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NSC

New bridges improve A14

Vol 26 No 7 July/August 2018

Paddington's new Brunel Building

Steel in Kilkenny spotlight

Sport boosted in York

Steel revitalising St James's


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Cover Image
Brunel Building, Paddington, London
Main client: Derwent London
Architect: Fletcher Priest Architects
Main contractor: Laing O'Rourke
Structural Engineer: Arup
Steelwork contractor: Severfield
Steel tonnage: 2,350t

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

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

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

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

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

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

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

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

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

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

Steel supports collaborative future

Nick Barrett - Editor

Recent advances in technology have made steel an even more attractive material for use in construction than ever before, as ArcelorMittal pointed out in its launch of Steligence™ (see News). Steel construction has been an enthusiastic and early adopter of new technologies that enhance its cost and quality offer, and is always looking for new ways to drive the next generation of high performance, high sustainability buildings.

Arguably all steel buildings built today are high performance, most obviously when compared to those framed with alternative materials, and even to steel buildings of the not too distant past. Efficiency advances in fabrication have gone hand-in-hand with the development of more efficient structural designs and new steels to greatly expand the possibilities of architectural ambition and vision. But there is much more to come.

One of the keys to creating this new generation of buildings will be enhanced cooperation and dialogue between the client, the design team and the steelwork contractors. Increased cooperation and collaboration is increasingly recognised as a major thing that the construction industry can do itself to improve its performance, which chimes with the messages delivered by BCSA President Tim Outteridge in his inaugural speech to the Association's National Dinner (see News).

A major theme of Tim's presidency is reform of some of the damaging procurement related practices that have long bedevilled construction. Recent contractor insolvency has highlighted the damage done by ingrained practices like retentions, late selection of specialists, and playing one subcontractor off against another with an over-focus on price.

That focus has led on occasion, as Tim pointed out, to the selection of blatantly unqualified steelwork contractors that lack proper expertise, qualifications, processes and appropriately trained workforces, leading to time and money being wasted somewhere else on the construction programme.

Using a BCSA member is of course still the best way to ensure that a steelwork contractor has the skills and experience needed for a particular project, as most clients recognise. Increasingly it will become obvious to the market that only steelwork suppliers that are properly set up to achieve the quality of work that BCSA membership demands will be able to play a proper role in a post-Carillion, collaborative construction world.

Developers and main contractors who have already taken advantage of the opportunities presented by increased collaboration with their own supply chains and other partners report a major competitive advantage, being able to balance the delivery of client needs against programme and cost. Reduced cost and shorter construction programmes are routinely delivered by engaging with specialists like steelwork contractors early in the process.

The case for involving specialist subcontractors early is easy to make; design, buildability and project planning have all been proven to benefit. Another benefit is that trust and mutual respect are fostered, which will surely have to be fully established if all the other benefits of modern construction are to be realised. That cycle of trust has to start now and the best way of getting it off to a good start on your projects is to respond positively to BCSA President Tim Outteridge's call and appoint your specialist contractors early.

ArcelorMittal launches steel construction industry concept

ArcelorMittal, the world's largest steel company has unveiled Steligence™, a new concept for the use of steel in construction which it hopes will create a more sustainable life cycle for buildings.

The concept revolves around the idea of buildings as holistic entities where all aspects are considered in an integrated way, and proposes the need for better dialogue between various specialist architectural and engineering disciplines.

Steligence™ further suggests that the use of the best available technology in steelmaking, as well as modularisation of steel components in buildings, has the capacity to generate efficiency gains in the design, construction and configuration of buildings.

Because steel is infinitely recyclable, Steligence™ sets the stage for architects to consider the life cycle, recyclability and reusability of a building and its components at the earliest point in the design process.

This new approach has been brought about by real advances in technology which now makes steel an even more attractive material for construction. As such, ArcelorMittal said the Steligence™ concept has the potential to drive significant architectural and sustainability benefits.

ArcelorMittal Global Head of Research and Development Greg Ludkovsky said: "As climate, energy and resource scarcity intensifies, win-win solutions like Steligence™ become imperative.

"Buildings play a huge part in all our lives, so creating a construction concept that improves their social, economic and environmental impact while dramatically enhancing their functionality and aesthetics has been a huge challenge.

"We have landed on a radical new approach to construction which is underpinned by a clear philosophy to build a sustainable business around a sustainable construction industry that delivers for future generations."

By using the Steligence™ concept ArcelorMittal claimed the construction industry could take advantage of numerous benefits, such as more building storeys within a given height, less deep and less costly foundations and far longer clear spans, resulting in better flexibility of interior floor layout.

ArcelorMittal Global Research and Development, Construction and Infrastructures, Olivier Vassart (pictured) said: "Steel is the construction material for the future and this is a concept for change. We want to optimise the use of materials and eliminate waste."

Manchester's Ordsall Chord receives Major Project Award

The Ordsall Chord, a new railway line connecting Manchester's Piccadilly, Victoria and Oxford Road stations for the first time, has received the Royal Academy of Engineering's Major Project Award for 2018.

The award was in recognition of the collaboration, skill and engineering flair necessary to deliver such a complex, multidisciplinary feat of railway engineering.

An integral part of the Great North Rail Project, the Ordsall Chord incorporates the first asymmetric network arch bridge in the world. Completed in December 2017, the Chord uses only 540m of entirely new track to connect Manchester's existing railway lines via a brand-new viaduct spanning the River Irwell.

By creating a link between Manchester city centre's main railway stations, as well as enabling new, direct services to Manchester Airport from the North, the Chord allows more trains to run on the network and reduce journey times into and through Manchester.

With collaboration at the heart of the Chord's engineering success, the team members that received the award represent the multidisciplinary partnership undertaken between Network Rail, Skanska BAM, Siemens, Amey, steelwork contractor Severfield, the designers, AECOM Mott MacDonald, WSP and Balfour Beatty to build the Chord.

Stands up for Headingley rugby ground

A new 7,721-capacity south stand at Headingley rugby league ground, home of Leeds Rhinos, is nearing completion.

The steel-framed structure will have 2,233 seats on its upper tier, with the remainder of the capacity standing in the lower paddock.

The stand forms part of the overall redevelopment of the Headingley stadium, and work is also currently ongoing for a new north stand that has back-to-back tiers overlooking both the rugby ground and adjacent cricket arena.

Working on behalf of main contractor Caddick Construction, Hambleton Steel is fabricating, supplying and erecting 1,800t of steel for both stands.

BCSA President highlights members' professionalism and high standards

Speaking at the British Constructional Steelwork Association's (BCSA) 41st National Dinner, BCSA President Tim Outteridge (pictured right) praised the high standards of the membership's steelwork contractors and called for more projects to enlist their expertise.

Mr Outteridge said that poor procurement practices have led to the engagement of non-BCSA member steelwork contractors on some projects and these firms are blatantly unqualified for the work.

"The selection of the wrong steelwork contractor without the expertise, the qualifications, the processes, and the appropriately trained workforce, really infuriates me."

Mr Outteridge said: "There are more than enough BCSA members out there to choose from for any type of project in any location. We are all subject to BCSA's rigorous assessment processes and, more than that, we collectively set ourselves high standards, beyond mandatory requirements.

"We receive invaluable support from BCSA that helps us achieve best practice, as well as keeping up-to-date with our statutory obligations. So, selecting a BCSA member means that the job will be done right first time."

In addition, he said the BCSA and its members are constantly promoting best practice in procurement, starting with early engagement with the supply chain. This then allows them the opportunity to drive real collaboration.

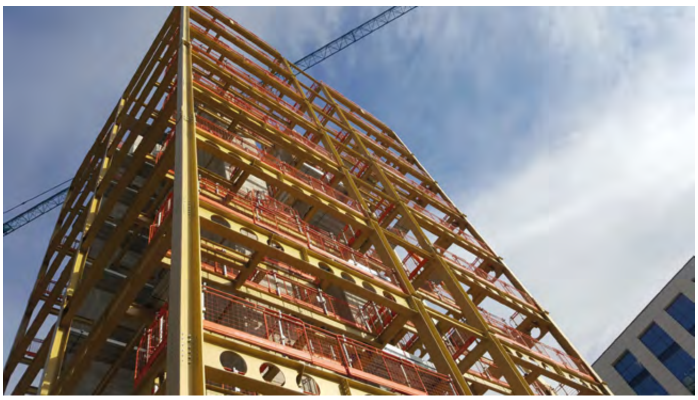
Mr Outteridge also supported Build UK's long-term objective of abolishing retentions through legislation by 2023, but added that ring-fencing retentions in the interim would assist greatly.

"The BCSA absolutely supports the objective of abolishing retentions, and we agree that legislation is the way to stamp it out forever, once and for all," he said.

Leeds development gets further commercial space

Two more steel-framed office blocks are under construction at the Wellington Place development in Leeds city centre.

7 & 8 Wellington Place are two conjoined eight-storey structures that will offer more than 35,000m² of Grade A office space. The buildings also aim to achieve a BREEAM 'Excellent' rating.



The offices have been named as the location of a brand-new Government Hub with HMRC taking the space on a 25-year lease.

Working on behalf of main contractor Wates, Billington Structures is fabricating, supplying and erecting the structural steelwork for the project.

Wellington Place will eventually boast a total of 140,000m² of commercial, retail, leisure and residential space and will be one of the biggest and most prestigious new city centre business quarters in Europe.

Billington Structures previously completed two other commercial blocks on the site known as 3 and 6 Wellington Place.

NEWS IN BRIEF

Underlying pre-tax profit at steelwork contractor **Severfield** rose 19% to £23.5M for the 12 months ending 31 March 2018, keeping the Group on track to deliver its strategic goal of having profits of £26M by 2020. Revenue was up 5% to £274.2M compared to £262.2M in 2017, while underlying basic earnings per share were up 15% at 6.4p per share compared to 5.5p last year.

Northstowe, a new town on the site of the former RAF Oakland barracks in Cambridgeshire has submitted plans to build an 1,800-place secondary school. The school will serve a community which is set to expand to include 10,000 properties and 25,000 residents. The initial phase of the Northstowe development will consist of 1,500 homes, a community building, shops, business premises, open space and sports facilities.

The steel-framed Porter Building in Slough town centre has achieved WELL Building Standard certification, making the 11,100m² development one of the UK's healthiest office blocks. The project, which was completed late last year, was a partnership between developers Landid and Brockton. Working on behalf of Bowmer & Kirkland, **Leach Structural Steelwork** erected more than 1,400t of steel for the job.

Transport for Greater Manchester is set to start work on Ashton-under-Lyne's new bus station, which will be closer to the town's Metrolink stop and train station. The Metrolink line to Ashton opened in October 2013 and plans for the new bus station were part of the 2012 town centre framework. The work will include a single covered concourse to replace the five island platforms, improved waiting areas, cycle parking and better access to travel information and tickets.

Following a robust UKAS assessment, **SCCS** has achieved accreditation status as a Certification Body for BS EN ISO 45001: 2018 for occupational health and safety management systems.

PRESIDENT'S COLUMN

BCSA's members came together in June for the Association's Annual General Meeting, National Meeting, and its National Dinner. My President's address at the dinner focused on commercial and contractual matters, just as readers of this column might expect.

But as well as the opportunity to hear about the work of our Association, discuss current issues, and get together to celebrate our industry, these events gave me the opportunity to reflect on the advantages of being a BCSA member and the myriad of benefits that using a BCSA member provide to clients and main contractors.

Of course, BCSA members are well aware of the benefits of membership, including exclusive access to expert advice, knowledge and programmes that improve our services to clients, reduce commercial risk, and make the workplace safer for everyone. Members can also raise and address issues and problems of mutual interest that can only be solved by working together. The point is, are our customers? It's also important for them to value BCSA membership and what it brings to the sector, both in terms of technical expertise but also as a benchmark for professionalism and the can-do attitude BCSA members have.

Since taking on the Presidency, I have been in awe of the work of the BCSA and the contribution that member companies make, all of which provide advantages for all those companies working in the steelwork supply chain. For example, without the BCSA we wouldn't have the NSSS; the sector wouldn't have any lobbying clout, and without the establishment of Steel for Life, we would be without our steel market development activities. Over time, BCSA has pushed faster compliance with new regulation, helped improve quality and health and safety in the sector and driven best practice among members. In turn, a better performing structural steelwork sector benefits clients and main contractors.

There are also the individual project by project benefits that using a BCSA steelwork contractor brings to clients and main contractors. BCSA members are pre-assessed across many different aspects. This means that clients and contractors can be assured they have the specialist experience and qualifications for the job. More and more I'm seeing BCSA membership as a preferred or required qualification for projects, and I'm sure that this is due to the better outcomes that are consistently being delivered.

From time to time, a main contractor might say to me that they don't want to restrict their choice of steelwork contractor by using a BCSA member. This is a weak argument because; with around 100 steelwork contactor members, there's more than enough choice to ensure a properly qualified and competitive tender list.

The BCSA member directories' can be viewed at *www.steelconstruction.org/directories*. If you haven't done so before, I suggest you try making BCSA membership a requirement for your next project – that's a win-win scenario and no-one will regret it.

Tim Outteridge
BCSA President & Sales Director Cleveland Bridge

Contractor named for steel-framed flagship showroom

Caddick Construction has been awarded the contract to deliver the £41M steel-framed Williams Group flagship automotive retail centre at TraffordCity, Greater Manchester.

The project consists of a three-storey BMW showroom, a two-storey Jaguar Land Rover showroom and a single-storey MINI showroom in a high-profile location opposite Event City and next to John Lewis at Intu Trafford Centre.

Designed by Wilmslow-based architects Taylor Design, work on the 14.3-acre site has already commenced with completion set for late summer 2019.

