwork erection initially involved Bourne Steel installing a steel-framed enclosure at level 46 floor level that provided access to the crown. The roof of this floor will be used as a maintenance platform once the project is complete, while level 46 will accommodate a communal space offering panoramic views over London.

The crown has been designed as a symmetrical structure consisting of four V-shaped arms in elevation. These four arms are supported, via a saddle connection, on four diagonal concrete walls placed at each corner of the core. The V-shaped arms are formed by tapering steel box sections.

The arms are connected to horizontal Macalloy bars which span between the long and short arms of the V, and vertical Macalloy bars which support the balconies below.

Connecting each of the four arms is a large tubular central inner ring fabricated from 25mm-thick plate. This was the first of the crown's components to be installed.

Once it was in place on top of the temporary trestle, each of the four 8m-long tapering inner arms were installed between the ring and the saddle. With each weighing 7.5t, these were the heaviest steel elements to be installed, but they were within the tower crane's 9t lifting capacity.

"As each and every individual steel component was installed, everything had to be continuously surveyed for uplift, sag and the correct geometry, with the trestle's jacks then adjusted accordingly," says Mr Lemmens.

Having installed the four inner arm sections, the saddle connection was then grouted onto the fin wall in its fixed and final position. This provided the portion of the crown already erected with stability, although the continual monitoring still had to be continued.

The tapered 11m-long outer arms were then fixed to the saddle via hidden bolted connections. The protruding ends of each outer arm were then connected back to the inner ring via a pair of 85mm diameter Macalloy bars.

"This size of bar is ordinarily seen on bridges but, because of the potential dynamic affects due to winds at high elevations, a large bar was needed to provide the required mass damping and stiffness to mitigate this," says AKT II Associate Director Tony Macey.

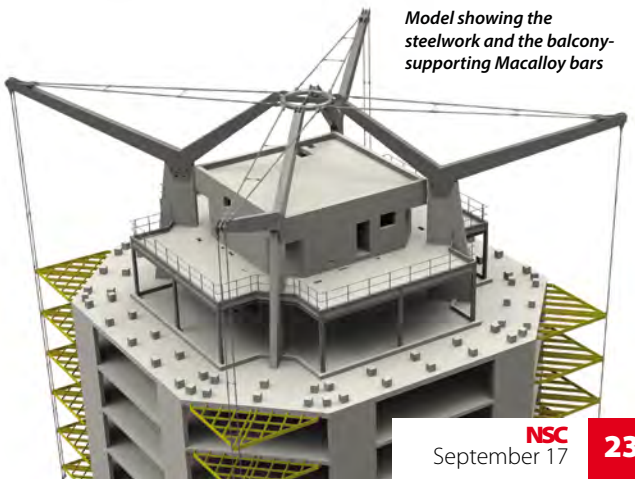
"Connecting and tensioning up all of the Macalloys was a tricky balancing act as each one introduced movement to the crown, which had to be carefully controlled," continues Mr Lemmens.

Having fully assembled the steel crown and made sure all of the bars were tensioned, the final task Bourne Steel had to perform was to dismantle the trestle. This was done piece by piece using the tower crane.

The Highpoint project is scheduled for completion in 2018.

Working at height was one of the main challenges which had to be overcome

A trial erection of the crown was undertaken



Model showing the steelwork and the balcony-supporting Macalloy bars

Leisure gets a boost

A replacement leisure centre in Newtownards showcases Ards and North Down Borough Council's commitment to improved health and wellbeing. Martin Cooper reports.

The construction market in Northern Ireland is currently buoyant as a wide variety of building projects are under way in the province.

According to figures from the Northern Ireland Statistics and Research Agency, the total volume of construction output in the fourth quarter of 2016 increased by 6.9%, which was 12.8% higher than the same period in 2015.

The outlook for this year and next is expected to remain at a similar level, which is good news for the construction industry in general.

One area which is seeing a lot of activity is the building of new leisure centres, as numerous existing facilities across the province come to the end of their useful lives.

An example of this is a new £30M leisure centre in Newtownards, County Down. Replacing an existing 1970s-built facility in the town, the new centre, which is due to complete at the end of 2018, is being built on land previously occupied by the Council-owned Dairy Hall Playing Fields and a small engineering works.

The new complex will offer a range of sports, recreation and family leisure facilities, including a six-lane 25m-long swimming pool, 20m-long teaching pool (both with moveable floors), water splash play and paddling pool, spa area, six-court sports hall, fitness suite, dance, cycle, spin studios, indoor soft play and café area.

It will also have an outdoor covered sports pitch, outdoor adventure play area, wheel park provision and a bike track.

The scheme has adopted a hybrid design, with structural steelwork being used for large parts of the leisure centre especially those areas with long spans, in conjunction with in-situ concrete and some glulam beams and columns.

"Leisure centres are usually complex structures as they have to accommodate numerous facilities under one roof," says WYG Director Stephen Alford. "This project is no different, and so we've had to use different materials to achieve the finish and build the client required."

The main steel element of the scheme is the sports hall which is formed with a series of 20m-long cellular beams. The cellular beams have been used for their efficiency and to allow ductwork and other services to be accommodated easily within

The main sports hall takes shape

Covered football pitches

Attached to the sports hall via a steel-framed link, a lightweight steel structure **(1)**, housing three synthetic pitches, suitable for a range of activities including five-a-side football, tennis, hockey, tag rugby and cricket, will ensure that play is unaffected by bad weather

The steel-framed structure is made from high-tensile steel, which is hot-dip galvanized to offer protection against corrosion. The steelwork forms a dome which is covered with a tensile membrane roofing.

(2) Sports halls

(3) Swimming pools and fitness suite

the steelwork's depth.

A series of 10m-high columns, founded on piled foundations, support the cellular roof rafters.

Attached to the sports hall, which measures 20m × 30m, is a slightly smaller flexible space unit formed with 15m-long cellular roof rafters.

The two spaces form one half of the much larger leisure centre main building. They are attached to the aquatics zone which has an in-situ concrete substructure.

"Because the ground conditions are quite poor, we decided that the best solution was to avoid excavation, so we've built the concrete substructure at ground floor level, with the swimming pools then accessed from the first floor," explains Heron Bros Contracts Manager Stephen Nevin.

Spanning the main pool are a series of long span glulam beams, supported at one end on glulam columns, positioned along the aquatics zone's perimeter, and steel columns on the other end.

The steel columns then form the internal wall of a two-storey structure that runs along one elevation adjacent to the pool hall. This structure accommodates changing rooms and terrace seating on the lower level, and a fitness suite on the upper floor.

"Steelwork works best for this two-storey part, as the columns are behind blockwork walls they won't be exposed to the corrosive pool environment. Meanwhile, the fitness suite is an open plan column-free space, something which is best achieved using steel," says Mr Alford.

Within the pool hall, elements of galvanized structural steelwork have been used. Steel bracings span between the glulam columns, providing structural stability, while lightweight galvanized secondary steelwork has been installed to form window openings.