Border Steelwork Structures will be fabricating, supplying and erecting the project's steelwork.

Caddick Construction will also deliver workshops, including a service drive-through, valet and car washing facilities together with roads and drainage works.

The scheme is part of the wider TraffordCity redevelopment by Peel Land and Property to create a further retail, leisure and commercial space around Intu Trafford Centre.

Steelwork aids nuclear decommissioning

The decommissioning of Magnox gas cooled nuclear reactors throughout the country is well under way, and steelwork contractor Caunton Engineering is playing a major role.

The steelwork framing for two major interim storage facilities (ISFs) has now been completed, one at Chapelcross in Annan, and one at Hinkley Point in Somerset.

Caunton has designed, fabricated and erected 200t of steelwork for Chapelcross (pictured) and a further 300t of steelwork for Hinkley.

The company's secondary steel division supplied ancillary walkways, stairs, and ladders to complement both the main structures.

These highly-engineered industrial grade interim storage facilities offer protection for Intermediate Level Waste (ILW) containers until the geological disposal facility is available.

Caunton has been working for Interserve, the international support services and construction group, who were appointed as the sole Tier 2 contractor to design and build these ISF's.

Plymouth scheme will transform city centre

Structural steelwork for the Drake Circus development in Plymouth city centre is rapidly taking shape and the project is due to complete in autumn 2019.

The new leisure scheme is set to transform the former coach station site and will become a key gateway entrance to Plymouth city centre.

Construction work started in November 2017 and is being carried out by McLaren Construction, with steelwork being fabricated, supplied and erected by BHC.

The development comprises a 12-screen Cineworld cinema, 15 restaurants and bars, including a Sky bar above the cinema to capture stunning views of the city and its coastline, and 420 car park spaces.

The scheme will create a new destination for dining and entertainment in Plymouth for both locals and visitors to enjoy. It will complement British Land's Drake Circus centre which includes shops from Apple, Superdry, M&S and Primark.

The new cinema will incorporate state-of-the-art audio and visual technology with screens ranging in size from an 80 seat to a giant 450 seat IMAX auditorium.

Work starts on state-of-the-art Hartlepool school

Steelwork erection has started on the new English Martyrs School in Hartlepool which forms part of a major Government education programme in the North East.

The new school will replace existing buildings that will be demolished once students and staff have decamped.

The new state-of-the-art school building will comprise a single, three-storey block offering more than 9,000m² of space. The U-shaped building will include a wide range of departments zoned around an external courtyard.

The school will have a capacity of 1,750 students and 220 staff. Working on behalf of main contractor BAM, Harry Marsh [Engineers] are fabricating, supplying and erecting the project's steelwork.

Stockholder promotes youth employment and apprentices

Pictured (L-R): Rob Fern - Commercial Manager, Brad Kendall - Commercial Sales Apprentice, Alisha Jarrett - Purchasing Coordinator and Ethan Donati - Commercial Sales Apprentice

Barrett Steel says it is proud to recognise the importance of apprenticeships in the steel industry as one of its divisions, Barrett Engineering Steel Midlands, is leading the way in showing that traditional industries can do things differently.

The company currently employs three local apprentices, and plans to increase this number over the coming year.

Apprenticeships typically last up to three years and allow an insight into a career that no amount of classroom-based learning can provide. On-the-job training is coupled with an income, and can be supplemented with academic work.

'It's challenging to encourage young people to work in this industry' said Rob Fern, Barrett Steel Commercial Manager, who started his career as an apprentice almost 20 years ago.

"We invest heavily in the apprentices we employ – two of our current staff are completing qualifications alongside their work-placed learning - and we hope we are providing them with a foundation in the industry that will see them working with us for many years to come."

Planning granted for major Crawley scheme

Crawley Borough Council has approved developer Westrock's plans for a major mixed-use town centre scheme.

The project will deliver 273 residential apartments, a landmark town hall and office building, a district heat network centre, new public square, restaurants/cafes, and upgraded parking facilities.

In 2017 Westrock secured planning consent for the first residential building of 91 units and will commence construction after the summer. Development of the new town hall and office building will commence in 2019.

Westrock is planning to achieve a BREEAM 'Excellent' rating for the Council's landmark town hall and office building. The new district heating network centre is planned to power the office and residential elements, as well as include expansion provisions to power other major users in Crawley

Matt Willcock, Development Director for Westrock, said: "This project is turning out to be a town centre landmark project exemplifying how thoughtful design can be balanced with sustainability, affordability, and the commercial goals of all stakeholders involved."

Councillor Andrew Skudder, Cabinet member for Resources, said: "This is a big step for the Council towards improving facilities for staff, customers and councillors. The new town hall will provide a significantly improved welcome and customer service experience for visitors. The overall scheme also brings forward another major regeneration project in the town centre. With Queens Square completed and Queensway, Eastern Gateway and Station Gateway coming forward these are exciting times for the town."

Diary

For SCI events contact Jane Burrell, tel: 01344 636500 email: *education@steel-sci.com* web: *www.steel-sci.com/courses*

Tuesday 11 & Wednesday 12 September 2018
Webinar - Fatigue design to EC3
The webinar will cover the fatigue phenomenon and the assessment of fatigue life. Fatigue loading and Miner's summation of fatigue damage and how it is dealt with by EN 1993-1-9 will be addressed.

Thursday 27 September 2018
Fire resistant design of steel structures
This one day course will give an introduction to structural engineers on how to design a steel structure to withstand a fire.
London.

SSDA celebrates 50 years

Having started in 1969, the Structural Steel Design Awards are this year celebrating their 50th anniversary. In the fourth of a series of articles, NSC looks back at the 2000s.

Since the Structural Steel Design Awards (SSDA) were initiated in 1969 by the British Constructional Steelwork Association (BCSA) and the British Steel Corporation there have been many changes in the construction and the steel sectors, but one constant asset is the way that steel not only confers efficiency and economy but also has an aesthetic which designers are able to exploit to the benefit of the built environment.

The qualities of engineering excellence, innovation, attention to detail, economy and speed of construction have been brought together in each of the structures that have been given awards during the past 49 years.

Following on from last month's look back at the 1990s, in this issue we highlight the 2000s. Two examples of this decade's Award winners are the Falkirk Wheel (a winner in 2002) and The Wellcome Trust Gibbs Building in London (a 2005 winner).

Weighing approximately 1,400t without water, the Falkirk Wheel is a unique machine that raises and lowers boats in a rotary motion, connecting the Forth and

The Falkirk Wheel is a unique machine for raising and lowering boats

The Falkirk Wheel is now one of central Scotland's most popular tourist sites

The Wellcome Gibbs Building consists of two parallel structures

Clyde Canal with the Union Canal.

The wheel concept consists of two arms fixed to an axle. The end of each arm forms a ring within which two gondolas rotate. The fact that the main structure is a continuous rotating machine means that the principal stresses within the majority of the rotating structure fully reverse each cycle of the wheel.

Additionally, as the gondolas are supported on four wheels within each arm ring then the rolling loads generate four load stress cycles on the gondola rail support structure every revolution. These fatigue limitations dominated the arms and axle structural design.

To accommodate these high fatigue cycles a combination of bolted and welded construction was adopted. This allowed the ring beam supporting the gondola rail to be a compact construction with the beam diaphragms bolted to the flanges and only welded at the mid third of the beam webs.

The structure, including the gondolas, was designed to eliminate all site welding and facilitate the full works trial erection of critical elements.

The wheel was delivered to site by road in some 40 major components. The longest element was approximately 21m, the widest 5m, the highest 5m and the heaviest 80t.

Working on behalf of the client British Waterways and main contractor Morrison Bachy Soletanche JV, the project's steelwork contractor was Butterley.

With steelwork fabricated, supplied and erected by William Hare, the Wellcome Trust Gibbs Building in London was designed to bring the company's administrative team together in a single, comfortable and inspiring workplace.

The building comprises two parallel blocks of open-plan, flexible, office space, separated by a 9m wide atrium. A 10-storey 18m-deep block addresses the Euston Road bypass, while a 9m-wide 5-storey structure fronts Gower Place.

Almost entirely clad in glass, the building incorporates a sophisticated series of triple glazed prefabricated façade cassettes, which, while unifying the building through their carefully considered proportion and repeated bay composition, help to reduce solar gain and heat build-up.

This component, combined with assisted ventilation through the atrium and high day-lighting levels helped achieve a BREEAM 'Excellent' rating.

The building is said to be exemplary in its detailed execution, demonstrating the highest order of integration. With no excess, no redundancy and no fuss, the building responds to brief with efficiency and discipline, while producing a working environment that is materially spatial and functionally rich.

The SSDA judges said, this 22,000m² building in the heart of London is a most successful outcome of structural and architectural design, with steelwork at the core of the solution.

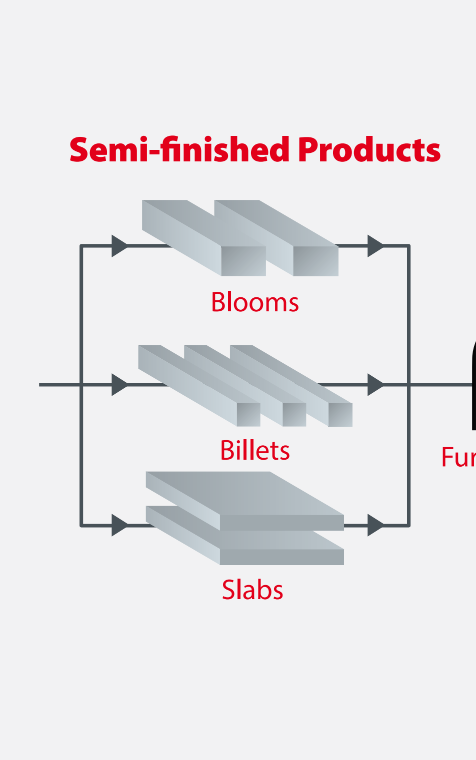
A full list and description of all Award winners can be found at: *https://www.steelconstruction.info/SSDA_2018_-_50th_Anniversary_Year*

The 2018 Awards, which are jointly sponsored by the BCSA and Trimble Solutions (UK) Ltd, will be announced in early October.

A large atrium is one of the main features of the Wellcome Gibbs building

An introduction to steel construction products

In this sector focus article, New Steel Construction provides an overview of the various forms of steel construction products and describes how they are produced.



Semi-finished billets, blooms and slabs from the continuous casting process (see *NSC* Sept 2017) are transformed into a variety of construction products by various processes of heating and mechanical working. The resulting products are either used directly in the fabrication of steel components, that are subsequently assembled into structures on site, or made into further products for use in construction.

Shaping Steel

Steel is a strong material that is highly resistant to shaping at normal temperatures, but this resistance lessens considerably at higher temperatures. For that reason, the billets, blooms and slabs from the steelmaking process are shaped into basic products at carefully controlled elevated temperatures.

The method that is most commonly used for shaping is to heat the steel to around 1280°C in a reheat furnace and then roll the steel, squeezing it between sets of rolls. Rolls are arranged in pairs, either just horizontally or both horizontally and vertically, and housed in a 'stand'.

To change the shape of a material as strong as steel the rolls must exert forces measured in hundreds 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 such as plates, sheets or strips of uniform thickness, and long products which are 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. These work rolls that contact the hot steel are often supported by larger diameter rolls to prevent them bending under the rolling loads to ensure a uniform thickness product.

For long products there are two types of mills; structural and universal. In a structural mill there are multiple stands each containing specially shaped rolls where the full set of rolls gradually shape the hot steel in successive passes through separate roll gaps. The product passes through each roll gap only once. In a universal mill the stands contain both vertical and horizontal rolls and the hot steel passes backwards and forwards through the same mill multiple times with the shape being formed by reducing the gap between rolls on successive passes.

Plates

Plates are available in a wide range of grades and sizes. For use in building construction plate will normally be welded into fabricated sections.

Normal plate sizes range from 5mm to 200mm thick, with widths up to 3.5m and lengths up to 18.0m. Plates with a nominal yield strength of 275N/mm² or 355N/mm², commonly used in construction, can be supplied in either the As Rolled (AR), Normalised (N), Normalised Rolled (NR) or Thermomechanically Rolled (TM) supply conditions, and are rolled from continuously-cast slab.

Close control of chemical composition is maintained to produce clean steels with consistent strength and toughness properties that meet all relevant national standards, as with all structural products, and state-of-the-art levellers produce flat plates with controlled residual stress.

Strip

Strip steel is used to produce many different products and in many applications. It is available in three main forms.

- Hot rolled
- Cold rolled
- Hot-dipped galvanized coil.

The most common form of strip steel used in construction is hot-dip galvanized coil. The typical thickness used in construction is 0.4 to 3.2mm. It is generally available in coiled form in widths from 900 to 1,800mm.

Standard open sections

Open sections commonly used in construction range from large columns, beams and piles down to smaller products including channels and angles.

Various types of mill are used to produce different long products. For example, heavy section and medium section mills have three or four stands using rolls with specially machined profiles corresponding to the initial roughing, and the intermediate and finishing stages of rolling.