Collaboration and coordination between the various trades is essential on this project as Walter Watson's Project Manager Trevor Irvine explains: "Temporary propping was initially installed along with the glulam columns. Once the roof was completed we then removed the props and installed the steel bracings having previously designed steel to timber connections between ourselves and the glulam installer."

Summing up, Stephen Reid, Ards and North Down Borough Council Chief Executive, says: "This is an exciting and much anticipated development for the Borough. The new leisure centre represents a very significant investment in high-quality sport and leisure facilities for people of all ages and will contribute much to our overall objective of promoting the health and wellbeing of residents.

"The features that will be included have been shaped by consultation with user groups and will complement the facilities available at Bangor Aurora Aquatic and Leisure Complex, Londonderry Park and across the wider Borough."

FACT FILE

Newtownards Leisure Centre, County Down

Main client: Ards and North Down Borough Council

Architect: McAdam Design

Main contractor: Heron Bros

Structural engineer: WYG

Steelwork contractor: Walter Watson

Steel tonnage: 650t

The main entrance will be located adjacent to the aquatics zone

Brittle fracture: selection of sub-grade for 'quasi-static' structures

Selection of steel sub-grade is an important responsibility for all steel designers, to manage the risk of brittle fracture. David Brown of the SCI discusses a new publication (P419[1]) which presents steel thickness limits which may be used in buildings where fatigue is not a design consideration.

The Eurocode basis

Designers familiar with BS EN 1993-1-10 or PD 6695-1-10 will know that the selection of a steel sub-grade depends on the stress level, the type of detail, the service temperature and the material thickness. BS EN 1993-1-10 presents (in Table 2.1) limiting thicknesses for steel sub-grades, depending on the so-called reference temperature. The reference temperature is the service temperature, but then subject to various adjustments.

In the UK, significant modifications are made to the 'core' Eurocode, via the National Annex. The effect of the UK NA is accounted for in the thickness limits presented in PD 6695-1-10, which contains look-up tables for steel in buildings (internal and external) and bridges. Worked examples showing how to select a steel sub-grade using the Eurocode, PD and UK NA were presented in NSC, October 2016[2].

A JRC publication[3] provides comprehensive background on how the thickness limits in BS EN 1993-1-10 were derived. The background document is not easy to digest, but after the various formulae have been committed to a spreadsheet, it is possible to replicate the values found in Table 2.1 of the Standard. For anyone rising to that challenge, there is some (variable) degree of rounding in the printed table.

The effect of fatigue

The Eurocode states in the Note to clause 2.1(2):

"For elements not subject to tension, welding or fatigue, the rules can be conservative. In such cases evaluation using fracture mechanics may be appropriate, see 2.4 (of the Standard). Fracture toughness need not be specified for elements only in compression."

The JRC background document is clear in paragraph 1.4.3(2) that Section 2 of the Eurocode was developed for structures subject to fatigue (such) as bridges, crane runways or masts subject to vortex induced vibrations. The background document goes on to say:

"its use for buildings where fatigue plays a minor role would be extremely safe-sided"

The effect of fatigue is to cause an initial crack to grow to a much larger design crack. The assessment of sub-grade is then carried out on the basis of the design crack.
The initial crack size is related to the thickness of the element, as shown in Figure 1.

The size of the initial crack assumed in the Eurocode is one that might be missed during inspection after fabrication. The JRC background document demonstrates that the minimum crack width detectable by inspection methods after fabrication is smaller than the assumed crack width, implying that the assumed crack sizes should be detected. It is assumed that the steelwork is fabricated, welded and inspected in accordance with the requirements of BS EN 1090-2.

The effect of fatigue is to grow the initial crack to a much larger defect, as shown in Figure 2 (over page). The curve is a representation of the expression given in the JRC background document.

The design crack depth a_d is expressed as:

$a_d = 2 \times 10^{-6}\, t^3 + 6 \times 10^{-4}\, t^2 + 0.1341t + 0.6349$

where:

t is the plate thickness.

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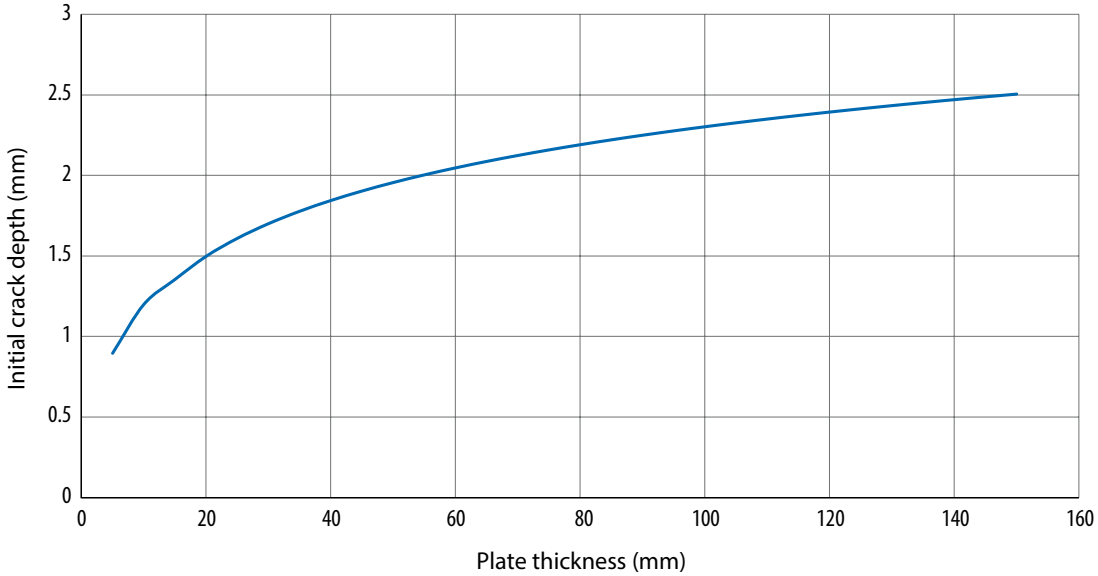