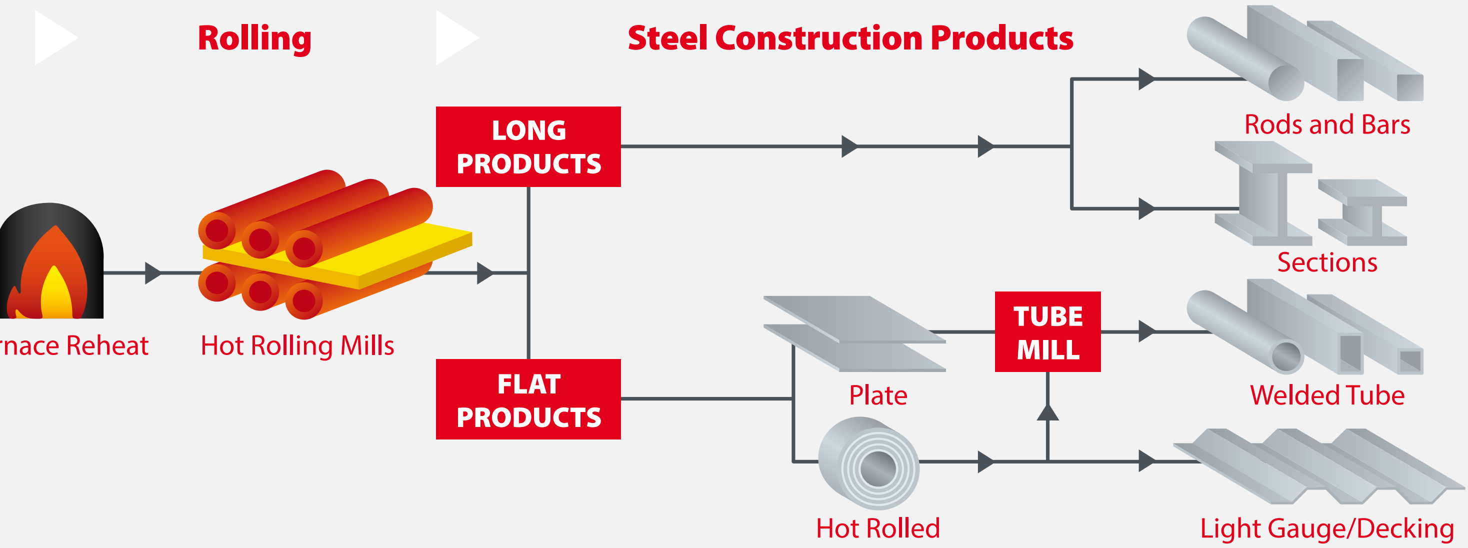
British, European and International standards define dimensions for a wide variety of open section shapes, such as I and

"We pride ourselves on the quality of our products and services, and our ability to respond to customer requirements.

"Our steel is produced to the highest standards - well within the tightest dimensional tolerances – and we've a proven track record of delivering cost-effective solutions for developments of all sizes, from skyscrapers and sports stadia to schools and shopping centres.

"We continue to invest in our manufacturing operations to further improve the quality of our steel, and we also have an established network of distribution centres across the UK and Ireland. In doing so, we're not only able to offer a first class service but offer great value in the UK steel construction supply chain."

British Steel Managing Director Construction, Richard Farnsworth



H shaped sections, angles and channels.

The nominal sizes of 'universal beams' (UB), 'universal columns' (UC) and 'parallel flange channels' (PFC) are given in BS EN 10365, which replaced the old BS4 in February 2017. These sections are typically defined by a serial size (nominal flange width and section depth) and a weight per metre created by varying the thickness of the web and flanges. (Note that the 'internal' width between flanges is constant for any serial size - it is determined by the rolls - and an increase in flange thickness results in a corresponding increase in depth.) Dimensions for design, detailing and resistance are given in the Steel for Life Interactive Blue Book and the ArcelorMittal Orange Book.

The nominal sizes of 'angles' are given in BS EN 10056 and these sections are typically defined by a serial size comprising the leg length, either equal or unequal, and the leg thickness.

Hot rolled open sections are produced in lengths up to about 25m. A nominal yield strength of 355N/mm² is most commonly used in construction, although 460N/mm² sections are also available. Such sections are typically supplied in either the As Rolled (AR) or Thermomechanically Rolled (TM) supply conditions, and are rolled from continuously-cast blooms, billets or 'dog bones'.

"Shortly customers will be able to benefit from ArcelorMittal Section's continued investment in quality and service; in 2017 we started a €40 million programme of upgrading the finishing facilities at our Differdange mill which includes the world's largest section roller straightener with a 2500cm^3 modulus."
ArcelorMittal Senior Technical Sales Engineer & Business Development, Neil Tilley

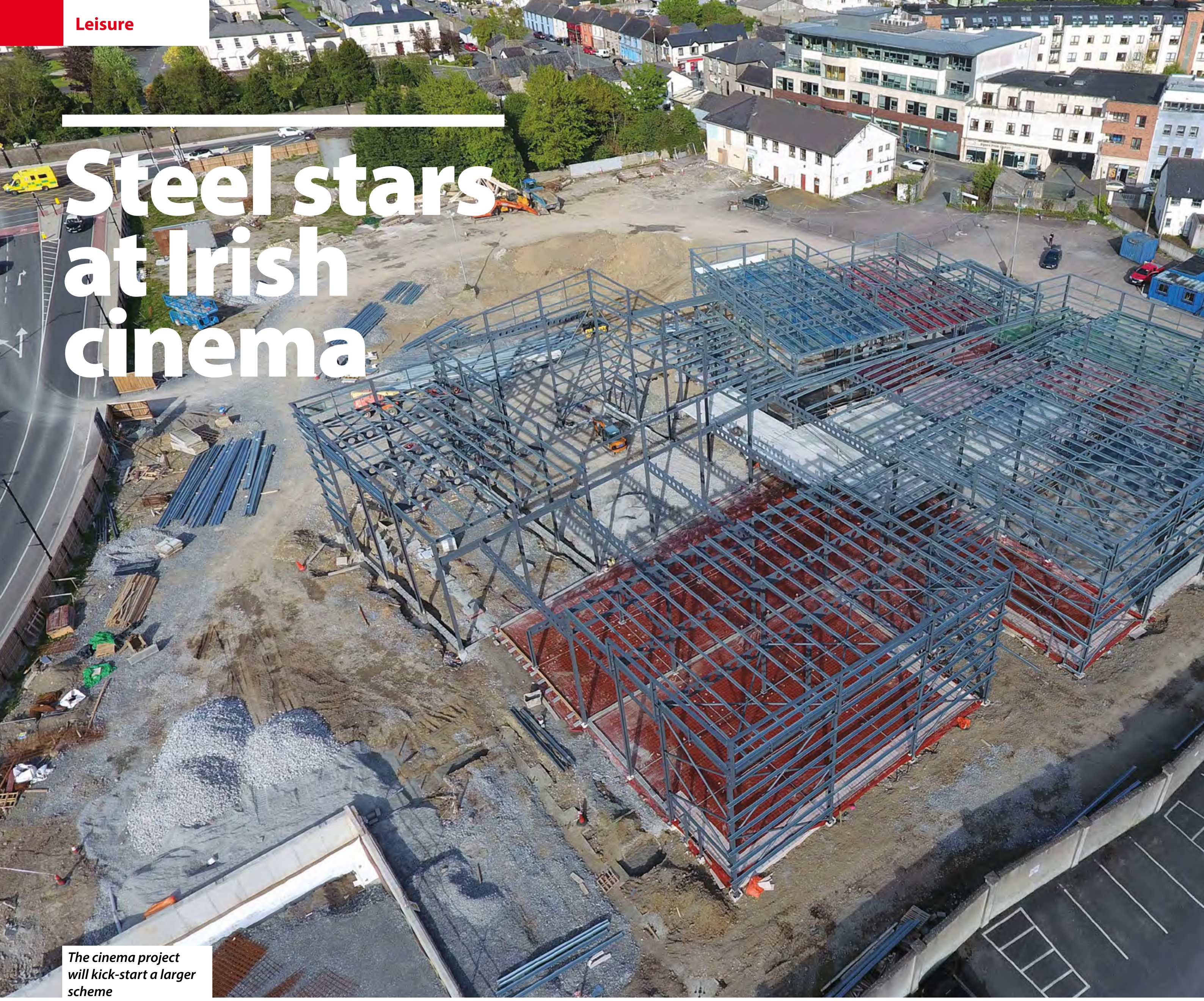
Structural hollow sections

There are two basic methods of producing hollow sections - the seamless process in which a hole is pierced through a hot solid bar to form the bore and then the bar is rolled to form the round tube, and the welded process in which a steel plate or strip is formed into a cylindrical shape and the edges welded together. The latter is the most commonly employed for structural applications. The High Frequency Electric Resistance Welding (HFERW) method forms the bulk of tube production in small and medium sizes, up to 508mm in diameter. Steel strip is uncoiled and guided, cold, through sets of forming rolls to produce the cylindrical shape. At the point where the edges meet, a high frequency current is introduced into the edges of the strip, either by induction using an encircling coil or by contacts sliding on the surface of the strip. The electric current produces enough local heat to melt the strip edges as they are forged together. The weld is formed instantly. Pipes of wall thicknesses above 16mm and with diameters above 508mm are produced by several consecutive forming processes and Submerged Arc Welded (SAW).

Square and Rectangular hollow sections are 'squared up' by passing them through a suitable series of work rolls that progressively changes the shape. This reduction and reshaping process can be carried out hot or cold, which results in the distinction between 'hot finished' and 'cold formed' products. For a cold formed rectangular section, the corner radius is not as tight as can be achieved with the hot process (which makes it easy to distinguish the two types visibly). The mechanical properties of hot finished and cold formed can also vary and for this reason it is unwise to consider these products as interchangeable.

Hollow sections are typically produced in lengths 6m to 14.5m, depending on the size and thickness, and these sections are typically defined by a serial size comprising the outer dimension(s), and the wall thickness. Dimensions for hollow sections are defined in BS EN 10210-2 for hot finished sections and BS EN 10219-2 for cold formed sections. A nominal yield strength of 355N/mm² is most commonly used in construction, although 420N/mm² hot finished hollow sections are also available.

Steel stars at Irish cinema



The cinema project will kick-start a larger scheme

The city of Kilkenny will soon have a new 10-screen cinema complex, as construction work is currently progressing apace on the site of a former cattle market.

FACT FILE
Kilkenny cinema
Main Client:
IMC Cinemas
Architect:
Brian Dunlop Architects
Main contractor:
Kevin Moore
Structural engineer:
Martin Peters Associates
Steelwork contractor:
Steel & Roofing Systems
Steel tonnage: 225t

A new landmark 1,400-seat cinema complex in the city of Kilkenny, represents the first phase of a much larger mixed-use development on a nine-acre city centre site formerly occupied by a cattle market.

The 4,180m² cinema will kick-start the scheme, which is anticipated to grow over the coming years offering Kilkenny a new leisure and shopping destination.

Locally-based contractor Kevin Moore started work early this year on a site that had previously been cleared of any structures. The company removed an old concrete slab and then installed new pad foundations prior to Steel & Roofing Systems (SRS) starting the steel erection programme.

SRS has also been contracted to install 1,800m² of Kingspan wall cladding and 4,300m² of Kingspan roof deck for the project.

Explaining the choice of steel for the project, Martin Peters of Martin Peters Associates (MPA) says this was always going to be a steel-framed solution due to the building's shape and size. "We have ten screens, all of which are column-free spaces as well as a large open-plan entrance area. Steel is the best option for this type building."

Project architect Brian Dunlop agrees and adds: "Speed of construction was also a major factor in choosing steel, plus, the design is based around a series of isolated boxes set within one large box, which ideally suits steel construction."

There are 12 boxes in total, 10 for the cinema screens and one each containing the foyer and concessions area. Each of these boxes is isolated from the adjoining boxes and from the outside world by acoustic partition and perimeter walls, which will be fitted to the steelwork frame.

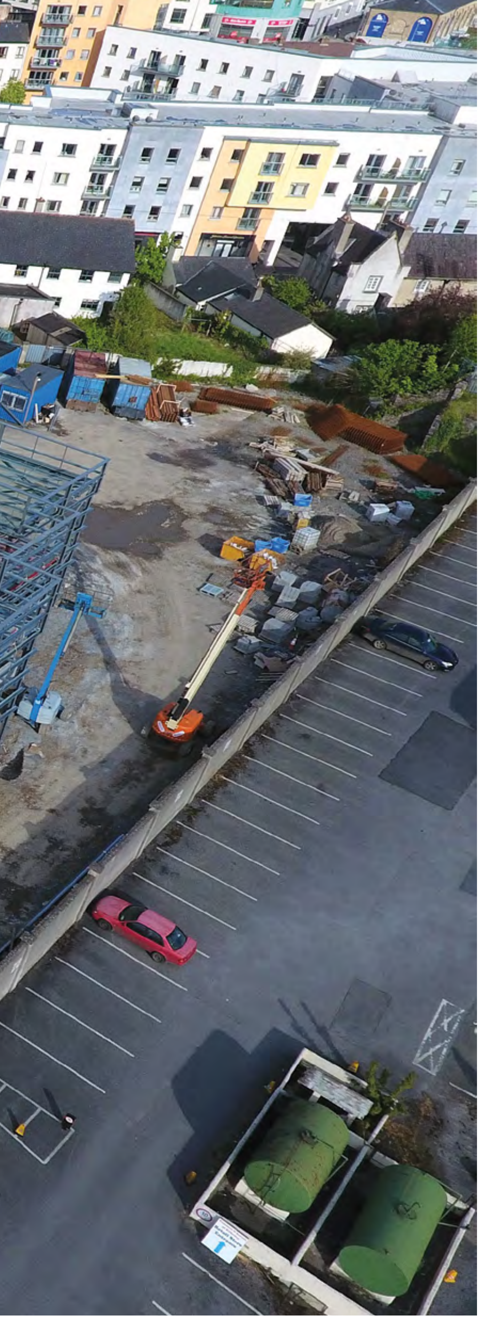
The cinema screen boxes vary in size with the largest measuring 19.5m × 25m, which accommodates 318 seats.