Figure 1: Initial crack size

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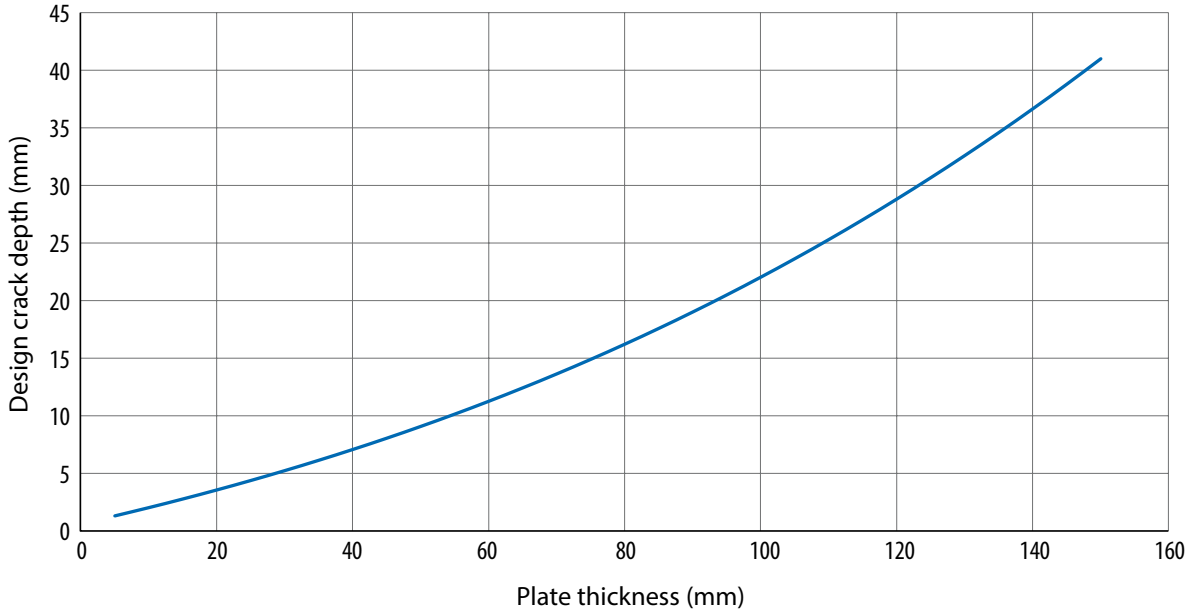

Figure 2: Design crack size

It is interesting (and possibly sobering) to note that the Standard is based on 0.5 million cycles, equivalent to a 25 year life. Usually, 2 million cycles are assumed for a 100 year life. The Eurocode approach therefore anticipates inspection of a fatigue-sensitive structure at 25 year intervals, and repair if necessary to reinstate the original conditions. Such inspection would be normal in bridges.

The new publication

The new guide reduces the growth due to fatigue. The word "reduces" has been used, since to assume no growth at all would be to eliminate the effect of fatigue altogether. After consultation, it was decided that some fatigue should be allowed for even though for the structures within the intended scope, fatigue would not be a design consideration. Based on indicative guidance from a DIN Standard, 20,000 cycles was chosen to allow for some fatigue in structures where fatigue is not a design consideration – most buildings. The term "quasi-static" would cover such structures – in reality that there may be some limited cycling of load, but that would not normally be considered – the design approach is to consider all loads as static.

The key to the new approach is the formula to express the crack growth under 20,000 cycles. Experts at the University of Aachen (who were also deeply involved with the development of the Eurocode) provided this all-important expression.

For structures where fatigue is not a design consideration, the new expression for crack growth is given by:

$$a_d = 3.6258 \times 10^{-11}\, t^5 - 2.2316 \times 10^{-8}\, t^4 + 5.3365 \times 10^{-6}\, t^3 + 6.3837 \times 10^{-4}\, t^2 + 0.045124\, t + 0.82483$$

The resulting design crack depth is only a little larger than the initial crack depth, as can be seen in Figure 3. The ratio (design crack depth)/(initial crack depth) is plotted on the right hand axis.

Based on the revised design crack size, limiting thicknesses are determined and presented in the new publication, including an equivalent Table 2.1 from the Eurocode, and equivalent look-up tables from PD 6695-1-10 for use in the UK.

Additional modifications

The title of this section is deliberately misleading. Apart from the revised crack growth, there are no other modifications to the process described in the background document. All the assumptions made in developing Table 2.1 of the Eurocode are followed, without exception.

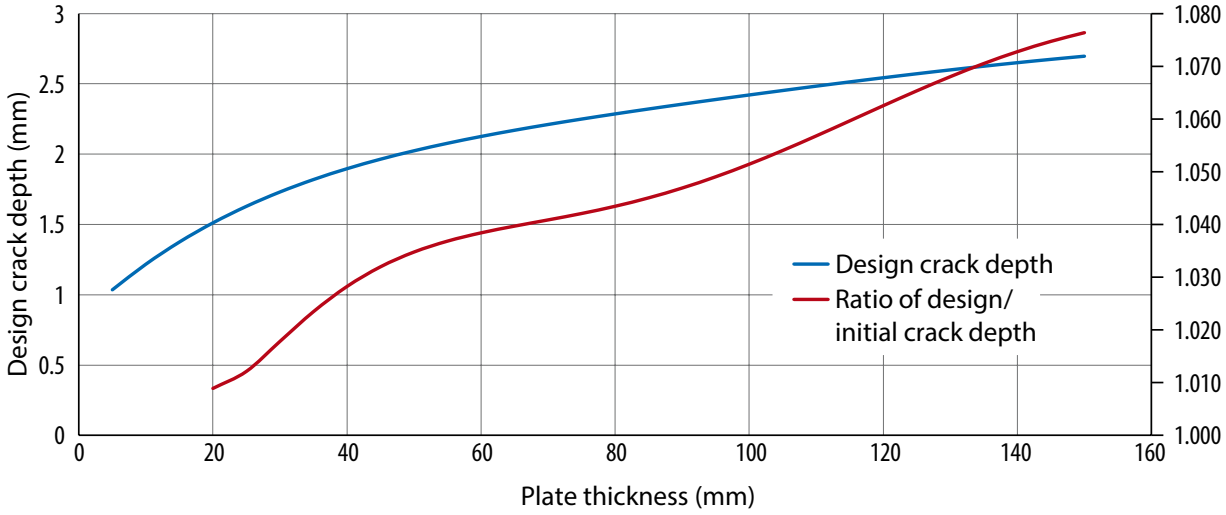

Figure 3: Initial and design crack depths (20,000 cycles)

The provisions of the UK NA have also been followed, without exception. These include:

- The adjustment for detail type, described in NA.2.1.1.2;
- The adjustment for the Charpy test temperature, described in NA.2.1.1.4;
- The adjustment for the applied stress, described in NA.2.1.1.5, which means that the limiting thickness values are based on an applied stress of 75% of the yield strength;
- The adjustment for the steel strength grade, as described in NA.2.1.1.6.

These provisions of the UK NA are listed simply to emphasise that they have been properly observed in developing the tables presented in the new publication. The publication does not allow for impact or cold forming; in these cases the limiting thicknesses can be calculated from the tabulated data provided.

Revised thickness limits

The effect of much reduced crack growth is very significant. The limiting thicknesses are much larger than those in PD 6695-1-10, which allowed for crack growth under 0.5 million cycles. Table 1 presents a comparison for external S355 J0 material, covering combinations 4 to 10 (the welded detail types).

Scope of the new publication

Firstly, if the structure under consideration is subject to fatigue, the tables in the new publication should not be used; The Eurocode, NA and PD 6695-1-10 must be followed in the UK. For structures where fatigue is not a design consideration, the new publication presents less onerous thickness limits. For structures outside the UK and not subject to fatigue, the new publication provides an equivalent to Table 2.1 of the Eurocode which may be used as a basis for steel sub-grade selection.