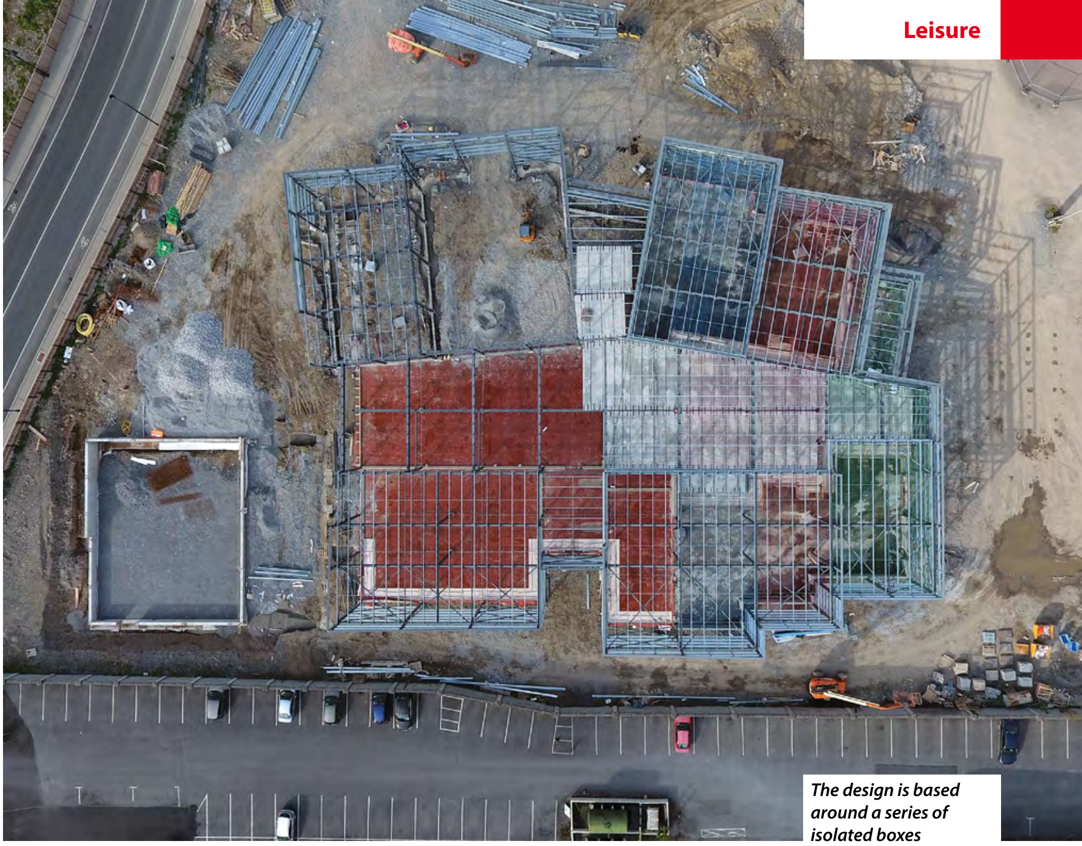
The majority have a clear span of around 14m and contain in the region of 200 seats. The smallest box is a 58-seat screen measuring 7m × 13m.

To create the clear spans for the screens SRS has used Westok cellular beams, chosen for their ease of service integration.

"This is a heavily serviced building and cellular members allow us to keep all services within the depth of the beam, thereby helping to reduce the height of the building," says Mr Peters.

Kloeckner Westok has a long history of working in the city of Kilkenny, stretching back many years, as Westok's Design Team Leader John Callanan explains, "Following on from a variety of schemes completed in the past in and around Kilkenny, including such diverse projects as car showrooms, grandstands at Nowlan Park GAA Stadium





The design is based around a series of isolated boxes

How the completed cinema will look

and motorway services, we were engaged once again to assist on this cinema project.

Kloeckner Westok provided free design guidance and calculations to MPA who were tasked with developing a cost-effective clear span solution, which fulfilled the requirement for significant building service integration within the strict depth limits set by the architect.

The Westok rafters over the cinema boxes have 450mm diameter cells and they have all been manufactured with a full string of cells to future-proof the MEP integration of the building."

The cellular beams also have the benefit of reducing the external cladding required and also reducing heat loss through the envelope.

Overall the structure gets its stability from cross bracing hidden in each of the boxes' partition walls. All of them are connected by the building's main concourse, or street, which adjoins the ground floor entrance foyer.

The foyer area of the cinema has the longest clear span in the structure at 20m-long, and this has been created by a single 1.5m-deep truss weighing 4t.

"The Westoks over the foyer are cut from UC sections to facilitate the wide flange/shallow beam solution required in this area. These beams were restricted to 450mm maximum depth with sufficient bearing required to carry the 200mm precast hollow units," adds Mr Callanan.

The concourse includes a first-floor mezzanine level from where customers will enter the screens. This floor has been formed with steelwork supporting precast planks, which SRS installed along with the steel, using its on-site 40t-capacity mobile crane.

The mezzanine level culminates with a 7.5m-deep cantilevering concessions box that sits directly above the main entrance. The concessions box also features a 3m-long curved glazed façade, which will offer cinema goers uninterrupted views across to Kilkenny city centre.

"The glazed cantilever is the shop window of the cinema, and signposts the main entrance to the building," explains Mr Dunlop.

Kilkenny cinema is scheduled to be open in early 2019.

Cellular beams have been used for service integration

Steel was the only viable framing solution for the job

The stadium is scheduled to be ready by May 2019

Sport in the frame

York's Community Stadium will host football and rugby league, as well as providing an array of leisure facilities and a 13-screen cinema. Martin Cooper reports.

York's professional football and rugby league teams (York City and York Knights), will both have a new home to share from next summer as an 8,000-seat stadium, including leisure and cinematic facilities, is currently under construction at Huntington on the city's outskirts.

As with many similar high-profile sports projects, getting the scheme under way has been a long and difficult process. From their original involvement in the project some five years ago, Buckingham Group was appointed, and started on site, late last year. It is scheduled to handover the stadium in time for next year's rugby league season which kicks off in May.

Buckingham inherited the site from a previous project team with the site already cleared of its previous buildings, which included an athletics track and a swimming pool, while all of the enabling works had also been completed.

"To ensure the scheme got under way this time we initially undertook a value engineering exercise of the original design, streamlining it and making it cost-effective and buildable," explains Buckingham Senior Project Manager Alan Domville.

Working in conjunction with Caunton Engineering, who are the design and build steelwork contractor for the project, the value engineering included a complete design review of the steel frames for the scheme.

One example was replacing precast planks with metal decking in the cinema seating areas, as it offers a more efficient build solution for the follow-on trades. Another was using Westok tapered cellular beams for the stadium's cantilevering roofs.

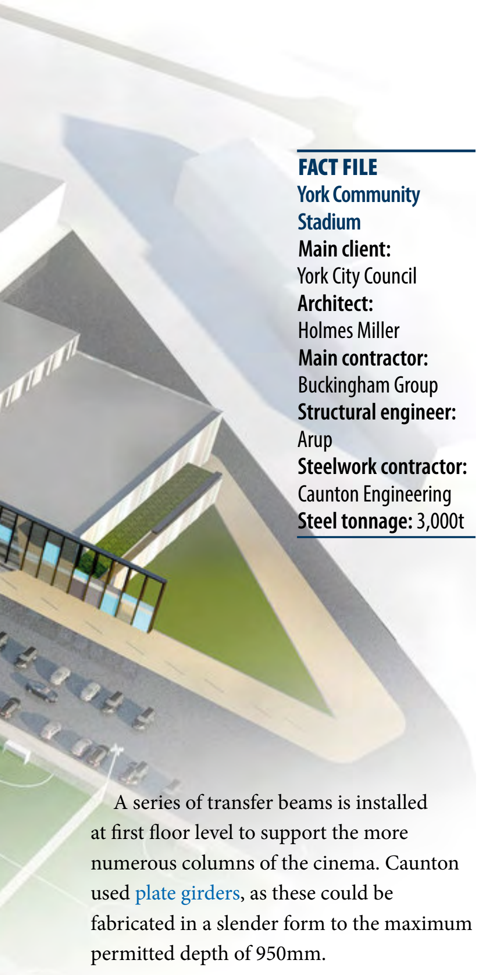
"The original design for the stadium roofs was for solid UB rafters. By changing to Westok beams we have lighter and less expensive members, and ones that are tapered at no extra cost to give a more aesthetic appearance," explains Caunton Engineering Senior Structural Engineer Richard Beesley.

Overall, structural steelwork is being used to form the entire stadium project, which consists of three main elements; the cinema block that adjoins the stadium's south stand, the east stand which also includes a two-storey building housing an NHS drop-in surgery, a library and the stadium's corporate facilities on the upper level, and a leisure block that adjoins the scheme's north east corner and includes three pools, a gym and a sports hall.

All three of these main structures are independent and separated by movement joints. These parts of the scheme are all founded on piled foundations, typically 13m-deep. The remaining parts of the scheme, which consist of the smaller west and north stadium stands are on pad foundations, as these structures are much lighter.

Steelwork erection began in March, with Caunton Engineering working on two fronts, with one gang erecting the cinema and the other building the leisure centre. The leisure centre gang then progressed on to the stadium.

The 13-screen cinema, which includes an IMAX, measures 44m-wide x 123m-long and is 24m-high. It is a braced box and sits above a ground floor retail level, which has a completely different grid pattern to the more complex arrangement needed for the two upper levels. The retail floor features long clear spans, ideal for shops, while the cinema's two floors are a forest of beams in comparison, needed for the screen's and projection room's partition walls.



FACT FILE
York Community Stadium
Main client: York City Council
Architect: Holmes Miller
Main contractor: Buckingham Group
Structural engineer: Arup
Steelwork contractor: Caunton Engineering
Steel tonnage: 3,000t

The sports hall has specatator terracing

A series of transfer beams is installed at first floor level to support the more numerous columns of the cinema. Caunton used plate girders, as these could be fabricated in a slender form to the maximum permitted depth of 950mm.

"The depth of the beams was important as the retail floor below them needed to have a 7m floor-to-ceiling height to allow a mezzanine level to be installed if it was needed in the future," adds Mr Beesley.

A movement joint and acoustically treated walls divide the cinema from the south stand's terracing, but the final four bays in the south-east corner are structurally connected. This area houses the 'fans zone' a large covered area where supporters can gather for refreshments, before and during a game. It was important to have no intrusive columns in this zone, and so to help create this open-plan zone the structures are linked via perimeter columns and roof beams.

Erected at the same time as the cinema, the project's leisure block is a large wedge-shaped building containing two open-plan zones, accommodating an aquatics zone and a sports hall, sandwiched either side of a two-storey section containing changing rooms, a gym, offices and dance and spinning studios.

The sports hall, which has a spectator terrace along one perimeter wall, will be used for netball, basketball and badminton. A series of 25.5m-long roof rafters, spliced at midpoint, creates this large column-free space.

Similarly, the aquatics zone, which houses a six-lane 25m-long main swimming pool, a smaller learner pool and a further splash pool, is spanned by a series of 18m-long beams.

Sat between the leisure centre and the cinema is the east stand structure. As well as being the stadium's main stand, housing changing and pre-match facilities on the ground floor beneath the seating, it also houses, at the rear of the structure, restaurants on the lowest floor, an NHS drop-in centre on the first floor and corporate facilities on the second level.

Like all the other three stands, the east stand features a single tier of terrace seating, formed with raking steel members supporting precast flooring terrace units.

The east stand is slightly larger than the other stands, at 19m-deep, and features the largest of the four cantilevering roofs. The south and west stands both have 13m-deep cantilevering roofs, while the north, which is the stadium's smallest stand, has a 6.5m-deep cantilevering roof. The Eurocode design of the stadium included full dynamic checks on the roof and terracing, undertaken by Caunton Engineering.

Mr Domville says: "This is the final scheme in the Vanguard development, and brings with it a host of sporting and leisure facilities to add to the existing retail offering. As well as giving the local population an array of things to do, the Community Stadium will hopefully be the catalyst to revitalise the city's football and rugby league teams."

Summing up, Wrenbridge Sport Project Manager Peter Baird says: "We've been part of the consortium with leisure operators Greenwich Leisure (GLL) for the past five years that has worked very closely with the Council to make the scheme a reality.

"We are the developers for the enabling commercial elements of the project that has been funded by Legal & General and includes a 13-screen state-of-the-art IMAX cinema, five restaurants as well as retail and leisure uses.

"With the construction works now well under way we are delighted with the progress being made by Buckingham and we looking forward to seeing the scheme continue to rise out of the ground. We believe that whole scheme will be a fantastic new leisure destination for the whole community of York and will offer something for everyone."

Work progresses on the cinema block

A nod to an engineer

Exposed steelwork is the order of the day for a new eye-catching commercial development in west London. Martin Cooper reports.

FACT FILE
Brunel Building, Paddington, London
Main client: Derwent London
Architect: Fletcher Priest Architects
Main contractor: Laing O'Rourke
Structural engineer: Arup
Steelwork contractor: Severfield
Steel tonnage: 2,350t

Brunel Building features an eye-catching steel exoskeleton

Overlooking the Grand Union Canal opposite Paddington Station, an innovative new workplace, which offers up more than a passing nod to the famous builder of the rail terminus, is taking shape.

Named in honour of Isambard Kingdom Brunel, the Brunel Building would undoubtedly have delighted the famous engineer with its exposed engineered steelwork and multiple connections, which sits perfectly next to his giant iron-framed station shed.

Together with exposed steelwork, the industrial palette of the building also includes exposed concrete flooring and cores as well as service runs, accommodated within cellular beams, all left in full view.

"As well as offering recognition to Brunel, as his first-ever bridge was once located on the northern boundary of our site, the steel design has enabled us to express the structure in a contemporary way and create the desired clear internal spans," says Fletcher Priest Architects' Senior Project Architect Chris Radley.

The scheme has been in the offing for nearly 14 years, but finally started to come out of the ground last year once Laing O'Rourke had been awarded the contract by Derwent London.

The design had always envisaged a stand-out commercial building, one that would make people stop and look up, and that is exactly what is now being delivered.

Topping out at 17-storeys high, the building's most visually exciting component is its exoskeleton that sits in front of the cladding and allows the structure to have continuous glazing to all facades.

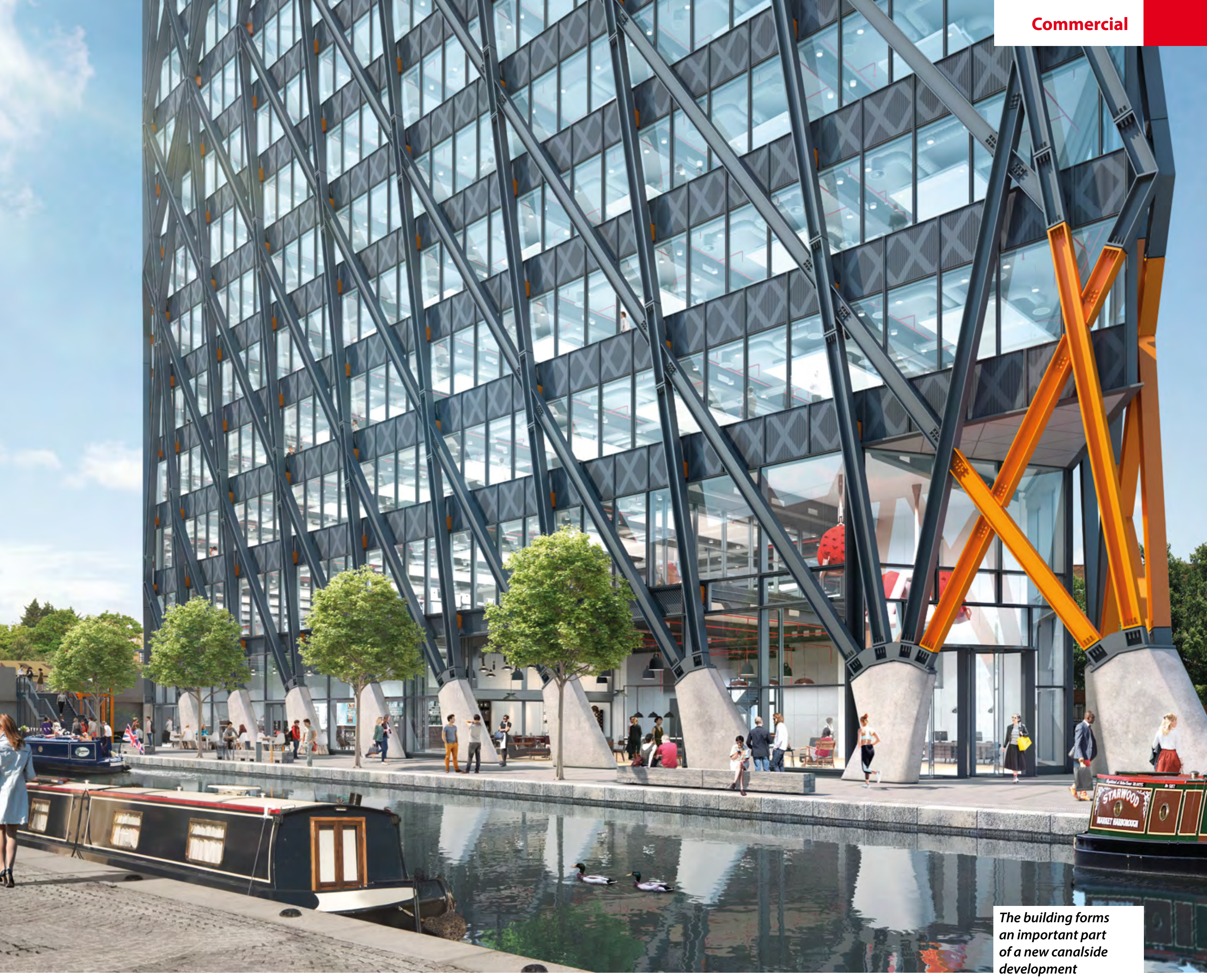
The glazing will offer the occupiers, especially those on higher floors, some spectacular views of London, while the exo-skeleton will provide solar shading.

The exoskeleton is a diagrid of steel beams that rakes out and then inclines back in at level nine as it wraps around the building's four elevations. Connecting the skeleton's beams are a series of nodes, that depending on their location, have up to seven beam connections.

The largest of the multiple nodes are generally 6m in diameter and weigh 2t, while the diagrid's steelwork is a combination of UC sections and fabricated plate girders up to 17m in length.

The fabricated column sections that make up the exoskeleton have a common overall dimension of 350mm x 400mm, with flange and web thicknesses optimised to suit loads.

"The skeleton is an architectural feature as it supports vertical loads, but does not contribute to the overall lateral stability of the building as this is done by three cores,"



The building forms an important part of a new canalside development

explains Arup Engineer Steve Peet.

"There are longitudinal forces generated and these are taken back to the cores, but generally the less steep elements are all non-structural, acting as bracing while the steel is being erected."

A series of Fabsec cellular beams connects the exterior skeleton frame to the three centrally-positioned concrete cores.

As the building splays outwards on plan, the eastern end of the structure has column-free spans of 6m, but this increases substantially to 18m-long clear spans, either side of the core at the western end.

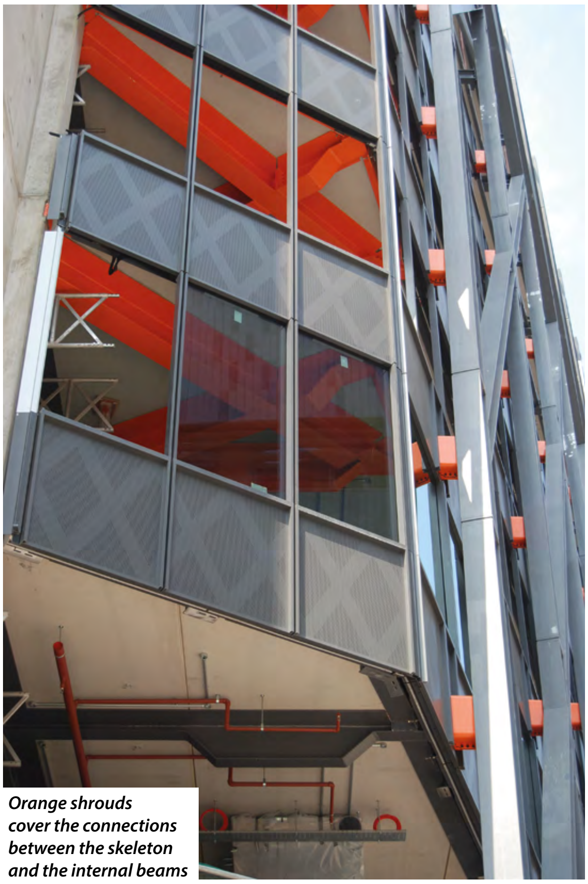
"Because the steelwork is left exposed as a feature element, the cellular beams have bespoke 'wishbone' connections to the core and exoskeleton," says Severfield Senior Project Manager Andy Luter.

'They taper down from 650mm-deep sections to 350mm in order to minimise the penetration through the cladding as well as providing aesthetically pleasing steelwork."

Architectural flourishes of bright orange are a feature adorning a number of areas within the building. The eastern elevation of the structure features orange-painted steel columns for the lower floors, highlighting the main entrance, while the 'wishbone' connections have all been ▶20

The skeleton's nodes have up to seven beam connections

Orange steelwork highlights the main entrance



Orange shrouds cover the connections between the skeleton and the internal beams

▶19

retrofitted with an orange aluminium shroud that sits outside of the cladding, providing another stand-out feature.

Forming the floors of the building, the Fabsec cellular beams support precast panels, all of which have been installed by Severfield along with the steelwork. They have a highly architectural polished finish to their undersides as this part will be left exposed in the final scheme, while on top, a concrete topping is applied to form the floor.

Prior to the topping being applied the panels would ordinarily need to be propped as they would not be stable. However, on this scheme, most of the temporary props have been dispensed with as the panels have a steel torsional restraint which provides rigidity during the temporary state.

The restraint is a steel beam fixed to the underside of each panel, which is removed once the floor has been cast. Either end of the panel has a steel plate that connects to the adjoining panel, and these are cast-in and hidden from view once the floor is complete.

Severfield's programme involved erecting three floors of steelwork before using the same tower cranes to install the concrete floor panels, by lifting them carefully down through the steel members.

The site's two tower cranes are positioned in voids either side of the main central core and the two outer cores. These areas, which measure up to 8m-wide, will be infilled by Severfield during a return visit once the cranes are no longer needed and dismantled.

"Coordination has been key to the success of this project," explains Laing O'Rourke Project Manager Craig Stokes. "Severfield has had to work closely with our offsite precast panel production to install the steel restraints prior to them being delivered to site."

Steelwork starts at ground level and is founded on a concrete substructure encompassing a two-level basement. This has been formed by a combination of raft foundations, a secant wall up to 25m-deep and a concrete capping beam.

"The secant wall and the raft have to work in conjunction as in one corner of the building the proximity of the Bakerloo Underground Line meant no deep piles could be installed," explains Mr Peet.

The Brunel Building is due to be completed during 2019.

Exoskeletons in buildings

The Brunel Building adopts an exoskeleton. Richard Henderson of the SCI discusses the structure.

Exoskeletons are present in various creatures to support and protect the animal's body. Examples are such insects as grasshoppers and crustaceans such as the lobster. Humans have an endoskeleton as do most buildings. Exceptions are described by Kathleen Villaluz[1] and include the Centre Pompidou (Paris) and the Hotel Arts (Barcelona). Placing the structure of the building externally allows large open spaces in the interior and using it to resist lateral loads maximises the lever-arm in the structure and therefore minimises the uplift forces due to overturning. A penalty is paid for this in the necessary penetrations through the building façade to allow the connections of the horizontal structure to the exoskeleton. Other building forms which employ the structure at the perimeter to resist lateral loads are the framed tube pioneered by Fazlur Khan in the 1960s (eg the Willis Tower, Chicago) and the braced tube (eg 30 St Mary Axe – colloquially, the Gherkin). In these buildings, although the lateral load resisting structure is on the perimeter, allowing the same generous open spaces in the interior, it is enclosed within the façade.

Another example of a building with an exoskeleton in London is Bush Lane House by Arup Associates in which the external diamond lattice structure transfers vertical loads to the main vertical columns and shares in resisting the lateral loads on the building in one of the orthogonal directions. A particular feature of the external structure in Bush Lane House is that the external bracing is of stainless steel and is water filled to provide fire protection. The external structure therefore has several different functions.

The exoskeleton of the Brunel Building is an architectural feature which supports vertical loads but does not resist lateral loads, thus not fully exploiting the available structure. The lateral stability of the building is provided by three substantial concrete cores. The absence of stiffeners in the connection details between the less-steeply inclined elements and the steeper ones in the exposed frame confirms that the forces in the former elements are not significant.

[1] https://interestingengineering.com/top-7-exoskeleton-structures-around-the-world

West End addition

The latest scheme in London's ongoing St James's redevelopment is an eight-storey steel-framed office block which will help to further enhance the area's business credentials.

FACT FILE
32 Duke Street St James's, London
Main client:
The Crown Estate
Architect:
Rolfe Judd
Main contractor:
Skanska
Structural engineer:
Waterman Structures
Steelwork contractor:
Bourne Steel
Steel tonnage: 600t

Situated on Jermyn Street, the eight-storey 32 Duke Street St James's forms part of the much wider St James's redevelopment, a major 10-year investment programme that will revitalise the renowned central London area with a new public square, offices, retail outlets and high quality residences.

The flagship project of this multi-million pound vision is the nearby St James's Market scheme [see NSC January 2015], just south of Piccadilly Circus, that delivered 24,100m² of commercial and retail space across two eight-storey blocks situated between two of London's most prestigious thoroughfares, Regent Street and Haymarket.

No less prestigious, 32 Duke Street St James's will provide 3,234m² of office accommodation, spread over six upper floors with two levels of retail offering 1,034m² of space.

The building aims to achieve BREEAM 'Outstanding' for its commercial floors and BREEAM 'Very Good' for its retail zone, while the project as a whole, is targeting a WELL Building Gold Standard rating for its shell and core. The latter certification recognises the building has been designed as a healthy and productive space for its future occupants.

The completed building will offer 3,234m² of office space in a prestigious location

Occupying a footprint of 36m × 21m, 32 Duke Street St James's replaces two old buildings that were demolished prior to main contractor Skanska starting on site. Inheriting a cleared plot, the initial construction task for Skanska was to deepen the existing single-level basement, to two levels, with the lowest floor [B2] housing the building's plant equipment, bicycle storage and changing rooms.

The building's substructure is formed with concrete, and the main steel frame begins at basement level one. The only exception being two columns which are founded on the lowest slab to form the retail zone's goods lift.

A concrete core, situated alongside a party wall provides the main vertical stability, with beams up to 13m-long, forming a diaphragm and connecting it to the perimeter columns to provide column-free floorplates.

Floor construction, above ground floor, is composite, with steel beams supporting 5,000m² of metal decking and a concrete topping.

"Cellular beams have been used throughout the project, with service holes at regular intervals to give maximum flexibility to future occupiers in terms of service distribution," says Bourne Steel Project Manager Stephane Dubois.

The use of cellular beams and their ability to accommodate services within their depth was one of the reasons for choosing a steel-framed solution for this project.