References

1 *Brittle fracture: selection of steel subgrade to BS EN 1993-1-10* Brown, D. and Cosgrove, T. SCI, 2017

2 *The selection of steel-subgrade* Henderson, J. R., NSC, October 2016

3 *Commentary and worked examples to EN 1993-1-10 "Material toughness and through thickness properties" and other toughness oriented rules in EN 1993* Sedlacek, G. et al, JRC, 2008

Detail type	Tensile stress level $\sigma_{Ed}/f_y(t)$						
Welded - moderate	≤ 0	0.15	0.3	≥ 0.5			
Welded - severe			≤ 0	0.15	0.3	≥ 0.5	
Welded - very severe				≤ 0	0.15	0.3	≥ 0.5
	Maximum thickness (mm)						
	Comb.4	Comb.5	Comb.6	Comb.7	Comb.8	Comb.9	Comb.10
PD6695-1-10	67.5	55	45	37.5	30	22.5	17.5
P419	200	200	200	188.5	145.5	95.5	65.5

Table 1: Limiting thicknesses for external S355 J0 steel

AD 410:
Pouring concrete to a constant thickness or to a constant plane

Composite flooring systems comprising concrete and profiled steel decking supported by a grillage of primary and secondary steel members are a popular form of floor construction. The in-situ concrete acts compositely with the steel decking which acts as permanent formwork for the concrete and as external reinforcement to the composite slab. This AD Note is an update to guidance given in AD 344 'Levelling techniques for composite floors' and reflects the most recent practice in pouring concrete to a constant level or thickness. However, the guidance in AD 344 is still valid.

For composite flooring systems the concrete can be poured to a constant thickness or to a constant plane. The type of floor construction is one of the issues that must be determined at the design stage and it is important that this is communicated to the concrete contractor. This AD Note describes the two methods that may be used to pour the concrete (constant plane or constant thickness), the expected surface finish (flatness and levelness) that may be achieved, the construction loads that should be taken in to account during design and the means of communicating the method of concreting to the concreting contractor.

1.0 Design considerations

An important design issue is to decide if the concrete is poured to a constant thickness or to a constant plane as the method of construction will affect the deflections of the steel decking and the steel frame and the amount of concrete placed. The two methods for concreting are:

- Pouring to a constant thickness and,
- Pouring to a constant plane

1.1 Constant thickness

Concreting a floor to a constant thickness can be achieved by using permanent proprietary formed tied construction joints, levelling pins (which are supported by either the steel decking and beams or the steel decking alone) or a depth gauge. The term 'Structural floor level' refers to the case where the screed rails etc. are supported by the steel decking and beams and the term 'Constant depth' refers to the case where the depth gauge or dip method is used. Both of these approaches are described below.

a. Structural floor level. In this approach the reference points defining structural floor level are supported by the steel decking and beams at the design slab depth from the decking profile. The reference points are usually placed as close as possible to the beam centre-lines to avoid excessive displacement during concreting. However, they will drop as the decking and beams deflect as concreting proceeds. The slab thickness will remain as defined by the reference point and deck levels but the finished profile will not be the same as the original position of the reference points. This method should give reasonable control over both the concrete thickness and flatness (but not levelness). This method will result in additional concrete (ponding) at mid-span decking regions as a result of deck deflection between the reference points.

b. A constant depth using a depth gauge. In this approach the reference point is a rod with the constant depth set off the steel decking so that the top profile will be parallel to the decking profile. Good control of thickness should be achieved but the finished surface profile will depend on the initial profile and subsequent deflection of the steel deck and supporting beams. This is typically the **recommended method** and should always be used where the beams are pre-cambered.

1.2 Constant plane

In this method the finished concrete level is determined using a staff and level, often a laser level. As levelling is to a constant reference plane, any deflection of the steel decking and supporting beams as the concreting proceeds can give rise to a considerable increase in the slab thickness and the volume of concrete placed. Additionally, previously levelled areas may drop as the supporting beams continue to deflect as adjacent areas are concreted. The fresh areas of concrete will continue to be levelled to the reference plane therefore small localised variations in level and flatness can occur across the slab pour. It is difficult with this method to achieve good control of level to datum, flatness and thickness. Using this method the slab thickness can be considerably thicker than designed due to the compound deflection of primary beam, secondary beams and steel decking. This depends on the centres and stiffness of the supporting beams.

1.3 Tighter tolerances on level

If tighter tolerances on floor level are required consideration should be given to providing a stiffer grillage of supporting primary and secondary floor beams. This will result in a combination of larger steel sections, short deck spans, more frequent beams and/or columns and possible a heavier gauge steel decking profile. Where strict control of floor level is required it is suggested that the deflection of the steel under construction loads is limited to 10mm. This approach is often considered uneconomic.

Alternatively propped construction may be used to reduce deflections during construction. However, use of propping should be considered at the design stage and not used as an afterthought on site. When a composite slab is propped during construction there is a higher demand on the shear connection between the decking and the concrete than in an unpropped slab, as a propped slab has to support the self-weight of the concrete through composite action. Consequently, a propped slab will have a higher degree of creep deflection under imposed loads than an unpropped slab, as well as the additional deflection of the decking under the self-weight of the concrete. A higher percentage of reinforcement must be specified for propped slabs to limit cracking over the supporting beams, and this clearly needs to be specified at the design stage.

Consideration should be given to deflections after the props are removed.

2.0 Construction loads

Clause 9.3.2(1) of BS EN 1994-1-1 gives recommendations for the actions to be considered during construction when the profiled sheeting is acting as permanent formwork. The following loads should be taken into account:

- Weight of concrete and steel deck,
- Construction loads including local heaping of concrete during construction, in accordance with clause 4.11.1 of BS EN 1991-1-6,
- Storage load, if any,
- 'ponding' effect (increased depth of concrete due to deflection of the sheeting)

Clause 3.2.2 of Technical Report 75 'Composite Concrete Slabs on Steel Decking' by the Concrete Society[4] gives further information on the loads to be considered during concreting.

With regard to 'ponding' clause 9.3.2(2) of BS EN 1994-1-1 gives the following recommends:

'If the central deflection ,δ, of the sheeting under its own weight plus that of the wet concrete, calculated for serviceability, is less than 1/10 of the slab depth, the ponding effect may be ignored in the design of the steel sheeting. If this limit is exceeded, this effect should be allowed for. It may be assumed in design that the nominal thickness of the concrete is increased over the whole span by 0.7δ.'

Pre-cambering of beams is sometimes used to decrease the deflections from construction loads. Where pre-cambering is used, Clause 5.4 of Technical Report 75[4] recommends that the composite floor slab is poured to a constant thickness. Unless the constant thickness method is used there is a risk that there will be insufficient cover to the mid-span of the beams should the camber not fully 'drop out'. Traditionally, engineers have specified a pre-camber of only ⅔ to ¾ of the calculated simply supported deflection of the beam, or up to half the concrete cover to the decking (whichever is less). Doing this will greatly reduce the risk of a thin slab when the other methods of concreting are used.