"We looked at other framing materials, but steelwork offered the most economical solution as we were able to keep the integrated structural void and services zone within the beam depths and thereby build the required number of floors within a 37m-high structure," says Waterman Structures Director Richard Whitehead.

Maximising the available space also had a bearing on the choice of column members used on this scheme. The majority of perimeter columns at 32 Duke Street St James's are solid billets, as opposed to the more traditional I-sections.

Billlets generally have smaller dimensions, 350mm × 125mm for this project, and consequently they intrude less into the building's useable space than one would expect from other steel sections.

"Billets are also flat to the façade, giving a more aesthetically-pleasing and neater interior finish," adds Mr Whitehead.

In keeping with the steelwork's aesthetic theme, many of the column splice connections were designed to be within the floor depth, in order to hide them from view as many areas of the steel frame will remain exposed in the completed building.

The majority of the steel frame's connections are via fin plates. However, due to the large loads at many locations on the upper floors where the floorplates step back, Bourne Steel also had to design more complex stub connections.

The building steps back at level four to create an outdoor terrace and then again at level six where the façade incorporates a mansard formed with raking columns. In these areas, transfer beams have been

The project is the latest scheme in the St James's redevelopment

installed to support the irregular column lines.

On the exterior, the building is clad with a concrete panel system which has required numerous connections around the steel frame's perimeter. The panels, which weigh up to 18t each, sit flush to the steelwork and necessitated flat bolted connections for the exterior steel splices.

All of the project's lifting duties are being carried out by the site's tower crane.

"This is a typical inner city site with no space for materials storage and so we had between two and four steel deliveries every week, which were immediately erected," explains Skanska Senior Engineer Nauman Soomro.

"In order to keep the many neighbours happy, which include residents, a hotel and an art gallery, we were restricted to an 8am to 6pm window for deliveries, all of which had to be made to the site's one very narrow pit lane."

Bourne Steel completed the main steel frame in June, but has been scheduled to return later this year to infill the gap left once the centrally-positioned tower crane is removed.

32 Duke Street St James's is due to be completed in Spring 2019.


Steel frame model of the building


Many splice connections are within the floor depth


All floors are formed with cellular beams

All structures over 40m long are being built with steel

Bridges improve major artery

A steelwork contractor's expertise has enabled challenging crossings to be erected safely, accurately and on time for the A14 improvement scheme.

FACT FILE
A14 Cambridge to Huntingdon improvement scheme
Main Client: Highways England
Delivery organisation: A14 Integrated Delivery Team
Main contractor: Costain Skanska, Balfour Beatty joint venture
Designer: Atkins and CH2M joint venture
Steelwork contractor: Cleveland Bridge
Steel tonnage: 9,245t

Highways England's £1.5 billion A14 improvement scheme between Cambridge and Huntingdon aims to relieve congestion, unlock economic growth, improve safety and enhance the local environment.

The existing road is notoriously congested and suffers from numerous delays as it is used by almost 85,000 vehicles every day, far more than it was originally designed to accommodate.

The improvements include a new bypass to the south of Huntingdon, widening sections of both the existing A14 and A1 trunk roads, the creation of new local access roads, and improved junctions.

A total of 34 bridge structures will be required for the scheme, crossing roads, railways and waterways. Working on behalf of the A14 Integrated Delivery Team, six of these structures are being fabricated, supplied and installed by Cleveland Bridge.

Steelwork for two of these bridges – the A14 Brampton Interchange Bridge and the East Coast Mainline Bridge - has been completed, while the viaduct over the River Great Ouse is currently ongoing and due to complete by early August. The final three bridges (see box) will all be completed by early 2019.

Commenting on the use of steel, A14 Integrated Delivery Team Construction Director Jim McNicholas says: "Prior to coming to site we carried out a value engineering exercise and from this we decided that any structure that was 40m or longer would be built with steel."

Completed in January, the A1 Brampton Interchange Bridge is an 80m-long curved bridge spanning the A1. The bridge was constructed from 30 curved and cambered girders, each up to 34m long and weighing a total of 1,400t.

Cleveland Bridge says the major challenge on this bridge was the curved and cambered nature of the structure. It had to use advanced modelling software to enable the manufacture of the girders for the deck, which had a high skew and a tight radius.

The complex geometry meant the girders had to be transported singly and then spliced and braced together on site. To achieve the total bridge length of 80m, ten lines of three girders, weighing up to 55t each, were used to span between abutments and piers.

Cleveland Bridge says it developed a jacking system on top of the piers which allowed the girders to cantilever out beyond the central pier. This enabled a whole line of supporting trestles to be removed from the scheme saving time for the client.

All of this work had to be completed to a very tight deadline around live A1 traffic management. Switching the traffic from one carriageway to another was precisely scheduled, so bridge construction had to be completed on time to allow diverted traffic to run safely beneath the new structure.

The bridge over the A1 was completed on schedule within the tight programme timetable, ensuring traffic could continue to flow throughout the works. The entire construction of this complex bridge was completed in just nine weeks.

A different set of challenges was negotiated for the 40m-long bridge spanning the East Coast Mainline.

"The biggest challenge for this bridge was the short possession periods during which the bridge could be constructed," says Cleveland Bridge Project Manager Michael Whinn.

"As one of the UK's busiest rail arteries, all construction work had to take place when no services were running, and all work had to be programmed in close partnership with Network Rail."

The bridge comprised five pairs of 40m-long girders, with each pair weighing 85t.

Initially the girders were due to be installed over five weekends. However, Cleveland Bridge says it was able to complete the work in just three weekends, within the 2am to 6am possession windows.

There was no room for error since any delay could have seriously disrupted rail services for thousands of passengers. Cleveland Bridge says it planned all works in meticulous detail to ensure that the steel girders were positioned well before the end of each possession window.

"This bridge was an exception and would have been built with steel even if it was less than 40m-long," explains Mr McNicholas. "Only by using steelwork with a slim profile could we achieve the required headroom for the railway, while keeping the road at the necessary level."

The project's longest bridge structure is the 750m-long River Great Ouse viaduct, which is considered to be a showpiece element of the A14 project. The bridge not only spans the river, but also a large area of floodplain on either side. This viaduct will require 6,000t of steel, comprising 76 separate main girders and 800 cross girders.

A time-saving construction method has been devised, which involves another subcontractor lifting prefabricated concrete slabs onto the steelwork erected by Cleveland Bridge at the same time as steelwork installation continues ahead of this activity.

A key feature of this method are the close tolerances required between the deck slabs and supporting steelwork. This requires precise steelwork fabrication and installation to ensure clashes between the slabs, projecting reinforcement and the steel are avoided.

Supported on 16 pairs of piers, most of the main girders required for the bridge are up to 40m-long, 2m-deep and weigh 50t. The section of bridge that crosses the river has a longer 70m span, requiring more complex girders, with larger, deeper haunches to carry the greater load.

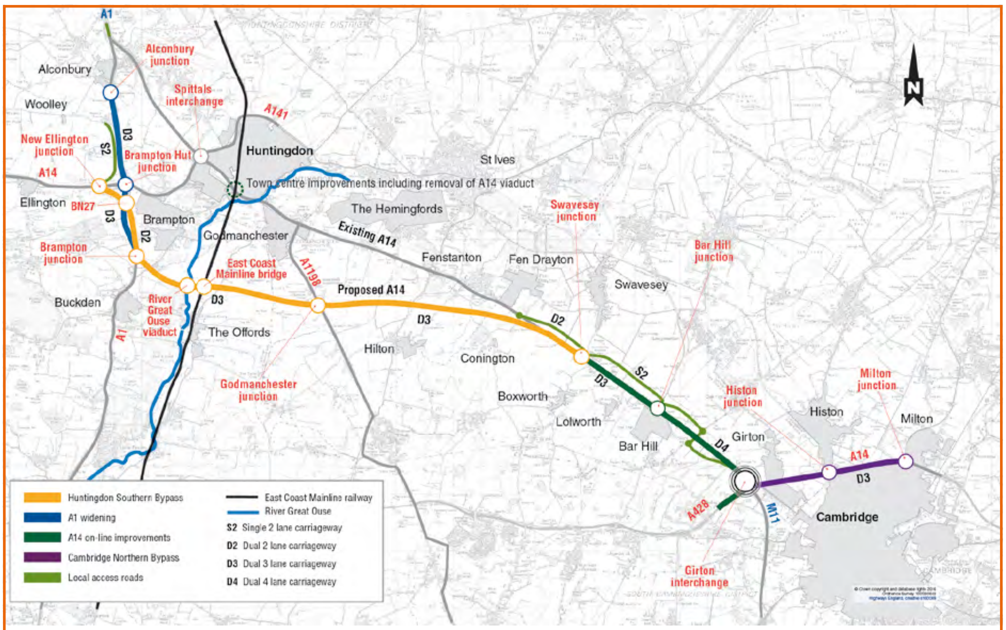
Cleveland Bridge says it suggested a different steel grade for these haunch girders, making them simpler to fabricate.

Cleveland Bridge is using a 600t-capacity crawler crane, which can lift all components for each bay from one position on both sides the river. This meant fewer crane movements were required, with no need to move the crane across the bridge footprint – reducing site congestion and saving time and money.

The A14 improvement scheme is due to be completed in 2021.

The River Great Ouse Viaduct with the East Coast Mainline bridge in the background

Elements forming the River Great Ouse Viaduct



Three more bridges

Cleveland Bridge is also fabricating and supplying three further bridges for the A14 scheme. These consist of the BN20 and BN21 Bar Hill Junction bridges and the BN27 structure, which is also known as the A14/A1 link overbridge.

The Bar Hill Junction consists of two identical 47.5m-long bridges, that will be constructed from six main girders each weighing 55t.

These two bridges are scheduled to be assembled on site, while being supported on trestles, before being manoeuvred into their final positions by Self-Propelled Mobile Transporters (SPMTs) over two successive weekends in September.

Measuring 102.5m-long, BN27 will be last of Cleveland Bridge's six bridges to be erected in early 2019. Curved in plan and elevation, the bridge will consist of nine pairs of girders measuring 29m, 34m and 39.5m long.

Buckling resistance of uniform members in bending

Richard Henderson of the Steel Construction Institute discusses the phenomenon of lateral-torsional buckling.

Introduction

A grid of beams is usually divided into primary and secondary beams and where there is no floor slab to provide continuous support to the compression flanges, the secondary beams provide discrete restraints to the primary. An end plate connection to the primary beam web detailed in accordance with the Green Book rules may be considered to provide a fork end restraint. The secondary beams also apply point loads to the primary and, for this type of connection, the loads are not destabilizing. The system of point loads results in a shear force diagram for the primary beam with constant values between the point loads and a bending moment diagram made up of straight lines (ignoring the effect of the primary beam self-weight).

In determining the resistance of the beam to bending, especially in hand calculations, it is common to consider the primary beam in segments defined by the incoming secondary beams where the segments have defined end restraints and end moments taken from the bending moment diagram of the full beam. This approach corresponds to the conditions set out in clause 6.3.3 of Eurocode 3 which deals with uniform members in bending and axial compression and the effect of these two actions in combination. Note 1 to clause 6.3.3(2) states: "The interaction formulae are based on the modelling of simply supported single span members with end fork conditions and with or without continuous lateral restraints, which are subjected to compression force, end moments and/or transverse loads". Taking the segments one by one is usually on the safe side as the study described in the following sections shows. The purpose of the study is to determine what effect continuity of the beam beyond the segment being considered has on the beam's calculated bending resistance.

Beam	Length (m)	No of point loads / restraints	Segment length (m)						
			1	2	3	4	5	6	7
1	9	2	3	3	3				
2	9	2	3.5	3	2.5				
3	15	4	3	3	3	3	3		
4	15	4	3.5	2.5	3	3.5	2.5		
5	15	6	2	2	2	3	2	2	2
6	15	4	3.5	2.5	3	2.5	3		

Table 1: Arrangement of beams and beam segments

Beams studied

A series of loading arrangements on a 610 × 229 UB 140 was examined. All the arrangements were chosen to result in a 3 m segment of beam subject to a uniform moment of 1200 kNm. The point loads were always applied at restraint positions and beams of length 9 m and 15 m were considered. The loads and restraint positions were chosen such that the lengths of the segments were not always the same so that the half-wave lengths of the buckled shape were uneven. The arrangements are set out in Table 1.

As an illustration, the bending moment diagrams for beams 2 and 6 (neglecting the beam self weight) are shown in Figure 1.

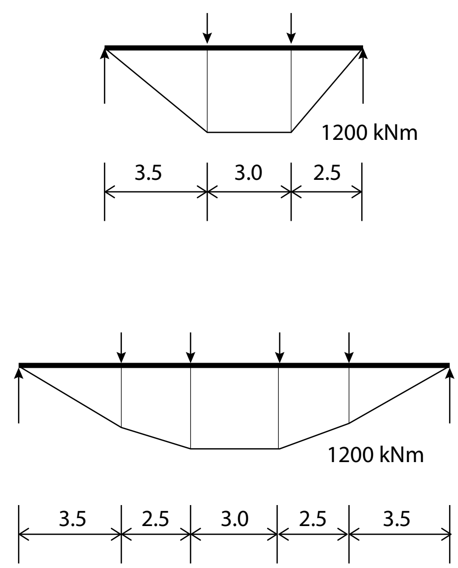


Figure 1: Bending moment diagrams, beams 2 and 6

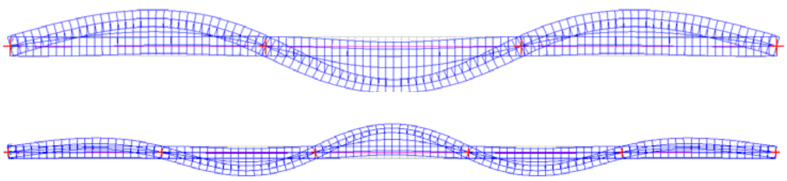


Figure 2: Buckled shape: 3-segment and 5-segment beams

Beams 1 and 3 have equally spaced loads and restraints, forming segments 3 m long. The buckled shape of the beam calculated by LTBeamN in determining M_{cr} is shown in plan in Figure 2. The top compression flange buckles into a series of half-waves. In each case, the central segment has a uniform bending moment and the adjacent segments have either triangular or trapezoidal-shaped bending moment diagrams. The amplitude of the half-waves can be seen to reduce where the bending moment is not uniform.