3.0 Flatness and level tolerances

The main consideration with regards to the specification of tolerances is the building's use; buildings where the finished slab is to provide

a wearing surface may require tight level and flatness tolerances, whereas buildings where subsequent finishes are applied such as office structures may not. The requirements in the specification need to be achievable: it is not possible to construct a composite slab to very tight level tolerance because of the deflections of the beams. However, tight tolerances are not necessary for most applications, and deviations can be taken up with screeds, levelling compounds or a raised floor. Where isolated areas in a building have more onerous flatness requirements, they can be achieved by using levelling compounds or screeds locally. Extensive grinding should not be used to modify flatness, as it can significantly reduce the slab thickness.

For the rare occasions where levelling compounds and screeds cannot be used, and tight level and flatness tolerances are required, the supporting beams will need to be designed to limit deflections to values which correlate with the required top surface tolerances. This could have significant implications for the cost of the beams.

The following general tolerances for levels are given in references 1, 2 and 3, relative to the level of the datum (normally structural floor level):

- ±15mm on top surface of concrete measured at a column
- ±10mm on top surface of supporting steel beams at a column position

The slab thickness tolerances at a column position will be about ±20mm using the above values. Further information on level and flatness tolerances can be found in reference 4.

4.0 Information required for the casting of the concrete

Where projects are working to the Construction (Design and Management) Regulations 2015 it is the responsibility of the Principal Designer to make sure the right information is given to those that need it prior to concrete pouring work commencing. If the Construction (Design and Management) Regulations 2015 do not apply to the project then the Main Contractor will need to ensure those contracted to carry out the concrete pouring are provided with this information.

To avoid overloading the decking and supporting steelwork during the construction phase it is recommended that the method of concreting (constant level or constant thickness) is communicated to the concreting contractor on the scheme designer's construction drawings. Whilst acceptable flatness (surface regularity over short distance) can be achieved, a level slab (level to a defined datum over large distances) can only be achieved where this has been considered early in the design of the steel frame with beam spacings, deck spans and deflections considered accordingly. Extensive guidance on this subject can be found in reference 4

5.0 References

1. British Standards Institute, BS EN 13670. Execution of concrete structures, BSI, London 2011.
2. British Standards Institute, BS 8204-2. Screeds, bases and in situ floorings. Part 2: Concrete wearing surfaces. Code of practice, BSI, London, 2003.
3. The Concrete Society. Concrete industrial ground floors. A guide to design and construction, Technical Report 34, 4th edition, 2013 (revised March 2016).
4. The Concrete Society. Composite concrete slabs on steel decking. Guidance on construction and associated design considerations, Technical Report 75, 2016

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Email: **david.moore@steelconstruction.org**

New and revised codes & standards

From BSI Updates July and August 2017

BS EN PUBLICATIONS

BS EN ISO 636:2017
Welding consumables. Rods, wires and deposits for tungsten inert gas welding of non-alloy and fine-grain steels. Classification
Supersedes BS EN ISO 636:2015

BS EN ISO 14343:2017
Welding consumables. Wire electrodes, strip electrodes, wires and rods for arc welding of stainless and heat resisting steels. Classification
Supersedes BS EN ISO 14343:2009

BS EN ISO 14713-1:2017
Zinc coatings. Guidelines and recommendations for the protection against corrosion of iron and steel in structures. General principles of design and corrosion resistance.
Supersedes BS EN ISO 14713-1:2009

BS EN ISO 14713-3:2017
Zinc coatings. Guidelines and recommendations for the protection against corrosion of iron and steel in structures. Sherardizing
Supersedes BS EN ISO 14713-3:2009

BE EN ISO 18276:2017
Welding consumables. Tubular cored electrodes for gas-shielded and non-gas-shielded metal arc welding of high strength steels. Classification
Supersedes BS EN ISO 18276:2006

UPDATED BRITISH STANDARDS

BS 8414-2:2015+A1:2017
Fire performance of external cladding systems. Test method for non-loadbearing external cladding systems fixed to and supported by a structural steel frame
AMENDMENT 1

BRITISH STANDARDS WITHDRAWN

BS EN ISO 636:2015
Welding consumables. Rods, wires and deposits for tungsten inert gas welding of non-alloy and fine-grain steels. Classification
Superseded by BS EN ISO 636:2017

BS EN ISO 14343:2009
Welding consumables. Wire electrodes, strip electrodes, wires and rods for arc welding of stainless and heat resisting steels. Classification
Superseded by BS EN ISO 14343:2017

BS EN ISO 14713-1:2009
Zinc coatings. Guidelines and recommendations for the protection against corrosion of iron and steel in structures. General principles of design and corrosion resistance
Superseded by BS EN ISO 14713:2017

BS EN ISO 14713-3:2009
Zinc coatings. Guidelines and recommendations for the protection against corrosion of iron and steel in structures. Sherardizing
Superseded by BS EN ISO 14713-3:2017

BS EN ISO 18276:2006
Welding consumables. Tubular cored electrodes for gas-shielded and non-gas-shielded metal arc welding of high-strength steels. Classification
Superseded by BS EN ISO 18276:2017

NEW WORK STARTED

EN 10058
Hot rolled flat steel bars and steel wide flats for general purposes. Dimensions and tolerances on shape and dimensions
Will supersede BS EN ISO 10058:2003

ISO 834-13
Fire resistance tests. Elements of building construction. Measurement of the thermal response and assessment of applied fire protection to steel beams with web openings

ISO 8504-3
Preparation of steel substrates before application of paints and related products. Surface preparation methods. Hand- and power-tool cleaning
Will supersede BS EN ISO 8504-3:2001

NA+A1:2015 to BS EN 1991-1-3:2003/A2
UK National Annex to Eurocode 1. Actions on structures. General actions. Snow loads

CEN EUROPEAN STANDARDS

EN 1993-4-2:-
Eurocode 3. Design of steel structures. Tanks
AMENDMENT 1: June 2017 to EN 1993-4-2:2007

ISO PUBLICATIONS

ISO 377:2017
Steel and steel products. Location and preparation of samples and test pieces for mechanical testing
Will be implemented as an identical British Standard

ISO 636:2017
Welding consumables. Rods, wires and deposits for tungsten inert gas welding of non-alloy and fine-grain steels. Classification
Will be implemented as an identical British Standard

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- **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, ● = Member)

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

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

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 & J Stead Ltd	01653 693742			●	●					●	●			●	●		2			Up to £400,000
A C Bacon Engineering Ltd	01953 850611			●	●	●	●				●			●			2			Up to £3,000,000
A&J Fabtech Ltd	01924 439614	●					●		●	●	●		●	●		✔	3			Up to £400,000
Access Design & Engineering	01642 245151					●				●	●			●	●	✔	2			Up to £4,000,000
Adey Steel Ltd	01509 556677	●		●	●	●	●	●	●	●	●			●	●	✔	3	✔	●	Up to £2,000,000
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
Apex Steel Structures Ltd	01268 660828					●	●			●	●			●	●		2			Up to £2,000,000
Arc Fabrication Services Ltd	01709 557654			●	●	●	●	●	●	●	●			●	●	✔	3			Up to £200,000
Arminhall Engineering Ltd	01799 524510	●			●	●		●		●	●			●	●	✔	2			Up to £400,000
Arromax Structures Ltd	01623 747466	●		●	●	●	●	●	●	●	●	●		●	●		2			Up to £800,000
ASA Steel Structures Ltd	01782 566366			●	●	●	●			●	●			●	●	✔	4			Up to £800,000
ASME Engineering Ltd	020 8966 7150				●	●				●	●			●	●	✔	4		●	Up to £2,000,000
Atlasco Constructional Engineers Ltd	01782 564711			●	●	●	●				●			●	●	✔	2			Up to £1,400,000
Austin-Divall Fabrications Ltd	01903 721950			●	●		●	●		●	●			●	●	✔	2			Up to £800,000
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 £2,000,000
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 Construction Engineering Ltd	01202 746666		●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	●	Above £6,000,000
Briton Fabricators Ltd	0115 963 2901	●		●	●	●	●	●	●	●	●			●	●	✔	4			Up to £6,000,000
Builders Beams Ltd	01227 863770			●	●	●	●			●	●			●	●	✔	3	✔		Up to £3,000,000
Cairnhill Structures Ltd	01236 449393	●			●	●	●	●	●	●				●	●	✔	4		●	Up to £3,000,000
Caunton Engineering Ltd	01773 531111	●	●	●	●	●	●	●		●	●	●		●	●	✔	4	✔	●	Above £6,000,000
Cementation Fabrications	0300 105 0135	●			●			●			●		●		●	✔	3		●	Up to £6,000,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	●	●	●		●		✔	4		●	Above £6,000,000
CMF Ltd	020 8844 0940				●		●	●		●	●				●	✔	4			Up to £6,000,000
Cook Fabrications Ltd	01303 893011				●					●	●			●	●		2			Up to £1,400,000
Coventry Construction Ltd	024 7646 4484			●	●	●	●		●	●	●			●	●	✔	4			Up to £800,000
D H Structures Ltd	01785 246269			●	●		●				●						2			Up to £100,000
D Hughes Welding & Fabrication Ltd	01248 421104				●	●	●	●		●	●		●	●	●	✔	4			Up to £800,000
Duggan Steel	00 353 29 70072		●	●	●	●	●	●	●		●	●			●	✔	4			Up to £6,000,000
ECS Engineering Services Ltd	01773 860001	●		●	●	●	●	●	●	●	●			●	●	✔	3			Up to £3,000,000
Elland Steel Structures Ltd	01422 380262		●	●	●	●	●	●	●	●	●	●		●		✔	4	✔	●	Up to £6,000,000
EvadX Ltd	01745 336413			●	●	●	●	●	●	●	●	●				✔	3		●	Up to £3,000,000
Four Bay Structures Ltd	01603 758141			●	●	●	●	●		●	●			●	●		2			Up to £1,400,000
Four-Tees Engineers Ltd	01489 885899	●											●	●	●	✔	3		●	Up to £2,000,000
Fox Bros Engineering Ltd	00 353 53 942 1677			●	●	●	●	●			●				●		2			Up to £2,000,000
Gorge Fabrications Ltd	0121 522 5770				●	●	●	●		●				●	●	✔	2			Up to £1,400,000
Gregg & Patterson (Engineers) Ltd	028 9061 8131			●	●	●	●	●				●		●		✔	3			Up to £3,000,000
Company name	**Tel**	**C**	**D**	**E**	**F**	**G**	**H**	**J**	**K**	**L**	**M**	**N**	**Q**	**R**	**S**	**QM**	**FPC**	**BIM**	**SCM**	**Guide Contract Value (1)**

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	BIM	SCM	Guide Contract Value (1)
H Young Structures Ltd	01953 601881			●	●	●	●	●		●	●			●	●	✔	2		●	Up to £2,000,000
Had Fab Ltd	01875 611711				●				●	●	●				●	✔	4			Up to £3,000,000
Hambleton Steel Ltd	01748 810598		●	●	●	●	●	●				●		●		✔	4		●	Up to £6,000,000
Harry Marsh (Engineers) Ltd	0191 510 9797			●	●	●	●			●	●				●	✔	2			Up to £1,400,000
Hescott Engineering Company Ltd	01324 556610			●	●	●	●			●				●	●	✔	2			Up to £3,000,000
Intersteels Ltd	01322 337766	●			●	●	●	●					●	●		✔	3			Up to £2,000,000
J & A Plant Ltd	01942 713511				●	●									●		4			Up to £40,000
James Killelea & Co Ltd	01706 229411		●	●	●	●	●				●	●		●			4			Up to £6,000,000*
John Reid & Sons (Strucsteel) Ltd	01202 483333		●	●	●	●	●	●	●	●	●	●		●	●	✔	4		●	Up to £6,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445			●	●	●	●	●	●	●	●	●		●	●	✔	4		●	Up to £6,000,000
Kloeckner Metals UK Westok	0113 205 5270												●			✔	4			Up to £6,000,000
Leach Structural Steelwork Ltd	01995 640133			●	●	●	●	●			●					✔	2		●	Up to £6,000,000
Legge Steel (Fabrications) Ltd	01592 205320			●	●		●		●	●	●			●	●		3			Up to £800,000
Luxtrade Ltd	01902 353182									●	●				●	✔	2			Up to £800,000
M Hasson & Sons Ltd	028 2957 1281			●	●	●	●	●	●	●	●				●	✔	4			Up to £2,000,000
M J Patch Structures Ltd	01275 333431				●					●	●			●	●	✔	2			Up to £1,400,000
M&S Engineering Ltd	01461 40111				●				●	●	●			●	●		3			Up to £1,400,000
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			●	●	●	●				●						2			Up to £3,000,000
Murphy International Ltd	00 353 45 431384	●			●		●	●	●		●				●	✔	4			Up to £1,400,000
Newbridge Engineering Ltd	01429 866722	●	●	●	●	●	●	●	●		●			●	●	✔	4		●	Up to £1,400,000
Nusteel Structures Ltd	01303 268112						●	●	●	●				●		✔	4		●	Up to £4,000,000
Overdale Construction Services Ltd	01656 729229			●	●		●	●			●				●		2			Up to £400,000
Painter Brothers Ltd	01432 374400								●		●			●	●	✔	3			Up to £6,000,000*
Pencro Structural Engineering Ltd	028 9335 2886			●	●	●	●	●	●		●			●	●	✔	2			Up to £2,000,000
Peter Marshall (Steel Stairs) Ltd	0113 307 6730									●					●	✔	2			Up to £800,000*
PMS Fabrications Ltd	01228 599090			●	●	●	●		●	●	●			●	●		2			Up to £1,400,000
Rippin Ltd	01383 518610			●	●	●	●	●						●	●		2			Up to £1,400,000
Robinson Structures Ltd	01332 574711			●	●	●	●				●			●	●	✔	2			Up to £3,000,000
S H Structures Ltd	01977 681931	●			●		●	●	●	●	●	●			●	✔	4	✔		Up to £2,000,000
SAH Engineering Ltd	01582 584220			●	●	●				●	●			●	●		2			Up to £800,000
SDM Fabrication Ltd	01354 660895	●	●	●	●	●	●				●			●	●	✔	4			Up to £2,000,000
Sean Brady Construction Engineering Ltd	00 353 49 436 4144			●	●	●	●			●	●			●	●		2			Up to £800,000
Severfield plc	01845 577896	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4		●	Above £6,000,000
SGC Steel Fabrication	01704 531286				●					●				●	●	✔	2			Up to £800,000
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 £1,400,000
South Durham Structures Ltd	01388 777350			●	●	●				●	●	●			●		2			Up to £1,400,000
Southern Fabrications (Sussex) Ltd	01243 649000				●	●				●	●			●	●	✔	2			Up to £800,000
Steel & Roofing Systems	00 353 56 444 1855			●	●	●	●					●		●	●	✔	4			Up to £3,000,000
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 £1,400,000
Tubecon	01226 345261						●	●	●	●				●	●	✔	4		●	Above £6,000,000*
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			Up to £6,000,000
Westbury Park Engineering Ltd	01373 825500	●		●	●		●	●	●	●	●				●	✔	4			Up to £800,000
William Haley Engineering Ltd	01278 760591			●	●	●			●	●	●			●		✔	4		●	Up to £4,000,000
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)