▶28

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Buildings

Bridgeworks

Components, Materials and Products

▶26 Where the bending moment is uniform over the whole beam, the half-waves of the buckled shape can be seen to have the same amplitude as shown in Figure 3.

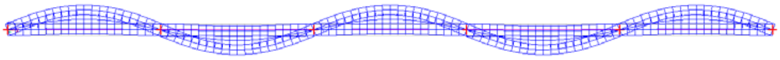


Figure 3: Buckled shape: 5-segment beam, uniform moment

Beam	Segment	length (m)	method	M_{cr} (kNm)	M_{cru} (kNm)	unity factor
1	1	3.0	Blue Book	-	-	0.839
1	2	3.0	Blue Book	-	-	0.984
1	1	3.0	hand calc.	5964	3370	0.840
1	2	3.0	hand calc.	3370	3370	0.982
1	1	3.0	LTBeamN	6235	3366	0.840
1	2	3.0	LTBeamN	3365	3366	0.982
1	-	9.0	LTBeamN	4559	3366	0.866
2	1	3.5	LTBeamN	4709	2544	0.840
2	2	3.0	LTBeamN	3366	3366	0.982
2	3	2.5	LTBeamN	8759	4725	0.852
2	-	9.0	LTBeamN	4636	3193	0.841
3	2	3.0	LTBeamN	4029	3366	0.908
3	3	3.0	LTBeamN	3366	3366	0.982
3	-	15.0	LTBeamN	4263	3366	0.888
4	2	2.5	LTBeamN	5519	4729	0.867
4	3	3.0	LTBeamN	3366	3366	0.982
4	4	3.5	LTBeamN	3206	2544	0.941
4	-	15.0	LTBeamN	4251	3234	0.882
5	3	2.0	LTBeamN	7877	7223	0.840
5	4	3.0	LTBeamN	3366	3366	0.982
5	-	15.0	LTBeamN	6003	3365	0.840
6	2	2.5	LTBeamN	5430	4725	0.872
6	3	3.0	LTBeamN	3366	3366	0.982
6	-	15.0	LTBeamN	4725	3227	0.848

Table 2: Analysis results

Beam Resistances

The resistances of beam segments and beams identified in Table 1 have been calculated for comparison. The segments examined all have a maximum bending moment of 1200 kNm with a bending moment diagram which is either uniform or trapezoidal, except for the 9 m long beams where the bending moment diagram is triangular in the non-uniform moment segments.

The resistances have been determined using EC3 clause 6.3.2.3 for rolled section with the modified strength reduction factor $\chi_{LT,mod}$ from 6.3.2.5(2) and the UK National Annex. The correction factor k_c is determined from the C_1 factor where

$$C_1 = \frac{M_{cr}}{M_{cru}} \quad and \quad k_c = \frac{1}{\sqrt{C_1}}$$

M_{cru} is the elastic critical moment for a uniform moment on the segment. For interest, the unity factors are calculated for Beam 1 using the Blue Book method, by hand and by using LTBeamN to determine values of the critical moments. In addition to considering beam segments defined by the fork-end restraints, LTBeamN was used to analyse the whole beam and determine the critical moments for this case. The results are presented in Table 2.

For beam 1, the Blue Book, hand and LTBeamN methods reassuringly give unity factors which vary by 0.2%. The Blue Book approach probably differs from the other two because the tabulated values in the Book use 3 significant figures. All the 3 m long segments in the beams examined where the bending moment is uniform and equal to 1200 kNm are essentially the same with a unity factor of 0.982.

A closer examination of the results for the full length beams shows that beam 5 has the lowest unity factor of 0.840, about 85% of 0.982. The reduction in unity factor is due to the effect of the continuity of the beam on either side of the segment carrying the uniform bending moment; the continuity is obviously not present if the segments are considered alone. All the beams exhibit this effect to varying degrees. The spacings of restraints in beam 5 have been chosen to inhibit the twisting of the segment with the uniform moment as much as possible. A plan view of the buckled shape of beam 5 is shown in Figure 4.

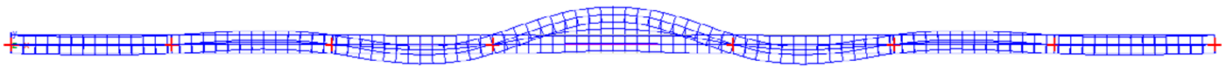


Figure 4: Beam 5 buckled shape

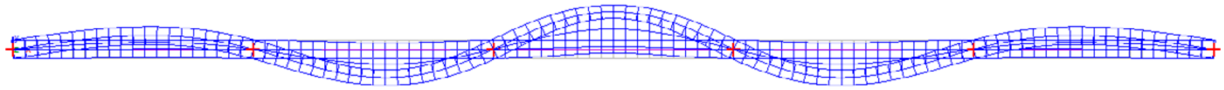


Figure 5: Beam 3 buckled shape

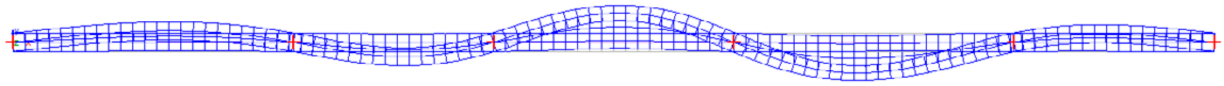


Figure 6: Beam 4 buckled shape

To illustrate the effect of continuity, the restraints are spaced at 2 m apart (except at the central segment), which may be considered unrealistically close spacing for secondary beams.

Beam 3 exhibits the highest unity factor, equal to 0.888 indicating that the continuity has the least effect. The spacing of the restraints are all equal at 3 m, allowing equal length half-waves. The buckled shape is shown in Figure 5.

The next highest unity factor 0.882 for Beam 4. The longer segment next to the segment with uniform moment allows a greater amplitude of lateral torsional distortion in the uniform moment segment. The buckled shape is shown in Figure 6

Conclusion

For the beams examined, continuity of the element beyond the most highly loaded segment (that with a uniform bending moment of 1200 kNm) results in a lower unity factor than is exhibited when considering individual beam segments. For beam 5, the unity factor is reduced from 0.982 to 0.840, 85% of the value for the individual segment. The lower unity factor corresponds to a higher buckling resistance moment $M_{b,Rd}$ for the beam. For the cases where the secondary beam spacing is equal, the corresponding unity factors are 0.866 for a 9 m beam with two point loads and 0.888 for a 15 m beam with four point loads. The buckling resistance moments are calculated as 1351 kNm and 1385 kNm respectively, compared with 1220 kNm for the individual segment. Considering individual segments can therefore be seen to be on the safe side for all the arrangements considered and if extra resistance has to be squeezed out of an existing beam designed segment by segment because of a change in circumstances, an extra 10% could possibly be found by considering the beam as a whole.

AD 420: Minimum values of shear and bending moment in beams with web openings

Table 3.1 of SCI publication P355 gives minimum values of co-existent shear and bending moment to be used at beam openings. This AD provides clarity on how these minimum values are to be used.

The concern behind the minimum values was to allow for non-uniform loading, to guard against the situation when the shear force at an opening could theoretically be zero. Table 3.1 therefore includes minimum values of the shear force to be allowed for in design. The minimum values of shear force in Table 3.1 have an associated bending moment.

The intention was that the minimum shear force and associated bending moment from Table 3.1 should only be applied if the theoretical shear at an opening was less than the minimum quoted. There is no requirement to apply the minimum bending moment at all openings – the minimum bending moment should only be applied if the minimum shear force is used in design.

Contact: Prof Mark Lawson
Tel: 01344 636555
Email: advisory@steel-sci.com

New and revised codes & standards

From BSI Updates June 2018

BS EN PUBLICATIONS

BS EN 1011-8:2018
Welding. Recommendations for welding of metallic materials. Welding of cast irons
Supersedes BS EN 1011-8:2004

CORRIGENDA TO BRITISH STANDARDS

BS EN 10219-1:2006
Cold formed welded structural hollow sections of non-alloy and fine grain steels. Technical delivery requirements
Corrigendum, April 2018

BS EN 10219-2:2006
Cold formed welded structural hollow sections of non-alloy and fine grain steels. Tolerances, dimensions and sectional properties
Corrigendum, April 2018

DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT - ADOPTIONS

18/30336161 DC
BS ISO 6930 High yield strength steel plates and wide flats for cold forming. Delivery conditions
Comments for the above document were required by 7 June, 2018

CEN EUROPEAN STANDARDS

EN 287-6:2018
Qualification test of welders. Fusion welding. Cast irons

EN 14399-9:2018
High-strength structural bolting assemblies for preloading. System HR or HV. Direct tension indicators for bolt and nut assemblies

EN 14399-10:2018
High-strength structural bolting assemblies for preloading. System HRC. Bolt and nut assemblies with calibrated preload.

BUILDING WITH STEEL

Reprinted from Volume 5 No. 2
June 1968

General Post Office Expansion and Composite Construction

The West Central District Office, Holborn, London, and the Postal and Sorting Office in Whitechapel Road, London

The West Central District and Eastern District Offices are large multi-storey projects for the mechanised handling and sorting of general letter and parcel mail. These offices require large basic grids and have storey heights much greater than normal offices. Likewise, there are the same requirements for future adaptability and modification. The basic grids are 40 ft by 32 ft and 47 ft by 47 ft respectively.

Mainly because of an insufficiency of repetition and irregular plan configuration, lightweight aggregate precast concrete floor panels have not been used on these projects. Instead both have the major basic skeleton in steelwork, with secondary beams and floor slab in *in situ* reinforced concrete, the two elements acting compositely.

This produces a waffle like grid which means that the slabs and their supporting beams span in both directions. Hence, the floor slabs are relatively thin, and because of the two-way span system can tolerate quite large holes being cut through in the future. The two-way system reduces overall floor and beam depth. The use of steel for the main skeleton minimises the overall dimensions of the main stanchions, and reduces dead loads.

It is of interest to note that at W.C. District Office (pictured) two lines of stanchions were eliminated between ground and first floor to provide clear areas for vehicles between the loading platforms. This was achieved by the introduction of twin welded plate girders in B.S. 968 steel spanning 65 ft, each pair supporting an upper stanchion at mid span carrying approximately 850 tons. The senior architect for these two projects was E.T. Sargeant, ARIBA, AMPTI, and the Senior Structural Engineer was R. C. Westbrook, MIStructE.

To read about the W.C. District Office's latest incarnation, see 'In the post', NSC March 2018

Steelwork contractors for buildings

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

Gillian Mitchell MBE, Deputy Director General, BCSA, 4 Whitehall Court, London SW1A 2ES
Tel: 020 7747 8121 Email: *gillian.mitchell@steelconstruction.org*

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

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

- **FPC** Factory Production Control certification to BS EN 1090-1
  1 – Execution Class 1 2 – Execution Class 2
  3 – Execution Class 3 4 – Execution Class 4
- **BIM** BIM Level 2 assessed
- **QM** Quality management certification to ISO 9001
- **SCM** Steel Construction Sustainability Charter
  (● = Gold, ● = Silver, ● = 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			●	●					●	●			●	●		3			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	✔	Silver	Up to £4,000,000
Adstone Construction Ltd	01905 794561			●	●	●	●									✔	2	✔	Gold	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 £40,000
Arminhall Engineering Ltd	01799 524510	●			●	●		●		●	●			●	●	✔	2			Up to £800,000
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		Gold	Up to £4,000,000
Atlasco Constructional Engineers Ltd	01782 564711			●	●	●	●			●	●			●	●	✔	2			Up to £1,400,000
Austin-Divall Fabrications Ltd	01903 721950			●	●		●	●		●	●			●	●	✔	2			Up to £1,400,000
B D Structures Ltd	01942 817770			●	●	●	●				●	●		●	●	✔	2		Silver	Up to £1,400,000
Ballykine Structural Engineers Ltd	028 9756 2560			●	●	●	●	●				●				✔	4			Up to £1,400,000
Barnshaw Section Benders Ltd	0121 557 8261												●			✔	4			Up to £1,400,000
BHC Ltd	01555 840006	●	●	●	●	●	●	●			●	●		●	●	✔	4		Silver	Above £6,000,000
Billington Structures Ltd	01226 340666		●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	Gold	Above £6,000,000
Border Steelwork Structures Ltd	01228 548744			●	●	●	●			●	●				●		4			Up to £3,000,000
Bourne Construction Engineering Ltd	01202 746666		●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	Gold	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		Silver	Up to £4,000,000
Caunton Engineering Ltd	01773 531111	●	●	●	●	●	●	●		●	●	●		●	●	✔	4	✔	Gold	Above £6,000,000
Cementation Fabrications	0300 105 0135	●			●			●			●		●		●	✔	3		Gold	Up to £6,000,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	●	●	●		●		✔	4		Gold	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 £1,400,000
D H Structures Ltd	01785 246269			●	●		●				●						2			Up to £40,000
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	✔	Gold	Up to £6,000,000
ESL (GB) Ltd	01482 787986	●					●	●	●	●	●	●	●	●	●	✔	4			Up to £400,000
EvadX Ltd	01745 336413			●	●	●	●	●	●	●	●	●			●	✔	3		Gold	Up to £3,000,000
Four Bay Structures Ltd	01603 758141			●	●	●	●	●		●	●			●	●		2			Up to £1,400,000
Four-Tees Engineers Ltd	01489 885899	●											●	●	●	✔	3		Member	Up to £2,000,000
Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	BIM	SCM	Guide Contract Value (1)

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	BIM	SCM	Guide Contract Value (1)
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
H Young Structures Ltd	01953 601881			●	●	●	●	●		●	●			●	●	✔	2		● (green)	Up to £2,000,000
Had Fab Ltd	01875 611711				●				●	●	●				●	✔	4			Up to £3,000,000
Hambleton Steel Ltd	01748 810598		●	●	●	●	●	●				●		●		✔	4		● (grey)	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		● (grey)	Up to £6,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445			●	●	●	●	●	●	●	●	●		●	●	✔	4		● (orange)	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		● (grey)	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		● (green)	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			●	●	●	●				●						3			Up to £3,000,000
Murphy International Ltd	00 353 45 431384	●			●		●	●	●		●				●	✔	4			Up to £1,400,000
Newbridge Engineering Ltd	01429 866722	●	●	●	●	●	●	●	●		●	●		●	●	✔	4		● (grey)	Up to £2,000,000
Nusteel Structures Ltd	01303 268112						●	●	●	●				●		✔	4		● (orange)	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			●	●	●	●		●	●	●			●	●		3			Up to £1,400,000
Rippin Ltd	01383 518610			●	●	●	●	●						●	●		2			Up to £1,400,000
Robinson Structures Ltd	01332 574711			●	●	●	●				●			●	●	✔	3			Up to £3,000,000
S H Structures Ltd	01977 681931	●			●		●	●	●	●	●	●			●	✔	4	✔	● (orange)	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		● (orange)	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
Structural Fabrications Ltd	01332 747400	●							●	●						✔	3		● (grey)	Up to £1,400,000
Taunton Fabrications Ltd	01823 324266				●					●				●	●	✔	2		● (green)	Up to £2,000,000
Taziker Industrial Ltd	01204 468080									●				●	●	✔	3			Above £6,000,000
Temple Mill Fabrications Ltd	01623 741720			●	●	●	●				●			●	●	✔	2			Up to £400,000
Traditional Structures Ltd	01922 414172			●	●	●	●	●	●		●			●	●	✔	3	✔	● (grey)	Up to £2,000,000
TSI Structures Ltd	01603 720031			●	●	●	●	●			●			●			2	✔		Up to £2,000,000
Underhill Engineering Ltd	01752 752483				●		●	●	●	●	●			●	●	✔	4	✔		Up to £3,000,000
W I G Engineering Ltd	01869 320515				●					●					●	✔	2			Up to £400,000
Walter Watson Ltd	028 4377 8711			●	●	●	●	●				●				✔	4			Above £6,000,000
Westbury Park Engineering Ltd	01373 825500	●		●	●	●	●	●	●	●	●				●	✔	4		● (green)	Up to £800,000
William Haley Engineering Ltd	01278 760591			●	●	●	●				●					✔	4		● (orange)	Up to £4,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	✔	● (orange)	Above £6,000,000
WT Fabrications (NE) Ltd	01642 691191			●	●	●	●				●			●	●		4			Up to £40,000
Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	BIM	SCM	Guide Contract Value (1)

Steelwork contractors for bridgeworks

RQSC The Register of Qualified Steelwork Contractors Scheme

BCSA

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:

FB Footbridges
CF Complex footbridges
SG Sign gantries
PG Bridges made principally from plate girders
TW Bridges made principally from trusswork
BA Bridges with stiffened complex platework (eg in decks, box girders or arch boxes)
CM Cable-supported bridges (eg cable-stayed or suspension) and other major structures (eg 100 metre span)
MB Moving bridges
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	FB	CF	SG	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
AJ Engineering & Construction Services Ltd	01309 671919	●			●	●	●	●	●	●	●	✓	4					Up to £3,000,000
Bourne Construction Engineering Ltd	01202 746666	●			●	●				●	●	✓	4	✓		✓	Gold	Above £6,000,000
Briton Fabricators Ltd	0115 963 2901	●	●	●	●	●	●	●	●	●	●	✓	4			✓		Up to £6,000,000
Cairnhill Structures Ltd	01236 449393	●	●	●	●	●	●	●		●	●	✓	4			✓	Silver	Up to £4,000,000
Cementation Fabrications	0300 105 0135	●			●						●	✓	3			✓	Gold	Up to £6,000,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓	Gold	Above £6,000,000
D Hughes Welding & Fabrication Ltd	01248 421104	●		●		●			●	●	●	✓	4			✓		Up to £800,000
Donyal Engineering Ltd	01207 270909	●		●						●	●	✓	3			✓	Member	Up to £1,400,000
ECS Engineering Ltd	01773 860001	●			●	●	●		●		●	✓	3					Up to £3,000,000
ESL (GB) Ltd	01428 787986									●	●	✓	4			✓		Up to £400,000
Four-Tees Engineers Ltd	01489 885899	●			●	●	●		●	●	●	✓	3			✓	Member	Up to £2,000,000
Had Fab Ltd	01875 611711									●	●	✓	4					Up to £3,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445	●				●				●	●	✓	4			✓	Gold	Up to £6,000,000
M Hasson & Sons Ltd	028 2957 1281	●	●	●	●	●	●	●			●	✓	4			✓	Member	Up to £2,000,000
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		✓	✓	Gold	Up to £4,000,000
S H Structures Ltd	01977 681931	●	●	●	●	●	●	●	●	●	●	✓	4	✓		✓	Gold	Up to £2,000,000
Severfield (UK) Ltd	01204 699999	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓	Gold	Above £6,000,000
Shaun Hodgson Engineering Ltd	01553 766499									●	●	✓	3			✓		Up to £800,000
Structural Fabrications Ltd	01332 747400	●		●	●	●	●			●	●	✓	3				Silver	Up to £1,400,000
Taziker Industrial Ltd	01204 468080	●			●	●	●			●	●	✓	3		✓	✓		Above £6,000,000
Underhill Engineering Ltd	01752 752483	●			●	●	●			●	●	✓	4	✓		✓		Up to £3,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	✓	4	✓	✓	✓	Gold	Above £6,000,000
Non-BCSA member																		
Allerton Steel Ltd	01609 774471	●		●	●	●	●			●	●	✓	4			✓	Silver	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			✓	Member	Up to £1,400,000
Ekspan Ltd	0114 261 1126	●				●			●	●	●	✓	2					Up to £400,000
Francis & Lewis International Ltd	01452 722200									●	●	✓	4			✓	Gold	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 £200,000
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		✓	✓	Gold	Up to £2,000,000
Total Steelwork & Fabrication Ltd	01925 234320	●		●		●				●	●	✓	3			✓		Up to £3,000,000
Victor Buyck Steel Construction	00 32 9 376 2211	●	●	●	●	●	●	●	●	●	●	✓	4		✓	✓	Silver	Above £6,000,000

Corporate Members

BCSA

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
Control Energy Costs Ltd	01737 556631
Gene Mathers	0115 974 7831
Griffiths & Armour	0151 236 5656
Highways England Company Ltd	08457 504030
Kier Construction Ltd	01767 640111
McGee Group (Holdings) Ltd	020 8998 1101
PTS (TQM) Ltd	01785 250706
Sandberg LLP	020 7565 7000
Structural & Weld Testing Services Ltd	01795 420264
SUM Ltd	0113 242 7390

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.

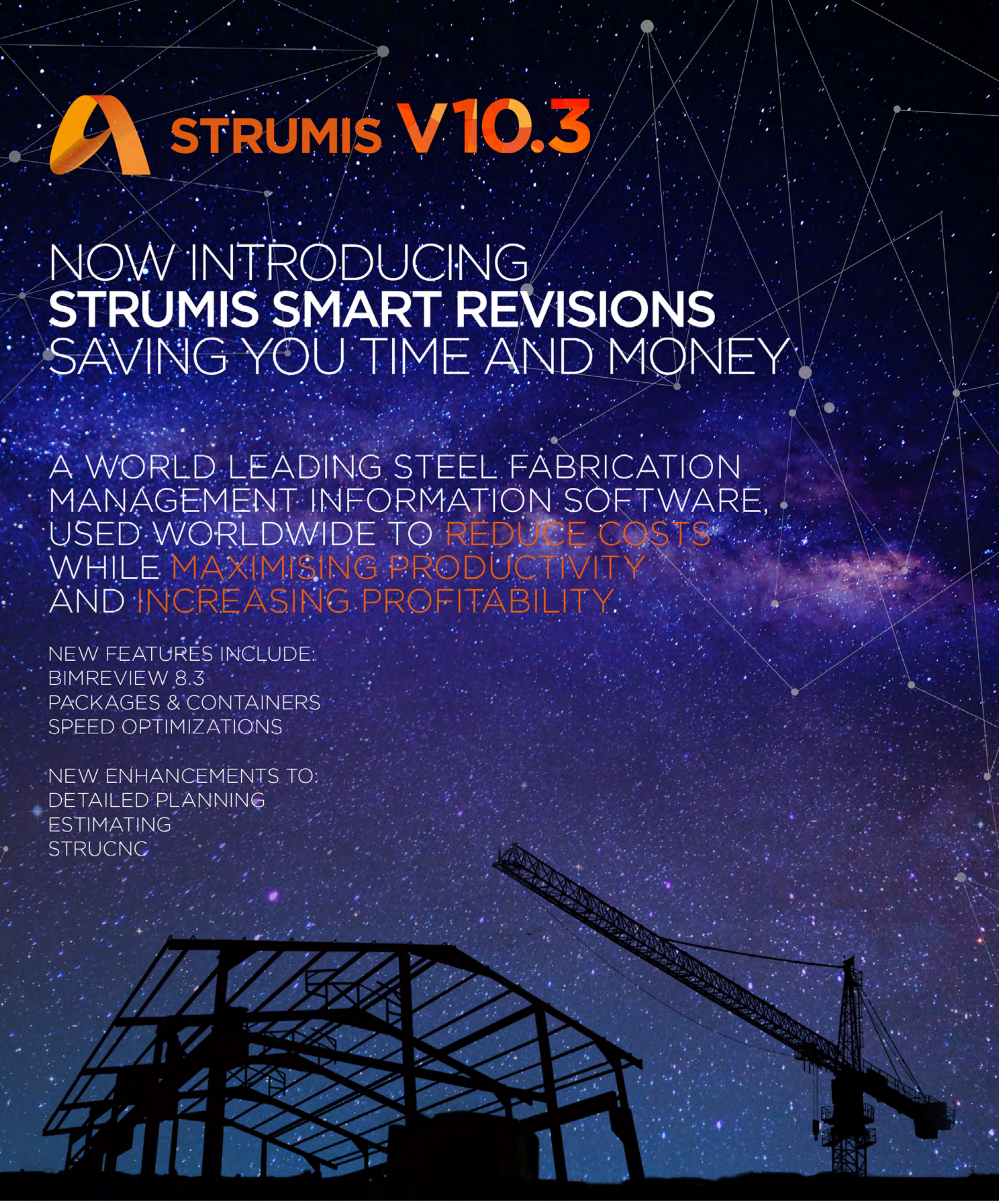
1 Structural components
2 Computer software
3 Design services
4 Steel producers
5 Manufacturing equipment
6 Protective systems
7 Safety systems
8 Steel stockholders
9 Structural fasteners

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		
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 Ltd	01724 404040				●						M		
British Steel Distribution	01642 405040								●		D/I		
BW Industries Ltd	01262 400088	●									M		
Cellbeam Ltd	01937 840600	●									M		
Cleveland Steel & Tubes Ltd	01845 577789								●		M		
Composite Metal Flooring Ltd	01495 761080	●									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 56 7722485	●							●		M		
easi-edge Ltd	01777 870901							●			N/A	Gold	
Fabsec Ltd	01937 840641	●									N/A		
Ficep (UK) Ltd	01924 223530					●					N/A		
FLI Structures	01452 722200	●									M	Gold	
Forward Protective Coatings Ltd	01623 748323						●				N/A		
Hadley Industries Plc	0121 555 1342	●									M	Silver	
Hempel UK Ltd	01633 874024						●				N/A		
Highland Metals Ltd	01343 548855						●				N/A		
Hi-Span Ltd	01953 603081	●									M	Member	

Company name	Tel	1	2	3	4	5	6	7	8	9	CE	SCM	BIM
International Paint Ltd	0191 469 6111						●				N/A	Gold	
Jack Tighe Ltd	01302 880360						●				N/A		
Jamestown Manufacturing Ltd	00 353 45 434288	●									M		
John Parker & Son 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	Gold	
Kloeckner Metals UK	0113 254 0711								●		D/I		
Lincoln Electric (UK) Ltd	0114 287 2401					●					N/A		
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 Architectural Coatings UK & Ireland	01924 354233						●				N/A		
Prodeck-Fixing Ltd	01278 780586	●									D/I		
Rainham Steel Co Ltd	01708 522311								●		D/I		
Sherwin-Williams Protective & Marine Coatings	01204 521771						●				N/A	Silver	
Structural Metal Decks Ltd	01202 718898	●									M		
StruMIS Ltd	01332 545800		●								N/A		
Stud-Deck Services Ltd	01335 390069	●									D/I		
Tata Steel – Tubes	01536 402121				●						M		
Tata Steel – ComFlor	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	Gold	
Wedge Group Galvanizing Ltd	01909 486384						●				N/A		
Yamazaki Mazak UK Ltd	01905 755755					●					N/A		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