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
A Lamb Associates Ltd	01772 316278
Balfour Beatty Utility Solutions Ltd	01332 661491
Griffiths & Armour	0151 236 5656
Highways England Company Ltd	08457 504030
Kier Construction Ltd	01767 640111
PTS (TQM) Ltd	01785 250706
Sandberg LLP	020 7565 7000
Structural & Weld Testing Services Ltd	01795 420264
SUM Ltd	0113 242 7390

Steelwork contractors for bridgeworks

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

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

- **FG** Footbridge and 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
- **RF** Bridge refurbishment
- **AS** Ancilliary structures in steel associated with bridges, footbridges or sign gantries (eg grillages, purpose-made temporary works)
- **QM** Quality management certification to ISO 9001
- **FPC** Factory Production Control certification to BS EN 1090-1
  1 – Execution Class 1 2 – Execution Class 2
  3 – Execution Class 3 4 – Execution Class 4
- **BIM** BIM Level 2 compliant
- **SCM** Steel Construction Sustainability Charter
  (● = Gold, ● = Silver, ● = Member)

Notes

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

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

BCSA steelwork contractor member	Tel	FG	PG	TW	BA	CM	MB	RF	AS	QM	FPC	BIM	NHSS 19A	NHSS 20	SCM	Guide Contract Value (1)
A&J Fabtech Ltd	01924 439614	●	●	●	●				●	✓	3					Up to £400,000
Bourne Construction Engineering 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 £3,000,000
Cementation Fabrications	0300 105 0135	●	●						●	✓	3			✓	●	Up to £6,000,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	✓	4		✓	✓	●	Above £6,000,000
D Hughes Welding & Fabrication Ltd	01248 421104	●		●			●	●	●	✓	4			✓		Up to £800,000
Donyal Engineering Ltd	01207 270909	●						●	●	✓	3			✓	●	Up to £1,400,000
ECS Engineering Ltd	01773 860001	●	●	●	●		●		●	✓	3					Up to £3,000,000
Four-Tees Engineers Ltd	01489 885899	●	●	●	●		●	●	●	✓	3			✓	●	Up to £2,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445	●		●				●	●	✓	4			✓	●	Up to £6,000,000
Millar Callaghan Engineering Services Ltd	01294 217711	●				●		●	●	✓	4			✓		Up to £1,400,000
Murphy International Ltd	00 353 45 431384	●	●	●	●				●	✓	4			✓		Up to £1,400,000
Nusteel Structures Ltd	01303 268112	●	●	●	●	●		●	●	✓	4		✓	✓	●	Up to £4,000,000
S H Structures Ltd	01977 681931	●	●	●	●	●	●		●	✓	4	✓		✓	●	Up to £2,000,000
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
Non-BCSA member																
Allerton Steel Ltd	01609 774471	●	●	●	●	●		●	●	✓	4			✓		Up to £4,000,000
Centregreat Engineering Ltd	029 2046 5683	●	●	●	●	●	●	●	●	✓	4					Up to £1,400,000
Cimolai SpA	01223 836299	●	●	●	●	●	●	●	●	✓	4					Above £6,000,000
CTS Bridges Ltd	01484 606416	●	●	●	●	●	●		●	✓	4			✓	●	Up to £800,000
Francis & Lewis International Ltd	01452 722200							●	●	✓	4			✓	●	Up to £2,000,000
Harland & Wolff Heavy Industries Ltd	028 9045 8456	●	●	●	●	●		●	●	✓	3					Up to £2,000,000
Hollandia Infra BV	00 31 180 540 540	●	●	●	●	●	●	●	●	✓	4					Above £6,000,000*
HS Carlsteel Engineering Ltd	020 8312 1879	●	●					●	●	✓	3			✓		Up to £40,000
IHC Engineering (UK) Ltd	01773 861734	●							●	✓	3			✓		Up to £400,000
Interserve Construction Ltd	020 8311 5500							●	●	✓	N/A					Above £6,000,000*
Lanarkshire Welding Company Ltd	01698 264271	●	●	●	●	●	●	●	●	✓	4		✓	✓	●	Up to £2,000,000
P C Richardson & Co (Middlesbrough) Ltd	01642 714791	●						●	●	✓	N/A					Up to £3,000,000
Total Steelwork & Fabrication Ltd	01925 234320	●		●				●	●	✓	3			✓		Up to £3,000,000
Victor Buyck Steel Construction	00 32 9 376 2211	●	●	●	●	●	●	●	●	✓	4		✓	✓	●	Above £6,000,000

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.

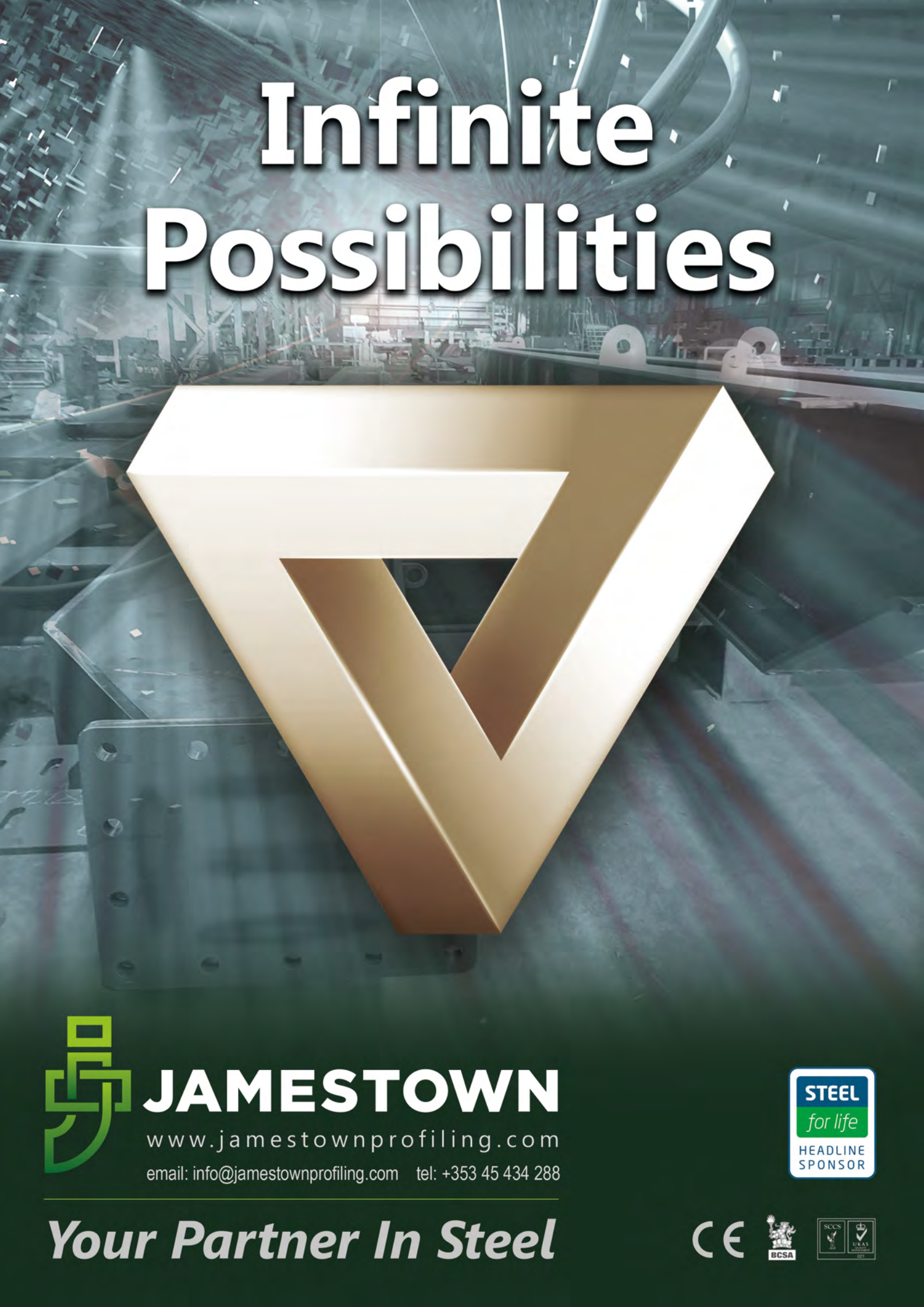
1 Structural components
2 Computer software
3 Design services
4 Steel producers
5 Manufacturing equipment
6 Protective systems
7 Safety systems
8 Steel stockholders
9 Structural fasteners

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

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

Company name	Tel	1	2	3	4	5	6	7	8	9	CE	SCM	BIM
AJN Steelstock Ltd	01638 555500								●		M		
Albion Sections Ltd	0121 553 1877	●									M		
Arcelor Mittal Distribution - Scunthorpe	01724 810810								●		D/I		
Autodesk Ltd	01252 456893		●								N/A		
AVEVA Solutions Ltd	01223 556655		●								N/A		
Ayrshire Metals Ltd	01327 300990	●									M		✓
BAPP Group Ltd	01226 383824									●	M		
Barrett Steel Services Limited	01274 682281								●		M		
Behringer Ltd	01296 668259					●					N/A		
British Steel	01724 404040				●						M		
BW Industries Ltd	01262 400088	●									M		
Cellbeam Ltd	01937 840600	●									M		
Cleveland Steel & Tubes Ltd	01845 577789								●		M		
Composite Profiles UK Ltd	01202 659237	●									D/I		
Cooper & Turner Ltd	0114 256 0057									●	M		
Cutmaster Machines (UK) Ltd	01226 707865					●					N/A		
Daver Steels Ltd	0114 261 1999	●									M		
Daver Steels (Bar & Cable Systems) Ltd	01709 880550	●									M		
Dent Steel Services (Yorkshire) Ltd	01274 607070								●		M		
Duggan Profiles & Steel Service Centre Ltd	00 353 567722485	●							●		M		
easi-edge Ltd	01777 870901							●			N/A	●	
Fabsec Ltd	01937 840641	●									N/A		
Ficep (UK) Ltd	01924 223530					●					N/A		
FLI Structures	01452 722200	●									M	●	
Forward Protective Coatings Ltd	01623 748323						●				N/A		
Graitec UK Ltd	0844 543 8888		●								N/A		
Hadley Group Ltd	0121 555 1342	●									M	●	
Hempel UK Ltd	01633 874024						●				N/A		
Highland Metals Ltd	01343 548855						●				N/A		
Hilti (GB) Ltd	0800 886100									●	M		
Hi-Span Ltd	01953 603081	●									M	●	
International Paint Ltd	0191 469 6111						●				N/A	●	

Company name	Tel	1	2	3	4	5	6	7	8	9	CE	SCM	BIM
Jack Tighe Ltd	01302 880360						●				N/A		
Jamestown Manufacturing Ltd	00 353 45 434288	●									M		
John Parker & Sons Ltd	01227 783200								●	●	D/I		
Joseph Ash Galvanizing	01246 854650						●				N/A		
Jotun Paints (Europe) Ltd	01724 400000						●				N/A		
Kaltenbach Ltd	01234 213201					●					N/A		
Kingspan Structural Products	01944 712000	●									M	●	
Kloeckner Metals UK	0113 254 0711								●		D/I		
Lindapter International	01274 521444									●	M		
MSW UK Ltd	0115 946 2316	●									D/I		
Murray Plate Group Ltd	0161 866 0266								●		D/I		
National Tube Stockholders Ltd	01845 577440								●		D/I		
Peddinghaus Corporation UK Ltd	01952 200377					●					N/A		
Pipe and Piling Supplies Ltd	01592 770312	●									M		
PPG Performance Coatings UK Ltd	01525 375234						●				N/A		
Prodeck-Fixing Ltd	01278 780586	●									D/I		
Rainham Steel Co Ltd	01708 522311								●		D/I		
Sherwin-Williams Protective & Marine Coatings	01204 521771						●				M	●	
Structural Metal Decks Ltd	01202 718898	●									M	●	
StruMIS Ltd	01332 545800		●								N/A		
Stud-Deck Services Ltd	01335 390069	●									D/I		
Tata Steel Distribution UK & Ireland	01902 484000								●		D/I		
Tata Steel Ireland Service Centre	028 9266 0747								●		D/I		
Tata Steel Service Centre Dublin	00 353 1 405 0300								●		D/I		
Tata Steel Tubes	01536 402121				●						M		
Tata Steel UK Panels & Profiles	01244 892199	●									M		
Tension Control Bolts Ltd	01948 667700						●			●	M		
Trimble Solutions (UK) Ltd	0113 887 9790		●								N/A		
voestalpine Metsec plc	0121 601 6000	●									M	●	
Wedge Group Galvanizing Ltd	01909 486384						●				N/A		
Yamazaki Mazak UK Ltd	01905 755755					●					N/A		



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